NIC Online Help User's Guide

January 2008
Document No. CO 004678L – Version 5.4

This document is provided so that you can print specific online help topics. It contains the same information that appears in the unit's online help file, which is accessed by selecting the HELP tab on the unit's screen.

Digital Lightwave

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Introduction

Welcome!

Digital Lightwave, Inc. is pleased to present the Network Information Computer (NIC) Online Help User's Guide.

To view help topics, use your finger or a smooth blunt object, such as a PDA stylus, to expand the folder icons and view the topics.

Have questions regarding your NIC unit? Contact our Technical Support personnel.

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Version Information

NIC Online Help Document Number: CO 004678L - Version 5.4

For the unit's hardware serial numbers, license keys and software release information, see About This Product.

In addition, unit configuration information is also available on the unit's rear label.

Product Overview

The NIC Platform provides a flexible solution for verifying and qualifying the performance of today's global communications networks. The unit's flexible software/firmware-based architecture combines several traditional hardware based test sets into a single platform.

The NIC family is comprised of three chassis configurations, a 2-slot and 5-slot portable and a 5-slot rack-mount.

Modules are available to enable the following test capabilities:

SONET: STS-1(51M), OC-1(51M), STS-3(155M), OC-3(155M), OC-12(622M), OC-48(2.5G), OC-192(10G), OC-768(40G)

SDH: STM-0e(51M), STM-0(51M), STM-1e(155M), STM-1(155M), STM-4(622M), STM-16(2.5G), STM-64(10G), STM-256(40G)

NextGeneration: VCAT, LCAS, GFP

OTN: OTU-1(2.66G), OTU-2(10.7G), OTU-3(42.8G)

SONET/SDH/OTN Jitter and Wander Testing: 51M, 155M, 622M, 2.5G, 2.66G, 10G, 10.7G

Ethernet: 10/100/1000BaseT, 1GigE, 10GigE LAN(10.3G), 10GigE WAN(9.953G), 10GigE FEC (11.049G/11.095G)

Fibre Channel: 1G, 2G

T-Carrier: DS1(1.5M), DS3(45M)

PDH: E1(2M), E3(34M), E4(139M)

T-Carrier/PDH Jitter and Wander Testing: 1.5M, 2M, 34M, 45M, 139M

Serial Port Testing: RS-530, RS-232

Asynchronous Transfer Mode (ATM)

Packet over SONET (POS)

Optical Spectrum Analyzer (OSA): C-Band, L-Band

For new capabilities added since the publishing date of this manual, see www.lightwave.com

The NIC Platform offers the following features:

Easy-to-use Graphical User Interface (GUI) with large color touch-screen

Multi-user remote control software

Simultaneous and independent testing of SONET/SDH, T-Carrier, PDH, and ATM. Separate protocol processors for OC-3/STM-1 through OC-192/STM-64, ATM, DS1, DS3, E1, E3, and E4.

Combines Telecom/Datacom testing into one box

Modular, upgradeable design provides investment protection

Three-year warranty

Free 24-hour technical support

DS1/DS3 and E1/E3 drop and insert from SONET/SDH, built in M13/E13

Through-mode with overhead manipulation

Pluggable SFP/XFP optics (on specific modules)

Advanced ATM testing features, including support for AAL0, AAL1, AAL5, traffic shaping, OAM, QoS measurements, and HEC generation

Auto configuration to pattern level

Dual-slot 32-bit PCMCIA CardBus interface for modem, GPIB, or memory storage. Supports two Type I or II cards, or one Type III card, including GPIB interface cards.

USB memory storage

USB mouse control

Chassis Configurations

The NIC Chassis: Configurable as NIC NXG, NIC 2.5G, NIC 10G or NIC GigE, the NIC chassis is a two-slot light, compact configuration for field testing of SONET, SDH, OTN, ATM, Ethernet and DWDM networks.

The NIC Plus Chassis: With five-slots available, the NIC Plus or NIC NXG provides Telecom and Datacom testing in one chassis, capable of unmatched multi-port configurations as well as jitter and wander testing.

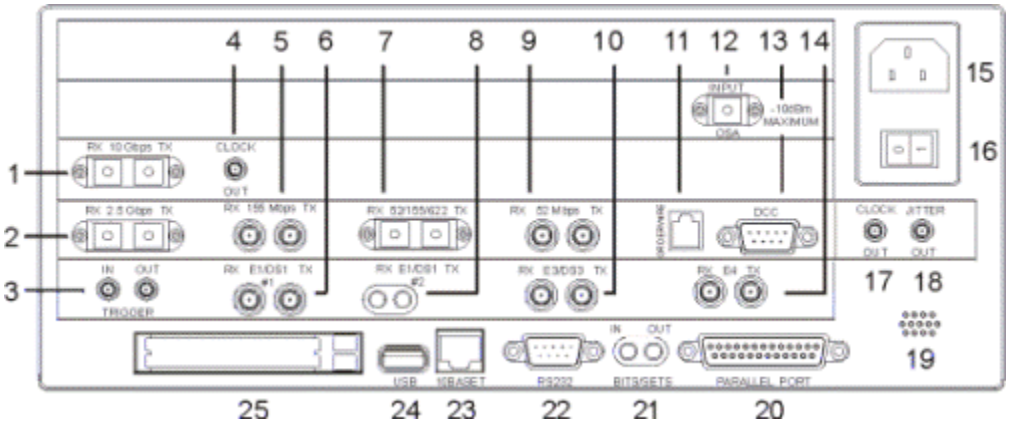
The NIC EP Chassis: Rack-mount five-slot chassis “Embedded Platform” with remote management software to enable remote circuit turn up, monitoring, troubleshooting and is also optimized for lab and manufacturing applications.

When is a NIC an NXG?

A NIC is designated “NXG” if it contains at least one NextGen Multi-Rate Module (NGMR). The NGMR is a revolutionary module supporting SONET, SDH, OTN, Ethernet and NextGeneration capabilities (VCAT, LCAS, GFP) that can be configured by licensing to suit exactly the users needs. The NGMR can be ordered initially with a minimum feature set, then upgraded in minutes by license key (no hardware upgrade required) to provide additional capabilities as needed.

NIC PLUS Connector Panel

The NIC Plus connector panel contains a variety of auxiliary interfaces as described below. Circuit packs not shown in this view include the OMR (Optical Multirate), NGMR (Next Generation Multirate) and the High Density Ethernet (HDEnet). Click to view their respective connector panels.



	Connector	Description
1	10 Gbps RX and TX	Optical output and input connectors for OC-192 and STM-64 optical rates. The unit supports the following optical connectors: SC, ST, and FC.
2	2.5 Gbps RX and TX	Optical output and input connectors for OC-48 and STM-16 optical rates. The unit supports the following optical connectors: SC, ST, and FC. **Note:** These connectors only appear if the unit is configured with the OC-48/STM-16 hardware.
3	Trigger In and Out	SMA connectors used for trigger operation.

4	Clock Out	SMA connector that allows a trigger output for use of optical OC-192/STM-64 eye diagram analysis.
5	155 Mbps RX and TX	BNC connectors SONET/SDH electrical rates.
6	E1/DS1 RX and TX	BNC connectors for E1 and DS1 electrical rates.
7	52/155/622 Mbps RX and TX	Optical output and input connectors for OC-1, OC-3, OC-12, STM-0, STM-1, and STM-4 optical rates. The unit supports the following optical connectors: SC, ST, and FC.
8	E1/DS1 RX and TX	Bantam connectors for DS1 and E1 electrical rates.
9	52 Mbps RX and TX	BNC connectors for STS-1 and STM-0e signals.
10	E3/DS3 RX and TX	BNC connectors for E3 and DS3 rates.
11	Orderwire	4-pin modular handset jack (A-law and Mu-law). Not intended for direct connection to telecommunications circuits.
12	OSA Input	SC optical input connector for Optical Spectrum Analyzer operation. **Note:** To avoid damaging the unit, do not exceed the maximum input power of -10 dBm.
13	DCC	DataCom Channel. RS-449, DB-15
14	E4 RX and TX	75 ohm unbalanced BNC connectors for E4 rates.
15	Power Cord Connector	AC input connector. Accepts a 3-prong, grounded Type 13 connector.
16	Power Switch	Turns unit on or off (0=off, 1=on).
17	Clock Out	SMA connector that allows a trigger output for use of optical OC-48/STM-16 eye diagram analysis. **Note:** This connector only appears if the unit is configured with the OC-48/STM-16 hardware.
18	Jitter Out	SMA connector for Jitter frequency measurement.
19	Speaker	Speaker for audible touch screen beeps, VF tones, and DS0 drop.
20	Parallel Port	25-pin female connector for parallel printer.
21	BITS/SETS In and Out	Bantam jacks for external timing equipment. BITS clocking supports 1.544 Mhz. SETS clocking

		supports 2.048 Mhz.
22	RS232	9-pin male connector for SCPI RS232 Direct and SCPI RS232 modem.
23	10BaseT	8-pin modular jack for Ethernet connection.
24	USB	USB: Universal Serial Bus v.1.1, type A female (System Controller 2 with Windows XP supports full USB plug and play functionality).
25	PCMCIA (PC Card)	PC Card (PCMCIA): Dual-slot 32-bit PCMCIA CardBus interface for modem, GPIB, or memory storage. Supports two Type I or II or one Type III device, including GPIB interface cards, Flash cards, etc.

Technical Specifications

The following is a list of technical specifications for the NIC Plus.

Physical Characteristics

Operating Temperature: 0° to 40° C @ 85% Relative Humidity

Storage Temperature: -20° to 60° C @ 95% Relative Humidity

Power Requirements: 100–120, 200–240 VAC, 50–60 Hz

Dimensions: 13.7" H x 13.0" W x 7.9" D (348 mm x 330 mm x 201 mm)

Weight: Approximately 20 to 25 pounds, depending on configuration.

New system controller (System Controller 2) with faster processing, more memory, and Windows XP embedded

Auxiliary Interfaces

RS-232: DB-9 male

Parallel Port: DB-25 female

Input/Output Trigger: SMA

10G and 2.5G Clock Out: SMA

10/100BaseT: RJ45

BITS/SETS Clock: Bantam

USB: Universal Serial Bus v.1.1, type A female (System Controller 2 with Windows XP supports full USB plug and play functionality.)

Flash memory — accepts any USB-based flash storage devices, e.g., a USB thumb drive. Also accepts flash memory cards that can be supported by a PCMCIA card adapter, such as a PCMCIA adapter card hosting a Compact Flash (CF) memory card.

PC Card (PCMCIA): Dual-slot 32-bit PCMCIA CardBus interface for modem, GPIB, or memory storage. Supports two Type I or II or one Type III device, including GPIB interface cards. Approved cards are:

33.6K and 56K Modems: Viking, 3Com, Xircom, US Robotics

Flash: SanDisk 48-MB Flash

GPIB: INES

Getting Started

Getting Started

This section includes information to help you to use your system. It is broken into the following topics:

General Information: Contains a broad range of information about Digital Lightwave and our NIC product

Common Row Function Buttons: Contains detailed information about the common function buttons located at the bottom of GUI

Common Tasks: Contains general instructions for performing common tasks, as well as common screen components, and other useful information on how to use the NIC product

Understanding Test Units: Contains information about what a Test Unit is, and how to Lock and Unlock Test Units

Remote Applications: Contains information on how to control the NIC unit via remote software

Troubleshooting: Includes resolutions to common user interface problems

Please click on the hyperlinks above or use the Online Help **Contents** tab to select and open topics.

General Information

General Information Overview

This section contains a broad range of information about Digital Lightwave and our NIC product. For tasks that are protocol processor specific, refer to the appropriate protocol processor section.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view the information in this section.

Agency Approvals

TUV Rheinland of North America is the test laboratory used.

For NIC 2.5G and NIC 10G:

TUV Safety File No. E2073411.01/E2073412.01/E2073414.01/.02

EMC Report File (NIC 10G) P2071068.01

EMC Report File (NIC 2.5G) P2071251.01/.02

CU License No. CU2071103.01

CDRH Accession No. 0021615

For NIC Plus:

TUV Safety File No. E2173656.01/E2173655.01

EMC Report File No. P2171264.01

CE Report File No. E2173659.01

CB Report File No. E2173657.01

CU License No. CU2173522.01

For NAA IV:

TUV Safety File No. E2171119.01/E2171120.01/E2171121.01

EMC Report No. P2171118.01

CU License No. CU2173727

GS License No. S2173726

CDRH Accession No. 9922616

Standards products were tested to:

EMC Standards

EN 55024

EN 55022

EN 61326-1

EN 55011

EN 300386-2 (NAA IV only)

Safety Standards

EN 60950

IEC950/UL1950/IEC60950

CSA 22.2 No. 950

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Digital Lightwave, Inc. reserves the right to revise and improve its product as it sees fit. This publication describes the state of this product at the time of its publication and may not represent the product at all times in the future.

Patent Information

NIC ®, as described in this publication, may be protected by one or more patents on file with the United States Patent Office.

Trademarks

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NIC 2.5G, DCA 425, NAA, NAA-I, NAA-IV, and NPP are trademarks of Digital Lightwave, Inc. for which application has been made.

Technical Support

Our Technical Support representatives are available 24-hours a day to help you.

1-877-929-4357 (Toll-Free in USA, 8:30 am to 5:30 pm EST, Monday through Friday)

+1-727-475-1206 (International, 8:30 am to 5:30 pm EST, Monday through Friday)

+1-727-448-1809 (After Business hours)

+1-727-536-3541 (FAX)

Email

You may also contact our Technical Support reps via email at support@lightwave.com.

Standard Service Hours

8:30 am to 5:30 pm EST, Monday through Friday.

Extended Service Hours

Note: Extended support service is available to all premier accounts free of charge. Ask your sales account manager for details.

A representative from Digital Lightwave Tech Support is available 24 hours a day, 7 days a week. Please call 1-727-448-1809 anytime after normal business hours, and our 24-hour answering service will direct your call to a tech support representative.

Company Address

Digital Lightwave, Inc

5775 Rio Vista Drive

Clearwater, FL 33760, USA

1-800-548-9283 (Main Receptionist)

Return Shipping Instructions

If it is necessary to return the unit, obtain a **Return Material Authorization (RMA)** number and return shipping address by contacting Customer Service between 8:30 A.M. and 5:30 P.M. eastern time, Monday through Friday.

Please enclose a letter that briefly describes the reason for returning the unit and include the following information:

Unit Serial Number

Customer name and shipping address

Customer contact name and telephone number

Secondary customer contact name and telephone number

Customer supplied purchase order number (if applicable)

Shipping with the Original Container

If you have the original shipping container (box):

Place the unit (and letter that describes the reason for the return) into the canvas carry bag, and pack it into the original Digital Lightwave, Inc. shipping container. Do **not** include personal items such as jumper cords or connectors. Digital Lightwave, Inc. will not be responsible for these items. Use the original foam inserts to protect all six sides of the unit.

Securely seal the shipping container and mark **FRAGILE** on the container to ensure careful handling.

Include the RMA number on the outside of the shipping container.

Contact Technical Support for the Repair Department's return shipping address.

Shipping Without the Original Container

If you do not have the original shipping container:

You may purchase a shipping container from Digital Lightwave, or

You can pack the unit (and letter describing the reason for return) into the canvas carry bag, and use the following general instructions to repack the unit using commercially available materials:

Use a strong shipping container, similar to the original unit shipping box. Verify that the substitute container is rated at 350 lbs. per square inch pressure durable.

Make sure that the unit is satisfactorily protected by using a layer of ESD-protected short absorbing foam material. The foam padding must be three to four inches in thickness (70 to 100 mm) and applied to all six sides of the unit to provide adequate protection. Make sure that the canvas bag and unit cannot move or shift within the container.

Securely seal the shipping container and mark **FRAGILE** on the container to ensure careful handling.

Include the RMA number on the outside of the shipping container.

Contact Technical Support for the Repair Department's return shipping address.

When service is complete, your unit will be returned to you postage paid if the shipment is within the United States. You are responsible for paying all shipping charges, duties, taxes, and other charges for products returned to Digital Lightwave, Inc. from any location within or outside of the United States.

Safety Guidelines for Portable Products

The following safety precautions are provided to avoid injury and prevent damage to this product or any products connected to it during normal operation. Only qualified maintenance personnel should perform service procedures.

Use Proper Power Cord: To avoid fire hazard, only use the power cord specified for this instrument. For use in North America, use a power cord (maximum 6-foot length) with a type SJT, 18 AWG, two conductor with ground, IEC 320 connector on one end and a NEMA 5-15 connector on the other end.

For use outside of North America, use an HO5VV-F power cord with a 1-mm^2, two conductor plus ground, IEC 320 connector on one end, and a wall-socket plug on the other end that is certified for use in the country of installation.

The entire cord set must be certified for use in the country of installation.

Avoid electric overload. This unit is designed to be powered from 100–120 and 200–240 VAC, 50–60 Hz. To avoid electric shock, fire hazard, or damage to the instrument, do not apply a higher voltage.

Ground the instrument. The unit is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the instrument, ensure that the product is properly grounded.

Do Not Operate in Hazardous Conditions. To avoid injury or fire hazard, do not operate this instrument in wet, damp, or other hazardous condition. Do not operate this instrument in an explosive atmosphere.

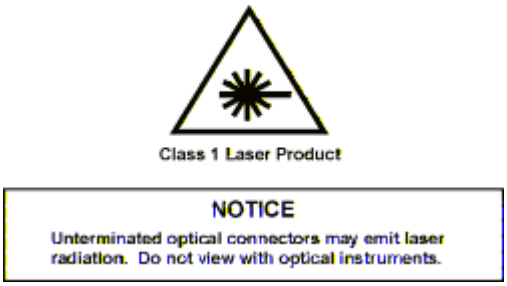
Eye Protection. Users should never stare into unterminated connectors or broken fibers. In addition, fiber cables and interfaces should always be handled as if they were emitting laser light. Always leave protective covers on optical connectors to prevent damage and prevent laser emissions.

Field Service: This equipment is not intended to be serviced in the field. All service is intended to be completed by Digital Lightwave, Inc.

Warning: This is a Class A product per EN55022. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures. Cables used should be less than 3-meters long for compliance with EMC directive.

Environmental Statement: This product may contain lead-based solder materials and a lithium battery for computer support. Please return all Digital Lightwave products to the factory for proper disposal. Operation of this product is not hazardous to the environment.

Laser Safety: The unit contains Class 1 laser devices (21 CFR 1040.10 and 1040.11 Compliant; EN60825-1:1993+A11+A2). Never look into an unterminated fiber. Always place dust caps on the optical ports when fiber is not attached to the optical ports.



Use of controls or adjustments or procedures other than those specified herein may result in hazardous radiation exposure.

CDRH Accession Numbers

NIC10G/NIC 2.5G: 0021615

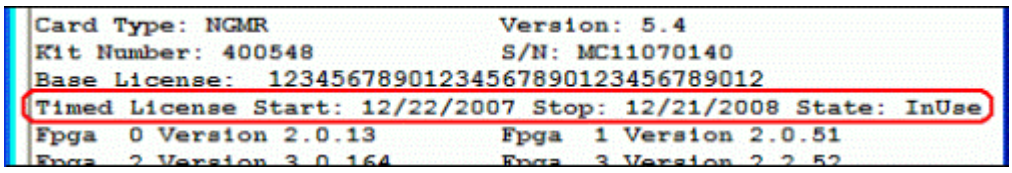
DCA 425: 9922616

Timed Licenses

License-based features on NIC products are normally enabled/disabled by permanent licenses based on a series of license keys, one for each installed module. However, in specific instances, features can be enabled for a limited time period using Timed Licenses.

Timed Licenses contain a start date and end date, and be for as little as one day or last as long as one year.

To determine whether a unit has an active Timed License, see “About this product” under System Tab > Misc. You will see the units permanent “base” licenses and, if applicable, any Timed Licenses.



To enable a Timed License, Digital Lightwave Technical Support will provide a license key along with instructions on how to enter it. Once the unit is rebooted, one of two things will occur:

If the Timed Licensed start date is in the past, the new licensed features will be enabled and the license State will be listed as "**InUse**".

Or

If the Timed Licensed options are scheduled to begin at a future date, the license State will be listed as "**InFuture**". A message displays when the unit boots up to reminding the user about the future Timed Licenses. On the date that the timed license becomes active, the applicable features will become enabled, and the license State will be listed as "**InUse**".

When a NIC unit is rebooted within seven (7) days of Timed Licenses expiration date, a notice will appear on the user interface to inform the user of this fact.

Once the Timed License period is over, the Timed License key will become invalid and the unit will restore the permanent "Base License" key and operate according to the options defined by that key.

A Timed License expires at midnight on the expiration date. At that moment, the circuit pack will revert to its previous base license. If a test is running on the unit prior to midnight, the test will continue to run and results can be viewed, printed, etc. No settings changes can be made. The test can be stopped, but cannot be restarted.

When a unit is rebooted after Timed License expiration, the Timed License information is no longer displayed in the About information.

Upgrade Software

The I/O Settings function allows you to configure your unit with the ability to upgrade your software using Digital Lightwave's Software Upgrade System, which is provided to you on a separate installation CD-ROM or via the DLI Software Upgrade web site.

The unit's FTP service must be enabled to successfully perform an upgrade.

To set up your unit to perform software upgrades using the Software Upgrade System:

Select **System**.

Select **I/O Settings**.

Select the **IP Address** button. A keypad appears.

Using the keypad, enter the IP address of your unit, and select **Enter** when you are done.

IP addresses **192.168.138.0 through 192.168.138.255** are reserved and should not be used. A serious system conflict can occur if these IP addresses are entered.

If you must use an IP address in the range of **192.168.x.y** (where x is not equal to 138), then you **must** set the Subnet Address to **255.255.255.0**.

Select the **Subnet Address** button. A keypad appears.

Using the keypad, enter the Subnet address, and select **Enter** when you are done.

Select the **Router** button. A keypad appears.

Using the keypad, enter the router address, and select **Enter** when you are done.

Power the unit off and then on again so that these changes take affect.

The unit is now set up to perform software upgrades using the Software Upgrade System.

Information on Digital Lightwave's Software Upgrade System is available through the Help button located on the Software Upgrade System. The application is available via CD-ROM or the DLI Software Upgrade web site.

Warranty and Repair

Limited Warranty for Equipment

Seller warrants to the first purchaser of this Digital Lightwave, Inc. product that all components of the product will function in accordance with Seller's published specifications under normal conditions of use for a period of three (3) years from the date of shipment. Seller warrants to the first purchaser of this Digital Lightwave, Inc. product that the laser transmitter unit will function in accordance with Seller's published specifications under normal conditions of use for a period of three (3) years from the date of shipment. During the warranty period, Seller's liability is expressly limited, at Seller's election, to repairing or replacing the product or component not complying with this Limited warranty as determined by

Seller's inspection, or to the repayment of, or crediting the first purchaser with, an amount equal to the purchase price of the product, whether the first purchaser's claims are for breach of warranty or negligence. The foregoing remedy as provided herein shall be the sole and exclusive remedy of the first purchaser.

Limited Warranty for Software and Firmware

Seller warrants to the first purchaser of this Digital Lightwave, Inc. product that each item of Software and Firmware included in the Product, in its unaltered form, will conform substantially to the then-current functional specifications for three (3) years from its installation date, provided such Software or Firmware is used in a manner consistent with Seller's applicable minimum equipment and software or firmware configuration specifications. Seller will make reasonable efforts to correct any errors reflecting significant deviations from the functional specifications as are reported by first purchaser to Seller during such warranty period. Because not all errors in Software or Firmware can or need be corrected, Seller does not warrant the all Software or Firmware defects will be corrected. Similarly, Seller does not warrant that the Software or Firmware will meet first purchaser's requirements or that the Software or Firmware will operate in combinations selected for use by first purchaser.

Limitations of all Warranties

All Equipment, Software and Firmware Limited Warranties apply only to the first purchaser of this Digital Lightwave, Inc. product and are not transferable without the express written permission of Seller. Any claim under any of these Limited Warranties shall be deemed waived unless submitted to Seller in writing within one hundred eighty (180) days from the date the first purchaser discovered, or should have discovered, the facts giving rise to the claim.

The foregoing Limited Warranties shall not apply to problems caused by or resulting from improper or inadequate maintenance, acts or omissions of first purchaser, first purchaser supplied software or interfacing, unauthorized modification or misuse, breaking the seals or otherwise attempting to open the plastic and/or metal housing, operation outside of the environment specifications for the products, improper site preparation or maintenance. Seller is not responsible for any damages caused by any person or entity through misuse, neglect or accident.

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Common Tasks

Common Tasks Overview

This section lists common tasks that are performed the same for each protocol processor mode. For tasks that are protocol processor specific, refer to the appropriate protocol processor section.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view the information in this section.

Differences Between Multi-Rate Circuit Packs

NIC test sets can be equipped with two different Multi-Rate Circuit Packs, each are capable of testing SONET, SDH, and OTN interface rates.

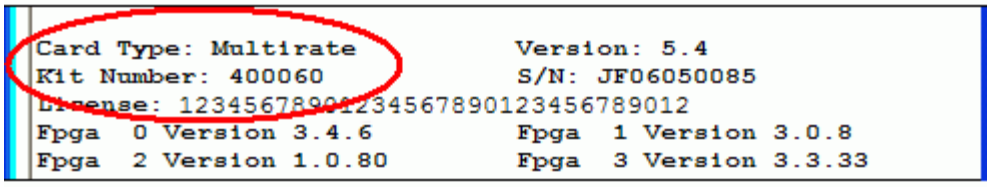
The legacy **OMR** (**Optical Multi-Rate**) circuit pack was the first Digital Lightwave module to offer SONET/SDH Interface testing from OC-1/STM-0 up to OC-192/STM-64, as well as OTU-1 and OTU-2 OTN testing.

The **NGMR** (**Next Generation Multi-Rate**) circuit pack, which succeeds the OMR circuit pack, can also offer the same SONET, SDH, and OTN interface rates offered on the OMR Circuit Pack. However, the NGMR circuit pack can also be licensed for some additional features not available on the OMR circuit pack such as VCAT, LCAS, GFP, 1G and 10G LAN, 10G LAN or G.709 (OTN), ODTU-12 Add/Drop multiplexing, as well as hot-swappable SFP and XFP lasers.

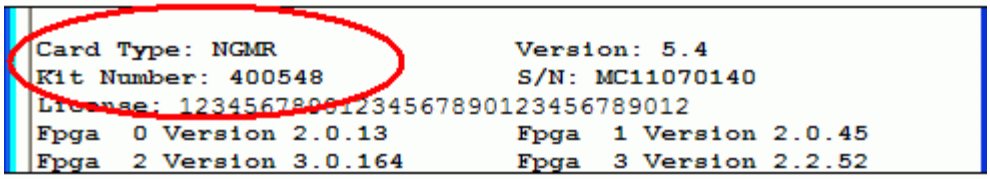
There are two straight-forward ways for you to know which Multi-Rate Circuit Pack your NIC unit is equipped with; looking up the Card Type, and looking at the connector panel.

Card Type: Select the **System tab**, then select the **About this product** from the Misc screen. Scroll down until you see a Card Type labelled NGMR or Multirate (OMR).

Optical Multirate (OMR) Card Type and Kit Number

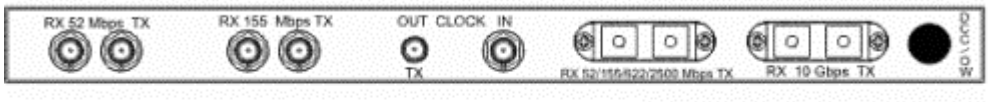


Next Generation (NGMR) Card Type and Kit Number

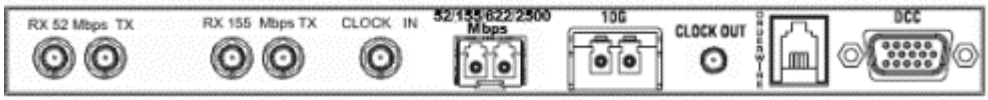


Connector Panel: Looking down on top of the NIC unit, find the multi-rate connector panel that is best described below.

Optical Multirate (OMR) Connector Panel



Next Generation (NGMR) Connector Panel



Fiber-Optic Cleaning Procedure

With fiber optics, the tolerance to dirt is near zero. Oils, greases, airborne particles of dust, lint, and other debris are all very harmful to fiber-optic cables. They can scratch and damage fiber-optic connectors if not removed. Not only can scratches and debris harm the connectors, but they also can jeopardize the integrity and accuracy of the optical signal.

The ferrule end faces of fiber optic patch cords and receptacle connectors are some of the most critical components for fiber optical networks. *Prior to inserting any patch cord into the test equipment's receptacle connector, clean and examine the patch cord's and the receptacle's connectors to verify the quality of each.*

Inspect the Ferrule End Face of a Patch Cord Connector

WARNING: Never look into the end of a fiber, through a microscope or your bare eye, if the other end is connected to an operating piece of network or test equipment!

Prior to inserting any patch cord into the microscope, verify that the other end is not connected to an operating piece of network equipment.

Visually examine the end face of the connector using a fiber-optic microscope.

If the end face of the connector is unacceptable, properly clean the connector prior to use.

If the end faces are acceptable, then use the fiber-optical patch cord as intended. If the end faces are not acceptable, then clean the connectors and reexamine them again.

To Clean a Patch Cord Connector Using Lint-Free Tissue and Alcohol

Using the pressurized canned air, blow away any dust particles that may be on the exterior surface of the connector, particularly the sides and end face of the ferrule. Hold the can approximately two inches from the surface to be cleaned and apply three to five short blasts of air.

Next, using an Optic Prep (or any lens-grade lint-free tissue moistened with isopropyl alcohol), gently and slowly slide the tissue across the tip of the ferrule end face in one sweeping move.

Repeat the last step again using a clean section of the tissue.

WARNING: Only isopropyl alcohol should be used because some solvents might attack epoxy.

Performing Periodic Maintenance on the Patch Cord Connector Using a CLETOP style cleaner

CLETOP cleaners provide a thorough and easy method of cleaning optical connectors. It uses a reel-type cassette of dry, woven polyester, alcohol-free, cloth film. It is a fast and reliable remover of dirt, lint, and debris from the ferrule end face of the optical connector. This cleaner should be used on the patch cord periodically if the patch cord is frequently inserted and removed from the test equipment.

To clean the ferrule end face of the connector, advance a clean portion of the reel by depressing the side lever with your thumb.

Gently stroke the tip of the connector along the exposed film in the manner according to the directions on the label.

While sliding the connector along the blue film, slightly twist the connector between your thumb and finger to assure a thorough cleaning.

If the end-face of the patch cord is damaged or scratched beyond cleaning or repair, replace the patch cord with a new one whose end faces are acceptable.

Inspect the connector receptacle of the network test equipment.

WARNING: Always turn the test equipment's laser OFF before inserting the video micro-scope into the receptacle, or looking directly into the receptacle of the test equipment!

Prior to inserting the video microscope, verify that either the unit or its laser is turned OFF.

Using the pressurized canned air, blow away any dust particles that may be on the interior surface of the receptacle. If dirt is present inside the receptacle, it can scratch the lens of the video microscope, or the end-face of the connector.

Insert the video microscope into the receptacle. Using the monitor, visually examine the receptacle's end face of the connector.

If the receptacle's end face has a build up of dust, dirt, or any debris, clean the receptacle according to the next procedure.

To Clean a Connector Receptacle (also referred to as a bulkhead or adapter)

Using the pressurized canned air, blow away any dust particles that may be on the interior surface of the receptacle, particularly the inside walls of the alignment sleeve. Hold the can approximately two inches from the receptacle to be cleaned and apply three to five short blasts of air.

Moisten the end of a 2.5-mm foam swab with isopropyl alcohol, and insert it into one side of the receptacle. Move the swab in and out two or three times and then remove it.

Moisten the end of a NEW swab with alcohol, and insert it into the open side of the receptacle. Rotate the swab back and forth 90-degrees twice and then remove it.

Dry the inside of the receptacle by holding the pressurized canned air approximately two inches from the end of the receptacle and applying three to five short blasts of air.

Only use foam swabs; cotton swabs leave particles and threads behind.

Upgrading Test Set Software from CD

The instructions outlined below provide a quick set of steps for upgrading your NIC/NAA test set and troubleshooting a cancelled upgrade. For more in-depth information, see the NIC/NAA Software Upgrade Online Help.

Warning: You must have the **Java® Runtime Environment (JRE)** installed on your PC before proceeding with the upgrade.

To upgrade the test set software from the CD:

Turn the NIC test set **On**.

From the **System** tab, select **I/O Settings**.

If the NIC test set is not on the network, use a cross-over cable to connect it to the PC.

Insert the **Software and Remote CD**, which you received with your NIC test set, into your computer's CD-ROM drive. The CD should automatically open the Remote NIC Software window.

From the **Software** tab, select **Upgrade NIC Software**.

Select **Install**. A DOS prompt window displays and then the Digital Lightwave's Software Upgrade dialog box appears. No action is required for the DOS prompt window.

From the Software Upgrade dialog box, select **Device Logon**. The Device Logon dialog box appears.

In the **New IP Address** box, type the IP Address for the NIC test set that is being upgraded. You can find the IP Address on the NIC test set's I/O screen.

Select **Add IP to List**. The address appears in the IP Address List box.

Up to 32 device IP Addresses can be stored in the IP Address List box.

Select the **IP Address** and click the > button. The IP Address moves to the IP Addresses Selected box.

Warning: Do not attempt to upgrade more than one test unit (device) at a time. Devices moved into the IP Addresses Selected box are scheduled for upgrade. Therefore, select only one device from the IP Address List box before proceeding to the next step.

Select **OK**. The upgrade software connects to the NIC test set and then the Scheduled Upgrades Notice dialog box appears.

Select **OK**. The notice box closes and you are returned to the Software Upgrade dialog box.

Select **Upgrade**. The Upgrade Activity Status dialog box appears and then the Upgrade Alert! dialog box.

This automatically upgrades all circuit packs in the NIC test set. The upgrade process may take several minutes.

Select **OK**.

Toggle the test set's On/Off switch to **Off**.

Warning: Leave the test set off for a minimum of 10 seconds before rebooting it.

Turn the test set **On**.

From the NIC Common Function buttons, select **Restore**. The Select Type of Restore dialog box appears.

Select **Factory Defaults**.

This completes the software upgrade.

Test - RTD (Round-Trip Delay)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

State: Starts and stops round-trip delay mode.

Single Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in frame counts and milliseconds. Frame counts indicates the number of frames received before the AIS frame is received by the unit. Milliseconds indicates how long it took for the AIS frame to travel out and return to the unit.

Continuous Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and continuously transmitted through your network. The current frame count and duration appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.

Stop Round-Trip Delay - Stops round-trip delay activity. The State returns to Inactive.

Round Trip Delay Time (milliSec): Indicates the duration in seconds that it took for the known frame to return to the unit.

Round Trip Delay Time (Frames): Indicates the number of frames received during the measurement.

Consecutive Good Time Required: This function allows you to enter the duration (in milliseconds) of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 0.125 to 2047.875 milliseconds and is entered using a keypad.

Consecutive Good Frames Required: This function allows you to enter the number of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 1 to 16383 frames and is entered using a keypad.

For more information about round-trip delay, select *Round-Trip Delay* in the Common Tasks section of the online help.

Measuring Service Disruption Activity

The NIC unit can measure service disruption switching intervals in your network and can be configured to monitor for a specific event that will cause a service disruption switch. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to an service disruption event and switch to a backup path.

The service disruption measurements show a granular accuracy of 1 frame duration.

For SONET and SDH networks, the granular accuracy is: 0.125 ms (125 µs)

For OTU 1 networks, the granular accuracy is: 0.049 ms (49 µs)

For OTU 2 networks, the granular accuracy is: 0.012 ms (12 µs)

For Ethernet networks, the granular accuracy is: 0.1 ms (100 µs).

To measure Service Disruption activity:

Select a protocol processor.

Select the **Test** button.

Select the **Service Disruptn** button. The Service Disruption measurement screen appears.

From **Protection Switch Criteria**, select the alarms, errors, and patterns to use for triggering a service disruption.

The measurement parameters that appear on the Service Disruption screen are dependant upon the protocol. A description of the possible parameters is provided below. Selecting the parameter button displays a key pad, from which you will enter the desired setting.

Consecutive Good Time Required: This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The value is entered using a keypad.

Consecutive Good Frames Required: This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The value is entered using a keypad.

From **Action**, select **State.** The Select APS Action dialog box appears.

Choose one of the following:

Single APS - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

Continuous APS - Constantly monitors for service disruption events, and updates the seconds and frames reported.

The unit will immediately begin monitoring the incoming signal for an event. If it occurs, the protection switch state and time will appear in both Protection Switch MilliSecs and Protection Switch Frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements.

A history of the event is recorded in the History Recent Milli Seconds and History Recent Frames fields. A complete summary of events can be viewed by selecting the System tab and choosing Service Disruption.

To stop monitoring Service Disruption measurement activity:

From **Action**, select **State.** The Select APS Action dialog box appears.

Select **Stop APS**.

To view the Service Disruption Summary:

Select the **System** tab.

Select the **Service Disruption** button. The Service Disruption Summary screen appears.

Changing the Protocol Mode

The unit can be configured to operate in SONET, SDH, PDH, or DS3/DS1 networks.

The options that appear on this screen are determined by your hardware configuration.

Changing the Protocol Mode from the System > Misc screen will globally apply the Protocol mode change to all Test Units in the NIC unit.

You must have all SONET/SDH and PDH/DSn processors locked.

Select the **System** tab and choose **Misc**.

Select the **Change Protocol Mode** button.

The following menu options appear:

Change Protocol Mode **SONET** Change Protocol Mode **SDH**	These options appear if your unit contains one or more SONET/SDH board, but no PDH board

Change Protocol Mode **DS1/DS3** Change Protocol Mode **E1/DS3** Change Protocol Mode **E1/E3**	These options appear if your unit contains one or more PDH board, but no SONET/SDH board
Change Protocol Mode **SDH/E1/E3** Change Protocol Mode **SDH/E1/DS3** Change Protocol Mode **SDH/DS1/DS3** Change Protocol Mode **SONET/DS1/DS3** Change Protocol Mode **SONET/E1/DS3**	These options appear if your unit contains one or more SONET/SDH board, and one or more PDH board

Select the desired protocol mode. The protocol tabs and settings will updated to reflect the selected mode.

Restoring Factory Defaults

This function will reconfigure all of the protocol processor's settings back to the original Factory Defaults, for the selected Protocol Mode.

The options that appear on this screen are determined by your hardware configuration.

Restoring the Factory Defaults from the System > Misc screen will globally apply to all protocol processors in the NIC unit.

You must have all protocol processors locked.

Select the **System** tab and choose **Misc**.

Select the **Restore To Factory Defaults** button.

The following menu options appear:

Restore To Factory Default **SONET** Restore To Factory Default **SDH**	These options appear if your unit contains one or more SONET/SDH board, but no PDH board
Restore To Factory Default **DS1/DS3** Restore To Factory Default **E1/DS3** Restore To Factory Default **E1/E3**	These options appear if your unit contains one or more PDH board, but no SONET/SDH board
Restore To Factory Default **SDH/E1/E3** Restore To Factory Default **SDH/E1/DS3** Restore To Factory Default **SDH/DS1/DS3** Restore To Factory Default **SONET/DS1/DS3** Restore To Factory Default **SONET/E1/DS3**	These options appear if your unit contains one or more SONET/SDH board, and one or more PDH board

Select the desired protocol mode. The protocol tabs and settings will updated to reflect the selected mode, and all of the protocol settings will revert back to their factory assigned default values.

Starting a Test

The Duration and Action After Duration functions determine how long a test runs and what activities occur at the end of the test.

To start a test:

Select the protocol processor that is running the test.

Select **Test**. The Duration and Action After Duration functions appear under **SET 1**.

Select **Duration**. The Select Duration of a Test dialog box appears.

Select how long you want the test to run.

Select **Action After Duration**. The Select Action After Test dialog box appears.

Choose the desired action that will occur at the end of the test. When you select **Repeat Actions**, the Select Repeat Action after Test dialog box appears. When you select **Realtime Actions**, the Select Realtime Actions after Test dialog box appears.

Real-time test reporting is only available locally (from the touch screen) on portable test sets.

To stop a test before the test duration expires:

Select the **Stop** common function button. All statistics and events logged and reported by the Performance Monitoring and Results functions stop. In addition, the Elapsed Time and Duration counts stop.

To restart a test:

Select the **Restart** common function button. The test and statistics clear and the Elapsed Time counter restarts at zero.

To pause a test:

Select **Pause Test**. When Pause is selected, the system will stop collecting data, but the elapsed time counter will continue.

To resume a paused test:

Select **Resume Test**.

Inserting Multiple Errors

Various errors can be transmitted by the system. One reason for transmitting errors is to determine if the receiving equipment can detect an error in the incoming signal. Inserting multiple errors not only allows you to initiate a continuous test, but it also allows you to set up a specific test duration and action to take when the duration ends. For example, you could set the test duration to

run for five minutes, the action after test to repeat the test, and print the statistics to a file or printer.

To insert multiple errors:

Select a protocol processor mode.

Select **Transmit** and choose **Error Alarm**.

Select **Error to Insert**. The Select Error to Insert window appears.

Select an error.

Select **Error Insert Rate**. The Select Error Insert Rate window appears.

Select an error rate. The system starts transmitting errors.

Selecting **None** will stop the error transmission.

To set up duration and after test actions:

Choose **Test**. The Test window appears, which provides the Duration and Action After Test options.

Select **Duration** and choose how long you want to run the test for.

Select **Action After Duration** button and choose the desired actions.

Inserting Alarms

The system can transmit alarms to simulate various alarm conditions. One reason for transmitting alarms is to determine if the receiving equipment can detect an alarm in the incoming signal.

To insert alarms:

Select a protocol processor**.**

Select **Transmit** and choose **Error Alarm**.

Select **Alarm Generated**. The Select Alarm to Insert window appears.

Select an alarm. The system starts transmitting alarms.

To stop alarm transmission:

Select the protocol processor mode.

Select **Transmit** and choose **Error Alarm**.

Select **Alarm Generated**. The Select Alarm to Insert window appears.

Select **Off**. Alarm transmission stops.

Making Pointer Adjustments

The beginning of a SONET or SDH payload is identified by a **Pointer**. It consists of the H1 and H2 Pointer bytes. You can stress a network by manually adjusting the Pointer using the Increment and Decrement Pointer buttons. By performing this task, you can stress your SONET or SDH equipment to verify if it can tolerate Pointer adjustments, and how your equipment will react and report these adjustments.

There are several Pointer parameters that must be configured before making a positive or negative Pointer adjustment.

To make Pointer adjustments:

Select a protocol processor mode.

Select **Transmit** and choose **PTR**.

Configure the Pointer Adjustment parameters. For example,

Select **NDF Flag** to allow a New Data Flag to be set when a new Pointer value has been transmitted.

Select **Pointer Value** to change the Pointer value from 0 to 782.

Select **Frequency Offset** to increase or decrease the speed of the Pointer adjustments.

Select **Pointer Action** to select the type of Pointer activity that occurs when the Increment Pointer or Decrement Pointer buttons are selected.

Use **Burst Count** to set the number of Pointer location movements (ranging from 1 to 8) to occur when the **Inc Pointer** or **Dec Pointer** buttons are pressed.

Select **INC Pointer** to make a positive pointer adjustment, or select **DEC Pointer** to make a negative pointer adjustment.

These buttons generate and control Pointer movements within the transmitted signal. You can stress test a network by changing pointers or introducing an offset that continuously adjusts the STS or AU Pointer.

Configuring APS (K1 and K2) Commands

The following only applies to SONET and SDH protocol processors.

Automatic Protection Switching (APS) is a function that allows an LTE to switch to a backup (or protection) channel in case errors or failures occur on the working channel. APS commands can be configured for either Linear- or Ring-based SONET and SDH networks and are transmitted using the K1 and K2 bytes of the Line Overhead.

You can test your network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response by configuring the K1 and K2 bytes.

You can create up to 16 different K1 and K2 byte configurations (known as byte sequences) to measure and stress your equipment's APS switching capabilities.

To configure K1 and K2 byte values:

Select a protocol processor mode.

Select the **Transmit** button.

Select the **APS** button. The initial APS screen appears containing a table of the K1 and K2 byte sequences that can be transmitted. A total of 16 K1 and K2 byte sequences can appear in the table.

Select a byte sequence button (for example,

).

The **Apply Maintenance to Entry** screen appears. It contains functions used to configure and set the measurement criteria of the K1 and K2 bytes.

Use the **APS Mode** function to configure APS commands for **Linear** protection switching mode or **Ring** APS signaling mode.

Edit the K1 byte.

The K1 byte is a request for switch action. There are three functions that allow you to edit the K1 byte:

Use the **K1 Full Byte** function to set all eight bits of the K1 byte at once.

Use the **K1 Bits 1-4** function to set the first four bits of the K1 byte.

Use the **K1 Bits 5-8** function to set the last four bits of the K1 byte.

Edit the K2 byte.

The K2 byte provides additional information about SONET network architecture and alarm conditions. There are four functions that allow you to edit the K2 byte:

Use the **K2 Full Byte** function to set all eight bits of the K2 byte at once.

Use the **K2 Bits 1-4** function to set the first four bits of the K2 byte.

Use the **K2 Bit 5 (provisioned)** function to set the fifth bit of the K2 byte.

Use the **K2 Bits 6-8** function to set the last three bits of the K2 byte.

Select **Duration in Frames** to determine how many frames will be transmitted containing the newly configured K1 and K2 bytes.

Select **Update**. The initial APS screen appears on the touch screen.

To configure additional K1 and K2 bytes, repeat steps 3-8 as described above. Otherwise, proceed to the next section to transmit K1 and K2 bytes.

To transmit K1 and K2 bytes:

Make sure that K1 and K2 byte sequences are configured as described above.

Select **Start** to transmit the K1 and K2 bytes.

To stop transmitting K1 and K2 bytes:

Select a protocol processor mode.

Select the **Transmit** button.

Select the **APS** button. The initial APS screen appears.

Select **Stop**.

Related Topic:

Decoding APS (K1 and K2) Values

Decoding APS (K1 and K2) Values

The APS function monitors incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 15 byte sequences can appear on the screen. You can choose to view APS activity in either K1 and K2 Hex values or decode them.

To view received K1 and K2 values:

Select the **Results** button.

Select **APS** from the tabs along the left side of the Results screen.

Select **APS View Mode**, and choose whether to decode the K1/K2 byte's value in either **Linear or Ring** Mode.

From the APS Results screen, you can decode a **specific** K1/K2 byte's value or decode the values for **all** K1/K2 bytes.

To decode a specific K1/K2 byte value:

- Select **APS Summary**.

The results table displays the K1 byte HEX value, K2 byte HEX value, number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

Select the desired **Item** row. The APS Decode dialog box appears with the K1 and K2 byte values decoded.

You can scroll through the Items by selecting the **Prev** and **Next** buttons at the bottom of the APS Decode dialog box. Choose **Cancel** when finished.

To decode all K1/K2 byte values:

- Select **APS Decode**.

  The results table splits into two horizontal tables: the top table displaying K1 byte results; the bottom table displaying K2 byte results.

  The K1 table decodes the values for bits 1-4 and bits 5-8. The K2 table decodes the values for bits 1-4, bit 5, and bits 6-8.

  Also displayed in the tables are the number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

Adding/Dropping SONET/SDH and PDH Signals

The NIC allows you to set up single, or multiple test sets, and provides multiplexing and demultiplexing functionality for signal levels. Using the NIC's Preset mode, you can add or drop a signal from optical/electrical SDH and SONET, or electrical PDH into another protocol processor's signal levels in order to monitor for error and alarm conditions. For additional information on test units see Understanding Test Units.

Important: When the NIC/NAA has multiple test units you must first select the desired test unit protocol tab before selecting the Presets button. The configuration options available through the Preset Selection screen are dependent on the test set that is selected.

Select the protocol processor.

Select **Presets**. The Apply Presets dialog box appears. Several examples are provided below.

To add (multiplex) an E1 into an E3 signal:

Select the **Interface** button and choose **E3**.

Select the **Configuration** button and choose either **E1 #1 A/D** or **E1 #2 A/D**.

Select **Apply**.

Both E1#1 and E1#2 signals can simultaneously be added to the E3 interface by pressing Presets and selecting E3 from

the Interface menu again, and then choose the other E1 processor from the Configuration menu.

The same example also applies to adding a **DS1** into a **DS3** signal, depending on the current Protocol Mode.

To add an E1 signal into an E3 signal, and then into an SDH signal:

Select the **Interface** button and choose SDH interface rate such as **STM-64**.

Select the **Configuration** button and choose **E3**.

Select the **Configuration** button **again** and choose either **E1 #1 A/D** or **E1 #2 A/D**.

The same example also applies to adding a DS1 into a DS3 and then into a SONET signal, depending on the current Protocol Mode.

To add a E1 #2 A/D LI (Line Interface) into an E3 signal:

Select the **Interface** button and choose **E3**.

Select the **Configuration** button and choose **E1 #2 A/D LI.**

Select **Apply**.

The Line Interface Add/Drop setting transmits the de-multiplexed signal from a higher interface rate out to the lower interface's transmit port, rather than just terminating the demultiplexed signal. This also multiplexes the received lower interface rate up to and out of the higher interface's transmit port.

For this example, the E3 signal is received and the specified E1 channel is demultiplexed down to the E1 processor and transmitted out to the E1#2 Interface port. Also the received E1#2 signal gets multiplexed up to the E3 processor, and is transmitted out the E3 transmit interface port (along with other background E1 signals generated by the E3 processor).

The unit is configured for Add/Drop mode. Go to the next section to specify different frames and patterns for the added signal.

If you make a mistake while creating connections, simply select **Interface** and reenter the interface value. This action erases any previously entered

interface or configuration values.

Pressing the **All to Tx/Rx** button will sever all Add/Drop connections and force each protocol processors to use their own Transmit and Receive connectors for sending and receiving data.

Specify Frames and Patterns for the Added Signal

If you have added an STM-4 signal into an STM-16 signal:

Select **STM-4**.

Select **Transmit**.

Select **SET 2**. The Mapping options appears.

Select the options on the screen to specify the **Foreground** and **Background** AU and TUG patterns and HP and LP signal labels to be added to the signal.

If you have added either E1#1 and/or E1#2 signals to an E3 signal:

Select **E3**.

Select **Transmit**.

Select **SET 2**. The E3 Transmit Mapping screen appears.

Select **E1#1 Channel Inserted** and select from channels 1 through 16 for E1 #1.

Select **E1#2 Channel Inserted** and select from channels 1 through 16 for E1 #2.

Select **E1 Background Frame** and select the background frame (Unframed, PCM30, PCM30CRC, PCM31, PCM31CRC) for the specified channel.

Select **E1 Background Pattern** and select up to a 32-bit background pattern for the specified channel.

Printer Port Configuration

The unit supports both parallel and serial printers.

For Parallel Printing:

Attach a parallel printer cable (with a 25-pin male connector on one end) to the unit's **Parallel Port** connector. This is a DB-25 female connector.

For Serial Printing:

Important: The following steps must be performed from the NIC unit touch screen. "Printer" is not an available Serial port assignment from the Remote Control Application.

Attach a serial printer cable (with a 9-pin female connector on one end) to the unit's **RS-232** port connector. This is a DB-9 male connector.

From the **System** tab, select **I/O Settings**.

Select the **Serial** button.

Select the **Port Assignment** button and choose **Printer**.

Printing or Viewing Saved Files

While running tests, you have the option to save the information to a file. The instructions below tell you where and how to print or view a saved file.

Important: Files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC. The NIC unit saves the files to its default D:\DLI... drive on the test unit.

To print or view a saved file:

From the **System** tab, select **File Services**.

Select a file from the **Disk** directory box. The desired report may display in the main Disk directory, or it may be stored in one of the folders in the directory. Folder names are enclosed in brackets **[foldername]**. To return to the main Disk directory after opening a folder, select **[. .]** or the **Disk** button.

Important: Real-time reports generated from the NIC unit touch-screen, using the Action after Duration function, are automatically stored in the [APP] folder. Select the folder to display those reports.

The following is a list of file extension used for files generated from the Print Report, Graph, or Action after Duration functions:

.aps - APS Report

.evt - Event Report

.perf - Performance Report

.real - Real-time Test Report (Stored in [APP} folder on NIC unit.)

.rep - Graph Report, BERT Analysis, RFC Thru Put Analysis

.set - Settings Report

.stat - Results Report

.statE - Event Report

.grp - Graph (This is not a text file. It can only be viewed as a graph by selecting **Results,** pointing to **Graph** and choosing the **Replay Graphs** button.)

Choose one of the following

To **Print** the file:

Select **Print**. A standard Print dialog box appears.

If you want to print a report directly from the NIC unit, make sure that a printer is attached to the unit's parallel or serial port.

Select the printer **Name** and choose **OK**.

To **View** the file:

Select **View**. The View File window appears.

Select **Exit** to close the window.

Printing a Report

Selecting the Print Report Common Function Button while on the allows you to print statistic and event reports to a printer or file.

Select **Print Report**. The Report Setup menu appears.

Choose one of the following:

From **Destination Printer**, select one or multiple reports to print directly to a printer. If printing a report from the NIC unit, make sure that a printer is attached to the unit's parallel or serial port. The following reports are available:

- **Settings** - (.set extension) Reports current values for all Transmit and Receive Set functions.

- **Statistics** - (.stat extension) Reports results for the Scan, Errors, Alarms, and PTR.

- **Events** - (.evt extension) Reports a detailed summary of events, such as alarms, errors, and pointer activity. This report includes the event, the number of events logged, the start and stop time of the event, and the duration of the event.

- **APS** - (.aps extension) Reports the results of the K1 and K2 byte sequences received by the unit.

- **Performance** - (.perf extension) Reports Performance Monitor results.

From **Destination File**, choose one or multiple reports to print to a file. The File Browser dialog box appears.

The **Comma Delimiter** option can be applied to the Settings To File and Statistics To File reports.

- Enter a filename and select **OK**.

Important: Files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC. The NIC unit saves the files to its default D:\DLI... drive on the test unit.

Click the **Input** button to enter any User Comments that you wish to appear in the printed or saved report file. Press the **Clear** button to clear the User Comments.

Select **OK**.

For information on retrieving saved files, see Print or View Saved Files.

Print a Graph Report

Select the protocol processor running the test for which you want to print the graph.

From the **Results** tab, select **Graph**.

Select the Graph screen's **Print Report** command button. The Report Setup menu appears.

Choose one of the following:

From **Destination Printer**, select **Graphs** to print reports to a printer.

If printing a report from the NIC unit, make sure that a printer is attached to the unit's parallel or serial port.

From **Destination File**, select **Graphs to File** to print reports to a file. The File Browser dialog box appears.

- Enter a filename and select **OK**. The file extension for a graph is .rep.

Important: Files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC. The NIC unit saves the files to its default D:\DLI... drive on the test unit.

Select **OK**.

For information on retrieving a graph saved to file, see Print or View Saved Files.

Recording in the Event Log

The Event Log is a table that displays events recorded by the unit. A scroll bar is available, allowing you to scroll up and down to view an extended history.

To use the Event Log:

Select a protocol processor tab.

Select the **Results** button.

Select **Event**. As events occur (such as alarms, errors, or Pointer activity) they appear and continuously scroll in the table.

Events display in a ascending order from the most recent event to the oldest event. The Descending button indicates that events appear in

descending order. (This button switches between descending event order appearance and ascending event order appearance. The current label of the button indicates the event order.)

To begin a new test, select the **Restart** function button located at the bottom of the touch screen. This will clear all history of previous events, and resets the **Start Test** Date and Time stamp to current time. You now have a reference point as to when new events occur, in comparison to when the test began.

Select **Pause**, to stop the scrolling action and then use the scroll bar to view events. Select **Resume** to restart the event log.

To display events in an ascending order, select **Descending**. The button changes to Ascending and the events appear from the oldest event to the most recent event.

Select **Resume**, to continue Event Log reporting.

If the test has completed a Timed Test, or if the **Stop** function button located at the bottom of the touch screen was pressed, then the **End Test** Date and Time will also be logged.

Select the **Print Report** function button located at the bottom of the touch screen to **Print** or **Save** (.evt extension) the Event Log report.

File Services

This function provides file management of saved reports. It allows you to:

Printing Saved Files

Viewing Save Files

Uploading Files

Downloading Files

Renaming Files

Deleting Files

Deleting Directories

Create a new directory for file storage

FTP files

Pausing/Resuming a Test

To pause a test:

Select **Test** and choose **Set 1**.

Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.

The events occurring while in pause mode will be recorded in the Event Log.

LED Quick Status Area

The left side of the screen provides an at-a-glance view of the current protocol processor's LEDs and Laser ON/Off button. The LEDs report incoming error and alarm activity, current status, and event history.

This portion of the screen allows you to quickly scan and target potential problem areas. It is broken down into the following areas:

Laser On/Off button: Enables you to turn the laser on and off. (only for optical interfaces)

TX: Displays the transmit interface configuration, such as rate, wavelength, framing, and/or duplex depending on the specific protocol processor

RX: Displays the receive interface configuration, such as optical power level or framing depending on the specific protocol processor

E/A: Displays any Errors or Alarms configured to be inserted into the transmitted signal

Test Paused: This LED will turn Red if the **Pause Test** button has been selected. Any errors or alarms received while the test is paused will not be recorded in any of the Results statistics.

All Tests: Provides a shortcut to the **All Test Status** screen (located under the System tab) which shows a general status summary of all circuit packs installed in the unit.

LEDs: The LEDs that appear are dependent on which protocol processor is selected.

These visual cues help to narrow the focus if problems are detected on the incoming protocol processors' signals and provide a starting point when trying to diagnose problems.

There are two ways to view LEDs from the screen: the **Quick Status LEDs**, which are located on the left side of the screen, and the **Large LEDS** side tab under Results.

The following tables describe what is indicated by the LED color.

For LED descriptions for a specific protocol processor, go to the appropriate protocol processor section of the online help and navigate to **Screen Functions and Definitions** > **LEDs**.

Quick Status LEDs Color Description

If the LED is ...	**Then this indicates ...**
Green with white text	Normal operation. The LED is used as a status indicator.
White with white text	Normal operation, no errors or alarms. The LED is used as an error and alarm indicator.
Red with **red** text	An error or alarm event is in progress. The LED is used as an error and alarm indicator.
White with **red** text	An error or alarm event was detected, but is now cleared. The text serves as a history indicator.

Large LED Tab Color Description

If the LED color is ...	**Then this indicates ...**
Green with **black** text	The specific function is active and OK.
Red with **red** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or

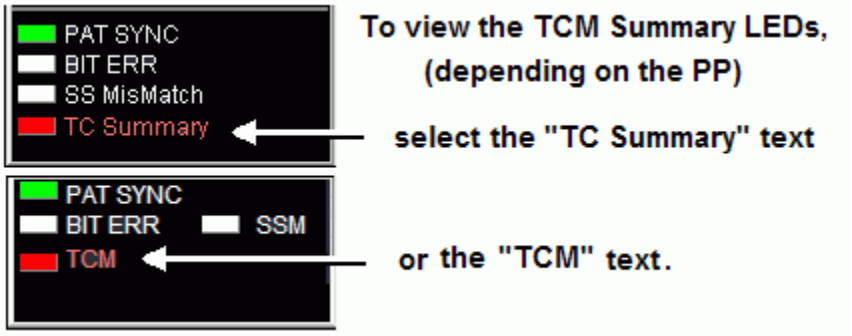
	alarm event. This event is cleared by selecting **Restart**.
White with **black** text	No activity from this specific function.

Some LEDs such as TCM or TC Summary, or VCAT or VCAT/LCAS are summary LEDs, which represent a larger group of LEDs that display in a pop-up window when their summary LED is selected.

TCM Summary LEDs

The **TC Summary** or **TCM** LED indicates if a TCM error or alarm has been detected.

If the LED is red, select the "**TC Summary"** or "**TCM"** text to display the TC LEDs



The TC LEDs window appears in the center of the screen. The following describes the TCM LEDs.

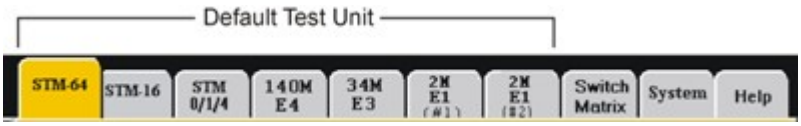
LED	Description
TC-IEC	Tandem Connection-Incoming Error Count. Indicates a B3 error count is being received from downstream TCM equipment. Bits 1-4 of the N1 byte are used for this indicator. This is an error LED.
TC-REI	Tandem Connection-Remote Error Indication. Indicates that an error has occurred at the downstream TCM equipment. The unit is receiving an error. Bit 5 of the N1 byte is used for this indicator. This is an error LED.

TC-OEI	Tandem Connection-Outgoing Error Indication. Indicates that the unit is sending an OEI error to upstream TCM equipment. Bit 6 of the N1 byte is used for this indicator. This is an error LED.
TC-RDI	Tandem Connection-Remote Defect Indication. Indicates that a defect has occurred at the downstream TCM equipment. The unit is receiving an alarm. Bit 8 in multiframe 73 of the N1 byte is used for this indicator. This is an alarm LED.
TC-ODI	Tandem Connection-Outgoing Defect Indicator. Indicates that the unit is sending an ODI alarm to upstream TCM equipment. Bit 7 in multiframe 74 of the N1 byte is used for this indicator. This is an alarm LED.
TC-AIS	Tandem Connection-Alarm Indication Signal. Indicates if IEC bits 1110 are being received from upstream TCM equipment. (Bits 1-4 of the N1 byte are the IEC bits.) This is an alarm LED.
TC-UNEQ	Tandem Connection-Unequipped. Indicates that a 00h pattern has been detected in the N1 byte of a Tandem Connection. This is an alarm LED.
TC-LOF	Tandem Connection-Loss of Frame. Indicates the loss of a valid multiframe frame alignment signal (FAS) pattern from upstream TCM equipment. This is an alarm LED.

Understanding Test Units

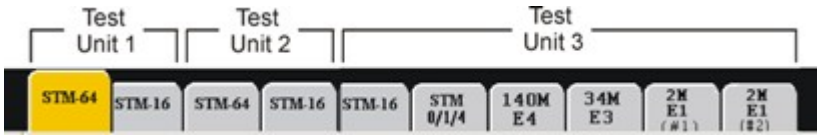
Understanding Test-Units

A test-unit (also known as test-set), is a series of adjacent circuit packs that are installed in one NIC chassis. The test-unit is based on a circuit pack's internal addressing and provides Add/Drop functionality between higher speed and lower speed processors.



For example, a NIC chassis may contain multiple circuit packs ranging from 10G down to PDH. When this type of configuration occurs, the test unit begins at higher speed circuit pack, and each lower speed circuit packs immediately to the right of the 10G card are included in the test unit.

The Add/Drop testing can then be setup between these circuit packs using the Preset menu.



However, when a second instance of a higher speed circuit pack is encountered, it is considered the beginning of a second test-unit. The image displayed above shows a NIC that has 10 protocol tabs, representing 3 individual test units.

Some circuit packs however, such as High Density Ethernet, may contain up to 13 individual Ports under the one protocol tab. In this case, each individual port is considered its own test-unit, since each port is operated independently of each other and there are no Add/Drop opportunities with any other circuit packs.

Also, when one protocol processor within a test-unit is Locked or Unlocked, then all of the protocol processors within that test-unit are automatically locked and unlocked as well.

Important: When the NIC has multiple test units, you must first select a protocol tab from desired test unit before selecting the Preset button. The configuration options available through the Preset Selection screen are dependent on the test unit that is selected.

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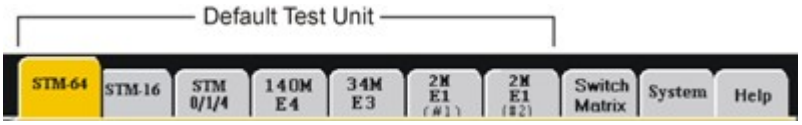

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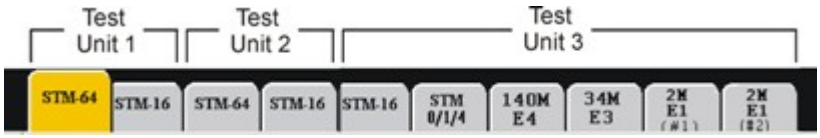

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Also, when one protocol processor within a test-unit is Locked or Unlocked, then all of the protocol processors within that test-unit are automatically locked and unlocked as well.

Important: When the NIC has multiple test units, you must first select a protocol tab from desired test unit before selecting the Preset button. The configuration options available through the Preset Selection screen are dependent on the test unit that is selected.

Locking and Unlocking a Test Unit

To prevent users from interfering with each other, an individual user can "lock" and take control of a test unit. This is done using the Lock icon that appears on the GUI. Permission levels determine the user's ability to lock and unlock a test set. When you lock the test set, you can configure protocol processors, start tests, and perform general product functions without the worry of contending for resources with another user.

When a test set is locked by someone else, the icon is displayed.

To unlock a test set locked by someone else:

Select the Lock icon. The Lock/Unlock dialog box appears.

Select **Force Unlock**. The command buttons change to "Lock and Exit" and "Lock."

You must have **Admin** privileges to be able to force the unlock.

Selecting one of the following causes the command buttons to change to "Unlock and Exit" and "Unlock", and the information boxes become available.

Lock and Exit - Locks the unit and automatically closes the dialog box. To enter notes after the dialog box closes, select the locked icon to reopen the dialog box.

Lock - Allows you to enter note information in the Circuit Info: and Contact Info: boxes before closing the dialog box. The notes carry

over to all protocol processors in the test set. When a different test set is locked the user can enter notes pertinent to it.

To enter note information, select **Circuit Info:** and/or **Contact Info:**. The Enter User String keyboard opens.

Type notes and select **Enter**. The notes appear in their associated information box.

Select **Exit** to close the Lock/Unlock dialog box.

When you have the test set locked, the icon is displayed.

To unlock a test set that you have locked:

Select the icon. The Lock/Unlock dialog box appears.

Selecting one of the following causes the command buttons to change to "Lock and Exit" and "Lock":

Unlock and Exit - Unlocks the unit and automatically closes the dialog box.

Unlock - Unlocks the unit without closing the dialog box. Select **Exit** to close the Lock/Unlock dialog box.

When the test set is unlocked, the icon is displayed.

To lock a test set:

Select the icon. The Lock/Unlock dialog box appears.

Selecting one of the following causes the command buttons to change to "Unlock and Exit" and "Unlock", and the information boxes become available.

Lock and Exit - Locks the unit and automatically closes the dialog box.

Lock - Allows you to enter note information in the **Circuit Info:** and **Contact Info:** boxes before closing the dialog box. The notes carry over to all protocol processors in the test set. When a different test set is locked the user can enter notes pertinent to it. Select **Exit** to close the dialog box.

Lock Icon

Overview

The unit's multi-user functionality allows up to eight (8) simultaneous users to be connected to a portable unit. This includes one (1) local user, via the unit's touch screen, and seven (7) remote users using the Remote Control Application (remote GUI), SCPI commands, or TL1 commands.

To prevent users from interfering with each other, an individual user can "lock" and take control of a test set. This is done using the Lock icon that appears on the GUI. Permission levels determine the user's ability to lock and unlock a test set. When you lock the test set, you can configure protocol processors, start tests, and perform general product functions without the worry of contending for resources with another user.

Using the Lock Icon

The following guidelines describe how to lock and unlock a test set using the Lock icon. See Locking and Unlocking a Test Set for more information. For setting the default lock state, see Configuring the Lock on Startup.)

If I see this icon on my GUI,	It means
	The test set is unlocked and available. No individual user has control of it. I can lock the test set by selecting this icon and choosing **Lock** or **Lock and Exit** from the Lock/Unlock dialog box.
	I have the test set locked. I currently control the test set and can configure protocol processors. I can unlock the test set by selecting the icon. Other users will see on their GUI.
	The test set is locked by another user. I can only view protocol processor screens. **If I have Admin privileges –** I can

	select this icon and force an unlock. **If I do not have the proper user privilege –** A message appears stating that the protocol processor is locked by the current owner. For example, "Protocol Processor locked by User X."
	The circuit pack (and its associated protocol processors) is **out of service**. A counter appears indicating how long the circuit pack has been out of service. A fault is also logged.

Configuring the Lock on Startup

To control the Lock's default state when the unit is started:

From the **System** tab, select **User Preference.**

Select **Startup Locking State**.

Select **Lock** to automatically lock the unit when it is started.

Select **Unlock** to make the unit available to anyone when it is started.

Adding Notes to a Test Unit

When you lock a test unit, you can add notes to the Add/Lock dialog box that are pertinent to the test set. Different test units can carry their own specific notes.

To add notes to the Lock/Unlock dialog box for a test unit:

Choose the desired protocol processor and select the **Lock** icon. The Lock/Unlock dialog box appears.

If the test unit is locked by someone else, select **Force Unlock** and choose **Lock and Exit** or **Lock**.

Select **Circuit Info:** and/or **Contact Info:**. The Enter User String keyboard opens.

Type notes and select **Enter**. The notes appear in their associated information box.

Select **Exit** to close the Lock/Unlock dialog box.

To edit notes on the Lock/Unlock dialog box for a test unit:

To edit the notes, the test unit must be placed in locked mode by the immediate user.

Choose the desired protocol processor and select the **Lock** icon. The Lock/Unlock dialog box appears.

Select **Circuit Info:** and/or **Contact Info:** and make appropriate changes using the Enter User String keyboard. Select **Enter**.

Select **Exit**.

Common Row Function Buttons

Error Insert

The Error Insert common function button is used to injects single errors into the transmitted protocol processor signal:

If no error types are specified for the **Error to Insert** setting in the Transmit > Error / Alarm screen, then a **Select Error to Insert** menu will appear when the Error Insert button is first pressed, allowing the user to specify which error type to insert.

The **Error Insert** button then causes single error insertions of the selected Error Type each time the button is pressed.

Stopping a Test

The Stop common function button stops the reporting of received data and takes a snapshot of error, alarm, and event activity.

When the Stop button is selected, the following occurs:

All statistics logged and reported by the Performance Monitoring function stop.

All alarm, error, and event statistics logged and reported by the Results function stop.

All elapsed time and duration counters stop.

The LEDs will continue to update and indicate current activity.

To stop a test:

Select the **Stop** common function button located at the bottom of the touch screen.

To restart test activity and statistic reporting, select the **Restart** button.

Restarting an Error, Alarm, or Event Test

The Restart common function button is used to initiate the following test activities:

Clears and resets error, alarm, and event activity counters, statistics, and LEDs for the current protocol processor.

Starts error, alarm, or event activity that was stopped using the Stop button.

To restart a test or reset statistics:

Select the **Restart** common function button located at the bottom of the touch screen. Configured testing on the current protocol processor is restarted.

Printing a Report

Selecting the Print Report Common Function Button while on the allows you to print statistic and event reports to a printer or file.

Select **Print Report**. The Report Setup menu appears.

Choose one of the following:

From **Destination Printer**, select one or multiple reports to print directly to a printer. If printing a report from the NIC unit, make sure that a printer is attached to the unit's parallel or serial port. The following reports are available:

- **Settings** - (.set extension) Reports current values for all Transmit and Receive Set functions.
- **Statistics** - (.stat extension) Reports results for the Scan, Errors, Alarms, and PTR.
- **Events** - (.evt extension) Reports a detailed summary of events, such as alarms, errors, and pointer activity. This report includes the event, the number of events logged, the start and stop time of the event, and the duration of the event.
- **APS** - (.aps extension) Reports the results of the K1 and K2 byte sequences received by the unit.
- **Performance** - (.perf extension) Reports Performance Monitor results.

From **Destination File**, choose one or multiple reports to print to a file. The File Browser dialog box appears.

The **Comma Delimiter** option can be applied to the Settings To File and Statistics To File reports.

- Enter a filename and select **OK**.

Important: Files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC. The NIC unit saves the files to its default D:\DLI... drive on the test unit.

In the **User Comment** box, select the **Input** button to enter notes that will display in the report. A keyboard opens.

Enter comment text using the keyboard. When working from NIC test set use the touch screen keyboard. Select **Enter**.

To clear comment text, select the **Clear** button.

Select **OK**.

For information on retrieving saved files, see Print or View Saved Files.

Files that are created when using the Remote Control Application are saved on your PC in the Remote Control directory. This directory can be overwritten when connecting to other remote units that have the same compatibility level, but are different models (for example, a NIC Plus, a NIC 10G, and so on).

If you want to keep these files, copy and save the following to a backup directory on your PC that is not in the Remote Control Application directory's path:

Any file with the .set, .stat, .evt, .aps, .perf, or .rep extension.

The client.prop file. Changes to this file are only needed if the remote unit uses a PCMCIA modem for its dial-up connection.

Presets Function

The Presets function provides a quick and convenient way to set up the system for operation. Using Presets involves selecting a starting protocol and its interface, and then making an internal connection to another protocol. See Adding/Dropping SDH/PDH Signals for more information.

To set up a connection using the Presets function:

Select **Presets** from the Common Function Buttons row.

Select **Interface**. All line interfaces available for your unit appear.

Select an interface as a starting point.

Select **Configuration**. The protocols available for the selected interface appear.

Select a protocol to connect to the interface. If required, select the **Configuration** button again to create additional connections.

If you make a mistake while creating connections, simply select **Interface** and reenter the interface value. This action erases any previously entered interface or configuration values.

Select **Apply**. The unit takes a few moments to apply the new protocol connections. Use the Switch Matrix to view the new connections.

To disengage the configured protocol connections:

Select **All to Tx/Rx**. This globally disconnects any internal connections between multiple protocol processors. A protocol processor will now expect to receive a signal using its line interface.

Auto Config

The Auto Config function allows you to quickly configure the unit to match the parameters of an incoming signal. This function uses the same mapping, framing, line coding, and pattern characteristics as the incoming signal without having to manually configure the unit.

To automatically configure the unit:

Make sure that the unit is receiving a valid input signal.

Select a Protocol Processor mode that corresponds to the network and the incoming signal.

Select the protocol processor tab (located at the top of the screen) that corresponds to the signal that you want to configure.

Select **Auto Conf** from the Common Function Buttons that appear at the bottom of the touch screen. The Select Type of Auto Configuration dialog box appears.

If the Auto Conf button is disabled or is not present, then the selected Protocol Processor does not support this feature.

You must have all protocol processors locked.

Select the type of auto configuration to perform. See the table below for a description of the options.

The unit starts detecting parameters about the incoming signal, such as signal rate, mapping, and payload pattern, and configures the unit accordingly. This process may take a few minutes to complete.

The following is a list of auto configuration types; availability is based on your unit's hardware configuration.

Auto Config Type	Description

Master Configuration	The unit detects the highest line rate, mapping, framing, and pattern of the incoming signal and configures the protocol processor to match these parameters. If successful, the unit then attempts to drop a signal to tributary protocol processors. This process continues until the lowest tributary is configured. If the auto configuration process is unsuccessful, the process terminates. For the STM-0/1/4 and the OC-1/3/12 protocol processors, Master Configuration detection starts with the incoming optical signals. For auto configuration of STM-0/1/4 and OC-1/3/12 electrical signals, refer to Master Electrical.
Configure STM-64 Only	Detects the parameters of the incoming STM-64 signal, and configures the STM-64 protocol processor to these parameters.
Configure STM-16 Only	Detects the parameters of the incoming STM-16 signal, and configures the STM-16 protocol processor to these parameters.
Configure OC-192 Only	Detects the parameters of the incoming OC-192 signal, and configures the OC-192 protocol processor to these parameters.
Configure OC-48 Only	Detects the parameters of the incoming OC-48 signal, and configures the OC-48 protocol processor to these parameters.
SDH Only	Detects the parameters of the incoming STM-0/1/4 optical signals, and configures the protocol processors to these parameters.
SDH Electrical	Detects the parameters of the incoming STM-1e or STM-0e electrical signals, and configures the protocol processors to these parameters.

SONET Only	Detects the parameters of the incoming OC-1/3/12 optical signals, and configures the protocol processors to these parameters.
SONET Electrical	Detects the parameters of the incoming STS-3 or STS-1 electrical signals, and configures the protocol processors to these parameters.
Master Electrical	Detects the parameters of the incoming SDH or SONET electrical signal, and configures the protocol processor to match these parameters. If successful, the unit then attempts to drop a signal to the E3, E1, DS3, or DS1 protocol processors. This process continues until the lowest tributary is configured. If the auto configuration process is unsuccessful, the process terminates.
E4 Only	Detects the parameters of the incoming E4 signal, and configures the E4 protocol processor to these parameters.
E3 Only	Detects the parameters of the incoming E3 signal, and configures the E3 protocol processor to these parameters.
DS3 Only	Detects the parameters of the incoming DS3 signal, and configures the DS3 protocol processor to these parameters.

Save / Restore Button

This menu provides the options to either **Save** the current Test Set configuration and settings, or to **Restore** either a previously saved settings file, or Restore the Test Set to Factory defaults for a specific Protocol Mode, or just change the current Protocol Mode.

Save This Test Set: Saves the current Test Set configuration and settings.

Restore This Test Set: Restores either a previously saved settings file, or Restores the Test Set to Factory defaults for a specific Protocol Mode, or used to just change the current Protocol Mode.

Clearing LED History and Resetting Results

The unit uses the following functions to log event, alarm, and error activity monitored on the incoming signal:

LEDs as displayed in the **Quick Status LEDs** area and the **Large LEDs** tab

Every LED has a text label (Status Indicator) which will turn Red when the specific occurs, and remain Red after the event clears

The many **Results** windows display the number of events counted and/or the total time the events occurred for

To only clear LEDs and Status Indicator history:

Select the **Clear History** common function button that appears at the bottom of the touch screen

The LEDs' recorded history clears (Status Indicator)

Refer to Using LEDs for LED color descriptions

The Clear History button does not reset error counts, alarm counts, or data that appear in graphs. To clear this data, use the Restart button.

To restart a test or reset statistics:

Select the **Restart** common function button that appears at the bottom of the touch screen.

Resets errors, alarms, and event activity counters, statistics back to 0 for the current protocol processor.

Restarts errors, alarms, and event activity that may be stopped from using the Stop button.

The LEDs' recorded history clears (Status Indicator)

The Elapsed Time reset to zero seconds, and begins counting over again.

Locking/Unlocking Screen Access

The test set screen can be disabled to prevent user access by others. This function requires a user ID and password to lock and unlock the screen. When unlocking the screen, the unit will only accept the last user ID and password entered, or the unit's original user ID and password.

To lock the screen:

Select **Lock Screen** from the common function buttons. The Off/Lock dialog box appears.

Enter your **User ID**.

On a portable unit, press ... to open a keyboard to enter the User ID.

Enter your **Password**.

On a portable unit, press ... to open a keyboard to enter the Password.

The Password is masked with Asterisks, so it will not be displayed on the screen.

Select **OK**. The Locked Unit dialog box appears. This dialog box remains on the screen until the screen is unlocked.

If the unit is locked because critical testing is in progress, select the **Unlock** button and enter the **User ID** and **Password** again. Select **OK**.

The unit will only accept the last User ID and Password entered or the unit's original User ID and Password. An error message appears if an invalid ID or Password in entered.

To unlock the screen:

Select the **Unlock** button from the **Locked Unit** dialog box. The Unlock Login dialog box appears.

Enter your **User ID.**

On a portable unit, press ... to open a keyboard to enter the user ID.

Enter your **Password**.

On a portable unit, press ... to open a keyboard to enter the password.

The Password is masked with Asterisks, so it will not be displayed on the screen.

Select **OK**.

The unit will only accept the last User ID and Password entered or the unit's original User ID and Password. An error message appears if an invalid ID or Password in entered.

Turning the Test Set Off

The procedure described below allows the system to write unsaved data to the disk before you shutdown the test set. This task is performed by selecting the Shut Down common function button on any Protocol Processor tab.

Important: It is important to use the procedure described below when Shutting down or Rebooting the test set. Failure to do so may result in lost data or corrupt system files which may prevent the unit to reboot successfully.

To shut down the test set from a Protocol Processor tab:

Select the **Shut Down** from the common function button row.

Select on of the two options

Shutdown

Reboot

Shut Down

When **Shutdown** is selected, a Shutdown window appears giving you the option to select OK or Cancel.

Selecting **OK** will begin the shutdown process, which may take up to 30 seconds or so.

After the GUI and the background applications close and the Windows OS turns of, the screen will turn black. At this point it is acceptable to toggle the **power switch** on the top of the test set to the off position to complete the shut down process.

Reboot

When **Reboot** is selected, a Reboot the Unit window appears giving you the option to select OK or Cancel.

Selecting **OK** will begin the Reboot process, which may take several minutes to complete..

After the GUI and the background applications close and the Windows OS turns of, the screen will turn black. At this point the unit should begin to boot back up again, as if it were just turn on.

NIC units with the original System Controller normally stay at the black screen that appears after Windows turns off. When this occurs the Power Switch will need to be toggle the **power switch** on the top of the test set to Off and back On again to complete the reboot process.

NIC units with the new System Controller card are full able to perform a Reboot command with having to toggle the power switch.

Remote Applications

Remote Control Application

The Remote Control Application software is a graphical user interface that allows you to remotely connect to and control portable and rackmount products from a PC.

Before using the Remote Control Application:

Verify the minimum software and hardware requirements.

Verify that the Ethernet parameters have been entered into your unit.

Verify that you have security access to the unit.

Verify that FTP service is enabled on the unit.

Install the Remote Control Application on to your PC.

If the remote unit uses a PCMCIA modem for dial-up connectivity, configure the Remote Control Application for PCMCIA operation.

To start the Remote Control Application:

Select the Remote Control Application shortcut icon that appears on your PC's desktop.

Enter the remote unit's IP address, and your user ID and password.

Select **OK**.

Once the connection is made, the remote unit's GUI appears. The title bar contains the product name and connection method. Use your mouse to select functions.

To automate the log on process, select Automating the Remote Control Icon for more information.

Important: Files that are created when using the Remote Control Application are saved on your PC in the Remote Control's compatibility directory. This directory can be overwritten when connecting to other remote units that have the same compatibility level, but are different models (for example, a NIC Plus, a NIC 10G, and so on).

If you want to keep these files, copy and save the following to a backup directory on your PC that is not in the compatibility directory's path:

Any file with the .set, .stat, .evt, .aps, .perf, or .rep extension.

The client.prop file. Changes to this file are only needed if the remote unit uses a PCMCIA modem for its dial-up connection.

Remote Control Application Requirements

Software

The minimum software requirements are:

Windows 98, 2000, NT 4.0, XP, or Vista operating systems.

Microsoft Internet Explorer 5.0 or greater.

Host domain and IP address information for LAN access.
Make sure that this information is entered into your unit. Refer to Ethernet Port Configuration for more information.

TCP/IP Network Protocol

Hardware

The minimum hardware requirements are:

A personal computer with a 300-MHz Pentium processor or faster.

128 MB RAM (256 MB RAM recommended for optimum performance)

60 MB of free disk space

An SVGA monitor with a minimum screen resolution of 800 by 600 pixels and 256 colors (1025 by 768 recommended for optimum viewing).

A CD-ROM drive (if installing from a CD-ROM) or web browser (if installing from the DLI web site) for software installation.

A standard 10BaseT Ethernet cable for connectivity between the unit and the network.

If you connect the unit directly to your PC, you will need the following:

A network interface card installed in your PC.

A crossover 10BaseT Ethernet cable for connectivity between the unit and the PC's network interface card.

Ethernet Port Configuration

To configure the unit's Ethernet port:

If Ethernet port parameters are changed, the unit must be rebooted for the changes to take affect.

Select **System**.

Select **I/O Settings**.

Enter the unit's **IP Address**, **Subnet Address**, and **Router Address** from the Ethernet Configuration functions.

IP addresses **192.168.138.000 through 192.168.138.255** are reserved and should not be used. A system conflict can occur if these IP addresses are entered.

Remote Control Application Installation

The Remote Control Application is supplied on the Software and Remote CD. Install the application from the CD upon first use of the application or when there is a major Feature Set change. For example from Feature Set 4.1 to 4.2.

Important: Uninstall previous versions of the Remote Control Application software from your PC before upgrading to a newer version.

To install from a CD:

Close any applications running on your PC before installing the software.

Insert the CD into the CD-ROM drive.

The Auto-Run feature starts and displays the Welcome screen.

If the Auto-Run feature is disabled on your system, open **Windows Explorer** and select the **CD-ROM** drive, to display the contents of the CD. Select the **DLIInstall.exe** file to launch the Welcome screen.

From the **Software** tab, select **Remote Control Application** and click **Install**.

Select **Next** and follow the on-screen instructions to install the software into a directory and create a program folder. The default directory is C:\Program Files\GalaxyNIC.

To complete the installation, you must restart your PC. A dialog box appears asking whether you want to restart your PC now or later**.** Select **Yes** to restart and **Finish** to complete installation.

After restarting your PC, a shortcut icon appears on the desktop and a GalaxyNIC program folder is created for the Remote Control Application. Open the application by clicking the **Remote NIC** icon.

This completes the installation.

Remote Control Application Removal

Important: Reports that were saved to the Compat4030 folder, located in the Remote Control Application directory (for example, C:\Program Files\GalaxyNIC\Compat4030) will be deleted during the uninstall process. To save historical reports, copy the data files to a folder located outside of the Remote Control Application directory before proceeding with the uninstall process.

To remove the Remote Control Application

Close the Remote Control Application.

Click the **Windows Start** button and choose **Settings**.

Select **Control Panel** and choose **Add/Remove Programs**.

Select **Remote NIC** and click the **Add/Remove** button.

Follow the on-screen instructions.

Open Windows Explorer and locate the Remote Control Application (GalaxyNIC) directory. For example, C:\Program Files\GalaxyNIC.

Delete the **GalaxyNIC** folder.

Install the new Remote Control Application.

Automating the Remote Control Application Icon

The Remote Control Application software is a graphical user interface (GUI) that allows you to remotely control portable and rackmount products from a PC. An icon for the Remote Control Application software is created and placed on your desktop when the software is installed.

Once installed, you can add a specific IP address, User ID, and Password parameters to the icon to automate the login process.

From the desktop, **right-click** on the **Remote NIC** application icon.

Select **Properties** and choose the **Shortcut** tab.

Place the cursor at the end of the **Target** text box.

Press the **space bar** and then type:

ip=*x.x.x.x*,uid=*y*,pw=*z*

x.x.x.x is the NIC unit's IP address

y is the user ID (case sensitive)

The default user ID is **Admin**

z is the password (case sensitive)

The default password is **Admin1**

do not include any spaces between fields

Example: *"C:\Program Files\GalaxyNIC\Galaxy.exe" ip=10.1.8.21,uid=Admin,pw=Admin1*

Click **OK**.

Right-click on the **Remote NIC** application icon again.

Select **Rename** and include the IP Address in the name of the icon for future reference.

Now when you double click the Remote NIC application's icon, a connection is automatically made, and the remote system's GUI appears.

If an invalid parameter is entered, the automatic login will fail, and you must enter the appropriate data.

Troubleshooting

This topic is intended to aid in resolving common user interface problems. For additional assistance, please contact Customer Service.

Interface	Symptom	Resolution

Power	No power (fans silent)	Check input power cord seating on both ends. Ensure input voltage and frequency is correct (100-120 VAC and 200-240 VAC, 50-60Hz). Check the fuse. If fuse is blown, contact Customer Service.
Touch Screen	Will not respond	Remove anything resting against the screen (cables, etc.) and restart the unit if it is still not responding.
Touch Screen	Too much or too little sensitivity.	Adjusting the touch screen sensitivity must be done by a trained Digital Lightwave representative. Contact Customer Support for assistance.
Speaker	Volume too loud or too soft	Adjust desired volume from the System, Misc screen.

Optical	SONET B1, B2 errors appearing when locally looped.	Inspect and clean fiber-optic surfaces. Check the Receive signal status and ensure that the optical power is -2dBm to -14dBm for OC-192/STM-64 and -2dBm to -26dBm for OC-48/STM-16. Also that the frequency is within +/- 100ppm. **Note:** Attenuation is required for local loopback of OC-48/STM-16.
Optical	Loss of signal or power level low	Check for optical connector tightness and eliminate any fiber kinks or knots.
Ethernet	Device not communicating	Ensure cable is the correct type (*Direct* if connected to a LAN, and *Crossover* connected to a computer. Set up a valid IP address in the System, I/O, Settings screen. IP addresses 192.168.138.000 through 192.168.138.255 are reserved and should not be used. A system conflict can occur if these IP

		addresses are entered.
Serial RS232	Device not communicating	Ensure the connecting cable is a null modem cable. Ensure communication settings of baud, bit, stop, and parity are set up correctly in the System, I/O, Settings screen.
Printer	Printing device will not print	Verify that the printer is in "standard text" print mode. Check that the cable is a "standard printer" cable.
PCMCIA	Card will not function in slot	Contact Customer Support to ensure the PCMCIA is properly licensed and enabled.

USB	Storage device will function when inserted.	Check device for proper seating. Remove the device, reboot the NIC, and attempt to insert the USB device again. Contact Customer Support if the above measures fail to work.
BITS	Unit not synchronizing up to timing source	Check that the cables are connected correctly (IN/OUT). Ensure the clock source is set to "BITS" from the System, Misc screen and enabled on the protocol processor's Transmit screen, Clock Reference option. Verify that the input clock source is a clean signal with a frequency of 1.544 MHz into a 100-ohm termination.
Clock out	Not triggering properly	Ensure that "trigger out" options are properly enabled. Ensure that the clock signal is terminated into a 50-ohm load.

SETS	Unit not synchronizing up to timing source	Check that the cables are connected correctly (IN/OUT). Ensure the clock source is set to "SETS" from the System, Misc screen and enabled on the protocol processor's Transmit screen, Clock Reference option. Verify that the input clock source is a clean signal with a frequency of 2.048 MHz into a 120-ohm termination.

SYSTEM Tab

System Tab

The System tab contains functions used to establish unit preferences, set up tests, and configure input and output port configuration settings in order to perform software upgrades, file transfers, and many other functions.

The System tab contains the following function screens:

- Misc
- I/O Setting
- File Service
- Security
- User Preference
- All Test Status
- All Ether Ports
- Service Disruption
- Monitor
- Chat
- Faults

Misc Screen

Miscellaneous System Settings

The following functions are available under the System Miscellaneous screen:

- Update License Keys
- Start Screen Saver *(Does not apply to Remote GUI connections)*
- Backlight Intensity *(Does not apply to Remote GUI connections)*
- Set the Unit's Date, Time, Time Zone and Daylight Savings Time

Oscillator Value

About this product

Speaker Volume *(Does not apply to Remote GUI connections)*

Boot Sound Enabled *(Does not apply to Remote GUI connections)*

User Login Required *(Does not apply to Remote GUI connections)*

Enable Calibration

Recalibrate Touch Screen *(Does not apply to Remote GUI connections)*

The following Global Settings apply to all Test Sets

Change Protocol Mode

Restore To Factory Defaults

Save Settings To File

Restore Settings From File

External Clock

Update License Keys

The Update License Key function allows you to enable functionality that you may not have initially purchased.

If you wish to enable functionality currently disabled, contact your Digital Lightwave sales manager or Digital Lightwave **Customer/Technical Service**.

The current License Keys can be viewed from the **About This Product** window.

If new features are purchased, you will be provided a License Key that will activate the requested features.

Timed License Keys can also be obtained, which will unlock requested features for a specific length of time. After the timed license key expires, the requested

feature will automatically become unavailable, and the unit will revert to its previous permanent license key.

To enter a new license key:

From the **System tab**, choose **Misc**.

Select **Update License Key**.

Select the **Circuit Pack** for which the new license key has been created. The Enter User String keyboard appears.

Enter the new license key and select **Enter** when done.

If you have established a Remote GUI connection from your PC to the NIC unit, then the new license key can easily be copied from your PC and pasted into the keyboard entry field.

Reboot the unit for the new functions to take effect.

Configuring the Screen Saver

The Screen Saver can only be configured from the NIC touch screen, and does not apply to Remote GUI connections.

The screen saver can be turned off or configured to activate after a set period of time. When the screen saver is operating, you can clear it by touching anywhere on the touch screen.

To enable the screen saver:

From the **System** tab, select **Misc**.

Select **Start Screen Saver**. The Select Screen Saver Delay dialog box appears.

Select the desired delay period.

To disable the screen saver:

From the **System** tab, select **Misc**.

Select **Start Screen Saver** and choose **Off**.

Adjusting Touch Screen Brightness

The touch screen's brightness level can only be adjusted from the NIC touch screen, and does not apply to Remote GUI connections.

To adjust a portable unit's touch screen brightness:

From the **System** tab, choose **Misc**.

Select **Backlight Intensity**. A keypad appears.

Enter the desired intensity setting. Valid values range from **0** (brightest setting) to **255** (dimmest setting).

Select **OK**.

Set the Unit's Date, Time, Time Zone, and Daylight Saving Time option

The current time and date settings are displayed to the right of this setting. The Time's format is displayed in 24-hour (military time format) as **HH/MM/SS**. The Date's format is displayed as **MM/DD/YYYY**.

To manually set the Time:

From the **System** tab, select **Unit Time, Date, Zone**. The Date/Time and Zone menu appears.

The Date/Time and Zone menu displays the following three items: Manually Adjust Date/Time, Automatically Adjust Date/Time and Adjust Time Zone

After manually setting the current time or date, the word (Enabled) will appear to the right of Manually Adjust Date/Time. Likewise, the word (Disabled) will appear to the right of Automatically Adjust Date/Time

Select **Manually Adjust Date/Time**. The Set the Date/Time window appear.

Press the **Time** button, and change any of the following options.

Press **Hour** to adjust the hour setting using 2-digit, 24-hour, military time format

Press **Minute** to adjust the minutes setting using a 2-digit format

Press **Second** to adjust the seconds setting using a 2-digit format

Select **Set**. The time change appears next to the Unit Time, Date, Zone setting

To manually set the Date:

From the **System** tab, select **Unit Time, Date, Zone**. The Date/Time and Zone menu appears.

The Date/Time and Zone menu displays the following three items: Manually Adjust Date/Time, Automatically Adjust Date/Time and Adjust Time Zone

After manually setting the current time or date, the word (Enabled) will appear to the right of Manually Adjust Date/Time. Likewise, the word (Disabled) will appear to the right of Automatically Adjust Date/Time

Select **Manually Adjust Date/Time**. The Set the Date/Time window appear.

Press the **Date** button, and change any of the following options.

Press **Month** to adjust the month setting using a 2-digit format

Press **Day** to adjust the day setting using a 2-digit format

Press **Year** to adjust the year setting using a 4-digit format

Select **Set**. The date change appears next to the Unit Time, Date, Zone setting.

To set your current Time Zone:

From the **System** tab, select **Unit Time, Date, Zone**. The Date/Time and Zone menu appears.

Select **Adjust Time Zone**. The Time Zone Properties window appear.

Select the desired Time Zone (and geographic location) from the drop-down menu.

Select **OK**. The system time will automatically update for the change in time zones.

To adjust clock automatically for Daylight Saving Time change:

To configure your unit's clock so it will adjust automatically when daylight saving time changes, make sure the Automatically adjust clock for daylight saving changes check box is selected.

This option is only available in Time Zones that support Daylight Saving Time changes.

From the **System** tab, select **Unit Time, Date, Zone**. The Date/Time and Zone menu appears.

Select **Adjust Time Zone**. The Time Zone Properties window appear.

Enable the Automatically adjust clock for daylight saving changes.

Select **OK**. The system time will automatically update for daylight saving time changes.

To Automatically set the Time and Date:

The NIC's clock can be synchronized with a network time server or an Internet time server (when you connect to a Network via Ethernet).

From the **System** tab, select **Unit Time, Date, Zone**. The Date/Time and Zone menu appears.

The Date/Time and Zone menu displays the following three items: Manually Adjust Date/Time, Automatically Adjust Date/Time and Adjust Time Zone

After configuring the unit to automatically adjust the Date and Time, the word (Enabled) will appear to the right of Automatically Adjust Date/Time. Likewise, the word (Disabled) will appear to the right of Manually Adjust Date/Time

Select **Automatically Adjust Date/Time**. The Enter User String keyboard appears.

Enter the Name or IP Address of the desired network/Internet time server, and select **Enter** when done.

By default the network time server is programmed as **time.nist.gov**

Reboot the unit for the network settings change to take effect.

Setting Oscillator Value

This setting is used for Calibrating the System internal Stratum III Clock Frequency

Important: The following procedure is for use by qualified Digital Lightwave personnel. It is assumed that you have already measured the frequency offset that must be entered into the unit.

To enter and adjust the frequency of the Stratum III clock:

From the **System** tab, select **Misc**.

Select **Oscillator Value**. A keypad appears. The unit's internal clock frequency can be adjusted in 255 steps, where **0** is the lowest frequency, **128** is the center frequency, and **255** is the highest frequency.

Using the keypad, enter a value, and select **OK** when you are done. The new Oscillator Value is set.

About This Product

This window displays the following information:

- Feature Set (this is the overall software version of the NIC unit.)

- Phone, website and email contact information for Digital Lightwave Technical Support

- Product Name (Digital Lightwave – NIC Plus, NIC 2.5G, NIC GigE, etc.)

- Product Serial Number (11 Digits)

- Usage Time (This is the total number of hours that the NIC unit has been operating.)

- Card Type, Software Version, Licensing and additional information for each installed module

If a circuit pack has a Timed License, then the Timed Licensed information will also be listed.

- Copyright and Patent Information

Saving Information

NOTE: The above information may be needed when calling for Technical Support.

The information contained in the window can be saved to a text file by pressing the **SAVE** bottom in the lower left corner of the window; so that it can easily be copied from the unit, and attached to an email.

The About file is saved to the location specified.

If this is done on the touch screen of the NIC unit, the text file will be stored on the unit's hard drive. The file can then be copied to USB drive or PCMCIA-Flash Ram card, or sent by FTP.

If done with remote control software, the file will be saved to the specified location on the PC's hard drive.

To close the About This Product window, select **OK**.

Increasing or Decreasing Speaker Volume

The unit's speaker volume can only be adjusted from the NIC touch screen, and does not apply to Remote GUI connections.

This function allows you to increase or decrease the speaker volume in order to hear the touch screen beep, the boot sound, as well as other features that emit sounds from the unit's speaker.

To increase or decrease speaker volume:

From the **System** tab, choose **Misc**.

From **Speaker Volume**, select the **Low** arrow to decrease the volume, or **High** arrow to increase the volume.

Common Function Buttons

The bottom of the touch screen contains task-oriented buttons. These buttons do not appear when using the System or Help tabs. Additionally, buttons that do not pertain to a protocol will not appear when that protocol tab is selected.

The Common Function Buttons include:

Error Insert

Stop

Restart

Print Report

Presets

Auto Conf

Save / Restore

Clear History

Lock Screen

Shut Down

Enabling Boot Sound

The Boot Sound setting can only be changed from the NIC touch screen, and does not apply to Remote GUI connections.

Enabling the Boot Sound option allows a .wav sound file to play that acknowledges when the NIC unit is fully booted and available.

To enable the boot sound:

From the **System** tab, select **Misc**.

From **System Setting**, select the **Boot Sound Enabled** check box.

To disable the Boot Sound, simply clear the Boot Sound Enabled check box.

Establishing a Required User Login

The User Login Required setting can only be changed from the NIC touch screen, and does not apply to Remote GUI connections.

This function allows an administrator to establish a required login, which results in the user having to enter a user ID and password each time they use the unit.

Administrators can create or change User-names, Passwords and Permissions from the System > Security screen.

To establish a required login:

From the **System** tab, choose **Misc**.

From **Local Setting**, select the **User Login Required** check box. When this box is checked, a required login has been established.

To disable the required login, clear the **User Login Required** check box.

Reboot the unit for this setting to take effect.

When the unit reboots, a valid User name and Password will be required in order for the local GUI to appear on the NIC touch screen.

Calibrating a Protocol Processor

The following calibration procedures do not apply to circuit packs that utilize hot-swappable SFP/XFP lasers.

Calibrating the system's optical power should be done carefully. To keep unauthorized users from changing calibration settings, the Update Signal Calibration button on the protocol processor's Receive > SIG screen is unavailable by default. To change the setting, a user with Admin or Calibrate privileges must enable the calibration mode. Once calibration has been enabled, each protocol processor has its own calibration procedure.

To enable protocol processor calibration:

From the **System** tab, select **Misc**.

From **Local Settings**, select **Enable Calibration**.

The user must have Admin or Calibrate privileges to enable the calibration mode.

The **Update Signal Calibration** button is now available on the protocol processor's **Receive SIG** screen.

Protocol processors have their own calibration procedures. You can find the procedures in **Specific Tasks** section of the protocol's **Online Help**.

To view a calibration procedure described in the online help file:

From the **NIC Online Help**, select the **Contents** tab and choose the desired protocol processor.

Expand the protocol processor's **Overview** book and select **Specific Tasks**.

Select the **Calibrate** topic.

For local touch screen calibration procedures, select Calibrating the Touch Screen.

Calibrating the Touch Screen

The touch screen can only be calibrated from the NIC's local GUI, and does not apply to Remote GUI connections.

Touch screen calibration is performed on all portable units prior to shipping from the factory. However, if your unit's touch screen requires recalibration, perform the procedure described below.

Although touch screen calibration can be performed using your finger, a pointing device, such as a stylus, is recommended for greater accuracy.

Below are two sets of instructions, which are based on two different touch screen utilities.

NIC units which are equipped with Windows NT Embedded will display the **MtsCal** calibration utility

NIC units which are equipped with Windows XP Embedded will display the **Hampshire** calibration utility

Follow the set of instructions below that apply to the Windows OS version in your unit.

To calibrate Windows NT the touch screen:

From the **System** tab, select **Misc**.

Select **Recalibrate Touch Screen**. The **MtsCal** dialog box appears.

Select the **5-point Calibration**.

Five touch screen targets (calibration points) appear on the screen.

The hand icon indicates which target to select.

Press down and hold your pointing device as close to the center of the target as possible.

The message **Touch Enabled** appears when calibration for that specific point is complete.

The hand icon moves to the next target. Repeat steps 4 and 5 for the remaining targets.

If the screen is not touched for a 20-second period or longer, the current calibration process is canceled. The calibration must be restarted using the first touch screen target.

When touch screen calibration is complete, a completion message briefly appears on the screen and the MtsCal dialog box reappears. Select **Close**.

To calibrate the Windows XP touch screen:

From the **System** tab, select **Misc**.

Select **Recalibrate Touch Screen**. The touch screen calibration window appears.

Starting in the upper left corner, press down and hold your pointing device as close to the target area indicated by animated red arrows as possible.

In all 20 touch screen targets (calibration points) will appear on the screen.

The message **Release** appears when calibration for that specific point is complete.

The animated red arrows then move to the next target. Repeat steps 4 and 5 for the remaining targets.

If the screen is not touched for a 15-second period or longer, the current calibration process is canceled. The calibration must be restarted using the first touch screen target.

When touch screen calibration is complete, move your pointing device around the touch screen and verify the touch screen is calibrated to your satisfaction.

Select **Accept** to apply the calibration settings.

Changing the Protocol Mode

The unit can be configured to operate in SONET, SDH, PDH, or DS3/DS1 networks.

The options that appear on this screen are determined by your hardware configuration.

Changing the Protocol Mode from the System > Misc screen will globally apply the Protocol mode change to all Test Units in the NIC unit.

You must have all SONET/SDH and PDH/DSn processors locked.

Select the **System** tab and choose **Misc**.

Select the **Change Protocol Mode** button.

The following menu options appear:

Change Protocol Mode **SONET** Change Protocol Mode **SDH**	These options appear if your unit contains one or more

	SONET/SDH board, but no PDH board
Change Protocol Mode **DS1/DS3** Change Protocol Mode **E1/DS3** Change Protocol Mode **E1/E3**	These options appear if your unit contains one or more PDH board, but no SONET/SDH board
Change Protocol Mode **SDH/E1/E3** Change Protocol Mode **SDH/E1/DS3** Change Protocol Mode **SDH/DS1/DS3** Change Protocol Mode **SONET/DS1/DS3** Change Protocol Mode **SONET/E1/DS3**	These options appear if your unit contains one or more SONET/SDH board, and one or more PDH board

Select the desired protocol mode. The protocol tabs and settings will updated to reflect the selected mode.

Restoring Factory Defaults

This function will reconfigure all of the protocol processor's settings back to the original Factory Defaults, for the selected Protocol Mode.

The options that appear on this screen are determined by your hardware configuration.

Restoring the Factory Defaults from the System > Misc screen will globally apply to all protocol processors in the NIC unit.

You must have all protocol processors locked.

Select the **System** tab and choose **Misc**.

Select the **Restore To Factory Defaults** button.

The following menu options appear:

Restore To Factory Default **SONET** Restore To Factory Default **SDH**	These options appear if your unit contains one or more SONET/SDH board, but no PDH board
Restore To Factory Default **DS1/DS3** Restore To Factory Default **E1/DS3** Restore To Factory Default **E1/E3**	These options appear if your unit contains one or more PDH board, but no SONET/SDH board
Restore To Factory Default **SDH/E1/E3** Restore To Factory Default **SDH/E1/DS3** Restore To Factory Default **SDH/DS1/DS3** Restore To Factory Default **SONET/DS1/DS3** Restore To Factory Default **SONET/E1/DS3**	These options appear if your unit contains one or more SONET/SDH board, and one or more PDH board

Select the desired protocol mode. The protocol tabs and settings will updated to reflect the selected mode, and all of the protocol settings will revert back to their factory assigned default values.

Saving and Restoring Global Settings Configurations

This function allows you to perform the following actions:

Save all protocol processor Transmit and Receive settings and configurations to file.

Restore all protocol processor Transmit and Receive settings and configurations by recalling a previously saved settings file.

To Save the current settings configuration:

Select **System** and choose **Misc**.

Select the **Save Settings To File** button. The File Browser window appears.

Press **File Name**. The Enter User String keyboard appears.

Enter a settings file name, and select **Enter** when done.

Do not include the Space character in any file name

Do not type a file extension; the .SET file extension will automatically be added to the filename.

Select **Drive**, if you wish to save the file to a different Drive letter.

Double click on an existing directory, or click New Dir and create a new directory, if you do not wish to save the file in the default directory.

Select **OK** to save the settings file.

To restore a settings configuration:

Select **System** and choose **Misc**.

Select the **Restore Settings From File** button. The File Browser window appears.

Type or select the name of the settings configuration file to be restored from the list of filenames.

Settings files will have a .SET file extension

If the desired settings file resides in a different drive or directory, then select the settings file for the appropriate location.

Click **OK** to recall the previously saved settings.

Setting the External Clock

This function allows you to set the external clock to BITS, SETS, 1.544 MHz Clock, or 2.048 MHz Clock.

To set the external clock:

Select **System** and choose **Misc**.

Select **External Clock**. The External Clock dialog box appears.

Select **BITS (1.544 Mbps)**, **SETS (2.048 Mbps)**, **1.544 MHz Clock**, or **2.048 MHz Clock**.

Option	Description
BITS (1.544 Mbps)	Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 Mbps. The **CLK:BITS** displays in the Quick LED Status area, when the Transmit Clock Reference is configured for BITS/SETS. If this option is selected, but BITS clocking is not available, then this function defaults to Internal.
SETS (2.048 Mbps)	Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 Mbps. The **CLK:SETS** displays in the Quick LED Status area, when the Transmit Clock Reference is configured for BITS/SETS. If this option is selected, but SETS clocking is not available, then this function defaults to Internal.
1.544 MHz Clock	This synchronizes the transmitted signal to a 1.544 MHz sine-wave clock input. The **CLK:BITS** displays in the Quick LED Status area, when the Transmit Clock Reference is configured for BITS/SETS. If this option is selected, but BITS clocking is not available, then this function defaults to Internal. This is only available on new System Controller cards.
2.048 MHz Clock	This synchronizes the transmitted signal to a 2.048 MHz sine-wave clock input. The **CLK:SETS** displays in the Quick LED Status area, when the Transmit Clock Reference is

	configured for BITS/SETS. If this option is selected, but SETS clocking is not available, then this function defaults to Internal. This is only available on new System Controller cards.

I/O Settings Screen

I/O Settings

The unit can be remotely controller by wired Ethernet port or Wireless Ethernet (via PCMCIA Wi/Fi card), as well as a GPIB port (via PCMCIA GPIB card) that can be used for sending SCPI commands to the NIC unit. The unit also has a Serial port that be configured for either SCPI communication or for Printing results to the Serial port.

The I/O Settings tab allows you to configure and control the unit's communications port parameters.

The I/O Settings tab also provides a way to Reboot the test set.

The following port settings and configuration options are available on the I/O Settings screens:

Ethernet Port Settings	Configuring the Ethernet Port
Wireless Ethernet Settings	Configuring Wireless Ethernet
Serial Port Settings	Configuring and Assigning the Serial Port
GPIB Port Settings	Configuring the GPIB Port

Ethernet Configuration

Ethernet Port Settings

If Ethernet port parameters are changed, the test set must be rebooted for the changes to take affect.

These settings are used to configure the Ethernet port's parameters:

Obtain an IP address from a DHCP server: The unit will uses the network's Dynamic Host Connection Protocol (DHCP) server to dynamically assign it an IP address. ***When selected, the IP Address, Subnet Address, Router, Host Name, and Domain Name functions are disabled, but will be populated by the DHCP server.***

Specify an IP address: Allows a static IP Address to be entered using the IP Address, Subnet Address, Router, Host Name, and Domain Name functions.

IP Address: Enter the unit's IP Address using dotted decimal notation. For example, **nnn.nnn.nnn.nnn**, where **nnn** is a value from 0 to 255.

IP addresses **192.168.138.0 through 192.168.138.255** are reserved and should not be used. A serious system conflict can occur if these IP addresses are entered.

If you must use an IP address in the range of **192.168.x.y** (where x is not equal to 138), then you **must** set the Subnet Address to **255.255.255.0**.

Subnet Address: Enter the Subnet Mask Address using dotted decimal notation.

Router: Enter the Router/Gateway Address using dotted decimal notation.

Host Name: Enter the unit's host name (for example, the NIC's Serial Number). This is an optional parameter, and is used to identify the NIC unit on your network, in the same way that each computer may have a unique name on the network.

Domain Name: Enter the unit's domain name (for example, lightwave.com). This is an optional parameter.

Port Assignment: Displays what has been assigned, by way of default or license. SCPI is automatically listed. If the unit is licensed for TL1, then TL1 is also displayed on the assignment line.

The **Host Name** and **Domain Name** parameters defined for Ethernet Configuration screen also apply to the Wireless Configuration screen. Any changes made to these parameters on one screen will also be made on the other screen.

Configuring the Ethernet Port

The unit can be controlled using SCPI commands, Remote GUI operation, as well as File Transferring through the unit's Ethernet port. The unit supports static IP addressing and dynamic IP addressing, using Dynamic Host Connection Protocol (DHCP).

If Ethernet port parameters are changed, the test set must be rebooted for the changes to take affect.

To configure the Ethernet port for a static IP address:

From the **System** tab, select **I/O Settings**.

Select **Ethernet**.

Select **Specify an IP address** from the **Ethernet Configuration** functions.

Enter the unit's **IP Address**, **Subnet Address**, and **Router Address**.

IP addresses **192.168.138.0 through 192.168.138.255** are reserved and should not be used. A serious system conflict can occur if these IP addresses are entered.

If you must use an IP address in the range of **192.168.x.y** (where x is not equal to 138), then you **must** set the Subnet Address to **255.255.255.0**.

Reboot the unit using the Reboot button for changes to take affect.

To configure the Ethernet port for a dynamic IP address using DHCP:

Plug an Ethernet cable into the unit's RJ-45 port, that is connected to a **DHCP network server**.

From the **System** tab, select **I/O Settings**.

Select **Ethernet**.

From **Ethernet Configuration**, select **Obtain an IP address from a DHCP server**.

Reboot the unit using the Reboot button for changes to take affect.

Upon rebooting, the unit will use the network's DHCP server to dynamically assign it an IP Address, Subnet Mask Address and Router Address.

Wireless Configuration

Wireless Ethernet Settings

The unit only supports the HP 11-Mbps Wireless LAN PC Card. This card is inserted into the unit's PCMCIA slot.

If the Wireless Ethernet port parameters are changed, the test set must be rebooted for the changes to take affect.

The unit can connect to a wireless network using an 802.11 compliant wireless LAN PC card. The following describes the wireless configuration parameters:

Access Point ID: Enter the wireless LAN's SSID name. The Access Point ID can be up to 32-characters in length.

Obtain an IP address from a DHCP server: The unit will uses the network's Dynamic Host Connection Protocol (DHCP) server to dynamically assign it an IP address. ***When selected, the IP Address, Subnet Address, Router, Host Name, and Domain Name functions are disabled, but will be populated by the DHCP server.***

Specify an IP address: Allows a static IP address to be entered using the IP Address, Subnet Address, Router, Host Name, and Domain Name functions.

IP Address: Enter the unit's IP address using dotted decimal notation. For example, **nnn.nnn.nnn.nnn**, where **nnn** is a value from 0 to 255.

Warning: IP addresses **192.168.138.0 through 192.168.138.255** are reserved and should not be used. A system conflict can occur if these IP addresses are entered.

If you must use an IP address in the range of **192.168.x.y** (where x is not equal to 138), then you **must** set the Subnet Address to **255.255.255.0**.

Subnet Address: Enter the subnet address using dotted decimal notation.

Router: Enter the Router address using dotted decimal notation.

Host Name: Enter the unit's host name (for example, NICPLUS). This is an optional parameter.

Domain Name: Enter the unit's domain name (for example, lightwave.com). This is an optional parameter.

The **Host Name** and **Domain Name** parameters defined for Wireless Configuration screen also apply to the Ethernet Configuration screen. Any changes made to these parameters on one screen will also be made on the other screen.

The Wireless settings only displays when configuring from the NIC touch screen.

Configuring Wireless Ethernet

The unit only supports 11-Mbps Wireless LAN Card Bus cards. This card is inserted into the unit's PCMCIA slot.

If the Wireless Ethernet port parameters are changed, the test set must be rebooted for the changes to take affect.

The unit can connect to a wireless network using an 802.11 compliant wireless LAN PC card. The unit supports static IP addressing and dynamic IP addressing, using Dynamic Host Connection Protocol (DHCP). For information about the wireless parameters listed below, select Wireless Ethernet Settings.

Initial wireless configuration:

Insert the wireless LAN PC card into the unit's PCMCIA slot. An audible tone indicates that the LAN card and PCMCIA drivers are initialized.

Select **System**.

Select **I/O Settings**.

Select **Wireless**. The wireless configuration parameters appear.

The Wireless settings only displays when configuring from the NIC touch

screen.

Select **Access Point ID** and enter the wireless LAN's SSID name.

Select one of the following:

Obtain an IP address from a DHCP server. The test set will use the network's DHCP server to dynamically assign it an IP address. The remaining wireless parameters that appear on the screen are disabled.

Specify an IP address. The Enter Default IP Information dialog box appears

Select **IP Address**. The Enter IP Address keypad appears.

Enter the new IP address for the test set and select **OK**.

Warning: IP addresses **192.168.138.0 through 192.168.138.255** are reserved and should not be used. A system conflict can occur if these IP addresses are entered.

If you must use an IP address in the range of **192.168.x.y** (where x is not equal to 138), then you **must** set the Subnet Address to **255.255.255.0**.

Select **Subnet Address**. A keypad appears.

Enter the Subnet address and select **OK**.

Select **Router**. A keypad appears.

Enter the Router address and select **OK**.

Configuring the **Host Name** and **Domain Name** is optional. If you choose to change the current setting, select its button to open a keypad that allows you to enter a new name.

The **Host Name** and **Domain Name** parameters defined for Wireless Configuration screen also apply to the Ethernet Configuration screen. Any changes made to these parameters on one screen will also be made on the other screen.

Reboot the unit using the Reboot setting for changes to take affect.

Serial Configuration

Serial Port Settings

If Serial parameters are changed, the test set must be rebooted for the changes to take affect.

Before changing serial port parameters, you must first disable the serial port by setting its assignment to **None**.

After changing parameters, you can reset the serial port to its previous assignment. Refer to Port Assignment for a list of serial port interfaces.

These settings are used to configure the Serial port's parameters:

Baud Rate: Set to 19200, 14400, 9600, 4800, 2400, or 1200

Parity: Set to None, Odd, or Even

Data Bits: Set to 7 or 8

Stop Bits: Set to 1 or 2

Port Assignment: Sets the serial port to one of the following interfaces – None, SCPI, or Printer.

The Printer option only displays when configuring from the NIC touch screen, and does not apply to Remote GUI connections.

The most common settings are:

Baud Rate = **9600**

Parity = **None**

Data Bits = **8**

Stop Bits = **1**

Flow Control (*on PC only*) = None

Configuring and Assigning the Serial Port

If Serial parameters are changed, the test set must be rebooted for the changes to take affect.

The unit's serial port is a physical interface that can be used to:

Transfer SCPI commands to the unit via null-modem serial cable connected to a PC running a serial interface program such as Hyper Terminal or ProComm Plus.

Print or transfer test results files via null-modem serial cable from the unit to a PC running a serial interface program such as Hyper Terminal or ProComm Plus.

To configure and assign the serial port:

Select the **System** tab.

Select **I/O Settings** and choose **Serial**.

If required, select the **Baud Rate**, **Parity**, **Data Bits**, and **Stop Bits** serial port settings and make the appropriate changes.

The most common settings are:

Baud Rate = **9600**

Parity = **None**

Data Bits = **8**

Stop Bits = **1**

Flow Control (*on PC only*) = None

Select **Port Assignment**, and select the desired port assignment from the Select Serial Port Assignment dialog box.

Reboot the unit using the Reboot setting for changes to take affect.

The Printer option only displays when configuring from the NIC touch screen, and does not apply to Remote GUI connections.

GPIB Configuration

GPIB Port Settings

If GPIB port parameters are changed, the test set must be rebooted for the changes to take affect.

The following configures the GPIB port's parameters.

GPIB Port: Sets the GPIB port address from 0 to 30. The primary address must match the GPIB host or communications cannot be established.

Port Assignment: The unit can be controlled using SCPI commands through the unit's GPIB port. The Port Assignment line of the GPIB screen automatically displays SCPI as its assignment.

Configuring the GPIB Port

If GPIB port parameters are changed, the test set must be rebooted for the changes to take affect.

The unit can be controlled using SCPI commands through the unit's GPIB port. The Port Assignment line on the GPIB screen automatically displays SCPI as its assignment.

To configure the GPIB port address:

From the **System** tab, select **I/O Settings**.

Select **GPIB**.

Select **GPIB Port** and enter the primary address for the GPIB interface. Address values are from 0 to 30. The primary address must match the GPIB host or communications cannot be established.

Select **OK**.

Reboot the unit using the Reboot setting for changes to take affect.

NIC units that have the new System Controller 2 running Windows XP embedded must use GPIB PCMCIA data-bus cards manufactured by INES.

NIC units that have the original System Controller running Windows NT embedded must use GPIB PCMCIA cards manufactured by National Instruments.

Rebooting the Test Set

This function allows the system to write unsaved data to the disk before you reboot the unit. You can perform this task from the System I/O window or by selecting the Off/Lock button on a protocol processor tab.

Important: Rebooting the test set must be done from the NIC touch screen.

To reboot the unit from the System, I/O Settings window:

Select the **System** tab and choose **I/O Settings**.

Select **Ethernet** and choose **Reboot**. The Reboot dialog box appears.

Select **OK** to continue with the reboot process, or Cancel to keep the unit on. The Shutdown in Progress message box appears.

After all unsaved data is written to the disk, the unit restarts.

Important: If the unit does not successfully reboot turn it off manually by toggling the On/Off switch to **Off**. It is recommended that you wait about 10 seconds before turning the unit back on.

File Services Screen

File Services

This function provides file management of saved reports. It allows you to:

Printing Saved Files

Viewing Save Files

Uploading Files

Downloading Files

Renaming Files

Deleting Files

Deleting Directories

Create a new directory for file storage

FTP files

Printing Saved Files

While running tests, you have the option to save the information to a file. The instructions below tell you where and how to print a saved file.

Important: The NIC unit saves the files to its default D:\DLI\FTP\APPL\ directory on the test unit.

However, files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC.

Open the Remote NIC (**GalaxyNIC**) directory. For example, the default directory is C:\Program Files\GalaxyNIC\.

Locate the **Compat** folder from which the Remote NIC is running. The folder name represents the Feature Set operating on the NIC unit. For example, the Compat folder for Feature Set 5.3.53 appears in the GalaxyNIC directory as **Compat500030053**.

To print a saved file:

From the **System** tab, select **File Services**.

Select a file from the **Disk** directory box. The desired report may display in the main Disk directory, or it may be stored in one of the folders in the directory. Folder names are enclosed in brackets **[foldername]**. To return to the main Disk directory after opening a folder, select **[. .]** or the **Disk** button.

Important: Real-time reports generated from the NIC unit touch-screen, using the Action after Duration function, are automatically stored in the [APP] folder. Select the folder to display those reports.

The following is a list of file extension used for files generated from the Print Report, Graph, or Action after Duration functions:

.aps - APS Report

.evt - Event Report

.perf - Performance Report

.rep - Graph Report, BERT Analysis, RFC Thru Put Analysis

.set - Settings Report

.stat - Results Report

.real - Real-time Test Report (Stored in [APP} folder on NIC unit.)

.statE - Event Report

.grp - Graph (This is not a text file. It can only be viewed as a graph by selecting **Results,** pointing to **Graph** and choosing the **Replay Graphs** button.)

Select a file from the File List box.

Select **Print**. A standard Print dialog box appears.

If you want to print a report directly from the NIC unit, make sure that a printer is attached to the unit's parallel or serial port.

Printing to a USB printer is not supported at this time.

Select the printer **Name** and choose **OK**.

Viewing Saved Report Files

While running tests, you have the option to save the information to a file. The instructions below tell you where and how to view a saved file.

Important: The NIC unit saves the files to its default D:\DLI\FTP\APPL\ directory on the test unit.

However, files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC.

Open the Remote NIC (**GalaxyNIC**) directory. For example, the default directory is C:\Program Files\GalaxyNIC\.

Locate the **Compat** folder from which the Remote NIC is running. The folder name represents the Feature Set operating on the NIC unit. For example, the Compat folder for Feature Set 5.3.53 appears in the GalaxyNIC directory as **Compat500030053**.

To view a saved file:

From the **System** tab, select **File Services**.

Select a file from the **Disk** directory box. The desired report may display in the main Disk directory, or it may be stored in one of the folders in the

directory. Folder names are enclosed in brackets **[foldername]**. To return to the main Disk directory after opening a folder, select **[. .]** or the **Disk** button.

Important: Real-time reports generated from the NIC unit touch-screen, using the Action after Duration function, are automatically stored in the [APPL] folder. Select the folder to display those reports.

The following is a list of file extension used for files generated from the Print Report, Graph, or Action after Duration functions:

.aps - APS Report

.evt - Event Report

.perf - Performance Report

.real - Real-time Test Report (Stored in [APP} folder on NIC unit.)

.rep - Graph Report, BERT Analysis, RFC Thru Put Analysis

.set - Settings Report

.stat - Results Report

.statE - Event Report

.grp - Graph (This is not a text file. It can only be viewed as a graph by selecting **Results,** pointing to **Graph** and choosing the **Replay Graphs** button.)

Select a file from the File List box.

The following file details display below the File List box.
File name
File size and date
File attributes

Select **View**. The View File window appears.

Use the **Display Hex** / **Display ASCII** toggle button to display the file in Hex or ASCII format.

By default the text may be highlighted. Select anywhere in the View File window to un-highlight the text.

Select **Exit** to close the View File window.

Uploading Files

A file can be transferred from the unit to a remote device (e.g., a PC), or to a local device, such as a PCMCIA or Flash storage card or a USB storage device. (Note that System Controller 2 with embedded Windows XP supports USB plug and play functionality.) If using the PCMCIA or USB function, make sure that the PC card or USB storage device is plugged into the NIC unit before selecting the File Services button. When the PC card or USB device is inserted, an audible tone indicates that the proper drivers are qualified. If using the FTP function, make sure you have the IP address of the receiving device.

See also Download Files

From the System tab, select **File Services**.

From the right File List box, select the upload method by clicking on the Drive — FTP button.

If using *FTP*, click on that button, then enter the IP Address of the device that will receive the file (unless you are using the Remote Control Software; then enter the test set address). If this device is secured with a User ID and Password, then enter this information. Enter an FTP session on the connecting device.

If using a PCMCIA card, Flash card, or USB device such as a thumb drive, plug the card or device into the appropriate slot. After a few seconds the system will recognize the device and update the drive selection window. New drive letters will appear in the File List box. Note that it is possible to have both a PCMCIA card and a USB device connected to the NIC at the same time. From one of the drives in the File List box, select a target directory to receive the file. Note that it is usually best to plug in the storage media before clicking the File Services button

From the left File List box, select the current directory location of the file you want to transfer.

Select the desired file to be transferred.

Select the upload button. The file will be transferred from the NIC unit.

Warning: When the unit is powered off, the root FTP directory is automatically purged. However, files contained in sub-directories of the FTP directory (such as APPL) will not be deleted.

Downloading Files

A file can be transferred to the NIC unit from a remote device (e.g., a PC), or from a local device such as a PCMCIA or Flash storage card or a USB storage device. (Note that System Controller 2 with embedded Windows XP supports USB plug and play functionality.) If using the PCMCIA or USB function, make sure that the PC card or USB storage device is plugged into the NIC unit before selecting the File Services button. When the PC card or USB device is inserted, an audible tone indicates that the proper drivers are qualified. If using the FTP function, make sure you have the IP address of the receiving device.

See also Uploading Files

From the System tab, select **File Services**.

From the right File List box, select the download method by clicking on the Drive — FTP button.

If using *FTP*, click on that button, then enter the IP Address of the device that will send the file to the NIC unit (unless you are using the Remote Control Software; then enter the test set address). If this device is secured with a User ID and Password, then enter this information. Enter an FTP session on the connecting device.

If using a PCMCIA card, Flash card, or USB device such as a thumb drive, plug the card or device into the appropriate slot. After a few seconds the system will recognize the device and update the drive selection window. New drive letters will appear in the File List box. Note that it is possible to have both a PCMCIA card and a USB device connected to the NIC at the same time. From one of the drives in the File List box, select the directory containing the file to transfer. Note that it is usually best to plug in the storage media before clicking the File Services button

From the left File List box, select the destination directory.

From the right File List box, select the desired file to be transferred.

Select the download button. The file will be transferred to the NIC unit.

Warning: When the unit is powered off, the root FTP directory is automatically purged. However, files contained in sub-directories of the FTP

directory (such as APPL) will not be deleted.

Renaming Files

From the **System** tab, select **Files Services**.

Select a file from the File List box.

Select **Rename**. A keyboard appears. Enter the new file name with extension.

Do not use spaces in file names

.aps - APS Report

.rep - Graph Report, BERT Analysis, RFC Thru Put Analysis

.evt - Event Report

.set - Settings Report

.perf - Performance Report

.stat - Results Report

.real - Real-time Test Report (Stored in [APP} folder on NIC unit.)

.bmp - Print Screen image

.grp - Graph (This is not a text file. It can only be viewed as a graph by selecting **Results,** pointing to **Graph** and choosing the **Replay Graphs** button.)

Select **Enter** from the keyboard. The file is renamed.

The extensions above are default file extensions. You are able change these to .txt (text) files using the **Rename** function.

Deleting Files

From the **System** tab, select **File Services**.

Select a file or multiple files from the File List box.

Note: Selecting multiple files does not cause previous files to be unselected. To un-select a previously selected file, you must click it a second time.

Select **Delete**. A confirmation message appears.

Select **Yes**. The file is deleted.

If you do not have authorization to delete files, the **Access Denied** message appears.

Deleting Directories

The APPL directories can not and should not be deleted.

From the **System** tab, select **File Services**.

Select a directories from the File List box. Directory names are shown between left and right brackets

Double-click the directory and delete all of the directory's contents.

A directory can not be deleted if it is not empty

Select **Delete**. A confirmation message appears.

Select **Yes**. The file is deleted.

If you do not have authorization to delete directories , the **Access Denied** message appears.

Double-clicking on directories whose name are shown as just two dots **[. .]** will move you up one level in the directory tree structure.

Creating a New Directory

From the System tab, select **File Services**.

Select **New Dir**. A keypad appears.

Enter a directory name and select **Enter**. The new directory appears at the bottom of the File List box.

Do not use spaces in directory names

FTP Files

File Transfer Protocol can be used to copy files to and from the unit.

If using the Remote Control Application or DLI Software Upgrade program, make sure that FTP service is enabled.

To upload files using FTP, select Upload Files

To download files using FTP, select Download Files.

Security Screen

Security Settings Screen

Security is an administrative function and only appears if you are logged on as an Administrator. This screen is divided into the following main sections: User Security Information, System Services, NT/FTP Administrator, and Reset System.

Important: The Security option is not available unless you have Admin privileges.

User Security Information

This function allows you to view the following security information on system users:

User Name

Permissions: Admin, Calibrate, Read/Write,or Read Only

Active: Displays “Yes” for user’s currently logged in to the test set.

Current: Displays permissions of active users.

Default User: This column only appears on the local GUI and is linked directly to the “User Login Required” setting on the System Misc screen. When User Login Required is not selected the default user appears in the Login dialog box.

Default User only appears on the NIC touch screen.

The Security function also enables a user with administrator privileges to perform the following tasks:

Add a User

Delete a User

Update a User Profile

Enable/Disable Security System Lock

Establish a Default Login

Establish a Required Login

Selecting the Security System Lock check box prevents other people from logging onto the test set. If a user with Read and Write permissions is already logged in, a window will appear giving you the option of logging in with Read-Only permissions only. When the user logs on with Read-Only permissions, all functionality will be disabled with the exception of the online help and the About this product function.

System Services

System Services allows an administrator to disable specific network services to meet their network's security policies. To enable a system service, select its check box. To disable a system service, clear the check box.

NT/FTP Administrator

NT/FTP Administrator assigns a user ID and password so that a user can log in to a remote computer and transfer files using the file transfer protocol service.

Reset System

Reset System restores default Security settings.

Adding a New User

If the System Lock function is enabled, only one user with Read and Write permissions (this includes Calibration and Admin users) can be logged in at a time. If a user with Read and Write permissions is already logged in, a window will appear giving you the option of logging in with Read permissions only.

From the **System** tab, select **Security**.

From the **User Name** column, select **NEW USER**.

From **Account Information**, select

, next to the **User Name** field. A keypad appears.

Enter the **user name**. Important: User name must between 5 and 18 characters long, and can not contain and spaces.

Select , next to the **Password** field. A keypad appears.

Enter a **password**. Important: Password must between 4 and 8 characters long, and can not contain and spaces.

Select , next to the **Permission** field. The Select User Permissions window appears.

Select one of the following user permissions:

Admin: Allows the user to perform network administrator tasks such as calibrating, adding, deleting, and updating user profiles.

Calibrate: Allows the user read and write privileges and the ability to perform calibration procedures on the unit.

Read/Write: Allows the user to read and update information.

Read: Allows the user read-only privileges.

Select **Update**. The new user profile is added and appears on the User List.

Deleting a User

If the System Lock function is enabled, only one user with Read and Write permissions (this includes Calibration and Admin users) can be logged in at a time. If a user with Read and Write permissions is already logged in, a window will appear giving you the option of logging in with Read permissions only.

From the **System** tab, select **Security**.

From the User List, select the **User Name** to be deleted.

With the user name highlighted, select **Delete**. The user is removed from the User List.

Updating a User Profile

If the System Lock function is enabled, only one user with Read and Write permissions (this includes Calibration and Admin users) can be logged in at a time. If a user with Read and Write permissions is already logged in, a window

will appear giving you the option of logging in with Read permissions only.

From the **System** tab, select **Security**.

From the User Name list box, select the user profile to be updated. The user name, password, and permission appears in the Account Information box.

Select , next to the field to be updated.

If *Password* was selected, a keypad appears, allowing you to modify the current information. Press **Enter** when you are done.

If *Permissions* was selected, the Select User Permissions window appears. Select the updated permissions that you wish to apply.

When you are done updating the user's profile, select **Update**. The updated information appears on the User List.

Enabling/Disabling Security System Lock

This function allows an administrator to enable a Security System Lock that only allows one user with Read and Write permissions (this includes Calibration and Admin users) to be logged in at a time. If a user with Read and Write permissions is already logged in, a window will appear giving you the option of logging in with Read Only permissions only. When the user logs on with Read Only permissions, all functionality will be disabled with the exception of the online help and the About this product function.

To enable Security System Lock:

From the **System** tab, select **Security**.

From **Default Entry**, select the **Security System Lock** check box. A checked box indicates that the Security System Lock function is enabled.

To disable Security System Lock:

From the **System** tab, select **Security**.

From **Default Entry**, clear the **Security System Lock** check box. A cleared check box indicates that the Security System Lock function is disabled.

Establishing a Default User Login

This function allows an administrator to establish a default login, which results in users not having to enter a user ID and password each time they use the unit.

Important: The default login function is only applicable for the NIC unit. When connecting to a NIC via the Remote NIC application, a user ID and password are required. Establishing a default login user can only be done from the NIC touch screen.

To establish a default login user:

From the **System** tab, select **Security**.

From the User Name list box, select the **User Name** that you wish to make the default upon login.

Select **Set as Default**. Under the Default User column, a "Yes" appears, indicating that the user has been established as default user.

The Set as Default button is only available from the NIC touch screen.

To disable a default login:

From the **System** tab, select **Misc**.

From **Local Settings**, clear the **User Login Required** check box. A cleared check box, indicates that User Login Required is disabled.

The User Login Required check box is only available from the NIC touch screen.

Reboot the unit for changes to take affect. When the unit restarts, a login box appears.

If you do not wish to reset a Default Login user, there is no need to continue to the next step.

If you wish to set another default user, log in as an Admin user and repeat the steps above under, *To establish a default login*.

Establishing User Login Parameters

This function allows an administrator to establish the user login parameters. The login parameters allow for the following:

A **default login**, which means when the test set is booted up a default user name already appears in the User Name of the login dialog box. However, the user must enter a password.

A **required login**, which means when the test set is booted up the user is required to enter a user name and password.

Important: The login function is only applicable for the NIC unit. When connecting to a NIC via the Remote NIC application, the NIC IP Address, User ID, and Password are required.

System Services

The following system services can be enabled or disabled by an Administrator.

A unit reboot is required if any changes are made to system services.

To enable or disable a system service:

From the **System** tab, select **Security**.

From **System Services**, enable the following services by selecting the check box, or disable the service by clearing the check box.

Internet Information. The IIS (Internet Information Server) service provides the ability to host a simple web server, which uses port 80 (http). This function can be disabled (deselect the checkbox) to prevent unauthorized access to the port.

File Transfer Protocol. The FTP service allows a user to remotely log in to the unit and transfer files. Disabling this function can prevent unauthorized access to ports 20 and 21.

FTP service must be enabled if you use the Remote Control Application or the DLI Software Upgrade software. You can not connect to the unit using these applications if FTP service is disabled.

Remote Procedure Call. This protocol allows an application on one PC to request a service from another application located on a different PC within in a LAN. Disabling this function can prevent unauthorized users from using the unit to access other equipment in a customer's network.

Telnet. The Telnet service allows a user to log in to a remote system. Disabling this function can prevent unauthorized users from using the unit to access a customer's network.

NetBIOS. The NetBIOS (Network Basic Input/Output System) program allows applications to use port 139 to communicate to different PCs

within a LAN. This function can be disabled to prevent unauthorized access to the port.

SCPI. The SCPI (Standard Commands for Programmable Instruments) service uses port 8090 to send and receive SCPI commands to the unit. Disabling this function will prevent unauthorized access to the port.

TL1. The TL1 (Transaction Language 1) service uses port 8080 to send and receive TL1 commands to the unit. Disabling this function will prevent unauthorized access to the port.

TL1 commands are no longer supported with the NIC unit.

SNMP. The SNMP (Simple Network Management Protocol) service uses ports 161 and 162 to transfer commands and traps to and from the unit. Disabling this function will prevent unauthorized access to these ports.

SNMP commands are no longer supported with the NIC unit.

Resetting the System

This Administrator function clears and restores default settings to the following:

User Accounts - Deletes all user accounts and restores the default Admin account.

FTP Administrator - Deletes the FTP account and restores the default FTP user ID and password.

System Services - Restores all default system service settings.

User files, such as the protocol processor's transmit and receive settings, report statistics, graphs, and test results, are not deleted. These files are managed using File Services.

To reset the system:

From the **System** tab, select **Security**.

Select **Reset System**.

A message asking to confirm that you want to reset the system appears. Select **Yes**.

A message stating that the system must be restarted for changes to take affect appears. Select **OK**.

Reboot the system.

User Preference Screen

User Preference

Allows you to customize various preferences, such as how to label function tabs, how often to refresh status rates, and how to assign sounds to alarm events. The following functions appear on the User Preference screen:

PP Label Information: You can assign a specific name (up to 20 characters in length) to each protocol processor function tab. When a protocol processor tab is selected, the name appears in the PP Name/Go To area of the screen. For example:

Refer to Changing a Tab Name for the Go To Label for more information.

Current Printer: Current Printer: When printing a report or a saved file to a network printer, you can disable or enable the Windows Print dialog. If No Prompt Use is selected, the report is sent to your default printer without any user intervention. If Prompt Each Time is selected, you can choose a printer using the Print dialog.

Startup Locking State: Determines if a test set is automatically locked (see Lock Icon) when the unit is started.

Alarm Beeper Status: Associates a WAV file sound with an alarm event. When using the unit's touch screen, a total of 10 sounds are available. When using the remote GUI, up to a total of 16 sounds can be used. This includes customized WAV files that you provide by copying your own WAV files into the Remote NIC directory.

EMail Alert Notification: Allows the NIC to be configured for sending automatic Email Alerts based on user specified Error/Alarm occurrences.

Changing the Tab Name for Protocol Processors

From the **System** tab, select **User Preference**.

Under **Label Preferences**, select **Local** or **Global**.

Local – Only changes the tab label for your session. Other users will not see the tab name that you enter.

Global – Changes the tab label on the unit so that all users see the same tab name that you enter.

Select a tab name from the **Assigned Name** column of the list box.

Under **PP Label Information**, enter a name in the **Assigned Name** text field.

(When using the touch screen, select

to open a keypad.)

Select **Update List Entry**, to add the name to the User Defined Name column of the list box.

Repeat steps 3 through 5 to continue adding user-defined names, as desired.

Select **Save All List Entries**.

User defined names instantly replaces the default tab names

User defined names also appear in the PP Name/Go To area of the screen, when the tab is selected

User defined names also appear in the Go To menu, located in the top-left corner of the touch screen

User defined names also appear in the Subject line of all Email Alerts pertaining to the specific protocol processor

To restore the default tab names, select Restoring Default Tab Names

Restoring Default Tab Names for the Go To Label

From the **System** tab, select **User Preferences**.

Under Label Preferences, select **Default**.

Select **Save All List Entries**. The default tab names are restored.

To change tab names, select Changing a Tab Name for the Go To Label.

Setting the Alarm Beeper Status

This function associates a WAV file sound with an alarm event. When using the unit's touch screen, a total of 10 sounds are available. When using the remote GUI, up to a total of 16 sounds can be used. This includes customized WAV files that can be added by copying the new file to the Remote Control's installation directory on your PC.

To assign an audible notification to an alarm:

From the **System** tab, select **User Preference**.

Select **Alarm Beeper Status**.

Select **On** or **Maintenance**. The Alarm Beep Definition dialog box appears.

Select an alarm type to display the Select Alarms Sound dialog box.

Select a sound. The sound selection uses the WAV file's name. For example, chord.wav appears as CHORD.

If desired, select **Test** to hear the sound.

Select **Apply**.

To turn off all alarm sounds:

Select **Alarm Beeper Status**.

Select **Off**.

To add new WAV files to the Remote NIC on your PC:

Make sure that your Remote NIC application is closed.

Place a copy of the WAV file into the Compat folder that you are running the Remote NIC from.

To locate the Compat folder:

Open the Remote NIC (**GalaxyNIC**) directory. For example, the default directory is C:\Program Files\GalaxyNIC.

Locate the **Compat** folder from which the Remote NIC is running. The folder name represents the Feature Set operating on the NIC unit. For example, the Compat folder for Feature Set 5.3.53 appears in the GalaxyNIC directory as **\Compat500030053**.

There can be more than one Compat folder in the GalaxyNIC directory. To determine the correct folder, check the Feature Set version operating on the NIC test set that you want to add the WAV file to by selecting its **System** tab, choosing **Misc**, and pointing to **About this product**. The **Feature Set** version is located near the top of the **About NIC** dialog box.

After the WAV file has been added to the appropriate Compat folder, open the Remote NIC application.

From the **System** tab, select **User Preference**.

Select **Alarm Beeper Status**.

Select **On** or **Maintenance**. The Alarm Beep Definition dialog box appears.

Select an alarm type to display the Select All Alarms Sound dialog box. The new WAV files appear in the dialog box. Only the first 16 sounds will appear in the selection window. The sound files that appear use the WAV file's name.

Select the new WAV file and choose **Apply**.

Sending Email Alerts

Before using the email alert feature, check with your Network Administrator to verify that your email account is set up to accept and forward SMTP mail.

Important: After the Email Alerts settings are completed, email notifications will only be sent if the GUI is actively viewing either the All Tests Status window or the protocol processor tab for which the Mail Notify setting has been configured. Email alert messages will not be generated if these conditions are not met.

To set up email alerts:

Ensure the NIC unit is connected via an **Ethernet cable to your network**; and it is properly configured with a valid IP Address, Subnet Mask, and Router if necessary.

From the **System** tab, select **User Preference**, and configure the following **Mail Notification** settings.

Select the **Mail From**, and enter the "From" name as it should appear in the email, and press **Enter**.

The default setting is the last four digits of the unit's serial number

Important: Some email servers may require the "**@*yourdomainname*.com**" extension to be added to this setting, in order for the email to be sent

Select the **Mail Server**, and enter the email server address and press **Enter**.

For example, ms1 or mail.*yourdomainname*.com, etc. (Your I/T administrator should be able to provide this information)

Select the **Mail To,** and enter the recipient's email address, and press **Enter**.

Multiple recipient email addresses can be entered by separating each of them with just a comma (do not use a semi-colon)

This entry is limited to a total of 65 characters. However, multiple Remote GUI's can be connected to one unit, and each used to send emails to different recipients. Also, you can set up group emails with your email system where one address delivers the message to several recipients

Select the **Mail Interval**, and pick a desired time setting from the **Duration of Test** window.

This option determines the minimum amount of time required to elapse between email notifications

The first email notification will be generated the instant that any of the selected errors/alarms occur, regardless of what the Mail Interval setting is set to. The **Mail Interval** setting then determines how long the system waits until it re-checks that processor's errors/alarms again

If the processor is still receiving the selected error/alarm (or any other errors/alarms if ALL is specified) after the Mail Interval time has elapsed, then the system will generate a follow-up email, and

continue to repeat in this manner for as long as the error/alarm condition(s) are being received

If the processor is no longer receiving the selected error/alarm after the Mail Interval time elapses, then the system will not generate another email, but rather wait until the next error/alarm occurrence. As before, the system will then wait for the Mail Interval time to elapse before re-checking the processor again

If more than one processor receives their specified errors/alarms at different times, then they will each independently generate an email when their respective event occurs, and they will each independently wait for the specified Mail Interval time to elapse before checking their errors/alarms again

If at any time the processor being monitored is **restarted**, causing the Elapsed Time to revert back to 000:00:00:00, then an email notification will be generated at the next onset of the specified error/alarm type, at which point the processor once again begins to wait for the specified Time Interval to elapse before it re-checks for errors/alarms again

Conditional: Select **Mail User**, and enter a valid network User ID. Select **Mail Password** enter the Password for the specified network User ID.

The **Mail User** and **Mail Password** settings may or may not be required, depending on the network's configuration and security settings

Only enter this information if Email Alerts are not being sent without it

Note: The **Mail Password** is <u>not</u> saved, displayed, shared, transmitted to anyone, or accessible by anyone in any way

Important: The **Mail Password** setting DOES NOT persist after the unit has been rebooted

From the **Processor / Mail Notify** list box, select the protocol processor for which you want to set up Email Alerts. The **Select Error/Alarm Mail Notification** window appears. Select the desired **error/alarm** type to monitor, or select **All** to monitor all of the errors and alarms listed for that processor.

When **None** is selected, then Email Alerts will not be generated from that processor, regardless to the error/alarm condition of the processor

Some processors have more selections than the window can display at one time. In this case, the last option will be More. Select **More** to see the next sheet of error/alarm types to choose from

You can configure additional protocol processors for Email Alerts by selecting another processor, after choosing the desired error/alarm type for this processor

When monitoring multiple processors, each processor can be configured for its own error/alarm type, or select **All** to monitor all errors and alarms listed for each

Important: The **Processor / Mail Notify settings** DO NOT persist after the unit has been rebooted

After you have finished configuring the Email Alerts, the GUI must actively be monitoring the specified protocol processor(s) for which the Email Alerts have been configured, at all times.

Important: If the GUI is not monitoring the selected processor(s) at the time a specified event occurs, an email will not be generated

For reliable email generation when multiple processors have been configured to be monitored, you must select the **All Tests Status** window located under the System tab. The All Test Status window is capable of monitoring all processors at the same time, allowing emails to be generated for any configured processor if a specified error or alarm event occurs

If you have configured to monitor a single processor, then you may select either the **All Tests Status** window, or any window under that processor's tab

Note: A Remote GUI connection could be used for the sole purpose of Email Alerts, to free up the local GUI (or other remote GUI's) for other protocol testing purposes

Important: To activate the email notification function for *multiple protocols* you must select the **All Tests Status** screen after the configurations are completed.

To terminate email alerts:

From the **System** tab, select **User Preference**. The User Preference screen appears.

Select the **Mail Interval** button. The **Select Duration of Test** dialog box appears.

Select **OFF**.

In the **Processor/Mail Notify** list box, select the protocol processor for which you want to terminate the Email Alerts for and choose **None** from the **Select Error/Alarm Mail Notification** window.

Testing/Troubleshooting Email Alerts (optional):

It is strongly suggested to test Email Alerts configurations prior to leaving the unit unattended of an important long-term test.

From the User Preference window, configure all of the Email Alert settings as describe in the sections above, customized for your specific test needs with two exceptions.

Choose either **ALL** or **LOS** from the **Select Error/Alarm Mail Notification** window for the specified processor

Enter 1 minute for the Mail Interval Time. This way, after the test email is sent, the processor only has to wait one minute before it is ready to send the next email

Select the configured Protocol Processor tab, and momentarily unplug the receive Fiber Optic or Electrical Interface cable, causing a brief LOS situation to occur.

Check the designated email inbox, and verify that the email notification was received.

If the email alert does not appear in the Inbox, then be sure to check any anti-spam mail folders before adjusting the Email Alerts settings

If a spam filter did not perceive the Email Alert to be junk-mail, then some adjustments to the Email Alerts' settings may need to be made

If the Mail Interval, Mail To and Mail Server settings all look correct, then add the "**@*yourdomainname*.com**" extension to the **Mail**

From setting, or enter a valid **Mail User ID** and **Mail Password**, and try the test again

If the test mail is received, then this completes the Email Alerts notification test.

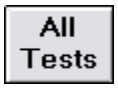
Reconfigure the **Processor / Mail Notify** setting for the desired error/alarm type

Reconfigure the **Mail Interval** to the desired duration for the actual test

Remember to leave the GUI parked on the configured Protocol Processor tab, or the All Test Status screen

Displaying All Test Status

The NIC can operate multiple tests simultaneously. Each Protocol Processor has a panel of Error, Alarm and Status LED Indicators to display the status and history of the current test. The All Test Status screen allows the user to observe, at a glance, the status of all simultaneous tests.

To view All Test Status, select the 

button from any protocol processor or select

under the System Tab.

When in this All Test Status mode, each circuit pack is polled. You may notice a slight delay in status reporting based on your unit's configuration.

The All Test Status screen is a general summary screen for up a maximum of 12 protocol processor tabs at one time. If the unit contains more than 12 circuit packs (protocol processor tabs), the protocol processor tabs appear in groups of 12. Select the All Test button (**All Test (1 to 12)**) to scroll through the various groups.

The following information appears for each protocol processor or individual port number:

1. Protocol Processor tab name

2. Elapsed time (in minutes)

3. Summary LED (*See Conditional LED options below*)

   A **Red** Summary LED indicates that at least one "Conditional" LED is currently Red in the LED Status Indicator section of the Protocol Processor

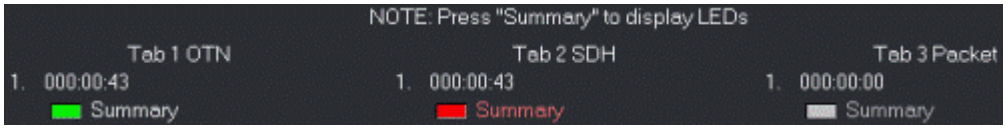
   A **Green** Summary LED indicates that at least one "Conditional" LED is currently Green, and none of the "conditional" LEDs are currently Red, in the LED Status Indicator section of the Protocol Processor

   A **White** Summary LED indicates either none of the "Conditional" LEDs are currently Green or Red in the LED Status Indicator section, or status LEDs are selected (checked) to be "Conditional"

   A **Gray** Summary LED indicates that the Protocol Processor tab is currently disabled

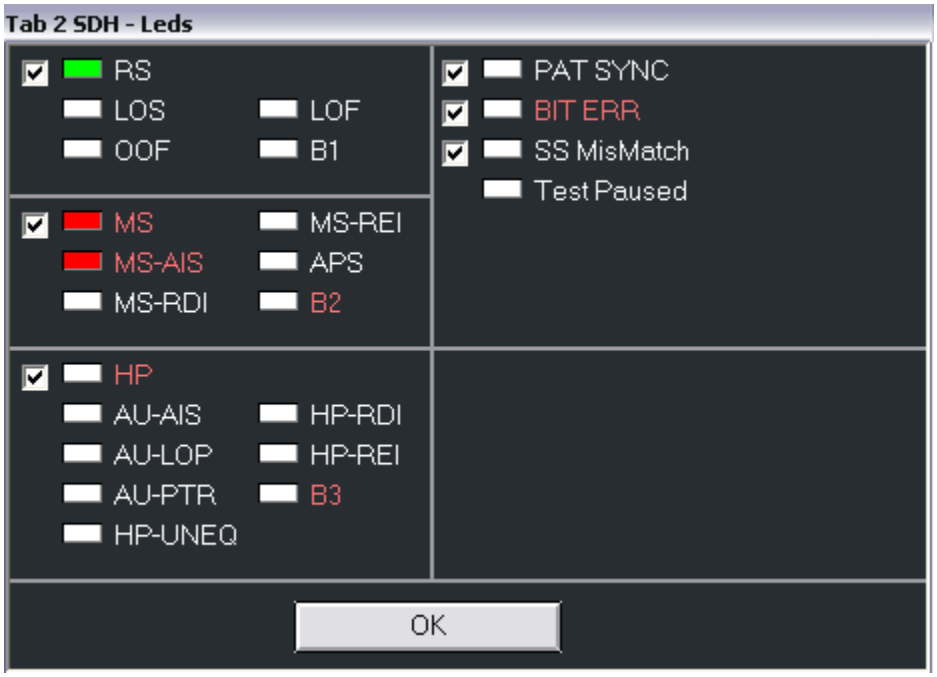
   The color of the word "**Summary**" indicates history. White text indicates that no alarm or error has been detected during the current test. Red text indicates that at least one "conditional" LED is or was Red during the test in progress

Below is an example of the All Test Status screen:



Expanded Alarm and Status Indicators

In order to display all Error, Alarm and Status Indicator LEDs for any one Protocol Processors, select "Summary" to expand the list of Status Indicator LEDs for the Protocol Processor. You will then see a pop-up window containing all Status LEDs for that Protocol Processor or Port number. Press "OK" to close the window.



Conditional LED Option

In the expanded Status Indicator LED pop-up window, there are a series of check boxes. When selected (checked), the specified LEDs are considered "Conditional", and will be used to trigger the Summary LED as either Green or Red depending on the current status of the Conditional LEDs. Regardless of number Conditional LEDs that are currently Green, if any of the Conditional LEDs turn Red, then the Summary LED and the word Summary will turn Red.

By default, all of the Status LEDs are selected, and considered to be Conditional. However, this feature allows the user to only monitor specific Errors or Alarms or specific sections of Errors and Alarms for each Protocol Processor in the All Test Status window by un-selecting certain LEDs. If a check box is unselected (unchecked), those Errors and Alarms will be ignored when displaying the Summary LED on All Test Status screen. Thus causing the Summary LED to not turn Red when any non-selected Status LEDs in the LED Status Indicator section do turn Red.

Multi-Page Display

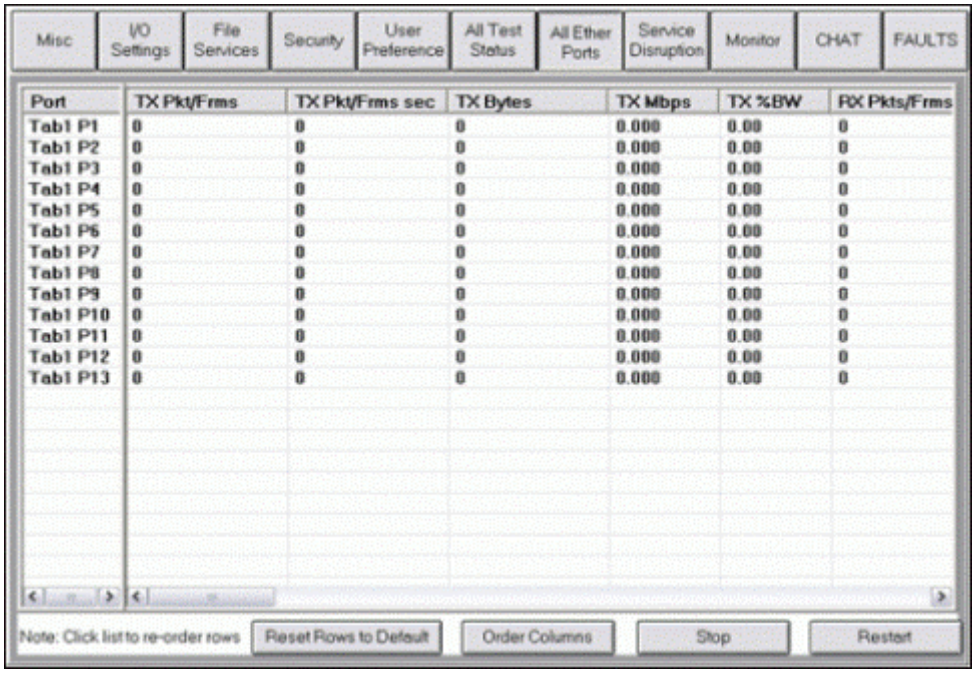
When a unit is equipped with more than 12 Protocol Processors or Port numbers, the All Test Status screen will be split into multiple groups. The All Test Status button will indicate the group being displayed, i.e. **All Test (1 to 12)**, **All Test (13 to 24)**, and so on. Select the All Test Status button again to advance to the next group.

All Ether Ports

The NIC with High-Density Ethernet module can operate multiple Ethernet tests simultaneously. The All Ether (Ethernet) Ports screen allows the user to observe, at a glance, results and statistics of all simultaneous tests.

If an HD Ethernet board is not installed, the "All Ether Ports" button will be grayed out.

To view the All Ether Ports screen, select [All Ether Ports] under the System Tab.



The All Ether Ports display operates similar to a spreadsheet. The user can re-size and re-order the rows and columns easily. There are 35 columns of information so not all can be shown simultaneously. Use the scroll bar at the bottom to scroll to the additional rows.

Re-Order Rows

Click on any row in the left-most column, “Port”. A pop-up window will allow the user to supply a new position for that row.

Reset Rows to Default

Click on to restore the sequence of rows to default.

Order Columns

Select to re-order columns. A pop-up window will appear. Select the column or columns to move to the front (left).

Global Stop (All Tests)

Selecting the Stop button will stop all tests on all HDEnet ports that the user has locked. Essentially, this is the equivalent of selecting the "Stop" button on all HDEnet ports at the same time.

Global Restart (All Tests)

Selecting the Restart button will reset the counters and restart all tests on all HDEnet ports that the user has locked. Essentially, this is the equivalent of selecting the "Restart " button on all HDEnet ports at the same time.

IMPORTANT: The **Stop** and **Restart** buttons only control those ports that the user has locked on all Ethernet cards. If a port is unlocked or was locked by someone else, it will not be affected.

Service Disruption

This functionality allows the NIC unit to measure service disruption intervals in your network.
The unit can be configured to monitor for a specific event that will cause a service disruption. When the service disruption event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path. This function also allows you to set a specific event as a trigger for service disruption activity.

The SDH/SONET/OTN service disruption measurement has an accuracy of 1 µs (microsecond). GigE service disruption tests show an accuracy of 0.1 ms (millisecond).

Monitoring SCPI Commands

The Monitor screen is a command window that allows you to view SCPI commands issued to the unit, command responses (for valid commands entered), and the error code (if an invalid command is entered).

To use the Monitor feature, the communications port must be configured. The Ethernet and GPIB ports are always enabled for SCPI commands, however, the Serial port assignment for the must be manually configured.

To open the monitor:

From the **System** tab, select **Monitor**.

Choose **Reverse** if you wish reverse the order in which commands appear.

By default, commands are listed such that the latest command will always be display at the top of the window, whereas the previous commands are pushed down. Thus you do not have to scroll down to see the commands as they occur.

Choose **Pause** if you wish to freeze the Monitor and prevent new commands from being displayed as they arrive, to give you time to review the commands that already appear in the list.

This does not pause the SCPI server from excepting new commands as they arrive, nor does it pause the processors from carrying out the commands

Choose **Resume** to continue to display new commands as they arrive

Choose **Clear** to delete the list of SCPI commands currently displayed.

The **Select Command Processor** currently only supports **SCPI** commands.

To issue SCPI commands to the unit:

Refer to the *SCPI Command Reference Guide* for procedures. The guide can be found in the Technical Documentation Library at http://www.lightwave.com.

Chatting

Use the Chat function to send brief messages to other networked units.

To send a message:

From the **System** tab, select **Chat**.

Enter your message in the **Input Message** box.

Select

if using the touch screen on a portable unit. A keypad appears allowing you to enter the message. Select **Enter** when done. The message appears in the Input Message window.

If using the Remote Control Application, place your mouse cursor in the Input Message box and type the message.

Pressing the Enter key on your keyboard will delete the message. To avoid this, select **Multi Lines** before starting to type the message. In addition, if you have a long message, select Multi Lines so that you can use the Enter key to keep your message within the Input Message window.

You can assign a **High Priority** level to the message, or you can require that the recipient respond to the message (**Reply Required**).

Another user will not see the Chat message unless High Priority or Reply Required is selected.

Select **Send**.

Faults

The unit maintains a fault log of critical hardware problems reported by circuit packs.

If a circuit pack is out of service, the icon appears.

To view system faults:

Select **System**.

Select **Faults**. If a fault has been logged, the following appears in the Fault Messages window:

Date and time that the fault occurred.

Fault description

Card – The circuit pack that is reporting the problem.

To clear the system fault log:

Select **Clear**.

ATM Tab

ATM Overview

This ATM section is divided into two areas:

- ATM Specific Tasks
- ATM Screen Functions and Descriptions

ATM Specific Tasks

ATM Specific Tasks Overview

This section includes tasks that are specific to the ATM protocol processor. For a list of general settings, refer to the Screen Functions and Descriptions section.

Please use the **Contents** tab and window (left side of the Help screen) to select, open, and view Specific Tasks for this protocol processor.

Activate or Disable VCC Table Data Transmission and Monitoring

1. Select **VCC Table**.
2. Select **VCC CTRL**.
3. Select a VCC.
4. Set the following parameters:

    - Select **All TX Mode** to enable data transmission for up to 255 Transmit connections, starting from the current selection in the VCC Table.
    - Select **All RX Mode** to enable data monitoring for all virtual channels listed in the VCC Table.

- Select **VCC TX Mode** to enable ATM Cell transmission for individual virtual channels in the VCC Table.
- Select **VCC RX Mode** to enable ATM Cell monitoring for individual virtual channels in the VCC Table.

5. Select **TX On/Off** to start or stop the transmission of ATM cells on all enabled virtual channels listed in the VCC Table.
6. Select **RX On/Off** to start or stop data traffic reception and monitoring on all enabled virtual channels listed in the VCC Table.

Add an SVC Table

1. Select **Config**.
2. Select **Set**.
3. Select **Signalling** and enable.
4. Select **SVC.** If a change is required, specify the default SVC parameters.
5. Select **VCC Table**.
6. Select **Edit Tbl**.
7. Select **Add VCC** and select **SVC**.
8. To specify the VCC header information in the case of UNI4.0, select **Header**.
9. To change the Default parameters, select **Edit** under the Default Parameter portion of the screen.

- To specify the VCC's Transmit pattern, select **Transmit Pattern**.
- To specify the VCC's Receive pattern, select **Receive Pattern**.
- To specify the traffic capability, select **Traffic Type.**
- To specify the forward QoS class, select **Fwd QoS Class**.
- To specify the backward QoS class, select **Bwd QoS Class**.

10. To change the AAL protocol mode, select **Edit** under the Aal Parameters portion of the screen.
11. Select **AAL** and select AAL0, AAL1, or AAL5.

- If AAL0 was selected, go to step 12.
- If AAL1 was selected, select **AAL1 CS1 Octet**.
- If AAL5 was selected, select **AAL5 CPCS SDU Length** and **AAL5 CPCS UU Octet**.

12. To change the forward traffic descriptors, select **Edit** in Forward Traffic Descriptor screen.

- Select **Combination** and select a combination.
- To specify the descriptors:
  - If the combination is 1, select PCR CLP0 and PCR CLP0+1.

- If the combination is 2, select PCR CLP0, PCR CLP0+1 and Tagging = Tagging Requested.
- If the combination is 3, select PCR CLP0+1, SCR CLP0 and MBS CLP0.
- If the combination is 4, select 4 PCR CLP0+1, SCR CLP0, MBS CLP0 and Tagging = Tagging Requested.
- If the combination is 5, select PCR CLP0+1.
- If the combination is 6, select PCR CLP0+1, SCR CLP0+1 and MBS CLP0+1.

13. To change the backward traffic descriptors, select **Edit** in the Backward Traffic Descriptor portion of the screen.

- Select **Combination** and select a combination.
- To specify the descriptors:
  - If the combination is 1, select PCR CLP0 and PCR CLP0+1.
  - If the combination is 2, select PCR CLP0, PCR CLP0+1 and Tagging = Tagging Requested.
  - If the combination is 3, select PCR CLP0+1, SCR CLP0 and MBS CLP0.
  - If the combination is 4, select 4 PCR CLP0+1, SCR CLP0, MBS CLP0 and Tagging = Tagging Requested.
  - If the combination is 5, select PCR CLP0+1.
  - If the combination is 6, select PCR CLP0+1, SCR CLP0+1 and MBS CLP0+1.

14. Select **Edit** under the Called Party Address portion of the screen and set the address.
15. If the ATM Interface is UNI4.0, select **Optional** and set the optional parameters.
16. Select **Save**.

Technical Specifications

Specification	**Description**
Physical Interfaces	STM-0, STM-1, STM-4, E1 (HEC, PLCP), E3 (HEC, PLCP)
Physical Layer	SDH bulk filled; C-3 (into VC-3), C-4 into VC-4, C4-4c Structure into VC-4-4c
Adaptation Layers	AAL0, AAL1, AAL5
Header and Interface Support	Control of all cell header bits, UNI and NNI support, filter on CLP and CI bits
Channel Capacity	**Transmit:** 255 channels (independent AAL, service class, and bandwidth on

	all VCCs) **Receive:** 256 channels (cell count, bandwidth, AAL5 PDU counts and errors on all channels), stress testing at full STS-12c rate
Traffic Management	Constant Bit Rate (CBR), real time/non-real time Variable Bit Rate (VBR), Unspecified Bit Rate (UBR), Available Bit Rate (ABR)
Quality of Service	Cell transfer delay (min, max, mean), cell delay, variation (1 and 2 point measurement), cell bandwidth analysis, correctable/uncorrectable HEC errors, BERT analysis, real-time channel analysis, CLP monitoring, CI monitoring
Performance Analysis	CER, CLR, CMR, SECBR
Protocol Analysis	**AAL0:** Cell count and bandwidth utilization, Bit error count, Pattern sync errors **AAL1:** AAL1 SAR PDU header SNP errors, Lost cells, misinserted cells for AAL1 VCCs **AAL5:** CPCS analysis, VCC simultaneous analysis, CRC, PDU length errors **Network Impairment:** Cell error generation, cell loss, cell misinsertion, CDV, cell reordering, test traffic insertion, VPI/VCI remapping, CLP tagging, CI setting
Error Measurement	HEC correctable and uncorrectable error counts and rates; AAL5 CRC errors, AAL5 length errors; PRBS bit error measurement, loss of PRBS sync; AAL1 SN/SNP error, lost cells, misinserted cell counts and rates; PLCP framing errors, PLCP BIP, PLCP FEBE counts and rates; PCLP B1 CNT, PLCP Framing Error Cnt, cell

	overflow
Error Injection	HEC-correctable and uncorrectable errors, HEC error rate from continuous to 10^{-9}, HEC error burst from 1 to 10 on consecutive cells; PLCP B1, PLCP, FEBE, PLCP POI, PLCP Frame (A1A2), PLCP (POI)
Alarm Detection	Cell synchronization loss, F4 and F5 AIS OAM flow (end-to-end/segment), F4 and F5 RDI OAM flow (end-to-end/segment); PLCP yellow alarm (RAI)
Cell Payload Patterns	PRBS 2^{15} -1, all 1's, 10101010, user-defined pattern
Alarm Generation	Cell synchronization loss, F4 and F5 AIS OAM flow (end-to-end/segment), F4 and F5 RDI flow (end-to-end/segment), PLCP yellow alarm
SVC Support	Self call SVC, Calling SVC's, Called SVC's
SVC Signaling Support	Call establishment, Cyclic calls, Call bursts, user defined SETUP message, background traffic
SVC Monitoring	All statistics, UNI signalling, ATM layer, AAL-5, Signaling filters, UNI signaling errors, SSCOP errors, port, errors/alarms
ATM Management	Analysis of F4, F5, and loopback OAM cells (ITU I.610), OAM performance monitoring

Cell Block Sizes and SECB Thresholds
(Per ITU-T Rec. 0.191)

PCR (cells/second)	**(User information rate in Mbit/s)**	**N (block size)**	**M (threshold)**
0 ___< x ≤3200	(0 ___< y ≤1.23)	128	4
3200 ___< x ≤6400	(1.23 ___< y ≤2.46)	256	8
6400 ___< x ≤12 800	(2.46 ___< y ≤4.92)	512	16
12 800 ___< x ≤25 600	(4.92 ___< y ≤9.83)	1 024	32
25 600 ___< x ≤51 200	(9.83 ___< y ≤19.66)	2 048	64
51 200 ___< x ≤102 400	(19.66 ___< y ≤39.32)	4 096	128

102 400 ___< x ≤204 800	(39.32 ___< y ≤78.64)	8 192	256
204 800 ___< x ≤409 600	(78.64 ___< y ≤157.29)	16 384	512
409 600 ___< x ≤819 200	(157.29 ___< y ≤314.57)	32 768	1024
NOTE – This table applies to the peak cell rate of the aggregate cell flow, CLP = 0 + 1.			

Delete a VCC Entry or Table

1. Select **VCC Table**.
2. Select **Edit Tbl**.
3. You can delete a single entry or entire table.
   - *To delete a single entry*

     Select the VCC that you wish to delete, and select the **Delete** button at the bottom of the table. From the Delete window, select **Single Entry**. The item is deleted.

   - *To delete an entire table*

     *S*elect the **Delete** *b*utton located at the bottom of the table. From the Delete window, select **Table**. The Confirm Delete window appears, confirming that you wish to delete the current table. Select **Yes**. The entry or table is removed.

Edit an SVC

This function allows you to edit an SVC.

The Edit VCC button modifies parameters of an existing virtual channel listed in the VCC Table. If there are no virtual channels listed in the VCC Table, then this button is disabled. Also this button is changed to View VCC when transmission or reception is on. View VCC allows you to view the parameters of the VCC without being able to edit them.

1. Select **VCC Table**.
2. Select **Edit Tbl**.
3. Choose the SVC table to be edited from the VCC Table grid and select the **Edit VCC** button. The Edit VCC <#> Type: SVC dialog box appears.

   You can also scroll to the table to be edited by selecting the Prev or Next buttons on the Edit VCC window.

4. See the section Add an SVC for descriptions of the options on the Edit screen. After the appropriate parameters are modified, select **Save**.

Enable Signalling

1. Select **Config**. and **SET**.
2. Select **ATM Mapping** and set the mapping.
3. To specify the ATM interface, select **ATM Interface** and select **User-UNI3.0**, **User-UNI3.1**, or **User-UNI4.0**.
4. To specify the signalling PCR, select **Signalling PCR** and set the value.
5. To specify the Timer values, select **TMR**.
6. Select **Signalling** and select **Enable**.

Filter Signalling Messages

1. Select **Config**.
2. Enable **Signalling**.
3. Select **SIG FTRS**.
4. Select **Signalling Filter** and select **Enable**.
5. Select **Filter Type** and select a type of filter.

   a. If the filter type selected is Message Filter/ Message and Call Reference Flag/ Message and Call Reference Value, press **Add** and select the message to be filtered.

   b. If the filter type selected is Call Reference Flag/ Message and Call Reference Flag/ Call Reference Value and Flag, select **Call Reference Flag** and set it to **1** or **0**.

   c. If the filter type selected is Call Reference Value/ Message and Call Reference Value/ Call Reference Value and Flag, select **Call Reference Value** and set the value.

6. For selecting multiple messages, repeat step a.

Add a VCC Table

The Add VCC function allows you to create or edit a new virtual channel in the VCC Table.

1. Select **VCC Table**.
2. Select **Edit Tbl**.
3. Select **Add VCC**. The Select VCC Type window appears.
   - When Signaling is not enabled, the Add VCC function adds a PVC. When Signaling is enabled the Add function opens the Select VCC Type list box from which you can select PVC or SVC.
4. Select **PVC** or **SVC**.

   - The PVC function allows you to add a permanent virtual channel. When selected, the Add VCC screen appears. Modify the

appropriate PVC parameters. See the section Permanent Virtual Circuit (PVC) for additional information.

- The SVC function allows you to add a switched virtual channel (SVC). When selected, the Add SVC screen appears. Modify the appropriate SVC parameters. See the section Add an SVC for additional information on adding SVCs.

5. When the appropriate parameters are modified, select **Save**.

Initiate a Loopback Test

1. Connect to the test unit to which you want to send a loopback.
2. Select **Config**.
3. Select **SET**.
4. Select **Loopback Response**.
5. Select **Enable**.
6. Select **Functions**.
7. Select **Loopback**.
8. Select the table item you wish to send and select **Edit**.
9. Select **Connection Type** and select a parameter.
10. Select **Duration of Insertion** and select a parameter.
11. Select **Single Loopback** and select a parameter.
12. Select **Clear Count** and select a parameter.

Insert ATM Alarms

1. Select **Functions**.
2. Select **Alarm Gen**.
3. Select a VCC in the table.
4. Select the **Edit** button located in the bottom right corner of the table. The Edit Alarm Settings window appears.
5. Select **ATM Alarm Generated** and select an alarm type.
6. Select **Duration of Alarm Generation** and select the duration.
7. If applicable, select **Defect Type**.
8. Select **Save**.

To stop alarm transmission:

1. Select **Functns**.
2. Select **Alarm Gen**.
3. Select an item in the table.
4. Select the **Edit** button located in the bottom right corner of the table. The Edit Alarm Settings window appears.
5. Select **Duration of Alarm Generation.**
6. Select **Off**.

Insert ATM Errors

1. Select **Functns**.
2. Select **Error Gen**.
3. Select a VCC entry from the table.
4. Select the **Edit** button located in the right bottom corner of the table. The Edit Error Settings window appears.
5. Select **Type of Error Added** and select an error type.
6. Select **Error Insertion Rate** and select the rate of the error insert.
7. Select **Error Burst Count** and use the key pad to enter the number of error bursts to occur.
8. Select **Duration of Error Insertion** and select the duration of the error.
9. Select **Save**.

To stop error transmission:

1. Select **Functions**.
2. Select **Error Gen**.
3. Select a VCC entry from the table.
4. Select the **Edit** button located in the right bottom corner of the table. The Edit Error Settings window appears.
5. Select **Error Insertion Rate** or **Duration of Error Insertion**.
6. Select **Off**.

Jitter Specific Tasks

This section includes tasks that are specific to the Jitter protocol processor. For general tasks, refer to the Common Tasks section.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view Specific Tasks for this protocol processor.

Monitor ATM Activity

Various ATM test and event activity can be viewed by select the ATM Results button. The Results screen offers the following options:

- Scan
- ERR
- Alarm
- Event
- Large LED
- Graph
- Call RSLTS

You can also display a summary report of current cell activity, bandwidth percentage used, virtual channel status, and virtual channel totals for a VCC table by using the SUM.

To access the SUM function:

1. From the ATM protocol processor, select **VCC Table**.
2. Select **SUM**.

Perform Load Tests

1. Select **Config**.
2. Select **Signalling** and select **Enable**.
3. Select **Load Test**.
4. Select **Type of Test** and select one of the types.
5. Select **Calls per Second** and enter a value.

    - If the type of test selected is Call Burst, select **Burst Period** and select a value.
    - If the type of test selected is Call Burst, select **Skip Period** and select a value.

6. Select **Duration** and select a value.

Print a Report

You are able to print the following types of ATM reports:

- **Summary Results Report:** Prints a summarized listing of ATM test results.
- **Summary Counts Report:** Prints a summarized count of idle cells, total monitored cells, discarded cells, valid OAM cells, errored OAM, transmitting VCCs, Receiving VCCs, and total VCCs.
- **VCC Counts Report:** Prints a listing of individual VCC counts or all VCC counts.
- **QOS Counts Report:** Prints a listing of individual QOS counts or all QOS counts.
- **Connection Details:** Prints a listing of individual connections details or all connections details.
- **Current Settings:** Prints the all current configuration settings for the ATM protocol processor.

To print a report:

1. Select **Print Report**. (This button is part of the Common Function Buttons that appear at the bottom of the touch screen.) The Report Setup menu appears.
2. Use the **Destination Printer** functions to print reports to a printer.
3. Use the **Destination File** functions to print reports to a file.
4. Select a report.
5. Select **OK**.

If printing to a file, the File Browser appears. Enter a filename and select **OK**.

Recall a VCC Table

1. Select **VCC Table**.
2. Select **Edit Tbl**.
3. Select **Recall Table** from the bottom of the screen. The File Browser window appears.
4. Select the table that you wish to restore. All table names have a .VCC extension.
5. Select **OK**. A warning message appears confirming that you wish to restore the selected table.
6. Select **Yes**. The table information appears in the Edit Tbl screen.

Save a VCC Table

1. Add the VCCs that you wish to save to a table. For more information, see the Add a VCC section.
2. With the table open, from the Edit Tbl screen, select **Save Table** (located at the bottom of the screen). The File Browser window appears.
3. Select **File Name**. A keypad appears.
4. Enter the name of the table to be saved, and select **Enter**. The table's file name appears next to the Filename field with a .VCC extension.
5. Select **OK**. The table is saved to the directory you specified.

Start and Stop a VCC Scan

The VCC Scan function is a filter that allows you to identify active virtual channels containing specific cell addressing. This feature allows you to filter specific ATM Cell Header addressing parameters and then capture only those ATM cells. This information can then be easily transferred into a VCC Table for additional analysis.

To start a VCC Scan:

1. Select **Functions**.
2. Select **VCC Scan**.
3. Select the **Scan Header** button. The Enter VCC Header keypad appears.
4. Enter the header information and press **Enter** when done.
5. Select the **Start Scan** button to start scanning. The Scan Status (in the top right corner of the table) displays "Active."

Additionally in this screen, you may:

- Use the **Add VCC to VCC Tbl** button to add a scan header to the VCC table.
- Use the **Add All** button to add all scan headers to the VCC table.
- Use the **Clear** button to clear all table entries.

To stop the VCC Scan:

- Select **Stop Scan**. The Scan Status (in the top right corner of the table) displays "Inactive."

Transmit a Burst Count

This function transmits a controlled amount of traffic using either AAL0 cells, AAL1 PDUs, or AAL5 PDUs. This type of traffic is determined by the parameters of the active channel (the virtual channel currently highlighted in the VCC table).

In order to send a Burst Count, TX On/Off must be turned off.

To transmit a single burst:

1. Select **Functns**.
2. Select **VCC Burst**.
3. Select a virtual channel on the VCC Burst table.
4. Select the **Burst Count** button. The Burst Count keypad appears.
5. Enter a value from 1 to 1000, and press **Enter** on the keypad.
6. Select the **Start** button. The burst is transmitted and increments on the Functns screen.

Use Turbo Add to Add Multiple VCCs

1. Select **VCC Table**.
2. Select **Edit Tbl**.
3. Select the **Turbo Add** button. The No. of VCCs to be Added keypad appears.
4. Enter the number of VCCs to be added to the table (1 through 250).
5. Select **OK**. The Turbo Add window appears.
6. Select **PVC** or **SVC**.

- If PVC is selected, the Add or Edit VCC screen appears. Modify the appropriate PVC parameters.
- If SVC is selected, the Add SVC screen appears. Modify the appropriate SVC parameters.

Depending on which parameters are selected for AAL and Traffic Shaping, additional options may appear on the Turbo Add screen.

7. When the appropriate parameters are modified, select **Save**.

Screen Functions and Descriptions

ATM Screen Functions and Descriptions Overview

The following function screens are available through the ATM protocol processor tab:

- Config
- VCC Table
- Functions
- Results
- LEDs

Config

Configuration (Config) Screens and Functions

The Config function provides access to functions that configure the system. The following options are available:

- SET

The options below only appear when ATM Interface is not set to NNI:

- SVC
- TMR

The options below only appear when ATM Interface is not set to NNI, ATM Mapping is configured, and Signalling is enabled:

- SIG FTRS
- LOAD TEST

Config - Settings (SET)

The SET button allows you to configure the system for a specific type of ATM interface (UNI or NNI). You can also set the unit of measure for the ATM interface (which defaults to a percentage of bandwidth), define how you numerically enter values for the VPI and VCI (these values default to Hex representation), and enable signalling.

The following options are available:

Option	Description
ATM Interface	Configures the system for User-to-Network Interface (UNI) or Network Node Interface (NNI) mode. Set this command based on the type of connection used by your ATM equipment. The following options are available for this command. • **User-UNI3.0:** User Network Interface version 3.0. If UNI is selected, then the Header Field uses a 4-bit GFC and an 8-bit VPI. • **User-UNI3.1:** User Network Interface version 3.1. If UNI is selected, then the Header Field uses a 4-bit GFC and an 8-bit VPI. • **User-UNI4.0:** User Network Interface version 4.0. If UNI is selected, then the Header Field uses a 4-bit GFC and an 8-bit VPI. • **NNI:** Network Node Interface. If NNI is selected, then the Header Field uses a 12-bit VPI and no GFC.

ATM Mapping	Physically maps ATM to one of the following interfaces (some mappings will only appear if you are currently running in that protocol processor mode): **For SDH:** None, STM-0 C11 ATM, STM-0 C12 ATM, STM-0 C2 ATM, STM-0 C3 ATM, STM-1 C11 ATM, STM-1 C12 ATM, STM-1 C2 ATM, STM-1 C3 ATM, STM-1 C4 ATM, STM-0e C11 ATM, STM-0e C12 ATM, STM-0e C2 ATM, STM-0e C3 ATM, STM-1e C11 ATM, STM-1e C2 ATM, STM-1e C3 ATM, STM-1e C4 ATM, STM-1e C11 ATM, STM-4 C11 ATM, STM-4 C12 ATM, STM-4 C2 ATM, STM-4 C3 ATM, STM-4 C4 ATM, STM-4 C4-4c ATM **For SONET:** OC-1 VT1.5 ATM, OC-1 VT2 ATM, OC-1 VT6 ATM, OC-1 Full SPE ATM, OC-3 VT1.5 ATM, OC-3 VT2 ATM, OC-3 VT6 ATM, OC-3 Full SPE ATM, OC-3 STS-3c ATM, STS-1 VT1.5 ATM, STS-1 VT2 ATM, STS-1 VT6 ATM, STS-1 Full SPE ATM, STS-3 VT2 ATM, STS-3 VT6 ATM, STS-3 Full SPE ATM, STS-3 STS-3c ATM, OC-12 VT1.5 ATM, OC-12 VT2 ATM, OC-12 VT6 ATM, OC-12 Full SPE ATM, OC-12 STS-3c ATM, OC-12 STS-12c ATM **For PDH:** None, E1 #1 ATM Direct, E1 # 1 ATM PLCP, E1 #2 ATM Direct, E1 #2 ATM PLCP, E3 ATM Direct (G.751), E3 ATM PLCP **For DS1/DS3:** DS1 #1 ATM Direct, DS1 #1 ATM PLCP, DS1 #2 ATM Direct, DS1 #2 ATM PLCP, DS3 ATM Direct, DS3 ATM PLCP, ATM STSX-1, ATM STS-3c, ATM STS-3c in STS-12, ATM STS-12c

Unit of Measure	Determines how the bandwidth of the ATM interface is represented in units of measure. The following options are available for this command. **% Bandwidth:** The bandwidth of the ATM Interface is entered and displayed as bandwidth percentage. **Mbps:** The bandwidth of the ATM Interface is entered and displayed as Mbps. **Kbps:** The bandwidth of the ATM Interface is entered and displayed as Kbps. **Cells/Second:** The bandwidth of the ATM Interface is entered and displayed as cells-per-second.
VPI/VCI Numeric Representation	Determines whether the VPI (Virtual Path Identifier) and VCI (Virtual Circuit Identifier) are represented as Hexadecimal or Decimal values. This affects how the VPI and VCI values are displayed on screen and how these values are entered using the Header Field keypad. The following options are available for this command. **Hex:** Uses hexadecimal values for the VPI and VCI. **Decimal:** Uses decimal values for the VPI and VCI.
Cell Scrambling	Enables or disables ATM cell payload scrambling. The default setting is **Disable**. When on, ATM cell payloads are scrambled when transmitted and descrambled when received.
Loopback Response	Enabling this function allows the system to generate a loopback test to ATM equipment on the network. Note: This function is only workable if

	connected to another test unit.
ADTF	Allowed Cell Rate Decrease Time Factor. Sets the ACR Decrease Time Factor for ABR traffic. This is entered using a keypad, and the range is from 0.01 to 10.23 seconds.
TRM	This function allows you to set the value for upper bound on the time between forward RM (Resource Management) cells. This is entered using a keypad. The TRM value can take 100*2n, where n can range from –7 to 0.
O.191 Cell Scrambling	Enables or disables O.191 cell scrambling. The default setting is Enable. When enabled, O.191 cells are scrambled when transmitted and descrambled when received.
Signalling	**Note**: For Signalling options to be active, the ATM Interface must NOT be set to NNI and ATM Mapping must be configured. Configures the system to enable or disable signalling. The following options are available for this command: **Enable:** Enables signalling **Disable:** Disables Signalling.
Signalling PCR	**Note**: For Signalling options to be active, the ATM Interface must NOT be set to NNI and ATM Mapping must be configured. Sets the Peak Cell Rate for the Signalling channel.

Address Plan	**Note**: For this option to be active, the ATM Interface must NOT be set to NNI. Sets the address of the system. Two addressing format options are available for this command: **NSAP-AESA:** The Network Service - Access Point ATM End System Address is set by this command. Three fields can be edited: N/W Prefix, ESI, and Selector. **E.164 Native:** The End system address is set by this command. N/W Prefix field can be edited

SVC

Config - SVC

The SVC function allows you to set the default SVC setup parameters QoS class, traffic parameters and called party address. The SVC screen is only available when ATM Interface is not set to NNI.

The following options are available:

- QoS Class
- AAL Type
- CPCS SDU Size
- Traffic Type
- Peak Cell Rate (PCR for CLP0, PCR for CLP0 + 1)
- Sustained Cell Rate (SCR for CLP0, SCR for CLP0 + 1)
- Max Burst Size (MBS for CLP0, MBS for CLP0 + 1)
- Traffic Combination
- Tagging
- ABR Parameters
- Default Called Party Address

Config SVC -QoS Class

Sets the QoS class. The options available for this command are 0, 1, 2, 3 and 4.

Config SVC - AAL Type

Sets the ATM Adaptation Layer (AAL) protocol for both Transmit and Receive. The AAL accomplishes a conversion from a higher level protocol into the ATM layer that is segmentation of the original and larger set of data into the size and format of an ATM cell (5 octet header and 48 octets of data or payload).

The following options are available for this command:

Option	Description
0	ATM Adaptation Layer 0 is used. AAL0 denotes an absence of any AAL function, meaning that AAL0 is not really an AAL type in the true sense of the term. AAL0 simply is the transfer of individual cells with no protocol processing of the cell payloads.
1	ATM Adaptation Layer 1 protocol is used. The ATM Cell consists of a 47-byte payload, a 1-byte sequence number, sequence number protection field and convergence ID field, and a 5 byte header.
5	ATM Adaptation Layer 5 protocol is used. AAL 5 supports variable length data packets or PDUs (1 to 65,535 octets). AAL5 utilizes a minimum of overhead for each PDU it sends. The entire payload is used for data except for the last cell in the PDU. Functionally, this larger type supports variable bit rate, delay tolerant, connection-oriented data traffic requiring minimal sequencing or error detection support.
CPCS SDU Size	This command sets the size in bytes of a Service Data Unit of the Common Part Convergence Sublayer. SDU Size is entered using a keypad. Values can range from 2,048 bytes to 65,512 bytes in length. The default value is 4,800 bytes.

Config SVC - CPCS SDU Size

This command sets the size in bytes of a Service Data Unit of the Common Part Convergence Sublayer. SDU Size is entered using a keypad. Values can range from 2048 bytes to 65,512 bytes in length. The default value is 4800 bytes.

Config SVC - Traffic Type

This function selects the type of data algorithm used to buffer cells before transmitting data to the network. The following options are available for this command.

Option	Description
Rt-VBR	Real-time Variable Bit Rate. Uses a real-time single leaky bucket algorithm (GCRA) and characterized by Sustained Cell Rate (SCR) and Peak Cell Rate (PCR).
Nrt-VBR	Non-Real-Time Variable Bit Rate. Uses a non-real-time single leaky bucket algorithm (GCRA) and characterized by Sustained Cell Rate (SCR) and Peak Cell Rate (PCR).
CBR	Constant Bit Rate. Supports CBR traffic as a subclass of VBR traffic. CBR is used by connections that request a static amount of bandwidth that is continuously available during the connection life time.
UBR	Unspecified Bit Rate. Specifically, UBR does not include the notation of a per-connection negotiated bandwidth. UBR channels will attempt to equally share, but not guarantee any remaining bandwidth after all CBR or VBR channels are allocated.
ABR	Available Bit Rate. Performs dynamic traffic shaping based on feedback received from the network.
CBR with CLR	Constant Bit Rate. Supports CBR traffic as a subclass of VBR traffic. CBR is used by connections that request a static amount of bandwidth that is continuously available during

	the connection lifetime. The maximum cell loss ratio can be specified. This can be set only if the ATM Interface is User-UNI4.0
RtVBR with CLR	Real-Time Variable Bit Rate. Uses a real-time single leaky bucket algorithm (GCRA) and characterized by Sustained Cell Rate (SCR) and Peak Cell Rate (PCR). The maximum cell loss ratio can be specified. This can be set only if the ATM Interface is User-UNI4.0
NrtVBR with CLR	Non-Real-Time Variable Bit Rate. Uses a non-real-time single leaky bucket algorithm (GCRA) and characterized by Sustained Cell Rate (SCR) and Peak Cell Rate (PCR). The maximum cell loss ratio can be specified. This can be set only if the ATM Interface is User-UNI4.0

Config SVC - Max Burst Size (MBS)

This function sets the maximum number of cells that can transmit at the peak rate and still be in conformance with the Traffic Shaping algorithm. It is only available for VBR Traffic Shaping.

If the maximum burst size (MBS) is changed from a value of two, then the Peak Cell Rate defaults to 100 percent.

For VBR traffic shaping, MBS and SCR are related by the following equation:

SCR MBS / (MBS+1), where MBS > 2

MBS for CLP0 sets the Max Burst Size for all cells with CLP field in the Header equal to 0.

MBS for CLP0+1 sets the Max Burst Size for all cells with CLP field in the Header equal to 0 or 1.

Config SVC - Sustained Cell Rate

This function sets the Sustained Cell Rate (SCR) for VBR traffic, and is only available only for VBR Traffic Shaping. For VBR traffic shaping, the SCR is closely related to the Maximum Burst Size (MBS).

The SCR is entered using a keypad and can be represented in the following units of measure:

- Bandwidth Percentage
- Mbps
- Kbps
- Cells per Second

These units are defined by the Units of Measure command located in the Config Set function.

SCR for CLP0 sets the Sustained Cell Rate for all cells with CLP field in the Header equal to 0.

SCR for CLP0+1 sets the Sustained Cell Rate for all cells with CLP field in the Header equal to 0 or 1.

TBE

This function allows you to set the Transient Buffer Exposure (TBE). TBE is the negotiated number of cells that the network would like to limit the source to sending during startup periods, before the first Resource Management (RM) cell returns.

TBE is set using a keypad and the range is from 0 to 16,777,215 cells.

Config SVC - Traffic Combination

This function sets the traffic combination for SVC setup. The following options are available.

Option	Description
1	PCR CLP0 and PCR CLP0+1
2	PCR CLP0, PCR CLP0+1 and Tagging = Tagging Requested
3	PCR CLP0+1, SCR CLP0 and MBS CLP0
4	PCR CLP0+1, SCR CLP0, MBS CLP0 and Tagging = Tagging Requested
5	PCR CLP0+1
6	PCR CLP0+1, SCR CLP0+1 and MBS CLP0+1

Config SVC - Tagging

The following options are available for the Tagging function:

- **Yes**: Tagging Requested
- **No**: Tagging not requested

Config SVC - ABR Parameters

This function allows you to set the default ABR parameters for SVCs. The following options are available:

- ICR
- RIF
- RDF
- MCR

ICR

This function sets the Initial Cell Rate (ICR) for ABR traffic, and is available only for ABR Traffic Shaping.

The ICR is entered using a keypad and can be represented in the following units of measure:

- Bandwidth Percentage
- Mbps
- Kbps
- Cells per Second

These units are defined by the Units of Measure command located in the Config Set screen.

RIF

This function allows you to set the Rate Increase Factor and controls the amount by which the cell transmission rate may increase upon receipt of a Resource Management (RM) cell. RIF is a power of two, ranging from $1/2^{15}$ to 1.

RIF is entered using a keypad, which allows you to enter the value of n, and the RIF is calculated as $1/2^{n}$.

RDF

This function allows you to set the Rate Decrease Factor and controls the amount by which the cell transmission rate may decrease upon receipt of a Resource Management (RM) cell. RIF is a power of two, ranging from ½^15 to 1.

RDF is entered using a keypad which allows you to enter the value of n and the RDF is calculated as ½^n

MCR

This function sets the Minimum Cell Rate (MCR) for ABR traffic, and is available only for ABR Traffic Shaping.

The MCR is entered using a keypad and can be represented in the following units of measure:

- Bandwidth Percentage
- Mbps
- Kbps
- Cells per Second.

These units are defined by the Units of Measure command located in the Config Set screen

Config SVC - Default Called Party Address

Set the address of the called party. Two addressing format options are available for this command

- **NSAP-AESA:** Network Service Access Point ATM End System Address is set by this command. Three fields can be edited. N/W Prefix, ESI and Selector.
- **E.164 Native:** End system address is set by this command. N/W Prefix field can be edited.

Config - TMR

This function allows you to set the timer values. All timer values are set using keypad and the range is from 1 second to 65535 seconds. The TMR screen is only available when ATM Interface is not set to NNI.

The following timer values can be set:

Timer	Description
T301	Timer for Alert
T303	Timer for Setup
T308	Timer for Release

T309	Timer for Link Connection
T310	Timer for Call Proceeding Received
T313	Timer for Connect
T316	Timer for Restart
T317	Timer for Restart Received
T322	Timer for Status
Timer for polling Message	Timer for polling Message
Timer for Keep Alive Message	Timer for Keep Alive Message
Timer for No Response	Timer for No Response
Timer for CC	Timer for Connection Control
Timer for idle	Timer for the Idle phase

Config - Signalling Filters (SIG FTRS)

This function allows filtering of Signalling messages. The SIG FTRS screen is only available when ATM Interface is not set to NNI, ATM Mapping is configured, and Signalling is enabled.

The following options are available:

Option	Description
Signalling Filter	This function enables or disables the filtering of signalling messages. The following options are available: • **Enable:** Enables Signalling filter. • **Disable:** Disables Signalling filter.

Filter Type	This function specifies what the filtering should be based on. The following options are available: • Message Filter • Call Reference Value • Call Reference Flag • Call Reference Value and Flag • Message and Call Reference Flag • Message and Call Reference Value
Call Reference Value	This function specifies the Call Reference Value based on which filtering is to be done.
Call Reference Flag	This function specifies the Call Reference Flag value based on which filtering is to be done. The value can be either 0 or 1.

Filtering Messages	This function specifies the message to be filtered based on the filter type. One or more messages can be filtered. The following options are available: • Call Proceeding • Connect • Connect Acknowledge • Setup • Release • Release Complete • Signalling Status • Signalling Status Enquiry • Connection Restart • Restart Acknowledge • Alert
Add	Adds the message to the list of messages to be filtered.
Delete	Deletes the message from the list of messages to be filtered.

Config - Load Test

This function allows you to perform load tests. The Load Test screen is only available when ATM Interface is not set to NNI, ATM Mapping is configured, and Signalling is enabled.

The following options are available:

Option	**Description**

Type of Test	This function allows you to set the type of Load Test to be performed. The following options are available. **Call Setup:** This function allows you to setup SVC at the rate of the number of calls per second specified for the duration mentioned. After the duration expires, the SVC are cleared. **Cyclic Load:** This function allows you to establish and release SVC connection at the rate of the number of calls per second specified for the duration mentioned. **Call Burst:** This function allows you to initiate setup calls at the rate of the number of calls per second specified for the duration mentioned with calls being initiated during the Burst Period specified and no calls being initiated during the Skip Period.
Calls Per Second	This function allows you to set the maximum number of calls per second. This is set using a keypad and the range is from 1 to 20. The Calls per Second can be set only if Type of Test is one of the options above.
Burst Period	This function allows you to set the Burst period. Burst period Defines the number of contiguous seconds during which SVC establishment takes place. The following options are available. • User Defined: Entered using a keypad and the range is from 1 to 4000. • Random Burst: A random number generated.

Skip Period	This function allows you to set the Skip period. Skip period Defines the number of contiguous seconds during which no SVC are established. The following option is available: User Defined: Entered using a keypad and the range is from 1 to 256.
Duration	This function allows you to set the duration of the load test. The load test starts once the duration is set. The following options are available • Off: To stop the load test. • 1 Sec: Set the duration to 1 seconds. • 10 Sec: Set the duration to 10 seconds. • User Defined: Entered using a keypad and the range is from 1 to 65535. • Random: A random number generated.

VCC Table

VCC Table Screens and Functions

The VCC Table function provides access to functions that control the creation of VCC tables. This function allows you to view the existing VCCs. Different colours indicate different types of VCCs.

Red indicates PVC.

Blue indicates SVC set up by the analyzer.

Pink indicates SVC set up by the peer.

Through this function, you are able to access the following options:

- VCC CNTRL
- EDIT TBL
- BKGND
- SUM
- VCC RES
- QoS RES
- O.191 RES
- QoS ANAL

VCC Cntrl

VCC Table - VCC CNTRL

The VCC Control function controls the transmission and monitoring of data traffic activity for an individual virtual channel or for multiple virtual channels. When selected, this function displays the virtual channels configured in the VCC Table.

The transmit (TX) and monitor (RX) states for each virtual channel appear in the TX and RX columns of the VCC Table screen display. A maximum of 20 virtual channels can appear on this screen. Use the **Page Up** and **Page Down** buttons (double arrows) to display the previous or next 20 entries in the VCC Table, or use the **Scroll Down** and **Scroll Up** buttons (single arrows) to scroll through the VCC Table one virtual channel at a time.

The following buttons are located at the bottom of the VCC Cntrl table:

- TX On/Off
- RX On/Off
- All TX Mode
- All RX Mode
- VCC TX Mode
- VCC RX Mode

VCC Table VCC CNTRL - TX On/Off

This button starts or stops the transmission of ATM cells on all enabled virtual channels listed in the VCC Table. The transmission status for each virtual channel appears in the TX column of the VCC Table, and displays the following values.

Option	Description
<on>	Indicates that the virtual channel is

	idle (enabled, but not transmitting data). When this value displays, the ATM TX Alarm and Status Indicator displays OFF.
ON	Indicates that the channel is enabled and transmitting ATM cells. The ATM TX Alarm and Status indicator displays ON.
(No Value Appears)	If the TX column is blank, then the channel is disabled. Refer to the All TX Mode and VCC TX Mode button descriptions for more information.

Note: When turned ON, all Enabled channels generate traffic. When Off (<on>), these channels are idle. If you do not want a specific virtual channel to transmit data, then you must Disable that channel before generating traffic flow.

VCC Table VCC CNTRL - RX On/Off

This button starts or stops data traffic reception and monitoring on all enabled virtual channels listed in the VCC Table.

The monitor and detection status for each virtual channel appears in the RX column of the VCC Table and displays the following values.

Option	Description
<mon>	Indicates that the virtual channel is idle (enabled, but not receiving ATM Cells). When this value displays, the ATM RX Alarm and Status Indicator displays OFF.
MON	Indicates that the circuit is enabled and is receiving ATM Cells. The ATM RX Alarm and Status Indicator displays ON.
<det>	Indicates that the virtual channel is idle, and configured for Detailed Detection mode. This means that the virtual channel is monitoring for Bit,

	pattern sync, CRC, padding, length, SN/SNP, lost cells, mis-inserted cells errors (depending on the AAL type). A maximum of 34 channels can be detailed for AAL0, AAL1, or AAL5 (30 non-Full PDU and 4 Full PDU).
DET	Indicates that the channels are actively detecting for Bit, pattern sync, CRC, padding, length, SN/SNP, lost cells, mis-inserted cells errors (depending on the AAL type). A maximum of 34 channels can be detailed for AAL0, AAL1, or AAL5 (30 non-Full PDU and 4 Full PDU).
(No Value Appears)	If the RX column is blank, then that virtual channel is disabled. Refer to the All RX Mode button and VCC RX Mode button descriptions for more information.

VCC Table VCC CNTRL - All TX Mode

This button enables data transmission for up to 16 Transmit connections, starting from the current selection in VCC table. This button is only active when data transmission is Off (as displayed by the Tx OFF indicator in the ATM LED Alarm and Status Indicators area).

If some channels are already disabled, and you press this button, then all channels are disabled. Selecting this button again enables all channels including any previously disabled channels. This button toggles all virtual channels between an enabled and disabled state.

The transmission status appears in the TX column and displays the following values.

Option	Description
<on>	Indicates that the virtual channel is idle (enabled, but not transmitting ATM cells). When this value displays, the ATM TX Alarm and Status Indicator displays OFF.
(No Value Appears)	If the TX column is blank, then the virtual channel is disabled.

VCC Table VCC CNTRL - All RX Mode

This button globally enables or disables data monitoring for all virtual channels listed in the VCC Table. This button is only active when data monitoring is Off (as displayed by the Rx OFF indicator in the ATM LED Alarm and Status Indicators area).

If some channels are already disabled, and you press this button, then all channels are disabled. Selecting this button again enables all channels including any previously disabled channels. This button toggles all virtual channels between an enabled and disabled state.

Option	Description
<mon>	Indicates that the virtual channel is idle (enabled, but not receiving ATM cells). When this value displays, the ATM RX Alarm and Status Indicator displays OFF.
(No Value Displays)	If the RX column is blank, then the channel is disabled.

VCC Table VCC CNTRL - VCC TX Mode

This button enables or disables ATM Cell transmission for individual virtual channels in the VCC Table. This button is only active when data transmission is Off (Tx - OFF) as indicated in the ATM LED area. The typical button action sequence is to toggle between enable (<on>) and disable.

Option	Description
<on>	Indicates that the virtual channel is idle (enabled, but not transmitting ATM Cells). When this value displays, the ATM TX Alarm and Status Indicator displays OFF.
(No Value Displays)	If the TX column is blank, then the channel is disabled.

VCC Table VCC CNTRL - VCC RX Mode

This button enables or disables ATM Cell monitoring for individual virtual channels in the VCC Table. This button is only active when data monitoring is Off (Rx - OFF) as indicated in the ATM LED area. The typical button action sequence is to toggle between enabled (<mon> or <det>) and disabled.

Option	Description

<mon>	Indicates that the virtual channel is idle (enabled, but not receiving ATM Cells). When this value displays, the ATM RX Alarm and Status Indicator displays OFF.
<det>	Indicates that the virtual channel is idle, and configured for Detailed Detection mode. This means that the virtual channel is monitoring for Bit, pattern sync, CRC, padding, length, SN/SNP, lost cells, mis-inserted cells errors (depending on the AAL type). A maximum of 34 channels can be detailed for AAL0, AAL1, or AAL5 (30 non-Full PDU and 4 Full PDU).
(No Value Appears)	If the RX column is blank, then the channel is disabled.

Edit Tbl

VCC Table - Edit Table (EDIT TBL)

The Edit Table function allows you to modify the parameters of an existing virtual channel listed in the VCC table.

The Edit Tbl function includes the following commands:

- Edit VCC
- Add VCC
- Turbo Add
- Delete
- Save Table
- Recall Table

Edit a VCC Table

The Edit VCC button modifies parameters of an existing virtual channel listed in the VCC Table. If there are no virtual channels listed in the VCC Table, then the button is disabled. The button changes to 'View VCC' when transmission or reception is on, which allows you to view the parameters of the VCC but not edit them.

1. Select **VCC Table**.
2. Select **Edit Tbl**.
3. Choose the table to be edited from the VCC Table grid and select the **Edit VCC** button. The Edit VCC <#> dialog box appears.

You can also scroll to the table to be edited by selecting the Prev or Next buttons on the Edit VCC window.

4. When the appropriate parameters are modified, select **Save**.

Add and Edit VCC

Permanent Virtual Circuit (PVC)

The following options are available on the Add or Edit VCC screen when Signalling is disabled, or when Signalling is enabled and Add VCC - PVC is selected.

Option	Description
Header Field	The Header Field is responsible for describing the type and destination of the ATM cell. For the Edit VCC button, the Header Field command displays the header components for the current virtual channel. If you press the Header Field button, then the Header Field Entry keypad appears. After entering a Header Field, select **Save** to confirm your entries. **GFC**: Generic Flow Control. Sets the first four bits of the ATM cell header for a UNI interface. The GFC field allows the use of wild card characters. A wild card is transmitted as a 0 and can be received as a 0 or 1. **VPI**: Virtual Path Identifier. This is a routing field for the network. If the connection is set for UNI, then is field is an 8 bit value. If the ATM connection is set for NNI, then this field is a 12 bit value (there is no GFC). **VCI**: Virtual Channel Identifier. This field, used together with the VPI, is the routing field for a cell. It is a 16 bit value. VCI values of 3, 4, 6, and 7 are reserved for F4 and Resource Management OAM cells and cannot be entered using the keypad. In addition, a VCI of 0 with a VPI of 0 is an idle cell and is not allowed. **PTI**: Payload Type Indicator. Only the last two bits, which are used for congestion indication, can be set. If the PTI is set to 0 then the value is User Data and No Congestion. If the PTI is set to 1, then the value is User Data with Congestion. The

	PTI field allows the use of wild card characters. A wild card is transmitted as a 0 and can be received as a 0 or 1. **CLP**: Cell Loss Priority. Sets bit 32 of the cell header. CLP can be set to either 0 or 1 (binary). A 0 indicates a high-priority cell and a 1 indicates a low-priority cell. The CLP field allows the use of wild card characters. A wild card is transmitted as a 0 and can be received as a 0 or 1.
Transmit Pattern	Selects the payload pattern sent in the transmit ATM stream for an individual virtual channel. 2^15-1 PRBS - Payload pattern transmitted is a random test pattern at 2^15-1 length. 2^15 PRBS (INV) - Payload pattern transmitted is an inverted PRBS pattern of 2^15-1 length. All Zeros - Payload pattern transmitted is a continuous all-zeros pattern (000000. . .). All Ones - Payload pattern transmitted is a continuous all ones pattern (111111. . .). 1010 - Payload pattern is a repeating pattern of alternating ones and zeros (101010. . .). Full PDU Programmable - Full Protocol Data Unit (PDU) Programmable. A PDU length is entered using a keypad. Values can range up to 100 bytes in length. User Defined - Define any 32 bit (four byte) pattern that is repeated 48 times to make up the ATM Cell Payload. O.191 REV-0 - O.191 Revision-0 Cell format O.191 REV-1 - O.191 Revision-1 Cell format
Receive Pattern	This function defines the payload pattern that is checked for bit errors if detailed monitoring is enabled. **2^15-1 PRBS** - Payload pattern received is a random test pattern at 2^15-1 length. **2^15 PRBS (INV)** - Payload pattern received is an inverted PRBS pattern of 2^15-1 length. **All Zeros** - Payload pattern received is a continuous all-

	zeros pattern (000000. . .). **All Ones** - Payload pattern received is a continuous all ones pattern (111111. . .). **1010** - Payload pattern is a repeating pattern of alternating ones and zeros (101010. . .). **Full PDU Programmable** - Full Protocol Data Unit (PDU) Programmable. A PDU length is entered using a keypad. Values can range up to 100 bytes in length. The number of full PDU connections allowed is four each on the Transmit and Receive sides. **User Defined** - Define any four byte pattern that is repeated 12 times to make up the ATM Cell Payload. **O.191 REV-0** - O.191 Revision-0 Cell format **O.191 REV-1** - O.191 Revision-1 Cell format
AAL	Sets the ATM Adaptation Layer (AAL) protocol for both transmit and receive. The AAL accomplishes a conversion from a higher level protocol into the ATM layer, that is, segmentation of the original and larger set of data into the size and format of an ATM cell (5 octet header and 48 octets of data or payload). **0** - ATM Adaptation Layer 0 is used. AAL0 denotes an absence of any AAL function, meaning that AAL0 is not really an AAL type in the true sense of the term. AAL0 simply is the transfer of individual cells with no protocol processing of the cell payloads. **1** - ATM Adaptation Layer 1 protocol is used. The ATM Cell consists of a 47 byte payload, a 1 byte sequence number, sequence number protection field and convergence ID field, and a 5 byte header. **5** - ATM Adaptation Layer 5 protocol is used. AAL 5 supports variable length data packets or PDUs (1 to 65512 octets). AAL5 utilizes a minimum of overhead for each PDU it sends. The entire payload is used for data except for the last cell in the PDU. Functionally, this larger type supports variable bit rate, delay tolerant, connection-oriented data traffic requiring minimal sequencing or error detection support.
AAL1 CSI	Sets the AAL1 protocol's Convergence Sublayer Indication

Byte Does not appear if AAL1 IS NOT selected.	(CSI) bit 0 or 1. Use the buttons on the keypad to toggle between 0 and 1. Up to eight bits can be entered (value is equivalent to 255 in decimal). The default value is 0 bit. This command is available only when using AAL1 protocol.
AAL5 PDU Length Does not appear if AAL5 IS NOT selected.	Sets the length of the AAL5 Protocol Data Unit (PDU). A PDU length is entered using a keypad. Values can range from 2048 to 65,512 bytes in length. The default value is 4800 bytes. There are PDU length limitations for CRC, LEN, and Padding errors. This command is available only when using AAL5 protocol.
AAL5 COCS UU Octet Does not appear if AAL5 IS NOT selected.	This parameter sets the ATM Adaptation Layer 5 (AAL5) Common Part Convergence Sublayer (CPCS) User-to-User (UU) information octet. A CPCS UU length can be up to eight bits and is entered using a keypad. This command is available only when using AAL5 protocol.
Traffic Shaping	This function selects the type of data algorithm used to buffer cells before transmitting data to the network. **Rt-VBR** - Real-time Variable Bit Rate. Uses a real-time dual leaky bucket algorithm (GCRA) and characterized by Sustained Cell Rate (SCR) and Peak Cell Rate (PCR). **Nrt-VBR** - Non-real-time Variable Bit Rate. Uses a non-real-time dual leaky bucket algorithm (GCRA) and characterized by Sustained Cell Rate (SCR) and Peak Cell Rate (PCR). **CBR** - Constant Bit Rate. Supports CBR traffic. CBR is used by connections that request a static amount of bandwidth that is continuously available during the connection lifetime. The amount of bandwidth is characterized by Peak Cell Rate (PCR).

	UBR - Unspecified Bit Rate. If this option is selected then the Peak Cell Rate (PCR), Sustained Cell Rate (SCR), and Max Burst Size (MBS) commands are disabled. Specifically, UBR does not include the notation of a per-connection negotiated bandwidth. UBR channels will attempt to equally share, but not guarantee, any remaining bandwidth after all CBR or VBR channels are allocated.
Peak Cell Rate Does not appear if UBR Traffic Shaping IS NOT selected.	For more information see Peak Cell Rate.
Sustained Cell Rate Does not appear if UBR or CBR Traffic Shaping IS NOT selected.	This function sets the Sustained Cell Rate (SCR) for VBR traffic, and is only available only for VBR Traffic Shaping. The SCR is entered using a keypad and can be represented in the following units of measure: • Bandwidth Percentage • Mbps • Kbps • Cells per Second These units are defined by the Units of Measure command located in the Config Set function.
Max Burst Size Does not appear if UBR or CBR Traffic Shaping IS selected.	This function sets the maximum number of cells that can transmit at the peak rate and still be in conformance with the Traffic Shaping algorithm. It is only available for VBR Traffic Shaping. If the maximum burst size (MBS) is changed from a value of 2, then the Peak Cell Rate defaults to 100 percent.
CDVT Does not appear if UBR or CBR Traffic Shaping IS selected.	Cell Delay Variation Tolerance. Set CDVT to maximum of 1047552.
Edit ABR	This function allows you to set the default ABR parameters

Parameters Appears only if Traffic Shaping is ABR.	for SVCs. **ICR** - This function sets the Initial Cell Rate (ICR) for ABR traffic, and is available only for ABR Traffic Shaping. The ICR is entered using a keypad and can be represented in the following units of measure: • Bandwidth Percentage • Mbps • Kbps • Cells per Second These units are defined by the Units of Measure command located in the Config Set screen. **RIF** - This function allows you to set the Rate Increase Factor and controls the amount by which the cell transmission rate may increase upon receipt of a Resource Management (RM) cell. RIF is a power of two, ranging from ½^15 to 1. RIF is entered using a keypad, which allows you to enter the value of n, and the RIF is calculated as ½^n. **RDF** - This function allows you to set the Rate Decrease Factor and controls the amount by which the cell transmission rate may decrease upon receipt of a Resource Management (RM) cell. RIF is a power of two, ranging from ½^15 to 1. RDF is entered using a keypad which allows you to enter the value of n and the RDF is calculated as ½^n. **MCR** - This function sets the Minimum Cell Rate (MCR) for ABR traffic, and is available only for ABR Traffic Shaping. The MCR is entered using a keypad and can be represented in the following units of measure: • Bandwidth Percentage • Mbps • Kbps • Cells per Second These units are defined by the Units of Measure command

	located in the Config Set screen.
O.191 Block Size	Appears only if Receive Pattern is O.191 REV-0 or O.191 REV-1. Refer to the Cell Block Size Table, per ITU-T Rec. 0.191.
O.191 CLP Flow	Appears only if Receive Pattern is O.191 REV-0 or O.191 REV-1.

VCC Table EDIT TBL - Edit and Add VCC Options

The **Edit VCC** button modifies parameters of an existing virtual channel listed in the VCC Table. If there are no virtual channels listed in the VCC Table, then this button is disabled. This button changes to 'View VCC' when transmission or reception is on, which allows you to view the parameters of the VCC but not edit them.

The **Add VCC** function allows you to create or edit a new virtual channel in the VCC Table. When Signalling is not enabled, the Add or Edit VCC function adds a PVC. When Signalling is enabled the Add or Edit function opens the Select VCC Type list box from which you can select one of the following:

- PVC: This function allows you to add or edit a permanent virtual channel.
- SVC: This function allows you to add or edit a switched virtual channel.

PVC

The following options are available on the Add or Edit VCC screen when Signalling is disabled, or when Signalling is enabled and Add VCC - PVC is selected.

- Header Field
- Transmit Pattern
- Receive Pattern
- AAL
- AAL1 CSI Byte (Does not appear if AAL1 is not selected.)
- AAL5 PDU Length (Does not appear if AAL5 is not selected.)
- AAL5 CPCS UU Octet (Does not appear if AAL5 is not selected.)
- Traffic Shaping
- Peak Cell Rate (Does not appear if UBR traffic shaping is selected.)
- Sustained Cell Rate: (Does not appear if UBR or CBR Traffic Shaping is selected.)
- Max Burst Size (Does not appear if UBR or CBR Traffic Shaping is selected.)
- CDVT (Does not appear if UBR or CBR Traffic Shaping is selected.)
- Edit ABR Parameters (Appears only if the Traffic Shaping is ABR).

- O.191 Block Size (Appears only if Receive Pattern is O.191 REV-0 or O.191 REV-1).
  Refer to the Cell Block Size Table, per ITU-T Rec. 0.191.
- O.191 CLP Flow (Appears only if Receive Pattern is O.191 REV-0 or O.191 REV-1)

Edit an SVC

This function allows you to add or edit a switched virtual channel.

The Edit VCC button modifies parameters of an existing virtual channel listed in the VCC Table. If there are no virtual channels listed in the VCC Table, then this button is disabled. Also this button is changed to View VCC when transmission or reception is on. View VCC allows you to view the parameters of the VCC without being able to edit them.

The following options are available on the Add SVC screen:

Header

Call Reference Value: Displays the call reference value.

Default Parameters

Transmit Pattern

Receive Pattern

Traffic Type

Fwd QoS Class: Allows you to select a value from 1 to 4 to specify forward Quality of Service class.

Bwd QoS Class: Allows you to select a value from 1 to 4 to specify backward Quality of Service class.

AAL Parameters

- AAL
- AAL1 CSI Byte (Does not appear if AAL1 is not selected.)
- AAL5 SDU Length (Does not appear is AAL5 is not selected.)
- AAL5 CPCS UU Octet (Does not appear is AAL5 is not selected.)

Forward Traffic Descriptors

- Combination
- PCR for CLP0

- PCR for CLP0+1
- Sustained Cell Rate: (CLP0 and CLP0+1)
- Max Burst Size (CLP0 and CLP0+1)

Backward Traffic Descriptors

- Combination
- PCR for CLP0
- PCR for CLP0+1

Called Party Number

- Address Plan
- Address

Function Buttons

- Optional (This function appears when the ATM Interface parameter is set to UNI4.0.)
- Save
- Exit

Header Field

The Header Field is responsible for describing the type and destination of the ATM cell. For the Edit VCC button, the Header Field command displays the header components for the current virtual channel.

If you press the Header Field button, then the Header Field Entry keypad appears. You can enter values for the following items:

- **GFC:** Generic Flow Control. Sets the first four bits of the ATM cell header for a UNI interface. The GFC field allows the use of wild card characters. A wild card is transmitted as a 0 and can be received as a 0 or 1.
- **VPI:** Virtual Path Identifier. This is a routing field for the network. If the connection is set for UNI, then is field is an 8 bit value. If the ATM connection is set for NNI, then this field is a 12 bit value (there is no GFC).
- **VCI:** Virtual Channel Identifier. This field, used together with the VPI, is the routing field for a cell. It is a 16 bit value. VCI values of 3, 4, 6, and 7 are reserved for F4 and Resource Management OAM cells and cannot be entered using the keypad. In addition, a VCI of 0 with a VPI of 0 is an idle cell and is not allowed.
- **PTI:** Payload Type Indicator. Only the last two bits, which is used for congestion indication, can be set. If the PTI is set to 0 then the value is User Data and No Congestion. If the PTI is set to 1, then the value is User Data with Congestion. The PTI field allows the use of wild card characters. A wild card is transmitted as a 0 and can be received as a 0 or 1.

- **CLP:** Cell Loss Priority. Sets bit 32 of the cell header. CLP can be set to either 0 or 1 (binary). A 0 indicates a high-priority cell and a 1 indicates a low-priority cell. The CLP field allows the use of wild card characters. A wild card is transmitted as a 0 and can be received as a 0 or 1.

After entering a Header Field, select **Save** to confirm your entries.

Transmit Pattern

Selects the payload pattern sent in the transmit ATM stream for an individual virtual channel.

The following options are available for this command.

Option	Description
2^15-1 PRBS	Payload pattern transmitted is a random test pattern at 2^15-1 length.
2^15 PRBS (INV)	Payload pattern transmitted is an inverted PRBS pattern of 2^15-1 length.
All Zeros	Payload pattern transmitted is a continuous all-zeros pattern (000000. . .).
All Ones	Payload pattern transmitted is a continuous all ones pattern (111111. . .).
1010	Payload pattern is a repeating pattern of alternating ones and zeros (101010. . .).
Full PDU Programmable	Full Protocol Data Unit (PDU) Programmable. A PDU length is entered using a keypad. Values can range up to 100 bytes in length.
User Defined	Define any 32 bit (four byte) pattern that is repeated 48 times to make up the ATM Cell Payload.
O.191 REV-0	O.191 Revision-0 Cell format
O.191 REV-1	O.191 Revision-1 Cell format

Receive Pattern

This function defines the payload pattern that is checked for bit errors if detailed monitoring is enabled.

The following options are available for this command.

Option	Description
2^15-1 PRBS	Payload pattern received is a random test pattern at 2^15-1 length.
2^15 PRBS (INV)	Payload pattern received is an inverted PRBS pattern of 2^15-1 length.
All Zeros	Payload pattern received is a continuous all-zeros pattern (000000. . .).
All Ones	Payload pattern received is a continuous all ones pattern (111111. . .).
1010	Payload pattern is a repeating pattern of alternating ones and zeros (101010. . .).
Full PDU Programmable	Full Protocol Data Unit (PDU) Programmable. A PDU length is entered using a keypad. Values can range up to 100 bytes in length. The number of full PDU connections allowed is four each on the Transmit and Receive sides.
User Defined	Define any four byte pattern that is repeated 12 times to make up the ATM Cell Payload.
O.191 REV-0	O.191 Revision-0 Cell format
O.191 REV-1	O.191 Revision-1 Cell format

AAL

AAL

Sets the ATM Adaptation Layer (AAL) protocol for both transmit and receive. The AAL accomplishes a conversion from a higher level protocol into the ATM layer, that is, segmentation of the original and larger set of data into the size and format of an ATM cell (5 octet header and 48 octets of data or payload).

The following options are available for this command.

Option	Description
AAL 0	ATM Adaptation Layer 0 is used.

	AAL0 denotes an absence of any AAL function, meaning that AAL0 is not really an AAL type in the true sense of the term. AAL0 simply is the transfer of individual cells with no protocol processing of the cell payloads.
AAL 1	ATM Adaptation Layer 1 protocol is used. The ATM Cell consists of a 47 byte payload, a 1 byte sequence number, sequence number protection field and convergence ID field, and a 5 byte header.
AAL 5	ATM Adaptation Layer 5 protocol is used. AAL 5 supports variable length data packets or PDUs (1 to 65512 octets). AAL5 utilizes a minimum of overhead for each PDU it sends. The entire payload is used for data except for the last cell in the PDU. Functionally, this larger type supports variable bit rate, delay tolerant, connection-oriented data traffic requiring minimal sequencing or error detection support.

AAL1 CSI Octet

Sets the AAL1 protocol's Convergence Sublayer Indication (CSI) bit 0 or 1. Use the buttons on the keypad to toggle between 0 and 1. Up to eight bits can be entered (value is equivalent to 255 in decimal). The default value is 0 bit.

This command is available only when using AAL1 protocol.

AAL5 CPCS UU Octet

This parameter sets the ATM Adaptation Layer 5 (AAL5) Common Part Convergence Sublayer (CPCS) User-to-User (UU) information octet. A CPCS UU length can be up to eight bits and is entered using a keypad.

This command is available only when using AAL5 protocol.

AAL5 PDU Length

Sets the length of the AAL5 Protocol Data Unit (PDU). A PDU length is entered using a keypad. Values can range from 2048 to 65,512 bytes in length. The default value is 4800 bytes.

There are PDU length limitations for CRC, LEN, and Padding errors.

This command is available only when using AAL5 protocol.

Traffic Shaping

This function selects the type of data algorithm used to buffer cells before transmitting data to the network. The following options are available for this command.

Option	Description
Rt-VBR	Real-time Variable Bit Rate. Uses a real-time dual leaky bucket algorithm (GCRA) and characterized by Sustained Cell Rate (SCR) and Peak Cell Rate (PCR).
Nrt-VBR	Non-real-time Variable Bit Rate. Uses a non-real-time dual leaky bucket algorithm (GCRA) and characterized by Sustained Cell Rate (SCR) and Peak Cell Rate (PCR).
CBR	Constant Bit Rate. Supports CBR traffic. CBR is used by connections that request a static amount of bandwidth that is continuously available during the connection lifetime. The amount of bandwidth is characterized by Peak Cell Rate (PCR).
UBR	Unspecified Bit Rate. If this option is selected then the Peak Cell Rate (PCR), Sustained Cell Rate (SCR), and Max Burst Size (MBS)

	commands are disabled. Specifically, UBR does not include the notation of a per-connection negotiated bandwidth. UBR channels will attempt to equally share, but not guarantee, any remaining bandwidth after all CBR or VBR channels are allocated.

Config SVC - Peak Cell Rate

This function sets the Peak Cell Rate (PCR) for VBR and CBR traffic and is available only for VBR and CBR Traffic Shaping.

If the PCR is not at 100 percent of line rate for non-OC-12 (or 25 percent for OC-12), then the Max Burst Size defaults to two. If the PCR is changed for a single CBR virtual channel, then all CBR channels are changed to the new PCR value.

The PCR is entered using a keypad and can be represented in the following units of measure:

- Bandwidth Percentage
- Mbps
- Kbps
- Cells per Second

These units are defined by the Units of Measure command located in the Config Set screen.

PCR for CLP0 sets the Peak Cell Rate for all cells with CLP field in the Header equal to 0.

PCR for CLP0+1 sets the Peak Cell Rate for all cells with CLP field in the Header equal to 0 or 1.

Sustained Cell Rate (SCR)

This function sets the Sustained Cell Rate (SCR) for VBR traffic, and is only available only for VBR Traffic Shaping.

The SCR is entered using a keypad and can be represented in the following units of measure:

- Bandwidth Percentage
- Mbps
- Kbps
- Cells per Second

These units are defined by the Units of Measure command located in the Config Set function.

Optional SVC

The Optional button appears when ATM Interface is set to UNI4.0. The Optional button allows you to set UNI4.0 parameters to valid or invalid states. When the optional parameters are validated, you are able to edit

- Alternate Traffic Descriptor
- Min Acceptable Traffic Descriptor
- Extended QoS Parameters
- ABR Setup Parameters
- End to end Transmit Delay Parameters

Max Burst Size

This function sets the maximum number of cells that can transmit at the peak rate and still be in conformance with the Traffic Shaping algorithm. It is only available for VBR Traffic Shapings.

If the maximum burst size (MBS) is changed from a value of 2, then the Peak Cell Rate defaults to 100 percent.

CDVT

Cell Delay Variation Tolerance. Set CDVT to maximum of 1047552.

Button Row

Button	Description
Save	Saves any changes made to the parameters for the virtual channel.
Exit	Closes the Edit VCC screen and returns to the Table Edit screen.
Previous	Displays the parameter settings for the previous virtual channel in the VCC Table.
Next	Displays the parameter settings for

	the next virtual channel in the VCC Table. Available only for the Edit VCC Table dialog.
Delete	Removes the virtual channel from the VCC Table. A Confirmation message appears stating that the virtual channel will be deleted.

VCC Table EDIT TBL - Turbo Add

The Turbo Add button allows you to add several virtual channels to a VCC Table at once instead of having to enter ATM cell parameters for each individual virtual channel.

A total of up to 256 PVCs or 20 SVCs (if Signalling is Enabled) can be added at once.

Channels added using this feature increment the VCI value based on the VCI starting point for the first virtual channel. Likewise, the parameter values entered are replicated for all virtual channels added using this feature. This includes all receive and transmit parameters, AAL settings, and traffic shaping. Once these channels are entered into the VCC Table, their parameters can be changed later, if necessary, using the Edit VCC button.

Only valid user VCIs above 32 decimal (20 Hex)VPI/ VCIs can be entered using Turbo Add. The following are invalid values for VPI/ VCI.

- VPI=0 and VCI=0
- VCI=3
- VCI=4
- VCI=6
- VCI=7

The Turbo Add button operates similar to the Add VCC button. The major difference is that you must identify the number of virtual channels to add. This is performed using the Number of VCCs to Add keypad. The Turbo Add button accepts values ranging from 1 to 256 (for PVCs) or from 1 to 20 (for SVCs).

Defining the Number of Virtual Channels to Add Using Turbo Add

After defining the number of virtual channels, the Add VCC Main Menu displays. This allows you to modify parameters for this group of virtual channels. For more information on these parameters, refer to Add VCC and Edit VCC.

VCC Table EDIT TBL - Delete Table

Use this button to delete the current VCC Table. When selected, you are able to delete:

- **Single Entry:** Deletes the currently selected item.
- **Table:** Deletes the entire table.
- **Exit**: Cancels this function.

Once the active table is deleted using this button, it cannot be recalled unless it was previously saved using the **Save Table** command.

VCC Table EDIT TBL - Save Table

Selecting the Save Table button opens a File Browser dialog box where you can enter a filename for the saved VCC Table. This button also allows access to the RAM drive (if using locally) or to your PC's hard drive (if using remotely).

VCC Table EDIT TBL - Recall Table

When the Recall Table button is selected the File Browser dialog box appears displaying a list of files on the Flash drive or RAM drive. Saved VCC tables are included in this list. Choose the desired VCC table and select the **OK** button to load the table. VCC tables are designated by a .vcc extension.

VCC Table - Background (BKGND)

This function allows you to configure a background pattern.

The following options are available from the BKGND function:

- Add Sequence
  - Header
  - Payload - Allows you to specify an eight bit payload pattern.
  - Burst - Allows you to specify burst count from 1 to 255.
  - Skip - Allows you to specify skip size from 1 - 255
  - Delete - Allows you to delete a background sequence.
  - Save - After background settings are completed select the **Save** button to add the new sequence to the Background Sequence Setting table. Once saved, the following options activated:
    - Enabled/Disable (EN/Dis) - Allows you to disable or enable the selected sequence.
    - View/Edit - Allows you to view or edit the current settings for the selected sequence.

    - Cancel - Allows you to cancel any changes or additions you are in the process of making to a sequence.
- Start Traffic - Starts background traffic activity. Button changes to Stop Traffic.

VCC Table - Summary (SUM)

The Summary button displays a summary report of current cell activity, bandwidth percentage used, virtual channel status, and virtual channel totals for the current VCC Table.

All count values can be reset to zero using the **Restart** button in the Common Function Buttons.

The following information appears for a Summary Counts report:

- **Total Monitor Cells:** Displays the cell count and bandwidth of all virtual channels in the VCC Table that are currently configured with an active monitor (MON or DET) status.
- **Idle Cells:** Reports Cell Count and Bandwidth Percentage.
- **Discarded Cells:** Reports the total number of user cells (non-zero VCI and VPI cells) that are not part of the monitored traffic. The cell count and bandwidth percentage display.
- **Valid OAM Cells:** Reports the total number and bandwidth of valid Operation and Maintenance cells.
- **Errored OAM Cells:** Reports the total number and bandwidth of errored Operation and Maintenance cells.
- **Transmit VCCs:** Reports the total number of virtual channels that are configured to transmit data. These channels are identified with the <on> status value in the VCC Table's TX column.
- **FNC Enabled VCCs:** Reports the total number of virtual channels that are error enabled.
- **Monitor VCCs:** Reports the total number of virtual channels that are configured to receive and monitor data traffic. These channels are identified with the <mon> status value in the VCC Table's RX column.
- **Detailed VCCs:** Reports the total number of detailed virtual channels.
- **VCC Table Entries:** Reports the total number of virtual channels (regardless of their TX and RX values) entered in the selected VCC Table.

VCC Res

VCC Table - VCC Results (VCC RES)

The VCC RES option displays a current status report for individual virtual channels defined in the VCC Table.

Use the **Previous** and **Next** buttons to scroll through and display other virtual channels in the VCC Table.

VCC Header Information

This line of information displays which virtual channel is currently selected (represented by #) and the associated values for GFC, VPI, VCI, PTI, and CLP.

As you display different virtual channels using the Previous and Next buttons, the status line is updated to reflect the selected virtual channel and its header settings.

VCC Error Counts and Rates Table

The following information can be reported on the Error Counts and Rates Table, depending on configuration settings.

- Cells Received
- AAL5 PDUs
- Bit Errors
- Lost Cells
- Mis Inserted
- SN + SNP
- AAL0
- AAL1
- AAL5

Alarm Seconds

- VPI (F4) AIS
- VPI (F4) RDI
- VCI (F5) AIS
- VCI (F5) RDI
- Pat Sync
- STA

AAL0 Config

If a VCC is configured for AAL0, then the following information appears in the VCC Counts screen:

- VCC Header information
- Error type, count, and rate
- Alarm type and how many seconds it occurred

Option	Description
Cells Received	Displays the cell count and bandwidth

	percentage for the selected virtual channel.
Bit Errors	Displays the Bit error count and rate for a virtual channel that has Detailed Detection mode enabled.
VPI (F4) AIS Seconds	Displays the total number of seconds an F4 AIS (Alarm Indication Signal) is detected when monitoring for OAM (Operation, Administration, and Maintenance) cells in the virtual path.
VPI (F4) RDI Seconds	Displays the total number of seconds an F4 RDI (Remote Defect Indicator) is detected when monitoring for OAM cells in the virtual path.
VCI (F5) AIS Seconds	Displays the total number of seconds an F5 AIS is detected when monitoring for OAM cells in the virtual channel.
VCI (F5) RDI Seconds	Displays the number of seconds an F5 RDI is detected when monitoring for OAM cells in the virtual channel.
Pattern Sync	Displays the duration of Pattern Sync Errors detected for a virtual channel that has Detailed Detection mode enabled.

AAL1 Config

If a VCC is configured for AAL1, then the following information appears in the VCC Res screen:

- VCC Header information
- Error type, count, and rate
- Alarm type and how many seconds it occurred

Option	Description
Cells Received	Displays the cell count and bandwidth percentage for the selected virtual channel.
Bit Errors	Displays the Bit error count and rate for a virtual channel that has Detailed Detection mode enabled.
Lost Cells	Indicates the difference between the expected and the received Sequence Number.(Appears only if the virtual

	channel has Detailed Detection mode enabled.)
Mis-sequenced Cells	Indicates that a cell, with a valid sequence number, is received out of order. (Appears only if the virtual channel has Detailed Detection mode enabled.)
SNP Errors	Displays the error count of Sequence Number Protection.
VPI (F4) AIS Seconds	Displays the total number of seconds an F4 AIS (Alarm Indication Signal) is detected when monitoring for OAM (Operation, Administration, and Maintenance) cells in the virtual path.
VPI (F4) RDI Seconds	Displays the total number of seconds an F4 RDI (Remote Defect Indicator) is detected when monitoring for OAM cells in the virtual path.
VCI (F5) AIS Seconds	Displays the total number of seconds an F5 AIS is detected when monitoring for OAM cells in the virtual channel.
VCI (F5) RDI Seconds	Displays the number of seconds an F5 RDI is detected when monitoring for OAM cells in the virtual channel.
Pattern Sync	Displays the duration of Pattern Sync Errors detected for a virtual channel that has Detailed Detection mode enabled.

AAL5 Config

If a VCC is configured for AAL5, then the following information appears in the VCC Counts screen:

- VCC Header information
- Error type, count, and rate
- Alarm type and how many seconds it occurred

Option	Description
Cells Received	Displays the cell count and bandwidth percentage for the selected virtual channel.

AAL5 PDUs	Displays the number of received AAL5 Protocol Data Units (PDU) for the selected virtual channel and the PDU per second rate.
Bit Errors	Displays the Bit error count and rate for a virtual channel that has Detailed Detection mode enabled.
PDU Len Errors	Displays the count and error rate for any PDU length errors detected during data reception.
Padding Errors	Displays the count and error rate for any padding errors detected during data reception.
CRC Errors	Displays the error count and error rate for any CRC (Cyclic Redundancy Check) errors detected during data reception.
VPI (F4) AIS Seconds	Displays the total number of seconds an F4 AIS (Alarm Indication Signal) is detected when monitoring for OAM (Operation, Administration, and Maintenance) cells in the virtual path.
VPI (F4) RDI Seconds	Displays the total number of seconds an F4 RDI (Remote Defect Indicator) is detected when monitoring for OAM cells in the virtual path.
VCI (F5) AIS Seconds	Displays the total number of seconds an F5 AIS is detected when monitoring for OAM cells in the virtual channel.
VCI (F5) RDI Seconds	Displays the total number of seconds an F5 RDI is detected when monitoring for OAM cells in the virtual channel.
Pattern Sync	Displays the total number of seconds a Pattern Sync error was detected for a virtual channel that has Detailed Detection mode enabled.

VCC Table - QoS Results (QoS RES)

The Quality of Service (QOS) Results (Res) button displays a summary report of current ratio, rate, and count of cell transfer delay and cell delay variation activity.

In order to receive QOS results, the PM OAM function must be enabled.

The following options are available:

Option	Description
Errored Cells	Displays the ratio of errored cells during the test.
Aggregate Cell Loss	Displays the ratio of cells lost during the test.
CLR for CLP=0	Displays the Cell Loss Ratio (CLR) for cells with Cell Loss Priority (CLP) bit 0 in ATM header.
CLR for CLP=1	Displays the CLR for CLP signaling bit in ATM header cell (1=low priority).
Misinserted Cells	Display the ratio of misinserted cells received.
SECB	Displays the ratio of Severely Errored Cell Blocks (SECB) received.
Non-Compliant to GCRA1	Displays the number of cells non-compliant to Generic Cell Rate Algorithm1.
Non-Compliant to GCRA2	Displays the number of cells non-compliant to Generic Cell Rate Algorithm 2 (valid for VBR channels).
CLP1 Cells	Displays the number of CLP cells in ATM header cell 1.

At the top of the screen, the VCC Header appears. This line of information displays which virtual channel is currently selected (represented by #) and the associated values for GFC, VPI, VCI, PTI, and CLP.

VCC Table - O.191 Results (O.191 RES)

The ITU defined O.191 test cell provides the most accurate method to calculate ATM-layer performance parameters for QoS tests.

The O.191 RES button displays a summary report of the ATM layer statistics for measuring ATM QoS.

VCC Header Information

At the top of the screen, the VCC Header appears. This line of information displays which virtual channel is currently selected (represented by #) and the associated values for GFC, VPI, VCI, PTI, and CLP.

Use the **Previous** and **Next** buttons to scroll through and display other virtual channels in the VCC Table. As you display different virtual channels using the Previous and Next buttons, the status line is updated to reflect the selected virtual channel and its header settings.

Summary Report Table

O.191 testing returns the following information:

Data Type	Description
Minimum Cell Transfer Delay (CTD)	Minimum round-trip time for transmitted (foreground) test cells.
Maximum CTD	Maximum round-trip time for transmitted (foreground) test cells.
Mean CTD	Average round-trip time for transmitted (foreground) test cells.
Lost Count	The number of cells not received.
Errored Count	The number of cells received with payload bit errors.
Mis-insertion Count	The number of cells detected on one virtual channel (VC) having payload information belonging to another VC.
SECB Count	The number of severely errored cell blocks (SECBs) received.
Loss Ratio	A measurement of the difference between the number of foreground test cells transmitted and the number of test cells received.
Error Ratio	The number of foreground test cells received with payload bit errors divided by the total number of transmitted test cells.
Mis-insertion Rate	The rate of cells detected on one VC having payload information belonging to another VC.
SECB Ratio	The number of SECBs received divided by the total number of transmitted test cells.
Unavailable Seconds	The number of seconds for which switch equipment was unavailable to

	transmit test cells.
Availability Ratio	The number of unavailable switch equipment seconds divided by the total number of available seconds.
MTBO	Mean time between outages (MTBO) represents the average time between equipment failures or significant outages that essentially render transmission useless.

VCC Table - QoS ANAL

This function configures the protocol to receive and analyze ATM cell streams to ensure they conform to certain QoS parameters.

The **QoS Analysis Settings** box provides the following configuration options:

Option	Description
Type of Analysis	Allows analysis of One Point Cell Delay Variation (CDV) or Inter Arrival Time.
Header	Provides access to the following configuration settings: **Generic Flow Control (GFC)** - The first four bits of the ATM cell header for a UNI interface. **Virtual path identifier (VPI)** - The virtual path address over which the transmitted data will flow from the transmitting device to the target device. **Virtual Channel Identifier (VCI)** - The address or label of a Virtual

	Channel (VC). **Payload Type Indicator (PTI)** - The payload type field value distinguishing the various management and user cells. **Cell Loss Priority (CLP**) - A signaling bit in the ATM header cell (0=high priority, 1=low priority).
Expected Cell Rate	Keypad entry allows setting the minimum and maximum cell rate value.
Start (Stop)	Starts and stops the QoS analysis test. Test results display in the QoS Analysis Results table.

The QoS Analysis Results table provides the following output data:

Result Parameter	Description
Max CDV	Maximum cell delay variation (CDV) experienced because of buffering and cell scheduling.
Min CDV	Minimum CDV experienced because of buffering and cell scheduling.

Functions

Function (Functns) Screens and Functions

This function allows you to perform the following activities:

- Define the type of errors, alarms, and loopback cells to transmit across the ATM
- Transmit a Burst Count
- Configure ATM cells for network impairment and QOS testing
- Selectively scan for specific ATM cell parameters, gather that information, and then add it to a VCC Table

The following functions are available for the Functions tab.

- VCC BURST
- ERR GEN
- ALRM GEN
- NET IMP
- LOOP BACK
- VCC SCAN
- PM OAM
- CAPT

Functns - VCC Burst

This function transmits a controlled amount of traffic using either AAL0 cells, AAL1 PDUs, or AAL5 PDUs. The type of traffic transmitted is determined by the configured parameters of the active channel (the virtual channel currently highlighted in the VCC Table).

- **Burst Count:** This value represents the number of cells or PDUs sent per burst. This is the value entered using the Burst Count button.
- **AAL0 Cells Sent, AAL1 PDUs Sent, or AAL5 PDUs Sent:** If the virtual channel is configured for AAL0, then the total number of cells sent is displayed. If the virtual channel is configured for AAL1 or AAL5, then the total number of PDUs sent displays.
- **Start:** Select **Start** to transmit the VCC Burst.

Functns - Error Generation (ERR GEN)

Use this function to define how the system generates and transmits errors for testing purposes. The following commands are associated with the ERR GEN button.

Select the **Edit** button to display the following options:

Option	Description
Type of Error Added	Select one of the following errors: • **None:** No errors are selected for transmission. • **HEC - Correctable:** Header Error Control. One bit in the Header is errored. Errors are inserted on all channels. • **HEC - Uncorrectable:** Header Error Control. Two or more bits in the Header are errored. Errors are inserted on all channels.

	• **Bit Error:** Bit errors are inserted only on the currently active channel as selected from the VCC Table. Bit errors are only inserted on AAL 0 or AAL 1 virtual channels. • **SN Error:** Inserts a Sequence Number error. • **SNP Error:** Inserts a Sequence Number Protection error. • **CRC Error:** Inserts a Cyclic Redundancy Check error. • **Padding Error:** Inserts a Padding error. • **PDU Length Error:** Inserts a Protocol Data Unit length error.
Error Insertion Rate	Sets the insertion rate for errors in the transmission stream. The following options are available for this command. • **Off:** No errors are inserted for transmission. • **Continuous (1):** Generates continuous errors into the transmission stream. If the system is configured to generate Bit errors, then this option does not display. • **1e-X:** Selects an error rate. Error rates range from 1e-1 through 1e-9. (For Bit errors, the error rates range from 1e-2 through 1e-9.) • **User Defined:** Allows you to enter a desired error insertion rate. Values are entered using a keypad display.
Error Burst Count	Defines the number of contiguous cells that contain an error. Selects burst count X, where X ranges from 1 to 10.

Duration of Error Insertion	Determines how long errors are inserted into the data transmission stream. Error insertion begins once you have selected a duration value. The following options are available: • **Off:** Turns Off any error that is in progress by setting the timer to 0 seconds. • **1 second** • **10 seconds** • **60 seconds** • **User Defined:** Allows you to enter the duration of the error burst. Values are entered using a keypad display and range from 1 second to 32,765 seconds. • **Continuous:** Errors are constantly inserted at the selected error insertion rate.

Functns - Alarm Generation (ALARM GEN)

The Alarm Gen function allows you to define the type and duration of alarms transmitted by the system. This allows you to solicit a response from a specific network element and verify if that element is correct.

Option	**Description**

ATM Alarm Generated	Selects the type of alarm generated by the system. The following options are available for this command: • None • LOCS • F4 AIS (Segment) • F4 RDI (Segment) • F4 AIS (End-to-End) • F4 RDI (End-to-End) • F5 RDI (Segment) • F5 AIS (End-to-End) • F5 RDI (End-to-End) • Patten Sync
Duration of Alarm Generation	Determines how long an alarm is generated. This alarm timer counts down to 0. • **Off:** Turns Off any alarm that is in progress by setting the timer to 0 seconds. • **1 second** • **10 seconds** • **60 seconds** • **Continuous:** Alarms are constantly reported at an interval of one per second for AIS and RDI alarms. • **User Defined:** Allows you to enter the duration of the alarm.

	Values are entered using a keypad display and range from 1 second to 32,765 seconds.
Defect Type	Select the type of alarm defect to transmit up to eight bits. **Note:** This function is only applicable for OAM alarms.

Net Imp

Functns - Network Impairment (NET IMP)

This function allows you to insert impairment types into an ATM cell stream to emulate real-world network impairments. You are able to insert the following impairment types:

- Cell Error Generation
- Cell Loss
- Cell Mis-insertion
- Cell Delay Variation
- Cell Reordering
- CLP Tagging
- CI Setting
- VPI/VCI Remapping

Functns NET IMP - Cell Error Generation

Cell errors are a result of bit errors caused by line noise. When **Cell Error Generation** is selected from the **Type** button on the **Functns** | **NET IMP** screen, the following parameters can be configured.

Option	Description
Error Mask	Select up to eight bits of an octet for corruption.
Octet Select	Select 1 through 53 octets.
Header Select	Specify the VCC Header (to include GFC, VPI, VCI, and CLP) to be compared with these bits.
Burst Size	Select the number of consecutive cells (1-10) to be corrupted.
Burst Rate	Select the number of unerrored cells that should occur between cell errors. • **Off:** No cells are inserted for transmission. • **Continuous (1):** Generates cell generation into the transmission stream. • **1e-X:** Selects a cell generation rate. Error rates range from 1e-1 through 1e-9. • **User Defined:** Allows you to enter a desired cell generation rate. Values are entered using a keypad display.
Duration	Select how long the impairment will occur. The options are: Off, 1 second, 10 seconds, 60 seconds, continuous, and user defined.

Functns NET IMP - Cell Loss

Cell loss results from network problems as buffer overflow, switch malfunction, traffic policing and uncorrectable header errors. When **Cell Loss** is selected from the **Type** button on the **Functns** | **NET IMP** screen, the following parameters can be configured.

Option	Description

Header Select	Specify the VCC Header (to include GFC, VPI, VCI, and CLP) to be compared with these bits.
Burst Size	Select the number of consecutive cells (1-10) to be corrupted.
Burst Rate	Select the number of unerrored cells that should occur between cell errors. • **Off:** No cells are inserted for transmission. • **Continuous (1):** Generates continuous cell insertion into the transmission stream. • **1e-X:** Selects a cell insertion rate. Error rates range from 1e-1 through 1e-9. • **User Defined:** Allows you to enter a desired cell insertion rate. Values are entered using a keypad display.
Duration	Select how long the impairment will occur. The options are: Off, 1 second, 10 seconds, 60 seconds, continuous, and user defined.

Functns NET IMP - Cell Misinsertion

Cell misinsertion is caused by transmission errors and situations in which an undetected header error matches an existing VPI/VCI. The misinserted cell is introduced in lieu of an idle cell. The header of the misinserted cell can be fully specified by the user. When **Cell Mis-insertion** is selected from the **Type** button on the **Functns | NET IMP** screen, the following parameters can be configured.

Option	Description
Mis-inserted Header	Specify the header (to include GFC, VPI, VCI, PTI, and CLP) of the misinserted cell.
Payload Octet	Select up to eight bits for the payload octet that the misinserted cells will have.

Burst Size	Specify the number of consecutive cells to be misinserted (select 1 through 10).
Burst Rate	Specify the number of cells between misinserted cells. The following options are available: • **Off:** No cells are inserted for transmission. • **Continuous (1):** Generates continuous cell insertion into the transmission stream. • **1e-X:** Selects a cell insertion rate. Error rates range from 1e-1 through 1e-9. • **User Defined:** Allows you to enter a desired cell insertion rate. Values are entered using a keypad display.
Duration	Specify the duration of the impairment. The options are: Off, 1 second, 10 seconds, 60 seconds, Continuous, and User Defined.

Functns NET IMP - Cell Delay Variation

Cell Delay Variation results from variation in the delay inserted because of problems as congestion, cell blocking, multiplexing cells from two or more connections, OAM cell insertion and physical layer overhead insertion. When **Cell Delay Variation** is selected from the **Type** button on the **Functns** | **NET IMP** screen, the following parameters can be configured.

Option	Description
Header Select	Specify the Header (to include GFC, VPI, VCI, and CLP) of the VCC on which impairment should occur.
Burst Size	Select the number of consecutive cells (1-15) to be delayed.
Duration	Select how long the impairment will occur. The options are: Off, 1 second, 10 seconds, 60 seconds, continuous, and user defined.

Functns NET IMP - Cell Reordering

Cell Reordering results from transmission errors. When **Cell Reordering** is selected from the **Type** button on the **Functns** | **NET IMP** screen, the following parameters can be configured.

Option	Description
Header Select	Specify the Header (to include GFC, VPI, VCI, and CLP) of the VCC on which impairment should occur.
Do Cell Reordering	Performs cell reordering once on two consecutive cells with the header specified.

CLP Tagging

CLP Tagging results from network problems due to buffer overflow and traffic policing. When **CLP Tagging** is selected from the **Type** button on the **Functns** | **NET IMP** screen, the following parameters can be configured.

Option	Description
Header Select	Specify the Header (to include GFC, VPI, VCI, and CLP) of the VCC on which impairment should occur.
Duration	Select how long the impairment will occur. The options are: Off, 1 second, 10 seconds, 60 seconds, continuous, and user defined.

Functns NET IMP - CI Setting

CI settings result from congestion in the network. When the CI Setting impairment type is selected, the following parameters can be specified.

Option	Description
Header Select	Specify the Header (to include GFC, VPI, VCI, and CLP) of the VCC on which impairment should occur.
Duration	Select how long the impairment will occur. The options are: Off, 1 second, 10 seconds, 60 seconds, continuous, and user defined.

Functns NET IMP - VPI/VCI Remapping

This function simulates behaviour of a switch. When **VPI/VCI Remapping** is selected from the **Type** button on the **Functns** | **NET IMP** screen, the following parameters can be configured.

Option	Description
Header Select	Specify the Header (to include GFC, VPI, VCI, and CLP) of the VCC on which impairment should occur.
New Header	Specify the Header (to include GFC, VPI, VCI, and CLP) of the VCC to which the received cells are to be sent.
Duration	Select how long the impairment will occur. The options are: Off, 1 second, 10 seconds, 60 seconds, continuous, and user defined.

Functns - LOOP BACK

This function allows the system to generate a loopback test to ATM equipment on the network. The commands associated with this function define the parameters for the loopback test.

Select the **Edit** button to display the following options are available.

Option	Description
Connection Type	Determines whether the loopback cells are looped at a virtual channel segment or throughout the network to an endpoint. The following options are available for this command. • **Segment:** Sends loopback cells though a portion of the ATM network. For this type of connection, the PTI defaults to 100. • **End-to-End:** Sends loopback cells to the endpoint of the ATM network. For this type of connection, the PTI defaults to 101.
Duration of Insertion	Sets the period of the loopback test. The test consists of the number of cells per second sent for the length of time defined by this command. Loopback cell results are displays in the Loopback Cell Received status box. The following options are available for this command. • **Off:** Stops any loopback test that is in progress. • **Seconds:** Sets the loopback cell test to last for 1, 10, or 60 seconds. • **User Defined:** Allows you to specify the duration of the test. Values are entered using a keypad and range from 1 second to 32765 seconds. • **Continuous:** Loopbacks are constantly inserted at the selected loopback insertion rate.

Single Loopback	Generates one loopback cell. This provides the ability to quickly send a loopback cell without having to configure the Loopback Insertion Rate or Duration of Loopback Insertion commands.
Clear Count	Sets the Cells Received counter to zero.

Functns - VCC SCAN

The VCC Scan function is a filter that allows you to identify active virtual channels containing specific cell addressing. This feature allows you to enter specific ATM Cell Header addressing parameters and then capture only those ATM cells. This information can then be easily transferred into a VCC Table for additional analysis.

The following commands are available.

Option	**Description**
Scan Header (Hex)	Displays a keypad. From here, you can enter specific ATM Cell Header address that will be scanned. Wild card characters can be entered to represent any value.
Start Scan	Initiates a scan. The Scan Status box displays the message "Active."
Stop Scan	Stops the scan in progress. The Scan Status box displays the message "Inactive."
Add to VCC Tbl	Selects the highlighted virtual channel and adds it to the VCC Table.
Add All	Selects all virtual channels identified (displayed in the scroll box) and adds them to the VCC Table.
Clear	Removes any identified virtual channels from the scroll box.

Functns - PM OAM

This function allows you to view and edit performance management settings for Operation, Administration, and Maintenance cells. When Forward Monitoring and

Backward Reporting are enabled for a connection, you are able to view the OAM-related information for a specified cell block.

The results of this function are viewable through the QOS Res function when the system is set up in Loopback mode.

The following options are available from this screen:

Option	Description
VPI/VCI	Displays which Virtual Path Indicator/Virtual Channel Indicator are currently being monitored.
Forward Monitoring	Displays whether Forward Monitoring mode is enabled or disabled on the transmitting unit.
Backward Reporting	Displays whether Backward Reporting mode is enabled or disabled on the receiving unit.
Block Size	Displays the interval in which the PM OAM cell sets (or blocks) will be sent. For example, if 256 is selected for Block Size, the cells will be sent after every 256 cells. The options include: • 128 • 256 • 512 • 1024 • 2048 • 4096 • 8192 • 16384 • 32768

Edit	The Edit button includes the following functions: • **VPI/VCI:** Displays the VPI/VCI currently being managed. • **Forward Monitoring:** A toggable button that enables or disables Forward Monitoring. • **Backward Reporting:** A toggable button that enables or disables Backward Reporting. • **Block Size:** Allows you to select the cell set (block) interval in which the PM OAM cells will be sent. • **Save:** Saves your changes. • **Exit:** Exits the function. If **Save** is not selected before exiting, no changes are made.

Functns - Capture Settings (CAPT)

This function allows you to specify VPI/VCI and the number of bytes to be captured. This function is enabled only when the VCC table contains a Capture-capable connection.

Capture Settings

Setting	Description
VPI/VCI	This function allows you to set the VPI/VCI. Cells on this VPI/VCI will be captured.
Bytes	This function specifies the number of bytes to be captured. This is entered using a keypad and the range is from 1 to 4096.
Start	This function starts the capture of

	cells.
Start/Stop	This function starts or stops the capture of cells.

Send Options

This function allows you to specify the VPI/VCI on which the captured (and modified) cells are to be sent. This function is enabled only when a Full PDU programmable connection exists in the VCC Table.

Setting	Description
VPI/VCI	This function allows you to set the VPI/VCI on which the captured cells will be transmitted.
Send	This function sends the captured cells on the specified VPI/ VCI.

Captured Data

After settings are configured and Capture is initialized, the capture data is displayed under the Captured Data portion of the screen. Use the Arrow Keys on the righthand side of the screen to scroll through the data view.

Additionally, you may select the **Edit** button

Test

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:

After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.

After configuring the Duration, you must select Restart in order for the Timed Test to begin.

To determine how long a test will run, refer to Duration.

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.
- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic Print or View Saved Files.

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	**Description**
None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.
Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-

	report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (,). The test does not repeat.
Print Statistics and Repeat Test This option appears when **Repeat Actions** is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting **Stop** from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics and Repeat Test This option appears when **Repeat Actions** is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting **Stop** from the Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test This option appears when **Repeat Actions** is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting **Stop** from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test This option appears when **Repeat Actions** is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting **Stop** from the Common Function Buttons, or by changing the Action After Duration value.
Print Statistics/Events and Repeat Test This option appears when **Repeat Actions** is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting **Stop** from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test This option appears when **Repeat**	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until

Actions is selected.	the test is stopped by selecting **Stop** from the Common Function Buttons, or by changing the Action After Duration value. Both **.statE** and **.stat** files are recorded.
Print Events and Repeat Test This option only appears on the NIC unit's touch screen when **Realtime Actions** is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.
Record Events and Repeat Test This option only appears on the NIC unit's touch screen when **Realtime Actions** is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test This option only appears on the NIC unit's touch screen when **Realtime Actions** is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events This option only appears on the NIC unit's touch screen when **Realtime Actions** is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.
Record Events This option only appears on the NIC unit's touch screen when **Realtime Actions** is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.
Print and Record Events This option only appears on the NIC unit's touch screen when **Realtime Actions** is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Results

Results - Screens and Functions

Test activity and event history can be viewed using the various functions of the Results screen.

The following buttons make up the Results functions:

- SCAN
- ERR
- ALARM
- EVENT
- LARGE LED
- GRAPH
- CALL RESULTS

Results - SCAN

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected. This function displays a list of received errors and alarms. For alarms, the duration is reported as a count in seconds. For errors, an error count is reported.

When no activity is occurring, the screen displays, "No Trouble."

Results - ERR

This function reports percentage and error count values. It displays the number of errors detected, and the average error rate (using an N.NNe-N format) and current error rate (using an N.NNe-N format for current seconds only). The errors detected are generated either by the ATM network or intentionally by the system.

The following ATM errors are reported:

- HEC - Correctable
- HEC - Uncorrectable
- BIT Error
- Lost Cells
- Mis-Inserted Cells
- SN + SNP Error
- CRC Error
- PDU Length Error
- Padding Error

The type of errors that appear vary depending on the type of Preset/Mapping selected.

Results – ALARM

This function displays how long (in seconds) alarms were received by the system.

The following ATM alarms can appear:

- LOCS Seconds
- SCNR Seconds
- CLP Seconds
- STA Seconds
- LOPS Seconds
- VPI (F4) AIS Seconds
- VPI (F4) RDI Seconds
- VCI (F5) AIS Seconds
- VCI (F5) RDI Seconds

The type of alarms that appear vary depending on the type of Preset and Mapping selected.

Results – EVENTS

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

Results – LARGE LED

The system uses LEDs to report alarm, error, and event activity. These visual cues help to narrow the focus if problems are detected on the incoming protocol processors' signals and provide a starting point when trying to diagnose problems.

There are two ways to view LEDs from the touch screen: the ATM Quick Status LEDs, which are located on the left side of the touch screen, and the **Large LEDS** tab. The following tables describe what is indicated by the LED color.

Quick Status LEDs Color Description

If the LED is ...	Then this indicates ...
Green with white text	Normal operation. The LED is used as a status indicator.
White with white text	Normal operation, no errors or alarms. The LED is used as an error and alarm indicator.
Red with **red** text	An error or alarm event is in progress. The LED is used as an error and alarm indicator.
White with **red** text	An error or alarm event was detected, but is now cleared. The text serves as a history indicator.

Large LED Tab Color Description

If the LED color is ...	Then this indicates ...
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

Using Graphs

Use the **Graph** button to view error and alarm results for the selected protocol processor. Graphs show the test history for either the current test or a previously saved test.

To use the graphs function:

1. Select a protocol processor that has been configured for Error Alarm testing.
2. From **Results**, select **Graph**. The Graph screen appears. It contains two graphs which allow you to display incoming alarms and errors.
3. Use the following buttons to control graphing parameters:

    - **Sample Rate** - Sets the timing for graph results at increments of 1 Second, 1 Minute, or 15 Minutes.

- **Change Scale** - Compresses or expands the displayed time scale for the graphed errors and alarms at time intervals of 30 minutes, 90 minutes, 3 hours, 6 hours, 12 hours, 24 hours, or 72 hours.
- **Change Upper** - Sets the type of errors or alarms that appear in the upper graph.
- **Change Lower** - Sets the type of errors or alarms that appear in the lower graph.
- **Shift Left and Shift Right** - Adjusts the graph's time scale to an earlier or later time.
- **Print Report** - Prints a graph report to printer or file.
- **Save Graphs** - Saves a graph to file as a .grp file that can be replayed at a later time.

Important: This is not a text file; when replayed, it appears as the original graph plot. Choose *Print a Graph to Report* if you desire graph information that can be printed out.)

- **Replay Graphs/Stop Replay** - Replays or stops saved graphs (.grp).

Call Results

This function reports Signalling results and is visible only when Signalling is enabled. This gives the values for the number of calls attempted, connected, rejected and cleared, setup time and teardown time. This also gives the SSCOP error statistics.

The following Call Results statistics appear

- TX Calls Attempted
- TX Calls Connected
- TX Calls Rejected
- TX Calls Cleared
- RX Calls Attempted
- RX Calls Connected
- RX Calls Rejected
- RX Calls Cleared
- Avg. Setup Time
- Min Setup Time
- Max Setup Time
- Avg. Teardown Time
- Min Teardown Time
- Max Teardown Time

The following SSCOP error statistics appear:

- Protocol Discriminator: Indicates error in Protocol Discriminator field.
- IE missing: Indicates that information element is missing.
- IE Content: Indicates that the content of the information element is errored.
- Unrecognized IE: Indicates that the information element is unrecognizable.
- Message Type: Indicates that the message type field is errored.
- Message Length: Indicates that the message length field is errored.
- SSCOP PDU Length: Indicates that the PDU length is errored.
- SSCOP Unknown PDU: Indicates that the PDU is not known.
- SSCOP PDU Align: Indicates error in PDU alignment.
- Call Reference Format: Indicates error in call reference format.
- Call Reference Value: Indicates error in Call reference value.

LED Quick Status Area

The ATM Processor Alarm and Status Indicators serve the following purposes:

- Provides access to ATM protocol processor functions.
- Provides a visual status of ATM activity such as data traffic transmission and reception on ATM virtual channels.
- Displays ATM alarm and error conditions.

The following describes the ATM Processor Alarm and Status Indicators area.

LED	**Description**
TX	Displays transmit status of virtual channels. **On** indicates selected virtual channels are active and transmitting. **Off** indicates all virtual channels are not transmitting.
RX	Displays monitor status of virtual channels. **On** indicates selected virtual channels are active and monitoring. **Off** indicates all virtual channels are not receiving.
Mapping	Displays the current mapping settings. If none are selected, "None" appears.
LOCS	Loss of Cell Synchronization. Indicates a loss of Cell Sync, which occurs when seven consecutive bad HECs are received. Cell Sync returns when six consecutive good HECs are received.

HEC	Header Error Control. Indicates if a correctable or uncorrectable Header Error Control occurred.
SCNR	Selected Cells Not Received. Monitor or Detail Channels are not receiving cells.
Bit Err	Indicates a Bit error has been received on the active detail channel.
Pat Sync	Loss of Pattern Synchronization. Indicates and displays the status of loss of Pattern Sync on any active details channel.
STA	Status. Indicates that a VCC has received cells with the CLP = 1.
CLP	Cell Loss Priority. Indicates that a VCC has received cells with the CLP = 1.
AAL	ATM Adaption Layer. Indicates that an AAL 1 SN or SNP error or lost or misinserted cell occurred, or a PDU length, padding, or CRC error occurred.
AIS	Alarm Indication Signal. Indicates if an AIS is received on an F4 or F5 OAM flow of an active VCC. This is an alarm LED.
RDI	Remote Defect Indicator. Indicates if a Remote Defect Indicator signal is received on an F4 or F5 OAM flow of an active VCC.
O.191 OVFL	Displays O.191 overflow status. **On** indicates that the block size set for the current rate is low and there is an overflow. **Off** indicates that there is no overflow.
SSCOP Link	Displays Service Specific Connection Oriented Protocol (SSCOP) link status. **On** indicates that the SSCOP link is up. **Off** indicates that the SSCOP link is down.
PLCP	Physical Layer Convergence Protocol. Indicates if a PLCP signal is received on the active detail channel.

DS1 Tab

DS1 Overview

The DS1 online help is divided into the following sections:

- DS1 Specific Tasks
- DS1 Screen Functions and Descriptions

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

DS1 Specific Tasks

DS1 Specific Tasks Overview

This section covers procedures that are specific to the operation of the DS1 protocol processor. For a list of general tasks, which apply to all protocol processors, see Common Tasks located in the Getting Started section.

- DS1 Electrical Power Calibration

DS1 Electrical Power Calibration

The following procedures describe the unit's negative, positive, negative bridged, and positive bridged power calibration. While performing this task, you will measure, record, and enter power reading input for zero power reading and 0.5 and 2.0 volt reading for DS1.

Required Equipment

The following equipment is required to perform DS1 calibration:

- Digital oscilloscope (use highest bandwidth available) or equivalent measuring equipment

- Variable attenuator
- Electrical power meter or a calibrated NIC that can provide 0.5 and 2.0 volts power
- BNC T-connector
- Bantam Connector
- Two 2-ft., 75 ohm coaxial cables with male BNC connectors
- Pencil and paper to record power measurements

Hardware Setup

The following describes how to attach cables to the measuring devices (an oscilloscope will be used in this example) and how to configure these devices for DS1 calibration.

To attach cables between the unit and the oscilloscope:

1. Make sure that the unit and oscilloscope are turned on.
2. Connect the BNC T-connector to the oscilloscope's BNC input connector.
3. Connect one end of a BNC cable to the unit's **E1/DS1 #1 TX** BNC connector and connect the other end of the cable to the BNC T-connector attached to the oscilloscope.
4. Connect one end of a BNC cable to the unit's **E1/DS1 #1 RX** BNC connector and connect the other end of the cable to the BNC connector attached to the oscilloscope.
5. Connect the Bantam cable to the oscilloscope's Bantam input connector.
6. Connect one end of a Bantam cable to the unit's **E1/DS1 #2 TX** Bantam connector and connect the other end of the cable to the Bantam connector attached to the oscilloscope.
7. Connect one end of a Bantam cable to the unit's **E1/DS1 #2 RX** Bantam connector and connect the other end of the cable to the Bantam connector attached to the oscilloscope.

Restoring Raw Power Readings for DS1

The following restores the unit's raw (unconverted) power readings for DS1 #1 or DS1 #2.

Raw Negative Power Readings for DS1 #1 or DS1 #2

The following procedures apply to the Negative button that appears for the DS1 #1 or DS1 #2 tabs.

1. From the **System** tab, select **Misc**.
2. From **Local Setting**, select **Enable Calibration**.

The user must have Admin. or Calibrate privileges to enable the

calibration mode.

3. From the **DS1** tab, select **Receive**.
4. Select **SIG** from the tabs along the left-side of the Receive screen and choose **Update Signal Calibration**.
5. Select the **Negative** button. The Negative Signal Calibration functions appear.
6. Select **Zero power reading**. A keypad appears. Enter **0** and select **OK**.
7. Select **0.5 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
8. Select **2.0 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
9. Select **Save**.

Raw Positive Power Readings for DS1 #1 or DS1 #2

The following procedures apply to the Positive button that appears for the DS1 #1 or DS1 #2 tabs.

1. Select the **Positive** button. The Positive Signal Calibration functions appear.
2. Select **Zero power reading**. A keypad appears. Enter **0** and select **OK**.
3. Select **0.5 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
4. Select **2.0 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
5. Select **Save**.

Raw Negative Bridged Power Readings for DS1 #2

The following procedures only apply to the Negative Bridged button that appears for the DS1 #2 tab.

1. From the **Receive** screen, select **SIG**.
2. Select the **Update Signal Calibration** button and choose **Negative Bridged**. The Negative Bridged Signal Calibration functions appear.
3. Select **Zero power reading**. A keypad appears. Enter **0** and select **OK** to accept the new value.
4. Select **0.5 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
5. Select **2.0 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
6. Select **Save**.

Raw Positive Bridged Power Readings DS1 #2

The following procedures only apply to the Positive Bridged button that appears for the DS1 #2 tab.

1. Select **Positive Bridged**. The Positive Bridged Signal Calibration functions appear.

2. Select **Zero power reading**. A keypad appears. Enter **0** and select **OK** to accept the new value.
3. Select **0.5 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
4. Select **2.0 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
5. Select **Save**.

Calibrating the DS1 Signal

The following procedures describe how to perform DS1 calibration using the unit and an oscilloscope. These procedures apply to both the Negative and Positive buttons that appear under the **DS1 #1** or **DS1 #2** tabs.

Obtain Zero Power Reading

1. Using the oscilloscope, measure and record the average positive and negative peak values.
2. For zero volt value, do not connect the cable to the Receive connector on the unit.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This value is the **Zero power reading** for **Positive Signal Calibration**.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This value is the **Zero power reading** for **Negative Signal Calibration**.

Obtain 0.5 Volts Power Reading

1. Using the oscilloscope, measure and record the average positive and negative peak values. *(Reconnect the cable to the Receive connector on the unit.)*
2. Attenuate the signal until the oscilloscope reads 0.5 volts.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This is the **0.5 Volts Reading** value.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This is the **0.5 Volts Reading** value.

Obtain 2.0 Volts Power Reading

1. Using the oscilloscope, measure and record the average positive and negative peak values.
2. Attenuate the signal until the oscilloscope reads 2.0 volts.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This is the **2.0 Volts Reading** value.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This is the **2.0 Volts Reading** value.

Enter Negative Signal Power Readings

1. Make sure that the **Negative Signal Calibration** functions appear on the **Receive SIG** screen. If necessary, select the **Negative** button.
2. Select **Zero power reading**. A keypad appears. Enter the value recorded earlier for the zero power reading and select **OK**.
3. Select **0.5 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.5 volts power reading and select **OK**.
4. Select **2.0 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 2.0 volts power reading and select **OK**.
5. Select **Save** to save the new Negative Signal Calibration values.

Enter Positive Signal Power Readings

1. Select the **Positive** button. The Positive Signal Calibration functions appear on the **Receive SIG** screen.
2. Select **Zero power reading**. A keypad appears. Enter the value recorded earlier for the zero power reading and select **OK**.
3. Select **0.5 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.5 volts power reading and select **OK**.
4. Select **2.0 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 2.0 volts power reading and select **OK**

This concludes signal calibration for the DS1 #1 tab.

If you are performing calibration using the DS1 #2 tab, continue to the next section to perform Negative Bridged and Positive Bridged signal calibration.

Calibrating the DS1 #2 Bridged Signal

The following procedures only apply to the Negative Bridged and Positive Bridged buttons that appear under the **DS1 #2** tab.

Configure the Unit for Bridged Termination

The following procedures only apply to the DS1 #2 tab.

1. From the **Receive** screen, select **SET 1**.
2. Select **Termination Type** and choose **Bridged**.
3. Select **SIG** from the tabs along the left-side of the Receive screen.
4. Select **Update Signal Calibration**.

Obtain Zero Power Reading for Bridged Termination

1. Using the oscilloscope, measure and record the average positive and negative peak values.

2. For zero volt value, do not connect the cable to the Receive connector on the unit.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This value is the **Zero power reading** for **Positive Bridged** Signal Calibration.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This value is the **Zero power reading** for **Negative Bridged** Signal Calibration.

Obtain 0.5 Volts Power Reading for Bridged Termination

1. Using the oscilloscope, measure and record the average positive and negative peak values. *(Reconnect the cable to the Receive connector on the unit.)*
2. Attenuate the signal until the oscilloscope reads 0.5 volts.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This value is the **0.5 Volts Reading** for **Positive Bridged** Signal Calibration.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This value is the **0.5 Volts Reading** for **Negative Bridged** Signal Calibration.

Obtain 2.0 Volts Power Reading for Bridged Termination

1. Using the oscilloscope, measure and record the average positive and negative peak values.
2. Attenuate the signal until the oscilloscope reads 2.0 volts.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This value is the **2.0 Volts Reading** for **Positive Bridged** Signal Calibration.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This value is the **2.0 Volts Reading** for **Negative Bridged** Signal Calibration.

Enter Negative Bridged Signal Power Readings

1. Select the **Negative Bridged** button. The Negative Bridged Signal Calibration functions appear on the **Receive SIG** screen.
2. Select **Zero power reading**. A keypad appears. Enter the value recorded earlier for the zero power reading and select **OK**.
3. Select **0.5 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.5 volts power reading and select **OK**.
4. Select **2.0 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 2.0 volts power reading and select **OK**.
5. Select **Save** to save the new Negative Bridged Signal Calibration values.

Enter Positive Bridged Signal Power Readings

1. Select the **Positive Bridged** button. The Positive Bridged Signal Calibration functions appear on the **Receive SIG** screen.
2. Select **Zero power reading**. A keypad appears. Enter the value recorded earlier for the zero power reading and select **OK**.
3. Select **0.5 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.5 volts power reading and select **OK**.
4. Select **2.0 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 2.0 volts power reading and select **OK**.
5. Select **Save** to save the new Positive Bridged Signal Calibration values.

This completes the unit's DS1 signal calibration.

Screen Functions and Descriptions

DS1 Screen Functions and Descriptions Overview

The following function screens are available through the DS1 protocol processor tab.

- Transmit
- Receive
- Results
- Test
- Performance Monitoring
- LEDs

Transmit

Transmit Screens and Functions

The Transmit functions provide a means for defining the signal parameters used in DS1 transmit operations.

The following functions are available through the DS1 Transmit screen.

- SET 1
- Loop Code
- ERROR ALARM

Transmit - Settings 1 (SET 1)

This function configures the unit's transmit parameters for your DS1 test environment.

The following parameters are available through the DS1 Transmit SET 1 screen.

Parameter	Description
Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Signal Level	Sets the strength of the DS1 transmit signal. The signal level values are relative to a normal DSX1 signal level. The following options are available: • **0 dBdsx:** Signal level is at the DSX1 signal level. • **-7.5 dBdsx:** Signal level is -7.5 dB below the normal DSX1 signal level. • **-15 dBdsx:** Signal level is -15 dB below the normal DSX1 signal level.
Line Code	Selects the type of signal coding transmitted by the DS1 protocol processor. The following options are available. • **AMI:** Alternate Mark Inversion coding (Default). • **B8ZS:** Binary 8 Zero Substitution coding.
Line Frequency Offset	Select Off (0, which means the frequency cannot be adjusted) or -100.0 to 100.0 in 0.1 increments.
Clock Reference	Determines the timing source for the DS1 transmit signal. The following options are available: • **Internal:** Derives the transmit data's timing source from the system's internal clock. • **Recovered:** Derives the transmit data's timing source

	from the system's recover clock. • **BITS:** Derives the transmit's data timing source from the BITS (Building Integrated Timing Supply) clock input, which is 1.544 MHz. If this option is selected, but BITS clocking is not available, then this function defaults to Internal. CLK:BITS displays when configured for BITS clocking • **SETS:** Derives the transmit's data timing source from the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 MHz. If this option is selected, but SETS clocking is not available, then this function defaults to Internal. CLK:SETS displays when configured for SETS clocking.
Framing	Configures the framing format used for the DS1 transmit signal. **Note:** Any changes made to this command are replicated to the DS1 receive signal. The following options are available: • **Unframed:** Configures the system to transmit a DS1 signal using an unframed format. • **D4/SF:** Configures the system to transmit a DS1 signal using D4 super frame format. • **ESF:** Configures the system to transmit a DS1 signal using Extended Super Frame format. • **SLC-96:** Configures the system to transmit a DS1 signal using SLC-96 format

	(Subscriber Loop Carrier).
Mapping	Sets mapping to Bulk Filled.
Payload Pattern	Selects the type of DS1 payload pattern that is transmitted by the system. The following options are available: • QRSS • PRBS 6 • PRBS 6 Inv • PRBS 9 • PRBS 9 Inv • PRBS 11 • PRBS 11 Inv • PRBS 15 • PRBS 20 • PRBS 23 • **All Ones:** Transmits a fixed test pattern of only pulses. This pattern is generally used to stress span repeater current regulator circuits. It can be used as an AIS in unframed circuits, or a keep alive signal, idle code, or red alarm in other circuits. • **3 in 24 (3:21):** Transmits a fixed test pattern of F0100 0100 0000 0000 0000 0100. The pattern is aligned with the F-bits as indicated. 3 in 24 provides the minimum ones density and the maximum excess zeros requirements to stress T1 circuits. When the pattern is framed, it violates the minimum ones density requirements. • **1 in 8 (1:7):** Transmits a fixed pattern of F01000000. This pattern stresses the minimum ones density requirement for B8ZS encoded T1 circuits if sent unframed. • **1010 Pattern:** A fixed test

	pattern of alternating marks (1) and spaces (0). This pattern is generally used to perform a minimum level stress test on clock recovery circuits. • **55DLY:** Transmits a 55 octet Daly pattern. • **T1-2:** Transmits a 96 octet pattern. • **T1-3:** Transmits a 54 octet pattern. • **T1-4:** Transmits a 120 octet pattern. • **T1-5:** Transmits a 53 octet pattern. • **55-OCTET:** Transmits a 55 octet pattern. • **Bridge Tap:** Transmits 21 different patterns to detect bridge taps on a DS1. The following patterns are performed in 30-second increments: All Ones, 1-in2, 1-in-4, 1-in-6, 1-in-7, 1-in-8, 2-in-9, 2-in-10, 2-in-11, 2-in-12, 2-in-13, 2-in-14, 2-in-15, 3-in-18, 3-in-19, 3-in-20, 3-in-21, 3-in-22, 3-in-23, 3-in-24, and QRSS. • **Multi-Pattern:** Transmits five different patterns to stress a DS1. The following patterns are performed in five-minute increments: All Ones, 1-in-8, 2-in-8, 3-in-24, and QRSS. • **User Defined:** Allows you to enter up to a 32-bit pattern.
Fractional T1 (1-24)	Configures the system for Fractional T1 testing.
Background DS0 Pattern	Enter any 8-bit pattern.

Transmit - Loop Code

The Loop Codes function allows you to isolate the connection between the system and the DS1 switch for loopback testing. With this segment isolated, you can configure the system to generate loopbacks in either direction. This allows the system to simulate a DS1 switch so that it can generate or receive loopback codes or place other DS1 facilities into or release from loopback.

Some option selections may be dependent on other settings.

The following options are available from Transmit Loop Code screen.

Option	Description
Loopback Type	Determines if the Loop Codes are sent as in-band signal or out-of-band signals. The following options are available: • **In-Band**: Available for all framing formats (Unframed, D4, ESF, and SLC-96). • **Out-of-Band:** Available only for ESF framing. • **DDS-Latching:** Typically used for 64K channels. Send a specific loopback signal for a set number of bytes. This option is available only if the unit is configured for Fractional T1 mode. • **DDS-Non-Latching:** Also known as Alternating Looback. Used for 56K channels only. The Non-Latching loopback sends the selected loopback signal as every other byte in the loopback pattern. This option is available only if the unit is configured for Fractional T1 mode.
Loopback Code	Selects the type of loopback code transmitted. The options available vary based on the whether Loopback Type is configured for in-band or out-of-band signaling. The following

	options are available: • **OCU Loopback:** Test is looped at the Office Channel Unit. This option is only available if the unit is configured for T1 mode. • **CSU Loopback:** Test is looped at the Channel Service Unit. This option is available only if the unit is configured for Fractional T1 mode. • **DSU Loopback:** Test is looped at the Data Service Unit. This option is available only if the unit is configured for Fractional T1 mode. • **4-Bit Smartjack (Facility 1):** A loop-up code "1100", with the framing bits (D4, SF) over writing the pattern, is transmitted indicating to a compatible facility interface to establish a loop back. A loop-down code "1110" is transmitted to terminate the loop back. This option is only available when the Loopback Type command is configured for In-Band. • **5-Bit Smartjack (Facility 2):** A loop-up code "11000", with the framing bits (D4, SF) over writing the pattern, is transmitted indicating to a compatible facility interface to establish a loop back. A loop-down code "11100" is transmitted to terminate the loop back. This option is only available when the Loopback Type command is configured for In-Band. • **Line Loopback (CSU):** F or In-Band signaling, the Line Loopback should only be

	responded to by CSU or CI. A loop-up code "10000", with the framing bits (D4, SF) over writing the pattern, is transmitted indicating to a compatible CSU or CI interface to establish a loop back. A loop-down code "100" is transmitted to terminate the loop back. The pattern should last for at least 5 seconds. The entire signal is looped back at the other end, no change in framing or BPV. • For Out-of-Band signaling, the Line Loopback codes are: Loop-up code 0000 1110 1111 1111 and the Loop-down code is 0011 1000 1111 1111. The bits are sent in the order from right to left. These codes are sent in the data link bit in the ESF. The entire signal is looped back at the other end, no change in framing or BPV. • **User Up Code:** Allows you to create an 8-bit loopback pattern for the Loop Up Code. This option is only available for In-Band signaling. • **User Down Code:** Allows you to create an 8-bit loopback pattern for the Loop Down Code. This option is only available for In-Band signaling.
Auto Response	Determines how the DS1 protocol processor responds to Loop Up and Loop Down codes. The following options are available: • **On:** The DS1 protocol processor automatically

	responds to Loop Up and Loop Down codes. The system responds only to the type of loopback code that is selected by the Loopback Code command. • **Off:** The DS1 protocol processor does not automatically respond to Loop Up and Loop Down codes.
Tester Line Looped	Controls whether or not the system loops back the entire signal it receives from a DS1 switch. (The entire signal consists of the payload and framing bits.) The following options are available: • **Down:** This is the normal operating mode for this command. • **Up:** This allows a received loop code to be immediately looped at the DS1 Line Interface. The entire signal (payload and framing bits) is looped. • **None:** The test line is not looped back.
Tester Payload Looped	Determines whether or not the system loops back just the payload of a signal received from a DS1 switch. This command allows the signal to enter the system. The signal's framing bits are stripped, new framing bits are added, and then the signal is returned to the DS1 switch. The following options are available: • **Down:** This is normal operating mode for this command. • **Up:** The received signal is stripped of its original framing bits, but the payload remains

	intact. The system inserts new framing bits and returns the signal to the DS1 switch. • **None:** The test payload is not looped back.
Loopback	Displays the selected Loopback type.
Loopup Code	Displays the selected Loopup code.
Loopdown Code	Displays the selected Loop down code.
Send Loop Up	Initiates the Loop Up test.
Send Loop DN	Initiated the Loop Down test.

Transmit - ERROR ALARM

The Transmit Error Alarm function allows you to select the type of errors and alarms transmitted by the DS1 protocol processor.

Determines the type of error that is transmitted by the DS1 protocol processor. Often, these errors are used by the receiving equipment to determine if a transmission error has occurred.

Use the Error Insert button to inject single errors into the DS1 transmit signal. When this occurs, the appropriate error LED flashes red, and the error is recorded by various functions in the Results function.

The following options are available:

Option	Description
Error to Insert	Select the error to insert. The following options are available: • **None:** Turns off DS1 error insertion. • **BPV:** Transmits Bipolar Violation errors, which result in a line code violation event for an AMI-coded signal, the occurrence of received excessive zeros or a bipolar violation that is not part of a zero substitution code. • **Bit Error:** Transmits a bit error which results in a frame-synchronization-bit error event. This also inserts a frame-bit

	error in the received frame-bit pattern. • **Frame:** Results in a severely errored framing event; the occurrence of two or more framing bit pattern errors within a three-microsecond period. This type of error is not available if the DS1 protocol processor is configured for Unframed framing format. • **CRC:** Results in a CRC error event; the occurrence of a received CRC code that is not identical to the corresponding locally calculated code. This option is available only when the DS1 protocol processor is configured for ESF framing.
Error Insert Rate	Sets the insertion rate for DS1 transmit errors. This command is not available if the Type of DS1 Error Added command is set to None. The following options are available: • **Off:** No errors are inserted for transmission. (The value displayed for this command is None.) This command effectively disables the Error Insert Action button. • **1e-3:** Where X is a value from 1 through 3. • **1e-4:** Where X is a value from 2 through 4. • **1e-5:** Where X is a value from 2 through 5. • **User Defined:** Allows you to enter and save a customized error insertion rate. The following range is available: Bit Error: 1e-2 to 1e-7.
Alarm Generated	Generates a specific type of alarm on the transmit side of the DS1 protocol

	processor. The following options are available: • **None:** No alarms generated. (The value displayed for this command is None.) • **LOS:** Generates a Loss of Signal alarm for the transmit DS2 signal. • **OOF:** Generates an Out of Frame alarm for the transmit DS1 signal. • **Yellow:** Generates a Yellow alarm for the transmit DS1 signal. • **AIS:** Generates an AIS (Alarm Indication Signal - also known as a Blue Alarm) signal for the transmit DS1 Signal.

Receive

Receive Screens and Functions

The DS1 Receive function provides settings for the signal parameters used in the DS1 protocol processor receive operations. These commands configure the system for the expected receive signal.

The following functions are available from the Receive screen:

- SET 1
- DS0
- SIG

Receive - Settings 1 (SET 1)

The Receive Settings function determines how the DS1 interface and processor parameters are configured.

Some option selections may be dependent on other settings.

The following options are available from the Receive SET 1 screen.

Option	Descriptions

Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Termination Type	Sets the termination point of the DS1 receive signal. The following options are available: • **Monitor:** Sets the receive sensitivity of the DS1 Line interface. Use this setting if the DS1 line connects to a monitor jack. • **Terminated:** Sets the receive sensitivity of the DS1 Line interface. Use this setting if the DS1 line terminates at the system's Line Interface. • **Bridged:** Allows the DS1 receive signal to be connected to both the DS1 interface and the DS1 protocol processor.
Framing	Configures the framing format used for the DS1 Receive signal. **Note:** Any changes made to this command are replicated to the DS1 Transmit signal. The following options are available: • **Unframed:** Configures the system to transmit a DS1 signal using an unframed format. • **D4/SF:** Configures the system to transmit a DS1 signal using D4 super frame format. • **ESF:** Configures the system to transmit a DS1 signal using Extended Super Frame format. • **SLC-96:** Configures the system to transmit a DS1

	signal using SLC-96 format (Subscriber Loop Carrier).
Mapping	Sets Receive mapping to: • **56K Fractional T1:** Configures the system for 56K channel rates. • **64K Fractional T1:** Configures the system for 64K channel rates. • **ATM Direct:** Uses HEC-based cell delineation. By using less overhead, the maximum ATM Cell throughput is 1.536 Mbps. • **ATM PLCP:** Physical Layer Convergence Protocol is used. ATM cells are enclosed in a frame defined by PLCP, which adds more overhead. Because of the extra overhead, the maximum ATM Cell throughput is 1.413 Mbps. • **Bulk Filled:**

Payload Expected	Selects the type of DS1 payload pattern that is received by the system. The following options are available: • QRSS • PRBS 15 • PRBS 20 • PRBS 23 • **All Ones:** A fixed test pattern of only pulses (marks) is received. This pattern is generally used to stress span repeater current regulator circuits. It can be used as an Alarm Indication Signal (AIS) in unframed circuits, or a keep alive signal, idle code, or red alarm in other circuits. • **3 in 24 (3:21):** A fixed test pattern of F0100 0100 0000 0000 0000 0100 is received. The pattern is aligned with the F-bits as indicated. 3 in 24 provides the minimum ones density and the maximum excess zeros requirements to stress T1 circuits. When the pattern is framed, it violates the minimum ones density requirements. • **1 in 8 (1:7):** A fixed pattern of F01000000 is received. This pattern stresses the minimum ones density requirement for B8ZS encoded T1 circuits if sent unframed. • **1010 Pattern:** A fixed test pattern of alternating marks (1) and spaces (0). This pattern is generally used to perform a minimum level stress test on clock recovery circuits. • **55DLY:** A 55 octet Daly pattern is received. • **T1-2:** A 96 octet pattern is

	received. • **T1-3:** A 54 octet pattern is received. • **T1-4:** A 120 octet pattern is received. • **T1-5:** A 53 octet pattern is received. • **55-Octet:** A 55 octet pattern is received. • **DDS-1:** An octet of 11111111 (repeated 100 times) followed by an octet of 00000000 (repeated 100 times) received continuously. **Note:** This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • **DDS-2:** An octet of 01111110 (repeated 100 times) followed by an octet of 00000000 (repeated 100 times) received continuously. **Note:** This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • **DDS-3:** An octet of 01001100 received continuously. **Note:** This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • **DDS-4:** An octet of 00000010 received continuously. **Note:** This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • **DDS-5:** DDS-1 pattern (repeated 4 times); DDS-2 (repeated 4 times); DDS-3 (once); DDS-4 (once) received continuously. **Note:** This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • **DDS-6:** An octet of 11111110

	(repeated 7 times) followed by an octet of 11111111 (once) received continuously. **Note:** This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • **Bridge Tap:** 21 different patterns are received to detect bridge taps on a DS1. The following patterns are performed in 30 second increments: All Ones, 1-in-2, 1-in-4, 1-in-6, 1-in-7, 1-in-8, 2-in-9, 2-in-10, 2-in-11, 2-in-12, 2-in-13, 2-in-14, 2-in-15, 3-in-18, 3-in-19, 3-in-20, 3-in-21, 3-in-22, 3-in-23, 3-in-24, and QRSS. • **Multi-Pattern:** Five different patterns are received to stress a DS1. The following patterns are performed in 5 minute increments: All Ones, 1-in-8, 2-in-8, 3-in-24, and QRSS. • **Live:** Uses live data traffic; no pattern. This is used primarily for monitoring errors and alarms within a live data stream. When selected, the Pattern Sync LED becomes non-functional. • **User Defined:** Allows you to enter up to a 32-bit pattern.

Fractional T1 (1-24)	Configures the system for Fractional T1 testing.
CODEC	Select A-law, MU-law, or True A-law.

Receive - DS0

The DS0 feature allows you to test and analyze T-Carrier transmission systems at the DS1 and DS0 levels from the DS1 access point. The DS0 function selects individual DS0 channels allowing data bits for D4 and ESF signaling bits (A, B, C, and D) to be monitored. A speaker provides audible VF outputs for the selected DS0 channel. The DS0 function provides analysis of individual circuits using the Chan Drop button or analysis of all 24 DS0 channels using the Chan Scan button.

The following describes the functions associated with each option.

Option	Description
Circuit Signal	Selects the specific type of signaling bits that are monitored and displayed within the DS0 Function Menu area. The following options are available: • Unknown • Loop-Start • Ground-Start • Loop-Rev Battery • Network-Prov-Rev Battery • E and M • CI-Prov Loop Start
Test Site	The network interface and the customer installation use compatible robbed-bit signaling states for each type of circuit signaling (refer to Tables 3-1 and 3-2). The Test Site command allows you to determine whether the Network Interface or the Customer Installation is responsible for generating these signals. The following options are available. • **Customer<--Network:** The network interface generates

	signaling states to the customer installation. • **Network<--Customer:** The customer installation generates signaling states to the network interface. • **Unknown:** Undefined signaling state. Under normal operation, undefined signaling states should only exist during the transition from one signaling state to another signaling state. The duration of these signaling state transmissions should not exceed 3 milliseconds.
DS0 Channel Dropped	Selects a DS0 channel (Channels 1 through 24) to drop from the DS1 signal. For ESF channel signaling, the four Channel Signaling Bits, labeled A, B, C, and D, indicate the status of the selected DS0 channel. For D4 or SLC-96, the two Channel Signaling Bits, labeled A and B, indicate the status of the selected DS0 channel.
Single Chan	Allows you to select a single channel to scan for errors.
Prev/Next Chan	The Prev Chan and Next Chan buttons allow you to select a DS0 channel (Channels 1-24) that is dropped from the DS1 signal by scrolling backwards or forwards through the 24-DS0 channels.
All Chans	Scans all DS0 channels within a DS1 signal for framing errors. This allows you to view the D4, SLC-96, or ESF signaling bits for all 24 DS0 channels at once.
Speaker	Provides audible VF outputs for the selected DS0 channel. You can control the volume of the output using the Volume arrow button options.

Circuit Signal

The DS1 application uses robbed-bit signaling to provide DS0 per-channel circuit signaling data. Eight bits are available for the payload in each channel during 5 out of 6 frames. Every 6th frame, however, the least significant bit (8th) of each time slot is used (robbed) to provide per-channel circuit signaling.

In the D4 format, bits are robbed in the 6th and 12th frame to derive the signaling channel. This bit is called the A bit and the bit from the 12th frame is called the B bit.

In the ESF format, bits are robbed in the 6th, 12th, 18th, and 24th frames to derive the signaling channel. These make up the A, B, C, and D bits respectively.

The contents and meaning of the signaling bits depend on the type of signaling selected using the Circuit Signaling command. The robbed-bit signaling states for six types of D4 and ESF circuit signaling are provided in the following tables.

The following table describes D4 and SLC-96 circuit signaling and bit formats.

Circuit Signalling	Circuit	Signalling States	A	B
Loop Start	Network to CI	LCF	0	1
		Ringing	0	0
	CI to Network	LO (On-hook)	0	1
		LC (Off-hook)	1	1
Ground-Start	Network to CI	LCF	0	1
		LCFO	1	1
		Ringing	0	0
	CI to Network	LO (on-hook)	0	1
		LC)off-hook)	1	1
		RG (service request)	0	0
Loop-Reverse Battery	Network to CI	LO (on-hook)	0	0
		LC (off-hook)	1	1
	CI to Network	LO (on-hook)	0	0
		LC (off-hook)	1	1

Network-Provided Reverse Battery	Network to CI	LCF (on-hook)	0	0
		RLCF (off-hook)	1	1
	CI to Network	LO (on-hook)	0	0
		LC (off-hook)	1	1
E and M Signalling	Network to CI	On-hook	0	0
		Off-hook	1	1
	CI to Network	On-hook	0	0
CI-Provided Loop Start	Network to CI	LO (on-hook)	0	1
		LC (off-hook)	1	1
	CI to Network	LCF	0	1
		Ringing	0	0
Loop Start	Network to CI	LCF	0	1

LCF = Loop Current Feed; RLCF = Reverse Loop Current Feed; LCFO = Loop Current Feed Open; LO = Loop Open LC = Loop Closure; RG = Ring Ground; CI = Customer Installation

The following table describes ESF circuit signaling and bit formats.

Circuit Signalling	Circuit	Signalling States	A	B	C	D
Loop Start	Network to CI	LCF	0	1	0	1
		Ringing	0	0	0	0
	CI to Network	LO (On-hook)	0	1	0	1
		LC (Off-hook)	1	1	1	1
Ground-Start	Network to CI	LCF	0			1
		LCFO	1	1	1	1
		Ringing	0	0	0	0

	CI to Network	LO (on-hook) LC)off-hook) RG (service request)	0 1 0	1 1 0	0 1 0	1 1 0
Loop-Reverse Battery	Network to CI	LO (on-hook) LC (off-hook)	0 1	0 1	0 1	0 1
	CI to Network	LO (on-hook) LC (off-hook)	0 1	1 1	0 1	1 1
Network-Provided Reverse Battery	Network to CI	LCF (on-hook) RLCF (off-hook)	0 1	0 1	0 1	0 1
	CI to Network	LO (on-hook) LC (off-hook)	0 1	0 1	0 1	0 1
E and M Signalling	Network to CI	On-hook Off-hook	0 1	0 1	0 1	0 1
	CI to Network	On-hook Off-hook	0 1	0 1	0 1	0 1
CI-Provided Loop Start	Network to CI	LO (on-hook) LC (off-hook)	0 1	1 1	0 1	1 1
	CI to Network	LCF Ringing	0 0	1 0	0 0	1 0

LCF = Loop Current Feed; RLCF = Reverse Loop Current Feed; LCFO = Loop Current Feed Open; LO = Loop Open LC = Loop Closure; RG = Ring Ground; CI = Customer Installation

Receive - Signal (SIG)

The Signal Status function displays the measured voltage, strength, line frequency, and frequency offset of the DS1 Receive signal as it enters the system.

The following information is displayed on the DS1 Receive SIG screen.

- Peak Positive Pulse Voltage
- Peak Negative Pulse Voltage
- Power in dBm
- Power in dBdSX
- Line Frequency in MHz
- Line Frequency Offset Received in Hz and ppm.
- Update Signal Calibration - Calibrating the system's optical power should be done carefully. To keep unauthorized users from changing calibration settings, the Update Signal Calibration button on the protocol processor's Receive SIG screen is unavailable by default. To change the setting, a user with Admin or Calibrate privileges must enable the calibration mode.

  The following calibration functions are available:

  - Select Negative, Positive, Negative Bridged (for DS1 #2 only), or Positive Bridged (for DS1 #2 only) to calibrate the following readings:
    - Zero Power Reading
    - 0.5 Volts Reading
    - 2.0 Volt Reading

To enable protocol processor calibration:

1. From the **System** tab, select **Misc**.
2. From **Local Settings**, select **Enable Calibration**.

The user must have Admin or Calibrate privileges to enable the calibration mode.

3. See Calibrate DS 1 Electrical Power for specific calibration instructions before proceeding.

4. After setting the power and volt readings, select the **Save** button to update the signal calibration.

Results

Result Screens and Functions

The Results function allows you to view DS1 error and alarm analysis and create a history of these events by graphing the information.

The following options are available through the Results screen:

- SCAN
- ERR
- ALARM
- EVENT
- LARGE LED
- GRAPH

Results - SCAN

The SCAN function provides a list of received errors and alarms for the DS1 protocol processor. The duration or count of each event also appears. This function is effective in identifying a general area to investigate when an error or alarm is detected.

When no problems are detected, "No Errors or Alarms" is displayed.

Results - ERR

This function displays the number of errors detected and the average and current error rate measurement. The errors reported are generated by the DS1 network or intentionally by the system using the Error Insert Action button.

The following DS1 errors are reported.

- BPV
- Frame
- CRC
- Excess 0's
- BIT

Results - ALARM

This function displays how long DS1 alarms were detected by the system. Results for the following alarms display.

- AIS Seconds
- Out of Frame Seconds
- Loss of Signal Seconds
- Pat Sync Seconds
- Yellow Seconds
- Excess 0's Seconds
- Clock Seconds
- Idle Seconds
- FBIT

Results - EVENT

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

Results - LARGE LED

This screen displays the LEDs and status indicators for in a large, easy to read format that covers the entire screen area. This is especially useful for viewing errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

Results - Graph

The Graph screen allows you to view error and alarm results for the DS1 protocol processor. These graphs show the test history for either the current test or the previous test. You can configure the graph function to display any combination of DS1 alarms and errors.

To use the Results Graph function, see Using Graphs.

Test

Test Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- SET 1
- Service Disruption

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Service Disruption

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The service disruption measurements show a granular accuracy of 1 frame duration. See the chart at the bottom of this page for time per frame durations for each protocol processor.

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

  For **E4**, **E3**, **E1**, **DS3** and **DS1** processors, the Protection Switch Criteria is limited to: Loss of Pattern Sync and Bit Errors.

  For **SONET** and **SDH** processors the Protection Switch Criteria include: B1, SEF / OOF, AIS-L / MS-AIS, AIS-P / AU-AIS, AIS-V / TU-AIS, and PRBS (Loss of Pattern Sync and Bit Errors).

  For **OTN** processors the Protection Switch Criteria include: OOF, OTU:AIS, OTU:BIP8, ODU:AIS, ODU:BIP8, and PRBS (Loss of Pattern Sync and Bit Errors).

- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **State** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

  - **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

  - **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.

Stop APS - Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)** - Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.
- **Protection Switch Time (Frames)** - Indicates the number of errored frames received during the service disruption event.
- **History Recent Milli Seconds** - Shows the time durations for the last ten measurements recorded.
- **History Recent Frames** - Shows the frame durations for the last ten measurements recorded.

A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing Service Disruption.

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
SONET / SDH	0.125 ms (125 µs)	16383 frames (2047.875 ms)
OTU 1	0.049 ms (49 µs)	16383 frames (802.302 ms)
OTU 2	0.012 ms (12 µs)	16383 frames (199.732 ms)
E4	0.021 ms (21 µs)	255 frames (5.361 ms)
E3	0.045 ms (45 µs)	255 frames (11.397 ms)
E1	0.125 ms (125 µs)	4095 frames (511.875 ms)
DS3	0.106 ms (106 µs)	255 frames (27.133 ms)
DS1	0.125 ms (125 µs)	4095 frames (511.875 ms)

Click this link for Ethernet Service Disruption specifics.

Performance Monitoring

Performance Monitoring Screens and Functions

Performance Monitoring provides greater detail about incoming Frame and Bit errors.

The following options are available:

- Frame
- CRC
- BIT

Performance Monitor - Frame

This provides a detailed breakdown for Frame errors detected and logged by the DS1 protocol processor.

This section is broken down into the following areas:

Statistics	Description
CV	Code violations by count.
ES	Errored seconds by count, rate percentage, and objective percentage.
EFS	Error-free seconds by count, rate percentage, and objective percentage.
SES	Severely Errored Seconds by count, rate percentage, and objective percentage.
UAS	Unavailable seconds by count, rate percentage, and objective percentage.

Performance Monitor - CRC

This provides a detailed breakdown for CRC errors detected and logged by the DS1 protocol processor.

This screen is only available when DS1 is set to ESF Framing.

This section is broken down into the following areas:

Statistics	Description
CV	Code violations by count.
ES	Errored seconds by count, rate percentage, and objective percentage.
EFS	Error-free seconds by count, rate percentage, and objective percentage.
SES	Severely Errored Seconds by count, rate percentage, and objective percentage.
UAS	Unavailable seconds by count, rate percentage, and objective percentage.

Performance Monitor - BIT

This provides a detailed breakdown for BIT errors detected and logged by the E1 protocol processor.

This section is broken down into the following areas:

Statistics	Description
CV	Code violations by count.
ES	Errored seconds by count, rate percentage, and objective percentage.
EFS	Error-free seconds by count, rate percentage, and objective percentage.
SES	Severely Errored Seconds by count, rate percentage, and objective percentage.
UAS	Unavailable seconds by count, rate percentage, and objective percentage.

LED Quick Status Area

When the DS1 protocol processor is selected, the following LEDs and status indicators are displayed in the LED Quick Status Area of the touch screen. They are also located under Results Large LEDs.

LED	Description
TX	TX indicates the current transmit DS1 Line Interface Signal Level.
RX	RX indicates the current value of the DS1 Line Interface Input Termination.
E/A BIT	Displays the error and/or alarm currently generated by the unit.
CLK	A status indicator that displays the type of transmit clock specified in the setting. Clock settings include SETS, Internal, or RCVD.
Test Paused	Indicates a test has been paused, when LED is red.
LOS	Loss of Signal: Indicates a Loss of Signal status was detected.
BPV	Bipolar Violation Error: Indicates the presence of a Bipolar Violation error. This happens when two consecutive pulses of the same polarity occur in the same digital bit stream.
LOF	Loss of Frame. An alarm LED indicating an alarm signal was generated due to a frame alignment problem.
OOF	Out of Frame. Indicates that four consecutive frames have been received with invalid or errored framing patterns.
FBIT	Frame Bit Error: Indicates a frame bit error in the received frame bit pattern. This applies to both SF and ESF framing.
Idle	Indicates a DS1 Idle alarm was received.
EXZ	Excess Zeros: Indicates that more than the permitted number of consecutive zeros were received. For AMI Line Coding, 16 or more zeros are excessive; for B8ZS Line

	Coding, 8 or more zeros are excessive.
AIS	Alarm Indication Signal: Indicates, to downstream equipment, that an upstream failure has occurred on the DS1 signal.
Yellow	Yellow Alarm: Also known as a Remote Alarm Indication (RAI) signal. Indicates to the far end that a failure was detected.
CRC	Cyclic Redundancy Check: Indicates that a CRC error has occurred. This applies to ESF framing only.
Pat Sync	Pattern Synchronization: Indicates cell synchronization condition
Bit Err	Indicates that a Bit error was received.

DS3 Tab

DS3 Overview

The DS3 online help is divided into the following sections:

- DS3 Specific Tasks
- DS3 Screen Functions and Descriptions

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

DS3 Specific Tasks

DS3 Specific Tasks Overview

This section covers procedures that are specific to the operation of the DS3 protocol processor. For a list of general tasks, which apply to all protocol processors, see Common Tasks located in the Getting Started section.

- DS3 Electrical Power Calibration
- Drop an E1 out of a DS3 Signal
- Enabling FEAC Codes
- Start/Stop DS3 Channel Scan

DS3 or E3 Electrical Power Calibration

The following procedures describe the unit's negative and positive power calibration. While performing this task, you will measure, record, and enter power reading input for zero power reading and 0.2 and 0.8 volt reading for E3 or DS3.

Required Equipment

The following equipment is required to perform E3 or DS3 calibration:

- Digital oscilloscope (use highest bandwidth available) or equivalent measuring equipment
- Variable attenuator
- Electrical power meter or a calibrated NIC that can provide 0.2 and 0.8 volts power
- BNC T-connector
- Two 2-ft., 75 ohm coaxial cables with male BNC connectors
- Pencil and paper to record power measurements

Hardware Setup

The following describes how to attach cables to the measuring devices (an oscilloscope will be used in this example) and how to configure these devices for E3/DS3 calibration.

To attach cables between the unit and the oscilloscope:

1. Make sure that the unit and oscilloscope are turned on.
2. Connect the BNC T-connector to the oscilloscope's BNC input connector.
3. Connect one end of a BNC cable to the unit's **E3/DS3 TX** BNC connector and connect the other end of the cable to the BNC T-connector attached to the oscilloscope.
4. Connect one end of a BNC cable to the unit's **E3/DS3 RX** BNC connector and connect the other end of the cable to the BNC connector attached to the oscilloscope.

Restoring Raw Power Readings for E3 or DS3

The following restores the unit's raw (unconverted) power readings.

1. From the **System** tab, select **Misc**.
2. From **Local Setting**, select **Enable Calibration**.

> The user must have Admin. or Calibrate privileges to enable the calibration mode.

3. From the **E3** or **DS3** tab on the unit, select **Receive**.
4. Select **SIG** from the tabs along the left-side of the Receive screen and choose **Update Signal Calibration**.
5. Select **Negative**. The Negative Signal Calibration functions appear.
6. Select **Zero power reading**. A keypad appears. Enter **0** and select **OK**.
7. Select the **Save** button to restore the raw power reading.
8. Select **Positive**. The Positive Signal Calibration functions appear.
9. Select **Zero power reading**. A keypad appears. Enter **0** and select **OK**.
10. Select **0.2 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
11. Select **0.8 Volts Reading**. A keypad appears. Enter **0** and select **OK**.

12. Select the **Save** button to restore the raw power reading.

Calibrating E3 or DS3 Signal Calibration

The following procedures describe how to perform E3 or DS3 calibration using a NIC and oscilloscope.

Obtain Zero Power Reading

1. Using the oscilloscope, measure and record the average positive and negative peak values.
2. For zero volt value, do not connect the cable to the Receive connector on the unit.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This value is the **Zero power reading** for **Positive Signal Calibration**.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This value is the **Zero power reading** for **Negative Signal Calibration**.

Obtain 0.2 Volts Power Reading

1. Using the oscilloscope, measure and record the average positive and negative peak values. *(Reconnect the cable to the Receive connector on the unit.)*
2. Attenuate the signal until the oscilloscope reads 0.2 volts.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This is the **0.2 Volts Reading** value.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This is the **0.2 Volts Reading** value.

Obtain 0.8 Volts Power Reading

1. Using the oscilloscope, measure and record the average positive and negative peak values.
2. Attenuate the signal until the oscilloscope reads 0.8 volts.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This is the **0.8 Volts Reading** value.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This is the **0.8 Volts Reading** value.

Enter Negative Signal Power Readings

1. Make sure that the **Negative Signal Calibration** functions appear on the **Receive SIG** screen. If necessary, select the **Negative** button.

2. Select **Zero power reading**. A keypad appears. Enter the value recorded earlier for the zero power reading and select **OK**.
3. Select **0.2 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.2 volts power reading and select **OK**.
4. Select **0.8 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.8 volts power reading and select **OK**.
5. Select **Save** to save the new Negative Signal Calibration values.

Enter Positive Signal Power Readings

1. Select the **Positive** button. The Positive Signal Calibration functions appear on the **Receive SIG** screen.
2. Select **Zero power reading**. A keypad appears. Enter the value recorded earlier for the zero power reading and select **OK**.
3. Select **0.2 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.2 volts power reading and select **OK**.
4. Select **0.8 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.8 volts power reading and select **OK**.
5. Select **Save** to save the new Positive Signal Calibration values. This completes the unit's E3 or DS3 signal calibration.

Drop an E1 Signal from a DS3 Signal

You are able to drop an E1 signal into an DS3 signal to monitor for error and alarm conditions. Additionally, you are able to specify which channel (1-21) to drop the signal into.

1. Select **Presets** from the Common Function Buttons.
2. Select the **Interface** button and choose **DS-3** from the Select from Interface list.
3. Select the **Configuration** button and choose **E1 #1 A/D** or **E1 #2 A/D**.
4. Select the **Apply** button.

   The unit is configured to drop an E1 out of the DS3 signal. Additionally, you can specify different frames and patterns for the dropped/inserted signal (see the section below).

Specifying Frames and Patterns for the Dropped/Inserted Signal

1. Select **DS3**.
2. Select **Transmit** and **Set 1**.
3. Select the **Mapping** button and set the mapping mode.
4. If you wish to enable Pass Thru Mode, select **Pass Thru Mode** and select **On**. Otherwise, keep this option turned off.
5. If you dropped the E1 #1 signal, select **E1 #1 Channel Inserted** and select the channel in which you want to drop the E1 signal.

6. If you dropped the E1 #2 signal, select **E1 #2 Channel Inserted** and select the channel in which you want to drop the E1 signal.
7. Select **E1 Background Frame** and select the background frame for the specified channel.
8. Select **E1 Background Pattern**. Using the keyboard that appears, enter up to a 32-bit background pattern for the specified channel.

View the Event Activity of the Dropped and Inserted Signals

- Select **Results** and choose the how you want to view the activity.
    - Select **Scan** to view a summary of the error and alarm counts that have occurred.
    - Select **Err** to view the count, average rate, and current rate of the errors that have occurred.
    - Select **Alarm** to view the alarms (in seconds) that have occurred.
    - Select **Event** to view a list of event activity, number of events, the time they occurred, and how long they occurred.
    - Select **Large LED** to view errors and alarms in the form of LEDs.
    - Select **Graph** to view errors and alarms in the form of a graph.

Enabling FEAC Codes

FEAC Codes are only available when the DS3 protocol processor is configured for C-BIT framing.

To enable FEAC Code functionality:

1. From the **DS3** tab, select **Transmit**.
2. Select **SET 1**.
3. Select **Framing**.
4. Select **C-BIT**.
5. The FEAC Codes button appears on the screen. Select **FEAC Codes** to display this functionality.

Start/Stop DS3 Channel Scan

The Chan Scan function inspects and then reports the contents of the 21 E1 channels or 28 DS1 channels that are obtained within a multiplexed DS3 signal. The information reported consists of items such as the framing and pattern activity detected on each E1 or DS1 channel.

The DS3 protocol processor must be receiving a valid signal, otherwise, the DS3 scan aborts. While a scan is in progress, you cannot access other functions.

To start an DS3 channel scan:

1. Select **DS3**.
2. Select **Receive**.
3. Select **Chan Scan**. The Channel Scan screen appears.
4. Select **Start Scan**. Framing and pattern activity for each channel is displayed on the screen.

To stop the DS3 scan:

- Select the **Stop Scan** button.

Screen Functions and Descriptions

DS3 Screen Functions and Descriptions Overview

The following function screens are available through the DS3 protocol processor tab.

- Transmit
- Receive
- Results
- Test
- Performance Monitoring
- LEDs

Transmit

Transmit Screens and Functions

This function allows you to define the parameters used in DS3 Transmit operations.

The following functions are available through the DS3 Transmit screen.

- SET 1
- SET 2
- ERROR ALARM
- FEAC CODES

Transmit - Settings 1 (SET 1)

This screen allows you to configure the transmit signal parameters for the DS3 line interface and the DS3 protocol processor to match the DS3 signal used in your test environment.

The DS3 Transmit SET 1 screen contains the following parameters:

Parameter	Description

Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Signal Level	Sets the signal strength of the DS3 transmit signal. The signal level values simulate high and low impedance experienced by a DS3 signal. The following options are available: • **DSX-3:** Sets the DS3 signal level to 0.48 Vp. This level is equal to a high signal sent through 450 feet of coaxial cable and is the standard cross-connect level. • **DS3 High:** Sends the DS3 signal at a higher voltage to simulate a "hot" signal sent over a short cable distance. The DS3 signal level is set to 0.95 Vp. Use this setting when testing from the network element location rather than at the DSX. This signal, sent through 450 feet of coaxial cable, is equal to DSX-3 level. • **DS3 Low:** Sends the DS3 signal at a lower voltage to simulate transmission over a long cable distance. The DSX-3 signal level is set to 0.35 Vp. This level simulates a standard DSX level sent through 450 feet of coaxial cable.
Line Freq Offset	Select Off (0, which means the frequency cannot be adjusted) or -100.0 to 100.0 in 0.1 increments.
Clock	Determines the timing source for the DS3 transmit signal. The following

	options are available: • **Internal:** Derives the transmit data's timing source from the system's internal clock. • **Recovered:** Derives the transmit data's timing source from the system's recover clock. • **BITS:** Derives the transmit's data timing source from the BITS (Building Integrated Timing Supply) clock input, which is 1.544 MHz. If this option is selected, but BITS clocking is not available, then this function defaults to Internal. CLK:BITS displays when configured for BITS clocking • **SETS:** Derives the transmit's data timing source from the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 MHz. If this option is selected, but SETS clocking is not available, then this function defaults to Internal. CLK:SETS displays when configured for SETS clocking.
Framing	Configures the framing format used for the DS3 transmit signal. The following options are available: • **Framed:** Configures the system to transmit a DS3 signal using a framed format. • **Unframed:** Configures the system to transmit a DS3 signal using an unframed format. • **M13:** Configures the DS3 protocol processor to transmit a signal in a an M13 framing

	format. • **C-Bit:** Configures the DS3 protocol processor to transmit a signal in a C-bit framing format. This type of formatting allows for the use of FEAC codes.

Transmit - Settings 2 (SET 2)

This function selects the type of DS3 Transmit mapping and patterns used by the DS3 protocol processor.

The following options are available:

Option	Description
Mapping	Select DS1, ATM Direct, ATM PLCP, or Bulk Filled. **Note:** The ATM options will only appear if the ATM hardware is available.
Pass Thru Mode	Select **On** to enable Passthru mode. Select **Off** to disable Passthru mode. **Note:** This option is unavailable if Mapping is not set to DS1.
Payload Pattern	Select User Defined (32-bit entry), PRBS 15, PRBS 15 INV, PRBS 20, PRBS 20 INV, PRBS 23, PRBS 23 INV, All Ones, or All Zeroes. **Note:** This option is unavailable if Mapping is not set to Bulk Filled.
DS1 #1 Channel Inserted	Selects from Channels 1 through 28. **Note:** This option is unavailable if Mapping is not set to DS1.
DS1 #2 Channel Inserted	Selects from Channels 1 through 28. **Note:** This option is unavailable if Mapping is not set to DS1.
DS1 Background Frame	Select from Unframed, D4/SF, and ESF.
DS1 Background Pattern	Enter any 32-bit pattern.

Transmit - Errors and Alarms (ERROR ALARM)

This function allow you to enter errors or alarms.

The following options are available for the DS3 ERROR ALARM screen:

Option	Description
Error to Insert	Inserts an error that is transmitted by the DS3 protocol processor. The options available include: • **None:** Turns off DS3 error insertion • **BPV Error:** Transmits Bipolar Violation errors which result in a line code violation event for an AMI-Coded signal, the occurrence of received excessive zeros, or a bipolar violation. • **Bit:** Transmits a bit error which results in a frame synchronization bit error event. This also inserts a frame bit error in the received frame bit pattern. • **Frame:** Results in a severely errored framing event, which occurs when two or more framing bit pattern errors occur within a 3-ms period. **Note:** This type of error is not available if the DS3 protocol processor is configured for Unframed framing format. • **P-Parity error:** Results in an error in the P-bit channel (P1 and P2) that provides parity information for the preceding M-frame. **Note:** This option is not available if the DS3 protocol processor is configured for Unframed framing format. • **C-Parity error:** Results in an error in the C-bit channel

	which is used to denote the presence or absence of stuffed bits. **Note:** This option is only available if the DS3 protocol processor is configured for C-Bit framing format. • **FEBE error:** Results in a error in one of the three C-Bits in the M-subframe designated as the Far End Block Error (FEBE) bit. **Note:** This option is only available if the DS3 protocol processor is configured for C-Bit framing format.
Error Insert Rate	Sets the insertion rate for DS3 transmit errors. This function is not available if Error to Insert is set to None. The following options are available for this command: • **Off:** No errors are inserted for transmission. • **1e-X**, where X is a value from 3 to 9
Alarm Generated	Generates a specific alarm on the transmit side of the DS3 protocol processor. The following options are available: LOS, OOF, AIS, Yellow, or Idle. **Note:** OOF, Idle, and Yellow alarms are not available if DS3 Framing is set to unframed.

Transmit - FEAC CODES

FEAC Code functionality only appears on the screen when the DS3 protocol processor is configured for C-BIT framing.

The Far-End Alarm and Control (FEAC) channel allows alarm and status information to be sent from the equipment at the far-end of the signal to the equipment at the far-end of the signal. It also allows the near-end equipment to initiate loopback tests from the far-end equipment.

This function configures the type of alarm or loopback test that is sent from the far end of the DS3 connection. In addition, it allows you to use the unit locally to send a command to the far-end equipment that will then initiate an alarm or loopback to the unit.

The following options are available:

Option	Description
FEAC Type	Determines if the far-end equipment sends an alarm/status code (**Alarm/Status**), or if the far-end equipment starts a loopback test to the unit (**Loopback Activate**) or stops a loopback test to the unit (**Loopback Deactivate**).
Alarm/Status Code	Selects the type of alarm code or status code that the far-end equipment sends to the unit**.** **Note:** This option is only available if TX FEAC Type is set to Alarm/Status.
Loopback Line	Selects an individual DS1 signal or the entire DS3 signal to activate and deactivate loopback tests. **Note:** This option is only available if TX FEAC Type is set to Loopback Activate.
Last RX Code	Displays the last alarm or status detected by the unit and how long ago (in seconds) it was detected.
Last RX Loopback Status	Displays the last loopback started by the far-end equipment and detected by the unit. It also displays how long ago (in seconds) it was activated**.** **Note:** This information only appears if the TX FEAC Type option is set to Loopback Activate.
Last RX Loopback Deactivate	Displays the last loopback stopped by the far-end equipment and detected by the unit. It also displays how long ago (in seconds) it was deactivated**.** **Note:** This information only appears if the TX FEAC Type option is set to Loopback Deactivate.
Burst	Resets the number of seconds since an alarm to zero.

Receive

Receive Screens and Functions

This function allows you to configure settings for the parameters used in the DS3 Receive operations.

The following functions are available through the DS3 Receive screen.

- SET 1
- SIG
- Chan Scan

Receive - Settings 1 (SET 1)

This screen allows you to configure your unit's Receive parameters for your DS3 test environment. The values selected for the parameters are expected values. This means that an error can occur if the unit does not receive the expected parameter value.

The DS3 Receive SET 1 screen contains the following parameters:

Parameter	Description
Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Termination Type	Configures the DS3 line input termination. Select one of the following options: • **Terminated:** Sets the Receive Sensitivity of the DS3 Line Interface. Use this setting if the DS3 line terminates at the system's Line Interface. • **Monitor:** Sets the Receive Sensitivity of the DS3 Line Interface. Use this setting if the DS3 line connects to a monitor

	jack.
Framing	Configures the framing format used for the DS3 Receive signal. An error occurs if the DS3 signal is not in the selected framing format. The following options are available: • **Unframed:** Configures the system to receive a signal in an unframed format. • **M13:** Configures the system to receive a signal in an M13 framing format. • **C-Bit:** Configures the system to receive a signal in a C-Bit framing format. This type of formatting allows the use of FEAC codes.
Mapping	Select ATM Direct, ATM PLCP, or Bulk Filled. **Note:** The ATM options only appear if the ATM hardware is available.
Payload Pattern	Selects the type of DS3 signal pattern that the system *expects* to receive. The following patterns are available: Live (uses live data traffic; no pattern; used primarily for monitoring errors and alarms within a data stream), User Defined (32-bit entry), PRBS 15, PRBS 15 INV, PRBS 20, PRBS INV 20, PRBS 23, PRBS 23 INV, All Ones, or All Zeroes. **Note:** This option is unavailable if Mapping is not set to Bulk Filled.

DS1 #1/E1 #1 Channel Drop	Selects from Channels 1 through 21 (for E1) and 28 (for DS1). **Note:** This option is unavailable if Mapping is not set to E1/DS1.
DS1 #2/E1 #2 Channel Drop	Selects from Channels 1 through 21 (for E1) and 28 (for DS1). **Note:** This option is unavailable if Mapping is not set to E1/DS1.

Receive - Signal Status (SIG)

This function displays the electrical power, line frequency, and line frequency offset of the incoming DS3 signal. It also contains the Calibration function, which allows you to calibrate the signal.

The following information is displayed on the DS3 Receive SIG screen:

- Peak Positive Pulse Voltage (in volts)
- Peak Negative Pulse Voltage (in volts)
- Power in dBm
- Power in dBdsx
- Line Frequency in MHz
- Line Frequency Offset Received in Hz and ppm
- Update Signal Calibration - Calibrating the system's optical power should be done carefully. To keep unauthorized users from changing calibration settings, the Update Signal Calibration button on the protocol processor's Receive SIG screen is unavailable by default. To change the setting, a user with Admin or Calibrate privileges must enable the calibration mode.

  The following calibration functions are available:

  - Select **Negative** or **Positive** to calibrate the following readings:
    - Zero Power Reading
    - 0.2 Volts Reading
    - 0.8 Volts Reading

To enable protocol processor calibration:

1. From the **System** tab, select **Misc**.
2. From **Local Settings**, select **Enable Calibration**.

The user must have Admin or Calibrate privileges to enable the calibration mode.

3. See Calibrate DS 1 Electrical Power for specific calibration instructions before proceeding.
4. After setting the power and volt readings, select the **Save** button to update the signal calibration.

Receive - Channel Scan (Chan Scan)

This function inspects and then reports the contents of the 28 DS1 channels that are contained within a multiplexed DS3 signal. The information reported consists of Mapping and Pattern values for each DS1 channel.

To use this function, Mapping must be set to DS1, and the system must receive a valid signal.

For more information, see Start/Stop Channel Scan.

Results

Result Screens and Functions

This function allows you to view DS3 error and alarm analysis and create a history of these events by graphing the information.

The following functions are available through the DS3 Results screen

- SCAN
- ERR
- ALARM
- EVENT
- LARGE LED
- GRAPH

Results - SCAN

The SCAN function provides a list of received errors and alarms for the DS3 protocol processor. The duration or count of each event also appears. This function is effective in identifying a general area to investigate when an error or alarm is detected.

When no problems are detected, "No Errors or Alarms" is displayed.

Results - ALARM

This function displays how long DS3 alarms were detected by the system. Results for the following alarms display.

- Clock

- Out of Frame (OOF)
- Pat Sync
- LOS
- AIS
- Idle
- Yellow

Results - ERRORS

This function reports statistical information on errors including the error count (11 digits), average error rate (in N.NNe-N format), and current error rate (in N.NNe-N format for the current second only).

The following errors are reported:

- Bit
- BPV
- Frame Error
- P-Parity
- C-Parity
- FEBE

Results - EVENT

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

Results - LARGE LEDs

This button displays the DS3 LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

Results - GRAPH

Use the Graphs button to view error and alarm results for the DS3 protocol processor. These graphs show the test history for either the current test or the previous test. You can configure the graph function to display any combination of DS3 alarms and errors.

To use the Results Graph functions, see Using Graphs.

Test

Test Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- SET 1
- Service Disruption

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test

- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Service Disruption

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The service disruption measurements show a granular accuracy of 1 frame duration. See the chart at the bottom of this page for time per frame durations for each protocol processor.

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

  For **E4**, **E3**, **E1**, **DS3** and **DS1** processors, the Protection Switch Criteria is limited to: Loss of Pattern Sync and Bit Errors.

  For **SONET** and **SDH** processors the Protection Switch Criteria include: B1, SEF / OOF, AIS-L / MS-AIS, AIS-P / AU-AIS, AIS-V / TU-AIS, and PRBS (Loss of Pattern Sync and Bit Errors).

  For **OTN** processors the Protection Switch Criteria include: OOF, OTU:AIS, OTU:BIP8, ODU:AIS, ODU:BIP8, and PRBS (Loss of Pattern Sync and Bit Errors).

- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The available range is listed in the chart below.

- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **State** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

  - **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

  - **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.

  - **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)** - Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.
- **Protection Switch Time (Frames)** - Indicates the number of errored frames received during the service disruption event.
- **History Recent Milli Seconds** - Shows the time durations for the last ten measurements recorded.
- **History Recent Frames** - Shows the frame durations for the last ten measurements recorded.

A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing Service Disruption.

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
SONET / SDH	0.125 ms (125 µs)	16383 frames (2047.875 ms)

OTU 1	0.049 ms (49 µs)	16383 frames (802.302 ms)
OTU 2	0.012 ms (12 µs)	16383 frames (199.732 ms)
E4	0.021 ms (21 µs)	255 frames (5.361 ms)
E3	0.045 ms (45 µs)	255 frames (11.397 ms)
E1	0.125 ms (125 µs)	4095 frames (511.875 ms)
DS3	0.106 ms (106 µs)	255 frames (27.133 ms)
DS1	0.125 ms (125 µs)	4095 frames (511.875 ms)

Click this link for Ethernet Service Disruption specifics.

Performance Monitoring

Performance Monitoring Screens and Functions

The DS3 Performance Monitor screen includes the following functions:

- LINE
- BIT
- PATH

Perf Monitor - LINE

Performance Monitoring provides greater detail about incoming Line errors.

The following statistics are reported on the LINE screen:

DS3 Line Statistics	Description
CV	Code Violation. This is an error count of incoming BPV errors.
ES	Errored Seconds. The number of seconds and percentage in which errors were detected in the monitored signal.
EFS	Error Free Seconds. The time, in seconds and percentage, in which

	there were no errors detected in the signal being monitored.
SES	Severely Errored Seconds. The number of seconds and percentage in which the signal has an extremely high error rate.
UAS	Unavailable Seconds. The time in seconds and percentage, in which the monitored signal was unavailable.

Perf Monitor - BIT

Performance Monitoring provides greater detail about incoming Bit errors.

The following statistics are reported on the BIT screen:

DS3 Bit Statistics	**Description**
CV	Code Violation. This is an error count of incoming BIT errors.
ES	Errored Seconds. The number of seconds and percentage in which errors were detected in the monitored signal.
EFS	Error Free Seconds. The time, in seconds and percentage, in which there were no errors detected in the signal being monitored.
SES	Severely Errored Seconds. The number of seconds and percentage in which the signal has an extremely high error rate.
UAS	Unavailable Seconds. The time in seconds and percentage, in which the monitored signal was unavailable.

Perf Monitor - PATH

Performance Monitoring provides greater detail about incoming P-Parity and C-Parity errors.

The following statistics are reported on the PATH screen:

DS3 Path Statistics	Description
CV	Code Violation. This is an error count of incoming P-Parity or C-Parity errors.
ES	Errored Seconds. The number of seconds and percentage in which errors were detected in the monitored signal.
EFS	Error Free Seconds. The time, in seconds and percentage, in which there were no errors detected in the signal being monitored.
SES	Severely Errored Seconds. The number of seconds and percentage in which the signal has an extremely high error rate.
UAS	Unavailable Seconds. The time in seconds and percentage, in which the monitored signal was unavailable.

LED Quick Status Area

When the DS3 protocol processor is selected, the following LEDs are displayed in the LEDs Quick Status Area of the touch screen.

LED	Description
TX	Displays the DS3 transmit signal level and transmit framing value.
RX	Displays the DS3 receive input termination value and the expected receive framing value.
E/A	Displays the error and/or alarm currently generated by the unit.
CLK	Indicates the timing source for the transmit signal. This value is specified by the Clock Reference function. Clock settings include: INT, BITS, SETS, or RCVD.
Line	Indicates received line code. Values that appear are: B3ZS or "blank" if an LOS exists.
LOS	Loss of Signal. Indicates a Loss of

	Signal status was detected. This is an alarm LED.
BPV	Bipolar Violation. Indicates two consecutive pulses of the same polarity occurred in the same digital bit stream.
OOF	Out of Frame. Indicates that four consecutive frames have been received with invalid or errored framing patterns. This is an alarm LED.
Frame Err	Indicates if the DS3 protocol processor has received framing errors. This is an error LED.
AIS	Alarm Indication Signal. Indicates an Alarm Indication Signal occurred on the Line layer. This is an alarm LED.
Yellow	Indicates that a yellow alarm was received on the DS3 signal. This is an alarm LED.
P-Parity	Indicates an error in the P-bit channel (P1 and P2) that provides parity information for the preceding M-frame on the DS3 signal. This is an error LED.
C-Parity	Indicates an error in the C-bit channel of the DS3 channel, which is used to denote the presence or absence of stuffed bits. This is an error LED.
FEBE	Far End Block Error. Indicates a Bit error occurred on the far end of the DS3 signal. This is an error LED.
Idle	Indicates an idle alarm was received. This is an alarm LED.
Pat Sync	Pattern Synchronization. Indicates a loss of pattern synchronization. This is an alarm LED.
Bit Err	Bit Error. Indicates a bit error was detected in the payload. This is an error LED.

E1 Tab

E1 Overview

The E1 online help is divided into the following sections:

- E1 Specific Tasks
- E1 Screen Functions and Descriptions

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

E1 Specific Tasks

E1 Specific Tasks Overview

This section contains tasks that are specific to the E1 protocol processor. For a list of general procedures, see Common Tasks located in the Getting Started section.

- Change E1 Transmit Overhead
- Configure Fractional E1 Testing
- Drop an E1 Signal from an STM-1 Signal
- E1 Calibration
- E1 Technical Specifications

Change E1 Transmit Overhead

The Transmit Overhead (OH) function allows you to stress a E1 network by directly editing overhead bits to simulate errors, alarms, and other stress conditions. For the E1 protocol processor, the following overhead bits can be edited:

- **CAS Signaling Bits:** If the framing is set to 30 channels (PCM30 or PCM30CRC), the CAS byte contains ABCD bits for 30 channels, at four bits per channel.
- **Spare Bits:** Contain odd-numbered bits in bits four to eight in the FAS channel (Timeslot 0). Spare bits can be set to a single five-bit value for all

bits. Additionally, one of the five bits can be a separate 4,000 bit per second channel with an eight bit sequence specified the channel.

- **E-Bits:** These are Far-End CRC (block) errors. There are two bits per multiframe, and one per super multiframe. If a FEBE is generated, its value will override the value specified for the E-Bit.
- **X-Bits:** These are bits 5, 7, and 8 of the CAS channel (Timeslot 16) in the first frame of the multiframe. X-Bits are only displayed when framing is set for 30 channels (PCM30 or PCM30CRC) and can only be entered on the Transmit side.

A specific slot can be selected, and its bytes can be changed for transmission out of the system. By altering the OH bytes, this allows other receiving equipment to detect and, if necessary, react to these changes.

To change Overhead bytes:

1. Select **E1**.
2. Select **Transmit**.
3. Select **OH**.
4. Select **CAS**, **Spare Bit**, **E Bits**, or **X Bits**.

   A keypad appears allowing the byte's pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

   The byte can also appear in HEX or decimal notation. Select the **HEX** or **DEC** button on the keypad.

The bit value can also be erased from the keypad using the **Clear** button.

5. When editing is complete, select **OK** to save the new value. **Cancel** discards any changes made to the byte and restores the previous value.

Configure Fractional E1 Testing

Configuring the system for fractional E1 testing enables you to bulk fill 0 to 31 DS0's in an E1 Transmit signal with a pattern. Additionally, you can specify an eight-bit pattern in background DS0's.

To configure for fractional E1 testing:

1. Select **E1**.
2. Select **Transmit**.

3. Select **SET 1**.
4. Select **Fractional E1**. A keypad appears.
5. Use the **1** and **0** buttons to specify the pattern you wish to inject. The maximum value is 32 bits. When you are done, select **OK**.
6. Select **Background 64K Pattern**. A keypad appears.
7. Use the **1** and **0** buttons to specify the background DS0 pattern you wish to inject. The maximum value is eight bits. When you are done, select **OK**.

Drop an E1 Signal from an STM-1 Signal

1. Select **Presets**, from the Common Function buttons.
2. Select **Interface** and choose **STM-1** from the Select Interface list.
3. Select **Configuration** and choose **E1 #1 A/D** or **E1 #2 A/D** from the Select To Configuration list.

E1 Electrical Power Calibration

The following procedures describe the unit's negative, positive, negative bridged, and positive bridged power calibration. While performing this task, you will measure, record, and enter power reading input for zero power reading and 0.5 and 2.0 volt reading for E1.

Required Equipment

The following equipment is required to perform E1 calibration:

- Digital oscilloscope (use highest bandwidth available) or equivalent measuring equipment
- Variable attenuator
- Electrical power meter or a calibrated NIC that can provide 0.5 and 2.0 volts power
- BNC T-connector
- Bantam Connector
- Two 2-ft., 75 ohm coaxial cables with male BNC connectors
- Two 2-foot, 120 ohm UTP cables with male Bantam connectors (for E1 only)
- Pencil and paper to record power measurements

Hardware Setup

The following describes how to attach cables to the measuring devices (an oscilloscope will be used in this example) and how to configure these devices for E1 calibration.

To attach cables between the unit and the oscilloscope:

1. Make sure that the unit and oscilloscope are turned on.
2. Connect the BNC T-connector to the oscilloscope's BNC input connector.
3. Connect one end of a BNC cable to the unit's **E1/DS1 #1 TX** BNC connector and connect the other end of the cable to the BNC T-connector attached to the oscilloscope.
4. Connect one end of a BNC cable to the unit's **E1/DS1 #1 RX** BNC connector and connect the other end of the cable to the BNC connector attached to the oscilloscope.
5. Connect the Bantam cable to the oscilloscope's Bantam input connector.
6. Connect one end of a Bantam cable to the unit's **E1/DS1 #2 TX** Bantam connector and connect the other end of the cable to the Bantam connector attached to the oscilloscope.
7. Connect one end of a Bantam cable to the unit's **E1/DS1 #2 RX** Bantam connector and connect the other end of the cable to the Bantam connector attached to the oscilloscope.

Restoring Raw Power Readings for E1

The following restores the unit's raw (unconverted) power readings for E1 #1 or E1 #2.

Raw Negative Power Readings for E1 #1 or E1 #2

The following procedures apply to the Negative button that appears for the E1 #1 or E1 #2 tabs.

1. From the **System** tab, select **Misc**.
2. From **Local Setting**, select **Enable Calibration**.

> The user must have Admin. or Calibrate privileges to enable the calibration mode.

3. From theE**1** tab, select **Receive**.
4. Select **SIG** from the tabs along the left-side of the Receive screen and choose **Update Signal Calibration**.
5. Select the **Negative** button. The Negative Signal Calibration functions appear.
6. Select **Zero power reading**. A keypad appears. Enter **0** and select **OK**.
7. Select **0.5 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
8. Select **2.0 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
9. Select **Save**.

Raw Positive Power Readings for E1 #1 or E1 #2

The following procedures apply to the Positive button that appears for the E1 #1 or E1 #2 tabs.

1. Select the **Positive** button. The Positive Signal Calibration functions appear.
2. Select **Zero power reading**. A keypad appears. Enter **0** and select **OK**.
3. Select **0.5 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
4. Select **2.0 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
5. Select **Save**.

Raw Negative Bridged Power Readings for E1 #2

The following procedures only apply to the Negative Bridged button that appears for the E1 #2 tab.

1. From the **Receive** screen, select **SIG**.
2. Select the **Update Signal Calibration** button and choose **Negative Bridged**. The Negative Bridged Signal Calibration functions appear.
3. Select **Zero power reading**. A keypad appears. Enter **0** and select **OK** to accept the new value.
4. Select **0.5 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
5. Select **2.0 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
6. Select **Save**.

Raw Positive Bridged Power Readings E1 #2

The following procedures only apply to the Positive Bridged button that appears for the E1 #2 tab.

1. Select **Positive Bridged**. The Positive Bridged Signal Calibration functions appear.
2. Select **Zero power reading**. A keypad appears. Enter **0** and select **OK** to accept the new value.
3. Select **0.5 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
4. Select **2.0 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
5. Select **Save**.

Calibrating the E1 Signal

The following procedures describe how to perform E1 calibration using the unit and an oscilloscope. These procedures apply to both the Negative and Positive buttons that appear under the **E1 #1** or **E1 #2** tabs.

Obtain Zero Power Reading

1. Using the oscilloscope, measure and record the average positive and negative peak values.
2. For zero volt value, do not connect the cable to the Receive connector on the unit.

3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This value is the **Zero power reading** for **Positive Signal Calibration**.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This value is the **Zero power reading** for **Negative Signal Calibration.**

Obtain 0.5 Volts Power Reading

1. Using the oscilloscope, measure and record the average positive and negative peak values. *(Reconnect the cable to the Receive connector on the unit.)*
2. Attenuate the signal until the oscilloscope reads 0.5 volts.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This is the **0.5 Volts Reading** value.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This is the **0.5 Volts Reading** value.

Obtain 2.0 Volts Power Reading

1. Using the oscilloscope, measure and record the average positive and negative peak values.
2. Attenuate the signal until the oscilloscope reads 2.0 volts.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This is the **2.0 Volts Reading** value.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This is the **2.0 Volts Reading** value.

Enter Negative Signal Power Readings

1. Make sure that the **Negative Signal Calibration** functions appear on the **Receive SIG** screen. If necessary, select the **Negative** button.
2. Select **Zero power reading**. A keypad appears. Enter the value recorded earlier for the zero power reading and select **OK**.
3. Select **0.5 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.5 volts power reading and select **OK**.
4. Select **2.0 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 2.0 volts power reading and select **OK**.
5. Select **Save** to save the new Negative Signal Calibration values.

Enter Positive Signal Power Readings

1. Select the **Positive** button. The Positive Signal Calibration functions appear on the **Receive SIG** screen.
2. Select **Zero power reading**. A keypad appears. Enter the value recorded earlier for the zero power reading and select **OK**.

3. Select **0.5 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.5 volts power reading and select **OK**.
4. Select **2.0 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 2.0 volts power reading and select **OK**

This concludes signal calibration for the E1 #1 tab.

If you are performing calibration using the E1 #2 tab, continue to the next section to perform Negative Bridged and Positive Bridged signal calibration.

Calibrating the E1 #2 Bridged Signal

The following procedures only apply to the Negative Bridged and Positive Bridged buttons that appear under the **E1 #2** tab.

Configure the Unit for Bridged Termination

The following procedures only apply to the E1 #2 tab.

1. From the **Receive** screen, select **SET 1**.
2. Select **Termination Type** and choose **Bridged**.
3. Select **SIG** from the tabs along the left-side of the Receive screen.
4. Select **Update Signal Calibration**.

Obtain Zero Power Reading for Bridged Termination

1. Using the oscilloscope, measure and record the average positive and negative peak values.
2. For zero volt value, do not connect the cable to the Receive connector on the unit.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This value is the **Zero power reading** for **Positive Bridged** Signal Calibration.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This value is the **Zero power reading** for **Negative Bridged** Signal Calibration..

Obtain 0.5 Volts Power Reading for Bridged Termination

1. Using the oscilloscope, measure and record the average positive and negative peak values. *(Reconnect the cable to the Receive connector on the unit.)*
2. Attenuate the signal until the oscilloscope reads 0.5 volts.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This value is the **0.5 Volts Reading** for **Positive Bridged** Signal Calibration.

4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This value is the **0.5 Volts Reading** for **Negative Bridged** Signal Calibration.

Obtain 2.0 Volts Power Reading for Bridged Termination

1. Using the oscilloscope, measure and record the average positive and negative peak values.
2. Attenuate the signal until the oscilloscope reads 2.0 volts.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This value is the **2.0 Volts Reading** for **Positive Bridged** Signal Calibration.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This value is the **2.0 Volts Reading** for **Negative Bridged** Signal Calibration.

Enter Negative Bridged Signal Power Readings

1. Select the **Negative Bridged** button. The Negative Bridged Signal Calibration functions appear on the **Receive SIG** screen.
2. Select **Zero power reading**. A keypad appears. Enter the value recorded earlier for the zero power reading and select **OK**.
3. Select **0.5 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.5 volts power reading and select **OK**.
4. Select **2.0 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 2.0 volts power reading and select **OK**.
5. Select **Save** to save the new Negative Bridged Signal Calibration values.

Enter Positive Bridged Signal Power Readings

1. Select the **Positive Bridged** button. The Positive Bridged Signal Calibration functions appear on the **Receive SIG** screen.
2. Select **Zero power reading**. A keypad appears. Enter the value recorded earlier for the zero power reading and select **OK**.
3. Select **0.5 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.5 volts power reading and select **OK**.
4. Select **2.0 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 2.0 volts power reading and select **OK**.
5. Select **Save** to save the new Positive Bridged Signal Calibration values.

This completes the unit’s E1 signal calibration.

Technical Specifications

Specification	Description
Ports	TX: 2 RX: 2
Line code	AMI, HDB3
Framing	PCM31, PCM31CRC, PCM30, PCM30CRC, unframed
Line Rates	2.048 MHz (TX), 2.048 MHz (RX), offset capability ± 100 ppm
Impedance	100 ohm or 120 ohm ± 5% balanced, 75 ohm unbalanced
Level (RX)	Terminated: 0 -36 dBsx with equalization
Connectors	BNC: 75 ohm unbalanced Bantam: 100 ohm balanced
Synchronization	Internal, Recovered, SETS
Input Signal Measurement	Peak voltage range: ± 0.1 Vp to ± 7 Vp Frequency measurement range: 2.048 MHz ± 200 ppm
Error Measurement	BPV, BIT, frame, CRC, FEBE
Alarm Detection	LOS, AIS, LOF, RAI, RMFAI, CASMFL, pattern sync loss, clock sync loss
Alarm Generation	LOS, AIS, LOF, RAI, RMFAI, CASMFL
Error Insertion	BPV, bit, frame, CRC, FEBE
Error Insertion Rate	Single, 10^{-7} to 10^{-3}, user-programmable
Patterns	**E1:** 2^6 -1, 2^6 -1 inverted, 2^9 -1, 2^9 -1 inverted, 2^{11} -1, 2^{11} -1 inverted, 2^{15} -1, 2^{15} -1 inverted, 2^{20} -1, 2^{20} -1 inverted, 2^{23} -1, 2^{23} -1 inverted, any 32-bit pattern **Fractional E1:** Fill 0 to 31 DS0's with one of the E1 patterns, specified by a 4-byte mask. Specify the 8-bit pattern in background (unselected) DS0's, with a default of 127
64k Bit Audible Connections	64k-bit audible monitoring via speaker

Loopback	Line and payload loopback (manual)
Automatic Configuration	Automatically configures test set to the incoming signal framing, line code, and pattern
E1 Jitter Measurement	**Jitter Measurement Characteristics:** • Acquisition time: 2 seconds typical, 5 seconds maximum • Jitter resolution: 0.01UI **Filter Characteristics:** • Wideband measurement: 10 Hz to 40 KHz • Highband measurement: 8 KHz to 40 KHz • Nominal filter attenuation at Fc: 3 dB **Jitter Output Characteristics:** • Scale: 0.1 V/UI • Bandwidth: 10 Hz to 40 KHz • Format: Single ended, referenced to ground • Impedance: 50 ohm ± 5%

Screen Functions and Descriptions

E1 Screen Functions and Descriptions Overview

The following function screens are available through the E1 protocol processor tab.

- Transmit
- Receive
- Results
- Test
- Performance Monitoring
- LEDs

Transmit

Transmit Screens and Functions

This function allows you to define the parameters used in E1 Transmit operations.

The following functions are available through the E1 Transmit screen.

- SET 1
- OH
- ERROR / ALARM

Transmit - Settings 1 (SET 1)

This screen allows you to configure the transmit signal parameters for the E1 line interface and the E1 protocol processor to match the E1 signal used in your test environment.

The E1 Transmit SET 1 screen contains the following parameters:

Parameter	**Description**
Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Signal Level	Sets the strength of the E1 transmit signal. The signal level values are relative to a normal E1 signal level. The following options are available: • **0 dBdsx:** Signal level is at the E1 signal level. • **-7 dBdsx:** Signal level is -7 dB below the normal E1 signal level. • **-15 dBdsx:** Signal level is -15 dB below the normal E1 signal level.
Line Code	Selects the type of signal coding transmitted by the E1 protocol

	processor. The following options are available: • **AMI:** Alternate Mark Inversion coding • **HDB3:** High Density Bipolar 3 Zero Substitution coding
Line Frequency Offset	Line Frequency Offset can be deactivated by setting it to "Off" or a customized amount between 100 and -100 can be entered.
Clock Reference	Determines the timing source for the E1 transmit signal. The following options are available: • **Internal:** Derives the transmit data's timing source from the system's internal clock. **Note: If you wish to drop an E1 from M13 and out the Line, then the clock must be set to Internal.** • **Recovered:** Derives the transmit data's timing source from the system's recover clock. • **BITS:** Derives the transmit's data timing source from the BITS (Building Integrated Timing Supply) clock input, which is 1.544 MHz. If this option is selected, but BITS clocking is not available, then this function defaults to Internal. CLK:BITS displays when configured for BITS clocking. • **SETS:** Derives the transmit's data timing source from the Synchronous Equipment Timing Source.
Loopback	Selects the type of loopback code transmitted. The options include: • **None:** The loopback function is

	not active. • **Payload:** Transmits the received payload in a frame formatted by the transmitter using either the internal or recovered clock. • **Line:** Transmits the entire received signal using the recovered clock.
Framing	Configures the framing format used for the E1 transmit signal. The following options are available: • Unframed • PCM30 • PCM30CRC • PCM31 • PCM31CRC
Mapping	Mapping options include: Fractional E1, ATM, or Bulk Filled.
Payload Pattern	Selects the type of E1 signal pattern that is transmitted by the system. The following options are available: • PRBS 2^9-1 • PRBS 2^9-1 Inverted • PRBS 2^11-1 • PRBS 2^11-1 Inverted • PRBS 2^15-1 • PRBS 2^15-1 Inverted • PRBS 2^20-1 • PRBS 2^20-1 Inverted • PRBS 2^23-1 • PRBS 2^23-1 Inverted • User Defined: Allows you to enter and save up to a 32-bit, customized pattern.
Fractional E1	A customized Fractional E1 pattern can be entered in hex, decimal, or bin format. 0 to 32 DS0's in an E1 with one of the E1 patterns can be entered.

Background 64K Pattern	A customized DS0 pattern can be entered in hex, decimal, or bin format.

Transmit - Overhead (OH)

This function displays the CAS Signaling Bits, Spare Bits, E Bits, and X Bits that are transmitted for a selected E1. These bytes can be edited to determine if the E1 facility can detect problems due to any of these types of overhead errors.

When a bit button is selected, a key pad appears enabling you to edit the bytes using a Hex, Decimal, or Bin format.

The following table describes the bits available in each Overhead section.

Overhead Bit Type	**Description**
CAS Signaling Bits	Allows you to select: • CH1 through 30 • Global CAS Bits: None or user defined.
Spare Bits	Allows you to select: • **Global Spare Bits:** Allows you to select a specific spare bit (4 through 8) of an eight-bit sequence. Select None to specify no bits. Selecting **None** will change the Global Spare Bits field to all zeros. • **Bit for 8 bit sequence:** None or bit 4 through 8. • **8 bit sequence:** Allows you to select a user pattern for an E1 spare overhead bit.
E Bits	Allows you to select an E Bit up to two bits (00).
X Bits	Allows you to select an X Bit up to three bits (000).

Transmit - ERROR ALARM

This function allows you to insert errors and alarms.

The following options are available on the E1 ERROR ALARM screen.

Option	Description
Error to Insert	Inserts an error that is transmitted by the E1 protocol processor. The options available include: • **None:** Turns off E1 error insertion. • **BPV Error:** Transmits Bipolar Violation errors which result in a line code violation event for an AMI-coded signal, the occurrence of received excessive zeros, or a bipolar violation. • **Bit:** Transmits a bit error which results in a frame synchronization bit error event. This also inserts a frame bit error in the received frame bit pattern. • **Frame:** Results in a severely errored framing event, which occurs when two or more framing bit pattern errors within a 3-ms period. This type of error is not available if the E1 protocol processor is configured for Unframed framing format. • **CRC:** Results in a CRC error event, which occurs when a received CRC code that is not identical to the corresponding locally calculated code. This option is available only when the E1 protocol processor is configured for CRC framing

	format. • **FEBE:** Results in a Far End Block Error, which occurs when a bit error has been detected at the Physical layer of the far end of the link. This option is available only when the E1 protocol processor is configured for CRC framing format.
Error Insert Rate	Sets the insertion rate for E1 transmit errors. This command is not available if Error to Insert is set to None. The following options are available for this command. • **Off:** No errors are inserted for transmission. This command effectively disables the Error Insert Action button. • **1e-X**, where X is a value from 3 through 10.
Alarm Generated	Generates a specific alarm on the transmit side of the E1 protocol process. The following options are available: LOS, LOF, AIS, RAI, RMFAI, and CASMFL.

Receive

Receive Screens and Functions

This function allows you to configure settings for the parameters used in the E1 Receive operations.

The following functions are available through the E1 Receive screen.

- SET 1
- OH
- SIG

Receive - Settings 1 (SET 1)

This screen allows you to configure your unit's Receive parameters for your E1 test environment.

The E1 Receive SET1 screen contains the following parameters:

Parameter	Description
Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Terminator Type	Configures the E1 line input termination. Select one of the following options: • **Terminated:** Sets the Receive Sensitivity of the E1 Line Interface. Use this setting if the E1 line terminates at the system's Line Interface. • **Monitor:** Sets the Receive Sensitivity of the E1 Line Interface. Use this setting if the E1 line connects to a monitor jack.
Framing	Configures the framing format used for the E1 Receive signal. The following options are available: • **Unframed:** Configures the system to receive an E1 signal using an unframed format. **Note:** For an E1 unframed, all-zeros user pattern, there is an insufficient ones density to detect a signal unless HDB3 encoding is used. Therefore, if E1 is receiving an unframed, all-zeros pattern in AMI encoding from the line interface, an LOS

	is reported. If E1 is receiving an unframed all-zeros pattern from an E3 or SDH drop, an LOS is suppressed; however, various framing LEDs will not function correctly. In an unframed, all-zeroes pattern, every bit is part of a zero substitution (000V/100V). The corruption of one bit corrupts the entire four-bit substitution. The result is one bit error can cause from two to three errors. Therefore, the insertion of bit errors into an unframed, all-zeroes pattern will not result in the correct number of errors detected. • **D4/SF:** Configures the system to transmit an E1 signal using D4 super frame format. • **ESF:** Configures the system to transmit an E1 signal using Extended Super Frame format. • **SLC-96:** Configures the system to transmit an E1 signal using SLC-96 format (Subscriber Loop Carrier). • PCM30 • PCM30CRC • PCM31 • PCM31CRC
Mapping	Mapping options include: Fractional E1, ATM, or Bulk Filled.
Payload Expected	Selects the type of E1 signal pattern that is transmitted by the system. The following options are available: • **Live:** Uses live data traffic; no pattern. This is used primarily for monitoring errors and alarms within a live data stream.

	• **PRBS 2^15-1:** Transmits a maximum of 14 consecutive zeros and 15 consecutive ones. • **PRBS 2^20-1:** Transmits a maximum of 19 consecutive zeros and 20 consecutive ones. • **PRBS 2^23-1:** Transmits a maximum of 22 consecutive zeros and 23 consecutive ones. • **All Ones:** A fixed test pattern of only pulses (marks) is received. This pattern is generally used to stress span repeater current regulator circuits. It can be used as an Alarm Indication Signal (AIS) in unframed circuits, or a keep alive signal, idle code, or red alarm in other circuits. • **3 in 24 (3:21):** A fixed test pattern of F0100 0100 0000 0000 0000 0100 is received. The pattern is aligned with the F-bits as indicated. 3 in 24 provides the minimum ones density and the maximum excess zeros requirements to stress T1 circuits. When the pattern is framed, it violates the minimum ones density requirements. • **1 in 8 (1:7):** A fixed pattern of F01000000 is received. This pattern stresses the minimum ones density requirement for B8ZS encoded T1 circuits if sent unframed. • **1010 Pattern:** A fixed test pattern of alternating marks (1) and spaces (0). This pattern is generally used to perform a minimum level stress test on clock recovery circuits. • **55DLY:** A 55 octet Daly pattern is received. • **T1-2:** A 96 octet pattern is received.

	• **T1-3:** A 54 octet pattern is received. • **T1-4:** A 120 octet pattern is received. • **T1-5:** A 53 octet pattern is received. • **55-Octet:** A 55 octet pattern is received. • **DDS-1:** An octet of 11111111 (repeated 100 times) followed by an octet of 00000000 (repeated 100 times) received continuously. Note: This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • **DDS-2:** An octet of 01111110 (repeated 100 times) followed by an octet of 00000000 (repeated 100 times) received continuously. Note: This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • **DDS-3:** An octet of 01001100 received continuously. Note: This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • **DDS-4:** An octet of 00000010 received continuously. Note: This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • **DDS-5:** DDS-1 pattern (repeated 4 times); DDS-2 (repeated 4 times); DDS-3 (once); DDS-4 (once) received continuously. Note: This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • **DDS-6:** An octet of 11111110 (repeated 7 times) followed by an octet of 11111111 (once) received continuously. Note:

	This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • **Bridge Tap:** 21 different patterns are received to detect bridge taps on a DS1. The following patterns are performed in 30 second increments: All Ones, 1-in-2, 1-in-4, 1-in-6, 1-in-7, 1-in-8, 2-in-9, 2-in-10, 2-in-11, 2-in-12, 2-in-13, 2-in-14, 2-in-15, 3-in-18, 3-in-19, 3-in-20, 3-in-21, 3-in-22, 3-in-23, 3-in-24, and QRSS. • **Multi-Pattern:** Five different patterns are received to stress a DS1. The following patterns are performed in 5 minute increments: All Ones, 1-in-8, 2-in-8, 3-in-24, and QRSS. • **User Defined:** Allows you to enter and save up to a 32-bit, customized pattern.
Fractional E1	A customized Fractional E1 pattern can be entered in hex, decimal, or bin format. 0 to 31 DS0's in an E1 with one of the E1 patterns can be entered. **This feature will be included in a future release.*
CODEC	Select A-law or MU-law.
64K Channel Dropped	Select the DS0 channel to be dropped, 1-31.
Speaker On/Off	This button that turns the speaker on and off.
Volume	Controls the speaker volume level. Click **High** to increase volume. Click **Low** to decrease volume.

Receive - Overhead (OH)

This function displays the overhead bytes for specific Channel Associated Signalling bytes, spare bits, E-Bits, and X-Bits on the incoming E1 signal. This is a read-only function.

The "Show Data Bits" portion of the screen displays the received data bits on the Fractional E1 channel.

Receive - Signal Status (SIG)

This function displays the electrical power, line frequency, and line frequency offset of the incoming E1 signal.

The following information is displayed on the E1 Receive SIG screen.

- Peak Positive Pulse Voltage
- Peak Negative Pulse Voltage
- Power in dBm
- Power in dBdSX
- Line Frequency in MHz
- Line Frequency Offset Received in Hz and ppm.
- Update Signal Calibration - Calibrating the system's optical power should be done carefully. To keep unauthorized users from changing calibration settings, the Update Signal Calibration button on the protocol processor's Receive SIG screen is unavailable by default. To change the setting, a user with Admin or Calibrate privileges must enable the calibration mode.

  The following calibration functions are available:

  - Select Negative, Positive, Negative Bridged (for E1 #2 only), or Positive Bridged (for E1 #2 only) to calibrate the following readings:
    - Zero Power Reading
    - 0.5 Volts Reading
    - 2.0 Volt Reading

To enable protocol processor calibration:

1. From the **System** tab, select **Misc**.
2. From **Local Settings**, select **Enable Calibration**.

The user must have Admin or Calibrate privileges to enable the calibration mode.

3. See E1 Electrical Power Calibration for specific calibration instructions before proceeding.
4. After setting the power and volt readings, select the **Save** button to update the signal calibration.

Results

Results Screens and Functions

This function allows you to view E1 error and alarm analysis and create a history of these events by graphing the information.

The following functions are available through the E1 Results screen.

- SCAN
- ERR
- ALARM
- EVENT
- GRAPH
- LARGE LED

Results - SCAN

The SCAN function provides a list of received errors and alarms for the E1 protocol processor. The duration or count of each event also appears. This function is effective in identifying a general area to investigate when an error or alarm is detected.

When no problems are detected, "No Errors or Alarms" is displayed.

Results - Errors (ERR)

This function reports statistical information on errors including the error count, average error rate, and current error rate.

The following errors are displayed on the E1 Results ERR screen:

- BIT
- BPV
- Frame
- CRC
- FEBE

Results - ALARM

This function displays how long E1 alarms were detected by the system. Results for the following alarms display.

- AIS
- LOF
- LOS
- PAT Sync
- RAI
- RMFAI
- CASMFL

Results - EVENT

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

Results - GRAPH

Use the Graphs button to view error and alarm results for the E1 protocol processor. These graphs show the test history for either the current test or the previous test. You can configure the graph function to display any combination of E1 alarms and errors.

To use the Results Graph functions, see the Using Graphs section.

Results - LARGE LEDs

This button displays the E1 LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

For a list of available LEDs in the E1protocol processor, see E1 LEDs.

Test

Test Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- SET 1
- Service Disruption

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Service Disruption

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The service disruption measurements show a granular accuracy of 1 frame duration. See the chart at the bottom of this page for time per frame durations for each protocol processor.

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

  For **E4**, **E3**, **E1**, **DS3** and **DS1** processors, the Protection Switch Criteria is limited to: Loss of Pattern Sync and Bit Errors.

  For **SONET** and **SDH** processors the Protection Switch Criteria include: B1, SEF / OOF, AIS-L / MS-AIS, AIS-P / AU-AIS, AIS-V / TU-AIS, and PRBS (Loss of Pattern Sync and Bit Errors).

  For **OTN** processors the Protection Switch Criteria include: OOF, OTU:AIS, OTU:BIP8, ODU:AIS, ODU:BIP8, and PRBS (Loss of Pattern Sync and Bit Errors).

- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **State** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the

previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

- **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.
- **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.
- **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)** - Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.
- **Protection Switch Time (Frames)** - Indicates the number of errored frames received during the service disruption event.
- **History Recent Milli Seconds** - Shows the time durations for the last ten measurements recorded.
- **History Recent Frames** - Shows the frame durations for the last ten measurements recorded.

A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing Service Disruption.

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
SONET / SDH	0.125 ms (125 µs)	16383 frames (2047.875 ms)
OTU 1	0.049 ms (49 µs)	16383 frames (802.302 ms)
OTU 2	0.012 ms (12 µs)	16383 frames (199.732 ms)
E4	0.021 ms (21 µs)	255 frames (5.361 ms)
E3	0.045 ms (45 µs)	255 frames (11.397 ms)

E1	0.125 ms (125 µs)	4095 frames (511.875 ms)
DS3	0.106 ms (106 µs)	255 frames (27.133 ms)
DS1	0.125 ms (125 µs)	4095 frames (511.875 ms)

Click this link for Ethernet Service Disruption specifics.

Performance Monitoring

Performance Monitoring Screens and Functions

The E1 Performance Monitoring screen includes the following functions:

- FAS
- CRC
- FEBE
- BIT

Perf Monitor - FAS

This provides a detailed breakdown for Frame Alignment Signal errors detected and logged by the E1 protocol processor.

This section is broken down into the following areas:

G.821

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.

- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.821 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

G.826

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

M.2100

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2100 Allocation: Select an allocation percentage from 0 to 100.

- Status: Pass, Uncertain, or failure

Perf Monitor - CRC

This provides a detailed breakdown for CRC errors detected and logged by the E1 protocol processor.

This section is broken down into the following areas:

G.821

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.821 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

G.826

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.

- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

M.2100

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2100 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

Perf Monitor - FEBE

This provides a detailed breakdown for FEBE errors detected and logged by the E1 protocol processor.

This section is broken down into the following areas:

G.821

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.

- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.821 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

G.826

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

M.2100

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.

- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2100 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

Perf Monitor - BIT

This provides a detailed breakdown for BIT errors detected and logged by the E1 protocol processor.

This section is broken down into the following areas:

G.821

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

G.826

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

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- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set monitoring duration to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

LED Quick Status Area

When the E1 protocol processor is selected, the following LEDs are displayed in the LEDs Quick Status area of the touch screen.

For information on Large LEDS, see E1 Results Large LEDs.

LED	Description
TX / RX	Displays the Transmit and Receive frequency.

E/A	Displays the error and/or alarm generated. If both an error and alarm is being generated concurrently, a slash (/) will separate the error and alarm. If neither are generated, "None" will display
CLK:	An alarm LED that displays the type of transmit clock specified in the setting. Clock settings include: SETS, Internal, or RCVD.
LOS	Loss of Signal. An alarm LED indicating a Loss of Signal status was detected.
BPV	Bipolar Violation. An error LED indicating two consecutive pulses of the same polarity occurred in the same digital bit stream. In E1 mode, BPV errors are only generated in the payload.
LOF	Loss of Frame. An alarm LED indicating an alarm signal was generated due to a frame alignment problem.
AIS	Alarm Indication Signal. An alarm LED indicating an Alarm Indication Signal occurred on the line layer.
FRAME ERR	An error LED indicating the E1 protocol processor has received framing errors.
CRC	Cyclic Redundancy Check. An error LED indicating the CRC data at the transmission end did not match the CRC data evaluated at the receiving end.
CASMFL	Channel Associated Signaling Multiframe Loss. Indicates that four zeros at the start of Time Slot 16 in frame 0 cannot be found.
RAI	Remote Alarm Indication. An alarm error indicating to the upstream circuit that a failure condition has been declared downstream.
RMFAI	Remote Multiframe Alarm Indication.

	This is an alarm LED.
FEBE	Far End Block Error. An error LED indicating a bit error has occurred in the physical layer at the far end of the link.
PAT Sync	An alarm LED indicating a loss of pattern synchronization.
BIT ERR	Bit Error. An error LED indicating a bit error was detected in the payload.

E3 Tab

E3 Overview

The E3 online help is divided into the following sections:

- E3 Specific Tasks
- E3 Screen Functions and Descriptions

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

E3 Specific Tasks

E3-Specific Tasks

This section includes tasks that are specific to the E3 protocol processor. For a list of general tasks, see Common Tasks located in the Getting Started section.

- Start/Stop E3 Channel Scan
- E3 Calibration
- E3/E4 Technical Specifications

E3 or DS3 Electrical Power Calibration

The following procedures describe the unit's negative and positive power calibration. While performing this task, you will measure, record, and enter power reading input for zero power reading and 0.2 and 0.8 volt reading for E3 or DS3.

Required Equipment

The following equipment is required to perform E3 or DS3 calibration:

- Digital oscilloscope (use highest bandwidth available) or equivalent measuring equipment
- Variable attenuator
- Electrical power meter or a calibrated NIC that can provide 0.2 and 0.8 volts power
- BNC T-connector
- Two 2-ft., 75 ohm coaxial cables with male BNC connectors
- Pencil and paper to record power measurements

Hardware Setup

The following describes how to attach cables to the measuring devices (an oscilloscope will be used in this example) and how to configure these devices for E3/DS3 calibration.

To attach cables between the unit and the oscilloscope:

1. Make sure that the unit and oscilloscope are turned on.
2. Connect the BNC T-connector to the oscilloscope's BNC input connector.
3. Connect one end of a BNC cable to the unit's **E3/DS3 TX** BNC connector and connect the other end of the cable to the BNC T-connector attached to the oscilloscope.
4. Connect one end of a BNC cable to the unit's **E3/DS3 RX** BNC connector and connect the other end of the cable to the BNC connector attached to the oscilloscope.

Restoring Raw Power Readings for E3 or DS3

The following restores the unit's raw (unconverted) power readings.

1. From the **System** tab, select **Misc**.
2. From **Local Setting**, select **Enable Calibration**.

The user must have Admin. or Calibrate privileges to enable the calibration mode.

3. From the **E3** or **DS3** tab on the unit, select **Receive**.
4. Select **SIG** from the tabs along the left-side of the Receive screen and choose **Update Signal Calibration**.
5. Select **Negative**. The Negative Signal Calibration functions appear.
6. Select **Zero power reading**. A keypad appears. Enter **0** and select **OK**.
7. Select the **Save** button to restore the raw power reading.
8. Select **Positive**. The Positive Signal Calibration functions appear.
9. Select **Zero power reading**. A keypad appears. Enter **0** and select **OK**.
10. Select **0.2 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
11. Select **0.8 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
12. Select the **Save** button to restore the raw power reading.

Calibrating E3 or DS3 Signal Calibration

The following procedures describe how to perform E3 or DS3 calibration using a NIC and oscilloscope.

Obtain Zero Power Reading

1. Using the oscilloscope, measure and record the average positive and negative peak values.
2. For zero volt value, do not connect the cable to the Receive connector on the unit.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This value is the **Zero power reading** for **Positive Signal Calibration**.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This value is the **Zero power reading** for **Negative Signal Calibration**.

Obtain 0.2 Volts Power Reading

1. Using the oscilloscope, measure and record the average positive and negative peak values. *(Reconnect the cable to the Receive connector on the unit.)*
2. Attenuate the signal until the oscilloscope reads 0.2 volts.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This is the **0.2 Volts Reading** value.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This is the **0.2 Volts Reading** value.

Obtain 0.8 Volts Power Reading

1. Using the oscilloscope, measure and record the average positive and negative peak values.
2. Attenuate the signal until the oscilloscope reads 0.8 volts.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This is the **0.8 Volts Reading** value.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This is the **0.8 Volts Reading** value.

Enter Negative Signal Power Readings

1. Make sure that the **Negative Signal Calibration** functions appear on the **Receive SIG** screen. If necessary, select the **Negative** button.
2. Select **Zero power reading**. A keypad appears. Enter the value recorded earlier for the zero power reading and select **OK**.
3. Select **0.2 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.2 volts power reading and select **OK**.
4. Select **0.8 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.8 volts power reading and select **OK**.
5. Select **Save** to save the new Negative Signal Calibration values.

Enter Positive Signal Power Readings

1. Select the **Positive** button. The Positive Signal Calibration functions appear on the **Receive SIG** screen.
2. Select **Zero power reading**. A keypad appears. Enter the value recorded earlier for the zero power reading and select **OK**.
3. Select **0.2 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.2 volts power reading and select **OK**.
4. Select **0.8 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.8 volts power reading and select **OK**.
5. Select **Save** to save the new Positive Signal Calibration values. This completes the unit's E3 or DS3 signal calibration.

E3/E4 Technical Specifications

E3/E4 Specification	**Description**
Line code	**E3:** HDB3 **E4:** CMI
Framing	Framed, unframed
Line Rates	**E3:** 34.368 MHz ± 4.6 ppm (TX), -2 ppm/yr 34.368 MHz ± 50 ppm (RX) **E4:** 139.264 MHz +20 ppm (TX), -2 ppm/yr 139.264 MHz +50 ppm (RX)
Impedance	75 ohm unbalanced
Level (TX)	**E3:** 1.00 Vp ± 0.1v **E4:** .5 Vp + .1v
Connectors	BNC: 75 ohm unbalanced
Synchronization	Internal, recovered, SETS
Input Signal Measurement	**E3:** Peak voltage range: ± 0.31 Vp to ± 1.2 Vp Frequency measurement range: 34.368 MHz ± 200 ppm **E4:** Peak voltage range: ± 0.3 Vp to ± .7 Vp Frequency measurement range: 139.264 MHz ± 200 ppm
Input Jitter Tolerance	Per G.823
Frequency Offset Generation	± 100 ppm in units of .1ppm
Error Measurement	**E3:** BPV, BIT, Frame

	E4: Bit, Frame
Alarm Detection	LOS, LOF, pattern sync, AIS, RDI
Alarm Generation	LOS, LOF, AIS, RDI
Error Injection	**E3:** BPV, bit, frame **E4:** Bit, Frame
Error Injection Rate	Single, 10^{-7} to 10^{-3}, user-programmable
Patterns	**E3:** 2^9 -1, 2^9 -1 inverted, 2^{11} -1, 2^{11} -1 inverted, 2^{15} -1, 2^{15} -1 inverted, 2^{20} -1, 2^{20} -1 inverted, 2^{23} -1, 2^{23} -1 inverted, any user-defined pattern up to 32 bits, ATM (mapping) Pass through with Drop & Insert: E3 pass thru with Drop/Insert of a single E1 for test **E4:** 2^{20} -1, 2^{20} -1 inverted, 2^{23} -1, 2^{23} -1 inverted, any user-defined pattern up to 32 bits.
E3 Jitter Measurement	**Jitter Measurement Characteristics:** • Acquisition time: 2 seconds typical, 5 seconds maximum • Jitter resolution: 0.01 UI **Filter Characteristics:** • Wideband measurement: 10 Hz to 400 KHz • Highband measurement: 30 KHz to 400 KHz • Nominal filter attenuation at Fc: 3dB **Jitter Output Characteristics:** • Scale: 0.1 V/UI • Bandwidth: 10 Hz to 40 KHz

Start/Stop E3 Channel Scan

The Chan Scan function inspects and then reports the contents of the 16 E1 channels that are obtained within the multiplexed E3 signal.

The information reported consists of items such as the framing and pattern activity detected on each E1 channel.

The E3 protocol processor must be receiving a valid signal, otherwise, the scan aborts. While a scan is in progress, you cannot access other functions.

To start a channel scan:

1. Select the **E3** protocol processor tab.
2. Select **Receive**.
3. Select **Chan Scan**.
4. Select **Start Scan**. Framing and pattern activity for each channel is displayed on the screen.

To stop the channel scan:

- Select the **Stop Scan** button.

Screen Functions and Descriptions

E3 Screen Functions and Descriptions Overview

The following function screens are available through the E3 protocol processor tab.

- Transmit
- Receive
- Results
- Test
- Performance Monitoring
- LEDs

Transmit
E3 Transmit

This function allows you to define the parameters used in E3 Transmit operations.

The following functions are available through the E3 Transmit screen.

- SET 1
- SET 2
- ERROR / ALARM

E3 Transmit Settings 1

This screen allows you to configure the transmit signal parameters for the E3 line interface and the E3 protocol processor to match the E3 signal used in your test environment.

The E3 Transmit Settings 1 screen contains the following parameters:

Parameter	Description
Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Line Freq Offset	Select Off (0; meaning the frequency cannot be adjusted) or -100.0 to 100.0 in 0.1 increments.
Clock	Determines the timing source for the E3 transmit signal. The following options are available: • **Internal:** Derives the transmit data's timing source from the system's internal clock. **Note: If you wish to drop an E1 from M13 and out the Line, then the clock must be set to Internal.** • **Recovered:** Derives the transmit data's timing source from the system's recover clock. • **Bits:** Derives the transmit's data timing source from the BITS (Building Integrated Timing Supply) clock input, which is 1.544 MHz. If this option is selected, but BITS clocking is not available, then this function defaults to Internal. CLK:BITS displays when configured for BITS clocking. • **SETS:** Derives the transmit's data timing source from the

	Synchronous Equipment Timing Source.
Framing	Configures the framing format used for the E3 transmit signal. The following options are available: • **Framed:** Configures the system to transmit an E3 signal using a framed format. • **Unframed:** Configures the system to transmit an E3 signal using an unframed format.

E3 Transmit Settings 2

This function selects the type of E3 Transmit mapping and patterns used by the E1 protocol processor.

The following options are available:

Option	Description
Mapping	Selects bulk filled or displays E1, ATM Direct, or ATM PLCP when Add/Drop to E1 or ATM mapped. Note: The ATM options will only appear if the ATM hardware is available.
Payload Pattern	Select User Defined (32-bit entry), PRBS 9, PRBS 9 Inverted (Inv), PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv. **Note:** This option is not available if Mapping is not set to Bulk Filled.
Pass Thru Mode	Select **On** to enable Pass Thru Mode. Select **Off** to disable Pass Thru Mode. **Note**: This option will be unavailable if Mapping is not set to E1.
E1 # 1 Channel Inserted	Select from Channels 1 through 16. **Note:** This option is unavailable if Mapping is not set to E1.
E1 #2 Channel Inserted	Select from Channels 1 through 16.

	Note: This option is unavailable if Mapping is not set to E1.
E1 Background Frame	Select from Unframed, PCM30, PCM30CRC, PCM31, and PCM31CRC. **Note:** This option is only available if Mapping is set to E1, and Pass-Thru Mode is turned off.
E1 Background Pattern	Enter any 32-bit pattern. **Note:** This option is only available if Mapping is set to E1, and Pass-Thru Mode is turned off.

E3 Transmit Errors and Alarms

This function allows you to enter errors and alarms.

The following options are available on the E3 Errors and Alarms screen.

Option	Description
Error to Insert	Inserts an error that is transmitted by the E3 protocol processor. The options available include: • **None:** Turns off E3 error insertion. • **BPV Error:** Transmits Bipolar Violation errors which result in a line code violation event for an AMI-coded signal, the occurrence of received excessive zeros, or a bipolar violation. • **Bit:** Transmits a bit error which results in a frame synchronization bit error event. This also inserts a frame bit error in the received frame bit pattern. • **Frame:** Results in a severely errored framing event, which occurs when two or more framing bit pattern errors within a 3-ms period. This type of error

	is not available if the E3 protocol processor is configured for Unframed framing format.
Error Insert Rate	Sets the insertion rate for E3 transmit errors. This command is not available if Error to Insert is set to None. The following options are available for this command: • **Off:** No errors are inserted for transmission. This command effectively disables the Error Insert Action button. • **1e-X**, where X is a value from 3 through 10.
Alarm Generated	Generates a specific alarm on the transmit side of the E3 protocol process. The following options are available: LOS, LOF, AIS, or RDI. **Note:** LOF and RDI alarms are not available if Framing is set to Unframed.

Receive

E3 Receive

This function allows you to configure settings for the parameters used in the E3 Receive operations.

The following functions are available through the E3 Receive screen.

- SET 1
- Signal Status
- Channel Scan

E3 Receive Settings 1

This screen allows you to configure your unit's Receive parameters for your E3 test environment.

The E3 Receive Settings 1 screen contains the following parameters:

Parameter	**Description**

Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Framing	Configures the framing format used for the E3 Receive signal. The following options are available: • **Unframed:** Configures the system to transmit an E3 signal using an unframed format. • **Framed:** Configures the system to transmit an E3 signal using a framed format.
Mapping	Selects bulk filled or displays E1, ATM Direct, or ATM PLCP when Add/Drop to E1 or ATM mapped. Note: The ATM options will only appear if the ATM hardware is available.
Payload Pattern	Selects the type of E3 signal pattern that is transmitted by the system. The following options are available: • **Live:** Uses live data traffic; no pattern. This is used primarily for monitoring errors and alarms within a live data stream. • **PRBS 2^9-1:** Transmits a maximum of 8 consecutive zeros and 9 consecutive ones. • **PRBS 2^9-1 Inverted:** Transmits an inverted 2^9-1 PRBS, inverts it, and transmits a maximum of 9 consecutive zeros and 8 consecutive ones. • **PRBS 2^11-1:** Transmits a maximum of 10 consecutive zeros and 11 consecutive ones. • **PRBS 2^11-1 Inverted:** Transmits an inverted 2^11-1 PRBS, inverts it, and transmits a

	maximum of 11 consecutive zeros and 10 consecutive ones. • **PRBS 2^15-1:** Transmits a maximum of 14 consecutive zeros and 15 consecutive ones. • **PRBS 2^15-1 Inverted:** Transmits an inverted 2^15-1 PRBS, inverts it, and transmits a maximum of 15 consecutive zeros and 14 consecutive ones. • **PRBS 2^20-1:** Transmits a maximum of 19 consecutive zeros and 20 consecutive ones. • **PRBS 2^20-1 Inverted:** Transmits an inverted 2^20-1 PRBS, inverts it, and transmits a maximum of 20 consecutive zeros and 19 consecutive ones. • **PRBS 2^23-1:** Transmits a maximum of 22 consecutive zeros and 23 consecutive ones. • **PRBS 2^23-1 Inverted:** Transmits an inverted 2^23-1 PRBS, inverts it, and transmits a maximum of 23 consecutive zeros and 22 consecutive ones. • **User Defined:** Allows you to enter and save up to a 32-bit, customized pattern.
E1 #1 Channel Drop	Select from Channels 1 through 16. **Note:** This option is unavailable if Mapping is not set to E1.
E1 #2 Channel Drop	Select from Channels 1 through 16. **Note:** This option is unavailable if Mapping is not set to E1.

E3 Receive Signal Status

This function displays the electrical power, line frequency, and line frequency offset of the incoming E3 signal. It also contains the Calibration function, which allows you to

The following information is displayed on the E3 Receive Signal Status screen:

- Peak Positive Pulse Voltage (in volts)
- Peak Negative Pulse Voltage (in volts)
- Power in dBm
- Power in dBdsx
- Line Frequency in MHz
- Line Frequency Offset Received in Hz and ppm

- Update Signal Calibration - Calibrating the system's optical power should be done carefully. To keep unauthorized users from changing calibration settings, the Update Signal Calibration button on the protocol processor's Receive SIG screen is unavailable by default. To change the setting, a user with Admin or Calibrate privileges must enable the calibration mode.

  The following calibration functions are available:

  - Select **Negative** or **Positive** to calibrate the following readings:
    - Zero Power Reading
    - 0.2 Volts Reading
    - 0.8 Volts Reading

To enable protocol processor calibration:

1. From the **System** tab, select **Misc**.
2. From **Local Settings**, select **Enable Calibration**.

The user must have Admin or Calibrate privileges to enable the calibration mode.

3. See E3 Electrical Power Calibration for specific calibration instructions before proceeding.
4. After setting the power and volt readings, select the **Save** button to update the signal calibration.

Receive - Channel Scan (Chan Scan)

This function inspects and then reports the contents of the 16 E1 channels that are contained within a multiplexed E3 signal. The information reported consists of Mapping and Pattern values for each E1 channel.

To use this function, Mapping must be set to E1, and the system must receive a valid signal.

For more information, see Start/Stop Channel Scan.

Results

E3 Results

This function allows you to view E3 error and alarm analysis and create a history of these events by graphing the information.

The following functions are available through the E3 Results screen.

- SCAN
- ERR
- Alarm
- Event
- Large LED
- Graph

E3 Results Scan

This function provides a quick report of detected errors and alarms and lists the duration of these events.

The following options are available in the E3 Results Scan screen.

Option	Description
Clock	Type of clock: internal, SETS, or Bits.
LOS Seconds	The number of seconds a Loss of Signal occurred.
BPV Error Count	The number of Bipolar Violations errors that occurred.
LOF Seconds	The number of seconds a Loss of Frame occurred.
AIS Seconds	The number of seconds a Alarm Indication Signal occurred.
FAS Error Count	The number of Frame Alignment Signal errors that occurred.
RDI Seconds	The number of seconds that a Remote Defect Indicator error occurred.
Pattern Loss Seconds	The number of seconds that a Loss of Pattern occurred.

Bit Errors Count	The number of Bit Errors that occurred.

E3 Results Errors

This function reports statistical information on errors including the error count (11 digits), average error rate (in N.NNe-N format), and current error rate (in N.NNe-N format for the current second only).

The following errors are reported:

- Bit
- BPV
- Frame

E3 Results Alarm

This function displays how long E3 alarms were detected by the system. Results for the following alarms display.

- Alarm Indication Signal (AIS)
- Loss of Frame (LOF)
- Loss of Signal (LOS)
- Pattern Synchronization (PAT SYNC)
- Remote Defect Indicator (RDI)

Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

E3 Results Large LEDs

This button displays the E3 LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	**Then this indicates ...**
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting **Restart**.
White with **black** text	No activity from this specific function.

For a list of available LEDs in the E3 protocol processor, see E3 LEDs.

E3 Results Graph

Use the Graphs button to view error and alarm results for the E3 protocol processor. These graphs show the test history for either the current test or the previous test. You can configure the graph function to display any combination of E3 alarms and errors.

To use the Results Graph functions, see Using Graphs.

Test

Test Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- SET 1
- Service Disruption

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Service Disruption

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The service disruption measurements show a granular accuracy of 1 frame duration. See the chart at the bottom of this page for time per frame durations for each protocol processor.

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

  For **E4**, **E3**, **E1**, **DS3** and **DS1** processors, the Protection Switch Criteria is limited to: Loss of Pattern Sync and Bit Errors.

  For **SONET** and **SDH** processors the Protection Switch Criteria include: B1, SEF / OOF, AIS-L / MS-AIS, AIS-P / AU-AIS, AIS-V / TU-AIS, and PRBS (Loss of Pattern Sync and Bit Errors).

  For **OTN** processors the Protection Switch Criteria include: OOF, OTU:AIS, OTU:BIP8, ODU:AIS, ODU:BIP8, and PRBS (Loss of Pattern Sync and Bit Errors).

- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse

before Protection Switch measurements stop accumulating. The available range is listed in the chart below.

- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **State** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

  - **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

  - **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.

  - **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)** - Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.
- **Protection Switch Time (Frames)** - Indicates the number of errored frames received during the service disruption event.
- **History Recent Milli Seconds** - Shows the time durations for the last ten measurements recorded.
- **History Recent Frames** - Shows the frame durations for the last ten measurements recorded.

A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing Service Disruption.

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
SONET / SDH	0.125 ms (125 µs)	16383 frames (2047.875 ms)

OTU 1	0.049 ms (49 µs)	16383 frames (802.302 ms)
OTU 2	0.012 ms (12 µs)	16383 frames (199.732 ms)
E4	0.021 ms (21 µs)	255 frames (5.361 ms)
E3	0.045 ms (45 µs)	255 frames (11.397 ms)
E1	0.125 ms (125 µs)	4095 frames (511.875 ms)
DS3	0.106 ms (106 µs)	255 frames (27.133 ms)
DS1	0.125 ms (125 µs)	4095 frames (511.875 ms)

Click this link for Ethernet Service Disruption specifics.

Performance Monitoring

E3 Performance Monitoring

The E3 Performance Monitoring screen includes the following functions:

- FAS
- BIT

E3 Performance Monitoring FAS

This provides a detailed breakdown for Frame Alignment Signal errors detected and logged by the E3 protocol processor.

This section is broken down into the following areas:

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- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.

- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure

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- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure

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- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Duration: Select the monitoring duration to be 2 hours, 1 day, or 7 days.

- Status: Pass, Uncertain, or failure

E3 Performance Monitoring Bit

This provides a detailed breakdown for BIT errors detected and logged by the E3 protocol processor.

This section is broken down into the following areas:

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- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure

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- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
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- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure

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- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Duration: Select the monitoring duration to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

E3 LEDs

When the E3 protocol processor is selected, the following LEDs are displayed in the LEDs Quick Status Area of the touch screen.

LED	Description
TX / RX	Displays the transmitted and received electrical power.
CLK:	Displays the type of transmit clock specified in the setting. Clock settings include: SETS, Internal, or RCVD. This is an alarm LED.
LOS	Loss of Signal. Indicates a Loss of Signal status was detected. This is an alarm LED.
BPV	Bipolar Violation. Indicates two consecutive pulses of the same polarity occurred in the same digital bit stream. In E3 mode, BPV errors are only generated in the payload. This is an error LED.

LOF	Loss of Frame. Indicates an alarm signal was generated due to a frame alignment problem. This is an alarm LED.
AIS	Alarm Indication Signal. Indicates an Alarm Indication Signal occurred on the line layer. This is an alarm LED.
FRAME ERR	Indicates if the E3 protocol processor has received framing errors. This is an error LED.
RDI	Remote Defect Indicator. Indicates a signal returned to the transmitting Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect. This is an alarm LED.
PAT Sync	Pattern Loss. Indicates a loss of pattern synchronization. This is an alarm LED.
BIT ERR	Bit Error. Indicates a bit error was detected in the payload. This is an error LED.

E4 Tab

E4 Overview

The E4 protocol processor section includes:

- E4 Specific Tasks
- E4 Screen Functions and Descriptions

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

E4 Specific Tasks

E4 Specific Tasks

This section includes tasks that are specific to the E4 protocol processor. For a list of general tasks, see Common Tasks located in the Getting Started section.

- Drop and Insert an E3 into an E4 Signal
- E4 Electrical Power Calibration
- E4 Technical Specifications

Add an E3 into an E4 Signal

You are able to drop and insert an electrical E3 PDH signal into an E4 protocol processor signal to monitor for error and alarm conditions.

1. Select **Presets**.
2. Select **Interface**. All line interfaces available for your unit appear.
3. Select **E4**.
4. Select **Configuration**. The available protocols appear.
5. Select **E3 A/D**.
6. Select **Apply**.

The unit is configured for Drop Insert mode. Go to the next section to specify different frames and patterns for the dropped/inserted signal.

Specifying Frames and Patterns for the Dropped/Inserted Signal

1. Select **Transmit**.

2. Select **SET 2**.
3. Select **E3 Channel Inserted**. Choose the channel to insert.
4. Select **E3 Background Frame.** Choose the background framing.
5. Select **E3 Background Pattern**. Using the calculator that appears, set the background pattern for the specified channel. Select **OK**.

View the Event Activity of the Dropped and Inserted Signals

1. Select **Results**.
2. Select **Scan** to view a summary of the error and alarm counts that have occurred.
3. Select **Error** to view the count, average rate, and current rate of the errors that have occurred.
4. Select **Alarm** to view the alarms (in seconds) that have occurred.
5. Select **Event** to view a list of events, count, time they occurred, and how long they occurred.
6. Select **Large LEDs** to view errors and alarms in the form of LEDs.
7. Select **Graph** to view a graph of the errors and alarms.

E4 Electrical Power Calibration

The following procedures describe the unit's negative and positive power calibration. While performing this task, you will measure, record, and enter power reading input for zero power reading and 0.1 and 0.4 volt reading for E4.

Required Equipment

The following equipment is required to perform E4 calibration:

- Digital oscilloscope (use highest bandwidth available) or equivalent measuring equipment
- Variable attenuator
- Electrical power meter or a calibrated NIC that can provide 0.1 and 0.4 volts power
- BNC T-connector
- Two 2-ft., 75 ohm coaxial cables with male BNC connectors
- Pencil and paper to record power measurements

Hardware Setup

The following describes how to attach cables to the measuring devices (an oscilloscope will be used in this example) and how to configure these devices for E3/DS3 calibration.

To attach cables between the unit and the oscilloscope:

1. Make sure that the unit and oscilloscope are turned on.

2. Connect the BNC T-connector to the oscilloscope's BNC input connector.
3. Connect one end of a BNC cable to the unit's **E4 TX** BNC connector and connect the other end of the cable to the BNC T-connector attached to the oscilloscope.
4. Connect one end of a BNC cable to the unit's **E4 RX** BNC connector and connect the other end of the cable to the BNC connector attached to the oscilloscope.

Restoring Raw Power Readings for E4

The following restores the unit's raw (unconverted) power readings.

1. From the **System** tab, select **Misc**.
2. From **Local Setting**, select **Enable Calibration**.

The user must have Admin. or Calibrate privileges to enable the calibration mode.

3. From the **E4** tab on the unit, select **Receive**.
4. Select **SIG** from the tabs along the left-side of the Receive screen and choose **Update Signal Calibration**.
5. Select **Negative**. The Negative Signal Calibration functions appear.
6. Select **Zero power reading**. A keypad appears. Enter **0** and select **OK**.
7. Select the **Save** button to restore the raw power reading.
8. Select **Positive**. The Positive Signal Calibration functions appear.
9. Select **Zero power reading**. A keypad appears. Enter **0** and select **OK**.
10. Select **0.1 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
11. Select **0.4 Volts Reading**. A keypad appears. Enter **0** and select **OK**.
12. Select the **Save** button to restore the raw power reading.

Calibrating E4 Signal Calibration

The following procedures describe how to perform E4 calibration using a NIC and oscilloscope.

Obtain Zero Power Reading

1. Using the oscilloscope, measure and record the average positive and negative peak values.
2. For zero volt value, do not connect the cable to the Receive connector on the unit.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This value is the **Zero power reading** for **Positive Signal Calibration**.

4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This value is the **Zero power reading** for **Negative Signal Calibration**.

Obtain 0.1 Volts Power Reading

1. Using the oscilloscope, measure and record the average positive and negative peak values. *(Reconnect the cable to the Receive connector on the unit.)*
2. Attenuate the signal until the oscilloscope reads 0.1 volts.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This is the **0.1 Volts Reading** value.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This is the **0.1 Volts Reading** value.

Obtain 0.4 Volts Power Reading

1. Using the oscilloscope, measure and record the average positive and negative peak values.
2. Attenuate the signal until the oscilloscope reads 0.4 volts.
3. Record the value for the Peak Positive Pulse Voltage that appears on the **Receive SIG** screen. This is the **0.4 Volts Reading** value.
4. Record the value for the Peak Negative Pulse Voltage that appears on the **Receive SIG** screen. This is the **0.4 Volts Reading** value.

Enter Negative Signal Power Readings

1. Make sure that the **Negative Signal Calibration** functions appear on the **Receive SIG** screen. If necessary, select the **Negative** button.
2. Select **Zero power reading**. A keypad appears. Enter the value recorded earlier for the zero power reading and select **OK**.
3. Select **0.1 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.1 volts power reading and select **OK**.
4. Select **0.4 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.4 volts power reading and select **OK**.
5. Select **Save** to save the new Negative Signal Calibration values.

Enter Positive Signal Power Readings

1. Select the **Positive** button. The Positive Signal Calibration functions appear on the **Receive SIG** screen.
2. Select **Zero power reading**. A keypad appears. Enter the value recorded earlier for the zero power reading and select **OK**.
3. Select **0.1 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.1 volts power reading and select **OK**.

4. Select **0.4 Volts Reading**. A keypad appears. Enter the value recorded earlier for the 0.4 volts power reading and select **OK**.
5. Select **Save** to save the new Positive Signal Calibration values. This completes the unit's E4 signal calibration.

E3/E4 Technical Specifications

E3/E4 Specification	**Description**
Line code	**E3:** HDB3 **E4:** CMI
Framing	Framed, unframed
Line Rates	**E3:** 34.368 MHz ± 4.6 ppm (TX), -2 ppm/yr 34.368 MHz ± 50 ppm (RX) **E4:** 139.264 MHz +20 ppm (TX), -2 ppm/yr 139.264 MHz +50 ppm (RX)
Impedance	75 ohm unbalanced
Level (TX)	**E3:** 1.00 Vp ± 0.1v **E4:** .5 Vp + .1v
Connectors	BNC: 75 ohm unbalanced
Synchronization	Internal, recovered, SETS
Input Signal Measurement	**E3:** Peak voltage range: ± 0.31 Vp to ± 1.2 Vp Frequency measurement range: 34.368 MHz ± 200 ppm **E4:** Peak voltage range: ± 0.3 Vp to ± .7 Vp Frequency measurement range: 139.264 MHz ± 200 ppm
Input Jitter Tolerance	Per G.823
Frequency Offset Generation	± 100 ppm in units of .1ppm
Error Measurement	**E3:** BPV, BIT, Frame **E4:** Bit, Frame
Alarm Detection	LOS, LOF, pattern sync, AIS, RDI
Alarm Generation	LOS, LOF, AIS, RDI
Error Injection	**E3:** BPV, bit, frame

	E4: Bit, Frame
Error Injection Rate	Single, 10^{-7} to 10^{-3}, user-programmable
Patterns	**E3:** 2^9 -1, 2^9 -1 inverted, 2^{11} -1, 2^{11} -1 inverted, 2^{15} -1, 2^{15} -1 inverted, 2^{20} -1, 2^{20} -1 inverted, 2^{23} -1, 2^{23} -1 inverted, any user-defined pattern up to 32 bits, ATM (mapping) Pass through with Drop & Insert: E3 pass thru with Drop/Insert of a single E1 for test **E4:** 2^{20} -1, 2^{20} -1 inverted, 2^{23} -1, 2^{23} -1 inverted, any user-defined pattern up to 32 bits.
E3 Jitter Measurement	**Jitter Measurement Characteristics:** • Acquisition time: 2 seconds typical, 5 seconds maximum • Jitter resolution: 0.01 UI **Filter Characteristics:** • Wideband measurement: 10 Hz to 400 KHz • Highband measurement: 30 KHz to 400 KHz • Nominal filter attenuation at Fc: 3dB **Jitter Output Characteristics:** • Scale: 0.1 V/UI • Bandwidth: 10 Hz to 40 KHz

Screen Functions and Descriptions

E4 Screen Functions and Descriptions Overview

The following function screens are available through the E4 protocol processor tab.

- Transmit
- Receive

- Results
- Test
- Performance Monitoring
- LEDs

Transmit

Transmit Screens and Functions

This function allows you to define the parameters used in E4 Transmit operations.

The following functions are available through the E4 Transmit screen.

- SET 1
- SET 2
- Error Alarm

Transmit - Settings 1 (SET 1)

This screen allows you to configure the transmit signal parameters for the E4 line interface and the E4 protocol processor to match the E4 signal used in your test environment.

The E4 Transmit Settings 1 screen contains the following parameters:

Parameter	Description
Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Framing	Configures the framing format used for the E4 transmit signal. The following options are available: • **Unframed:** Configures the system to transmit an E4 signal using an unframed format. • **Framed:** Configures the system to transmit an E4 signal using a

	framed format.
Line Freq Offset	Line Frequency Offset can be deactivated by setting it to "Off" or a customized amount between 100 and -100 can be entered.
Clock	Determines the timing source for the E4 transmit signal. The following options are available: • **Internal:** Derives the transmit data's timing source from the system's internal clock. • **Recovered:** Derives the transmit data's timing source from the system's recover clock. • **BITS:** Derives the transmit's data timing source from the BITS (Building Integrated Timing Supply) clock input, which is 1.544 MHz. If this option is selected, but BITS clocking is not available, then this function defaults to Internal. CLK:BITS displays when configured for BITS clocking • **SETS:** Derives the transmit's data timing source from the Synchronous Equipment Timing Source.

Transmit - Settings 2 (SET 2)

This function selects the type of E4 Transmit mapping and patterns used by the E4 protocol processor.

The following options are available:

Option	Description
Mapping	Selects bulk filled or displays E3 when E4 is Add/Dropped to E3. Note: The ATM options will only appear if the ATM hardware is available.

Payload Pattern	Select User Defined (32-bit entry), PRBS 9, PRBS 9 Inverted (Inv), PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv. **Note:** This option is not available if Mapping is not set to Bulk Filled.
E3 Channel Inserted	Select from Channels 1 through 4, All, or None. **Note:** This option is unavailable if Mapping is not set to E3.
E3 Background Frame	Select from Framed, Unframed, PCM30, PCM30CRC, PCM31, and PCM31CRC. **Note:** This option is only available if Mapping is set to E3.
E3 Background Pattern	Enter any 32-bit pattern. **Note:** This option is only available if Mapping is set to E3.

Transmit - Errors and Alarms (Error Alarm)

This function allows you to enter errors and alarms.

The following options are available on the E4 Errors and Alarms screen.

Option	**Description**
Error to Insert	Inserts an error that is transmitted by the E4 protocol processor. The options available include: • **None:** Turns off E4 error insertion. • **LCV:** Transmits Line Code Violation errors, which result in a line code violation event for an AMI-coded signal. • **Bit:** Transmits a bit error, which results in a frame synchronization bit error event. This also inserts a frame bit error in the received frame bit pattern.

	• **Frame:** Results in a severely errored framing event, which occurs when two or more framing bit pattern errors within a 3-ms period. This type of error is not available if the E4 protocol processor is configured for Unframed framing format.
Error Insert Rate	Sets the insertion rate for E4 transmit errors. This command is not available if Error to Insert is set to None. The following options are available for this command. • **Off:** No errors are inserted for transmission. This command effectively disables the Error Insert Action button. • **1e-X**, where X is a value from 3 through 10.
Alarm Generated	Generates a specific alarm on the transmit side of the STM-4 protocol process. The following options are available: None, LOS, LOF, AIS, and RDI.

Receive

Receive Screens and Functions

Functions on the Receive screens allow you to configure settings for the parameters used in E4 Receive operations.

The following functions are available through the E4 Receive screen.

- SET 1
- SIG

Receive - Settings 1 (SET 1)

This screen allows you to configure your unit's Receive parameters for your E4 test environment.

The E4 Receive Settings 1 screen contains the following parameters:

Parameter	Description
Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Termination Type	Configures the E4 line input termination. Select one of the following options: • **Terminated**: Sets the Receive Sensitivity of the E4 Line Interface. Use this setting if the E4 line terminates at the system's Line Interface. • **Monitor**: Sets the Receive Sensitivity of the E4 Line Interface. Use this setting if the E4 line connects to a monitor jack.
Mapping	Selects bulk filled or displays E3 when E4 is Add/Dropped to E3. Note: The ATM options will only appear if the ATM hardware is available.
Framing	Configures the framing format used for the E4 Receive signal. The following options are available: • **Unframed:** Configures the system to transmit an E4 signal using an unframed format. • **Framed:** Configures the system to transmit an E4 signal using a framed format.
Payload Expected	Selects the type of E4 signal pattern that is transmitted by the system. The following options are available: • **Live:** Uses live data traffic; no pattern. This is used primarily for

	monitoring errors and alarms within a live data stream. • **PRBS 2^9-1:** Transmits a maximum of 8 consecutive zeros and 9 consecutive ones. • **PRBS 2^9-1 Inverted:** Transmits an inverted 2^9-1 PRBS, inverts it, and transmits a maximum of 9 consecutive zeros and 8 consecutive ones. • **PRBS 2^11-1:** Transmits a maximum of 10 consecutive zeros and 11 consecutive ones. • **PRBS 2^11-1 Inverted:** Transmits an inverted 2^11-1 PRBS, inverts it, and transmits a maximum of 11 consecutive zeros and 10 consecutive ones. • **PRBS 2^15-1:** Transmits a maximum of 14 consecutive zeros and 15 consecutive ones. • **PRBS 2^15-1 Inverted:** Transmits an inverted 2^15-1 PRBS, inverts it, and transmits a maximum of 15 consecutive zeros and 14 consecutive ones. • **PRBS 2^20-1:** Transmits a maximum of 19 consecutive zeros and 20 consecutive ones. • **PRBS 2^20-1 Inverted:** Transmits an inverted 2^20-1 PRBS, inverts it, and transmits a maximum of 20 consecutive zeros and 19 consecutive ones. • **PRBS 2^23-1:** Transmits a maximum of 22 consecutive zeros and 23 consecutive ones. • **PRBS 2^23-1 Inverted:** Transmits an inverted 2^23-1 PRBS, inverts it, and transmits a maximum of 23 consecutive zeros and 22 consecutive ones. • **User Defined:** Allows you to enter and save up to a 32-bit, customized pattern.
E3 Channel Dropped	Select a channel to drop, 1-4. **Note:**

	This function is only available if Mapping is set to E3.

Receive - Signal Status (SIG)

This function displays the electrical power, line frequency, and line frequency offset of the incoming E4 signal.

The following information is displayed on the E4 Receive Signal Status screen.

- Peak Positive Pulse Voltage (in volts)
- Peak Negative Pulse Voltage (in volts)
- Power in dBm
- Power in dBdsx
- Line Frequency in MHz
- Line Frequency Offset Received in Hz and ppm

- Update Signal Calibration - Calibrating the system's optical power should be done carefully. To keep unauthorized users from changing calibration settings, the Update Signal Calibration button on the protocol processor's Receive SIG screen is unavailable by default. To change the setting, a user with Admin or Calibrate privileges must enable the calibration mode.

  The following calibration functions are available:

  - Select **Negative** or **Positive** to calibrate the following readings:
    - Zero Power Reading
    - 0.1 Volts Reading
    - 0.4 Volts Reading

To enable protocol processor calibration:

1. From the **System** tab, select **Misc**.
2. From **Local Settings**, select **Enable Calibration**.

The user must have Admin or Calibrate privileges to enable the calibration mode.

3. See E4 Electrical Power Calibration for specific calibration instructions before proceeding.
4. After setting the power and volt readings, select the **Save** button to update the signal calibration.

Results

Result Screens and Functions

Result screens allow you to view E4 error and alarm analysis and create a history of these events by graphing the information.

The following functions are available through the E4 Results screen.

- SCAN
- ERR
- ALARM
- EVENT
- LARGE LED
- GRAPH

Results - SCAN

The SCAN function provides a list of received errors and alarms for the E4 protocol processor. The duration or count of each event also appears. This function is effective in identifying a general area to investigate when an error or alarm is detected.

When no problems are detected, "No Errors or Alarms" is displayed.

Results - Errors (ERR)

This function reports statistical information on errors including the error count, average error rate, and current error rate.

The following errors are displayed on the E4 Results Errors screen:

- Bit
- LCV
- Frame
- CRC
- FAS
- FEBE

Results - ALARM

This function displays how long E4 alarms were detected by the system. Results for the following alarms display.

- Alarm Indication Signal (AIS)
- Loss of Frame (LOF)
- Loss of Signal (LOS)
- Pattern Loss (PAT LOSS)
- Remote Defect Indication (RDI)

Results - EVENT

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

Results - Large LEDs (LARGE LED)

This button displays the E4 LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting **Restart**.
White with **black** text	No activity from this specific function.

For a list of available LEDs in the E4 protocol processor, see E4 LEDs.

Results - GRAPH

Use the Graphs button to view error and alarm results for the E4 protocol processor. These graphs show the test history for either the current test or the previous test. You can configure the graph function to display any combination of E4 alarms and errors.

To use the Results Graph functions, see Using Graphs.

Test

Test Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- SET 1
- Service Disruption

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Service Disruption

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The service disruption measurements show a granular accuracy of 1 frame duration. See the chart at the bottom of this page for time per frame durations for each protocol processor.

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

  For **E4**, **E3**, **E1**, **DS3** and **DS1** processors, the Protection Switch Criteria is limited to: Loss of Pattern Sync and Bit Errors.

  For **SONET** and **SDH** processors the Protection Switch Criteria include: B1, SEF / OOF, AIS-L / MS-AIS, AIS-P / AU-AIS, AIS-V / TU-AIS, and PRBS (Loss of Pattern Sync and Bit Errors).

  For **OTN** processors the Protection Switch Criteria include: OOF, OTU:AIS, OTU:BIP8, ODU:AIS, ODU:BIP8, and PRBS (Loss of Pattern Sync and Bit Errors).

- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **State** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the

previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

- **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.
- **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.
- **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)** - Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.
- **Protection Switch Time (Frames)** - Indicates the number of errored frames received during the service disruption event.
- **History Recent Milli Seconds** - Shows the time durations for the last ten measurements recorded.
- **History Recent Frames** - Shows the frame durations for the last ten measurements recorded.

A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing Service Disruption.

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
SONET / SDH	0.125 ms (125 µs)	16383 frames (2047.875 ms)
OTU 1	0.049 ms (49 µs)	16383 frames (802.302 ms)
OTU 2	0.012 ms (12 µs)	16383 frames (199.732 ms)
E4	0.021 ms (21 µs)	255 frames (5.361 ms)
E3	0.045 ms (45 µs)	255 frames (11.397 ms)

E1	0.125 ms (125 µs)	4095 frames (511.875 ms)
DS3	0.106 ms (106 µs)	255 frames (27.133 ms)
DS1	0.125 ms (125 µs)	4095 frames (511.875 ms)

Click this link for Ethernet Service Disruption specifics.

Performance Monitoring

Performance Monitoring Screens and Functions

The E4 Performance Monitoring screen includes the following functions:

- FAS
- BIT

Perf Monitor - FAS

This provides a detailed breakdown for Frame Alignment Signal (FAS) errors detected and logged by the E4 protocol processor.

This section is broken down into the following areas:

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- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.

- Status: Pass or failure

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- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure

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- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Duration: Select the monitoring duration to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

Perf Monitor - BIT

This provides a detailed breakdown for BIT errors detected and logged by the E4 protocol processor.

This section is broken down into the following areas:

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- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure

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- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure

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- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.

- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Duration: Select the monitoring duration to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

LED Quick Status Area

When the E4 protocol processor is selected, the following LEDs and status indicators are displayed in the LED Quick Status Area of the touch screen. They are also located under Results Large LEDs.

LED	Description
TX / RX	Displays the transmitted and received electrical power.
CLK:	Displays the type of transmit clock specified in the setting. Clock settings include: SETS, Internal, or RCVD. This is an alarm LED.
LOS	Loss of Signal. Indicates a Loss of Signal status was detected. This is an alarm LED.
LCV	Line Code Violation. Indicates a Line Code Violation was detected. This is an error LED.
AIS	Alarm Indication Signal. Indicates an Alarm Indication Signal occurred on the line layer. This is an alarm LED.
Frame Err	Indicates if the E4 protocol processor has received framing errors. This is an error LED.
RDI	Remote Defect Indicator. Indicates a signal returned to the transmitting Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect. This is an alarm LED.
PAT Sync	Indicates a loss of pattern synchronization. This is an alarm LED.

BIT ERR	Bit Error. Indicates a bit error was detected in the payload. This is an error LED.

GigE Tab

GigE (10/100 and 1GbE) Overview

The GigE Protocol Processor enables users to perform Packet-level testing, BERT testing, RFC 2544 (throughput, frame loss, and latency) testing, and Service Disruption testing on both 10/100 Base-T and 1 Gigabit Ethernet traffic, via an easy to use graphical user interface.

The GigE is equipped with four fully independent, factory-configurable ports. Two ports can be configured individually as SX ports (multimode fiber, 850 nm), LX ports (single-mode fiber, 1310 nm), or ZX ports (single-mode fiber, 1550 nm); while the other two ports are RF-45 10/100 Base-T ports. See Connector Panel to view the connector panel design.

The following GigE 10/100 related topics are discussed in this section of the online help system:

- GigE 10/100 Specific Tasks
- GigE 10/100 Screens Functions and Descriptions

GigE Specific Tasks

GigE (10/100 and 1GbE) Specific Tasks

This section includes tasks that are specific to the GigE 10/100 (Ethernet) protocol processor. For a list of general tasks, see Common Tasks located in the Getting Started section. For a description of specific GigE screens and their functionality, refer to Screen Functions and Description.

- GigE Connector Panel
- BERT - Using BERT Test Mode
- BERT - Configuring Framed Mode
- BERT - Auto Negotiation
- BERT - Print and Save Statistics
- Packet - Adding a Stream
- Packet - Rearrange Columns

- Packet - Transmitting a Stream
- Packet - VLAN Tagging
- Packet - Insert Stream Errors
- Packet - Error and Alarm Results
- Packet - Capture Packets
- Packet - Deleting a Stream
- RFC Test - Frame Loss Testing
- RFC Test - Thru Put Testing
- Test - Service Disruption Activity
- Printing and Saving Reports

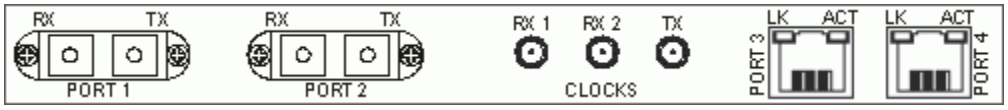
GigE (10/100 and 1GbE) Connector Panel

The NIC GigE can be configured with two or four fully independent ports:

The four-port configuration is the most common configuration, and contains the following Ethernet ports.

- Two Gigabit Ethernet optical ports (Ports 1 and 2) that can be configured individually as SX ports (multimode fiber, 850 nm), LX ports (single-mode fiber, 1310 nm), or ZX ports (single-mode fiber, 1550 nm)

- Two 10/100 Mbps ports (Ports 3 and 4) are RF-45 that can be configured individually as 10 Base-T or 100 Base-T ports

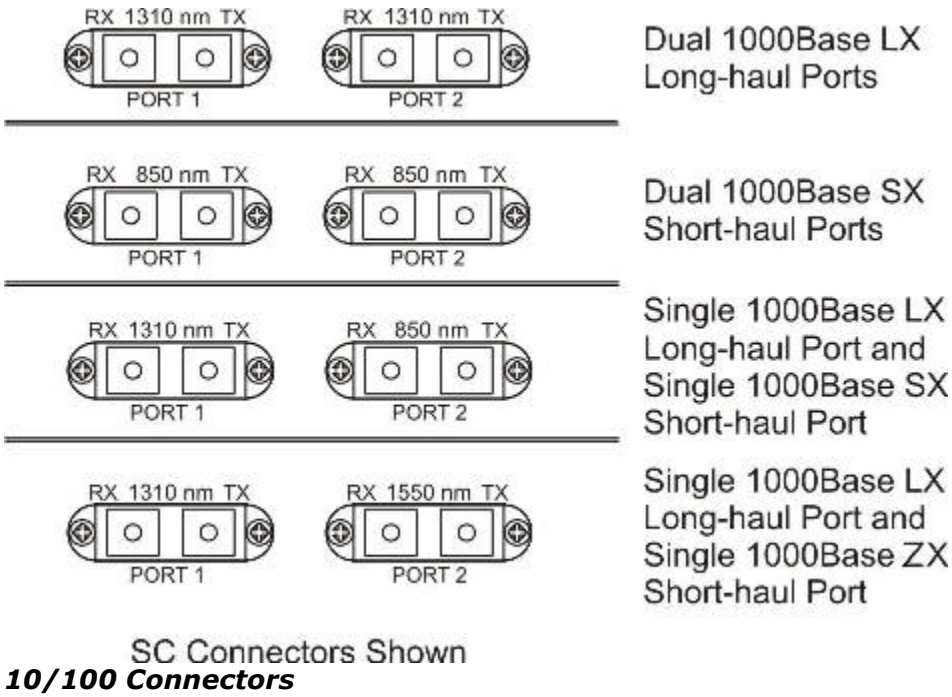


The two-port configuration is referred to as a **GigE "Lite"** board.

- The GigE Lite board contains two Gigabit Ethernet optical ports (Ports 1 and 2) that can be configured individually as SX ports (multimode fiber, 850 nm), LX ports (single-mode fiber, 1310 nm), or ZX ports (single-mode fiber, 1550 nm)

Optical Connectors

Port 1 and Port 2 can be configured with SC, ST, or FC type optical connectors and they accept both singlemode and multimode fiber. The following shows various GigE optical connector configurations:



10/100 Connectors

Port 3 and Port 4 are 8-pin modular jacks for 10/100 Mbps that use 10BaseT connectors.

Using BERT Test Mode

The BERT function provides a bit-error-rate tester that generates bit errors using PRBS or user-defined patterns within a frame.

Important: Several BERT functions are grayed-out (unavailable) unless certain conditions are met. In addition to the laser being turned on, the following list describes the conditions required to enable specific functions:

- Mode - Only visible on Port 3 and Port 4
- Frame Size (Bytes) - Framing must be set to Framed.
- Packet Rate - Framing must be set to Framed.
- Packet Header - Framing must be set to Framed.
- IP Reflection - Framing must be set to Framed and BERT must be active.

- Error Type - Framing must be set to Framed and BERT must be active.
- Error Rate - An Error Type must be selected.
- AutoNegotiate - Framing must be set to Framed, BERT must be active, and TX must be On.

To configure BERT and generate bit errors:

1. With the desired Port selected from the **GigE** tab, select **BERT**.
2. If the laser been turned on, do so now.
3. Select **Test** from the tabs along the left-side of the BERT screen.
4. Select **Mode** and choose either 10 Mbps @ Full or Half Duplex, or 100 Mbps @ Full or Half Duplex (Ports 3 or 4 only).
5. Select **Framing** and choose Framed or Unframed to configure the bit stream.
6. Select **Test Pattern** and select the transmit pattern.
7. Select **Frame Size (Bytes)** and enter a frame size (64 to 9000 bytes). Frame Size (Bytes) is unavailable unless Framing is set to Framed.
8. Select **Packet Rate**. You can choose either %Bandwidth or MBit/sec to set the rate.
9. Select **Packet Header**. The Traffic Stream Profile screen appears. Configure MAC and IP Source and Destination Addresses. Select **Save**.
10. Select **Activate** and **TX On**.
11. If desired, select **IP Reflection** and choose **DLI Packets** to start the IP packet reflection mode.
12. Select **Error Type** and choose an error to generate.
13. Select **Error Rate** and set an error insertion rate. The unit starts transmitting bit errors.
14. If desired, select **AutoNegotiation** to enable it.

When BERT mode is active, Ethernet stream transmission is disabled.

To stop bit error transmission:

- Select **Error Rate** and choose **Off**.

To generate a single bit error:

1. With the desired **Port** selected from the **GigE** tab, select **BERT**.
2. Select **Test** from the tabs along the left-side of the BERT screen and choose **Activate** to start BERT mode.
3. Select **Mode** and choose a 10Mbps or 100Mbps Ethernet Rate and Duplex mode (Ports 3 or 4 only).
4. Select **Framing** and select Framed or Unframed to configure the bit stream.
5. Select **Test Pattern** and select the transmit pattern.

6. Select **Frame Size (Bytes)** and enter a frame size (64 to 9000 bytes).
7. Select **Packet Rate**. Choose either %Bandwidth or MBit/sec and set the rate.
8. Select **Packet Header**. The Traffic Stream Profile screen appears. Configure MAC and IP Source and Destination Addresses.
9. Select **Save**.
10. Select **Start TX**.
11. Select **Error Type** and select an error to generate.
12. Select the **Error Insert** Common Function button located at the bottom of the screen, to transmit one bit error.

Configuring BERT for Framed Mode

Framed mode is required for various GigE activity. Framing the bit stream encapsulates it in an Ethernet frame of a fixed length.

To select Framed mode:

1. From the **GigE** tab, select **BERT**.
2. Select the **Test** tab from along the left-side of the BERT screen and choose **Framing**. The Select Framing dialog box appears.
3. Select **Framed**.

Auto Negotiation

Auto Negotiation is an Ethernet handshaking mechanism that looks at the incoming signal and determines the link speed and duplex mode (full-duplex or half-duplex). The AutoNegotiation button enables or disables auto-negotiation mode.

When auto-negotiation is first enabled, it attempts to auto-negotiate the link with a remote device. After successful negotiation, auto-negotiation will not be performed again unless the remote device initiates an auto-negotiation sequence.

By disabling auto-negotiation, the test set can simulate older Ethernet equipment that does not support auto-negotiation logic.

IMPORTANT: The AutoNegotiation button is not available unless BERT is active and TX is turned on.

To turn auto-negotiation on:

- From the **BERT** screen, select the **AutoNegotiation** button and choose **Enabled**. When first enabled, the negotiation status displays "Negotiation

Pending Link", while it attempts to auto-negotiate with a remote device. Upon successful negotiation, the status displays "Negotiation Complete".

To turn auto-negotiation off:

- From the **BERT** screen, select the **AutoNegotiation** button and choose **Disabled**. The button negotiation status displays "Negotiation Disabled".

Printing and Saving BERT Reports Using the Print Button

The BERT screen provides the ability to print and save a BERT Analysis report by selecting the on-screen Print button.

You can choose to view or print a saved report at a later time using the File Service's Print function located under the System tab. See Printing or Viewing Saved Files.

To print report:

1. Select **Print**. The File Browser window appears, which allows you to save report to a file.
2. Select **Cancel** to close the File Browser window. The Print dialog box appears.
3. If working from the Remote Control Application, choose the printer name and select **OK**. If printing from the NIC unit, make sure that a printer is attached to the unit's parallel or serial port.

To save report:

1. Select **Print**. The File Browser window appears.
2. Select **File Name** and enter the desired name using the Enter User String keyboard. Select **Enter**.
3. From the File Browser dialog box, select **OK**. The file is saved with the default .Rep extension. (When using the touch screen, the file is saved on the unit. When working from the Remote Control Application, the file is stored in the GalaxyNIC folder on the PC.)
4. The Print dialog box appears, which allows you to print the report. Select **Cancel** to close the Print dialog box.

Adding a Stream

A maximum of four Ethernet streams can be created and added to the Stream Control table.

To add a stream:

1. With the desired Port selected from the **GigE** tab, select **Packet**.
2. Select the **Set** tab from along the left-side of the Packet screen.
3. Select **Add Stream** from the Maintenance Functions box.

IMPORTANT: The Add Stream button is not available if the maximum allowed four Ethernet streams have already been added.

4. The Traffic Stream Profile window appears. Enter parameters for the Ethernet stream.
    - Payload - Sets the type of data used for the stream's payload.
    - MAC Src Address - Sets a 6-byte HEX value hardware MAC source (origination) address for generated traffic.
    - MAC Dest Address - Sets a 6-byte HEX value hardware MAC destination address.
    - IP Src Address - Sets the IP address of the frame's original sender using a dotted-decimal notation.
    - IP Dest Address - Sets the IP address of the frame's final destination using a dotted-decimal notation.
    - UDP Src Port - Sets the UDP source port.
    - UDP Dest Port - Sets a UDP destination port.
    - Frame Length - Sets the frame size in bytes.
    - Packet Rate - Sets the bandwidth percentage.
    - VLAN Tag - Enables VLAN tagging for the frame.
5. Select **Save**. The Ethernet stream appears in the Stream Control table.

Rearrange Stream Control Columns

The Stream Control table can be customized so that the parameters that are most important to you can appear first in the table. This reduces the need to scroll left and right through the table to view different statistics.

To rearrange the columns that appear in the Stream Control table:

1. From the **GigE** tab, select **Packet**.
2. Select **Set** from the tabs along the left-side of the Packet screen.
3. Select **Rearrange Columns**. The Rearrange Columns dialog box appears.
4. Select **Columns**. The Select Next Column dialog box appears.
5. Select the column that you want to appear first in the Stream Control table. It is added to the Column list.
6. Repeat Steps 4 and 5 to continue adding subsequent columns to the list; otherwise, continue to the next step.
7. Select one of the following:
    - **Apply** - Temporarily applies the changes to the Stream Control table. After a system reboot, the columns return to their default order.

- **Save** - Applies and saves changes to the Stream Control table. When the system reboots, the columns remain in the saved order.

8. The Stream Control table columns now appear in the selected order.

Transmitting a Stream

To start transmission of an Ethernet stream:

1. With the desired Port selected from the **GigE** tab, select **Packet**.
2. Select **Set** from the tabs along the left-side of the Packet screen.
3. Select the desired Ethernet stream by choosing one of the **Selections** buttons (1 through 4). The Stream ID # appears in the **Selected** box.
4. From **Transmit/Receive Functions** box, select **TX On/Off**. Selecting **All Tx Mode** turns all streams on. The TX State column of the stream table displays "On".

IMPORTANT: When Ethernet stream transmission is enabled, BERT mode is disabled.

To stop transmission of an Ethernet stream:

- Choose the Ethernet stream as described above and select **TX On/Off** or All Tx Mode. The TX State column of the stream table displays "Off".

WARNING: Do **not** turn off an Ethernet stream while an RFC 2544 test is active. Turning off a stream, while the test is in progress, will disrupt test results.

VLAN Tagging

To configure an Ethernet stream for VLAN tagging:

1. From the **GigE** tab, select Port. Choose **Port 3** or **Port 4**.
2. Select **Packet** and choose **Set** from the tabs along the left-side of the Packet screen.
3. Select the desired Ethernet stream by choosing one of the **Selections** buttons (1 through 4). The Stream ID # appears in the **Selected** box.
4. From Maintenance Functions, select **Add Stream** or **Edit Stream**.
5. The Traffic Stream Profile window appears.

6. Select **VLAN Tag** and choose **Yes**. The VLAN ID and VLAN QOS functions become available.
7. Select **VLAN ID** and enter an ID value to the frame.
8. Select **VLAN QOS** and enter a user priority value.
9. Select **Save**.
10. Select **TX ON** to enable just the one stream, or select **All Tx Mode** to enable all streams.

Insert Stream Errors

To determine if receiving equipment can detect an error on an incoming signal, you can configure the system to insert specific Frame Check Sequence (FCS) errors into an Ethernet stream.

To insert multiple errors:

1. With the desired Port selected from the **GigE** tab, select **Packet**.
2. Select **Set** from the tabs along the left-side of the Packet screen.
3. Select the desired Ethernet stream by choosing one of the **Selections** buttons (1 through 4). The Stream ID # appears in the **Selected** box.
4. From the **Transmit/Receive Functions** box, select **TX On/Off**. The TX State column of the stream table displays "On".

Selecting **All Tx Mode** turns all of the Ethernet streams on.

5. Select **Error Alarm** from the tabs along the left-side of the Packet screen and choose **Generate**.
6. Select **Error Type**. The Select Error Type dialog box appears.
7. Select the type of error you want to transmit.
8. Select **Error Rate**. The Select Error Rate to Insert dialog box appears.
9. Select an error rate. The test set starts transmitting errors when the error rate has been selected.

To stop error transmission:

1. From the **Ethernet** tab, select **Packet**.
2. Select **Error Alarm** from the tabs along the left-side of the Packet screen and choose **Error Rate**.
3. Select **OFF**.

To insert a single error:

1. With the desired Port selected from the **GigE** tab, select **Packet**.
2. Select **Set** from the tabs along the left-side of the Packet screen.

3. Select the desired Ethernet stream by choosing one of the **Selections** buttons (1 through 4). The Stream ID # appears in the **Selected** box.
4. From the **Transmit/Receive Functions** box, select **TX On/Off**. The TX State column of the stream table displays "On".

Selecting **All Tx Mode** turns all of the Ethernet streams on.

5. Select **Error Alarm** from the tabs along the left-side of the Packet screen and choose **Generate**.
6. Select **Error Type**. The Select Error Type dialog box appears.
7. Select the type of error you want to transmit.

IMPORTANT: DO NOT set an Error Rate when inserting a single error.

Select **Restart** from the Common Function buttons to clear any previously collected data.

8. Select the **Error Insert** Common Function Button at the bottom of the screen to inject the error.

View Error and Alarm Results

To view error or alarm results:

1. From the **GigE** tab, select **Packet**.
2. Select the **Error Alarm** tab along the left-side of the Packet screen.
3. Select **Errors** or **Alarms** from the Error Alarm screen.

Capture Packets

Use this screen to capture packets on a port. Up to 2047 packets can be held in the capture buffer. After capture, the packets can be filtered, based on a selected criteria, and viewed.

IMPORTANT: The Capture option does not appear unless the unit has been licensed for Capture functionality.

To capture packets:

1. With the desired Port selected from the **GigE** tab, select **Packet**.
2. Select **Capture** from the tabs along the left-side of the Packet Screen.
3. Select the **Capture** button. All packets coming through on the wire are captured and held in the buffer.
4. To view the contents of the captured packets:

- Use the **Select** button to enter the number of a specific packet.
- Use the **First**, **Prev**, **Next**, and **Last** buttons to scroll through the captured packet list.

Deleting a Stream

To delete a stream from the Stream Control table:

1. With the desired Port selected from the **GigE** tab, select **Packet**.
2. Select **Set** from the tabs along the left-side of the Packet screen.
3. Select the desired Ethernet stream by choosing one of the **Selections** buttons (1 through 4). The Stream ID # appears in the **Selected** box.
4. Select **Delete Stream**. A delete confirmation dialog box appears.
5. Select **Yes**. The stream is removed from the table.

RFC Test - Frame Loss Testing

This is an RFC 2544 benchmark test. Its purpose is to determine the number of frames lost by looping a stream through the network at varying transmit frame rates. The Frame Loss screen allows you to select a specific frame size to use in the Ethernet stream.

A Frame Loss test cannot be performed if a Throughput test is running.

The Frame Loss test starts by transmitting a stream at 1% bandwidth using a default frame size of 64 bytes. The total number of transmitted and received frame counts are displayed. If any frames are lost, then the percentage of lost frames is displayed in the Loss % column. After the Trial Duration time elapses, this process continues for 12% bandwidth, and continues over and over again, incrementing the bandwidth by 11% until the bandwidth reaches 100%.

Once this is completed, the frame size is increased to a default frame size of 128 bytes, and the test is repeated beginning at 1% and increasing in the same increments up to 100%. Subsequent tests are performed using default frame sizes of 256, 512, 1024, 1280, and 1518 bytes, or any user-defined sizes.

Before performing a throughput test, you can adjust the following parameters to fine-tune your test results:

- **Trial Duration –** which determines how long the test runs for each test attempt.
- **Frame Size Buttons** – Allows the user to change from the default Frame Size to a user defined Frame Size for the test.
- **Frame Size Checkboxes –** Selecting the Frame Size check box for a frame size enables it for the test.

Frame Loss Test Procedures:

1. After **configuring BERT**, select **Test** and choose **Frame Loss** from the tabs along the left-side of the Test screen.
2. The Dest MAC Address reflects the address configured in the BERT settings. If you want a different destination address, select **Dest MAC Address** and enter the 6-byte HEX address of the desired Ethernet stream.
3. Select **Trial Duration** and set the duration of the test.
4. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid are 10– 100.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 9. For example, if the BW
   Floor is set to 1, then the BW Ceiling must be set to 10, or greater.

5. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid are 1 – 91.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 9. For example, if the BW
   Floor is set to 1, then the BW Ceiling must be set to 10, or greater.
6. You can use standard frame sizes for the test or assign a user-defined frame size(s).

   To assign a user-defined frame size:

   a. Select a **frame size** button (for example, 64). A data calculator appears.
   b. Enter a new value and select **OK**. Value ranges are 64 - 9000.

   To return frame sizes to default settings:

   ▶ Select the **Restore to Standard** button.

To start the Frame Loss test:

1. From the **Test**, **Frame Loss** screen, select the frame size (rate) check boxes that you want included in the test.
2. Select **Activate**. Once the test begins, the button toggles to Deactivate.

   The unit transmits a stream at 10% of the maximum byte-size rate. When multiple frame sizes are selected, the transmission starts at the lowest size.

A status message appears at the bottom of the screen indicating the current frame size and stream rate that is being transmitted. For example, *Processing size 64 Rate 10.00.* When this completes, the number of frames transmitted and the number of frames received appears in the Frame Loss table. This process continues until 100% of the maximum byte-size rate is reached (at 10% increments).

After transmitting at 100%, the entire test is repeated using the next larger frame size, for example, 128, 256, 512, 1024, 1280, and 1518 bytes.

Do **not** Activate BERT or Packet streams while an RFC 2544 test is active. Turning on or off a stream, while the test is in progress, will disrupt test results.

3. To view results for a specific frame size after starting a test:

- Choose the **Select** button located next to the Frame Loss table and select a frame size. The Frame Loss table displays the transmit and receive statistics for the selected frame size.

OR

- Select the **First**, **Prev**, **Next**, or **Last** button to move through the frame sizes.

The status message that appears at the bottom of the screen always indicates which frame size and stream rate is currently being transmitted and not the report statistics selected.

To save and print frame test results:

1. Select **Print**. The File Browser window appears.
2. Enter a file name in the **File Name** box or select the File Name button to display a keyboard. The results are saved to a file using the .REP extension. (The file can be saved locally on the unit, or remotely on a PC if using the Remote Control Application software.)
3. Select **OK**. The Print dialog box appears.
4. To print the report, select the **Printer Name** and choose **OK**. Select **Cancel** if you do not want to print the report. Saved files can be printed later using the File Service's Print function located under the System tab.

RFC Test -Thru Put Testing

This is an RFC 2544 benchmark test that calculates your network's throughput rate. The fastest throughput speed is indicated by the rate at which the

transmission and reception of the Ethernet test stream is accomplished without packet loss.

A Throughput test cannot be performed if a Frame Loss test is running.

The Throughput test starts by transmitting a stream at 100% using a default frame size of 64 bytes. If it fails (i.e., an unacceptable number of frames are lost), the stream transmission rate falls back a certain percentage and is transmitted again. This process continues until the test passes without losing frames. The test then tries to zero in on the best throughput rate based on the Resolution Rate. The final rate appears as the Passing Rate.

Once this is completed, the frame size is increased to a default frame size of 128 bytes, and the test is repeated until a passing rate is achieved. Subsequent tests are performed using default frame sizes of 256, 512, 1024, 1280, and 1518 bytes, or any user-defined sizes.

Before performing a throughput test, you can adjust the following parameters to fine-tune your test results:

- **Trial Duration –** which determines how long the test runs for each test attempt.
- **Acceptable Lost Rate** – Defines the percentage of frames that can be lost without being considered a failure.
- **Resolution Rate –** Sets the level of precision for the test. The finer the resolution, the longer it takes to complete the test.

- **Frame Size Buttons** – Allows the user to change from the default Frame Size to a user defined Frame Size for the test.
- **On Checkboxes –** Selecting the On check box for a frame size enables it for the test.

Throughput Test Procedures:

1. After **configuring BERT**, select **Test** and choose **Thru Put** from the tabs along the left-side of the Test screen.
2. The Dest MAC Address reflects the address configured in the BERT settings. If you want a different destination address, select **Dest MAC Address** and enter the 6-byte HEX address of the desired Ethernet stream.
3. Select **Trial Duration** and set the duration of the test.
4. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid are 10– 100.

IMPORTANT: The minimum delta between the ceiling and floor setting is 9. For example, if the BW
Floor is set to 1, then the BW Ceiling must be set to 10, or greater.

5. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid are 1 – 91.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 9. For example, if the BW
   Floor is set to 1, then the BW Ceiling must be set to 10, or greater.

6. Select **Accept Lost Rate** and enter an acceptable packet loss rate ranging from 0% to 100%. This value serves as a threshold. The default rate is 0%, which means that even one lost packet is a failure.
7. Select **Resolution Rate**, and enter a value ranging from 1% to 100%. The lower the rate, the more precise the measurement. The default rate is 1%.

8. You can use standard frame sizes for the test or assign a user-defined frame size(s).

   To assign a user-defined frame size:

   a. Select a **frame size** button (for example, 64). A data calculator appears.
   b. Enter a new value and select **OK**. Value ranges are 64 - 9000.

   To return frame sizes to default settings:

   ▶ Select the **Restore to Standard** button.

To start the Throughput test:

1. From the **Test**, **Thru Put** screen select the **frame size** (rate) check boxes that you want included in the test.
2. Select **Activate**. Once the test begins, this button toggles to Deactivate.

   The unit transmits a test stream using the configured parameters, starting with the smallest frame size.

   The packets are looped through the network and returned to the unit. If no packet loss is reported, results are posted for the first frame size and the unit starts transmitting a stream containing packets for the next size byte frame. (For example, the first frame size transmitted is 64-bytes followed by 128-bytes and so on.)

If frame loss is detected in a byte transmission, the stream is retransmitted at a reduced rate. This process continues until results are within the Resolution Rate percentage.

Do **not** Activate BERT or Packet streams while an RFC 2544 test is active. Turning on or off a stream, while the test is in progress, will disrupt test results.

3. Throughput test results appear on the results table.

To save and print Throughput test results:

To save and thru put test results:

1. Select **Print**. The File Browser window appears.
2. Enter a file name in the **File Name** box or select the File Name button to display a keyboard. The results are saved to a file using the .REP extension. (The file can be saved locally on the unit, or remotely on a PC if using the Remote Control Application software.)
3. Select **OK**. The Print dialog box appears.
4. To print the report, select the **Printer Name** and choose **OK**. Select **Cancel** if you do not want to print the report. Saved files can be printed later using the File Service's Print function located under the System tab.

Measuring Service Disruption Activity

The system can measure service disruption switching intervals in your network by monitoring for a specific event, such as FCS errors, that cause a service disruption switch. When an event occurs, the duration is logged in milliseconds. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path. GigE service disruption tests show a granular accuracy of .1 ms (100 µs) .

To measure GigE service disruption activity:

1. Select Port and choose the port for the service disruption measurement.
2. With a BERT or Packet Stream active, select **BERT** and make sure Framing is set to **Framed**.
3. Select **Error Type** and choose **FCS**.
4. From **GigE** tab, select **Test** and choose **Service Disruption** from the tabs along the left-side of the Test screen.
5. Select Consecutive Good Time Required and enter a time interval ranging from 0.1 milliseconds to 409.0 milliseconds. This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.

6. Select **Consecutive Bad Time Required** and enter a time interval ranging from 0.1 milliseconds to 409.0 milliseconds. This function allows you to enter the time-duration (in milliseconds) of consecutive errored frames to elapse before Protection Switch measurements begin to accumulate.
7. From the **Action** box, select **State.** The Select APS Action dialog box appears.
8. Select **Single APS** or **Continuous APS** to begin measuring. The test set will begin monitoring the incoming signal for the event. If it occurs, the protection switch state and time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for consecutive good and bad time parameters.

A history of events is recorded in the History Recent Milliseconds box. The complete summary of event can be viewed by selecting the **System** tab and choose **Service Disruption**.

To stop monitoring Service Disruption measurement activity:

1. From the **GigE** tab, select **Port** and choose the desired port for measuring service disruption.
2. Select **Test** and choose **Service Disruption** from the tabs along the left-side of the Test screen.
3. From the **Action** box, select **State** and choose **Stop APS**.

Printing and Saving Reports

The Print Report button in the Common Row Functions allows the following reports to be printed or saved to file.

To Print just BERT Statistics, use the Print button on the BERT screen.

Statistics report provides:

- BERT analysis statistics including: BERT Settings, BERT Error Insertion, BERT TX/RX Frame Analysis, BERT Error Analysis, and BERT VLAN Frame Counts
- PACKET analysis statistics including: PACKET Error Analysis, PACKET Alarm Analysis, PACKET Counts, PACKET VLAN Frame Counts, and STREAM Settings/Results

Event report provides:

- Reports a detailed summary of events such as, start of test and end of test times, alarms, errors, and other Ethernet activity. This report includes the event, the number of events logged, the start and stop time of the event, and the duration of the event.

RFC Thru Put report provides:

- RFC Thru Put Test Settings and RFC Thru Put Test Results

RFC Frame Loss report provides:

- RFC Frame Loss Test Settings and RFC Frame Loss Test Results

Screen Functions and Description

GigE 10/100 Screen Functions and Descriptions Overview

This section describes the various screens and functions that control GigE 10/100 configuration and operation:

- BERT
- Packet
- Test
- Port
- LEDs

BERT

BERT Screens and Functions

The BERT screen contains the following functions:

- Test
- Event
- VLAN

BERT - Test

By design, bit errors that occur in an Ethernet frame are automatically discarded because of CRC detection. However, the unit's **BERT Test** provides a bit-error-rate tester that generates bit errors using PRBS or user-defined patterns within a frame. The unit can insert and monitor bit errors by looping this pattern through the network and back to the unit.

BERT mode can be configured to operate independently on each port.

Select Using BERT Test Mode for procedures to transmit and monitor a Bit error test.

The following appears on the BERT screen.

Function	Description
Mode	Configures Port 3 or Port 4 Ethernet Mode for either 10 Mbps or 100 Mbps, and either Full Duplex or Half Duplex.
Framing	Configures the bit stream to be unframed or encapsulated in an Ethernet frame of a fixed length. Select either **Unframed** or **Framed**.
Test Pattern	Selects and transmits a pattern. • PRBS • PRBS Inverted • User Defined. Allows a fixed, 32-bit user defined pattern to be created and transmitted. • Live. Live user data is transmitted and received instead of a pattern.
Frame Size (Bytes)	Allows setting frame size (64 to 9000 bytes). Important: Frame Size is not available unless Framing is set to Framed.
Packet Rate	Allows selection and %Bandwidth or Mbit/Sec setting for the packet rate. Important: Packet Rate is not available unless Framing is set to Framed.
Packet Header	Configures MAC and IP Source and Destination Addresses. Important: Packet Header is not available unless Framing is set to Framed.
IP Reflection	Allows start of IP Packet Reflection Mode for DLI Packets. Important: IP Reflection is not available unless Framing is set to

	Framed and BERT is active.
Error Type	Enables and disables bit error generation. Important: Error Type is not available unless Framing is set to Framed and BERT is active. Choose one of the following • **None** - No errors are generated and bit error transmission is turned off. • **BIT** - Bit errors are generated at a rate determined by the Error Rate function. • **FCS** - Frame check sequence errors are generated at a rate determined by the Error Rate function.
Error Rate	Sets a bit error insertion rate that ranges from **1e-3** to **1e-9**. Selecting **Off** turns error transmission off. Important: Error Rate is not available unless an Error Type is selected.
Auto Negotiate	Enable and disables auto-negotiation function. Important: Auto-negotiation is not available unless Framing is set to Framed, BERT is active, and TX is On.
Sent and Received Statistics Table	This table reports the number of bits and frames sent and received. Statistics in this table are cleared when the Restart button (located at the bottom of the screen) is selected.
Error Statistics Table	Reports the following received error statistics: • Error count using an 11-digit format • Errored seconds using an 8-

	digit format • Average error rate using an N.NNe-N format • Current error rate using an N.NNe-N format
Activate/Deactivate	Enables and disables BERT mode operation.
Start TX/Stop TX	Starts and stops TX Frame transmissions.
Print	Saves BERT test results to a file using the .REP extension, and prints the file to an attached printer. The file can be saved locally on the unit, or remotely on a PC if using the Remote Control Application software. If a printer is not attached, the file can be printed later using the File Services' Print function located under the System tab.

BERT - Event Log

The Event Log provides a detailed summary of Gigabit Ethernet alarm and error events that have occurred and have been recorded by the unit.

The events appear in a table that lists:

- The type of event.
- The number of times the event was logged.
- The start and stop time of the event.
- The duration of the event.

To use the Event Log:

1. Select **GigE**.
2. Select **BERT**.
3. Select **Event**. As events occur (such as alarms or errors) they appear and continuously scroll in the table.

   Events display in a ascending order from the most recent event to the oldest event. The Descending button indicates that events appear in

descending order. (This button switches between descending event order appearance and ascending event order appearance. The current label of the button indicates the event order.)

4. Select **Pause** to stop the scrolling action and then use the scroll bar to view events. Select **Resume** to restart the event log.

5. To display events in an ascending order, select **Descending**. The button changes to Ascending and the events appear from the oldest event to the most recent event.
6. Select **Resume** to continue Event Log reporting.

BERT - VLAN

GigE Port 3 and Port 4 allow VLAN tagging in both BERT Mode and Packet Mode. The VLAN screen, accessed from the BERT function, provides description and count information.

PACKET

Packet Screens and Functions

The Packet screen contains the following:

- SET
- Error Alarm
- Count
- Strm Rslt
- Capture

Packet - SET (Strm Ctrl)

The SET screen provides stream control and defines the Ethernet frame parameters that you create to generate a traffic flow, or stream, into the network. Use the SET screen to view, add, delete, edit, or transmit an Ethernet stream

The following functions appear on this screen.

Function	Description
Add Stream	Configures and saves a traffic stream. When selected, the Traffic Stream Profile dialog box appears, from which the stream parameters are set. A total of four streams can be saved for each port.
Edit Stream	Allows the user to edit an existing stream. By selecting a stream using a

	Selections button, the Traffic Stream Profile dialog box appears, from which a parameter can be edited and saved.
Delete Stream	Allows the user to delete an existing stream.
TX On/Off	Starts and stops the transmission of a selected stream. The status of the stream transmission is displayed in the TX State column of the Stream ID table.
All Tx Mode	Starts and stops the transmission of all streams. The status of the stream transmission is displayed in the TX State column of the Stream ID table.
Send Pause	Allows the user set a duration for pausing a stream transmission.
Selected	Displays the stream chosen using the Selections button.
Selections	Allows the user to elect a stream by choosing one of the Selections buttons (1 through 4). The Stream ID # appears in the Selected box.
Rearrange Columns	Adjusts the order in which traffic profile values appear in the Stream Control table. This allows you to customize the table so that the parameters that are most important to you can appear first in the table. This reduces the need to scroll left and right through the table to view different statistics.
Stream ID Table	Displays the traffic profiles for the current streams configured for the port. A total of four streams can be configured.
Error Statistics Table	Reports the following received Ethernet stream error statistics: • Error count using an 11-digit format • Errored seconds using an 8-digit format • Average error rate using an N.NNe-N format

	• Current error rate using an N.NNe-N format
Count Statistics Table	Reports the total number of frames and bytes transmitted and received by the selected Ethernet stream.

Packet - Error / Alarm

This function allows you to transmit GigE errors to simulate various defects and anomalies. One reason for transmitting these defects is to determine if the receiving equipment can detect an error in the incoming signal.

This function also allows you to monitor GigE Errors and Alarms being received.

The following options are available from the Errors and Alarms screen:

Generate	**Description**
Error Type	Determines the type of error transmitted by the unit. The purpose of generating an error with the unit is to stress the network element that is receiving the error by testing if it can detect the incoming error and then report error statistics such as error counts and rates. Select one of the following: • **None** - Clears previous error selections. • **Invalid CRC (FCS Error)** - Generates a Frame Check Sequence error. The unit sends an invalid FCS to an end system. This can be used to verify that an end system can detect such an error. • I**nvalid IP Checksum Error** - Generates an IP header checksum error. The unit sends an invalid IP checksum value to an end system.
Error Rate	This function sets the error rate for the selected error. (The **Error Type**

	function determines the type of error transmitted.) The system starts transmitting errors after the insertion rate is selected. Select one of the following: • **Off** - Turns error transmission off. • **1e -<*X*>** - X is a value from 3 to 5; for example, 1e-3 through 1e-5. X will vary based on the type of error selected.

Errors

The unit can monitor and report a detailed analysis of errors on the incoming signal. The errors reported are a result of:

- Incoming errors that are generated by other devices in the network, or
- Errors being intentionally generated by the unit when it is used in a loopback environment

The following errors can be monitored:

- **Invalid CRC.**
- **Invalid IP Checksum.** An invalid IP can be caused by an error introduced in the packet by a network router or bridge.
- **Fragment Frames.** Indicates that the unit has received an undersized frame with a bad CRC checksum.
- **Undersized Frames.** Indicates that the unit has received a frame that is smaller than 64 bytes (an undersized frame) with a good CRC checksum.
- **Oversized Frames.** Indicates that the unit has received an extended (jumbo) frame that is larger than 1518 bytes.

The following parameters (statistics) are measured for these incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format

Alarms

The unit can monitor and report alarms and durations on the incoming signal. An alarm's duration appears in seconds.

The following alarms can be monitored:

- LOS (Loss of Signal)
- Link (Link State)

Packet - Count

The Count screen displays the following Packet statistics and VLAN statistics:

Packets Count	Description
Transmitted Packets	Reports the total number of frames sent.
Received Packets	Reports the total number of frames received.
Received Jumbo Frames	Reports the total number of frames received, whose payload is greater than 1500 bytes.
Transmitted Bytes	Reports the total number of bytes sent.
Received Bytes	Reports the total number of bytes received.
Pause Packets Received	Reports the total number of Pause frames received. A pause occurs when the Pause frame's time parameter is a non-zero value.
Pause Quantas Taken	Reports the total number of quantas received. A quanta is a 512-bit timing increment used by a Pause frame. The number of quanta (N x 512-bits) indicate the duration of the pause.
Pause End Packets	Reports the number of times that a Pause condition ended allowing data transmission to resume. The pause condition ends when the Pause frame's time parameter is set to 0.
IP Packets	Reports the total number of IP

	packets received.
ICMP Packets	Reports the total number of ICMP packets received.
TCP Packets	Reports the total number of TCP packets received.
UDP Packets	Reports the total number of UDP packets received.
IGMP Packets	Reports the total number of IGMP packets received.
BGP Packets	Reports the total number of BGP packets received.
OSPF Packets	Reports the total number of OSPF packets received.

VLAN Count	**Description**
VLAN Tagged Frames	Reports the total number of frames received that are identified as VLAN frames. The 4-byte VLAN tag is inserted in the Ethernet frame between the Source MAC Address field and the Length/Type field.
Quality of Service Entry # 0 – 7	Reports the number of frames received for each user priority level value. A total of 8 different counters appear in the table.

Packet - Strm Rslt

The Stream Results screen displays statistics for a selected incoming Ethernet stream.

You can scroll to different stream results by selecting the **First**, **Prev**, **Next**, or **Last** buttons located at the bottom of the screen.

The following results appear on the Stream Results screen:

Stream Results	Description
Packets Transmitted	Indicates the number of packets transmitted by the selected stream.
Bytes Transmitted	Indicates the number of bytes transmitted and the bandwidth percentage used by the selected stream.
Packets Received	Indicates the total number of packets received by the selected stream.
Bytes Received	Indicates the total number of bytes received and the bandwidth percentage used by the selected stream.
VLAN Tagged Frames	Indicates the total number of VLAN tagged frames received in the selected stream.
Out of Sequence Packets	Indicates the number of out-of-sequence packets received. Each sent packet is marked with a sequence number. One is added to this count when a packet arrives that has a sequence number different than one plus the sequence number of the previous packet.
CRC Errors	Indicates the total number of CRC checksum errors received in the selected stream.
Lost Frames	Indicates the total number of frames lost by the selected stream.
UDP/TCP Checksum Errors	Indicates the total number of UDP or TCP checksum errors received in the selected stream.

Packet - Capture

IMPORTANT: The Capture option does not appear unless the unit has been licensed for Capture functionality.

The Capture screen allows you to capture packets on the port. (Up to 2047 packets can be held in the capture buffer.)

Select the **Capture** button to initiate the process. After capturing, you can locate a specific packet by choosing the **Select** button and entering the packet number, or scroll through the packets using the **First**, **Prev**, **Next**, **Last** buttons

Select **Capture Packets** for capture procedures.

The captures results include the following:

Capture Results	Description
MAC Source Address Mask:	Enters a 6-byte, hardware source address in Hex notation. When selected, a keypad appears that allows you to enter the address. The last four fields can be filled with a wild card, or variable, to broaden the filter. When a variable is entered, all fields to the right automatically use a variable value. For example, if a variable is entered in position 3, then positions 4, 5, and 6 are filled with variables – 0a-44-**-**-**-**.
MAC Dest Address Mask:	Enters a 6-byte, hardware destination address in Hex notation. Variable values can be entered in the last four fields of the address.
IP Source Address Mask:	Enters the source IP address using dotted-decimal notation. When selected, a keypad appears that allows you to enter the address. The last three fields can be filled with variables to broaden the filter. When a variable is entered, all fields to the right automatically use a variable value. For example, if a variable is entered in position 2, then positions 3 and 4 are filled with variables – 10.*.*.*.
IP Destination Address Mask:	Enter the destination IP address using dotted-decimal notation. Variable values can be entered in the last three fields of the address.
Frame Size:	Selects one of the following frame sizes: 64, 128, 256, 512, 1024, 1280, and 1518 bytes.
VLAN Tag:	Enables Virtual LAN tagging detection.

QoS Level:	Enables Quality of Service detection.

TEST & RFC 2544
Test Screens and Functions

The Test screen configures test parameters associated with the protocol processor.

The Test screen contains the following functions:

- Set 1
- Thru Put (RFC 2544 Test)
- Frame Loss (RFC 2544 Test)
- Service Disrptn

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Thru Put

Select **Throughput Testing** for additional information describing how to use the unit's RFC 2544 functions.

The RFC 2544 Throughput and Latency benchmark tests can be performed using the functions that appear on the Test Thru Put screen. For test procedures, select Throughput Testing.

The following options appear on the Thru Put screen:

Option	Description
Dest Mac Address	The Dest MAC Address reflects the address configured in the BERT settings. If you want a different destination address, select **Dest MAC Address** and enter the 6-byte HEX address of the desired Ethernet stream.
Trial Duration	Determines how long the test runs for each frame size. This duration is used each time the test fails. The default is 240 seconds.
BW Ceiling	Sets the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 2 – 100.
BW Floor	Sets the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1 – 99.
Activate/Deactivate	This button starts and stops the test. It toggles between Activate (when a test is not running) and Deactivate (when a test is running).
Print	Saves Throughput test results to a file using the .REP extension, and prints the file to an attached printer. The file can be saved locally on the unit, or remotely on a PC if using the Remote Control Application software. If a printer is not attached, the file can be printed later using the File Services' Print function located under the System tab.
Restore to Standard	Returns frame sizes to default settings.
Acceptable Loss Rate	Sets a packet loss rate threshold. The test fails if packet loss exceeds this value. The default is 0%, which means that even one lost packet is a failure.

Resolution Rate	Sets a level of precision for the test. The default resolution is 1%. The finer the resolution (for example, 1%), the longer it takes to complete the test. Likewise, the less precise the test (for example, 10%), the faster, yet less accurate, the test completes.
On Column	Selecting the On check box for a frame size enables it for the test.
Size Column	Allows the user to change from the default Frame Size to a user defined Frame Size for the test.
Rate Column	Reports the passing rate (percentage) for the specific packet size.
Tx Packets	Reports the number of packets transmitted in the stream for the specific frame size.
Rx Packets	Reports the number of packets received by the unit.
Latency Columns (Minimum, Maximum, and Average in milliseconds)	Reports how long it takes for the test frames to traverse the network and return to the unit. The values that appear are in milliseconds. If the unit is looped on itself, the latency may appear as 0 ms.

Test - Frame Loss

This is an RFC 2544 benchmark test. Its purpose is to determine the number of frames lost by looping a stream (with a specified frame size) through the network at varying transmit frame rates. Select Frame Loss Testing for test procedures.

The following appears on the RFC 2544 Frame Loss screen:

Screen Functions	**Description**
Dest Mac Address	The Dest MAC Address reflects the address configured in the BERT settings. If you want a different destination address, select **Dest MAC Address** and enter the 6-byte

	HEX address of the desired Ethernet stream.
Trial Duration	Determines how long the test runs for each frame size. This duration is used each time the test fails. The default value is 240 seconds.
BW Ceiling	Sets the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 10 – 100. IMPORTANT: The minimum delta between the ceiling and floor setting is 9. For example, if the BW Floor is set to 1, then the BW Ceiling must be set to 10, or greater.
BW Floor	Sets the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1 – 91. IMPORTANT: The minimum delta between the ceiling and floor setting is 9. For example, if the BW Floor is set to 1, then the BW Ceiling must be set to 10, or greater.
Activate/Deactivate	Starts and stops the test. It toggles between Activate (when a test is not running) and Deactivate (when a test is running).
Print	Saves Frame Loss test results to a file using the .REP extension, and prints the file to an attached printer. The file can be saved locally on the unit, or remotely on a PC if using the Remote Control Application software. If a printer is not attached, the file can be printed later using the File Services' Print function located under the System tab.
Restore to Standard	Returns frame sizes to default settings.
Frame Size Buttons	Allows the user to change from the default Frame Size to a user defined

	Frame Size for the test.
Frame Size Checkboxes	Selecting the Frame Size check box for a frame size enables it for the test.
Select	Allows selection of a specific frame size for viewing its results after a test.
First, Prev, Next, Last	Allows scrolling through frame sizes for viewing their results after a test.
Rate % Column	Indicates the percentage of bandwidth transmitted.
Transmit Frames Column	Reports the total number of frames transmitted.
Receive Frames Column	Reports the total number of frames received.

Test - Service Disruption

The unit can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The GigE service disruption tests show a granular accuracy of .1 ms (100 µs).

Test Service Disruption functions include:

- **Consecutive Good Time Required**: This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The range is 0.1 to 409.0 milliseconds and is entered using a keypad.
- **Consecutive Bad Time Required**: This function allows you to enter the time-duration (in milliseconds) of consecutive errored frames to elapse before Protection Switch measurements begin to accumulate. The range is 0.1 to 409.0 milliseconds and is entered using a keypad.
- **State**: Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

- **Single APS**: Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

- **Continuous APS**: Constantly monitors for service disruption events, and updates the seconds and frames reported.

- **Stop APS:** Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)**: Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.

For more information about monitoring service disruption activity, select *Measuring Service Disruption Activity* in the Common Tasks section of the online help.

GigE Port Screens and Functions

The GigE board comes in two varieties, 2 Ports or 4 Ports.

The **2-Port** variety only came with:

- Two Gigabit Ethernet optical ports. See Ports 1 and 2 below.

The **4-Port** variety came with:

- Two Gigabit Ethernet optical ports. See Ports 1 and 2 below.
- Two 10/100 Mbps ports. See Ports 3 and 4 below.

To select a port to configure or monitor:

1. From the Ethernet tab, select the **Port <#>** button.
2. Depending on your configuration, the following options may appear in the Port menu:

   - **Port 1 GigE** - 1GigE Optical port. Indicates that Port 1 is selected. Functions that appear on the screen, control and configure Port 1 operations.
   - **Port 2 GigE** - 1GigE Optical port. Indicates that Port 2 is selected. Functions that appear on the screen, control and configure Port 2 operations.
   - **Port 3 10/100** - 10/100 Mbps RJ-45 port. Indicates that Port 3 is selected. Functions that appear on the screen, control and configure Port 3 operations.

- **Port 4 10/100** - 10/100 Mbps RJ-45 port. Indicates that Port 4 is selected. Functions that appear on the screen, control and configure Port 4 operations.

Each port that works independently from each other

GigE LED Quick Status Area

When the Ethernet tab is selected, the following appears in the LEDs/Quick Status Area.

LED/Quick Status	Description
E/A:	Error/Alarm Indicator. Indicates the type of error inserted and/or alarm generated.
FCS ERR	Frame Check Sequence. Flashes red when an FCS error occurs.
LOS	Loss of Signal. When red, indicates that a valid signal is not being received. If an all zeros pattern exists for 100 milliseconds or longer on the incoming signal, then an LOS is reported. This is an alarm LED.
Collision	Indicates a collision was detected. Collisions are only monitored when Port 3 or Port are set to either 10 or 100 Half Duplex.
Link State	Indicates the port's connection status. If green, the port is receiving a valid signal.
Code Err	Indicates an error (an invalid 10B code) was detected on the incoming Ethernet stream.
Pat Sync	Indicates a loss of pattern synchronization. This is an alarm LED.
BIT Err	Indicates that BERT mode detected a BIT error.

HDEnet Tab

High-Density Ethernet (HDEnet) Overview

The High-Density Ethernet (HDEnet) enables users to perform high-speed packet-level testing, **RFC-2544 (throughput**, **frame loss**, **latency**, and **Back to Back Burst)** testing, **Service Disruption testing**, and **1Gbps / 2Gbps Fibre Channel** testing.

The HDEnet circuit pack can be fully equipped with four full-duplex SFP optical ports, eight full or half-duplex RJ-45 electrical ports, and one full-duplex XFP optical 10 Gbps port.

Each port is fully independent and can be configured for four independent streams of traffic generation and analysis.

The following High-Density Ethernet related topics are discussed in this section of the online help system:

- **Ethernet** - Specific Tasks Overview
- **Ethernet** - Screens Functions and Descriptions
- **Fibre Channel** - Specific Tasks Overview
- **Fibre Channel** - Screen Functions and Descriptions

Ethernet - Specific Tasks

High-Density Ethernet (HDEnet) Specific Tasks Overview

This section includes tasks that are specific to the HDEnet protocol processor. For a list of general tasks, see Common Tasks located in the Getting Started section.

For a description of specific screens and their functionality, refer to High-Density Ethernet Screen Functions and Descriptions.

Please use the **Contents** tab and window (left side of the Help screen) to select, open, and view Specific Tasks for this protocol processor.

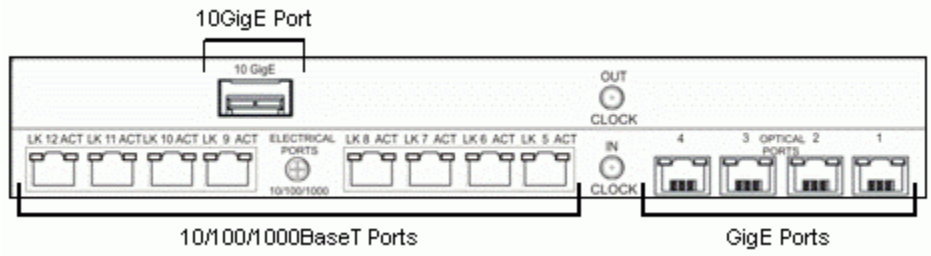
- HDEnet - Connector Panel
- Selecting a Port
- Configuring Packet Streams

- Enabling VLAN Tagging
- Initiating Auto Negotiation
- Transmitting Packet Streams
- Inserting a Pause in a Stream
- Inserting Errors and Alarms
- Viewing Error and Alarm Results
- Measuring Service Disruption
- PING Functionality
- Configuring an RFC-2544 Test
- RFC-2544 - Throughput Testing
- RFC-2544 - Frame Loss Testing
- RFC-2544 - B2B Burst Testing
- Timed Test Using Acceptance Criteria
- Saving and Printing Statistics and Port Settings

High-Density Ethernet - Connector Panel

The High-Density Ethernet circuit pack contains twelve fully independent ports and one optional port. Each port provides four independently configurable traffic generation and analysis streams.

- Four 1-Gbps full-duplex optical ports. These ports accept SFP optical transceiver modules.
- Eight 10/100/1000 Mbps full or half-duplex electrical ports.
- One optional 10 Gbps full-duplex optical port. The 10 Gbps port is only available for NIC test sets that have the High-Density Ethernet module. This port accepts XFP optical transceiver modules.



Optical Connectors

Ports 1 through 4 are 1 Gbps optical SFP ports that use LC connectors, as does the optional 10 Gbps optical XFP port.

Note that the SFP/XFP wavelength value displayed on the NIC screen is derived from the SFP/XFP module as programmed by the device vendor.

Electrical Connectors

Ports 5 through 12 are 10/100/1000 Mbps electrical ports that use RJ-45 8-pin connectors.

Port numbering is from right to left and not labeled physically across the entire panel. Port numbering also varies with each unit's licensing and configuration. For example, in a fully configured unit, port positions are ports 1-4 for 1 Gbps, ports 5-12 for 10/100/1000 Mbps, and port 13 for 10 Gbps. On a unit that is configured without 1 Gbps ports, ports 1-8 are for 10/100/1000 Mbps and port 9 is for 10 Gbps. Port numbering is correctly reflected in the Select Port dialog display, which is accessible by selecting the Port *n* tab.

Selecting a Port

The High-Density Ethernet circuit pack contains 12 connection ports that operate independently. For NIC test sets equipped with the 10G Ethernet module, there are 13 connection ports.

- Four 1 Gbps optical ports - ports 1 through 4. (SFP's)
- Eight 10/100/1000 Mbps electrical ports - ports 5-12. (RJ-45's)
- One Optional 10 Gpbs optical port - Port 13. (XFP)

To select a port to configure or monitor:

1. From the **HD Enet** tab, select the **Port** <#> button.
2. Choose the desired port.

Any subsequent configurations made to the GigE unit apply to the selected port. For example, if Port 3 is selected then all configurations, testing, and results pertain to Port 3.

The following ports are available:

- Port 1 GigE - (1 Gbps optical port / full duplex)
- Port 2 GigE - (1 Gbps optical port / full duplex)
- Port 3 GigE - (1 Gbps optical port / full duplex)
- Port 4 GigE - (1 Gbps optical port / full duplex)

- Port 5 10/100/1000 - (10/100/1000 Mbps electrical port / configurable as full or half duplex)
- Port 6 10/100/1000 - (10/100/1000 Mbps electrical port / configurable as full or half duplex)
- Port 7 10/100/1000 - (10/100/1000 Mbps electrical port / configurable as full or half duplex)
- Port 8 10/100/1000 - (10/100/1000 Mbps electrical port / configurable as full or half duplex)
- Port 9 10/100/1000 - (10/100/1000 Mbps electrical port / configurable as full or half duplex)
- Port 10 10/100/1000 - (10/100/1000 Mbps electrical port / configurable as full or half duplex)
- Port 11 10/100/1000 - (10/100/1000 Mbps electrical port / configurable as full or half duplex)
- Port 12 10/100/1000 - (10/100/1000 Mbps electrical port / configurable as full or half duplex)
- Port 13 10 GigE (optional 10 Gpbs optical port / full duplex)

Port numbering is from right to left and not labeled physically across the entire panel. Port numbering also varies with each unit's licensing and configuration. For example, in a fully configured unit, port positions are ports 1-4 for 1 Gpbs, ports 5-12 for 10/100/1000 Mbps, and port 13 for 10 Gbps. On a unit that is configured without 1 Gpbs ports, ports 1-8 are for 10/100/1000 Mbps and port 9 is for 10 Gbps. Port numbering is correctly reflected in the Select Port dialog display, which is accessible by selecting the Port *n* tab

Configuring Packet Streams

The Stream Control screen provides the tools required to configure or edit any or all of the four packet streams.

To configure a packet stream:

1. Select the **HD Enet** tab, select a **Port** and point to the desired port link speed and duplex mode.
2. Select **Config** and choose **Set**.
3. Select a stream (1, 2, 3, or 4) from the Stream Profile table. The Traffic Stream Profile table appears.
4. From the Traffic Stream Profile table, set the parameters for the packet stream.
5. Select **Save**. The stream configuration parameters display in the Stream Profile table.

Use the vertical scroll bar at the bottom of the Stream Profile table to view hidden columns.

To use the **Order Columns** feature :

1. Select the **Columns** button, to display the **Rearrange Columns** dialog box.
2. In the **Rearrange Columns** dialog box, select the **Columns** button to display the **Select Next Column** dialog box.
3. In the **Select Next Column** dialog box, select a button for the associated description to appear in the top row of the display. The **Select Next Column** dialog box disappears and your selection appears in the top row of **Rearrange Columns** dialog box display window.
4. Again, in the **Rearrange Columns** dialog box, select the **Columns** button to redisplay the **Select Next Column** dialog box.
5. In the **Select Next Column** dialog box, select another button for the associated description to appear in order immediately following the previous row entry. The **Select Next Column** dialog box again disappears.
6. Repeat Steps 4 and 5 to select the chosen order for all remaining entries in the **Select Next Column** dialog box.
7. There are two choices for submitting the selected column display order: (1) Selecting the **Apply** button retains the column display order settings until the next time the unit's power is cycled; (2) Selecting the **Save** button retains the column display order settings indefinitely.

The **Columns** settings entered locally on the touch screen panel and those entered via a remote connection are completely independent of each other. The remote settings are saved on the remotely connected PC, while the local settings are saved in the unit. The **Clear** button can be used to clear the entries in the **Rearrange Columns** dialog box display window, should you want to rearrange the existing order in the display window. The **Cancel** button can be used to cancel out of the operation without changing the existing column display order. Clicking on the **Apply** button when no items are listed in the display window will set up the default columns display order.

Enabling VLAN Tagging

Enabling VLAN tagging allows the user to create a 4-byte VLAN identifier value to be inserted into the packet stream.

To enable VLAN tagging:

1. Select **Config** and choose **Set**.
2. From the **Stream Profile** table, select the packet stream (**1**, **2**, **3**, or **4**) that you want to enable VLAN tagging on. The Traffic Stream Profile dialog box appears.
3. From the Traffic Stream Profile dialog box, select **VLAN Tag** and choose **Yes**.
4. Select **VLAN ID** and enter an ID value to the stream.
5. Select **VLAN QOS** and enter a user priority value.
6. Select **Save**.

Initiating Auto Negotiation

Negotiation is an Ethernet handshaking mechanism that looks at the incoming signal and determines the link speed and duplex mode (full-duplex or half-duplex). The Negotiate button enables or disables negotiation mode.

When auto negotiation is first enabled, it attempts to negotiate the link with a remote device. After successful negotiation, negotiation will not be performed again unless the remote device initiates an auto negotiation sequence.

By disabling auto negotiation, the test set can simulate older Ethernet equipment that does not support auto negotiation logic.

Negotiate is only available for Optical Ethernet ports.

To enable auto negotiation:

1. Select the **HD Enet** tab, choose **Port** and point to the desired port link speed and duplex mode.
2. Select **Config** and choose **Set**.
3. Select **Negotiate** and choose **Enabled**.

    - When first enabled, the Status displays "Enabled". Upon successful negotiation with a remote device, the Status displays the negotiated Interface Rate and Duplex mode.

To disable auto negotiation:

1. From the **HD Enet** tab.
2. Select **Config** and choose **Set**.
3. Select **Negotiate** and choose **Disable**.
    - When disabled, the Status displays "Disabled".

Transmitting Packet Streams

The Config > Set (Stream Control) screen provides the tools required to transmit all streams or specific streams. Up to four streams can be transmitted for each port. The Ethernet ports are independent and can transmit the streams simultaneously. For example, you can choose Port 3 and start stream transmission, then choose Port 7 and start stream transmission and so on.

To start transmission of all packet streams:

1. Select the **HD Enet** tab, choose a **Port**.
2. Select **Config** and choose **Set**.
3. Select **Tx Mode** to turn all streams On or Off.

> Important: "Tx Mode" and individual stream TX on/off buttons are not available when IP Reflection is enabled.

4. The stream transmission status displays in the TX State column of the Stream Profile table.
5. Packets begin or stop transmitting as soon as the Tx Mode is selected. Count statistics continually increment in the Count Statistics table while the streams are active.

To start transmission of specific packet streams:

1. Select the **HD Enet** tab, choose a **Port**.
2. Select **Config** and choose **Set**.
3. From the **Stream Profile** table, select the packet stream (**1**, **2**, **3**, or **4**) that you want to transmit. The Traffic Stream Profile dialog box appears.
4. From the Traffic Stream Profile dialog box, select **TX Enable** to turn the stream On or Off.
5. Select **Save**. The Traffic Stream Profile dialog box closes and the stream transmission status displays in the TX State column of the Stream Profile table.
6. The packet begins or stops transmitting as soon as the TX Enable command is saved. Count statistics continually increment in the Count Statistics table while the stream is active.

Inserting a Pause into a Stream

Pausing frames is a means of flow control that specifies how long the transmitting device should remain quite. The flow control gives limited ability to regulate a (high bandwidth) source by sending pause frames to the source. Inserting a pause into a stream causes the source to stop sending frames for a specified amount of time, allowing the (low bandwidth) receiver to catch up and process queued frames.

To start insert a pause in a packet stream:

1. Select **Config** and choose **Set**.
2. Select **Pause**. The Enter Pause Quanta keypad appears.

Important: Pause is not available when **IP Reflection** is enabled.

Important: **Flow Control** must be enabled in order to count received Pause Packets.

4. Enter a pause value and select **OK**. Valid pause values are 0-65535.

Inserting Errors and Alarms

To determine if receiving equipment can detect an error on an incoming signal, you can configure the system to insert specific errors and alarms into an Ethernet stream.

Note that error insertion is disabled when in IP Reflection Mode.

To insert multiple errors:

1. Select the **HD Enet** tab, choose **Port** and point to the desired port link speed and duplex mode.
2. Select **Config** and choose **Set**.
3. From the **Stream Profile** table, select the packet stream (**1**, **2**, **3**, or **4**) that you want to inject errors into. The Traffic Stream Profile dialog box appears.
4. Select **TX Enable** to turn the transmission status **On** and choose **Save**.
5. Select **Error / Alarm** from the tabs along the left side of the Config Screen.
6. Select **Error Type** and choose an error type from the Select Error Type dialog box.
7. Select **Error Rate** and choose an error rate from the Select Error Rate to Insert dialog box.
8. Errors immediately start injecting into the packet stream when the error rate is selected.
9. View various result statistics by selecting the **Results** function.

To stop error transmission select **Error Rate** and choose **Off**.

To insert a single error:

1. Select the **HD Enet** tab, choose **Port** and point to the desired port link speed and duplex mode.

> Important: Traffic generation on at least one stream must be enabled to inject errors.

2. Select **Error / Alarm** from the tabs along the left side of the Config Screen.
3. Select **Error Type** and choose an error type from the Select Error Type dialog box.

> Important: DO NOT set an Error Rate when inserting a single error.

4. If you want to clear any previously collected data, select **Restart** from the common function button at the bottom of the screen before inserting the error.
5. Select the **Error Insert** common function button at the bottom of the screen.
6. View various result statistics by selecting the **Results** function.

To insert an Alarm:

1. Select the **HD Enet** tab, choose **Port** and point to the desired port link speed and duplex mode.

> Important: Traffic generation on at least one stream must be enabled to inject errors.

2. Select **Error Alarm** from the tabs along the left side of the Config Screen.
3. Select **Alarm Generated** and choose an alarm type from the Select Alarm dialog box.

> Important: Once an alarm is selected, then alarm will continuously insert until turned off.

4. If you want to clear any previously collected data, select **Restart** from the common function button at the bottom of the screen before inserting the error.
5. View various result statistics by selecting the **Results** function.

Viewing Error and Alarm Results

After inserting error and alarms into a packet stream the receiving equipment detects the event and reports it. The Results screen provides different result reports.

To view error or alarm results:

1. From the **HD Enet** tab, select **Results**.
2. Select one of the following:
    - Scan - Displays a list of errors and alarms along with their count and duration.
    - Err - Displays a list of errors along with their count, errored seconds, average and current rates.
    - Alarm - Displays a list of alarms along with the number of seconds spent in the alarm condition.
    - Count - Displays Packet and VLAN statistics.
    - Strm Rslt - Displays Stream ID specific statistics.
    - Event - Displays a summary of error alarm activity.
    - Large LED - Displays easy to read LEDs of error alarm activity.

Measuring Service Disruption

The system can measure service disruption switching intervals in your network by monitoring for a specific event, such as FCS errors, that cause a service disruption switch. When an event occurs, the duration is logged in milliseconds. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The Ethernet service disruption tests show a granularity accuracy of 0.1 ms (100 µs).

To measure Ethernet service disruption activity:

1. Select the **Test** tab and choose **Service Disrptn** from the tabs along the left-side of the screen.
2. Select **Consecutive Good Time Required** and enter a time interval ranging from 10 milliseconds to 1638.3 milliseconds. This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.
3. Select **Consecutive Bad Time Required** and enter a time interval ranging from 0.1 milliseconds to 1638.3 milliseconds. This function allows you to enter the time-duration (in milliseconds) of consecutive errored frames to elapse before Protection Switch measurements begin to accumulate.
4. From the **Action** box, select **State**. The Select APS Action dialog box appears.
5. Select **Single APS** or **Continuous APS** to begin measuring. The test set will begin monitoring the incoming signal for the event. If it occurs, the

protection switch state and time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for consecutive good and bad time parameters.

6. In the **Protection Switch Time (MilliSecs)** table, view the duration, in seconds, that it took for the service disruption to occur.
7. In the History Recent MilliSeconds table, view a history of events. The complete summary of events can be viewed by selecting the **System** tab and choosing **Service Disruption**.

To stop monitoring Service Disruption measurement activity:

1. Select the **Test** tab and choose **Service Disrptn** from the tabs along the left-side of the screen.
2. From the **Action** box, select **State** and choose **Stop APS**.

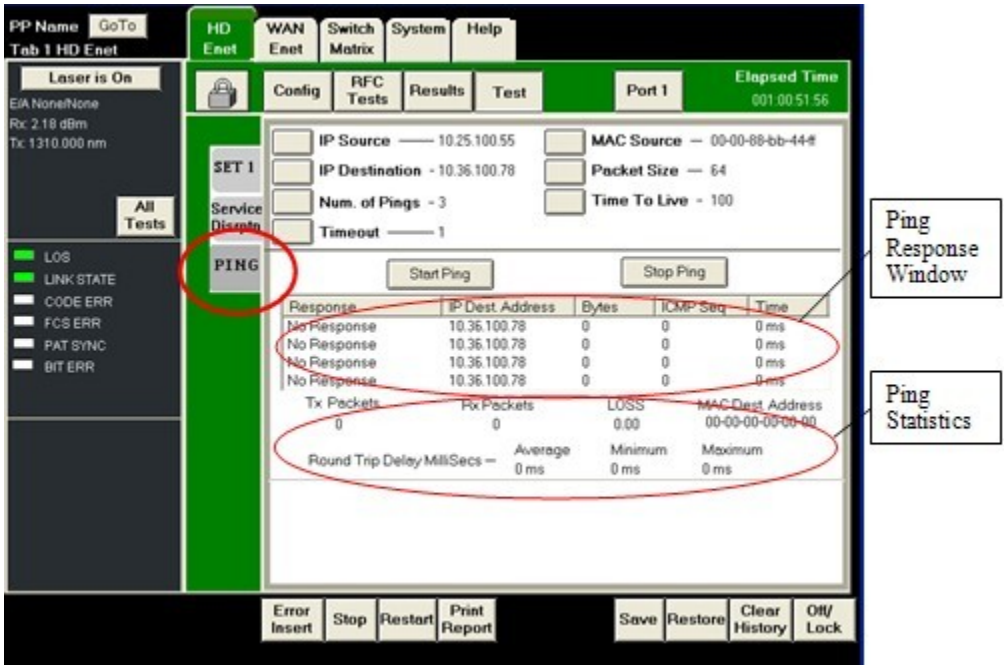
PING Functionality

PING is a utility used to determine whether a specific IP address is accessible. It works by sending a packet to the specified address and waits for a reply. PING is used primarily to troubleshoot Internet connections.

A PING packet is an IP packet requesting that a copy of the contents be echoed back to the sender. This packet type is called an ICMP Echo Request. When a site is “pinged”, an echo request is sent, and the destination site that receives it responds back. The response packet is called an ICMP Echo Reply.

The Ping utility is essentially a system administrator's tool that is used to see if a computer is operating and also to see if network connections are intact. Ping uses the Internet Control Message Protocol (ICMP) Echo function which is detailed in RFC 792.

The PING screen selection is implemented under the Test Tab.



Configuring an RFC-2544 Test

RFC 2544 benchmark tests provides a specific set of tests that can be used to measure and report the performance characteristics of network devices. Test results provide data used to evaluate these devices. The steps below provide preliminary stream configuration instructions.

Note that if the Flow Control box is checked (Rx Enabled), it will automatically default to unchecked when an RFC test is activated. This is to ensure test validity and accuracy.

To configure the an RFC test:

1. Select **RFC Tests** and choose **Conf**.
2. Select **Stream ID** and choose the packet stream (**1**, **2**, **3**, or **4**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.
4. Select **Dest Port** and choose the port that will receive the test signal.

   Note that if a port is in IP Reflection Mode, or is already in an active RFC test, this setting will be unavailable.

5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100.

IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.
7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

   To assign a user-defined frame size:

   a. Select a **Packet Size** button (for example, 64). A keypad appears.
   b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
   c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.

8. Select the type of RFC test that you wish to run by choosing its tab from along the left side of the RFC Tests screen. Complete any necessary configurations these tabs.

   - To run a **Thru Put** test see **Throughput Testing**
   - To run a **Frame Loss** test see **Frame Loss Testing**
   - To run a **B2B Burst** test see **Back-to-Back Burst Testing**

RFC-2544 - Throughput Testing

Throughput testing is an RFC 2544 benchmark test that calculates your network's throughput rate. The fastest throughput speed is indicated by the rate at which the transmission and reception of the Ethernet test stream is accomplished without packet loss.

For example, the Throughput test starts by transmitting a stream at 100% using a packet size of 64 bytes. If it fails (i.e., an unacceptable number of packets are lost), the stream transmission rate falls back a certain percentage and is transmitted again. This process continues until the test passes without losing packets. The test then tries to zero in on the best throughput rate based on the Resolution Rate. he final rate appears as the Passing Rate.

Once this is completed, the packet size is increased to 128 bytes, and the test is repeated until a passing rate is achieved. Subsequent tests are performed using

default packet sizes of 256, 512, 1024, 1280, and 1518 bytes, or any user-defined sizes.

When performing a throughput test, you can adjust the following parameters to fine-tune your test results:

- Accept Lost Rate – Defines the percentage of frames that can be lost without being considered a failure.
- Resolution Rate – Sets the level of precision for the test. The finer the resolution, the longer it takes to complete the test.

A Throughput test cannot be performed if another RFC Test is running.

To configure the Throughput test:

configure the Frame Loss test:

1. Select **RFC Tests** and choose **Conf**.
2. Select **Stream ID** and choose the packet stream (**1**, **2**, **3**, or **4**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.
4. Select **Dest Port** and choose the port that will receive the test signal.
5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.
7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

   To assign a user-defined frame size:

   a. Select a **Packet Size** button (for example, 64). A keypad appears.
   b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
   c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.

8. Select **Thru Put** from the tabs along the left side of the RFC Tests screen.
9. Select **Accept Lost Rate** and enter an acceptable packet loss rate ranging from 0% to 100%. This value serves as a threshold. The default rate is 0%, which means that even one lost packet is a failure.
10. Select **Resolution Rate**, and enter a value ranging from 1% to 100%. The lower the rate, the more precise the measurement. The default rate is 1%.

To start the Throughput test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.
2. The unit immediately starts transmitting a test stream using the configured parameters, starting with the smallest packet size. The packets are looped through the network and returned to the unit. If no packet loss is reported, results are posted for the first packet size and the unit starts transmitting a stream containing packets for the next size byte frame. (For example, the first packet size transmitted is 64-bytes followed by 128-bytes and so on.)

   If packet loss is detected in a byte transmission, the stream is re-transmitted at a reduced rate. This process continues until results are within the Resolution Rate percentage.

3. View Throughput test results on the statistics table at the bottom of the screen.
4. Select **Print**. The File Browser window appears, which allows you to name and save results to a file using the .thru extension. (The file can be printed or saved locally on the unit, or remotely on a PC if using the Remote Control Application software.)
5. To save and print Throughput test results see Saving and Printing Statistics and Port Settings.

RFC-2544 - Frame Loss Testing

Frame Loss testing is an RFC 2544 benchmark test. Its purpose is to determine the number of packets lost, by looping a stream through the network at varying transmit packet rates. The Frame Loss screen allows you to select a specific packet size to use in the Ethernet stream.

A Frame Loss test cannot be performed if another RFC Test is running.

To configure the Frame Loss test:

1. Select **RFC Tests** and choose **Conf**.
2. Select **Stream ID** and choose the packet stream (**1**, **2**, **3**, or **4**) for the Frame Loss test.

3. Select **Trial Duration** and set the duration of the test.
4. Select **Dest Port** and choose the port that will receive the test signal.
5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.
7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

   To assign a user-defined frame size:

   a. Select a **Packet Size** button (for example, 64). A keypad appears.
   b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
   c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.

8. Select **Frame Loss** from the tabs along the left side of the RFC Tests screen.

To start the Frame Loss test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.
2. The unit immediately starts transmitting a test stream at 10% of the maximum byte-size rate. When multiple frame sizes are selected, the transmission starts at the lowest size.

   A status message appears at the bottom of the screen indicating the current frame size and stream rate that is being transmitted. For example, Processing size 64 Rate 10.00. When this completes, the number of frames transmitted and the number of frames received appears in the Frame Loss table. This process continues until 100% of the maximum byte-size rate is reached (at 10% increments).

   After transmitting at 100%, the entire test is repeated using the next larger frame size, for example, 128, 256, 512, 1024, 1280, and 1518 bytes.

3. View Frame Loss test results on the statistics table at the bottom of the screen. The table displays the frame loss test results for a specified packet size. The results represent the nine rates determined by the BW Ceiling and BW Floor settings.

   To change the packet size and view its results:

   ▸ Choose the **Packet Size** button (for example, 256). The Frame Loss table displays the transmit and receive statistics for the selected packet size.

   OR

   ▸ Select the **First**, **Prev**, **Next**, or **Last** button to move through the frame sizes.

Important: The status message that appears at the bottom of the screen always indicates which frame size and stream rate is currently being transmitted and not the report statistics selected.

4. Select **Print**. The File Browser window appears, which allows you to name and save results to a file using the .loss extension. (The file can be printed or saved locally on the unit, or remotely on a PC if using the Remote Control Application software.)
5. To save and print test results see Saving and Printing Statistics and Port Settings.

RFC-2544 - B2B Burst Testing

This is an RFC 2544 benchmark test. Back-to-Back Burst test is used to determine the buffering capability of the Device Under Test (DUT). This is done by sending a burst of frames to the unit, and then counting how many frames are forwarded by the unit.

During the test a burst of fixed length frames with the minimum inter-frame gap between them is sent through the packet stream. The trial duration must be between 2 and 10 seconds. The RFC standard recommends (but does not required) that this trial should be repeated at least 50 times with the average value reported.

If the unit successfully transmits all the frames that it receives, the frame burst size is increased and the test is repeated. If this stage of the test fails, the frame burst size is halved and the test is repeated until the unit successfully transmits the frame burst. The default frame burst sizes used are 64, 128, 256, 512, 1024, 1280, and 1518 bytes.

A Back-to-Back Burst test cannot be performed if another RFC Test is

running.

To configure the B2B Burst test:

1. Select **RFC Tests** and choose **Conf**.

   The **BW Ceiling** and **BW Floor** settings do not apply to the Back-to-Back Burst test.

2. Select **Stream ID** and choose the packet stream (**1**, **2**, **3**, or **4**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.

   This value determines how long each trial runs. Valid values range from 2 to 10 seconds.

4. Select **Dest Port** and choose the port that will receive the test signal.

6. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

   To assign a user-defined frame size:

   a. Select a **Packet Size** button (for example, 64). A keypad appears.
   b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
   c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.

8. Select **B2B Burst** from the tabs along the left side of the RFC Tests screen.
9. Select **Resolution (in frames)**. A keypad appears.
10. Enter a precision level for the test. The value is the number of frames in the longest burst that the DUT will handle without the loss of any frames.
11. Select **# Of Repetitions**. A keypad appears.
12. Enter the number of times the trial length should be repeated. The RFC recommended repetition is 50.

To start the Back-to-Back test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.
2. The unit immediately starts sending a burst of frames with the minimum inter-frame gap between them. If all frames are received, the burst size is increased and the test repeated. If all frames are not received, the burst size is lowered and the test repeated until the longest burst the DUT can handle (without loss of frames) is determined.

3. View B2B Burst test results on the statistics table at the bottom of the screen.
    - Frame Size (bytes) – Indicates the tested frame size.
    - Max Possible Number of Frames – Indicates the number of frames transmitted without errors.
    - Avg Observed B2B Frames – Indicates the data stream's average frame count.

4. Select **Print**. The File Browser window appears, which allows you to name and save results to a file using the .b2b extension. (The file can be printed or saved locally on the unit, or remotely on a PC if using the Remote Control Application software.)
5. To save and print test results see Saving and Printing Statistics and Port Settings.

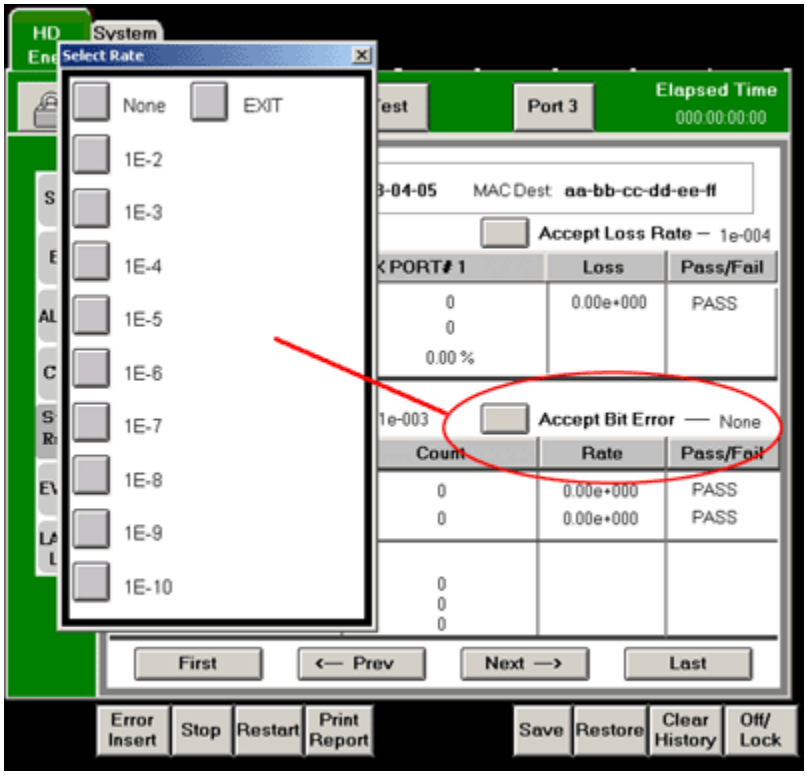
Timed Test - Using Acceptance Criteria

The NIC unit has the capability to run a timed test (a test with Ethernet streams enabled for a certain time period) specifying user-defined acceptance criteria for Pass/Fail results.

To Set Up the Test

1. Set up the port on which the test will be initiated. This includes the ports Interface, stream parameters. A test can be performed on a single port or port-to-port basis.
2. Enable the stream(s) to be used for the test.
3. Under the Results > Strm Rslt tab, configure the acceptance criteria options. These include Acceptable Loss Rate, Acceptable Out of Sequence rate, and Acceptable Bit Error rate. These values are set up on a stream-by-stream basis.
4. Under the Test tab, select the desired duration for the test. Note that if "Continuous" is used, the test will continue to operate until manually interrupted.
5. Restart the port that will be used for the timed test using the Restart button at the bottom of the screen.
6. When the time duration of the test is reached, the Ethernet streams will automatically stop counting received packets and the Pass/Fail acceptance results are displayed under the Results > Strm Rslt tab.

A typical screen is shown below with two of the three parameters (Accept Loss Rate and Accept Out of Seq) already set and the third (Accept Bit Error) ready to be set by using the pop-up Select Rate window.



User-Defined Acceptance Criteria

Accept Loss Rate: A user-specified threshold value for determining the acceptable Packet Loss rate for a timed test. Test results are displayed as the calculated loss rate and a Pass/Fail status.

Accept Out of Seq: A user-specified threshold value for determining the acceptable Out of Sequence packet rate for a timed test. Test results are displayed as an error count, rate, and Pass/Fail status.

Accept Bit Error: A user-specified threshold value for determining the acceptable bit error rate for a timed test. Test results are displayed as an error count, rate, and Pass/Fail status.

Saving and Printing Statistics and Port Settings

The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and Stream Test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.

The following reports are available:

- Settings - (.set extension) Reports the Stream Settings for the selected Port .
- Statistics - (.stat extension) Reports all Steam Tx/Rx Packet counts, Errors, and Alarms.
- Events - (.evt extension) Reports a summary of Events, such as alarm and error activity.
- APS (.aps extension) Reports Service Disruption statistics.
- RFC Thru Put - (.thru extension) Reports the Throughput test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).
- RFC Frame Loss - (.loss extension) Reports the Frame Loss test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).
- RFC B2B Burst - (.b2b extension) Reports the Back to Back Burst test settings and a summary of the test results for each packet size (Max Possible Number of Frames, and Average Observed B2B Frames).

To save or print RFC test results:

1. Configure and run Packet Stream transmissions or run an RFC test such as Throughput, Frame Loss, B2B Burst.
2. Select the **Print Report** common function button located at the bottom of the screen. The Report Setup dialog box appears.
3. Choose one of the following:
   - From Destination Printer:

     ▶ Select one or multiple reports to print directly to a printer. If printing a report from the NIC unit, make sure that a printer is attached to the unit's parallel or serial port.

   - From Destination File:

     ▶ Select one or multiple reports to print to a file. The File Browser dialog box appears.

     The Comma Delimiter option can be applied to the Settings To File and Statistics To File reports.

     ▶ Enter a file name and select **OK**.

     Important: Files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC. The NIC unit saves the files to its default D:\DLI... drive on

the test unit.

For instructions on retrieving saved files see Printing or Viewing Saved Files.

4. Click the **Input** button to enter any User Comments that you wish to appear in the printed or saved report file. Press the **Clear** button to clear the User Comments.
5. Select **OK**.

Ethernet - Screen Functions and Description

High-Density Ethernet Screen Functions and Descriptions Overview

This section describes the various screens and functions that control High Density Ethernet configuration and operation:

- Config
- RFC Tests
- Results
- Test
- Ports
- LEDs

Config

Config Screens and Functions

(Specifically for Ethernet)

The Config screen contains the following functions:

- Set (Stream Control)
- Traffic Stream Profile
- Error Alarm

Config - Set screen

(Specifically for Ethernet)

The Stream Control screen (Config > Set) allows you to define the frame parameters that will be used to generate a traffic flow or stream into the network. Up to four different streams can be generated simultaneous.

The following functions appear on the Stream Control screen:

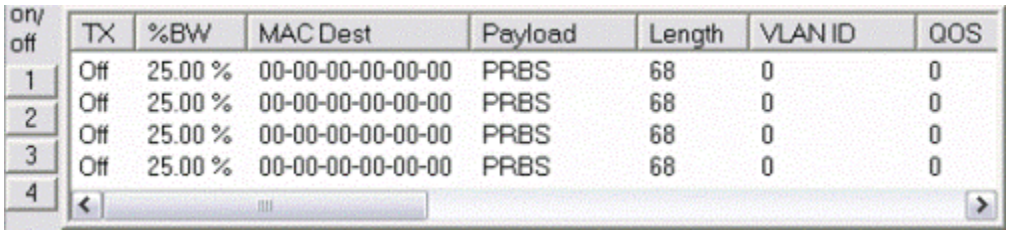
Function	Description
Interface	Selects the interface rate and type as applicable for the port type selected. For 10GigE port, this button is disabled. For 10/100/1000BaseT ports, the choices are: • 10Mbps Full Duplex • 100Mbps Full Duplex • 1000Mbps Full Duplex • 10Mbps Half Duplex • 100Mbps Half Duplex • 1000Mbps Half Duplex • Auto Negotiate For 1GigE ports, the choices are: • 1Gbps Ethernet • 1Gbps Fibre Channel (if unit is licensed for 1G Fibre Channel test option) • 2Gbps Fibre Channel (if unit is licensed for 2G Fibre Channel test option)

Negotiate This setting is only available for Optical Ethernet ports.	Allows the user to enable or disable the Auto Negotiation function. **Enabled** - Enabling auto negotiation allows the system to look at the incoming signal and automatically determine the link speed and duplex mode of the port's remote device and adjust accordingly. **Disabled** - Disabling auto negotiation allows the test set to simulate older Ethernet equipment that does not support auto negotiation logic.
Line Control	Configures link negotiation for 1Gbps Electrical interfaces. Auto - Automatically configures the link for either Master or Slave, depending on the reference signal. Master - Configures the port as the Master Link, and expects the reference signal to be Auto or Slave. Slave - Configures the port as the Slave Link, and expects the reference signal to be Auto or Master.
Status	Displays the Negotiation and Line Control Status information.
Col (Columns)	Rearrange order of columns displayed in the Stream Profile Table
Reflect	Allows the user to start IP Packet Reflection Mode for DLI Packets or All Non-Routing Packets.
Flow Control	Enable or Disable Flow Control Important: Flow Control must be enabled in order to count Pause Packets.

TX Mode	Starts and stops the transmission of ALL streams. The status of the stream transmission is displayed in the “TX” column of the Stream Profile table. Selecting TX Mode while all streams are “Off” will turn all streams “On”. If at least one stream is “On”, selecting TX Mode will turn all streams “Off”. Important: "All TX Mode" and individual stream TX on/off buttons are not available when IP Reflection is enabled.
Pause	Allows the user to generate Pause frames and set Pause Quanta value, Valid values are 1-65535. Important: Flow Control must be enabled in order to count Pause Packets. Important: Send Pause is not available when IP Reflection is enabled.
Stream Profile Table	The Stream Profile Table contains four packet streams that can be configured. Selecting a stream from the profile table opens the Traffic Stream Profile dialog box from which the stream parameters are configured. A total of four streams can be configured and saved for each port. Use the horizontal scroll bar at the bottom of the table to view hidden columns for the stream settings. See below for more information on the Stream Profile Table.

Count Statistics Table	The Count Statistics Table displays the following information for both transmitted (TX) and received (RX) packets: • **TX/RX** - Defines which row of statistics is designated for Transmit counts (TX) and which row is designated for Receive counts (RX) • **Packets** - Displays the total number of packets sent or received since the test was started. • **Pkts/sec** - Displays the current rate of packets sent or received in packets per second. • **Bytes** - Displays the total number of bytes sent or received since the test was started. • **Mbit/sec** - Displays the current rate of packets sent or received in Megabits per second. • **%BW** - Displays the total percent of bandwidth used by each active stream.
Initial Laser Setting	Selects the condition of the laser upon reboot – On, Off or Restore Previous State

Information about the configuration of the streams are displayed in the Stream Profile Table.



At the left, there are four (4) buttons to turn on and off each individual stream. The other columns of information can be seen by using the scroll bar at the bottom or by rearranging the columns. These are the columns (note that the

sequence may be different, depending upon how the user has arranged the columns):

TX	Indicates whether that stream 1-4 is being transmitted
%BW	Percentage of bandwidth selected on that stream
MAC Dest	Destination MAC address
Payload	Payload Pattern selected
Length	Frame Length
VLAN ID	VLAN ID selected
VLAN QOS	VLAN QOS selected
IP Dest	Destination IP address
UDP Port Dest	UDP Destination Port
MAC Src	Source MAC address
IP Src	Source IP address
UDP Port Src	UDP Source Port
VLAN Tag	VLAN Tag (yes or no)
IP TOS	IP Type of Service
IP TTL	IP Time to Live
IP FRAG	Select whether to allow or disallow fragments

Traffic Stream Profile Configuration

(Specifically for Ethernet)

A packet stream's profile defines the type, size, content, destination address, and source addresses for the frame

The **Traffic Stream Profile** dialog box is used to set the stream profile parameters. To access this dialog box, select any of the four streams in the Stream Profile Table.

The stream protocol is set to UDP/IP by default.

Parameter	**Description**

Dest Port	Sets the Destination Port. The default is “same”. This setting is mainly useful for RFC2544 testing where the test involves sending packets and evaluating received packets for lost packages, latency and other factors. These test can be done using only one port or sending on one port and receiving on another.
auto setup peer	Applicable only if Destination Port is set to anything except “same”. Check “auto setup peer” and once “Save All” is selected, the Destination Port will be automatically configured to mirror the source port in IP address, MAC address and destination port.
Stream ID #	Displays which of the four Streams the settings are being modified for. The title bar of this Traffic Stream Profile window also shows which Stream ID # is currently selected
MAC Src Address	Sets a MAC source (origination) address for generated traffic. The address is a 12-digit (6-byte) HEX value that is entered using a keypad. The address is entered into 6 separate fields, 2 characters each. There are no restrictions on value entered but all a value must be entered in all fields.
MAC Dest Address	Sets a MAC destination address for generated traffic. The address is a 12-digit (6-byte) HEX value that is entered using a keypad. The address is entered into 6 separate fields, 2 characters each. There are no restrictions on value entered but all a value must be entered in all fields.

IP Src Address	Sets the IP address of the source (origination). The address is entered in decimal notation using a keypad. There are no restrictions on value entered but the format must be correct, i.e: xxx.xxx.xxx.xxx. If three digits are entered in a field, a period will be automatically added. If only one or two digits are entered, you must enter a period manually.
IP Dest Address	Sets the IP address of the destination. The address is entered in decimal notation using a keypad. There are no restrictions on value entered but the format must be correct, i.e: xxx.xxx.xxx.xxx. If three digits are entered in a field, a period will be automatically added. If only one or two digits are entered, you must enter a period manually.
UDP Src Port	Selects a User Data Protocol source port number (0 to 65535).
UDP Dest Port	Selects a User Data Protocol destination port number (0 to 65535). Note: Stream Counts are only displayed when UDP Dest Port is 312.
Frame Length	Sets the frame size (bytes). The frame size is entered as a decimal value, entered using a keypad, ranging from 64 to 9600. The default value is 64 bytes. Note that when in 1Gbps Half-Duplex (HDX) mode, the minimum packet size is 512 bytes. The maximum packet size for 10M or 100M HDX is 1518 bytes.

Rate	Sets the bandwidth percentage used. The value can be set using a bandwidth percent or Mbit/sec. Valid values are: • For 1 GigE Optical ports - 0.01 to 100%BW or 0.1 to 1000 Mb/s • For 10Mb electrical ports - 0.01 to 100%BW or 0.001 to 10Mb/s • For 100Mb electrical ports - 0.01 to 100%BW or 0.1 to 100Mb/s • For 1GigE electrical ports - 0.01 to 100%BW or 0.1 to 1000Mb/s • For 10G Optical port - 0.01 to 100%BW or 1 to 100000 Mb/s
Payload	Sets the type of data used for the stream's payload. The payload can be set to: • PRBS_31 • PRBS_31_INV • User Defined
VLAN Tag	Enables VLAN tagging for the frame. The VLAN tag is a 4-byte tag that is inserted into the frame.
VLAN ID	Assigns a VLAN ID to the frame. This identifies to which VLAN the frame belongs. IDs are entered as a decimal value from 0 to 4095. (VLAN tagging must be enabled to use this parameter.)
VLAN QOS	Sets the user priority level. Levels range from 0 to 7.
IP TOS	Sets the IP Type of Service. TOS is a 2-character HEX value.

IP TTL	IP Time to Live. TTL is a decimal value from 0 to 255.
IP Fragment Flag	Select whether to allow or disallow fragments
Prev	Moves to the stream with the next lower number. If currently looking at stream #1, selecting “Prev” will bring up stream #4. Note that changes made will not be saved until “Save All” is selected.
Next	Moves to the stream with the next higher number. If currently looking at stream #4, selecting “Next” will bring up stream #1. Note that changes made will not be saved until “Save All” is selected.
Save All	Saves all changes made and closes the Traffic Stream Profile window.
Exit	Closes the Traffic Stream Profile window without saving changes.

Config - Error Alarm

(Specifically for Ethernet)

The Error and Alarm screen allows the user to configure errors and alarms for insertion into a stream to simulate various defects and anomalies. Simulating defects can determine if the receiving equipment can detect and report an error in the incoming signal.

Note that error insertion is disabled when in IP Reflection Mode.

Option	Description
Error Type	Selects the type of error to transmit into a stream. Selecting one of the following will not send an error immediately but will only

	select the type of error to send when the “Send Error” button is pressed or when a rate is selected. The following types are available: • **Line Code** - Generates line code errors • **FCS** - Generates an invalid Frame Check Sequence • **IP Checksum** - Generates an invalid IP header checksum • **Bit Error** - Generates bit errors in the payload • **Sequence Error (Stream #n)** - Generates Sequence errors in the payload for the specified stream number.
Error Rate	Selects the error rate to be transmitted for the selected error type. Once the error rate is selected, the system begins transmitting errors. Select one of the following: • **1E-<x>** - *X* is an exponential value from 2 to 10. Selecting one of these sets the error rate to 1 x 10^{-x} (The smaller the exponential the higher the error rate.) • **User Defined** – Enter the desired error rate in increments of 0.1. For example, with user defined, error rates are not limited to 1 x 10^{-x} but more exact choices are available such as 2.6 x 10^{-4} or 7.1 x 10^{-3}
Alarm Generated	Selects an alarm to be transmitted. Once selected the system begins sending the alarm condition. Select one of the following:

	• **LOS** - Transmits a loss of signal
Reply to Local Fault	When enabled, the test interface will respond to Local Fault alarms by generating Remote Faults This setting is only available for 10Gbps Optical LAN/WAN.

RFC Tests

RFC Tests - Screen Functions and Descriptions Overview

The RFC Tests screen contains the following functions:

- Conf
- Thru Put
- Frame Loss
- B2B Burst

RFC Tests - Configuration (Conf)

RFC testing provides a specific set of tests that can be used to measure and report the performance characteristics of network devices. The RFC Tests Conf screen provides the preliminary stream configuration settings. After these settings are made the user selects the type of RFC test to initiate by choosing its tab along the left side of the RFC Tests screen.

The following options appear on the Conf screen:

Option	Description
Stream ID	Allows the user to select one of the four streams for the RFC test.
Trial Duration	Determines how long the test runs for each packet size. This duration is used each time the test fails. Valid duration values are 1-600 seconds. The default value is 240 seconds.
Dest MAC Address	Reflects the destination MAC address

	for the selected Stream. The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Allows the user to select the destination port that will receive the test signals. If a port is in IP Reflection Mode, or is already in an active RFC test, it will not appear in the Select Port window.
Restore to RFC Standard Setting	Returns frame sizes to default RFC test standards when user-defined sizes have been set.
Enable/Disable check boxes	Allows the user to select the packet sizes that will be used for the RFC tests.
Packet Sizes	Displays the packet sizes. Selecting a Packet Size button allows the user to assign a user-defined frame size to the packet. Valid value ranges are 64 - 9600.
BW Ceiling	Sets the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100. IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.
BW Floor	Sets the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99. IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be

	set to 9, or lower.

RFC Tests - Through Put Test (Thru Put)

This is an RFC 2544 benchmark test that calculates your network's throughput rate. The fastest throughput speed is indicated by the rate at which the transmission and reception of the Ethernet test stream is accomplished without packet loss.

The following options appear on the Thru Put screen:

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test. The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails. The Trial Duration is configured from the RFC Tests - Conf screen.
BW Ceiling	Displays the setting for the high-end of the bandwidth test range. The BW Ceiling is configured from the RFC Tests - Conf screen.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test. The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal. The Dest Port is configured from

	the RFC Tests - Conf screen.
BW Floor	Displays the setting for the low-end of the bandwidth test range. The BW Floor is configured from the RFC Tests - Conf screen.
Accept Lost Rate	Sets a packet loss rate threshold. The test fails if packet loss exceeds this value. Valid values are 0-100%. The default is 0%, which means that even one lost packet is a failure.
Resolution Rate	Sets a level of precision for the test. The default resolution is 1%. The finer the resolution (for example, 1%), the longer it takes to complete the test; the less precise the test (for example, 10%), the faster the test completes but with less accuracy.
Statistics Table	Reports the test results. The following statistics are displayed: **Size** - Indicates the transmitted test packet size. **Rate** - Reports the passing rate (percentage) for the specific packet size. **TX Packets** - Reports the number of packets transmitted in the stream for the frame. **RX Packets** - Reports the number of packets received by the test set. **Latency Min/Max/Avg** - Reports how long it takes for the test frames to traverse the network and return to the unit. The values that appear are in milliseconds. If the test set is looped to itself with a short patch cable, the latency may appear as 0 ms.
Start/Stop Test	Starts and stops the Through Put

	test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

RFC Tests - Frame Loss Test

This is an RFC 2544 benchmark test. Its purpose is to determine the number of frames lost by looping a stream (with a specified frame size) through the network at varying transmit frame rates. Select Frame Loss Testing for test procedures.

The following options appear on the Frame Loss screen:

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test. The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails. The Trial Duration is configured from the RFC Tests - Conf screen.
BW Ceiling	Displays the setting for the high-end of the bandwidth test range. The BW Ceiling is configured from the RFC Tests - Conf screen.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test. The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.

Dest Port	Displays the destination port that will receive the test signal. The Dest Port is configured from the RFC Tests - Conf screen.
BW Floor	Displays the setting for the low-end of the bandwidth test range. The BW Floor is configured from the RFC Tests - Conf screen.
Packet Size buttons	Determines which packet size results appear in the statistics table. Selecting a packet size button displays its results.
Statistics Table	Displays the frame loss test results for a specified packet size. The results display the nine rates determined by the BW Ceiling and BW Floor settings. The following statistics are displayed: **Rate %** - Indicates the percentage of bandwidth transmitted using the bandwidth ceiling and floor settings. **Transmit Frames** - Reports the total number of frames transmitted. **Receive Frames** - Reports the total number of frames received. **Loss %** - Reports the percentage of frame loss that occurred during the test. This calculation is the received frames divided by transmitted frames.
First, Prev, Next, Last	Allows the user to scroll through packet sizes to view their test results.
Start/Stop Test	Starts and stops the Frame Loss test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

This is an RFC 2544 benchmark test. Back-to-Back Burst test is used to determine the buffering capability of the Device Under Test (DUT). This is done by sending a burst of frames to the unit, and then counting how many frames are forwarded by the unit.

During the test a burst of fixed length frames with the minimum inter-frame gap between them is sent through the packet stream. The trial duration must be between 2 and 10 seconds. The RFC standard recommends (but does not required) that this trial should be repeated at least 50 times with the average value reported.

If the unit successfully transmits all the frames that it receives, the frame burst size is increased and the test is repeated. If this stage of the test fails, the frame burst size is halved and the test is repeated until the unit successfully transmits the frame burst. The default frame burst sizes used are 64, 128, 256, 512, 1024, 1280, and 1518 bytes.

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test. The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails. The Trial Duration is configured from the RFC Tests - Conf screen. Important: The trial duration must be between 2 and 10 seconds.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test. The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.

Dest Port	Displays the destination port that will receive the test signal. The Dest Port is configured from the RFC Tests - Conf screen.
Resolution (in frame:)	Sets the level of precision for the B2B test, by frames. The value is the number of frames in the longest burst that the DUT will handle without the loss of any frames. Valid values are 1-812.
# Of Repetitions	Enter the number of times the trial length should be repeated. The RFC recommended repetition is 50, however valid values are 1-100.
Statistics Table	Reports the test results. The system recovery results are displayed by Frame Size (bytes) tested as follows: • Max Possible Number of Frames - The frame rate (resolution) used as the throughput rate. • Avg Observed B2B Frames - Average frame count for each type of data stream tested.
Start/Stop Test	Starts and stops the Back-to-Back Burst test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

The **BW Ceiling** and **BW Floor** settings do not apply to the Back-to-Back Burst test.

Results

Results - Screens and Functions

Test activity and event history can be viewed using the various functions of the Results screen.

The Results screen contains the following functions:

- Scan
- ERR
- ALARM
- Count
- Strm Rslt
- Event
- Large LED

Results - Scan

This function displays a list of received errors and alarms.

For **alarms**, the duration is reported as a count in seconds.

For **errors**, an error count is reported.

The message *No Errors or Alarms* appears if no events are received by the system.

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

Results - Errors (ERR)

The Err screen reports error statistics on the incoming signal.

The following statistics appear:

Statistic	Description
Error	Displays the error type recognized and recorded by the unit.
Count	Displays the number of errors.
Errored Seconds	Displays the number of errored seconds.
Average	Displays the average error rate using an N.NNe-N format.
Current	Displays the current error rate using an N.NNe-N format.

Results - Alarm

The Alarm screen reports the various alarms detected by the receiving equipment.

The following statistics appear:

Statistic	Description
Alarm Description	Displays the alarm type recognized and recorded by the unit.
Seconds	Displays the number of seconds the alarm spent in the alarm condition.

Results - Count

The Count screen displays Packets, VLAN, and Packet Size statistics by type and count.

To view packet results, select the **Packets** button. The following statistics appear:

Packets	Description
Transmit Packets	Reports the total number of packets sent.
Received Packets	Reports the total number of packets received.
Received Jumbo Packets	Reports the total number of jumbo packets received. Jumbo packets are those from 1519 – 9000 bytes in size.
Transmit Bytes	Reports the total number of bytes sent.
Received Bytes	Reports the total number of bytes received.
Pause Packets Received	Reports the total number of Pause frames received. Important: Flow Control must be enabled in order to count Pause Packets.
Pause Quantas Taken	Reports the total number of quantas received. A quanta is a 512-bit timing increment used by a Pause frame. The number of quanta (N x 512-bits) indicate the duration of the pause.

	Important: Flow Control must be enabled in order to count Pause Packets.
Pause End Packets	Reports the number of times that a Pause condition ended allowing data transmission to resume. The pause condition ends when the Pause frame's time parameter is set to 0. Important: Flow Control must be enabled in order to count Pause Packets.
IP Packets	Internet Protocol. Reports the total number of IP packets received.
ICMP Packets	Internet Control Message Protocol. Reports the total number of ICMP packets received.
TCP Packets	Reports the total number of TCP packets received.
UDP Packets	User Data Protocol. Reports the total number of UDP packets received.
IGMP Packets	Internet Group Management Protocol. Reports the total number of IGMP packets received.
Broadcast Packets	Reports the total number of Broadcast packets received.
Multicast Packets	Reports the total number of Multicast packets received.
Unicast Packets	Reports the total number of Unicast packets received.

To view VLAN results, select the **VLAN** button. The following statistics appear:

VLAN	**Description**
VLAN Tagged Frames	Reports the total number of frames received that are identified as VLAN frames. The 4-byte VLAN tag is inserted in

	the Ethernet frame between the Source MAC Address field and the Length/Type field.
Quality of Service Entry	Displays separate data rows for QOS entries 1-7. Reports the number of frames received for each user priority level value. A total of 8 different counters appear in the table.

To view Packet Size results, select the **Packet Sizes** button. The following statistics appear:

Packet Sizes	Description
Packet Byte Size	Reports the count and percentage of each packet size range found: 64; 65-127; 128-255; 256-511; 512-1023; 1024-1518; 1519-Max (Jumbo Packets).

Results - Stream Results (Strm Rslt)

The Stream Results screen displays statistics for a specified incoming packet stream. The screen allows you to scroll through the different packet streams and view their individual results.

The following statistics appear:

Statistic	Description
Selected Stream Entry	Displays the stream ID number and its MAC source and MAC destination addresses to which the Total Stream Statistics data on the stream control screen belongs.
Total Stream Statistics Table	Provides transmit and receive statistics by Count and %BW. • Count - Displays the total number for the criteria. • %BW - Displays the total percent of bandwidth used by the stream.
Transmit Statistics	Provides statistic totals, by count

	and/or percent of bandwidth, for the following criteria: • Packets Transmitted • Bytes Transmitted • %BW Transmitted
Receive Statistics	Provides statistic totals, by count and/or percent of bandwidth, for the following criteria: • Packets Received • Bytes Received • %BW Received • Out of Sequence Packets - Each sent packet is marked with a sequence number. This count is incremented when a packet arrives that has a sequence number different than one plus the sequence number of the previous packet. • Bit Errors Received
Latency Values (in microseconds)	Displays minimum, average, and maximum latency (delay) values over time. A latency measurement is taken every quarter-second (0.25 sec.) during stream transmission. These values are updated (realtime) as new latency measurements are logged. If the unit is looped on itself, the latency may appear as 0 µs.
User-Defined Acceptance Criteria (Refer to "Timed Test Using Acceptance Criteria")	**Accept Loss Rate:** A user-specified threshold value for determining the acceptable Packet Loss rate for a timed test. Test results are displayed as the calculated loss rate and a Pass/Fail status. **Accept Out of Seq:** A user-specified threshold value for determining the

	acceptable Out of Sequence packet rate for a timed test. Test results are displayed as an error count, rate, and Pass/Fail status. **Accept Bit Error:** A user-specified threshold value for determining the acceptable bit error rate for a timed test. Test results are displayed as an error count, rate, and Pass/Fail status.
First, Prev, Next, Last	Allows the user to scroll through the four packet streams and view their individual results. Selecting **First** immediately moves the stream statistics to Stream 1; selecting **Last** immediately moves the stream statistics to Stream 4; selecting **Prev** or **Next** moves the stream statistics to/from one stream to the next.

Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

Results - Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

For a list of available LEDs in the HDEnet protocol processor, see HDEnet LEDs.

Test

Test - Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- Set 1
- Service Disruption
- PING

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Service Disruption

The unit can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The Ethernet service disruption tests show a granular accuracy of .1 ms (100 µs).

Test Service Disruption functions include:

- **Consecutive Good Time Required**: This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The range is 10 to 1638.3 milliseconds and is entered using a keypad.
- **Consecutive Bad Time Required**: This function allows you to enter the time-duration (in milliseconds) of consecutive errored frames to elapse before Protection Switch measurements begin to accumulate. The range is 10 to 1638.3 milliseconds and is entered using a keypad.
- **State**: Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

  - **Single APS**: Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

  - **Continuous APS**: Constantly monitors for service disruption events, and updates the seconds and frames reported.

  - **Stop APS:** Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)**: Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.

For more information about monitoring service disruption activity, select *Measuring Service Disruption Activity* in the Specific Tasks section of the online help.

Test - PING

This section provides a brief overview of the PING functions that are available on the Test screen.

See the PING Functionality page for detailed descriptions on using the PING feature.

Function	Description
IP Source	This is the IP Source address that is used for the PING operation.
IP Destination	This is the IP Destination target address that is used for the PING operation.
Num. of PINGs	This is the number of PING attempts.
Timeout	This is the amount of time (in seconds) that the unit will wait for a PING reply. Valid values are 1-5 (secs.) in one-second intervals. The default value is 1.
MAC Source	This is the MAC Source address that is used for the PING operation.
Packet Size	This is the size of the PING packet used for the PING operation. Valid values are 64-9600 (bytes). The default value is 64.
Time To Live	One of the parameters on a PING packet (and any packet) is called "Time to live", or TTL. TTL is an IP header field designed to keep packets from running in loops, essentially forever, through a network (this can happen when there is a route change, and the routers involved don't all know the same information as new information is being replicated and updated). The TTL is usually set to somewhere between 64 and 255, and is reduced by 1 every time it passes through a server. If the TTL should ever reach 0, that packet has expired. The router

	that it is passing through will then send it back to the source. Valid values are 1-255 . The default value is 128.
Start PING	This begins the Ping Operation. When “Start PING” button is selected, the unit will send an ARP request to the target Destination IP address to determine what the MAC address is. When the ARP reply is received, the target MAC address will be displayed in the “MAC Dest Address” field. The specified number of PING requests will be sent, with the last 4 responses displayed in the PING Response Window. The statistics of the PING operation are displayed in the PING Statistics section.

Port Screen Overview

The High-Density Ethernet circuit pack contains 12 connection ports that operate independently. For NIC test sets equipped with the 10G Ethernet module, there are 13 connection ports.

- Four 1 Gbps optical ports - ports 1 through 4. (SFP's)
- Eight 10/100/1000 Mbps electrical ports - ports 5-12. (RJ-45's)
- One Optional 10 Gbps optical port - Port 13. (XFP)

The following table displays the port assignments.

Important: Port selection determines what functions and controls you will see on the NIC GUI. Consequently, the selected configurations apply only to the operation of the selected port. For example, if you select Port 2, the functions that appear on the GUI control and configure Port 2 operations.

1 Gbps LAN Optical Ports / 1G and 2G Fibre Channels	10/100/1000 Electrical Ports	10 Gbps Optical Port (Optional)
Port 1	Port 5	Port 13
Port 2	Port 6	
Port 3	Port 7	
Port 4	Port 8	
	Port 9	
	Port 10	
	Port 11	
	Port 12	

LED Quick Status Area

When the **HD Enet** tab is selected, the following status LEDs appear in the LED Quick Status Area.

The LED indicates the instantaneous state of the specific condition. The text to the right of the LED is used as a “history” indicator. White text indicates that the specific error, alarm or condition has not been present during the current test. Red text indicates that the specific error, alarm or condition has been present during the current test.

Indicator, LED or Control	Description
Laser On/Laser Off Control	Pressing the button will toggle the status of the laser. If no SFP or XFP module is installed, the button will state “No Laser”. Optical Ethernet ports only
E/A	Error/Alarm Indicator. Indicates the type of error inserted and/or alarm generated.
LOS	Loss of Signal. When red, indicates that a valid signal is not being received. If an all zeros pattern exists for 100 milliseconds or longer on the incoming signal, then an LOS is reported. This is an alarm LED. Optical Ethernet ports only

Link State	Indicates the port's connection status. If green, the port is receiving a valid signal.
Code ERR	Indicates an error (an invalid 10B code) was detected on the incoming Ethernet stream. Optical Ethernet ports only
FCS ERR	Frame Check Sequence. Flashes red when an FCS error occurs.
JABBER	Indicates the presence of a jabber condition 10/100/1000BaseT ports only
Pat Sync	Indicates a loss of pattern synchronization in at least one of the 4 streams. This is an alarm LED.
BIT ERR	Indicates a detected BIT error in at least one of the 4 streams.
SEQ ERR	Indicates a sequence error detected in at least one of the 4 streams.

The following describes the LED colors:

If the LED color is ...	**Then this indicates ...**
Green with **white** text	The specific function is active and OK.
Red with **white** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **white** text	No activity from this specific function.

Fibre Channel - Specific Tasks

Fibre Channel Specific Tasks Overview
(Specifically for Fibre Channel SAN testing)

This section includes how to setup and use Fibre Channel procedures, that are specific to the 1G or 2G Fibre Channel SAN Interfaces.

This is a licensable option. Please contact Tech Support, or your DLI sales representative, to enable this option on your NIC unit.

There are separate software licenses for 1G and 2G Fibre channel test interfaces on the High Density Ethernet module.

For a description of specific screens and their functionality, refer to Fibre Channel Screen Functions and Descriptions Overview.

The following procedure demonstrates how to interconnect the NIC with a 1G or 2G Fibre Channel SAN switch, and establish test-stream data connections.

Please use the **Contents** tab and window (left side of the Help screen) to select, open, and view Specific Tasks for this protocol processor.

- Select Connect (without Server login) procedure to establish connection that does not require a Fabric and Name Server login
- Select Fabric and Name Server login process to establish connection that requires a Fabric and Name Server login
- Select Analyzing Fibre Channel Test Results to view statistics for any errors or alarms that occurred
- HDEnet - Connector Panel
- Selecting a Port
- Saving and Printing Statistics and Port Settings

Connect (without Server login) procedure
(Specifically for Fibre Channel SAN testing)

This procedure demonstrates how to interconnect the NIC with a 1G or 2G Fibre Channel SAN switch.

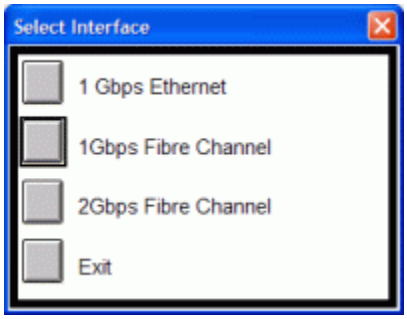
This procedure will establish a connection that does not require a Fabric and Name Server login.

1. Verify the optical SFP module being used supports the selected Fibre Channel data rate, and the wavelength is compatible SAN equipment being tested.
2. To enable a Fibre Channel test interface, first select the desired test port on the HDEnet module.

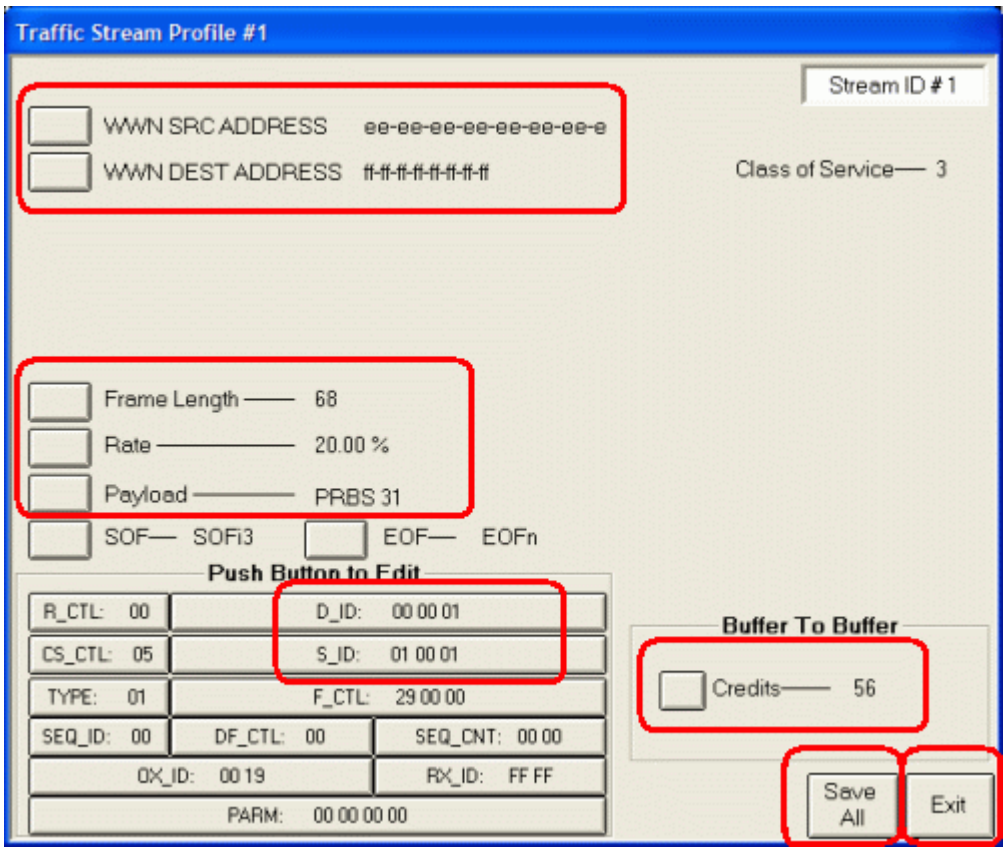
Optical ports 1, 2, 3, & 4 support Fibre Channel testing on the HDEnet circuit pack.

Optical ports 1 & 2 support Fibre Channel testing on the HDEnet Lite" circuit pack.

3. From the Interface menu, select the desired Fibre Channel data rate.



4. Turn the TX Laser on and verify both transmit and receive optical power levels are within specification. Then interconnect the transmit and receive NIC test port interfaces with the SAN equipment.
5. The NIC test port and the SAN equipment should quickly establish a valid Link State. The "Active" link state status can be observed under the Status section in the Config > Set screen, and the Link State LED should be green.
6. Select the stream from the stream profile table to open the Traffic Stream Profile dialog box, from which the stream parameters need to be configured.



7. Enter the correct **WWN Source and Destination addresses**, Destination ID (**D_ID**), and Source ID (**S_ID**) addresses. These will be network dependent.
8. Also, configure the correct Buffer to Buffer **Credits**, Data **Rate**, **Frame Length**, and **Payload** test pattern.
9. Select the **Save All** button to save the entered test stream parameters, then select the **Exit** button.
10. Verify the test stream is **TX** is set to **Off** before continuing. The required Fabric and Name Server login options are not available while the test stream is enabled.
11. Select the **Fabric Login** button to perform a Fabric Login.

    - The Fabric Login status will display “Waiting for Response” while it attempts to login to the SAN equipment
    - The Fabric Login status will display “Logged In” when the process completes

12. Select the **Name Server Login** button to perform a Name Server Login.

    - The Name Server Login status will display “Waiting for Response” while it attempts to login to the SAN equipment
    - The Name Server Login status will display “Logged In” when the process completes

13. At this point the Fibre Channel test interface will have a valid Fabric and Name Server login with the SAN equipment, and the test stream can be enabled.
14. Select the button labelled **1** to the left of the stream to turn on stream traffic generation.
15. Fibre Channel verification statistics may now be observed.

Fabric and Name Server login procedure
(Specifically for Fibre Channel SAN testing)

This procedure demonstrates how to interconnect the NIC with a 1G or 2G Fibre Channel SAN switch.

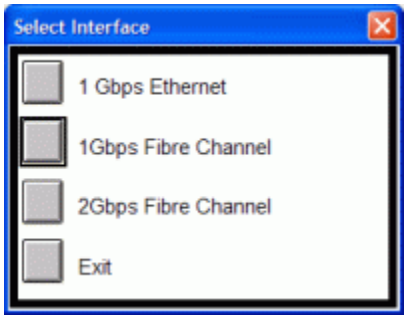
This procedure will establish a connection that requires a Fabric and Name Server login.

1. Verify the optical SFP module being used supports the selected Fibre Channel data rate, and the wavelength is compatible SAN equipment being tested.
2. To enable a Fibre Channel test interface, first select the desired test port on the HDEnet module.

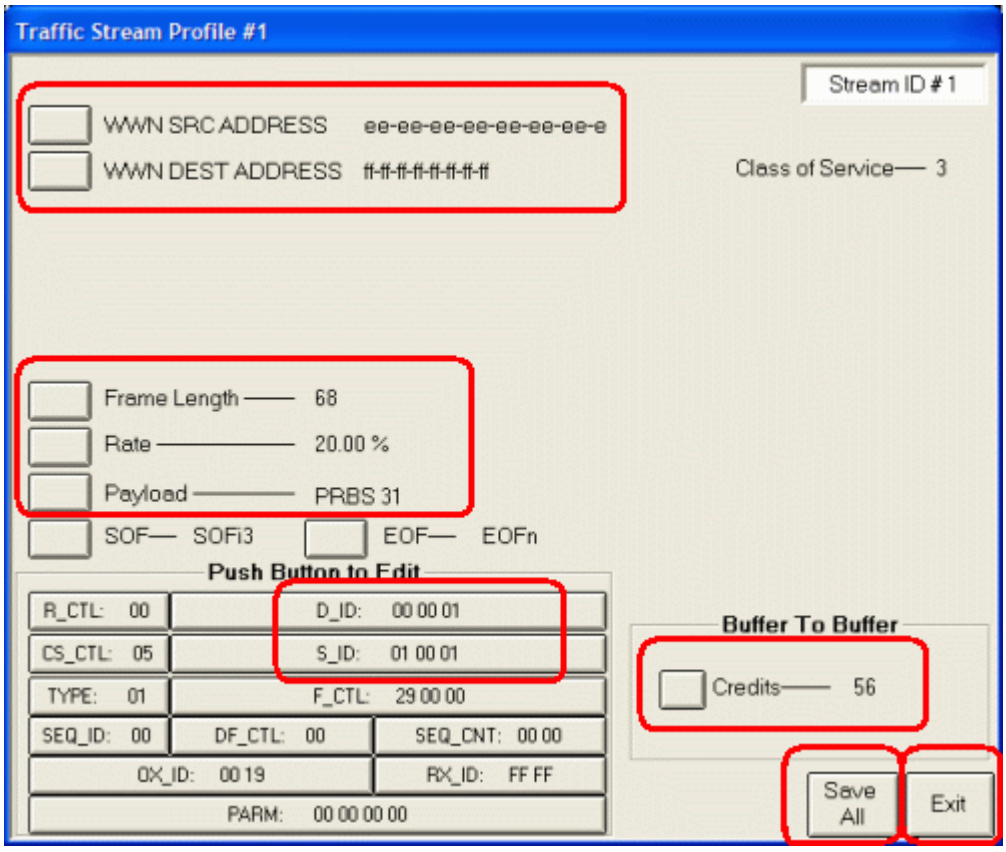
Optical ports 1, 2, 3, & 4 support Fibre Channel testing on the HDEnet circuit pack.

Optical ports 1 & 2 support Fibre Channel testing on the HDEnet Lite" circuit pack.

3. From the Interface menu, select the desired Fibre Channel data rate.



4. Turn the TX Laser on and verify both transmit and receive optical power levels are within specification. Then interconnect the transmit and receive NIC test port interfaces with the SAN equipment.
5. The NIC test port and the SAN equipment should quickly establish a valid Link State. The "Active" link state status can be observed under the Status section in the Config > Set screen, and the Link State LED should be green.
6. Select the stream from the stream profile table to open the Traffic Stream Profile dialog box, from which the stream parameters need to be configured.



7. Enter the correct **WWN Source and Destination addresses**, Destination ID (**D_ID**), and Source ID (**S_ID**) addresses. These will be network dependent.
8. Also, configure the correct Buffer to Buffer **Credits**, Data **Rate**, **Frame Length**, and **Payload** test pattern.
9. Select the **Save All** button to save the entered test stream parameters, then select the **Exit** button.
10. Verify the test stream is **TX** is set to **Off** before continuing. The required Fabric and Name Server login options are not available while the test stream is enabled.
11. Select the **Fabric Login** button to perform a Fabric Login.

    - The Fabric Login status will display “Waiting for Response” while it attempts to login to the SAN equipment
    - The Fabric Login status will display “Logged In” when the process completes

12. Select the **Name Server Login** button to perform a Name Server Login.

    - The Name Server Login status will display “Waiting for Response” while it attempts to login to the SAN equipment
    - The Name Server Login status will display “Logged In” when the process completes

13. At this point the Fibre Channel test interface will have a valid Fabric and Name Server login with the SAN equipment, and the test stream can be enabled.
14. Select the button labelled **1** to the left of the stream to turn on stream traffic generation.
15. Fibre Channel verification statistics may now be observed.

Analyzing Fibre Channel Test Results
(Specifically for Fibre Channel SAN testing)

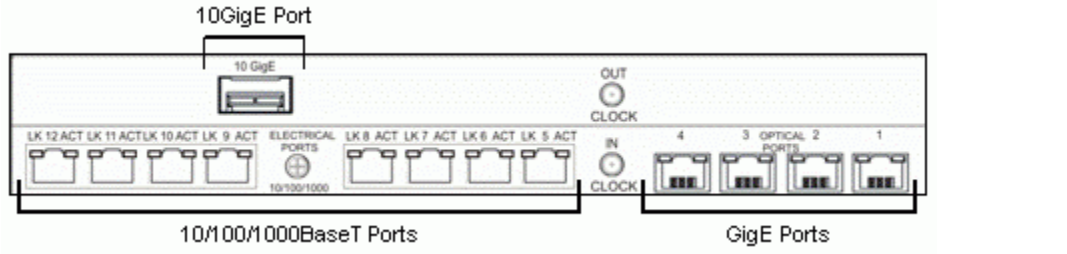
Error and Alarm activity and other frame statistics can be viewed using the various screens.

- The Config > Set screen has a Count Statistics Table that displays a summary view of transmitted and received Frame counts and Byte counts, as well as the transmitted and received bandwidth
- The Results screens display all error and alarm counts and history, as well as transmitted and received Frame statistics
- The System > All Ether Ports screen displays a summary view for all of the Ethernet and Fiber Channel test ports in the instrument (depending on the mode of the test port)
- The System > All Test Status screen displays a summary LED view for all of the protocol processors including all HDEnet ports in the instrument

High-Density Ethernet - Connector Panel

The High-Density Ethernet circuit pack contains twelve fully independent ports and one optional port. Each port provides four independently configurable traffic generation and analysis streams.

- Four 1-Gbps full-duplex optical ports. These ports accept SFP optical transceiver modules.
- Eight 10/100/1000 Mbps full or half-duplex electrical ports.
- One optional 10 Gbps full-duplex optical port. The 10 Gbps port is only available for NIC test sets that have the High-Density Ethernet module. This port accepts XFP optical transceiver modules.



Optical Connectors

Ports 1 through 4 are 1 Gbps optical SFP ports that use LC connectors, as does the optional 10 Gbps optical XFP port.

Note that the SFP/XFP wavelength value displayed on the NIC screen is derived from the SFP/XFP module as programmed by the device vendor.

Electrical Connectors

Ports 5 through 12 are 10/100/1000 Mbps electrical ports that use RJ-45 8-pin connectors.

Port numbering is from right to left and not labeled physically across the entire panel. Port numbering also varies with each unit's licensing and configuration. For example, in a fully configured unit, port positions are ports 1-4 for 1 Gbps, ports 5-12 for 10/100/1000 Mbps, and port 13 for 10 Gbps. On a unit that is configured without 1 Gbps ports, ports 1-8 are for 10/100/1000 Mbps and port 9 is for 10 Gbps. Port numbering is correctly reflected in the Select Port dialog display, which is accessible by selecting the Port *n* tab.

Selecting a Port

The High-Density Ethernet circuit pack contains 12 connection ports that operate independently. For NIC test sets equipped with the 10G Ethernet module, there are 13 connection ports.

- Four 1 Gbps optical ports - ports 1 through 4. (SFP's)
- Eight 10/100/1000 Mbps electrical ports - ports 5-12. (RJ-45's)
- One Optional 10 Gpbs optical port - Port 13. (XFP)

To select a port to configure or monitor:

1. From the **HD Enet** tab, select the **Port** <#> button.
2. Choose the desired port.

Any subsequent configurations made to the GigE unit apply to the selected port. For example, if Port 3 is selected then all configurations, testing, and results pertain to Port 3.

The following ports are available:

- Port 1 GigE - (1 Gbps optical port / full duplex)
- Port 2 GigE - (1 Gbps optical port / full duplex)
- Port 3 GigE - (1 Gbps optical port / full duplex)
- Port 4 GigE - (1 Gbps optical port / full duplex)
- Port 5 10/100/1000 - (10/100/1000 Mbps electrical port / configurable as full or half duplex)
- Port 6 10/100/1000 - (10/100/1000 Mbps electrical port / configurable as full or half duplex)
- Port 7 10/100/1000 - (10/100/1000 Mbps electrical port / configurable as full or half duplex)
- Port 8 10/100/1000 - (10/100/1000 Mbps electrical port / configurable as full or half duplex)

- Port 9 10/100/1000 - (10/100/1000 Mbps electrical port / configurable as full or half duplex)
- Port 10 10/100/1000 - (10/100/1000 Mbps electrical port / configurable as full or half duplex)
- Port 11 10/100/1000 - (10/100/1000 Mbps electrical port / configurable as full or half duplex)
- Port 12 10/100/1000 - (10/100/1000 Mbps electrical port / configurable as full or half duplex)
- Port 13 10 GigE (optional 10 Gpbs optical port / full duplex)

Port numbering is from right to left and not labeled physically across the entire panel. Port numbering also varies with each unit's licensing and configuration. For example, in a fully configured unit, port positions are ports 1-4 for 1 Gpbs, ports 5-12 for 10/100/1000 Mbps, and port 13 for 10 Gbps. On a unit that is configured without 1 Gpbs ports, ports 1-8 are for 10/100/1000 Mbps and port 9 is for 10 Gbps. Port numbering is correctly reflected in the Select Port dialog display, which is accessible by selecting the Port *n* tab

Saving and Printing Statistics and Port Settings

The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and Stream Test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.

The following reports are available:

- Settings - (.set extension) Reports the Stream Settings for the selected Port .
- Statistics - (.stat extension) Reports all Steam Tx/Rx Packet counts, Errors, and Alarms.
- Events - (.evt extension) Reports a summary of Events, such as alarm and error activity.
- APS (.aps extension) Reports Service Disruption statistics.
- RFC Thru Put - (.thru extension) Reports the Throughput test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).
- RFC Frame Loss - (.loss extension) Reports the Frame Loss test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).
- RFC B2B Burst - (.b2b extension) Reports the Back to Back Burst test settings and a summary of the test results for each packet size (Max Possible Number of Frames, and Average Observed B2B Frames).

To save or print RFC test results:

1. Configure and run Packet Stream transmissions or run an RFC test such as Throughput, Frame Loss, B2B Burst.
2. Select the **Print Report** common function button located at the bottom of the screen. The Report Setup dialog box appears.
3. Choose one of the following:
   - From Destination Printer:

     ▶ Select one or multiple reports to print directly to a printer. If printing a report from the NIC unit, make sure that a printer is attached to the unit's parallel or serial port.

   - From Destination File:

     ▶ Select one or multiple reports to print to a file. The File Browser dialog box appears.

     The Comma Delimiter option can be applied to the Settings To File and Statistics To File reports.

     ▶ Enter a file name and select **OK**.

     Important: Files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC. The NIC unit saves the files to its default D:\DLI... drive on the test unit.

     ▶ For instructions on retrieving saved files see Printing or Viewing Saved Files.

4. Click the **Input** button to enter any User Comments that you wish to appear in the printed or saved report file. Press the **Clear** button to clear the User Comments.
5. Select **OK**.

Fibre Channel - Screen Functions and Description

Fibre Channel Screen Functions and Descriptions
(Specifically for Fibre Channel SAN testing)

This section describes the various screens and functions that control 1G or 2G Fibre Channel configuration and operation:

- Config
- Results
- Test
- Ports
- LEDs

Config

Config Screens and Functions

(Specifically for Fibre Channel SAN testing)

The Config screen contains the following functions:

- Set (Stream Control)
- Traffic Stream Profile
- Error Alarm
- Prim Seq

Config - Set screen

(Specifically for Fibre Channel SAN testing)

The Stream Control screen (Config > Set) allows you to define the Fibre Channel frame parameters that will be used to generate a traffic flow or stream into the network.

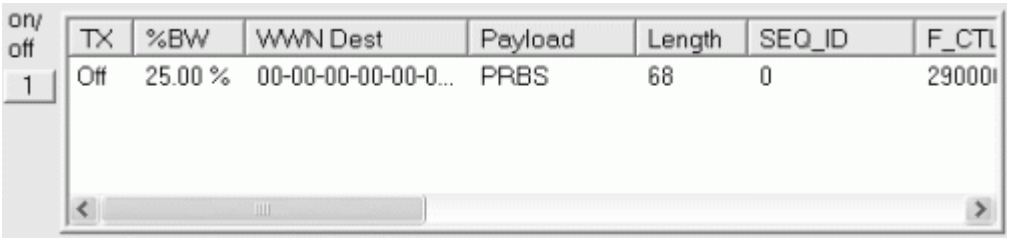
The following functions appear on the Stream Control screen:

Function	Description

Interface	For 1GigE ports, the choices are: • 1Gbps Ethernet • 1Gbps Fibre Channel (if unit is licensed for 1G Fibre Channel) • 2Gbps Fibre Channel (if unit is licensed for 2G Fibre Channel) Separate licenses are required for 1G and 2G Fibre Channel interfaces
Fabric Login	Attempts a Fabric Login
Name Server Login	Attempts a name server Login
Status	**Link**: – displays the current Link status **Fabric:** - displays the current Fabric status **Name Server:** - displays the current status
Col (Columns)	Rearrange order of columns displayed in the Stream Profile Table
R_T_TOV	Sets the R_T_TOV timeout setting. The default value is 100ms, and supports a range of 0.01ms to 655.35ms, specified in units of 10us. This is the timeout value used by the receiver logic to detect loss of synchronization. When the receiver goes into the Loss of Synchronization state for more than the R_T_TOV timeout value, then a link failure is detected.
Stream Profile Table	The Stream Profile Table contains one Fibre Channel stream that can be configured. Selecting the stream from the profile table opens the Traffic Stream Profile dialog box from which the stream parameters are configured. Use the horizontal scroll bar at the bottom of the table to view hidden columns for the stream settings. See below for more information on the Stream Profile Table.

Count Statistics Table	The Count Statistics Table displays the following information for both transmitted (TX) and received (RX) frames: • **TX/RX** - Defines which row of statistics is designated for Transmit counts (TX) and which row is designated for Receive counts (RX) • **Frames** - Displays the total number of frames sent or received since the test was started. • **Frms/sec** - Displays the current rate of frames sent or received in frames per second. • **Bytes** - Displays the total number of bytes sent or received since the test was started. • **Mbit/sec** - Displays the current rate of frames sent or received in Megabits per second. • **%BW** - Displays the total percent of bandwidth used by each active stream.
Initial Laser Setting	Selects the condition of the laser upon reboot – On, Off or Restore Previous State

Information about the configuration of the streams are displayed in the Stream Profile Table.



At the left, there is one button to turn on and off the fibre channel stream. The other columns of information can be seen by using the scroll bar at the bottom or by rearranging the columns. These are the columns (note that the sequence may be different, depending upon how the user has arranged the columns):

TX	Indicates whether that stream 1-4 is being transmitted

%BW	Percentage of bandwidth selected on that stream
WWN Dest	Destination World Wide Name address
Payload	Payload Pattern selected
Length	Frame Length
SEQ_ID	Sequence Identifier selected
F_CTL	Frame Control address
D_ID	Destination Identifier address
OX_ID	Originator Exchange ID address
WWN Src	Source World Wide Name address
S_ID	Source Identifier address
RX_ID	Responder Exchange Identifier address
R_CTL	Routing Control address

Traffic Stream Profile Configuration

(Specifically for Fibre Channel SAN testing)

A frame stream's profile defines the size, content, and several addresses, and other parameters for the frame.

The **Traffic Stream Profile** dialog box is used to set the stream profile parameters. To access this dialog box, select stream #1 in the Stream Profile Table.

The Fibre Channel Class of Service is set to 3 by default.

Parameter	Description
WWN SRC ADDRESS	Sets the World Wide Name Source Address. Important: This value must be set before a Fabric & Name Server login is attempted

WWN DEST ADDRESS	Sets the World Wide Name Destination Address. Important: This value must be set before a Fabric & Name Server login is attempted
Class of Service	Supports Class of Service 3
Frame Length	Sets the frame size (bytes). The frame size is entered as a decimal value, entered using a keypad, ranging from 68 to 2090. The default value is 68 bytes.
Rate	Sets the bandwidth percentage used, from 0.01 to 100% BW.
Payload	Sets the type of data used for the stream's payload. The payload can be set to: • **PRBS 31** • **PRBS 31 INV** • **User Defined**
SOF	Select the **Start of Frame** Delimiter used. SOF Delimiter Functions are: • **SOFc1** – SOF Connect Class 1 • **SOFi1** – SOF Initiate Class 1 • **SOFn1** – SOF Normal Class 1 • **SOFi2** – SOF initiate Class 2 • **SOFn2** – SOF Normal Class 2 • **SOFi3** – SOF Initiate Class 3 • **SOFn3** – SOF Normal Class 3 • **SOFc4** – SOF Connect Class 4 • **SOFi4** – SOF Initiate Class 4 • **SOFn4** – SOF Normal Class 4 • **SOFf** - SOF Fabric
EOF	Selects the **End of Frame** Delimiter Used. EOF Delimiter Functions are:

	• **EOFt** – EOF Terminate • **EOFdt** – EOF Disconnect-Terminate • **EOFa** – EOF Abort • **EOFn** – EOF Normal • **EOFni** – EOF Normal-Invalid • **EOFdti** – EOF Disconnect-Terminate-Invalid • **EOFrt** – EOF Remove Terminate • **EOFrti** – EOF Remove Terminate-Invalid
R_CTL	Routing Control – used for categorizing the frame function supports raw edit of field values only
D_ID	Destination Identifier – address identifier of the frame's destination port supports raw edit of field values only
CS_CTL	Class Specific Control/Priority supports raw edit of field values only
S_ID	Source Identifier – address identifier of the frame's source port supports raw edit of field values only
TYPE	Data Structure Type – categorization of the Frame's data supports raw edit of field values only
F_CTL	Frame Control – contains control information relating to the frames content supports raw edit of field values only
SEQ_ID	Sequence Identifier – unique identifier for the frame's Sequence supports raw edit of field values only
DF_CTL	Data Field Control – specifies the presence or absence of optional headers between the

	frame header and frame payload. supports raw edit of field values only
SEQ_CNT	Sequence Count – used to uniquely identify frames within a sequence not editable
OX_ID	Originator Exchange ID – provides association of frames within specific exchanges originating at a particular port - supports raw edit of field values only
RX_ID	Responder Exchange ID – provides the same function for the exchange responder that the OX_IID provides for the Exchange Originator. supports raw edit of field values only
PARM	For Link Control frames, indicates the specific type of Link control frame. For ACK frames, used to indicate how many frames are being acknowledged and whether all frames with lower SEQ_CNT values have been acknowledged. supports raw edit of field values only
Credits	Specifies the initial number of frames that can be sent on the link prior to receiving an R_RDY reply, range of 1 to 65535. default of 16. Important: This value must be set before a Fabric & Name Server login is attempted
Save All	Saves all changes made to the Traffic Stream Profile window.
Exit	Closes the Traffic Stream Profile window without saving changes.

Config - Error Alarm

(Specifically for Fibre Channel SAN testing)

The Error and Alarm screen allows the user to configure errors and alarms for insertion into a stream to simulate various defects and anomalies. Simulating defects can determine if the receiving equipment can detect and report an error in the incoming signal.

Option	Description
Error Type	Selects the type of error to transmit into a stream. Selecting one of the following will not send an error immediately but will only select the type of error to send when the "Send Error" button is pressed or when a rate is selected. The following types are available: • **Code** - Generates line code errors • **Bit Error** - Generates bit errors in the payload • **CRC** - Generates an invalid CRC error
Error Rate	Selects the error rate to be transmitted for the selected error type. Once the error rate is selected, the system begins transmitting errors. Select one of the following: • **1E-<x>** - *X* is an exponential value from 2 to 10. Selecting one of these sets the error rate to 1 x 10^{-X} (The smaller the exponential the higher the error rate.) • **User Defined** – Enter the desired error rate in increments of 0.1. For example, with user

	defined, error rates are not limited to 1 x 10^{-x} but more exact choices are available such as 2.6 x 10^{-4} or 7.1 x 10^{-3}
Alarm Generated	Selects an alarm to be transmitted. Once selected the system begins sending the alarm condition. Select one of the following: • **LOS** - Transmits a loss of signal

Config - Prim Seq

(Specifically for Fibre Channel SAN testing)

Supports the generation of Primitive Sequences including:

- **Send NOS** - NOS Ordered Set: K28.5 D21.2 D31.5 D5.2
- **Send LR** - LR Ordered Set: K28.5 D9.2 D31.5 D9.2
- **Send LRR** - LRR Ordered Set: K28.5 D21.1 D31.5 D9.2
- **Send OLS**- OLS Ordered Set: K28.5 D21.1 D10.4 D21.1

Select the option and then the duration:

- **Selectable Duration**: Supports the generation of **1 to 10** consecutive sequences or **continuous** sequence generation.

If **Continuous** sequence generation is selected, then select the option again to turn of the selected Primitive Sequence generation

Results

Results - Screens and Functions

(Specifically for Fibre Channel SAN testing)

Test activity and event history can be viewed using the various functions of the Results screen.

The Results screen contains the following functions:

- Scan - Displays a list of errors and alarms along with their count and duration.
- ERR - Displays a list of errors along with their count, errored seconds, average and current rates.
- ALARM - Displays a list of alarms along with the number of seconds spent in the alarm condition.
- Count - Displays Frame count statistics.
- Strm Rslt - Displays the Stream specific statistics.
- Event - Displays a summary of error alarm activity.
- Large LEDs - Displays easy to read LEDs of error alarm activity.

Results - Scan

(Specifically for Fibre Channel SAN testing)

This function displays a list of received errors and alarms.

For **alarms**, the duration is reported as a count in seconds.

For **errors**, an error count is reported.

The message *No Errors or Alarms* appears if no events are received by the system.

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

Results - ERR (Errors)

(Specifically for Fibre Channel SAN testing)

The Err screen reports error statistics on the incoming signal.

The following statistics appear:

Statistic	Description
Error	Displays the error type recognized and recorded by the unit.
Count	Displays the number of errors.
Errored Seconds	Displays the number of errored

	seconds.
Average	Displays the average error rate using an N.NNe-N format.
Current	Displays the current error rate using an N.NNe-N format.

The following error types can be monitored:

- **Code** – Indicates the count of line code errors received
- **Oversized** – Indicates the count of oversized frames (frames larger than 2144 bytes)
- **Undersized** – Indicates the count of undersized frames (frames less than 28 bytes)
- **Alignment Error** – Indicates the count of word alignment errors
- **EOFa** – Indicates the count of EOFa (End Of Frame - Abort) primitives received
- **EOF Error** – Indicates the count of frames received that were missing an EOF (End Of Frame)
- **Disparity Error** – Indicates the count of Ordered Set Disparity errors
- **CRC Error** – Indicates the count of CRC errors

Results - Alarm

(Specifically for Fibre Channel SAN testing)

The Alarm screen reports the various alarms detected by the receiving equipment.

The following statistics appear:

Statistic	Description
Alarm Description	Displays the alarm type recognized and recorded by the unit.
Seconds	Displays the number of seconds the alarm spent in the alarm condition.

The following alarm types can be monitored:

- **CP Power Loss**
- **Paused**
- **LOS** (Loss Of Signal)
- **Link Down**
- **Stream #1 Pat Sync**

Results - Count

(Specifically for Fibre Channel SAN testing)

The Count screen displays the following statistics for the incoming stream:

Statistic	Description
Transmit Frames	Reports the total number of frames sent.
Received Frames	Reports the total number of frames received.
Transmit Bytes	Reports the total number of bytes sent.
Received Bytes	Reports the total number of bytes received.
Tx R_RDYs Transmitted	Indicates the count of R_RDYs (Receiver Ready) transmitted
Rx R_RDYs Received	Indicates the count of R_RDYs received
BB Credit Available	Indicates the amount of Buffer-to-Buffer credit that is currently available for sending frames to the far end device
R_RDY Credit Pending	Indicates the amount of credit (R_RDYs) currently pending for return to the far end device. The R_RDY counter keeps track of how many R_RDY primitives need to be transmitted based on how many frames were received. Credit is returned for frames that have a valid SOF and at least one word of data following the SOF, independent of the validity of the CRC

Results - Strm Rslt (Stream Results)

(Specifically for Fibre Channel SAN testing)

The Stream Results screen displays the following statistics for the incoming stream:

Statistic	Description
Selected Stream Entry	Displays the stream's WWN source and WWN destination addresses.
Total Stream Statistics Table	Provides transmit and receive

	statistics by Count and %BW. • Count - Displays the total number for the criteria. • %BW - Displays the total percent of bandwidth used by the stream.
Transmit Statistics	Provides statistic totals, by count and/or percent of bandwidth, for the following criteria: • Frames Transmitted • Bytes Transmitted • %BW Transmitted
Receive Statistics	Provides statistic totals, by count and/or percent of bandwidth, for the following criteria: • Frames Received • Bytes Received • %BW Received • Bit Errors Received
User-Defined Acceptance Criteria (Refer to "Timed Test Using Acceptance Criteria")	**Accept Loss Rate:** A user-specified threshold value for determining the acceptable frame Loss rate for a timed test. Test results are displayed as the calculated loss rate and a Pass/Fail status. **Accept Bit Error:** A user-specified threshold value for determining the acceptable bit error rate for a timed test. Test results are displayed as an error count, rate, and Pass/Fail status.

Results - Event

(Specifically for Fibre Channel SAN testing)

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

Results - Large LEDs

(Specifically for Fibre Channel SAN testing)

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	**Then this indicates ...**
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

For a list of available LEDs for Fibre Channel, see Fibre Channel LEDs.

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.

- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Port Screen Overview

The High-Density Ethernet circuit pack contains 12 connection ports that operate independently. For NIC test sets equipped with the 10G Ethernet module, there are 13 connection ports.

- Four 1 Gbps optical ports - ports 1 through 4. (SFP's)
- Eight 10/100/1000 Mbps electrical ports - ports 5-12. (RJ-45's)
- One Optional 10 Gbps optical port - Port 13. (XFP)

The following table displays the port assignments.

Important: Port selection determines what functions and controls you will see on the NIC GUI. Consequently, the selected configurations apply only to the operation of the selected port. For example, if you select Port 2, the functions that appear on the GUI control and configure Port 2 operations.

1 Gbps LAN Optical Ports / 1G and 2G Fibre Channels	**10/100/1000 Electrical Ports**	**10 Gbps Optical Port (Optional)**
Port 1	Port 5	Port 13
Port 2	Port 6	
Port 3	Port 7	
Port 4	Port 8	
	Port 9	
	Port 10	
	Port 11	
	Port 12	

LED Quick Status Area
(Specifically for Fibre Channel SAN testing)

When **Fibre Channel** is selected, the following status LEDs appear in the LED Quick Status Area.

The LED indicates the instantaneous state of the specific condition. The text to the right of the LED is used as a “history” indicator. White text indicates that the specific error, alarm or condition has not been present during the current test. Red text indicates that the specific error, alarm or condition has been present during the current test.

Indicator, LED or Control	Description
Laser On/Laser Off Control	Pressing the button will toggle the status of the laser. If no SFP module is installed, the button will state “No Laser”.
RX:	Displays the received optical power in dBm.
TX:	Indicates current transmit laser wavelength.
E/A	Error/Alarm Indicator. Indicates the type of error inserted and/or alarm generated.
Test Paused	If red, indicates that the current test has been paused.
All Tests (button)	This is a short-cut button to the general "All Test Status" summary LED screen for all circuit packs installed in the unit.
LOS	Loss of Signal. When red, indicates that a valid signal is not being received. This is an alarm LED.
Link State	Indicates the port's connection status. If green, the port is receiving a valid signal.
Code	Indicates a line code error was detected on the incoming frame.
CRC	Indicates a CRC error was detected on the incoming frame.
Pat Sync	Indicates a loss of pattern synchronization in at least one of the 4 streams. This is an alarm LED.
BIT ERR	Indicates a detected BIT error in at

	least one of the 4 streams.

The following describes the LED colors:

If the LED color is ...	**Then this indicates ...**
Green with **white** text	The specific function is active and OK.
Red with **white** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **white** text	No activity from this specific function.

Jitter Optical Tab

NIC Jitter System Overview

The NIC Jitter system is used to generate and analyze jitter. Jitter can be generated manually or programmed to execute Automated Compliance Tests.

In manual mode, the user can set up a number of parameters for jitter generation, or measurement and then manually start the process. The process continues until the user stops it.

In automated mode, the user can program the Jitter system to execute Jitter Output, Jitter Tolerance, or Jitter Transfer Automated Compliance Tests. The compliance tests allow the user to programmatically scan through a number of setup parameters and make measurements in accordance with mask sets. These masks can be standardized sets prescribed by various standards organizations, or custom user-defined mask sets.

Jitter configurations are made from the Transmit, Receive, Output Jitter, Test, and Toler/Transfer screens.

To assist you in performing tasks and understanding protocol functionalities, this Online Help is divided into the following sections:

- Jitter Specific Tasks
- Jitter Screen Functions and Descriptions

You can navigate through the topics by using the Contents, Index, or Search tabs in the box that appears on the left side of the Help window. In addition, links are strategically placed throughout the Help topics to give you quick access to pertinent information.

Jitter Specific Tasks

Jitter Specific Tasks

This section includes tasks that are specific to the Jitter protocol processor.

For a list of general tasks for a NIC test set, see **Common Tasks**, located in the Getting Started section of the NIC test set's Online Help.

ACT

Performing Automated Compliance Tests

Automated compliance tests differ from manual measurements in that the system can be programmed to make multiple test point measurements instead of just one. This allows the multiple test points to be compared against a set of allowable limits to those measurements. This is done by using the Jitter Stimulus Mask to define the set of points to be measured for the device-under-test that meets a set of standardized or user-defined criteria. This frees the user from the burden of having to manually set up and run a test for each of the data points. The NIC provides for three types of automated compliance tests: Jitter Output, Jitter Tolerance, and Jitter Transfer.

- **Jitter Output Automated Compliance Test** - A number of different filter settings can be used, each with its own jitter output limit.
- **Jitter Tolerance Automated Compliance Test** - A number of different frequency/level pairs can be used as stimulus for the DUT. The pass/fail criteria can be programmed to either ‘Onset’ or ‘Power Penalty’.
- **Jitter Transfer Automated Compliance Test** - Both stimulus and response criteria can be programmed. The stimulus can be programmed to vary in both frequency and level. The response mask can also be programmed with frequency and level points.

Transfer Automated Compliance Test

The Transfer Automated Compliance test verifies that a network element generates or re-transmits no more than an allowed fraction of the jitter it receives at its input.

To perform a jitter transfer automated compliance test, the NIC applies jitter over a range of frequencies to the device under test. At each frequency, it makes a narrow-band measurement of the jitter received from the device under test and calculates the ratio, or jitter gain, of the measured jitter amplitude to the jitter amplitude applied. If, at all frequencies measured, the device’s jitter gain is at or below the allowable threshold, the test passes.

Setting up a Jitter Tolerance Test or Measurement

Before starting a jitter tolerance test or measurement you are required to set up parameters on the Toler/Transfer screen.

To run a jitter tolerance test:

Set 1

Test Type

Make one of the following selections:

- **Acceptance test** using the onset-of-errors measurement method
- **Acceptance test** using the 1-dB optical power penalty method
- **Jitter tolerance measurement** using the onset-of-errors measurement method
- **Jitter tolerance measurement** using the 1-dB optical power penalty method

Auto Distributed Frequency Points

Select this button to enter the number of automatically distributed test points in the mask.

You are not allowed to enter a number that is less than the minimum number of points required to define the set of vertices in the mask.

Error Type

From the list that appears, select the type of error that is to be measured for determining the largest bit-error ratio (BER) for a given jitter stimulus frequency.

Edit Mask

The Edit Mask pop-up list offers a choice of jitter tolerance masks applicable to the currently selected line rate. Both standard (fixed) masks and user-defined masks appear in this list.

ES Threshold

For tests using the '*Onset-of-Errors'* method, the threshold is the maximum number of errored seconds (ES) that are allowed to occur during the measurement time, for one point.

A measured count that exceeds this threshold causes that point to fail.

BER Parameters

For tests using the '*1-dB Optical Power Penalty'* method, the threshold is the largest BER that is allowed to occur during the measurement time for one point. A measured ratio that exceeds this threshold causes that point to fail.

As a convenience in setting this threshold, the NIC can show the currently measured BER and a recommended BER threshold based on the line rate and monitored bit error type. The recommended BER threshold is set to 100 errors per second for the chosen error type. This is computed as 100/(bit opportunities per second), where the number of bit opportunities is affected by which error type you select and the line rate. For example, the B1 byte covers all the bits in a frame. That translates into 311040 bit opportunities per frame for OC48 at 8000 frames per second. This is 2488320000 bit opportunities per second yielding a recommended BER of 4.018E-8. B3 errors would cover fewer of the bytes in a frame and yield a slightly higher BER.

SET 2

Stimulus Level %

Jitter tolerance acceptance tests may be performed at a multiple of the amplitude specified by the mask, which allows verifying a desired operating margin without the need for a user-defined mask. This value is expressed as a percentage of the mask value, therefore, setting it to 100 performs the test at the mask value.

The maximum amplitude capability of the jitter generator may, at some frequencies, limit the jitter applied to less than the specified multiple of the mask value.

DUT Settling Time per Point

The time, in seconds, between when jitter is applied to the device under test and the start of monitoring its output for bit errors.

Measurement Time per Point

The time, in seconds, allowed to apply jitter at a single frequency and monitor the errors that result. This setting allows trading off test execution speed for measurement thoroughness. Some industry standards specify a value, typically 30 seconds, for this parameter.

Measurement Search Method

If you have chosen to do a '*tolerance measurement*'**,** you can use this button to chose the method of searching for a jitter stimulus level that toggles the error condition. The available choices are:

- Binary, Decrease amplitude from maximum
- Binary, Increase amplitude from 0
- Linear, Increase amplitude from 0

Measurement Resolution

This is a numeric percentage of the mask value for each measurement point. The search will continue until the difference between the pass and fail levels is less than this value.

Calibrating a Transfer Measurement

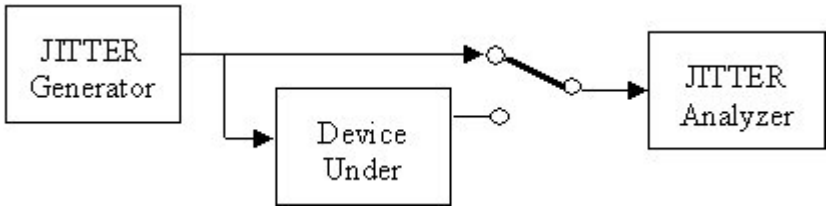
A jitter transfer measurement applies jitter to a device's input and measures the resulting jitter at its output. The jitter amplitude at the output can be small errors or inaccuracies in the jitter measurement. These small problems can be reflected as significant errors in the calculated jitter transfer ratio. There are two opportunities for error in the jitter transfer measurement:

1. Error in generating the applied jitter - This results in the actual amplitude of the applied jitter being different from the intended value.
2. Error in measuring the output jitter - This results in the value measured being different from the actual value.

Because jitter transfer is defined as the ratio of two jitter amplitudes, it is possible to measure not only the jitter at the output of the device under test, but also at its input, and to calculate the jitter transfer ratio from these two measured values. This approach minimizes the effect of both the errors described above for the following reasons:

- Errors in the generated jitter amplitude are irrelevant, because the transfer ratio is calculated from the measured jitter at the input and output of the device under test and not the absolute amplitude to which the jitter generator is set.
- Gain errors in the basic jitter measurement affect measured input and output jitter amplitudes equally and do not enter into the ratio calculation.

Performing a calibration step, in which the NIC's output is connected directly to its input and the jitter amplitude measured at each frequency, can significantly improve the accuracy of jitter transfer measurements. In effect, the measurements are made in a configuration like the one shown below.



Calibration should be performed after the NIC system has warmed up for 20 minutes or more, and repeated at least once a day.

To start the calibration:

1. From the **Jitter** tab, select **Toler/Transfer**.

   Before continuing, ensure that the system has been set up for a Jitter Transfer Test, looped back to itself for calibration, and that the mask and test settings are configured at the desired values.

2. Select the **Test** tab along the left-side of the screen and choose **Start Calibrate**.

   During calibration, the Elapsed Time indicator increments and the Percent Complete progress bar advances. When calibration is complete, the GUI displays "**Calibrated.**"

Do not change the mask selection or test settings after calibration is completed. Changing these settings erases the calibration data and requires that you repeat of the calibration process.

Starting an Output Test

A Jitter Output Test measures the jitter on an incoming optical or electrical signal. That incoming signal may be either a clock or data signal. To prepare for the Output test the module line rate must be programmed.

The system measures jitter as a peak-to-peak or RMS value after selecting and applying a filter. The filters are standardized sets of filters defined by the ITU and Telcordia, and are line rate dependant.

1. From the **Jitter** tab, select **Output Jitter**.
2. Select **Test Standard** and choose a test standard from the Select Test Standard dialog box.

If you choose **User Defined** as the Test Standard, select the **Modify User Settings** button on the Output Jitter screen to select the filters and levels that you want as part of your test. See the section “Configuring a User-Defined Mask Set” for more information on modifying user settings.

3. Select **Start Test**. Test progress displays in the Percent Complete bar.
4. When the test is complete the results of each filter are shown in the box below the Start button.

Starting Transfer Test

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select the **Set** tab along the left-side of the screen and choose **Set 1**.
3. Select **Test Type** and choose a transfer test.
4. Select the **Test** tab along the left-side of the Toler/Transfer screen and choose **Start Test**.

   During the execution of the test the Elapsed Test Time indicator increments, the Percent Complete progress bar advances, and the graph and results box are updated.

   Individual measurements appear as dots on the graph, using a visual coding system, which is described below.

   - **Green triangles** - Measurements that pass testing.
   - **Red triangles** - Measurements that fail testing.
   - **Green or red dot with a black center** - A measurement's whose applied jitter amplitude is limited by the maximum capability of the jitter generator and has reached its source limit. If space permits, the word **LIMIT** appears next to or below it.
   - The frequency, jitter transfer threshold value, measured jitter transfer value, and pass/fail status for each point are shown in the box below the graph. These values also appear in the Cursor window for the point at the cursor.

To view measurement data results more precisely use the optimization features.

Running an Output Compliance Test

1. From the **Jitter** tab, select **Output Jitter**.

2. Select **Test Standard** and choose a test standard from the Select Test Standard dialog box.

If you choose **User Defined** as the Test Standard, select the **Modify User Settings** button on the Output Jitter screen to select the filters and levels that you want as part of your test. See the section "Configuring a User-Defined Mask Set" for more information on modifying user settings.

3. Select **Start Test**. Test progress displays in the Percent Complete bar.

4. When the test is complete the results of each filter are shown in the box below the Start Test button.

Starting a Measurement Test

A jitter tolerance measurement displays the value measured rather than the amplitude applied.

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select the **Set** tab along the left-side of the screen and choose **Set 1**.
3. Select **Test Type** and choose a tolerance test.
4. Select the **Test** tab along the left-side of the screen and choose **Start Test**.

   During the execution of the test the Elapsed Time indicator increments, the Percentage Complete progress bar advances, and the graph and results box are updated.

   Individual measurements appear as dots on the graph, using a visual coding system, which is described below.

   - **Green triangles** - Measurements that pass testing.
   - **Red triangles** - Measurements that fail testing.
   - **Green or red dot with a black center** - A measurement's whose applied jitter amplitude is limited by the maximum capability of the jitter generator and has reached its source limit. If space permits, the word **LIMIT** appears next to or below it.
   - The frequency, mask value, measured value, and pass/fail status for each point are shown in the window below the graph. These values also appear in the Cursor window for the point at which the vertical cursor is located on the graph.

Measurement results can be viewed in a variety of ways the will optimize data interpretation.

Toler/Transfer - SET Screen Settings 1 (Set 1)

The Transfer and Tolerance Settings 1 screen contains the following options:

Option	Description

Test Type	Provides selection of four types of tolerance tests and two types of transfer tests.
Test Standard	Provides a list of industry standard transfer and tolerance masks from which to choose.
Auto Distributed Frequency Points	Allows the user to set the number of automatically distributed test points in the mask. You are not allowed to enter a number that is less than the minimum number of points required to define the set of vertices in the mask.
Error Type	Provides a list of error types used in determining onset of errors or a BER rate in a jitter tolerance test. The Error Type button does not apply if jitter transfer is selected as a test type.
Edit Mask	Provides access to the Edit Mask screen, where you can view and add measurement points to a standardized mask. If the mask is user-defined it allows you to add or edit vertices points to the mask.
ES Threshold	Allows the user to set the number of errored seconds that are allowed in an onset of errors tolerance test before that point is marked as failed. This does not apply to transfer measurements or 1db power penalty tolerance measurements.
BER - Threshold	Allows the user to set the BER operating point, around which the 1db power penalty measurements are made.
BER - Recommended Threshold	Displays the current recommended BER threshold for power penalty measurements. By selecting the button to the left of Recommended Threshold, you can set the threshold to the recommended displayed value.
BER - Current Reading	Displays the current reading at the receiver. By selecting the button to the left of Current Reading, you can set the threshold to the current reading value.

TX Toler/Transfer - SET Screen Settings 2 (Set 2)

The Transfer and Tolerance Settings 2 screen contains the following options:

Option	Description
Stimulus Level %	Provides ability to set a stimulus level for acceptance tests. By setting this value higher than 100%, the user can build margin into an acceptance test. Setting this to 100% causes the measurements to run exactly at the standardized acceptance point.
Jitter Transfer Start Frequency Override	For Transfer tests, this function provides the ability to change the start frequency of the measurements by checking the **Enable** checkbox and selecting the **Frequency** button to enter a starting value different from that of the standardized mask.
DUT Settling Time/Point	For Tolerance tests, this function allows the user to program a delay between the time that the stimulus is applied at a particular frequency and the time the measurement is started.
Measurement Time/Point	For Tolerance tests, this function is used to program the number of seconds for which each frequency point is tested.
Meas. Search Method	For Tolerance measurements, this function allows selection of the search method used in arriving at the pass fail point.
Meas. Resolution (% of Mask)	For Tolerance measurements, this function allows the user to program the accuracy of the measurement. The search will cease when the difference between the pass and fail level is less than the programmed percentage of the total measurement level.

TX Toler/Transfer - Test

The Test screen contains a variety of options that provide different views of measurement points, frequency and amplitude annotations, coordinate displays, amplitude capability, and measured jitter tolerance values.

The Toler/Transfer Test screen contains the following options:

Options	Description
Start/Stop Test	Starts and stops the test.
Show	Allows the user to change the appearance of the graph in the right-hand portion of the screen. • **Grid** shows or hides the frequency and amplitude annotations for the graph axis. • **Vertices** shows or hides the coordinate display for the mask vertices. • **Gen. Limit** shows or hides a display of the maximum amplitude capability of the jitter generator. • **Connect** enables or disables drawing a line between adjacent dots that show measured jitter tolerance values. This function is not applicable to acceptance tests.
Cursor	Selecting the Cursor buttons moves the cursor to various measurement points on the graph. The window immediately below the buttons displays the frequency, mask value, measured value, and pass/fail status of the current point.

Transfer Test - Settings 2 (Set 2)

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select the **Set** tab along the left side of the screen and choose **Set 2**.
3. Select **Stimulus Level %** to control the applied jitter level, at which the jitter transfer is measured. The value is expressed as a percentage of the amplitude specified by the stimulus mask.
4. From **Jitter Transfer Start Frequency Override**, select the **Enable** check box.

The Enable check box must be selected for the Frequency option to be available.

5. Select **Frequency** and enter a precise start frequency transfer value. This setting causes the jitter transfer test to perform over only that part of the frequency range specified by the jitter transfer mask.

Tolerance Automated Compliance Test

A fully automated tolerance compliance test applies jitter and measures errors at a series of frequency/amplitude points. The NIC performs both jitter tolerance 'acceptance' tests and jitter tolerance 'measurements' tests.

Creating a New User-Defined Mask

When a user-defined mask is selected for the Transfer/Tolerance Test Standard, the Edit Mask screen provides the capability to create a new user-defined mask.

To create a new user-defined mask:

1. Configure a Jitter Tolerance or Transfer test. You must select a **User-Defined** mask for the **Test Standard** selection during the configuration.
2. From the **Transmit Set 1** screen, select **Edit Mask**. The Edit Mask screen appears.
3. Select the **Mask name/description** button and enter a new mask name using the keyboard that appears.

IMPORTANT: If you configured the system for a *Transfer* test, then both **Mask name/description** and **Associated stimulus mask name/description** options appear. Use the same procedure described below to create a new jitter tolerance mask that will define the stimulus for the jitter transfer mask.

4. Select **Enter**. The new mask name appears in the Mask name/description text field.
5. Select **Auto Distributed Freq Points** and enter the number of measurement points to display along the mask curve.
6. From the **Mask Segment definition** box, select **Add**. The Modify Jitter Frequency and Amplitude dialog appears.
7. Select **Jitter Frequency** and enter the frequency vertex coordinate using the frequency calculator that appears. Select **OK**.
8. Select **Jitter Amplitude** and enter the amplitude vertex coordinate using the amplitude calculator that appears. Select **OK**.

IMPORTANT: A minimum of two vertices must be defined for the mask segment.

9. From the **Modify Jitter Frequency and Amplitude** dialog box, select **OK** after the segments have been added. Additional segments can be added later and existing segments can be modified by selecting the segment and choosing the appropriate control button. The new segments appear on the mask plot window.
10. You can add extra frequency measurement points to the vertice by selecting **Add** from the **Extra measurement points** box.
11. Enter the frequency value using the frequency calculator that appears. Select **OK**. The measurement point appears as a dot on the mask plot.
12. After all coordinates have been configured, select **OK**. The Edit Mask screen closes and the new mask displays as the selected **Test Standard**.

For more information on using the Edit Mask screen, see Editing a Tolerance Mask and Editing a Transfer Mask.

Jitter TX Tolerance Tests and Measurements

A jitter tolerance test verifies a network element's ability to perform its function in the presence of jitter on its input signal. The NIC performs tolerance tests that apply jitter and measures errors at a series of frequency/amplitude points. These can be performed as an acceptance or measurement test.

- **Jitter Tolerance Acceptance Test** - An acceptance test applies jitter at a set of particular frequencies and amplitudes, and verifies that the device under test functions under those conditions. Any point for which the device under test cannot tolerate the specified jitter causes the test to fail.
- **Jitter Tolerance Measurement Test** - A measurement test attempts to determine the maximum level of jitter with which a device will function. The NIC applies jitter at the same frequencies as the acceptance test but at each frequency it varies the jitter amplitude to find the level at which the device under test fails the selected criterion. The highest level at which the device under test passes becomes the measured jitter tolerance for that frequency.

A tolerance test is traditionally measured in one of two ways:

1. **1-dB Optical Power Penalty Method** - This method uses an attenuated input signal that is adjusted to achieve a specified error rate, typically approximately 100 errors per second with no jitter applied. The input power level is increased by 1dB, which reduces the error rate. Jitter of a specified frequency and amplitude is then applied and the error rate measured again. If the error rate with jitter is at or below the error rate

initially measured at reduced power, the device under test can tolerate the jitter applied.

2. **Onset-of-errors Method** - This method starts with a signal that is error free when no jitter is applied. Jitter of a specified frequency and amplitude is then applied to the input of the device under test and its output is monitored for errors for a specified time interval. If, during this interval, the number of errored seconds – one-second intervals in which one or more errors occur – is at or below a threshold, the device under test can tolerate the jitter applied.

Before starting a jitter tolerance test or measurement you are required to set up parameters on the Toler/Transfer screen. The parameters are configured from the Set 1 and Set 2 screens. Once configured, you can begin taking jitter tolerance measurement tests and viewing different types of test result data.

- Configuring Tolerance Test - Set 1
- Configuring Tolerance Test - Set 2
- Starting a Measurement Test
- Optimizing Toler/Transfer Test Screen Results

Optimizing Test Screen Results

The Tolerance/Transfer Test screen contains a variety of options that provide different views of measurement points, frequency and amplitude annotations, coordinate displays, amplitude capability, and measured jitter tolerance values.

To view the test screen results:

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select **Test** from the tabs along the left-side of the Toler/Transfer screen.
3. Use one of the following display controls to view output information:

    - **Graph Display** - Select or clear the check boxes in the Show group to change the way the graph displays data.

    Grid shows or hides the frequency and amplitude annotations for the graph axis.

    Vertices shows or hides the coordinate display for the mask vertices.

    Gen. Limit shows or hides a display of the maximum amplitude capability of the jitter generator.

Connect enables or disables a line between adjacent dots that show measured jitter tolerance values. This function is not applicable to acceptance tests.

- **Cursors** - Select a cursor button to move a vertical cursor to various measurement points on the graph. The window immediately below the buttons displays the frequency and mask values for the cursor point.

Performing Transfer Tests and Measurements

Before starting a jitter transfer test or measurement you must set up parameters on the Jitter TX, Toler/Transfer screen. The parameters are configured from Set 1 and Set 2 windows. Running jitter transfer tests and measurements consists of three steps:

- Configuring a Transfer Test
- Calibrating a Transfer Measurement
- Starting a Transfer Test

Screen Function and Definitions

Jitter Screen Functions and Descriptions Overview

This section of the online help describes the function screens, buttons, and tabs that control Jitter configuration and operation.

The following screens are found in the Jitter protocol processor:

- Transmit
- Receive
- Results
- Test
- Output Jitter
- Toler/Transfer
- LEDs

Transmit
Jitter Transmit

The Jitter Transmit functionality allows the user to inject jitter onto a selected transmit signal at a chosen sinusoidal frequency that ranges from 10 Hz to the maximum jitter rate of 20 Mhz for the 2.5G line rate. It receives its signal content from the rest of the system. As such, any signal content parameters must be set up in the module that is responsible for signal content.

The following testing criteria is provided:

- Tolerance Tests and Measurements
- Transfer Tests and Measurements

The Jitter laser remains ON when the optical interface is changed to a non-jitter SONET/SDH signal, allowing the Jitter laser and Optical Multirate laser to remain on at the same time

.

Transmit Screen and Functions

The Transmit function allows the user to inject jitter onto a selected transmit signal at a chosen sinusoidal frequency that ranges from 10 Hz to the maximum jitter rate of 20 Mhz for the 2.5G line rate. It receives its signal content from the rest of the system. As such, any signal content parameters must be set up in the module that is responsible for signal content.

The Transmit parameters are configured on the Set 1 screen. The following options are available:

Option	**Description**
Generation Mode	When licensed for Wander Client, the user can choose either Jitter or Wander generation.
Start Wander GUI	This command button appears on the Remote GUI for NIC test sets licensed for Jitter and Wander Client. Selecting the Start Wander GUI button Installs and launches the Wander Client application.
Transmit Jitter Mode	Allows the user to manually turn jitter generation on and off.

Jitter Frequency and Amplitude	Displays a pop-up window that allows the manual setting of the jitter frequency and amplitude.
Interface Rate	Displays the line rate of the transmitted signal. This must be programmed to the correct line rate in order for a valid signal to be generated. The line rate is set using the Presets function.
Clock Reference	Displays the selected clock reference for the jitter/wander measurement.

Receive

Jitter Receive

Jitter Receive functionality measures jitter on an incoming optical or electrical signal. Signal parameters are configured from the Receive screens and functions.

Receive Screens and Functions

The Receive function screens allow you to configure and view receive settings for incoming signals.

The following options are available on the Jitter RX Receive screen:

- Set 1
- SIG

Receive - Settings 1 (SET 1)

The Receive SET 1 screen provides the following options and controls:

Option	Description
Measurement Mode	When licensed for Wander Client, the user can choose either Jitter or Wander generation.
Start Wander GUI	This command button appears on the Remote GUI for NIC test sets licensed for Jitter and Wander Client. Selecting the Start Wander GUI button Installs and launches the Wander Client application.

Interface Type	Allows the user to select from a variety of optical or electrical interfaces as the source for the input signal to be measured for jitter.
STM1e Gain	Allows the user to select between unamplified and amplified signals for measuring jitter. When selected, the amplification is 20db.
Threshold Offset	Allows for programming an optical level at which the selection between a low and high level is made. A value of 0mV puts the optical threshold at midpoint between the high and low optical level.
Filter	Allows the user to select from a number of line rate dependant filters to use in the measurement.
Jitter Hit Threshold	Programs the number of UI that is allowed in a jitter measurement before a jitter hit is registered.
Measurement Window Size	Programs the size of the measurement window in seconds.
Frequency Tolerance	Programs the allowable frequency offset in PPM. If the input frequency exceeds this in either direction, a Frequency Out of Range error is registered.
Demodulated Output Range	Programs the gain of the demodulated jitter output signal. Values are in UI/V.
Interface Rate	Displays the line rate of the incoming signal. This must be programmed to the correct line rate in order for a correct jitter/wander measurement to be made. The line rate is set using the Presets function.
Clock Reference	Displays the selected clock reference for the jitter/wander measurement.

Receive - Signal (SIG)

The Receive Signal (SIG) screen shows a number of different measure values concerning the incoming signal.

Option	Description
Frequency	Shows the current measured frequency of the incoming signal.
Line Frequency Offset Received	Shows the difference, in PPM, between the incoming line frequency and the jitter systems reference frequency.
Optical Power	Shows the current measured optical power of the incoming signal.

Results

Results Screens and Functions

This function allows you to view jitter test results and measurements in various formats.

The following functions are available through Jitter Results screen:

- Count
- Alarm
- Large LED
- Jitter vs. Time

Results - Count

The Count screen shows status indicators, current measurements, and jitter hits.

The following information is displayed:

Option	Description
Interface Rate and Type	Shows the currently selected line rate.
Filter	Shows the currently selected filter.
Measurement Window Size	Shows the currently programmed window size, in seconds.

Current Measurements Table	The table below the three status indicators described above (Interface Rate and Type, Filter, Measurement Window Size) displays the window status, as well as the current measurements for: • Peak-to-Peak • Positive Peak • Negative Peak • RMS (Available when a filter is selected that includes RMS measurement it is shown as well.) These measurements are for the current window and the windows where the minimum and maximum readings were recorded.
Jitter Hit Threshold	Below the Count Measurements Table is another table showing jitter hits. It shows both the jitter hit seconds, as well as the total number of jitter hits.

Results - Jitter vs. Time

The Jitter vs. Time screen is used to display a running graphical representation of the jitter results. These results can be displayed in either a UI versus Time format or a Histogram format. The screen contains a number of check boxes and buttons that allow the user to change the details of how the results are displayed.

Option	**Description**
Peak to Peak	When selected, the Peak to Peak values are displayed in the graph.
Negative Peak	When selected, the Negative Peak values are displayed in the graph.
Positive Peak	When selected, the Positive Peak values are displayed in the graph.

RMS	When selected, the RMS values are displayed in the graph. If the user has not selected a filter that allows RMS measurement, this item will not be available.
Hit Threshold	Allows the user to program the Jitter Hit Threshold from the Jitter vs Time screen. This has the same effect as the Jitter Hit Threshold button on the Receive Set 1 screen.
Display Threshold	When selected, the Hit Threshold is displayed as a dotted line on the Results graph.
Live Update	When selected, the screen updates each time a new measurement window is evaluated. Clearing the check box freezes the graph until you check the box again.
Histogram	When selected, the graph displays results in histogram form. The Horizontal axis is measured UI and vertical axis is the number of windowed measurements at a particular UI level. When Histogram is selected the Hit Threshold button is not available.
Undo Zoom	Restores the zoom level of the graph to the default size.
Scale Up	Decreases the resolution of the time axis in the UI versus time display.
Scale Down	Increases the resolution of the time axis in the UI versus time display.
Auto Scale	Automatically sets the resolution of the axis such that the entire results can be seen.

You can zoom in on portions of the graph by simply dragging the cursor across a section of the Histogram.

Results - Alarm

The Alarm screen tabulates the various alarms detected by the jitter receiver. The tabulation is displayed in seconds, indicating the number of seconds spent in the alarm condition.

Results - Large LED

The Large LED screen displays a large version of the status LEDs, which are found on the left-hand portion of the Jitter screen. This is useful for visually monitoring the status of the system from across the room.

Test

Test Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- SET 1
- Service Disruption

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Service Disruption

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The service disruption measurements show a granular accuracy of 1 frame duration. See the chart at the bottom of this page for time per frame durations for each protocol processor.

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

  For **E4**, **E3**, **E1**, **DS3** and **DS1** processors, the Protection Switch Criteria is limited to: Loss of Pattern Sync and Bit Errors.

  For **SONET** and **SDH** processors the Protection Switch Criteria include: B1, SEF / OOF, AIS-L / MS-AIS, AIS-P / AU-AIS, AIS-V / TU-AIS, and PRBS (Loss of Pattern Sync and Bit Errors).

  For **OTN** processors the Protection Switch Criteria include: OOF, OTU:AIS, OTU:BIP8, ODU:AIS, ODU:BIP8, and PRBS (Loss of Pattern Sync and Bit Errors).

- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **State** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

  - **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

  - **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.

Stop APS - Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)** - Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.
- **Protection Switch Time (Frames)** - Indicates the number of errored frames received during the service disruption event.
- **History Recent Milli Seconds** - Shows the time durations for the last ten measurements recorded.
- **History Recent Frames** - Shows the frame durations for the last ten measurements recorded.

A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing Service Disruption.

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
SONET / SDH	0.125 ms (125 µs)	16383 frames (2047.875 ms)
OTU 1	0.049 ms (49 µs)	16383 frames (802.302 ms)
OTU 2	0.012 ms (12 µs)	16383 frames (199.732 ms)
E4	0.021 ms (21 µs)	255 frames (5.361 ms)
E3	0.045 ms (45 µs)	255 frames (11.397 ms)
E1	0.125 ms (125 µs)	4095 frames (511.875 ms)
DS3	0.106 ms (106 µs)	255 frames (27.133 ms)
DS1	0.125 ms (125 µs)	4095 frames (511.875 ms)

Click this link for Ethernet Service Disruption specifics.

Output Jitter

Output Jitter Screen and Functions

The Output Jitter screen is used to configure and display results for an Output Compliance Test. It contains the following functions:

Option	Description
Test Standard	Allows the user to select from a variety of standardized jitter output masks. It also allows the user to select a user-defined mask.
Modify User Settings	If a User Defined mask is selected under Test Standard then the Modify User Settings button allows the user to choose a set of filters and levels to make up their own mask.
Rate	Displays the transmit interface rate.
Start/Stop Test	Starts/Stops the Output Jitter compliance test.
Result table	Displays the test results for each filter.

Output Automated Compliance Test

The Output Compliance Test allows the user to test a device's output jitter against a set of allowable jitter levels at each of a number of different filter settings. These combinations of filter settings and levels are organized into test standards.

The following is a list of available test standards that can be selected.

- GR-253 Equipment, Category II
- GR-812 Equipment

- G.783 Equipment, Option 1 (Ref.G.813)
- G.783 Equipment, Option 2 (Ref.G.813)
- G.783 Equipment, Type A Regen
- G.783 Regen. (1.544 Mbits/S networks)
- GR-253 Network Equipment, Category II
- GR-253 Network
- GR-253 Network, Type B
- GR-813 Equipment, Option 1
- GR-813 Equipment, Option 2
- G.825 Network
- T1.105.03 Network, Type A Regen
- T1.105.03 Network, Type B Regen
- EN 300 462-4-1 Equipment

In addition to the test standards listed above, a user-defined standard can also be set up.

Output Jitter

The Output Jitter functionality allows the user to test a device's output jitter against a set of allowable jitter levels at each of a number of different filter settings. These combinations of filter settings and levels are organized into test standards. The NIC provides a number of test standards that can be selected from the NIC touch screen.

Toler / Transfer
Masks

Configuring a User-Defined Mask Set

1. From the **Jitter** tab select **Output Jitter**.
2. Select **Test Standard** choose **User Defined** from the Select Test Standard dialog box.
3. Select **Modify User Settings**. The Configure User Test Standard dialog box appears.
4. Enable the desired filter(s) by selecting its check box.

5. Select the **Modify** button next to the enabled filter(s) and enter its allowable jitter value. Select **OK**.
6. Select **OK** to close the Configure User Test Standard dialog box.

Editing a Tolerance Mask

Editing a jitter tolerance (stimulus) mask allows the user to define or modify the currently selected mask and set the number of measurement points.

1. From the **Jitter** tab, select **Toler/Transfer** and choose **Set 1**.
2. Select **Test Type** and choose a tolerance test from the Select Test Type dialog box.
3. Select **Test Standard** and choose the tolerance mask to be edited.
4. Select **Edit Mask**. The Edit Mask screen appears.
5. The following options are available:
    - **Mask name / description** - Displays the mask selected from the Set 1 Test Standard option.

      ▸ If a *standardized mask,* you can add extra measurement points; however, you cannot change the end points (vertices).

      ▸ If a *user-defined* mask, you can add extra measurement points and end points, or create a new user-defined mask.

    - **Auto Distributed Freq Points** - Displays the number of points along the mask curve at which measurements will be performed. The system forces at least as many points as the number of mask vertices.

      ▸ To change this number, select the **Auto Distributed Freq Points** button and enter the new number of points.

    - **Copy Mask** - Allows you to copy data from a standard mask or another user-defined mask. This function is only available for user-defined masks.

      ▸ To copy the mask, select **Copy Mask** and choose the desired mask.

    - **Mask Segment Definition** - The segment box displays the parameters for the vertices of the mask segments. Examining the segment definitions of a standard mask is an effective way to become familiar with the format in which mask definitions are displayed and entered. These coordinates are only editable for user-defined masks.

To edit user-defined mask segments:

a. To add a new segment, select **Add** and enter the coordinates.
b. To delete a segment, choose the segment and select **Delete**.
c. To modify a segment, choose the segment, select **Modify** and enter the new coordinates.

- **Show meas. points** - Displays dots in the mask plot at the selected measurement frequency points.

  ▶ Select the check box to display the dots or clear the check box to remove the dots.

- **Show generator limits** - Displays the mask trace on the mask plot, which represents the maximum jitter amplitude capability of the jitter generator.

  ▶ Select the check box to display the mask trace or clear the check box to remove mask trace.

- **Cursor** - Allows you to move a vertical cursor across the mask plot from measurement point to measurement point. The value of frequency and level at the current cursor point are shown in the box to the right of the cursor buttons.

  ▶ Select the left-arrow or right-arrow Cursor button to move the vertical cursor across the plot.

- **Extra measurement points** -Allows you to specify particular frequencies at which you want measurements to be made. These points are independent of automatically assigned frequencies. The frequencies specified must be within the range covered by the mask. This feature may be used to concentrate measurements in a frequency range that is of particular interest. These points are defined by frequency only and do not create vertices.

  To edit user-defined mask segments:

  a. To add a new frequency, select **Add** and enter the coordinates.
  b. To delete a frequency, choose the segment and select **Delete**.
  c. To modify a frequency, choose the segment, select **Modify** and enter the new coordinates.

6. Select **OK**.

Editing a Transfer Mask

Editing a jitter transfer mask allows the user to define or modify the currently selected mask and to select the number of measurement points.

This is the same mask editor used for editing a tolerance mask but with minor differences in its configuration.

1. From the **Jitter** tab, select **Toler/Transfer** and choose **Set 1**.
2. Select **Test Type** and choose a transfer test from the Select Test Type dialog box.
3. Select **Test Standard** and choose the transfer mask to be edited.
4. Select **Edit Mask**. The Edit Mask screen appears.
5. The following options are available:
    - **Mask name / description** - Displays the mask selected from the Set 1 Test Standard option.

      ▶ If a *standardized mask,* you can add extra measurement points; however, you cannot change the end points (vertices).

      ▶ If a *user-defined* mask, you can add extra measurement points and end points, or create a new user-defined mask.

    - **Associated stimulus mask name/description** - Displays the name of the jitter tolerance mask that defines the stimulus for the jitter transfer mask.

      ▶ If a *standardized mask,* you can add extra measurement points; however, you cannot change the end points (vertices).

      ▶ If a *user-defined* mask, you can add extra measurement points and end points, or create a new user-defined mask.

- **Auto Distributed Freq Points** - Displays the number of points along the mask curve at which measurements will be performed. The system forces at least as many points as the number of mask vertices.

  ▶ To change this number, select the **Auto Distributed Freq Points** button and enter the new number of points.

- **Copy Mask** - Allows you to copy the Response Mask and/or Stimulus Mask from a standard mask or another user-defined mask to the current user-defined mask. This function is only available for user-defined masks.

  ▶ To copy the mask, select **Copy Mask** and choose the desired mask.

- **Mask Segment Definition** - Displays the coordinates of the end points (vertices) of the mask segments. Examining the segment definitions of a standard mask is an effective way to become familiar with the format in which mask definitions are displayed and entered. For user-defined masks this field is editable and may be used to add, delete, or modify the vertex coordinates.

  To edit user-defined mask segments:

  a. To add a new segment, select **Add** and enter the coordinates.
  b. To delete a segment, choose the segment and select **Delete**.
  c. To modify a segment, choose the segment, select **Modify** and enter the new coordinates.

- **Display** - Displays a Response Mask or Stimulus Mask on the mask plot. For user-defined masks, this option selects the mask currently open for editing.

  ▶ Select the **Stimulus Mask** or **Response Mask** radio button.

- **Show meas. points** - Displays dots in the mask plot at the selected measurement frequency points.

  ▶ Select the check box to display the dots or clear the check box to remove the dots.

Measurement points are allocated based on the Response Mask, independent of whether the Response Mask or Stimulus Mask is displayed. Extra measurement points are similarly allocated within the range specified by the response mask.

- **Show generator limits** - Displays the mask trace on the mask plot, which represents the maximum jitter amplitude capability of the jitter generator.

  ▶ Select the check box to display the mask trace or clear the check box to remove mask trace.

- **Cursor** - Allows you to move a vertical cursor across the mask plot from measurement point to measurement point. The value of frequency and level at the current cursor point are shown in the box to the right of the cursor buttons.

  ▶ Select the left-arrow or right-arrow Cursor button to move the vertical cursor across the plot.

- **Extra measurement points** -Allows you to specify particular frequencies at which you want measurements to be made. These points are independent of automatically assigned frequencies. The frequencies specified must be within the range covered by the mask. This feature may be used to concentrate measurements in a frequency range that is of particular interest. These points are defined by frequency only and do not create vertices.

  To edit user-defined mask segments:

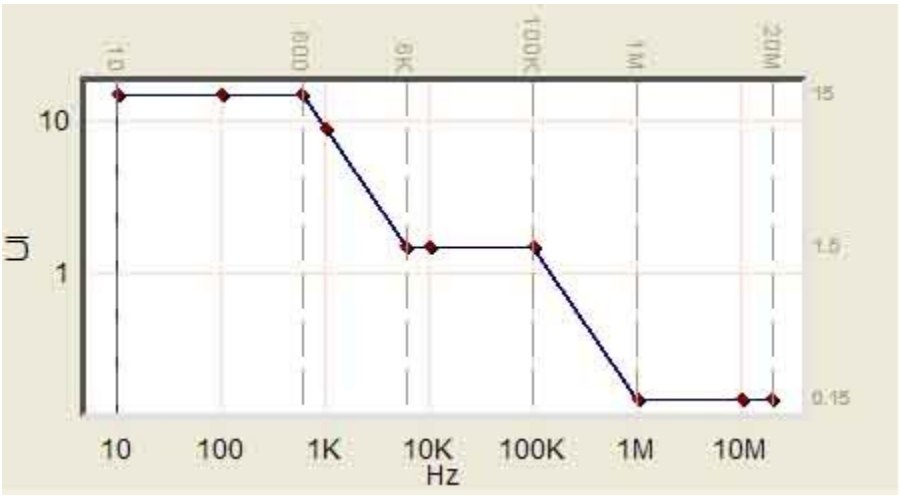
  a. To add a new frequency, select **Add** and enter the coordinates.
  b. To delete a frequency, choose the segment and select **Delete**.
  c. To modify a frequency, choose the segment, select **Modify** and enter the new coordinates.

6. Select **OK**.

Jitter Stimulus Mask

The amplitude of jitter that a network element must accept depends on the jitter frequency. It is typically specified by a mask represented in a graph of jitter amplitude, in unit intervals (UI) vs. frequency, called a mask.

The example below, the GR-253 OC-48 Jitter Tolerance Requirement Mask, is a typical jitter mask used for jitter tolerance tests.



In this example:

- The device under test must accept jitter at an amplitude of 15 UI or greater over the frequency range 10 Hz to 1 KHz.
- The required amplitude declines to 1.5 UI at 10 KHz, a slope of one decade of amplitude for one decade of frequency.
- The amplitude value is 1.5 UI to 100 KHz.
- It then declines to 0.15 UI at 1 MHz, again at a slope of one amplitude decade per frequency decade.
- The amplitude remains a constant 0.15 UI up to 20 MHz.
- The frequency range outside of 10 Hz to 20 MHz is not covered by this mask. The standard for which this mask is defined covers only 10 Hz to 20 MHz.

Standard Masks and User-Defined Masks

The telecommunications industry standards define a number of jitter tolerance masks for different line rates and applications. The NIC software includes these standard masks.

In addition to standard masks, there are user-defined masks whose parameters may be chosen to meet the needs of a particular application. User-defined masks are specified by the frequency and amplitude coordinates of their segment's end points (vertices).

Configuring Tolerance Test - Set 1

1. From the **Jitter** tab select **Toler/Transfer**.
2. Select the **Set** tab along the left-side of the screen and choose **Set 1**.
3. Select **Test Type**. The Select Test Type window appears. For a Tolerance test, choose one of the following:

    - **Tolerance - Power Penalty (Acceptance)** -An acceptance test using the 1-dB optical power penalty method.
    - **Tolerance - Power Penalty (Measure)** - A jitter tolerance measurement using the 1-dB optical power penalty method.
    - **Tolerance - Onset (Acceptance)** - An acceptance test using the onset-of-errors measurement method.
    - **Tolerance - Onset (Measure)** - A jitter tolerance measurement using the onset-of-errors measurement method.

4. Select **Test Standard**. The Select Test Standard dialog box appears.
5. Choose the tolerance mask applicable to the currently selected line rate. Both standard (fixed) masks and user-defined masks appear in the list.
6. Select **Auto Distributed Freq Points** and enter the number of automatically distributed test points that you want in the mask.

You are not allowed to enter a number that is less than the minimum number of points required to define the set of vertices in the mask.

5. Select **Error Type**. The Select Error Type dialog box appears.
6. Select the type of measurement error that is to be used for determining the largest bit-error ratio (BER) for a given jitter stimulus frequency.
7. Select **Edit Mask**. The Edit Mask screen appears.
8. Make any necessary changes to the mask and select **OK**. Select **Cancel** if no changes are required.
9. Select **ES Threshold** to enter the errored second threshold. A measured count that exceeds this threshold causes that point to fail. The ES Threshold button is only available when an ‘Onset’ Test Type is selected.

For tests using the 'Onset' method, the threshold is the maximum number of errored seconds (ES) that are allowed to occur during the measurement time for one point.

10. If available, select **Threshold**. The BER Parameters section is available when a ‘Power Penalty’ Test Type is selected.
    a. Enter the BER Threshold. The threshold is the largest BER that is allowed to occur during the measurement time for one point. A measured ratio that exceeds this threshold causes that point to fail.
    b. Select the **Set** button for either **Recommended Threshold** or **Current Reading**.

The NIC shows a recommended BER threshold (**Recommended Threshold**) and the currently measured BER (**Current Reading**) based on the line rate and monitored bit error type. The recommended BER threshold is set to 100 errors per second for the chosen error type. This is computed as 100/(bit opportunities per second), where the number of bit opportunities is affected by which error type you select and the line rate. For example, the B1 byte covers all the bits in a frame. That translates into 311040 bit opportunities per frame for OC48 at 8000 frames per second. This is 2488320000 bit opportunities per second yielding a recommended BER of 4.018E-8. B3 errors would cover fewer of the bytes in a frame and yield a slightly higher BER.

11. To complete the Tolerance test configuration, configure Set 2 parameters.

Configuring Tolerance Test - Set 2

1. From the **SONET/SDH Jitter** tab, select **Toler/Transfer**.
2. Select the **Set** tab along the left side of the screen and choose **Set 2**.
3. Select **Stimulus Level %** to perform a tolerance acceptance test at a multiple of the amplitude specified by the mask. The Stimulus Level % button is only available when an ‘Acceptance’ Test Type is selected.
4. Enter the desired stimulus level. This allows for verification of a desired operating margin without the need for a user-defined mask. This value is expressed as a percentage of the mask value; therefore, setting it to 100 performs the test 'at' the mask value.

The maximum amplitude capability of the jitter generator may, at some frequencies, limit the jitter applied to less than the specified multiple of the mask value.

5. Select **DUT Settling Time/Point** and set the time, in seconds, between when jitter is applied to the device under test and the start of monitoring its output for bit errors.
6. Select **Meas. Time/Point** and set the allowable time, in seconds, for applying jitter at a single frequency and monitoring the resulting errors. This setting allows trading-off test execution speed for measurement thoroughness. Some industry standards specify a value, typically 30 seconds, for this parameter.
7. Select **Meas. Search Method** to choose the method of searching for a jitter stimulus level that will toggle the error condition. The Meas. Search Method button is available when a tolerance ‘Measurement' Test Type is chosen in the Set 1 configurations. The available choices are:

- Binary, Decrease amplitude from maximum
- Binary, Increase amplitude from 0
- Linear, Decrease amplitude from maximum
- Linear, Increase amplitude from 0
- Linear, Increase amplitude per 0.171
- Binary, Decrease amplitude from maximum (fast)

8. Select **Meas. Resolution (% Of Mask)** to enter a numeric percentage of the mask value for each measurement point. The search will continue until the difference between the pass and fail levels is less than this value. The Meas. Resolution (% Of Mask) button is available when a tolerance 'Measurement' Test Type is chosen in the Set 1 configurations.

Configuring a Transfer Test

Configuring a transfer test consists of setting up all of the test parameters. The user can select from a number of standardized stimulus and response masks, or create their own custom masks.

There are two transfer test sets to configure:

- Set 1
- Set 2

Toler/Transfer Settings Screens

The Toler/Transfer, Set screen provides the configuration settings for all of the test parameters. The user can select from a number of standardized stimulus and response masks, or create their own custom masks.

Settings are configured on the following screens:

- Set 1
- Set 2

Transfer Test - Settings 1 (Set 1)

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select the **Set** tab along the left side of the screen and choose **Set 1**.
3. Select the **Test Type** button. The Select Test Type dialog box appears. Choose one of the following:

    - **Transfer (Fast)** - Uses an efficient jitter transfer measurement to achieve the shortest test time. For most test situations, this technique yields satisfactory accuracy.

- **Transfer (High Accuracy)** - Uses an integration technique to minimize the effects of noise and random variation in the jitter measurement at the expense of a longer test time.

5. Select **Test Standard**. The Select Test Standard dialog box appears.
6. Choose the transfer mask applicable to the currently selected line rate. Both standard (fixed) masks and user-defined masks appear in the list.
7. Select **Auto Distributed Freq Points** and enter the number of automatically distributed test points you want in the mask.

You are not allowed to enter a number that is less than the minimum number of points required to define the set of vertices in the mask.

8. Select the **Edit Mask** button. The Edit Mask window appears.
9. Make any necessary changes to the mask and select **OK**. Select **Cancel** if no changes are required.
10. Configure Set 2 parameters.

LED Quick Status Area

The LED Quick Status Area allows you to quickly view the status of transmit and receive signals.

The Jitter laser remains ON when the optical interface is changed to a non-jitter SONET/SDH signal, allowing the Jitter laser and Optical Multirate laser to remain on at the same time.

The LED Quick Status Area is located on the left-hand side of the Jitter screen. The following indicators are displayed:

LED	Description
Tx	Displays the status of Transmit interface rate.
Rx	Displays the status of the Receive interface rate.
Opt. Power	Displays the optical signal power, when the Receive Interface Type is set to Optical Data.

Test Paused	Displays a red LED when a test paused.
Tx Clk:	Displays the status of the Transmit Clock Reference.
Rx Clk:	Displays the status of the Receive Clock Reference.
Tx PP Ref.	Confirms that the Jitter Tx Protocol Processor internal clock reference is okay and that the test set is operating normally.
Rx PP Ref.	Confirms that the Jitter Rx Protocol Processor internal clock reference is okay and that the test set is operating normally.
Jitter	Indicates whether or not jitter is activated. (i.e. generating jitter).
Laser Over Temp	Indicates that the temperature control on the laser, for the Jitter TX has failed to keep the laser temperature within the specified guidelines. It may be due to a failure of the jitter TX board's temperature control or general system overheating. This condition could be injurious to the laser. The system should be immediately powered down and sent in for service.
Laser Under Temp	Indicates that the temperature control on the laser, for the Jitter TX has failed to keep the laser temperature within the specified guidelines. This is usually to a failure in the Jitter TX board's temperature control circuit. If this condition persists the system should be sent in for service.
Input Optical Data	Indicates the presence of an optical signal at the input of the module.
LOS	Loss of Signal. An alarm LED indicating a valid signal is not being received. If an all-zeros pattern exists for 100 milliseconds or longer on the incoming SONET signal, then an LOS is reported.

Optical Overload	Indicates that the optical power level is exceeds the maximum allowable (0 dBm) level.
Power Loss	Indicates there has been a loss of line power.
Frequency Out of Range	Indicates that the measured line rate of the incoming signal is greater or less than the reference line rate of the measurement system by more than the amount programmed by the Frequency Tolerance button.
Jitter Hits	Indicates that the system had instances of measured jitter exceeding the Jitter Hit Threshold.
STM1-e Code Violations	For an STM-1e input, a red LED indicates CMI Code Violations.

Jitter Misc

Testing Jitter on a Multirate Unit Overview

NIC units that have the Jitter module and are licensed for Optical Multirate, and contain the Multirate circuit pack can set up jitter interfaces from the Multirate (SONET/SDH) tab.

- Attaching Optical Cables
- Configuring Jitter for a Multirate Unit

The Jitter TX laser remains ON when the optical interface is changed to a non-jitter SONET/SDH signal, allowing the Jitter laser and Optical Multirate laser to remain on at the same time.

Configuring Jitter for a Multirate Test Set

1. Select the **SDH/SONET** tab.
2. Select **Transmit** and choose **Set 1**.
3. Select **Interface**. The Select Type of Interface dialog box appears
4. Select the desired Jitter Interface for testing.
5. Configure all other necessary SDH parameter settings.
6. From the **Jitter** tab, select **Transmit**.

7. Turn the laser **On**.
8. Select **Receive** and choose **SIG**. Ensure that a valid signal is being received for the configured line rate.

When testing Jitter, the Multirate lasers are disabled and the Jitter laser is used.

The Jitter TX laser remains ON when the optical interface is changed to a non-jitter SONET/SDH signal, allowing the Jitter laser and Optical Multirate laser to remain on at the same time.

Attenuate the received optical power level if necessary so that the power level going into the Jitter RX laser is less than -10 dBm.

Attaching Optical Cables

Before starting jitter tests on a NIC Multirate test set you must disconnect the cables from the Multirate TX or RX connector on the NIC connector panel and reconnect them to the Jitter TX or RX connector.

For instructions on connecting cables, see the **Common Tasks** section of Getting Started, located in the NIC Online Help.

OC-1/3/12 Tab

OC-1/3/12 Overview

The OC-1/3/12 function is broken down into the following sections:

- OC-1/3/12 Specific Tasks
- OC-1/3/12 Screen and Function Descriptions

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

OC-1/3/12 Specific Tasks

OC-1/3/12 Specific Tasks

This section includes tasks that are specific to the OC-1/3/12 protocol processor. For a list of general tasks, see Common Tasks located in the Getting Started section.

- Calibrate OC-1/3/12 Optical Power
- Monitor OC-1/3/12 Section Overhead
- Monitor OC-1/3/12 Path Overhead
- Change OC-1/3/12 Section Overhead
- Change OC-1/3/12 Path Overhead
- Change Overhead Bytes in Passthru Mode
- **Add a DCC Channel**
- Start/Stop an OC-1/3/12 VT Scan
- Transmit APS Commands

Calibrate OC-1/3/12 Optical Power

The following procedures describe the unit's optical power calibration. While performing this task, you will measure, record, and enter power reading input for:

- Channel 1 calibration, which includes the Zero power reading input and the optical power readings for -10 dBm and -5 dBm.
- Channel 2 calibration, which includes the Zero power reading input and the optical power readings for -30 dBm and -10 dBm.

Before You Begin

Read these procedures before trying to calibrate the unit.

WARNING: Power the unit off before removing the optical connector dust caps to clean the unit's fiber optic ports.

Before performing optical power calibration, use a fiber-optics cleaning kit to clean the fiber-optic ports on the unit, the optical power meter, the optical attenuator, and the fiber cables. Dirty optical fibers will affect optical measurements.

The following equipment is required for unit optical calibration:

- Two three-foot singlemode, fiber-optic cables
- Variable optical attenuator
- Optical power meter
- Fiber-optics cleaning kit
- Pencil and paper to record optical power measurements

Procedures

How to Calibrate Optical Power for Channel 1

How to Calibrate Optical Power for Channel 2

Monitor OC-1/3/12 Section Overhead

The system can monitor and display the Section Overhead bytes and STS pointer.

The Section Overhead consists of the Section and Line Overhead bytes. You can monitor the incoming signal and view individual bytes for any of the 12 slots in the STS signal.

To view incoming path overhead bytes:

1. Select **OC-1/3/12**.
2. Select **Receive**.
3. Select **SOH**. The Section Overhead bytes appear.
4. Select the **Showing** button to choose an STS slot from the Select Showing Slot Entry list.

   For example, if you select Slot 2 then second slot of SOH bytes are displayed.

The number of Slots available and the specific set of STS OH bytes displayed for each slot is dependent on the selecting Interface Rate and Mapping.

5. The Receive / SOH screen shows the Section OH, Line OH and J0 Trace for the selected slot, while the Receive / POH screen shows the STS Path OH and J1 trace for the selected STS, and the VT OH and J2 trace if VT mapped.

Monitor OC-1/3/12 Path Overhead

The system can monitor and display the Path and VT Overhead bytes and the J1 and J2 Trace bytes.

The Path Overhead consists of the Path and VT Overhead bytes. You can monitor the incoming signal and view individual bytes for any of the 12 slots in the STS signal.

To view incoming path overhead bytes:

1. Select **OC-1/3/12**.
2. Select **Receive**.
3. Select **POH**. The Path Overhead bytes appear.

Change OC-1/3/12 Section Overhead

The Section Overhead (SOH) function allows you to stress an STS network by directly editing the Section and Line OH bytes to simulate errors, alarms, and other stress conditions.

A specific slot can be selected, and its Section and Line Overhead bytes can be changed for transmission out of the system. By altering the OH bytes, this allows other STS equipment to detect, and if necessary, react to these changes.

To change Section Overhead bytes:

1. Select **OC-1/3/12**.
2. Select **Transmit**.
3. Select **SOH**. The Section Overhead bytes appear.
4. Select the **Showing** button to choose an STS slot from the Select Showing Slot Entry list.

   For example, if you select Slot 2 then second slot of SOH bytes are displayed.

The number of Slots available and the specific set of STS OH bytes displayed for each slot is dependent on the selecting Interface Rate and Mapping.

5. Select an **Section** or **Line** OH byte button.

   A keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

   The byte can also appear in HEX or decimal notation. Select the **HEX** or **DEC** button on the keypad.

The bit value can also be erased from the keypad using the **Clear** button.

6. When editing is complete, select **OK** to save the new value. **Cancel** discards any changes made to the byte and restores the previous value.

Change OC-1/3/12 Path Overhead

The Path Overhead (POH) function allows you to stress an STS network by directly editing the Path and VT OH bytes to simulate errors, alarms, and other stress conditions.

A specific slot can be selected, and its Path and VT Overhead bytes can be changed for transmission out of the system. By altering the OH bytes, this allows other STS equipment to detect, and if necessary, react to these changes.

To change Path Overhead bytes:

1. Select **OC-1/3/12**.
2. Select **Transmit**.
3. Select **POH**.
4. Select an **Path** or **VT** OH byte.

   A keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

   The byte can also appear in HEX or decimal notation. Select the **HEX** or **DEC** button on the keypad.

The bit value can also be erased from the keypad using the **Clear** button.

5. When editing is complete, select **OK** to save the new value. **Cancel** discards any changes made to the byte and restores the previous value.

Change Overhead Bytes in Passthru Mode

Passthru mode allows an incoming OC-1/3/12 signals to pass through the unit without altering the data in the signal. However, the Section, Line, Path, and VT Overhead bytes can be changed to simulate errors, alarms, and other stress conditions such as Pointer Adjustments. This lets you verify if equipment in the SDH network can detect changed Overhead bytes.

To configure the unit for Passthru mode:

1. From the **OC-1/3/12** tab, select **Transmit**.
2. Select **SET 1**.
3. Select the **Passthru Mode** function. The **Select Passthru Mode** window appears.
4. Select **Intrusive** to enable Passthru mode.

To change SOH and POH bytes in Passthru mode:

1. Select **SOH** or **POH**. When Passthru mode is enabled:
   - By default, the OH bytes are passed-through (looped) the unit without being altered. (These bytes are currently disabled on the touch screen.)
   - However, the **Intrusive Overhead buttons** appear to the right of the OH bytes. These buttons allow you to select a specific which OH bytes to intrude on, allowing their values to be changed.
2. Select an **Intrusive Overhead button**. For example, select F1 Pass.

   The selected Intrusive Overhead button changes to indicate that a specific byte has been selected. For example, F1 Pass now appears as F1 Intrude. In addition, the OH byte is now enabled and displays its value.

3. Select the same OH byte (from the left side of the screen) that you selected for Passthru mode (on the right side of the touch screen). For example, select the F1 byte.

   A keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

The byte can also appear in HEX or decimal notation by selecting the **HEX** or **DEC** button on the keypad.

4. When editing is complete, select **OK** to save the new value which will be transmitted out of the unit.
5. Repeat steps 2-4 to reconfigure other SOH or POH bytes.

When you intrude on any Section OH byte, you automatically intrude on the B1 OH byte. The B1 byte is calculated over all OH bytes. If any OH bytes are changed while in Passthru mode, the transmitted B1 byte will be different from the initial byte value received.

For Line OH, both the B1 and B2 bytes are automatically intruded. When these bytes are unintruded, the transmitted B1 and B2 bytes will be different from the initial byte values received.

For Path and VT OH, the B1, B2, and B3 bytes are automatically intruded. When these bytes are unintruded, the transmitted B1, B2, and B3 bytes will be different from the initial byte values received.

Add a DCC Channel

The system supports the addition of DCC Channels into the STS overhead. Adding a DCC channel defines specific bytes in the Section and Line overhead that are used to send operation and maintenance information between equipment.

To add a DataCom Channel:

1. Select **OC-1/3/12**.
2. Select **Transmit**.
3. Select **SET 1**.
4. Select **DataCom Channel Added**. A window with pattern options appears.
5. Select a pattern. Options include:
   - Section PRBS 2^7-1 and Section PRBS 2^7-1 (Inv)
   - Section DCC Port
   - Line PRBS 2^7-1 and Line PRBS 2^7-1 (Inv)
   - Line DCC Port
   - None

The system will add a DataCom channel into the STS Overhead.

Start/Stop an OC-1/3/12 VT Scan

The VT Scan function inspects and then reports the contents of the 28 foreground VT drops that are obtained within a multiplexed STS signal.

The information reported consists of items such as the framing and pattern activity detected on each STS channel.

The protocol processor must be receiving a valid signal, otherwise, the scan aborts. While a scan is in progress, you cannot access other functions.

To start a TU scan:

1. Select the **OC-1/3/12** protocol processor tab.
2. Select **Test**.
3. Select **VT Scan**.
4. Select **Start Scan**. Framing and pattern activity for each VT drop is displayed on the screen.

To stop the VT scan:

- Select the **Stop Scan** button.

Configuring and Transmitting OC-1/3/12 APS Commands

For OC-1/3/12 mode, the APS function appears on a multifunctional screen that displays both Transmit and Receive APS commands.

To configure K1 and K2 byte values:

1. Select **OC-1/3/12**.

2. Select **Transmit**.

3. Select **APS**. The initial APS screen appears containing a table of the K1 and K2 byte sequences that can be transmitted.

   The three columns (User Setup, Transmit, and Receive) on the screen display the current bit value for the K1 and K2 bytes. Any changes made to the K1 and K2 bytes are automatically updated in the User Setup column.

   The Transmit column displays the bit values transmitted when you select either **Transmit User**, **Transmit Default**, or **Transmit Illegal**. The Receive Column displays the bit values received for the K1 and K2 bytes.

4. Select **APS Mode** to configure APS commands for Linear protection switching mode or Ring APS signaling mode.

5. Edit the K1 byte. The K1 byte is a request for switch action. There are three functions that allow you to edit the K1 byte:

    - **K1 Full Byte** - Sets all eight bits of the K1 byte at once.
    - **K1 Bits 1-4** - Sets the first four bits of the K1 byte.
    - **K1 Bits 5-8** - Sets the last four bits of the K1 byte.

6. Edit the K2 byte. The K2 byte provides additional information about the SONET network architecture and alarm conditions. There are four functions that allow you to edit the K2 byte:

    - **K2 Full Byte** - Sets all eight bits of the K2 byte at once.
    - **K2 Bits 1-4** - Sets the first four bits of the K2 byte.
    - **K2 Bit 5 (provisioned)** - Sets the fifth bit of the K2 byte.
    - **K2 Bits 6-8** - Sets the last three bits of the K2 byte.

7. Use the following options to transmit bit values:

    - Use the **Transmit User** button to transmit the bit values that appear in the User Setup column. When pressed, the User Setup values are transmitted and appear in the Transmit column. You can edit the transmitted K1 and K2 bytes directly from the SOH function screen.
    - Use the **Transmit Default** button to transmit the default bit values (10101010) for the K1 and K2 bytes. When pressed, the default bit values appear in the Transmit column.
    - Use the **Transmit Illegal** button to transmit the illegal bit values (11111111) for the K1 and K2 bytes. When pressed, the illegal bit values appear in the Transmit column.

Screen Functions and Descriptions

OC-1/3/12 Screen Functions and Descriptions Overview

The following function screens are available through the OC-1/3/12 protocol processor tab.

- OC-1/3/12 Transmit
- OC-1/3/12 Receive
- OC-1/3/12 Results
- OC-1/3/12 Test
- OC-1/3/12 Performance Monitoring
- OC-1/3/12 LEDs

Transmit

OC-1/3/12 Transmit Screen

This screen allows you to configure the transmit signal parameters for the OC-1/3/12 line interface and the OC-1/3/12 protocol processor to match the OC-1/3/12 signal used in your test environment.

The OC-1/3/12 Transmit screen contains the following functions:

- Settings 1
- Settings 2
- SOH
- POH
- PTR
- APS
- Errors and Alarms

OC-1/3/12 Transmit Settings 1 (SET 1)

The OC-1/3/12 Transmit Settings 1 screen contains the following options:

Option	Description
Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Passthru Mode	Activates or deactivates pass-thru mode, allowing an incoming STM signal to pass through the unit without altering the data in the signal. Select **Off**, **Intrusive**, or **Intrusive Add/Drop**.
Interface	Selects the optical or electrical interface. The following options are available: **OC-1**, **STS-1**, **OC-3**, and **OC-12**.

Clock Reference	Determines the timing source for the OC-1/3/12 transmit signal. The following options are available:
	
	• **Internal.** Derives the transmit data's timing source from the unit's internal clock.
	• **Recovered (RX Clock).** Derives the transmit timing source from the clock signal on the receive interface. If this option is selected, but a signal is not available, then this function defaults to Internal.
	• **BITS/SETS.**
	  • BITS: Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 MHz. If this option is selected, but BITS clocking is not available, then this function defaults to Internal.
	  • SETS: Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 MHz. If this option is selected, but SETS clocking is not available, then this function defaults to Internal.

Line Frequency Offset	Line Frequency Offset can be deactivated by setting it to "Off" or a customized amount between 100 and -100 can be entered.
SS Bits in H1 Label	Allows you to select the SS Bit.
DataCom Channel Added	Defines specific bytes in the Section and Line overhead that is used to send

	operation and maintenance information between the Section and Line equipment. The following options are available: • None • Section PRBS 2^7-1 • Section 2^7-1 (Inverted) • Section DCC Port • Line DCC Port • Line PRBS 2^7-1 • Line PRBS 2^7-1 (Inverted)
Orderwire Add	Allows you to add or drop an orderwire circuit. The following options are available: • None • E1 • E2
Laser Type	Select the laser type: 1310 nm or 1550 nm for the OC-1/3/12 protocol processors.
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. • **Off.** The unit's laser will be off when the unit is turned on. • **On.** The unit's laser will be on when the unit is turned on. • Restore Previous State. When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.

OC-1/3/12 Transmit Settings 2 (SET 2)

This function selects the type of SONET Transmit mapping and patterns used by the OC-1/3/12 protocol processor.

The following options are available:

Option	Description
Mapping	Select one of the following mappings: • DS1/E1 • DS3/E3 • E4 • VT1.5 Bulk Fill • VT2 Bulk Fill • VT6 Bulk Fill • Full SPE Bulk Fill • STS-3c Bulk Fill • STS-12c Bulk Fill • VT1.5 ATM • VT2 ATM • VT6 ATM • Full SPE ATM • STS-3c ATM • STS-12c ATM **Note:** E1 and DS1 mappings may be disabled depending on selections made in the Options, Protocol, and System settings. Additionally, ATM options will only appear if ATM hardware is installed on your system.
AU Type	**Note:** This option is not available for the OC-1/3/12 protocol processor.
SPE Under Test	Select 1 to N, where N is equal to: • OC-1/STSX-1 = 1 • OC-3 and mapping is not STS-3c = 3 • OC-3 and mapping is STS-3c = 1 • OC-12 and mapping is STS-12c = 1 • OC-12 and mapping is STS-3c = 4 • OC-12 and mapping is not STS-12c or STS-3c = 12
Pattern in Other SPEs	Select any eight bits.
Path Signal Label	Set the C2 byte to:

	• Unequipped (00) • Equipped (01) • VT Structured STS (02) • Lock VT Mode (03) • Asyn Mapping for DS3 (04) • Asyn Mapping for DS4NA (12) • Mapping for ATM (13) • Mapping for DQDB (14) • HDLC Over SONET Mapping (16) • O.181 Test Signal Mapping (FE) • User Defined (any eight bit pattern 0 to FF. **Note:** This option is coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will change in the Overhead screen as well.
Synchronization Status (S1)	Sets the S1 byte to: • Quality Unknown: Sets byte value to 00000000. • Rec. G.811: Sets byte value to 00000010. • Rec. G.812 Transmit: Sets byte value to 00000100. • Rec. G.812 Local: Sets byte value to 00001000. • Sync Eqip Timing Src: Sets byte value to 00001011. • User Defined (any eight bit pattern 0 to FF.
Foreground TUG - 3 Inserted	Select 1 to 3 TUGs. Default is None.
VT Under Test	Select the VT tributary.
Pattern in Other VTs	Set the pattern for other VTs in the configuration.
VT Signal Label Inserted	Set to Unequipped (00), Equipped (01), or User Defined (any eight bit pattern 00 to FF). **Note:** This function is disabled if mapping is not set to VT1.5, VT2, or VT6.
Foreground Pattern	Select User Defined, PRBS 9, PRBS 9

	INV, PRBS 11, PRBS 11 INV, PRBS 15, PRBS 15 INV, PRBS 20, PRBS 20 INV, PRBS 23, PRBS 23 INV. **Note**: This option is not available if Container Contents is not set to Bulk.

OC-1/3/12 Transmit SOH

This function displays the Section, Line, and Intrusive overhead bytes for a selected OC-1/3/12. These bytes can be edited to determine if the equipment can detect problems due to any of these types of overhead errors.

The following options are available:

Option	Description
Showing	Select an Section Overhead slot. If you are mapped to: • **OC-3:** Select 1 through 3. • **OC-12:** Select 1 through 12.
Section Overhead	Select a Section overhead byte. These bytes consist of the first nine bytes of the SOH. Options are: A1, A2, Z0, B1, E1, F1, D1, D2, and D3.
Line Overhead	Select Line overhead bytes. These include: H1, H2, H3, K1, K2, D4 through D12, Z1, Z2, or E2.
Intrusive Overhead	Select an Intrusive Overhead byte to transmit. This is a toggle button that switches between intrude and pass. Options include: A1, A2, J0/Z0, B1, E1, F1, D1-3, H1-3, D4-12, B2, K1, K2, S1/Z1, MI, and E2.
J0 Trace	The J0 byte is part of the Section OH and is known as the Section trace or J0 trace. The J0 trace is a 64-byte pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The J0 trace can be configured to send the system's default pattern or a customized pattern. The following options are available: • **Default:** Selects the Digital

	Lightwave ASCII message as the J0 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined:** Selects a user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones:** Selects an All Ones pattern as the J0 trace pattern. • **All Zeros:** Selects an All Zeros pattern as the J0 trace pattern.

OC-1/3/12 Transmit POH

The OC-1/3/12 Transmit Path Overhead consists of eight bytes that are responsible for monitoring performance and transporting the OC-1/3/12 SPE payload.

The system allows direct access and editing of the Path, VT Overhead bytes, and J1 and J2 Trace to simulate errors, alarms, and other stress conditions. This method of stressing the network is an alternative to using the error and alarm functions.

The following OC-1/3/12 STS Overhead bytes can be edited.

Option	**Description**
B3	STS Path BIP-8
C2	STS Path Signal Label
G1	Path Status
F2	Path User Channel
H4	Indicator
Z3	Path Growth
Z4	Path Growth

Z5	Tandem Connection.
V5	Virtual Tributary Path Overhead byte.
N2	A LP OH byte allocated for Tandem Connection Monitoring for the VC2, VC-12, and VC-11 level.
K4	LP OH byte. Bits 1-4 are allocated for APS signaling for protection at the VT path level. Bits 5-7 are reserved for optional use. Bit 8 is reserved for future use and has no defined value.
J1 Trace	STS Path Trace. This user-programmable byte repetitively transmits a 15-byte, E.64 format string plus 1 byte CRC-7. A 64 byte free format string is also permitted for this Access Point Identifier. This allows the receiving terminal in a path to verify its continued connection to the intended transmitting terminal.
J2 Trace	VT Path Trace.

OC-1/3/12 Transmit PTR

The beginning of a SONET payload is identified by a Pointer, located in the H1 and H2 Pointer bytes. A SONET network can be stressed by adjusting Pointer parameters that appear on the PTR screen.

The functions associated with this screen provide a number of ways to stress the network by manipulating the SONET Pointer and payload.

What is a Pointer?

The beginning of a SONET payload is identified by a Pointer. A Pointer is a reference marker indicating the beginning of the Virtual Tributary.

The components of the H1 and H2 bytes are:

- The New Data Flag (NDF), which is the first four bits of the H1 byte. These bits are used to indicate if a new Pointer is present. If a new Pointer value is present, then the NDF bits are toggled.
- The SS bits (bits 5 and 6)
- The Pointer Value, which is the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes.

The following options are available on the PTR screen for STS and VT pointers.

Option	Description
NDF Flag	**Yes (On):** Generates an NDF when a new Pointer is transmitted. **No (Off):** Disables NDF functionality.
Pointer Value	The Pointer Value function provides another method for stressing a SONET network to verify if the receiving SONET equipment can detect Pointer Value changes. The Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the VT. The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from 0 to 782. After entering the new value, the Pointer automatically moves to the new position.
Freq Offset	Frequency Offset function adjusts the rate at which Pointer adjustments are needed in the VT. By slowing the rate, the SONET network is forced to increment the H1 and H2 Pointer bytes. This is known as positive frequency justification. By increasing the rate, the SONET network is forced to decrement the H1 and H2 Pointer bytes. This is known as negative frequency justification. This type of adjustment simulates network clocks that either run fast or slow. By adjusting the rate, this forces the SONET equipment to compensate by decrementing or incrementing the H1 and H2 Pointer bytes. The Frequency Offset function uses a keypad to enter a frequency offset ranging from -100.0 ppm to +100.0 ppm.
Pointer Action	Select a pointer action to include STS or VT single, increment/decrement, or

	continuous.
Burst Count	This function allows you to determine the number of Pointer location movements to occur when the Inc Pointer or Dec Pointer buttons are pressed. The Pointer burst count ranges from 1 to 8.

Under The **INC** Pointer button starts a positive Pointer adjustment movement.

The **DEC** Pointer button starts a negative Pointer adjustment movement.

The number of adjustments generated depends on the setting of the Burst Count function, which ranges from two to eight Pointer positions.

OC-1/3/12 Transmit APS

The Transmit APS function configures APS transmit activity. APS is a feature that allows the LTE to switch to a backup line in case of errors or failures on the main line. APS commands can be configured for either Linear- or Ring-based networks and are transmitted using bytes K1 and K2 of the Line overhead. You can test the network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response.

The following options are available:

- Linear
- Ring

The three columns (User Setup, Transmit, and Receive) on the screen display the current bit value for the K1 and K2 bytes. Any changes made to the K1 and K2 bytes are automatically updated in the User Setup column. The **Transmit** column displays the bit values transmitted when you press either the Transmit User button, the Transmit Default button, or the Transmit Illegal button. The **Receive Column** displays the bit values received for the K1 and K2 bytes.

Transmit User Button

This button transmits the bit values that appear in the User Setup column. When pressed, the User Setup values are transmitted and appear in the Transmit column. You can edit the transmitted K1 and K2 bytes directly from the Transport Overhead function menu.

Transmit Default Button

This button transmits the default bit values (10101010) for the K1 and K2 bytes. When pressed, the default bit values appear in the Transmit column:

Command	Linear Mode Bit Value	Ring Mode Bit Value
K1 Full Byte	10101010	10101010
K1 Bits 1-4	SD-LP	SD-P
K1 Bits 5-8	#10	#10
K2 Full Byte	10101010	10101010
K2 Bits 1-4	#10	#10
K2 Bit 5 (provisioned)	1:n	LNG/OTN
K2 Bits 6-8	(010)	Br & Sw

Transmit Illegal Button

This button transmits the illegal bit values (11111111) for the K1 and K2 bytes. When pressed, the illegal bit values appear in the Transmit column:

Command	Linear Mode Bit Value	Ring Mode Bit Value
K1 Full Byte	11111111	11111111
K1 bits 1-4	LP	LP-S
K1 Bits 5-8	EXTRA	#15
K2 Full Byte	11111111	11111111
K2 Bits 1-4	EXTRA	#15
K2 Bit 5 (provisioned)	1:n	LNG/OTN
K2 Bits 6-8	AIS-L	AIS-L

OC-1/3/12 Transmit Errors and Alarms

This function allows you to enter errors and alarms. The following options are available on the OC-1/3/12 Errors and Alarms screen.

Option	Description
Error Inserted	Inserts an error that is transmitted by the OC-1/3/12 protocol processor. The options available include: None, B1, B2, REI-L, B3, REI-P, BIP-V, REI-V, HP-REI, and Bit.
Error Insert Rate	Sets the insertion rate of the OC-1/3/12 Transmit error from 1e-3 through 1e-9. A user-defined rate and Max (the maximum rate) is also available.

Alarm Generated	Generates a specific alarm on the transmit side of the OC-1/3/12 protocol process. The following options are available: None, LOS, LOF, AIS-L, RDI-L, RDI-P, UNEQ-P, LOP-P, AIS-P, UNEQ-V, RDI-V, RFI-V, and LOM-V.

Receive

OC-1/3/12 Receive

The Receive function contains several functions and options that configure the receive signal parameters. If the incoming signal does not match the expected parameters, errors, and alarms can be logged by the unit.

The OC-1/3/12 Receive screen contains the following functions:

- Receive Settings 1
- Receive Settings 2
- SOH
- POH
- SIG

OC-1/3/12 Receive Settings 1 (SET 1)

This function configures the unit's Receive parameters for the OC-1/3/12 test environment.

The OC-1/3/12 Receive Settings 1 screen contains the following options:

Option	Description
Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Interface	Selects the optical or electrical interface. The following options are available: OC-1, STS-1, OC-3, and OC-12.
Mapping	Maps the OC-1/3/12 interface to one of the following:

	• DS1/E1#1 • DS1/E1 #2 • DS3/E3 • VT1.5 Bulk Fill • VT 1.5 ATM • VT2 Bulk Fill • VT2 ATM • VT6 Bulk Fill • STS-1 Bulk Fill • STS-1 ATM • STS-3c Bulk Fill • STS-3c ATM • STS-12c Bulk Fill • STS-12c ATM **Note:** Some options may not appear depending on your current configuration and hardware.
SPE Under Test	Select 1 to N, where N is equal to: • OC-1/STSX-1 = 1 • OC-3 and mapping is not STS-3c = 3 • OC-3 and mapping is STS-3c = 1 • OC-12 and mapping is STS-12c = 1 • OC-12 and mapping is STS-3c = 4 • OC-12 and mapping is not STS-12c or STS-3c = 12
Orderwire Drop	Allows you to drop an orderwire circuit. The following options are available: • None • E1 • E2
DataCom Channel Dropped	Defines specific bytes in the Section and Line overhead that is used to send operation and maintenance information between the Section and Line equipment. The following options are

	available: • None • Section PRBS 2^7-1 • Section PRBS 2^7-1 (Inv) • Section DCC Port • Line PRBS 2^7-1 • Line PRBS 2^7-1 (Inv) • Line DCC Port
Foreground TUG-3 Dropped	Selects a TUG-3 to be dropped.
VT Under Test	Selects a Virtual Tributary to be dropped. Select 1 to N, where N is equal to: • VT2=21 • VT1.5=28 **Note:** This function is disabled if VT1.5 or VT2 is not selected.
Foreground Pattern Expected	Selects the expected Foreground Pattern. The following options are available: PRBS 9, PRBS 9 INV, PRBS 11, PRBS 11 INV, PRBS 15, PRBS 15 INV, PRBS 20, PRBS 20 INV, PRBS 23, PRBS 23 INV, Live, and User Defined. **Note:** If Container Contents is not set to *Bulk*, this option will not be available.

OC-1/3/12 Receive Settings 2 (SET 2)

This function configures the OC-1/3/12 Receive mapping, which maps a pattern into the OC-1/3/12 interface.

The following options appear on the OC-1/3/12 Receive Settings 2 screen.

Option	**Description**
PLM Alarm Reporting	Enables or disables reporting of Payload Label Mismatch alarms.
Expected Path Signal Label	Enter any eight bits for Path Signal Label expected.

Expected VT Signal Label	Select any eight bits for Virtual Tributary Signal Label Expected.
TIM Alarm Reporting	Disables or enables Trace Identifier Mismatch reporting. This function enables TIM alarm reporting. A Trace Identifier Mismatch (TIM) alarm occurs when the incoming J1 or J0 trace does not match the expected J1 or J0 trace.
SS Bits Alarm Reporting	Disables or enables SS bits reporting. This function is used in conjunction with the Expected SS Bits function. If enabled, and an SS Bits mismatch is detected on the received signal, the duration in seconds will appear under the Results Scan function.
Expected SS Bits	Selects one of the following as the expected SS Bits value: • 00 (SONET) • 01 (Undefined) • 10 (SDH) • 11 (Undefined)
Expected J0 Trace	Defines the expected J0 trace received on the incoming SONET signal. A TIM-S alarm occurs if the incoming J0 trace does not match the expected J0 trace. The following options are available: • **Default:** Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 62 characters appended with a CR and LF. • **All Ones:** Selects an All Ones pattern as the expected J0 trace pattern. • **User String:** Selects a user-defined ASCII message as the expected J0 trace pattern. The

	message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF).
Expected J1 Trace	Defines the expected J1 trace received on the incoming SONET signal. A TIM-P alarm occurs if the incoming J1 trace does not match the expected J1 trace. The following options are available: • **Default:** Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • **All Ones:** Selects an All Ones pattern as the expected J1 trace pattern. • **User String:** Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF).
Expected J2 Trace	Defines the expected J2 trace received on the incoming SONET signal. The following options are available: • **Default:** Selects the Digital Lightwave ASCII message as the expected J2 trace pattern. The message consists of 62 characters appended with a CR and LF. • **All Ones:** Selects an All Ones pattern as the expected J2 trace

	pattern. • **User String:** Selects a user-defined ASCII message as the expected J2 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF).

OC-1/3/12 Receive SOH

This function displays the Transport Overhead bytes for a specific STS-1 slot on the incoming SONET signal. This is a read-only function.

The following options are available in the OC-1/3/12 Receive Transport Overhead screen.

Options	Description
Showing	Selects the Section Overhead slot being monitored on the incoming side SOH signal.
Section Overhead	Displays the Section Overhead bytes (A1, A2, Z0, B1, E1, F1, D1, D2, and D3).
Line Overhead	Displays the Line Overhead bytes (H1, H2, H3, B2, K1, K2, D4–D12, Z1, Z2, and E2).
J0 Trace	Displays the J0 trace.

OC-1/3/12 Receive POH

This function displays the incoming Path Overhead bytes. It also displays the J1 and J2 Trace messages. This is a read-only function.

The following are viewed on the Receive Path Overhead screen.

Options	Description

STS Overhead	Displays the STS Overhead bytes to include: B3, C2, G1, F2, H4, F3, K3, N1.
VT Overhead	Displays the VT Overhead bytes to include: V5, N2, and K4.
J1 Trace	Displays the J1 Trace pattern.
J2 Trace	Displays the J2 Trace pattern.

OC-1/3/12 Receive Signal Status

This function displays the following measurements of the incoming SONET signal:

- Frequency in MHz.
- Optical Power in dBm
- Line Frequency offset received in Hz and ppm
- Update Signal Calibration - Calibrating the system's optical power should be done carefully. To keep unauthorized users from changing calibration settings, the Update Signal Calibration button on the protocol processor's Receive SIG screen is unavailable by default. To change the setting, a user with Admin or Calibrate privileges must enable the calibration mode.

  By selecting the Update Signal Calibration button you can update the following calibrations:

  Channel 1:

  - Zero power reading
  - -10 dBm power reading
  - -5 dBm power reading

  Channel 2:

  - Zero power reading
  - -30 dBm power reading
  - -10 dBm power reading

To enable protocol processor calibration:

1. From the **System** tab, select **Misc**.
2. From **Local Settings**, select **Enable Calibration**.

The user must have Admin or Calibrate privileges to enable the calibration mode.

3. See Calibrate OC-1/3/12 Optical Power for specific calibration instructions before proceeding.
4. After setting the **Zero power reading**, -**10 / 30 dBm power reading**, and **-5 / 10 dBm power reading**, select the **Save** button to update the signal calibration.

Results

OC-1/3/12 Results

All monitored activity that the system receives is eventually reported to the Results screen. This screen provides several layers of granularity for analyzing the incoming signal, pattern, errors, and alarms.

The main functions under Results are:

- SCAN
- ERR
- ALARM
- PTR
- EVENT
- LARGE LED
- GRAPH
- DCC Mon

OC-1/3/12 Results Scan

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected. This function displays a list of received errors and alarms. For **alarms**, the duration is reported as a count in seconds. For **errors**, an error count is reported.

When no activity is occurring, the screen displays, "No errors or alarms."

OC-1/3/12 Results Errors

The system can monitor and report errors on the incoming OC-1/3/12 signal. The Errors function provides a detailed analysis of the incoming errors.

The errors reported are a result of:

- Incoming errors that are generated by the SONET network, or

- Errors being intentionally generated by the system when it is used in a loopback environment

The following parameters are measured for these incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format for current seconds only

OC-1/3/12 Results Alarms

This function monitors and reports alarms and their duration on the incoming OC-1/3/12 signal. The Alarms function lists the duration of the alarm in seconds.

The alarms that appear depend on what mapping is selected.

The following alarms can be monitored:

- LOS
- LOF
- OOF
- SEF
- TIM-S
- AIS-L
- APS-L
- RDI-L
- APS-L
- AIS- P
- LOP-P
- UNEQ -P
- RDI-P
- TIM-P
- PLM-P
- AIS-V
- LOP-V
- LOM-V
- UNEQ-V
- RDI-V
- RFI-V
- Pat Sync
- TIM-V
- PLM-V
- CONCAT

OC-1/3/12 Results PTR

This function monitors and reports received STS Pointer statistics. A count of the following Pointer statistics appear:

- Positive Justification: Indicates the Positive Pointer Justification count.
- Negative Justification: Indicates the Negative Pointer Justification count.
- Pointer Justification Seconds: Indicates the duration of a Pointer adjustment.
- NDF Count: Indicates the New Data Flag count.
- Receive Pointer Bytes and Value (in HEX and decimal format): Valid Pointers range from 0 to 782.

OC-1/3/12 Results Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

Results Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	**Then this indicates ...**
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.

White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

For a list of available LEDs in the OC-12 protocol processor, see OC-12 LEDs.

OC-1/3/12 Results Graphs

Use the Graphs button to view error and alarm results for the OC-1/3/12 protocol processor. These graphs show the test history for either the current test or the previous test. You can configure the graph function to display any combination of OC-1/3/12 alarms and errors.

To use the Results Graph functions, see the Using Graphs section.

Results DCC Mon

The DCC Monitor allows you to view the following Datacom channel TX/RX configuration data:

The following options are available for this command.

Option	Description
DataCom Channel Drop	Specifies the bytes that have been dropped over the DataCom channel.
LEDs	Displays Pay Sync and Bit Error LEDs as a status check.
Pat Sync	If a Loss of Pattern Synchronization occurred, displays how long, in seconds, the error occurred.
Bit Error	If Bit errors occurred, displays the count, how long they occurred (in seconds), the current rate, and average rate.

Test
OC-1/3/12 Test

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- SET 1
- Service Disruption
- RTD
- VT Scan

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Service Disruption

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The service disruption measurements show a granular accuracy of 1 frame duration. See the chart at the bottom of this page for time per frame durations for each protocol processor.

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the

specified event. If it occurs, its duration in both seconds and frames is measured and logged.

For **E4**, **E3**, **E1**, **DS3** and **DS1** processors, the Protection Switch Criteria is limited to: Loss of Pattern Sync and Bit Errors.

For **SONET** and **SDH** processors the Protection Switch Criteria include: B1, SEF / OOF, AIS-L / MS-AIS, AIS-P / AU-AIS, AIS-V / TU-AIS, and PRBS (Loss of Pattern Sync and Bit Errors).

For **OTN** processors the Protection Switch Criteria include: OOF, OTU:AIS, OTU:BIP8, ODU:AIS, ODU:BIP8, and PRBS (Loss of Pattern Sync and Bit Errors).

- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **State** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

  - **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

  - **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.

  - **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)** - Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.
- **Protection Switch Time (Frames)** - Indicates the number of errored frames received during the service disruption event.
- **History Recent Milli Seconds** - Shows the time durations for the last ten measurements recorded.

- **History Recent Frames** - Shows the frame durations for the last ten measurements recorded.

  A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing Service Disruption.

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
SONET / SDH	0.125 ms (125 µs)	16383 frames (2047.875 ms)
OTU 1	0.049 ms (49 µs)	16383 frames (802.302 ms)
OTU 2	0.012 ms (12 µs)	16383 frames (199.732 ms)
E4	0.021 ms (21 µs)	255 frames (5.361 ms)
E3	0.045 ms (45 µs)	255 frames (11.397 ms)
E1	0.125 ms (125 µs)	4095 frames (511.875 ms)
DS3	0.106 ms (106 µs)	255 frames (27.133 ms)
DS1	0.125 ms (125 µs)	4095 frames (511.875 ms)

Click this link for Ethernet Service Disruption specifics.

Test - RTD (Round-Trip Delay)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **State:** Starts and stops round-trip delay mode.

  Single Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in frame counts and milliseconds. Frame counts indicates the number of frames received before the AIS frame is received by the unit. Milliseconds indicates how long it took for the AIS frame to travel out and return to the unit.

  Continuous Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and continuously transmitted through your network. The current frame count and duration appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.

  Stop Round-Trip Delay - Stops round-trip delay activity. The State returns to Inactive.
- **Round Trip Delay Time (milliSec):** Indicates the duration in seconds that it took for the known frame to return to the unit.
- **Round Trip Delay Time (Frames):** Indicates the number of frames received during the measurement.
- **Consecutive Good Time Required:** This function allows you to enter the duration (in milliseconds) of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 0.125 to 2047.875 milliseconds and is entered using a keypad.
- **Consecutive Good Frames Required**: This function allows you to enter the number of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 1 to 16383 frames and is entered using a keypad.

For more information about round-trip delay, select *Round-Trip Delay* in the Common Tasks section of the online help.

Test - VT Scan

The VT Scan function inspects and then reports the contents of the 28 foreground VT drops that are obtained within a multiplexed SONET signal.

The information reported consists of items such as the framing and pattern activity detected on each VT channel drop.

The protocol processor must be receiving a valid signal, otherwise, the scan aborts. While a scan is in progress, you cannot access other functions.

Select **Start Scan** to view the Foreground VT framing and pattern activity on each of the 28 VT drops. The Foreground VT was configured from the Receive / Set 1 screen.

Select **Stop Scan** to halt the process.

Performance Monitoring

OC-1/3/12 Performance Monitoring

Performance Monitoring provides greater detail about GR-253 incoming Section, Line, STS Path, VT Path, and Bit errors.

The following functions are available on the OC-1/3/12 Performance Monitoring screen:

- Section
- Line
- STS Path
- VT Path
- Bit

OC-1/3/12 Performance Monitoring Section

This function displays a detailed breakdown of incoming B1 errors (Section BIP-8, also known as Coding Violations).

The following statistics are reported:

Statistics	Description
Near End Coding Violations (CV)	This is an error count of incoming B1 errors.
Near End Errored Seconds (ES)	This reports the duration of the incoming B1 errors in seconds. This statistic also reports the percentage of errored seconds compared to the duration of error-free seconds.
Error-Free Seconds (EFS)	This reports the duration of the incoming B1 error free seconds. This statistic also reports the percentage of error-free seconds compared to the duration of errored seconds.
Near End Severely Errored Seconds (SES)	This reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal. An SES is

	reported when 8554 or more B1 errors occur in one second, or when a Severely Errored Frame (SEF) alarm, Loss of Frame (LOF) alarm, or Loss of Signal (LOS) alarm occurs.

OC-1/3/12 Performance Monitoring Line

This function displays a detailed breakdown of incoming B2 (Line BIP-8, also known as Coding Violations) and Line Remote Error Indicator (REI-L) errors.

The following statistics are reported:

Statistics	Description
Near End Coding Violations (CV)	This is an error count of incoming B2 errors.
Near End Errored Seconds (ES)	This reports the duration of the incoming B2 errors (in seconds). This statistic also reports the percentage of errored seconds compared to the duration of error-free seconds.
Error-free Seconds (EFS)	This reports the duration of the incoming B1 error free seconds. This statistic also reports the percentage of error-free seconds compared to the duration of errored seconds.
Near End Severely Errored Seconds (SES)	This reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal. An SES is reported when 9835 or more B2 errors occur in one second, or when a Severely Errored Frame (SEF) alarm, Loss of Frame (LOF) alarm, Loss of Signal (LOS) alarm, or Line Alarm Indication Signal (AIS-L) alarm occurs.
Near End Unavailable Seconds (UAS)	This reports the number of seconds that the Line layer was considered unavailable. A Line is unavailable when 10 consecutive seconds that qualify as SES-L seconds occur.
Far End Coding Violations (CV-LFE or REI-L)	This is an error count of the number of B2 errors detected by the far-end

	Line Terminating Equipment (LTE). These errors are reported back to the NIC 10G using the M1 byte of the Line overhead. The M1 byte is also known as the Line Remote Error Indicator - REI-L. (A CV-LFE was formerly known as a Line FEBE.)
Far End Errored Seconds (ES-LFE)	This is a counter that indicates the number of seconds that an REI-L alarm is reported.
Far End Severely Errored Seconds (SES-LFE)	This reports the duration when 9835 or more REI-L errors are present at the far-end LTE, or when a Line Remote Defect Indicator (RDI-L) alarm is present.
Far End Unavailable Seconds (UAS-LFE)	This is a counter that indicates the number of seconds that an SES-LFE error was present at the far-end LTE. At least 10 consecutive errored seconds of SES-LFE errors must be present before a UAS-LFE is declared.

OC-1/3/12 Performance Monitoring Path

This function displays a detailed breakdown of incoming B3 (Path BIP-8, also known as Path Coding Violations) and STS Path Remote Error Indicator (REI-P) errors.

The following statistics are reported:

Statistics	**Description**
Near End Coding Violations (CV-P)	This is an error count of incoming B3 errors.
Near End Errored Seconds (ES-P)	This reports the duration of the incoming B3 errors (in seconds). This statistic also reports the percentage of errored seconds compared to the duration of error-free seconds.
Error-Free Seconds (EFS-P)	This reports the duration of the incoming B1 error free seconds. This statistic also reports the percentage of error-free seconds compared to

	the duration of errored seconds.
Near End Severely Errored Seconds (SES-P)	This reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal. An SES is reported when 2400 or more B3 errors occur in one second, or when an AIS-P alarm, UNEQ-P alarm, LOS alarm, LOF alarm, AIS-L alarm, or LOP-P alarm occurs.
Near End Unavailable Seconds (UAS-P)	This reports the number of seconds that the STS Path layer was considered unavailable. A Path is unavailable when 10 consecutive seconds that qualify as SES-P seconds occur.
Far End Coding Violations (CV-PFE or REI-P)	This is an error count of the number of B3 errors detected by the far-end STS Path Terminating Equipment (PTE). These errors are reported back to the NIC 10G using the G1 byte of the STS Path overhead. The G1 byte is also known as the STS Path Remote Error Indicator - REI-P. (A CV-PFE was formerly known as an STS Path FEBE.)
Far End Errored Seconds (ES-PFE)	This is a counter that indicates the number of seconds that an REI-P alarm is reported.
Far End Severely Errored Seconds (SES-PFE)	This reports the duration when 2400 or more REI-P errors are present at the far-end LTE, or when a Line Remote Defect Indicator (RDI-P) alarm is present.
Far End Unavailable Seconds (UAS-PFE)	This is a counter that indicates the number of seconds that an SES-PFE error was present at the far-end LTE. At least 10 consecutive errored seconds of SES-PFE errors must be present before a UAS-PFE is declared.

OC-1/3/12 Performance Monitoring VT Path

This function displays a detailed breakdown of incoming Virtual Tributary path BIP (Section BIP-8, also known as Coding Violations) errors and Virtual Tributary path Remote Error Indicator (REI-P) errors.

The following statistics are reported:

Statistics	**Description**
CV	Code violations by count.
ES	Errored seconds by count, rate percentage, and objective percentage.
EFS	Error-free seconds by count, rate percentage, and objective percentage.
SES	Severely Errored Seconds by count, rate percentage, and objective percentage.
UAS	Unavailable seconds by count, rate percentage, and objective percentage.

OC-1/3/12 Performance Monitoring BIT

This provides a detailed breakdown for BIT errors detected and logged by the OC-1/3/12 protocol processor.

The following statistics are reported:

Statistics	Description
CV	Code violations by count.
ES	Errored seconds by count, rate percentage, and objective percentage.
EFS	Error-free seconds by count, rate percentage, and objective percentage.
SES	Severely Errored Seconds by count, rate percentage, and objective percentage.
UAS	Unavailable seconds by count, rate

	percentage, and objective percentage.

OC-1/3/12 LEDs

When the OC-1/3/12 protocol processor is selected, the following LEDs are displayed in the LEDs Quick Status Area of the touch screen.

The errors and alarms that appear depend on what mapping is selected.

LED	Description
Laser On/Off	Enables or disables the laser.
TX	Displays the transmit interface and laser frequency.
RX	Displays the receive interface and laser frequency.
E/A	Displays the error and/or alarm generated. If both an error and alarm is being generated concurrently, a slash (/) will separate the error and alarm. If neither are generated, "None" will display.
Test Paused	Indicates if a timed test has been paused using the Action/Duration button.
SECT	Section Overhead status LED.
LOS	Loss of Signal. An alarm LED indicating a valid signal is not being received. If an all-zeros pattern exists for 100 milliseconds or longer on the incoming SONET signal, then an LOS is reported.
LOF	Loss of Frame. An alarm LED indicating that a frame alignment problem with the incoming signal has been detected. An LOF is reported if a severely errored framing (SEF) defect continues for three milliseconds or

	longer.
SEF	Severely Errored Framing. A SONET defect alarm that is the first indication of trouble in detecting valid signal framing patterns. Four consecutive errored framing patterns constitutes an SEF defect.
B1	Section Bit Interleaved Parity 8 Code Violation. An error LED indicating parity errors occurred on one of the eight parity checks when evaluated by byte 1.
Line	Line status LED.
AIS -L	Alarm Indication Signal - Line. An alarm LED Indicating an all-ones characteristic or adapted information signal was detected on the line. It is generated to replace the normal traffic signal when it contains a defect condition in order to prevent consequential downstream failures being declared or alarms being raised.
RDI - L	Remote Defect Indicator - Line. An alarm LED indicating a signal returned to the transmitting Line Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect.
REI - L	Remote Error Indication - Line. An error LED indication returned to a transmitting node that an errored block has been detected at the Line receiving node.
APS - L	Automated Protection Switching. An alarm LED indicating the K1 and K2 bytes on the incoming STM signal have changed.
B2	Multiplex Section Bit Interleaved Parity Code byte. An error LED indicating parity errors occurred on any of the 24 parity checks when evaluated by the byte B2 of the OC-12.
Path	Path status LED.

AIS-P	Alarm Indication Signal - Path. An alarm LED indicating an all-ones characteristic or adapted information signal was detected on the path. It is generated to replace the normal traffic signal when it contains a defect condition in order to prevent consequential downstream failures being declared or alarms being raised.
LOP - P	Loss of Pointer - Path. An alarm LED indicating a consecutive number of invalid pointers of NDFs were received on the Path.
PTR-P	Pointer - Path. Pointer Adjustment. An event LED indicating there was pointer movement occurring on the STS.
UNEQ-P	Path - Unequipped. An alarm LED indicating an all-zeros patterns was detected in the C2 byte. This byte is received from the Path terminating equipment.
RDI-P	Remote Defect Indicator - Path. An alarm LED indicating a signal was returned to the transmitting Path Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect.
REI-P	Remote Error Indication - Path. An error LED indicating to the transmitting node that an errored block has been detected at the Path receiving node.
B3	Path Bit Interleaved Parity Code (Path BIP-8) byte. An error LED indicating that a parity code (even) was used to determine if a transmission error has occurred over a path. Its value was calculated over all the bits of the previous virtual container before scrambling and placed in the B3 byte of the current frame.
VT	Virtual Tributary status LED.
AIS-V	Alarm Indication Signal - Virtual Tributary. An alarm LED indicating an

	all-ones characteristic or adapted information signal was detected on the VT. It is generated to replace the normal traffic signal when it contains a defect condition in order to prevent consequential downstream failures being declared or alarms being raised. **Note:** This alarm appears only if Mapping is set to VT1.5 or VT2.
LOP-V	Loss of Pointer - Virtual Tributary. An alarm LED indicating a consecutive number of invalid pointers or NDFs were received on the VT.
PTR V	Virtual Tributary Pointer Adjustment. An event/status LED indicating pointer movement is occurring on the VT. This LED flashes red during a Pointer Adjustment event.
LOM-V	Loss of Multiframe Alignment - Virtual Tributary.
BIP-V	Bit Interleaved Parity 2. An error LED indicating an error occurred during a parity check, which involves grouping all the bits in a block into units and then performing a parity check of each bit position in the group.
RDI-V	Remote Defect Indicator - Virtual Tributary. An alarm LED indicating a signal was returned to the transmitting VT Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect.
RFI-V	Remote Failure Indicator - Virtual Tributary. An alarm LED indicating a defect on the VT at persisted beyond the maximum time allocated to the transmission system protection mechanisms. When this occurs, the RFI is sent to the far end and initiates a path protection switch.
REI-V	Remote Error Indication - Virtual Tributary. And error LED indicating to the transmitting node that an errored

	block has been detected at the VT receiving node.
UNEQ-V	Unequipped - Virtual Tributary. An alarm LED indicating that an all-zeros patterns has been detected in the C2 byte. This byte is being received from VT terminating equipment.
PAT Sync	An alarm LED indicating a loss of pattern synchronization. **Note:** This LED is enabled only if the Payload contents selected are Bulk Filled and Bulk Filled Pattern is not set to "Live."
Bit ERR	An error LED indicating a bit error was detected in the payload. **Note:** This LED is enabled only if the Payload contents selected are Bulk Filled and Bulk Filled Pattern is not Live.
SS Mismatch	Displays when the expected SS bit setting does not match what is received. SS Bits Alarm Reporting must be enabled for this alarm to generate. This is an alarm LED.

OC192 Tab

OC-192 Overview

This section of the online help system has topics that discuss:

- OC-192 Specific Tasks
- OC-192 Screen and Function Descriptions

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

OC192 Specific Tasks

OC-192 Specific Tasks

This section includes tasks that are specific to the OC-192 protocol processor. For general tasks, refer to Common Tasks located in the Getting Started section.

- Calibrate OC-192 Optical Power
- Change OC-192 Section Overhead
- Change OC-192 Line Overhead
- Change OC-192 Path Overhead
- Configuring APS Commands
- Change Overhead Bytes in Passthru Mode

Calibrate Optical Power (OC-192)

The following procedures describe the optical power calibration. While performing this task, you will measure, record, and enter the Zero optical power input (no optical power, not to be confused with 0 dBm) and the optical power readings for -20 dBm and -10 dBm.

Before You Begin

- Read these procedures before trying to calibrate the system.

WARNING: Power the system off before removing the optical

connector dust caps to clean the unit's fiber optic ports.

- Before performing optical power calibration, use a fiber-optics cleaning kit to clean the fiber-optic ports on the unit, the optical power meter, the optical attenuator, and the fiber cables. Dirty optical fibers will affect optical measurements.
- The following equipment is required for optical calibration:
  - Two three-foot singlemode, fiber-optic cables
  - Variable optical attenuator (set to the correct wavelength)
  - Optical power meter (set to the correct wavelength)
  - Fiber-optics cleaning kit
  - Pencil and paper to record optical power measurements

Restoring Raw Power Readings

The following restores the raw (unconverted) power readings.

1. Make sure that the dust caps are on the unit's TX and RX optical ports.
2. Turn the unit on.

1. From the **System** tab, select **Misc**.
2. From **Local Setting**, select **Enable Calibration**.

The user must have Admin. or Calibrate privileges to enable the calibration mode.

5. From the **SONET** tab, select **Receive**.
6. Set the Interface rate to **OC-192** (9953.28 MHz)
7. Select **SIG** from the tabs along the left-side of the Receive screen and choose **Update Signal Calibration**.
8. Select **Zero power reading**. A touch screen keypad appears. Enter **0** and select **OK**.
9. Select **-20 dBm power reading**. A touch screen keypad appears. Enter **0** and select **OK**.
10. Select **-10 dBm power reading**. A touch screen keypad appears. Enter **0** and select **OK**.
11. Select the **Save** button to restore the raw (unconverted) power reading.

Obtaining Zero Optical Power Input

1. Make sure that the dust caps are still on the unit's RX optical ports so that no light is present on the RX optical port.
2. Record the Raw optical power reading, which is the **Zero power reading** value.

Obtaining -20 dBm Power Reading

1. Connect a fiber-optic cable from the **10 Gbps TX** optical port to the optical attenuator's input connector.
2. Attach a fiber-optic cable from the attenuator's output port to the reference optical power meter.
3. Turn the laser on.
4. Adjust the variable attenuator so that the optical power meter reads -20 dBm.
5. Disconnect the fiber-optic cable from the optical power meter, and attach it to the **10 Gbps RX** optical port.
6. Record the Raw optical power reading, which is the **-20 dBm power reading** value.

Obtaining -10 dBm Power Reading

1. Disconnect the fiber-optic cable from the unit's **10 Gbps RX** optical port and re-attach it to the optical power meter.
2. Adjust the variable attenuator so that the power meter reads -10 dBm.
3. Disconnect the fiber-optic cable from the optical power meter, and re-attach it to the **10 Gbps RX** optical port.
4. Record the Raw optical power reading, which is the **-10 dBm power reading** value.

Entering Optical Power Readings

1. Select **Zero power reading**. A touch screen keypad appears. Enter the value recorded earlier for the Zero Power Reading and select **OK**.
2. Select **-20 dBm power reading**. A touch screen keypad appears. Enter the value recorded earlier for the -20 dBm Power Reading and select **OK**.
3. Select **-10 dBm power reading**. A touch screen keypad appears. Enter the value recorded earlier for the -10 dBm Power Reading and select **OK**.
4. Select the **Save** button to save the new calibration values.
5. Adjust the variable attenuator to different degrees of attenuation, and compare the NIC's measured power levels to the reference optical power meter.
6. Tweak and save the above raw power values as needed to ensure that the accuracy of the NIC's measured power levels are within +/- 1.5 dBm of the reference optical power meter.
7. This completes the optical calibration procedure.

Section Overhead

The Section Overhead (OH) consists of the first nine bytes of the Transport OH.

The system allows direct access and editing of the Section OH bytes to simulate errors, alarms, and other stress conditions. This method of stressing the network is an alternative to using the system's error and alarm functions.

The following Section OH bytes can be edited:

Section OH Byte	Description
A1	Framing byte
A2	Framing byte
Z0	Section Growth byte
B1	Section BIP-8. This byte is also used to generate B1 errors.
E1	Orderwire byte
F1	Section User Channel
D1	Section Data Communication Channel (DCC)
D2	Section DCC
D3	Section DCC

To Edit Section OH Bytes:

1. Select the **OC-192** tab.
2. Select the **Transmit** button.
3. Select the **SOH** button.

   The Section, Line, and Path Overhead bytes appear.

4. Select a slot using the **STS-1** slot function.

   A touch screen keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

   The byte can also appear in HEX or decimal notation. Simply select the **HEX** or **DEC** button on the keypad.

The bit value can also be erased from the keypad using the **Clear** button.

5. When editing is complete, select **OK** to save the new value. (**Cancel** discards any changes made to the byte and restores the previous value.)

Line Overhead

The Line OH bytes consists of 18 bytes that are responsible for:

- Defining the SONET Pointer
- Controlling linear and ring APS switching
- Setting Line Data Communication Channel (DCC) parameters

The following Line OH bytes can be edited:

Line OH Bytes	Description
H1	STS Pointer byte. Bits 1 through 4 represent the New Data Flag (NDF) value. Bits 5 and 6 are reserved. Bits 7 and 8 are combined with the H2 byte to identify the beginning of a SONET payload, the Synchronous Payload Envelope (SPE). This marker is called a Pointer.
H2	STS Pointer byte. This byte is combined with the H1 byte to create the Pointer.
H3	STS Pointer Action.
B2	Line BIP-8. This byte is also used to generate B2 errors.
K1	Automatic Protection Switching (APS). This byte is a request for switch action.
K2	Automatic Protection Switching (APS). This byte is also used to generate RDI-L alarms.
D4 through D12	Line Data Communication Channel (DCC).
Z1	Growth
Z2	Growth
E2	Orderwire.

To Edit Line Overhead Bytes:

1. Select the **OC-192** tab.
2. Select the **Transmit** button.
3. Select the **OH** button.

The Section, Line, and Path Overhead bytes appear.

4. Select a slot using the **Showing** function.
5. Select a Line Overhead byte.

   A touch screen keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

   The byte can also appear in HEX or decimal notation. Simply select the **HEX** or **DEC** button on the keypad.

The bit value can also be erased from the keypad using the Clear button.

6. When editing is complete, select **OK** to save the new value. (**Cancel** discards any changes made to the byte and restores the previous value.)

Path Overhead

The Path Overhead consists of eight bytes that are responsible for monitoring performance and transporting the payload in an STS SPE.

The system allows direct access and editing of the Path OH bytes to simulate errors, alarms, and other stress conditions. This method of stressing the network is an alternative to using the system's error and alarm functions.

The following STS Path Overhead bytes can be edited:

STS Path OH Byte	Description
B3	STS Path BIP-8. This byte is also used to generate B3 errors.
C2	STS Path Signal Label.
G1	Path Status. This byte is also used to generate REI-P errors.
F2	Path User Channel
H4	Indicator
Z3	Path Growth
Z4	Path Growth
Z5	Tandem Connection

To Edit Path Overhead Bytes:

1. Select the **OC-192** tab.
2. Select the **Transmit** button.
3. Select the **POH** button. The Path Overhead bytes appear.
4. Select a **Path Overhead** byte.

   A touch screen keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

   The byte can also appear in HEX or decimal notation. Simply select the **HEX** or **DEC** button on the keypad.

The bit value can also be erased from the keypad using the **Clear** button.

6. When editing is complete, select **OK** to save the new value. (**Cancel** discards any changes made to the byte and restores the previous value.)

Change Overhead Bytes in Passthru Mode

Passthru mode allows an incoming OC-192 signal to pass through the unit without altering the data in the signal. However, the Transport Overhead bytes (A1/A2, K1/K2, D1-D3, D4-D12, E1, F1, M1, and E2) can be changed to simulate errors, alarms, and other stress conditions such as Pointer Adjustments. This lets you verify if equipment in the SONET network can detect changed Transport Overhead bytes.

To configure the unit for Passthru mode:

1. From the **OC-192** tab, select **Transmit**.
2. Select **SET 1**.
3. Select the **Passthru Mode** function. The **Select Passthru Mode** window appears.
4. Select **On** to enable Passthru mode.

To change SOH bytes in Passthru mode:

1. Select **SOH**. When Passthru mode is enabled:
   - By default, the OH bytes are passed-through (looped) the unit without being altered. (These bytes are currently disabled on the touch screen.)
   - However, the **Intrusive Overhead buttons** appear to the right of the OH bytes. These buttons allow you to select a specific which OH bytes to intrude on, allowing their values to be changed.
2. Select an **Intrusive Overhead button**. For example, select F1 Pass.

The selected Intrusive Overhead button changes to indicate that a specific byte has been selected. For example, F1 Pass now appears as F1 Intrude. In addition, the OH byte is now enabled and displays its value.

3. Select the same OH byte (from the left side of the screen) that you selected for Passthru mode (on the right side of the touch screen). For example, select the F1 byte.

   A keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

   The byte can also appear in HEX or decimal notation by selecting the **HEX** or **DEC** button on the keypad.

4. When editing is complete, select **OK** to save the new value which will be transmitted out of the unit.

When you intrude on any Section OH byte, you automatically intrude on the B1 OH byte. The B1 byte is calculated over all OH bytes. If any OH bytes are changed while in Passthru mode, the transmitted B1 byte will be different from the initial byte value received.

For Line OH, both the B1 and B2 bytes are automatically intruded. When these bytes are unintruded, the transmitted B1 and B2 bytes will be different from the initial byte values received.

Screen and Function Definitions

OC-192 Screen Functions and Descriptions Overview

The following function screens are available through the OC-192 protocol processor tab.

- OC-192 Transmit
- OC-192 Receive
- OC-192 Results
- OC-192 Test
- OC-192 Performance Monitoring
- OC-192 LEDs

Transmit

OC-192 Transmit Screen

The OC-192 Transmit function contains a variety of functions and options that allow you to control the transmit parameters for a SONET signal from the system.

This functionality allows you to control and adjust specific overhead bytes and to verify if the SONET facility can detect problems and adjust accordingly. In addition, it allows you to inject errors and alarms to verify if the SONET facility is capable of detecting and responding to these conditions.

OC-192 Transmit functions consist of the following buttons:

- **SET 1:** Configures the unit's transmit parameters for your SONET test environment.
- **SET 2:** Configures the unit's transmit parameters for your SONET test environment.
- **SOH:** Allows editing of the Section and Line Overhead bytes to determine if the SONET facility can detect problems due to changes and errors in Overhead bytes. In addition, the J0 Trace byte can be edited and transmitted to stress a continuous connection between SONET Network Elements (NE).
- **POH:** Allows editing of the Path Overhead bytes to determine if the SONET facility can detect problems due to changes and errors in Overhead bytes. In addition, the J1 Trace and TCM Trace bytes can be edited and transmitted to stress a continuous connection between SONET Network Elements (NE).
- **PTR:** Allows editing, incrementing, and decrementing of the SONET Pointer.
- **APS:** Controls APS functions and allows manipulation of K1 and K2 bytes.

- **ERROR ALARM:** Configures the type of error or alarm transmitted by the unit.

OC-192 Transmit Settings 1

The OC-192 Transmit Settings 1 screen contains the following functions.

Options marked with an asterisk (*) indicate that the function is coupled with the Receive settings if Setting Control is set to "Coupled."

Functions	Description
*Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.

Passthru Mode	Activates or deactivates pass-thru mode, allowing an incoming STS signal to pass through the unit without altering the data in the signal. The following options are available: **On** and **Off**.
*Mapping	Defines the concatenated mapping setting. The following mappings can be applied using only the 10 Gbps circuit pack (OC-192 protocol processor): **STS-192c Bulk**, **STS-48c Bulk**, **STS-12c Bulk**, **STS-3c Bulk**, and **STS-1 Bulk.** • STS-192c Bulk. Maps a concatenated STS-192c signal into an OC-192. • STS-48c Bulk. Maps a concatenated STS-48c signal into an OC-192. Four STS-48s make up an OC-192. • STS-12c Bulk. Maps a concatenated STS-12c signal into an OC-192. Sixteen STS-12s make up an OC-192. • STS-3c Bulk. Maps a concatenated STS-3c signal into an OC-192. Sixty-four STS-3s make up an OC-192. • STS-1 Bulk. Maps a concatenated STS-1 signal into an OC-192. 192 STS-1s make up an OC-192. If the unit is equipped with a 2.5 Gbps circuit pack (OC-48 protocol processor), the following mappings also appear and are described below: **STS-48c A/D** and **STS-48 A/D LI**. • **STS-48c A/D**. Maps four STS-48s into an OC-192. The STS-48s are generated internally from the OC-48 protocol processor. • **STS-48c A/D LI**. Maps four

	STS-48s into an OC-192. The STS-48s are derived externally and enter the unit using the OC-48 protocol processor's line interface connectors.
STS-48 Added **Note:** STS-48 Added only appears when Mapping is set to STS-48c Bulk.	Selects a specific STS-48 signal as the foreground (or source) channel in the STS-192 signal. The source channel can be used to transmit alarms, errors, or patterns. The unit multiplexes four STS-48 signals into a single STS-192 signal. • **1 - 4.** Selects a specific STS-48 (STS-48 #1 through STS-48 #4) to transmit as the source channel. • **ALL.** Transmit the foreground channel across all four STS-48 channels. • **None.** No foreground channel is selected.
STS-12 Added **Note:** STS-12 Added only appears when Mapping is set to STS-12c Bulk.	Selects one of 16 STS-12 signals as the foreground channel in the STS-192 signal. • **1 - 16**. Selects a specific STS-12 (STS-12 #1 through STS-12 #16) as the foreground channel. • **ALL.** Transmits the foreground channel across all 16 STS-12 channels. • **None.** No foreground channel is selected.
STS-3 Added **Note:** STS-3 Added only appears when Mapping is set to STS-3c Bulk.	Selects one of 64 STS-3 signals as the foreground channel in the STS-192 signal. • **1 - 64.** Selects a specific STS-3 (STS-3 #1 through STS-3 #64) as the foreground channel.

	• **ALL.** Transmits the foreground channel across all 64 STS-3 channels. • **None.** No foreground channel is selected.
STS-1 Added **Note:** STS-1 Added only appears when Mapping is set to STS-1 Bulk.	Selects one of 192 STS-1 signals as the foreground channel in the STS-192 signal. • **1 - 192.** Selects a specific STS-1 (STS-1 #1 through STS-1 #192) as the foreground channel. • **ALL.** Transmits the foreground channel across all 192 STS-1 channels. • **None.** No foreground channel is selected.
Background STS-48 Pattern **Note:** Only appears when Mapping is set to STS-48c Bulk.	Determines the type of pattern inserted into the three remaining STS-48 background channels of an OC-192 signal. The pattern can range from 1 bit to 32 bits and is entered using screen keypad. It can be entered in Hex, decimal, or binary format.
Background STS-12 Pattern **Note:** Only appears when Mapping is set to STS-12c Bulk.	Determines the type of pattern inserted into the 15 remaining STS-12 background channels of an OC-192 signal. The pattern can range from 1 bit to 32 bits and is entered using screen keypad. It can be entered in Hex, decimal, or binary format.
Background STS-3 Pattern **Note:** Only appears when Mapping is set to STS-3c Bulk.	Determines the type of pattern inserted into the 63 remaining STS-3 background channels of an OC-192 signal. The pattern can range from 1 bit to 32 bits and is entered using screen keypad. It can be entered in Hex, decimal, or binary format.
Background STS-1 Pattern	Determines the type of pattern inserted into the 191 remaining STS-

Note: Only appears when Mapping is set to STS-1 Bulk.	1 background channels of an OC-192 signal. The pattern can range from 1 bit to 32 bits and is entered using screen keypad. It can be entered in Hex, decimal, or binary format.
Payload Pattern	Select User-defined (32 bit value), PRBS 15, PRBS 15 INV, PRBS 23, PRBS 23 INV, PRBS 31,or PRBS 31 INV.
Clock Reference	Select Internal, Recovered, or Bits/Sets.
Laser Type	This is a read only setting that displays installed 10G laser's wavelength. The 10G circuit pack only supports a single wavelength configuration.
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. • **Off.** The unit's laser will be off when the unit is turned on. • **On.** The unit's laser will be on when the unit is turned on. • **Restore Previous State.** When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.

OC-192 Transmit Settings 2

The OC-192 Transmit Settings 2 screen contains the following functions.

Functions	Description
Line Frequency Offset	Adjusts the offset of the signal frequency of the transmitted SONET signal. The frequency can be adjusted in parts per million (PPM). The following options are available: **Off** = 0: The frequency cannot be adjusted.

	Edit: Adjusts the signal frequency in PPM. Use the + and - arrow keys to adjust the 00.0 decimal place. The frequency offset ranges from -100.0 to 100.0 in increments of 0.1. The default value is 00.0. After an offset value is entered, the Confirm button on the touch screen keypad must be selected for the new offset value to be accepted.
SS Bits in H1 Label	This function allows bits 5 and 6, which are the SS bits, of the H1 Pointer byte to be set to support a SONET or SDH Transport OH. Changes to the Transport OH are another way to stress an SDH network by simulating errors, alarms, and other stress conditions. The following options are available: • **00 (SONET)**: Sets bits 5 and 6 of the H1 Pointer byte to 0 (****00**). • **01 (Undefined)**: Sets bit 5 to 0 and bit 6 to 1 (****01**). • **10 (SDH)**: Sets bit 5 to 1 and bit 6 to 0 (****10**). • **11 (Undefined)**: Sets bit 5 and 6 of the H1 Pointer byte to 1 (****11**).
Path Signal Label	The Path Signal Label is part of the POH and identifies the type of traffic contained in the SPE. The C2 byte is used to indicate the content of the SPE, including the status of the mapped payload. The following options are available: • **Unequipped (00)** • **Equipped (01)** • **VT Structured STS (02)** • **Lock VT Mode (03)** • **Async Mapping for DS3 (04)** • **Async Mapping for DS4NA (12)** • **Mapping for ATM (13)** • **Mapping for DQDB (14)** • **HDLC Over SONET Mapping (16)** • **10G WAN IEEE802.3ae (1A)** • **GFP Mapping (1B)** • **User Defined** (any eight bit pattern 0 to FF. **Note:** This option is coupled with the C2 byte

	option in the Transmit Overhead screen. If it is changed in this screen, it will change in the Overhead screen as well.
Synchronization Status (S1)	Allows the user to set the S1 byte to one of the following: • **00 (Sync Trace Unknown-STU)** • **01 (Stratum 1 Trace-PRS)** • **04 (Transit Node Clock-TNC)** • **07 (Stratum 2 Trace-ST2)** • **0A (Stratum 3 Trace-ST3)** • **0C (SONET Minimum Clk-SMC)** • **0D (Stratum 3E Trace-ST3E)** • **0F (Do Not Use for Sync-DUS)** • **User Defined** (any eight bit pattern 0 to FF)
Trigger In	Determines how the protocol processor responds when an external pulse is received. Each protocol processor can be configured to respond to an external pulse received using the Trigger In connector. The following options are available: • **Restart**: The protocol processor will restart when an external pulse is received. • **Error Insert**: The protocol processor will insert an error (as defined by the Output Trigger function) when an external pulse is received. • **None**: The protocol processor will do nothing when an external pulse is received.
TC Overhead Processing	Enables Tandem Connection Monitoring (TCM) transmit mode. • **Enable:** For SDH, the unit uses its TCM circuitry and the N1 byte to generate errors and alarms between TCM equipment. For SONET, the unit uses the Z5 byte. • **Disable:** TCM mode is disabled, and the N1 and Z5 bytes follow normal operation.

OC-192 Transmit Section and Line Overhead

The OC-192 Transmit SOH screen contains the following functions:

Function	Description
Showing	Selects a specific STS-1 slot within the OC-192 signal. The overhead bytes that appear on the OH screen are associated with this slot. There are 192 STS-1 slots available in an OC-192 signal.
Section Overhead	Select and edit the following Overhead bytes: A1, A2, Z0, B1, E1, F1, D1, D2, and D3.
Line Overhead	Select and edit the following Overhead bytes: H1, H2, H3, B2, K1, K2, D4-D12, Z1, Z2, and E2.
J0	Selects a default or customized pattern to be used as the J0 trace. Select one of the following patterns: • **Default (64 byte)**: Selects the Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 62 characters, appended with a CR and LF. • **User Defined (64 byte)**: Selects a user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 62 characters, appended with a CR and LF. • **All Ones**: Selects an All Ones pattern as the J0 trace pattern. • **All Zeros**: Selects an All Zeros pattern as the J0 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to15 characters, appended with a CRC-7.

OC-192 Transmit POH

The OC-192 Transmit POH screen contains the following functions:

Functions	Description
STS-48 Added	Select 1 to 4, All, or None as the foreground STS-48 channel.
Path OH	Select and edit the following Overhead bytes: B3, J1, C2, G1, F2, H4, Z3, Z4, and Z5.
J1 Trace	Selects a default or customized pattern to be used as the J1 trace. Select one of the following patterns: • **Default (64 byte)**: Selects the Digital Lightwave ASCII message as the J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)**: Selects a user-defined ASCII message as the J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones**: Selects an All Ones pattern as the J1 trace pattern. • **All Zeros**: Selects an All Zeros pattern as the J1 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.
TC Trace	The TC Trace is a 16-byte pattern that can be created for repeated transmission between TCM (Tandem Connection Monitoring) equipment. The pattern is a string of ASCII characters and can be configured to send the unit's default pattern or a customized pattern. Enable TCM mode (using **TC Overhead Processing**) before sending the TC Trace. The following options are available:

	• **Default** : Selects the 16-byte Digital Lightwave ASCII message as the TC trace pattern. • **All Ones**: Selects a 16-byte All Ones pattern as the TC trace pattern. • **All Zeros**: Selects a 16-byte All Zeros pattern as the TC trace pattern. • **User Defined** : Selects a 16-byte user-defined ASCII message as the TC trace pattern. The message is entered and saved using a touch screen keyboard.

OC-192 Transmit Pointer Generation

The OC-192 Transmit Pointer screen contains the following functions.

Function	Description
NDF Flag	The NDF Flag allows you to specify whether the NDF bits are set when a new Pointer is present in the generated signal. The following options are available: **Yes** (On): Generates an NDF when a new Pointer is transmitted. **No** (Off): Disables NDF functionality.
Pointer Value	The Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the Virtual Container. The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from 0 to 782. After entering the new Pointer Value, the Pointer automatically moves to the new position.
Frequency Offset	Adjusts the rate at which AU Pointer adjustments are needed in the Synchronous Payload Envelope (SPE). Enter a frequency type ranging from -100.0 ppm to +100.0

	ppm. This function is disabled by entering 0.
Pointer Action	Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. **Single options** - Inserts a single Pointer movement with each selection of the INC Pointer or DEC Pointer button. The Pointer value changes by one. **Increment/Decrement option** - Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. **Continuous options** - Inserts a continuous Pointer movement with the selection of the INC Pointer or DEC Pointer button. The movement continues until the Stop Sequence button is selected.
Burst Count	This function allows you to determine the number of Pointer location movements to occur when the INC Pointer or DEC Pointer buttons are pressed. The Pointer burst count ranges from 1 to 8.
Ms between Bursts	Allows the user to set the number of Milliseconds between bursts. Valid valued are 34 - 10000.
INC Pointer / DEC Pointer	Alternates the Pointer insertion from increment to decrement with a 200-msec delay in between.

Related Topic:

For information about making Pointer adjustments, refer to *Make Pointer Adjustments* in the Common Tasks section of the online help.

Transmit APS

This is an Automatic Protection Switching (APS) function used to configure transmit APS activity. APS is a feature that allows the LTE to switch to a backup line in case of errors or failures on the main line. APS commands can be configured for either Linear- or Ring-based networks and are transmitted using bytes K1 and K2 of the Line overhead.

You can test the network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response.

The following options are available on the APS screen:

- **New Item** - Opens the Apply Maintenance to Entry window, from which you configure K1 and K2 bytes.
- **Start** - Begins transmission of the K1 and K2 byte configuration.
- **Clear** - Clears the table.

The following Apply Maintenance to Entry window APS Transmit functions are available:

APS Mode - Linear

This function configures the system to transmit APS functions for a Linear (span) network.

- K1 Full Byte (Linear Mode)
- K1 Bits 1-4 (Linear Mode)
- K1 Bits 5-8 (Linear Mode)
- K2 Full Byte (Linear Mode)
- K2 Bit 5 (Provisioned) (Linear Mode)
- K2 Bits 1-4 (Linear Mode)
- K2 Bits 6-8 (Linear Mode)

APS Mode - Ring

This function configures the system to transmit APS functions for a Ring network.

- K1 Full Byte (Ring Mode)
- K1 Bits 1-4 (Ring Mode)
- K1 Bits 5-8 (Ring Mode)
- K2 Full Byte (Ring Mode)
- K2 Bit 5 (Provisioned) (Ring Mode)
- K2 Bits 1-4 (Ring Mode)
- K2 Bits 6-8 (Ring Mode)

Duration in Frames

The Duration in Frames function determines the number of frames transmitted that contain specific K1 and K2 bytes. These bytes are configured using the functionality located on the transmit APS screen.

Frame count is entered using a keypad. Values ranging from 1 to 65535 frames can be entered.

K1 Bits 1-4 (Linear Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description
(0000) NR	No Request, Bit pattern 0000
(0001) Non Rev	Do not revert, Bit pattern 0001
(0010) RR	Reverse Request (Ring), Bit pattern 0010
(0011) Unused	Not Used, Bit pattern 0011
(0100) EXER	Exerciser (Ring), Bit pattern 0100
(0101) Unused	Not used, Bit pattern (0101)
(0110) WTR	Wait to restore, Bit pattern (0110)
(0111) Unused	Not used, Bit pattern (0111)
(1000) MS	Manual switch, Bit Pattern 1000
(1001) Unused	Not used, Bit pattern (1001)
(1010) SD-LP	Signal degrade low priority, Bit pattern (1010)
(1011) SD-HP	Signal degrade high priority, Bit pattern (1011)
(1100) SF-LP	Signal fail low priority, Bit pattern (1100)
(1101) SF-HP	Signal fail high priority, Bit pattern (1101)
(1110) FS	Forced switch, Bit pattern (1110)
(1111) LP	Lockout of protection, Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description
(0000) NR	No request, Bit pattern 0000
(0001) RR-R	Reverse request (Ring), Bit pattern 0001
(0010) RR-S	Reverse request (Span), Bit pattern 0010
(0011) EXER-R	Exerciser (Ring), Bit pattern 0011
(0100) EXER-S	Exerciser (Span), Bit pattern 0100
(0101) WTR	Wait to restore, Bit pattern (0101)
(0110) MS-R	Manual switch (Ring), Bit pattern (0110)
(0111) MS-S	Manual switch (Span), Bit pattern (0111)
(1000) SD-R	Signal degrade (Ring), Bit Pattern 1000
(1001) SD-S	Signal degrade (Span), Bit pattern (1001)
(1010) SD-P	Signal degrade (Path), Bit pattern (1010). This is the Transmit Default button setting.
(1011) SD-R	Signal degrade (Ring), Bit pattern (1011)
(1100) SF-S	Signal fail (Span), Bit pattern (1100)
(1101) FS-R	Forced switch (Ring), Bit pattern (1101)
(1110) FS-S	Forced switch (Span), Bit pattern (1110)
(1111) LP-S	Lockout of protection (Span), Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 5-8 (Linear Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Linear mode, these bits indicate the channel number. For example, Code 0 is the Null Channel, Codes 1-14 are the working channels, and Code 15 is an extra traffic channel.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Bits 5-8 (Ring Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Ring mode, these bits contain the Destination Code Identification.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit

	pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Full Byte (Linear Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K1 Full Byte (Ring Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.

Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Bit 5 (Provisioned) (Linear Mode)

This function edits the 5th bit of the K2 byte. In Linear mode. This bit controls the type of protection switching architecture used.

The following options are available:

Options	**Description**
1+1	Provisioned for 1+1 mode; Bit 5 = 0
1 : n	Provisioned for 1:n mode; Bit 5 = 1

K2 Bit 5 (Provisioned) (Ring Mode)

This function edits the 5th bit of the K2 byte. In Ring mode, this bit controls the type of path code used.

The following options are available:

Options	**Description**
SHT / OTO	Short Path Code; Bit 5 = 0
LNG / OTN	Long Path Code; Bit 5 = 1. When selected, both the Transmit Default and Transmit Illegal button settings are configured for LNG/OTN.

K2 Bits 1-4 (Linear Mode - SDH)

This function edits the first four bits of the K2 byte. In Linear mode, the first four bits indicate which working channel is bridged onto the protection channel during a traffic switching event.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011

#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K2 byte. In Ring mode, the first four bits are the Source Node Identification. (The Source Node ID is set to the Node's own ID.)

The following options are available:

Options	**Description**
#0	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit

	pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Linear Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	**Description**
(000) Unused	Not used, Bit pattern 000
(001) Unused	Not used, Bit pattern 001
(010) Unused	Not used, Bit pattern 010
(100) Unused	Not used, Bit pattern 100
(100) Uni-direct	Provisioned for Unidirectional switching, Bit pattern 10
(101) Bi-direct	Provisioned for Bidirectional switching, Bit pattern 101
(110) MS-RDI /	Multiplex Section Remote Defect Indicator,

RDI-L	Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Ring Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	**Description**
(000) Idle	Idle, Bit pattern 000
(001) Br	Bridged, Bit pattern 001
(010) Br&Sw	Bridged and switched, Bit pattern 010. This is the Transmit Default button setting.
(100) Ex Tr	Extra traffic on protection channel, Bit pattern 100
(100) Unused	Not used, Bit pattern 10
(101) Unused	Not used, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Full Byte (Linear Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Full Byte (Ring Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

OC-192 Transmit Error Alarm

This function determines the type of error transmitted by the unit. The purpose of generating an error with unit is to stress the network element that is receiving the error by testing if it can detect the incoming error and then report error statistics such as error counts and rates. The following options are available:

Error to Insert

Select an error to insert. Choose one of the following options.

Options	Descriptions
None	No errors are generated. Turns errors off.
B1 Error	Generates a BIP-8 (Bit Interleaved Parity, 8-bit) error over the Section layer. Bits in the B1 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
B2 Error	Generates a BIP-8 error over the Line layer. Bits in the B2 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
B3 Error	Generates a BIP-8 error over the STS Path layer. Bits in the B3 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
REI-L Error (Line FEBE)	Generates a Remote Error Indicator over the Line layer. An REI-L is a count of B2 errors received at the far end. When the system transmits this error, it simulates a downstream NE sending

	an error count back to the source of its incoming SONET signal. The system uses the M1 byte of the Line OH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and rates. (This type of error was formerly called a Line Far End Block Error - FEBE-L.)
REI-P Error (Path FEBE)	Generates a Remote Error Indicator over the Path layer. An REI-P is a count of B3 errors received at the far end. When the system transmits this error, it simulates an NE sending an error count back to the source of its incoming SONET signal. The system uses the G1 byte of the Path OH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and error rates. (This type of error was formerly called a Path Far End Block Error - FEBE-P.)
BIT Error	Generates bit errors. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and error rates.
TC-IEC	Generates a Tandem Connection Incoming Error Count over the Path layer. A TC-IEC is a count of B3 errors received by TCM equipment at the far

	end. Bits 1-4 of the N1 byte are the IEC bits.
TC-REI	Generates a Tandem Connection Remote Error Indicator over the Path layer between TCM equipment. Bit 5 of the N1 byte is used for this error.
TC-OEI	Generates a Tandem Connection Outgoing Error Indicator over the Path layer between TCM equipment. Bit 6 of the N1 byte is used for this error.

Error Insert Rate

The Error to Insert function determines the type of error transmitted. The Error Insert Rate function sets the error rate for the selected error. The unit starts transmitting errors after the insertion rate is selected.

The following options are available:

Option	Descriptions
Off	Turns error transmission off.
1e-X	X is a value from 3 to 10; for example, 1e-3 through 1e-10. X will vary based on the type of error selected.
Maximum	Generates errors at the maximum rate listed below.

If this error is inserted...	Then this range of rates is available...
B1 error	1e-6 to 1e-10; maximum rate is 6.43e-6
B2 error	1e-3 to 1e-10; maximum rate is 1.25e-3
B3 error	1e-6 to 1e-10; maximum rate is 6.65e-6
REI-L error (FEBE-L)	1e-4 to 1e-10; maximum rate is 2.07e-4
REI-P error (FEBE-P)	1e-6 to 1e-10; maximum rate is 6.65e-6
BIT error	1e-3 to 1e-10; maximum rate is 1e-3
TC-IEC error	1e-6 to 1e-10; maximum rate is 6.65e-6
TC-REI error	1e-7 to 1e-10; maximum rate is 8.31e-7
TC-OEI error	1e-7 to 1e-10; maximum rate is 8.31e-7

For information about inserting errors, select *Insert Errors* in the Common Tasks section of the online help.

Alarm Generated (SDH)

This function configures the unit to generate an alarm in the transmit SDH signal. Alarm generation by the unit is one way to test if downstream SDH equipment reacts properly to the alarm it receives in the incoming SDH signal.

The following alarms are available:

Option	Description
None	No alarms are generated. Turns alarms off.
LOS	Loss of Signal. An all-zeros pattern is transmitted to simulate a loss of signal or loss of optical power. This forces the downstream SONET equipment to (1) generate an AIS alarm to its downstream network elements (NE), and (2) generate an RDI alarm to its upstream NEs.
LOF	Loss of Frame. An all-zeros pattern is inserted into the A1 and A2 framing bytes of the Section OH. This simulates the absence of a valid framing pattern. This forces the downstream SONET equipment to generate an AIS alarm to its downstream network elements (NE), and generate an RDI alarm to its upstream NEs.
LOP-P	STS Path Loss of Pointer. This simulates a loss of a valid STS Pointer. When the downstream NE receives an LOP-P, it generates a DSn AIS alarm to its downstream equipment and an RDI-P alarm to its upstream equipment.
AIS-L	Line Alarm Indication Signal. The transmission of an AIS-L to a downstream NE forces that NE to send an AIS-P alarm to the next downstream NE. The NE will also send an RDI-L

	alarm to its upstream equipment. An AIS-L simulates an alarm generated by Line terminating equipment (LTE).
RDI-L	Line Remote Defect Indicator. This generates an RDI-L condition using the K2 byte of the Line OH. This simulates a downstream NE (in this case the NIC) at the Line layer, reporting a failure to an upstream NE. The downstream NE (NIC 10G) has encountered a downstream failure and is alerting upstream SONET equipment. To do this, the NIC 10G changes the pattern of the K2 byte. The NE receiving the RDI-L alarm should detect a change to the K2 byte on the incoming SONET signal. This forces the NE to generate a Remote Alarm Indicator (RAI) to its upstream NEs.
AIS-P	Path Alarm Indication Signal. The transmission of an AIS-P to a downstream NE forces that NE to send an AIS alarm to the next downstream NE. The NE will also send an RDI alarm to its upstream equipment. An AIS-P simulates an alarm generated by Path terminating equipment (PTE).
RDI-P	Path Remote Defect Indicator. This generates an RDI-P condition using the G1 byte of the Path OH. This simulates a downstream NE (in this case, the NIC), at the Path layer, reporting a failure to an upstream NE. To do this, the system changes the pattern of the G1 byte in the Path OH. The NE receiving the RDI-P alarm should detect a change to the G1 byte

	on the incoming SONET signal.
UNEQ-P	Path Unequipped Alarm. An all-zeros pattern is inserted into the C2 byte of the Path OH. The C2 byte is the STS Path Signal Label. (This type of error is used between Path terminating equipment-PTE) When a PTE receives this alarm, it will generate an AIS to downstream NEs.
TC-RDI	Tandem Connection-Remote Defect Indicator. Generates an alarm to upstream equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 8 in multiframe 73 of the N1 byte.
TC-ODI	Tandem Connection-Outgoing Defect Indicator. Generates an alarm to upstream TCM equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 7 in multiframe 74 of the N1 byte.
TC-AIS	Tandem Connection-Alarm Indication Signal. Generates an AIS alarm to downstream TCM equipment by setting Bits 1-4 of the N1 byte to 1110.
TC-UNEQ	Tandem Connection-Unequipped. Generates an all-zeros pattern is inserted into the N1 byte of the Path OH.
TC-LOF	Tandem Connection-Loss of Frame. Generates a loss of a valid multiframe pattern to downstream equipment.

After selecting an alarm, the alarm continues until one of the following occurs:

- The alarm is turned off using the **None** option.
- A **mapping** change occurs.

For more information about inserting alarms, select *Insert Alarms* in the Common Tasks section of the online help.

Receive

OC-192 Receive

The Receive screen contains the following functions:

- OC-192 Receive Settings 1
- OC-192 Receive Settings 2
- OC-192 Receive Overhead Screens (SOH / POH)
- OC-192 Receive Signal Status

OC-192 Receive Settings 1

This function allows you to configure the unit's receive parameters for your OC-192 environment.

Options marked with an asterisk (*) indicate that the function is coupled with the Transmit settings if Setting Control is set to "Coupled."

The OC-192 Receive Settings screen contains the following functions.

Function	Description
*Settings Control	If **Coupled** is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If **Independent** is selected, settings established on the Receive screen will only affect Receive mode.
*Mapping	Defines the concatenated mapping setting. The following mappings can be applied using only the 10 Gbps circuit pack (OC-192 protocol processor): **STS-192c Bulk**, **STS-48c Bulk**, **STS-12c Bulk**, **STS-3c Bulk**, and **STS-1 Bulk**. • **STS-192c Bulk**. Maps a concatenated STS-192c signal into an OC-192. • **STS-48c Bulk**. Maps a

	concatenated STS-48c signal into an OC-192. Four STS-48s make up an OC-192. • **STS-12c Bulk**. Maps a concatenated STS-12c signal into an OC-192. Sixteen STS-12s make up an OC-192. • **STS-3c Bulk**. Maps a concatenated STS-3c signal into an OC-192. Sixty-four STS-3s make up an OC-192. • **STS-1 Bulk**. Maps a concatenated STS-1 signal into an OC-192. 192 STS-1s make up an OC-192. If the unit is equipped with a 2.5 Gbps circuit pack (OC-48 protocol processor), the following mappings also appear and are described below: **STS-48c A/D** and **STS-48 A/D LI**. • **STS-48c A/D**. Maps four STS-48s into an OC-192. The STS-48s are generated internally from the OC-48 protocol processor. • **STS-48c A/D LI**. Maps four STS-48s into an OC-192. The STS-48s are derived externally and enter the unit using the OC-48 protocol processor's line interface connectors.
STS-48 Dropped **Note:** STS-48 Dropped only appears when Mapping is set to STS-48c Bulk.	Selects a specific STS-48 signal to monitor in the STS-192 signal. The unit receives an STS-192 signal that is demuxed into four STS-48 signals and then processed. • **1 - 4.** Selects a specific STS-48 (STS-48 #1 through STS-48 #4) as the dropped and monitored channel. • **None.** No STS-48s are

	selected.
STS-12 Dropped **Note:** STS-12 Dropped only appears when Mapping is set to STS-12c Bulk.	Selects a specific STS-12 signal to monitor in the STS-192 signal. The unit receives an STS-192 signal that is demuxed into 16 STS-12 signals and then processed. • **1 - 16.** Selects a specific STS-12 (STS-12 #1 through STS-12 #16) as the dropped and monitored channel. • **None.** No STS-12s are selected.
STS-3 Dropped **Note:** STS-3 Dropped only appears when Mapping is set to STS-3c Bulk.	Selects a specific STS-3 signal to monitor in the STS-192 signal. The unit receives an STS-192 signal that is demuxed into 64 STS-3 signals and then processed. • **1 - 64.** Selects a specific STS-3 (STS-3 #1 through STS-3 #64) as the dropped and monitored channel. • **None.** No STS-3s are selected.
STS-1 Dropped **Note:** STS-1 Dropped only appears when Mapping is set to STS-1 Bulk.	Selects a specific STS-1 signal to monitor in the STS-192 signal. The unit receives an STS-192 signal that is demuxed into 192 STS-1 signals and then processed. • **1 - 192.** Selects a specific STS-1 (STS-1 #1 through STS-1 #192) as the dropped and monitored channel. • **None.** No STS-1s are selected.
Payload Pattern	Selects the type of pattern that the unit expects to receive on the incoming SONET signal.

	The following options are available: Live (user data is received; no pattern is used), User Defined (range from 1 bit to 32 bits and is entered using a touch screen keypad), PRBS 2^15-1, PRBS 2^15-1 Inverted, PRBS 2^23-1, PRBS 2^23-1 Inverted, PRBS 2^31-1, and PRBS 2^31-1 Inverted.
Trigger Out	Allows the protocol processor to respond to an external "pulse" received. The following options can be selected: None, LOF, LOP, B1, B2, B3, BIT, Frame, RDI-L, RDI-P, REI-L, REI-P, or Ptr Increment, Ptr Decrement, New Ptr with NDF, or New Ptr without NDF.

OC-192 Receive Settings 2 (SET 2)

This function configures the OC-192 Receive mapping, which maps a pattern into the OC-192 interface.

The following options appear on the OC-192 Receive SET 2 screen.

Options	Description
PLM Alarm Reporting	This function enables PLM-P alarm reporting. An STS Payload Label Mismatch (PLM-P) alarm occurs when the incoming Higher-Order Path Signal Label (C2 byte) does not match the expected Higher-Order Path Signal Label (C2 byte). The following options are available: • **Enabled:** PLM-P alarms are recognized and reported. • **Disabled:** PLM-P alarms are ignored.
Expected Path Signal Label	Configure to receive a specific value for the C2 byte. The following options

	are available: • **Unequipped (00):** The expected C2 byte is 00000000. • **Equipped (01):** The expected C2 byte is 00000001. • **VT Structured STS (02):** The expected C2 byte is 00000010. • **Lock VT Mode (03):** The expected C2 byte is 00000011. • **Asyn Mapping for DS3 (04):** The expected C2 byte is 00000100. • **Asyn Mapping for DS4NA (12):** The expected C2 byte is 00010010. • **Mapping for ATM (13):** The expected C2 byte is 00010011. • **Mapping for DQDB (14):** The expected C2 byte is 00010100. • **HDLC Over SONET Mapping (16):** The expected C2 byte is 00010110. • **O.181 Test Signal Mapping (FE):** The expected C2 byte is 11111110. • **User Defined:** Allows an 8-bit Path Signal Label, from 00h to FFh, to be entered for the C2 byte value.
TIM Alarm Reporting	An STS Path Trace Identifier Mismatch (TIM-P) alarm occurs when the incoming J1 trace does not match the expected J1 trace. A Section Trace Identifier Mismatch (TIM-S) alarm occurs when the incoming J0 trace does not match the expected J0 trace. A Tandem Connection Trace Identifier Mismatch (TC-TIM) alarm occurs when the incoming TC trace

	does not match the expected TC trace. The following options are available: • **Enabled:** TIM alarms are recognized and reported. • **Disabled:** TIM alarms are ignored.
Expected J0	Defines the expected J0 trace received on the incoming SONET signal. The following options are available: • **Default (64 byte):** Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte):** Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones:** Selects an All Ones pattern as the expected J0 trace pattern. • **All Zeros:** Selects an All Zeros pattern as the expected J0 trace pattern. • **Default (16 byte):** Selects the Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte):** Selects a user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a

	touch screen keyboard. The message can be up to15 characters, appended with a CRC-7.
Expected J1	Defines the expected J1 trace received on the incoming SONET signal. The following options are available: • **Default (64 byte):** Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte):** Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones:** Selects an All Ones pattern as the expected J1 trace pattern. • **All Zeros:** Selects an All Zeros pattern as the expected J1 trace pattern. • **Default (16 byte):** Selects the Digital Lightwave ASCII message as the J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte):** Selects a user-defined ASCII message as the J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a

	CRC-7.
SS Bits Alarm Reporting	Disables or enables SS bits reporting. This function is used in conjunction with the Expected SS Bits function. If enabled, and an SS Bits mismatch is detected on the received signal, the duration in seconds will appear under the Results Scan function.
Expected SS Bits	Selects one of the following as the expected SS Bits value: • **00 (SONET)** • **01 (Undefined)** • **10 (SDH)** • **11 (Undefined)**
TC Error/Alarm Processing	Enables or disables Tandem Connection Monitoring (TCM) mode. This function is used in conjunction with the **Expected TC Trace** and **TIM Alarm Reporting** functions. The **TC Summary LED** turns red if a TCM error or alarm is reported. Select the TC Summary text for more details. • **Enable:** Turns on TCM error and alarm reporting mode. • **Disable:** Turns off TCM error and alarm reporting mode. (**Note:** Disable this option if you are not performing TCM testing. This will prevent false error and alarm reporting.)
Expected TC Trace	Defines the expected TC trace received on the incoming signal. For SONET, this is in the Z5 byte. For SDH, this is in the N1 byte. The following options are available: • **Default:** Selects the 16-byte Digital Lightwave ASCII

	message at the expected TC trace pattern. • **All Ones (16 byte):** Selects a 16-byte All Ones pattern as the expected TC trace pattern. • **All Zeros (16 byte):** Selects a 16-byte All Zeros pattern as the expected TC trace pattern. • **User Defined:** Selects a 16-byte user-defined ASCII message as the expected TC trace pattern. The message is entered and saved using a screen keypad.

OC-192 Receive Overhead Screens for SOH and POH

The OC-192 Receive Overhead SOH and POH screens allow you to view bytes and traces on specified slots within the OC-192 signal. The screens contain the following functions.

Function	Options
Showing (SOH)	Selects a specific STS-1 slot within the OC-192 signal to view. The overhead bytes that appear on the OH screen are associated with this slot. There are 192 STS-1 slots available in an OC-192 signal.
STS-48 Dropped (POH)	Selects 1 to 4 as the specific STS-48 signal to monitor in the STS-192 signal.
Section OH (SOH)	Displays the Section Overhead bytes for the selected STS-1 on the incoming OC-192 signal. This is a read-only function.
Line OH (SOH)	Displays the Line Overhead bytes for the selected STS-1 on the incoming OC-192 signal. This is a read-only function.
Path OH (POH)	Displays the Path Overhead for the selected STS-1 on the incoming OC-192 signal. This is a read-only

	function.
J0 Trace (SOH)	Displays the J0 trace received on the incoming OC-192 signal. This is a read-only function.
J1 Trace (POH)	Displays the J1 trace received on the incoming OC-192 signal. This is a read-only function.
TC Trace	Displays the Tandem Connection trace received on the incoming OC-192 signal. This is a read-only function.

OC-192 Receive Signal Status

Displays the following measurements of the incoming SONET signal:

- Received optical power in dBm
- Line Frequency in MHz for OC-192
- Frequency offset received in KHz and ppm
- Update Signal Calibration - Calibrating the system's optical power should be done carefully. To keep unauthorized users from changing calibration settings, the Update Signal Calibration button on the protocol processor's Receive SIG screen is unavailable by default. To change the setting, a user with Admin or Calibrate privileges must enable the calibration mode.

To enable protocol processor calibration:

1. From the **System** tab, select **Misc**.
2. From **Local Settings**, select **Enable Calibration**.

The user must have Admin or Calibrate privileges to enable the calibration mode.

3. See Calibrate Optical Power for specific calibration instructions before proceeding.
4. After setting the **Zero power reading**, -**20 dBm power reading**, and **-10 dBm power reading**, select the **Save** button to update the signal calibration.

Related Topics:

Line Frequency Offset

Results

OC-192 Results

All monitored activity that the system receives is eventually reported to the Results screen. This screen provides several layers of granularity for analyzing the incoming signal, pattern, errors, and alarms.

The OC-192 Results screen contains the following functions:

- Scan
- Err
- Alarm
- PTR
- Event
- APS
- Large LEDs
- Graphs

Scan

This function displays a list of received errors and alarms. For **alarms**, the duration is reported as a count in seconds. For **errors**, an error count is reported.

The message **No Errors or Alarms** appears if no events are received by the system.

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

Results - Errors

The system can monitor and report errors on the incoming SONET signal. The **Errors** function provides a detailed analysis of the incoming error as described below.

The errors reported are a result of:

- Incoming errors that are generated by the SONET network, or
- Errors being intentionally generated by the system when it is used in a loopback environment

The following errors can be monitored:

- B1 (Section BIP-8, also known as a Section Coding Violation - CV-S)
- B2 (Line BIP-8, also known as a Line Coding Violation - CV-L)
- B3 (Path BIP-8, also known as an STS Path Coding Violation - CV-P)

- REI-L (Line Remote Error Indicator; also known as a Line Far End Block Error - FEBE-L)
- REI-P (Path Remote Error Indicator; also known as a Path Far End Block Error - FEBE-P)
- BIT (BIT errors reported in the payload)
- NDF-P (Path New Data Flag counts)
- TC-IEC (Tandem Connection-Incoming Error Count)
- TC-REI (Tandem Connection-Remote Error Indicator)
- TC-OEI (Tandem Connection-Outgoing Error Indicator)

The following parameters are measured for these incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format
- Error-free seconds using an 8-digit format
- Errored seconds
- Severely Errored seconds
- Unavailable errored seconds

Results - Alarms

The system can monitor and report alarms and their duration on the incoming SONET signal. The **Alarms** function lists the duration of the alarm in seconds.

The following alarms can be monitored:

- Clock Sync
- LOS (Loss of Signal)
- LOF (Loss of Frame)
- SEF (Severely Errored Frame)
- TIM-S (Section Trace Identifier Mismatch for the J0 byte)
- AIS-L (Line Alarm Indication Signal)
- RDI-L (Line Remote Defect Indicator)
- APS (Automatic Protection Switching)
- AIS-P (Path Alarm Indication Signal)
- LOP-P (Path Loss of Pointer)
- UNEQ-P (Unequipped STS Payload)
- RDI-P (Path Remote Defect Indicator)
- TIM-P (STS Path Trace Identifier Mismatch for the J1 byte)
- PLM-P (STS Payload Label Mismatch)
- Pattern Sync
- TC-RDI (Tandem Connection-Remote Defect Indicator)
- TC-ODI (Tandem Connection-Outgoing Defect Indicator)
- TC-AIS (Tandem Connection-Alarm Indication Signal)

- TC-UNEQ (Tandem Connection-Unequipped)
- TC-TIM (Tandem Connection-Trace Identifier Mismatch)
- TC-LOF (Tandem Connection-Loss of Frame)
- CONCAT (Concatenated)

Results - Pointer (PTR)

This function monitors and reports received STS Pointer statistics. A count of the following Pointer statistics appear:

- **Positive Justification**: Indicates the Positive Pointer Justification count.
- **Negative Justification**: Indicates the Negative Pointer Justification count.
- **Pointer Justification Seconds**: Indicates the duration of a Pointer adjustment.
- **NDF Count**: Indicates the New Data Flag count.
- **Rx Pointer Bytes (in HEX)**: Valid Pointers range from 0x0 to 0x30e.
- **Rx Pointer Value (in decimal)**: Valid Pointers range from 0 to 782.

Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

Results APS

The APS Results monitor incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 16 byte sequences can appear on the touch screen.

The following information appears in the APS report for the last 16 K1 and K2 byte sequences received:

- The HEX value of the K1 byte.
- The HEX value of the K2 byte.
- The number of frames received that contain the K1 and K2 bytes.

- The elapsed time of the frames that contain the K1 and K2 bytes.

Per GR-253-CORE, only the upper 12 bits of the K1/K2 bytes (K1 bits 1-8 and the K2 bits 1-4) are used for APS operation. K2 bit 5 sets the APS mode type (1+1, 1:1) and cannot be changed during operation. K2 bits 6-8 are for alarms. Any changes to the lower four bits of the K2 byte do not affect APS operation. The Results APS table only starts and displays a new entry item if the upper 12 K1/K2 bits stabilize on a new value for a minimum of three consecutive frames.

Results - Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	**Then this indicates ...**
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

For a list of available LEDs in the OC-192 protocol processor, see OC-192 LEDs.

Results - Graphs

This function allows incoming errors and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

For more information about graphs, select *Use Graphs* in the Common Tasks section of the online help.

Performance Monitoring

Performance Monitoring

Performance Monitoring provides greater detail about incoming Section, Line, and Path errors.

- Section Analysis
- Line Analysis
- Path Analysis
- BIT Analysis

Performance Monitoring - Section Analysis

This function displays a detailed breakdown of incoming **B1** errors (Section BIP-8, also known as Coding Violations).

The following statistics are reported:

Statistics	Description
CV - Near End Coding Violations	This is an error count of incoming B1 errors.
ES - Near End Errored Seconds	This reports the duration of the incoming B1 errors in seconds. This statistic also reports the percentage of errored seconds compared to the duration of error-free seconds.
EFS - Error-Free Seconds	This reports the duration of the incoming B1 error free seconds. This statistic also reports the percentage of error-free seconds compared to the duration of errored seconds.
SES - Near End Severely Errored Seconds	This reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal. An SES is reported when 8554 or more B1 errors occur in one second, or when a Severely Errored Frame (SEF) alarm, Loss of Frame (LOF) alarm, or Loss of Signal (LOS) alarm occurs.

Performance Monitoring - Line Analysis

This function displays a detailed breakdown of incoming **B2** (Line BIP-8, also known as Coding Violations) and Line Remote Error Indicator (**REI-L**) errors.

The following statistics are reported:

Statistic	Description
Near End Coding Violations (CV)	This is an error count of incoming B2 errors.
Near End Errored Seconds (ES)	This reports the duration of the incoming B2 errors (in seconds). This statistic also reports the percentage of errored seconds compared to the duration of error-free seconds.
Error-free Seconds (EFS)	This reports the duration of the incoming B1 error free seconds. This statistic also reports the percentage of error-free seconds compared to the duration of errored seconds.
Near End Severely Errored Seconds (SES)	This reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal. An SES is reported when 9835 or more B2 errors occur in one second, or when a Severely Errored Frame (SEF) alarm, Loss of Frame (LOF) alarm, Loss of Signal (LOS) alarm, or Line Alarm Indication Signal (AIS-L) alarm occurs.
Near End Unavailable Seconds (UAS)	This reports the number of seconds that the Line layer was considered unavailable. A Line is unavailable when 10 consecutive seconds that qualify as SES-L seconds occur.
Far End Coding Violations (CV-LFE or REI-L)	This is an error count of the number of B2 errors detected by the far-end Line Terminating Equipment (LTE). These errors are reported back to the NIC 10G using the M1 byte of the Line overhead. The **M1** byte is also known as the Line Remote Error Indicator - **REI-L**. (A CV-LFE was formerly known as a Line FEBE.)
Far End Errored Seconds (ES-LFE)	This is a counter that indicates the number of seconds that an **REI-L** alarm is reported.
Far End Severely Errored Seconds (SES-LFE)	This reports the duration when 9835 or more REI-L errors are present at the far-end LTE, or when a Line

	Remote Defect Indicator **(RDI-L)** alarm is present.
Far End Unavailable Seconds (UAS-LFE)	This is a counter that indicates the number of seconds that an **SES-LFE** error was present at the far-end LTE. At least 10 consecutive errored seconds of SES-LFE errors must be present before a UAS-LFE is declared.

Performance Monitoring - Path Analysis

This function displays a detailed breakdown of incoming **B3** (Path BIP-8, also known as Path Coding Violations) and STS Path Remote Error Indicator (**REI-P**) errors.

The following statistics are reported:

Statistics	**Description**
Near End Coding Violations (CV-P)	This is an error count of incoming B3 errors.
Near End Errored Seconds (ES-P)	This reports the duration of the incoming B3 errors (in seconds). This statistic also reports the percentage of errored seconds compared to the duration of error-free seconds.
Error-free Seconds (EFS-P)	This reports the duration of the incoming B1 error free seconds. This statistic also reports the percentage of error-free seconds compared to the duration of errored seconds.
Near End Severely Errored Seconds (SES-P)	This reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal. An SES is reported when 2400 or more B3 errors occur in one second, or when an AIS-P alarm, UNEQ-P alarm, LOS alarm, LOF alarm, AIS-L alarm, or LOP-P alarm occurs.
Near End Unavailable Seconds (UAS-P)	This reports the number of seconds that the STS Path layer was considered unavailable. A Path is

	unavailable when 10 consecutive seconds that qualify as SES-P seconds occur.
Far End Coding Violations (CV-PFE or REI-P)	This is an error count of the number of B3 errors detected by the far-end STS Path Terminating Equipment (PTE). These errors are reported back to the NIC 10G using the G1 byte of the STS Path overhead. The **G1** byte is also known as the STS Path Remote Error Indicator - **REI-P**. (A CV-PFE was formerly known as an STS Path FEBE.)
Far End Errored Seconds (ES-PFE)	This is a counter that indicates the number of seconds that an **REI-P** alarm is reported.
Far End Severely Errored Seconds (SES-PFE)	This reports the duration when 2400 or more REI-P errors are present at the far-end LTE, or when a Line Remote Defect Indicator **(RDI-P)** alarm is present.
Far End Unavailable Seconds (UAS-PFE)	This is a counter that indicates the number of seconds that an **SES-PFE** error was present at the far-end LTE. At least 10 consecutive errored seconds of SES-PFE errors must be present before a UAS-PFE is declared.

Performance Monitoring – Bit Error Analysis

This provides a detailed breakdown for detected Payload **Bit** errors.

The following statistics are reported:

Statistics	**Description**
CV	Code violations by count.
ES	Errored seconds by count, rate percentage, and objective percentage.
EFS	Error-free seconds by count, rate percentage, and objective percentage.
SES	Severely Errored Seconds by count,

	rate percentage, and objective percentage.
UAS	Unavailable seconds by count, rate percentage, and objective percentage.

OC-192 LED Definitions

This section defines the SONET LEDs that appear on the touch screen's LED area.

To view TCM LEDs, select the **TC Summary** text that appears in the LED/Quick Status area.

LED	Description
AIS-L	Line Alarm Indication Signal. Indicates if an alarm is being received from upstream Line terminating equipment. This is an alarm LED.
AIS-P	STS Path Alarm Indication Signal. Indicates if an alarm is being received from upstream Path terminating equipment. This is an alarm LED.
APS	Automatic Protection Switching. Indicates that the K1 and K2 bytes on the incoming SONET signal have changed.
B1	Section BIP-8 Code Violation. Indicates an error in the SONET frame. B1 errors are parity errors. The B1 byte carries the parity information, so a B1 error is a Section error that applies not only to the Section OH, but the entire frame. Any error in the frame will result in a B1 error. This is an error LED.
B2	Line Overhead BIP-8 Code Violation. Indicates that parity errors were detected at the Line layer of the incoming SONET signal. This is

	calculated over the Line OH, Path OH, and payload of each STS-1. This is an error LED.
B3	Path Overhead BIP-8 Code Violations. Indicates that parity errors were detected at the Path layer of the incoming SONET signal. This is calculated over the Path OH and payload of each STS-1. This is an error LED.
BIT ERR	BIT Error. Indicates a Bit error was detected in the payload. This is an error LED.
CLK	Clock. Indicates the timing source for the SONET transmit signal. The timing source is set using the **Clock Reference** function. This is a status LED.
LINE	Line Status. Indicates if errors or alarms are being received from upstream Line terminating equipment. This is a status LED.
LOF	Loss of Frame. Indicates that a frame alignment problem with the incoming SONET signal has been detected. An LOF is reported if a severely errored framing (SEF) defect continues for 3 milliseconds or longer. This is an alarm LED.
LOP-P	Loss of STS Pointer. Indicates that an invalid Pointer has been received or a Pointer loss has been detected on the incoming SONET signal. This is an alarm LED.
LOS	Loss of Signal. Indicates that a valid SONET signal is not being received. If an all zeros pattern exists for 100 milliseconds or longer on the incoming SONET signal, then an LOS is reported. This is an alarm LED.
PAT SYNC	Pattern Sync. Indicates a loss of pattern synchronization. This is an alarm LED.

PATH	Path Status. Indicates if errors or alarms are being received from upstream Path terminating equipment. This is a status LED.
PLM-P	STS Payload Label Mismatch. Indicates that a mismatch has been detected for the Path Signal Label . This is an alarm LED. Note: This function will be available in a future release.
PTR	Pointer Adjustment. Indicates that a Pointer Adjustment has been received. This LED flashes red during a Pointer Adjustment event. It is an event LED.
RDI-L	Line Remote Defect Indicator. Indicates that a downstream defect has occurred along the Line layer. (An RDI is also known as a Far-End Remote Failure, FERF). This is an alarm LED.
RDI-P	STS Path Remote Defect Indicator. Indicates that a remote alarm is being received from downstream Path terminating equipment. The G1 byte of the SONET Path Overhead is used for this indicator. This is an alarm LED.
REI-L	Line Remote Error Indicator. Indicates that an error is occurring at downstream Line terminating equipment. An REI is also known as a Far-End Block Error (FEBE). The M0 and M1 bytes of the SONET Line Overhead are used for this indicator. This is an error LED.
REI-P	Path Remote Error Indicator. Indicates that an error count is being received from downstream Path terminating equipment. An REI is also known as a Far-End Block Error (FEBE). This is an error LED.
RX	Receive Signal. Indicates the value of the received optical signal in dBm. For OC-192, the optimum input range is from -2 dBm to -14 dBm. A value of -25

	dBm or below indicates no signal. This is a status LED.
SECTION	Section Status. Indicates current error, alarm, and event activity for the Section layer on the incoming SONET signal. This is a status LED.
SEF	Severely Errored Frame. Declared when four or more consecutive errored frames are detected on the incoming SONET signal. This is an alarm LED.
UNEQ-P	Unequipped STS Payload. Indicates that a 00h pattern has been detected in the C2 byte. This byte is being received from Path terminating equipment. This is an alarm LED.
TC SUMMARY	Tandem Connection Summary. Indicates if a TCM error or alarm has been detected. If this LED is red, select the LED text (**TC Summary**) to display the TC LEDs.
TC-AIS Select the text, "**TC Summary**" to display the TC LEDs	Tandem Connection-Alarm Indication Signal. Indicates if IEC bits 1110 are being received from upstream TCM equipment. (Bits 1-4 of the N1 byte are the IEC bits.) This is an alarm LED.
TC-IEC Select the text, "**TC Summary**" to display the TC LEDs	Tandem Connection-Incoming Error Count. Indicates a B3 error count is being received from downstream TCM equipment. Bits 1-4 of the N1 byte are used for this indicator. This is an error LED.
TC-LOF Select the text, "**TC Summary**" to display the TC LEDs	Tandem Connection-Loss of Frame. Indicates the loss of a valid multiframe frame alignment signal (FAS) pattern from upstream TCM equipment. This is an alarm LED.
TC-ODI Select the text, "**TC Summary**" to display the TC LEDs	Tandem Connection-Outgoing Defect Indicator. Indicates that the unit is sending an ODI alarm to upstream TCM equipment. Bit 7 in multiframe 74 of the N1 byte is used for this indicator. This is an alarm LED.

TC-OEI Select the text, "**TC Summary**" to display the TC LEDs	Tandem Connection-Outgoing Error Indication. Indicates that the unit is sending an OEI error to upstream TCM equipment. Bit 6 of the N1 byte is used for this indicator. This is an error LED.
TC-RDI Select the text, "**TC Summary**" to display the TC LEDs	Tandem Connection-Remote Defect Indication. Indicates that a defect has occurred at the downstream TCM equipment. The unit is receiving an alarm. Bit 8 in multiframe 73 of the N1 byte is used for this indicator. This is an alarm LED.
TC-REI Select the text, "**TC Summary**" to display the TC LEDs	Tandem Connection-Remote Error Indication. Indicates that an error has occurred at the downstream TCM equipment. The unit is receiving an error. Bit 5 of the N1 byte is used for this indicator. This is an error LED.
TC-UNEQ Select the text, "**TC Summary**" to display the TC LEDs	Tandem Connection-Unequipped. Indicates that a 00h pattern has been detected in the N1 byte of a Tandem Connection. This is an alarm LED.

OC-48 Tab

OC-48 Overview

The OC-48 online help is divided into the following sections:

- OC-48 Specific Tasks
- OC-48 Screen and Function Descriptions

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

OC48 Specific Tasks

OC-48 Specific Tasks

This section contains OC-48-specific tasks. General tasks are listed in Common Tasks located in the Getting Started section

- Calibrate OC-48 Optical Power
- Monitor OC-48 Section Overhead
- Monitor OC-48 Path Overhead
- Change OC-48 Section Overhead
- Change OC-48 Path Overhead
- Configuring APS Commands
- Change Overhead Bytes in Passthru Mode

Calibrate OC-48 Optical Power

The following procedures describe the unit's optical power calibration. While performing this task, you will measure, record, and enter the Zero optical power input and the optical power readings for -20 dBm and -10 dBm.

Before You Begin

Read these procedures before trying to calibrate the unit.

WARNING: Power the unit off before removing the optical connector dust caps to clean the unit's fiber optic ports.

Before performing optical power calibration, use a fiber-optics cleaning kit to clean the fiber-optic ports on the unit, the optical power meter, the optical attenuator, and the fiber cables. Dirty optical fibers will affect optical measurements.

The following equipment is required for unit optical calibration:

- Two three-foot singlemode, fiber-optic cables
- Variable optical attenuator
- Optical power meter
- Fiber-optics cleaning kit
- Pencil and paper to record optical power measurements

Restoring Raw Power Readings

The following restores the unit's raw (unconverted) power readings.

1. Make sure that the dust caps are on the unit's TX and RX optical ports.
2. Turn the unit on.
3. Make sure that the dust caps are on the unit's TX and RX optical ports.
4. Turn the unit on.
5. From the **System** tab, select **Misc**.
6. From **Local Setting**, select **Enable Calibration**.

> The user must have Admin. or Calibrate privileges to enable the calibration mode.

7. From the **OC-48** tab, select **Receive**.
8. Select **SIG** from the tabs along the left-side of the Receive screen and choose **Update Signal Calibration**.
9. Select **Zero power reading**, and enter **0** from touch screen keypad, then select **OK**.
10. Select **-20 power reading**, and enter **0** from touch screen keypad, then select **OK**.
11. Select **-10 power reading**, and enter **0** from touch screen keypad, then select **OK**.
12. Select **Save** to restore the raw (unconverted) power reading.

Obtaining Zero Optical Power Input

1. Make sure that the dust caps are still on the unit's RX optical ports so that no light is present on the RX optical port.
2. Record the Raw optical power reading, which is the **Zero power reading** value.

Obtaining -20 dBm Power Reading

1. With the unit turned on, connect a fiber-optic cable from the protocol processor's **TX optical port** to the optical attenuator's input connector.
2. Attach a fiber-optic cable from the attenuator's output port to the optical power meter.
3. Turn the unit's laser on.
4. Adjust the attenuator so that the optical power meter reads **-20 dBm**.
5. Disconnect the fiber-optic cable from the optical power meter, and attach it to the protocol processor's **RX optical port**.
6. Record the optical power reading, which is the **-20 dBm power reading** value.

Obtaining -10 dBm Power Reading

1. With the unit turned on, connect a fiber-optic cable from the protocol processor's **TX optical port** to the optical attenuator's input connector.
2. Attach a fiber-optic cable from the attenuator's output port to the optical power meter.
3. Turn the unit's laser on.
4. Adjust the attenuator so that the optical power meter reads **-10 dBm**.
5. Disconnect the fiber-optic cable from the optical power meter, and attach it to the protocol processor's **RX optical port**.
6. Record the optical power reading, which is the **-10 dBm power reading** value.

Entering Power Readings

1. Select **Zero power reading**. A touch screen keypad appears. Enter the value recorded earlier for the Zero Power Reading, and select **OK**.
2. Select **-20 dBm power reading**. A touch screen keypad appears. Enter the value recorded earlier for the -20 dBm Power Reading, and select **OK**.
3. Select **-10 dBm power reading**. A touch screen keypad appears. Enter the value recorded earlier for the -10 dBm Power Reading and, select **OK**.
4. Select the **Save** button to save the new calibration values.

Monitor OC-48 Section Overhead

The system can monitor and display the Section and Line Overhead bytes and STS pointer.

You can monitor the incoming signal and view individual bytes for any of the 48 slots in the STS signal.

To view incoming path overhead bytes:

1. Select **OC-48**.
2. Select **Receive**.
3. Select **SOH**. The Section Overhead bytes appear.
4. Select the **Showing** button to choose an STS slot from the Select Showing Slot Entry list.

   For example, if you select Slot 2 then second slot of SOH bytes are displayed.

   The number of Slots available and the specific set of STS OH bytes displayed for each slot is dependent on the selecting Interface Rate and Mapping.

5. The Receive / SOH screen shows the Section OH, Line OH and J0 Trace for the selected slot, while the Receive / POH screen shows the STS Path OH and J1 trace for the selected STS mapping.

Monitor OC-48 Path Overhead

The system can monitor and display the Path Overhead bytes and the J1 and TCM Trace bytes.

You can monitor the incoming signal and view individual bytes for any of the 48 slots in the STS signal.

To view incoming path overhead bytes:

1. Select **OC-48**.
2. Select **Receive**.
3. Select **POH**. The Path Overhead bytes appear.

Change OC-48 Section Overhead

The Section Overhead (SOH) function allows you to stress an SONET network by directly editing the Section and Line OH bytes to simulate errors, alarms, and other stress conditions.

A specific slot can be selected, and its STS Overhead bytes can be changed for transmission out of the system. By altering the OH bytes, this allows other OC-48 equipment to detect, and if necessary, react to these changes.

To change Section Overhead bytes:

1. Select **OC-48**.
2. Select **Transmit**.

3. Select **SOH**. The Section Overhead bytes appear.
4. Select the **Showing** button to choose an STS slot from the Select Showing Slot Entry list.

   For example, if you select Slot 2 then second slot of SOH bytes are displayed.

   The number of Slots available and the specific set of STS OH bytes displayed for each slot is dependent on the selecting Interface Rate and Mapping.

5. Select a **Section** or **Line** OH byte button.

   A keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

   The byte can also appear in HEX or decimal notation. Select the **HEX** or **DEC** button on the keypad.

The bit value can also be erased from the keypad using the **Clear** button.

6. When editing is complete, select **OK** to save the new value. **Cancel** discards any changes made to the byte and restores the previous value.

Change OC-48 Path Overhead

The Path Overhead (POH) function allows you to stress an Path OH bytes to simulate errors, alarms, and other stress conditions.

By altering the OH bytes, this allows other OC-48 equipment to detect, and if necessary, react to these changes.

To change Path Overhead bytes:

1. Select **OC-48**.
2. Select **Transmit**.
3. Select **POH**.
4. Select any **Path Overhead** byte.

   A keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to

change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

The byte can also appear in HEX or decimal notation. Select the **HEX** or **DEC** button on the keypad.

The bit value can also be erased from the keypad using the **Clear** button.

5. When editing is complete, select **OK** to save the new value. **Cancel** discards any changes made to the byte and restores the previous value.

Configuring APS (K1 and K2) Commands

Automatic Protection Switching (APS) is a function that allows an LTE to switch to a backup (or protection) channel in case errors or failures occur on the working channel. APS commands can be configured for either Linear- or Ring-based SONET and SDH networks and are transmitted using the K1 and K2 bytes of the Line Overhead.

You can test your network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response by configuring the K1 and K2 bytes.

You can create up to 16 different K1 and K2 byte configurations (known as byte sequences) to measure and stress your equipment's APS switching capabilities.

To configure K1 and K2 byte values:

1. Select **Transmit** button.
2. Select the **APS** button. The initial APS screen appears containing a table of the K1 and K2 byte sequences that can be transmitted. A total of 16 K1 and K2 byte sequences can appear in the table.
3. To make a new entry:
   - Select **New Item**

   To edit an item:

   - Select **Item <#>**, for example, Item 12.

   The Apply Maintenance to Entry screen appears, which contains functions used to configure and set the measurement criteria of the K1 and K2 bytes.

4. From the Apply Maintenance to Entry dialog box, select **APS Mode**. The APS Mode dialog box appears.
5. Choose **Linear** protection switching mode or **Ring** signaling mode.

6. From the Apply Maintenance to Entry dialog box, select a K1 byte/bit option. A value dialog box associated with the K1 selection appears. The K1 byte is a request for switch action. There are three functions that allow you to edit the K1 byte:

    - Use the **K1 Full Byte** function to set all eight bits of the K1 byte at once.
    - Use the **K1 Bits 1-4** function to set the first four bits of the K1 byte.
    - Use the **K1 Bits 5-8** function to set the last four bits of the K1 byte.

7. From the Apply Maintenance to Entry dialog box, select a K2 byte/bit. A value dialog box associated with the K2 selection appears. The K2 byte provides additional information about SONET/SDH network architecture and alarm conditions. There are four functions that allow you to edit the K2 byte:

    - Use the **K2 Full Byte** function to set all eight bits of the K2 byte at once.
    - Use the **K2 Bits 1-4** function to set the first four bits of the K2 byte.
    - Use the **K2 Bit 5 (provisioned)** function to set the fifth bit of the K2 byte.
    - Use the **K2 Bits 6-8** function to set the last three bits of the K2 byte.

8. From the Apply Maintenance to Entry dialog box, select **Duration** in Frames to set up the number of frames that will be transmitted containing the newly configured K1 and K2 bytes.
9. Select **Update**. The initial APS screen appears on the touch screen.
10. To configure additional K1 and K2 bytes, repeat steps 3-9 as described above. Otherwise, proceed to the next section to transmit K1 and K2 bytes.

To transmit K1 and K2 bytes:

1. Make sure that K1 and K2 byte sequences are configured as described above.
2. Select **Start** to transmit the K1 and K2 bytes.

To stop transmitting K1 and K2 bytes:

1. Select the **APS** button and choose **Stop**.

Related Topic:

Monitor incoming APS activity

Change Overhead Bytes in Passthru Mode

Passthru mode allows an incoming OC-48 signals to pass through the unit without altering the data in the signal. However, the Section and Line Overhead bytes can be changed to simulate errors, alarms, and other stress conditions such as Pointer Adjustments. This lets you verify if equipment in the SONET network can detect changed Overhead bytes.

To configure the unit for Passthru mode:

1. From the **OC-48** tab, select **Transmit**.
2. Select **SET 1**.
3. Select the **Passthru Mode** function. The **Select Passthru Mode** window appears.
4. Select **On** to enable Passthru mode.

To change SOH bytes in Passthru mode:

1. Select **SOH**. When Passthru mode is enabled:
    - By default, the OH bytes are passed-through (looped) the unit without being altered. (These bytes are currently disabled on the touch screen.)
    - However, the **Intrusive Overhead buttons** appear to the right of the OH bytes. These buttons allow you to select a specific which OH bytes to intrude on, allowing their values to be changed.
2. Select an **Intrusive Overhead button**. For example, select F1 Pass.

    The selected Intrusive Overhead button changes to indicate that a specific byte has been selected. For example, F1 Pass now appears as F1 Intrude. In addition, the OH byte is now enabled and displays its value.

3. Select the same OH byte (from the left side of the screen) that you selected for Passthru mode (on the right side of the touch screen). For example, select the F1 byte.

    A keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

    The byte can also appear in HEX or decimal notation by selecting the **HEX** or **DEC** button on the keypad.

4. When editing is complete, select **OK** to save the new value which will be transmitted out of the unit.

When you intrude on any Section OH byte, you automatically intrude on the B1 OH byte. The B1 byte is calculated over all OH bytes. If any OH bytes are changed while in Passthru mode, the transmitted B1 byte will be different from the initial byte value received.

For Line OH, both the B1 and B2 bytes are automatically intruded. When these bytes are unintruded, the transmitted B1 and B2 bytes will be different from the initial byte values received.

Screen Function and Definitions

OC-48 Screen Functions and Descriptions Overview

The following function screens are available through the OC-48 protocol processor tab.

- OC-48 Transmit
- OC-48 Receive
- OC-48 Results
- OC-48 Test
- OC-48 Performance Monitoring
- OC-48 LEDs

Transmit
OC-48 Transmit

The OC-48 Transmit screen contains the following functions:

- Transmit Settings 1 (SET 1)
- Transmit Settings 2 (SET 2)
- Transmit Section Overhead (SOH)
- Transmit Section Overhead (POH)
- Transmit Pointer Adjustments (PTR)
- Transmit Automatic Protection Switching (APS)
- Transmit Errors and Alarms (Error Alarm)

Transmit Settings 1

The OC-48 Transmit Settings 1 screen contains the following options.

Option	Description
Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.
Passthru Mode	Activates or deactivates pass-thru mode, allowing an incoming STM signal to pass through the unit without altering the data in the signal. The following options are available: **On** and **Off**.
Mapping	Sets mapping to STS-48c. Note: STS-12c Add/Drop mappings are available in systems that also contain an OC-1/3/12 circuit pack.
STS-12 Added	Select 1 to 4, All, or None as the foreground channel. **Note:** This function is not available in systems that do not contain an OC-1/3/12 circuit pack.
Background STS-12 Pattern	Enter any 32 bit value as the background channel. **Note:** This function is not available in systems that do not contain an OC-1/3/12 circuit pack.
Payload Pattern	Select User-defined (32 bit value), PRBS 15, PRBS 15 INV, PRBS 23, PRBS 23 INV, PRBS 31,or PRBS 31 INV.
Clock Reference	Select Internal, Recovered, or Bits/Sets.
Laser Type	Select 1310 nm or 1550 nm laser type on the 2.5G circuit pack. Some NIC units might be equipped with a single laser type, based on the purchased configuration.
Initial Laser Setting	Controls whether the laser is on or off

	when the unit is turned on. • **Off.** The unit's laser will be off when the unit is turned on. • **On.** The unit's laser will be on when the unit is turned on. • Restore Previous State. When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.

Transmit Settings 2

The OC-48 Transmit Settings 2 screen contains the following options.

Option	Description
Line Frequency Offset	Adjusts the offset of the signal frequency of the transmitted SDH signal. The frequency can be adjusted in parts per million (PPM). The following options are available: • **Off**=0: The frequency cannot be adjusted. • **Edit:** Adjusts the signal frequency in PPM. Use the + and - arrow keys to adjust the 00.0 decimal place. The frequency offset ranges from -100.0 to 100.0 in increments of 0.1. The default value is 00.0. After an offset value is entered, the Confirm button on the touch screen keypad must be selected for the new offset value to be accepted.
SS Bits in H1 Label	Set to SONET (00) or SDH (10).
Path Signal Level	Set the C2 byte to: • Unequipped (00)

	• Equipped (01) • VT Structured STS (02) • Lock VT Mode (03) • Async Mapping for DS3 (04) • Async Mapping for DS4NA (12) • Mapping for ATM (13) • Mapping for DQDB (14) • Async Mapping for FDDI (15) • HDLC Over SONET Mapping (16) • 10G WAN IEEE802.3ae (1A) • User Defined (any eight bit pattern 0 to FF. **Note:** This option is coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will change in the Overhead screen as well.
Synchronization Status (S1)	Sets the S1 byte to: • 00 (Sync Trace Unknown-STU) • 01 (Stratum 1 Trace-PRS) • 04 (Transit Node Clock-TNC) • 07 (Stratum 2 Trace-ST2) • 0A (Stratum 3 Trace-ST3) • 0C (SONET Minimum Clk-SMC) • 0D (Stratum 3E Trace-ST3E) • 0F (Do Not Use for Sync-DUS) • User Defined (any eight bit pattern 0 to FF)
Trigger In	Determines how the protocol processor responds when an external pulse is received using the Trigger In connector. Select one of the following: • **Restart:** The protocol processor restarts when an external pulse is received. • **Error Insert:** The protocol processor inserts an error (as

	defined by **Trigger Out**) when an external pulse is received. • **None:** The protocol processor does not respond to an external pulse.
TC Overhead Processing	Enables Tandem Connection Monitoring (TCM) transmit mode. • **Enable**: For SDH, the unit uses its TCM circuitry and the N1 byte to generate errors and alarms between TCM equipment. For SONET, the unit uses the Z5 byte. • **Disable**: TCM mode is disabled, and the N1 and Z5 bytes follow normal operation.

OC-48 Transmit SOH

The OC-48 Transmit SOH screen contains the following options:

Function	Description
Showing	Select an Overhead slot from one to 48. This function selects a specific SOH slot within the OC-48 signal. The overhead bytes that appear on the OH screen are associated with this slot. There are 48 SOH slots available in an OC-48 signal.
Section Overhead	Select the Section Overhead to include: A1, A2, Z0, B1, E1, F1, D1, D2, and D3.
Line Overhead	Select the Line Overhead to include:H1, H2, H3, B2, K1, K2, D4-12, Z1, Z2, and E2.
Intrusive Overhead	Select an intrusive overhead button. **Note**: This option is only enabled if Pass Thru is enabled.
J0	Selects a default or customized

	pattern to be used as the J0 trace. Select one of the following patterns: • **Default (64 byte)**: Selects the Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 62 characters, appended with a CR and LF. • **User Defined (64 byte)**: Selects a user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 62 characters, appended with a CR and LF. • **All Ones**: Selects an All Ones pattern as the J0 trace pattern. • **All Zeros**: Selects an All Zeros pattern as the J0 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to15 characters, appended with a CRC-7.

OC-48 Transmit POH

The OC-48 Transmit POH screen contains the following options:

Function	Description

STS-12 Added	Select 1 to 4, All, or None.
Path Overhead	Select the Higher-Order Path Overhead to include: B3, J1, C2, G1, F2, H4, Z3, Z4, and Z5. **Note**: This option will be disabled if Passthru mode is enabled.
J1 Trace	Selects a default or customized pattern to be used as the J1 trace. Select one of the following patterns: • **Default (64 byte)**: Selects the Digital Lightwave ASCII message as the J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)**: Selects a user-defined ASCII message as the J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones**: Selects an All Ones pattern as the J1 trace pattern. • **All Zeros**: Selects an All Zeros pattern as the J1 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters , appended with a CRC-7.

TC Trace	The TC Trace is a 16-byte pattern that can be created for repeated transmission between TCM equipment. The pattern is a string of ASCII characters and can be configured to send the unit's default pattern or a customized pattern. **Note**: Enable TCM mode (using TC Overhead Processing) before sending the TC Trace. Select one of the following patterns: • **Default**: Selects the 16-byte Digital Lightwave ASCII message as the TC trace pattern. • **User Defined**: Selects a 16-byte user-defined ASCII message as the TC trace pattern. The message is entered and saved using a touch screen keyboard.

Transmit Pointer

The OC-48 Transmit Pointer screen contains the following options.

Option	Description
NDF Flag	The NDF Flag allows you to specify whether the NDF bits are set when a new Pointer is present in the generated signal. The following options are available: • **Yes (On):** Generates an NDF when a new Pointer is transmitted. • **No (Off):** Disables NDF functionality.

Pointer Value	The Pointer Value function provides another method for stressing a SONET network to verify if the receiving SONET equipment can detect Pointer Value changes. The Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the SPE. The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from **0 to 782**. After entering the new Pointer Value, the Pointer automatically moves to the new position.
Frequency Offset	The SPE Frequency Offset function adjusts the rate at which Pointer adjustments are needed in the Synchronous Payload Envelope (the payload). By slowing the rate, the SONET network is forced to increment the H1 and H2 Pointer bytes. This is known as **positive frequency justification**. By increasing the rate, the SONET network is forced to decrement the H1 and H2 Pointer bytes. This is known as **negative frequency justification**. This type of adjustment simulates network clocks that either run fast or slow. By adjusting rate, this forces the SONET equipment to compensate by decrementing or incrementing the H1 and H2 Pointer bytes. The **SPE Frequency Offset** function uses a keypad to enter a frequency offset ranging from -100.0 ppm to

	+100.0 ppm. For OC-48, this allows a line frequency range from 2,488,568,832 Hz to 2,488,071,168 Hz. This function is disabled by entering 0 for the frequency offset.
Pointer Action	Determines the type of Pointer activity that occurs when the Inc Pointer and Dec Pointer buttons are selected. • **Single:** Inserts a single Pointer movement with each selection of the Inc Pointer or Dec Pointer button. The Pointer value changes by one. • **Increment/Decrement:** Determines the type of Pointer activity that occurs when the Inc Pointer and Dec Pointer buttons are selected. • **Continuous options:** Inserts a continuous Pointer movement with the selection of the INC Pointer or DEC Pointer button. The movement continues until the Stop Sequence button is selected.
Burst Count	This function allows you to determine the number of Pointer location movements to occur when the Inc Pointer or Dec Pointer buttons are pressed. The Pointer burst count ranges from 1 to 8.
Ms between Bursts	Allows the user to set the number of Milliseconds between bursts. Valid valued are 34 - 10000. This setting is not available for single Pointer increments and decrements.

INC Pointer/DEC Pointer	Alternates the Pointer insertion from increment to decrement with a 200-msec delay in between.

Transmit - APS

Transmit APS

This is an Automatic Protection Switching (APS) function used to configure transmit APS activity. APS is a feature that allows the LTE to switch to a backup line in case of errors or failures on the main line. APS commands can be configured for either Linear- or Ring-based networks and are transmitted using bytes K1 and K2 of the Line overhead.

You can test the network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response.

The following options are available on the APS screen:

- **New Item** - Opens the Apply Maintenance to Entry window, from which you configure K1 and K2 bytes.
- **Start** - Begins transmission of the K1 and K2 byte configuration.
- **Clear** - Clears the table.

The following Apply Maintenance to Entry window APS Transmit functions are available:

APS Mode - Linear

This function configures the system to transmit APS functions for a Linear (span) network.

- K1 Full Byte (Linear Mode)
- K1 Bits 1-4 (Linear Mode)
- K1 Bits 5-8 (Linear Mode)
- K2 Full Byte (Linear Mode)
- K2 Bit 5 (Provisioned) (Linear Mode)
- K2 Bits 1-4 (Linear Mode)
- K2 Bits 6-8 (Linear Mode)

APS Mode - Ring

This function configures the system to transmit APS functions for a Ring network.

- K1 Full Byte (Ring Mode)
- K1 Bits 1-4 (Ring Mode)
- K1 Bits 5-8 (Ring Mode)
- K2 Full Byte (Ring Mode)

- K2 Bit 5 (Provisioned) (Ring Mode)
- K2 Bits 1-4 (Ring Mode)
- K2 Bits 6-8 (Ring Mode)

Duration in Frames

The Duration in Frames function determines the number of frames transmitted that contain specific K1 and K2 bytes. These bytes are configured using the functionality located on the transmit APS screen.

Frame count is entered using a keypad. Values ranging from 1 to 65535 frames can be entered.

K1 Bits 1-4 (Linear Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description
(0000) NR	No Request, Bit pattern 0000
(0001) Non Rev	Do not revert, Bit pattern 0001
(0010) RR	Reverse Request (Ring), Bit pattern 0010
(0011) Unused	Not Used, Bit pattern 0011
(0100) EXER	Exerciser (Ring), Bit pattern 0100
(0101) Unused	Not used, Bit pattern (0101)
(0110) WTR	Wait to restore, Bit pattern (0110)
(0111) Unused	Not used, Bit pattern (0111)
(1000) MS	Manual switch, Bit Pattern 1000
(1001) Unused	Not used, Bit pattern (1001)
(1010) SD-LP	Signal degrade low priority, Bit pattern (1010)
(1011) SD-HP	Signal degrade high priority, Bit pattern (1011)
(1100) SF-LP	Signal fail low priority, Bit pattern (1100)
(1101) SF-HP	Signal fail high priority, Bit pattern (1101)
(1110) FS	Forced switch, Bit pattern (1110)
(1111) LP	Lockout of protection, Bit pattern (1111).

	This is also the Transmit Illegal button setting.

K1 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description
(0000) NR	No request, Bit pattern 0000
(0001) RR-R	Reverse request (Ring), Bit pattern 0001
(0010) RR-S	Reverse request (Span), Bit pattern 0010
(0011) EXER-R	Exerciser (Ring), Bit pattern 0011
(0100) EXER-S	Exerciser (Span), Bit pattern 0100
(0101) WTR	Wait to restore, Bit pattern (0101)
(0110) MS-R	Manual switch (Ring), Bit pattern (0110)
(0111) MS-S	Manual switch (Span), Bit pattern (0111)
(1000) SD-R	Signal degrade (Ring), Bit Pattern 1000
(1001) SD-S	Signal degrade (Span), Bit pattern (1001)
(1010) SD-P	Signal degrade (Path), Bit pattern (1010). This is the Transmit Default button setting.
(1011) SD-R	Signal degrade (Ring), Bit pattern (1011)
(1100) SF-S	Signal fail (Span), Bit pattern (1100)
(1101) FS-R	Forced switch (Ring), Bit pattern (1101)
(1110) FS-S	Forced switch (Span), Bit pattern (1110)
(1111) LP-S	Lockout of protection (Span), Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 5-8 (Linear Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Linear mode, these bits indicate the channel number. For example, Code 0 is the Null Channel, Codes 1-14 are the working channels, and Code 15 is an extra traffic channel.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit

	pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Bits 5-8 (Ring Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Ring mode, these bits contain the Destination Code Identification.

The following options are available:

Options	**Description**
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit

	pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Full Byte (Linear Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	**Description**
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K1 Full Byte (Ring Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Bit 5 (Provisioned) (Linear Mode)

This function edits the 5th bit of the K2 byte. In Linear mode. This bit controls the type of protection switching architecture used.

The following options are available:

Options	Description
1+1	Provisioned for 1+1 mode; Bit 5 = 0
1 : n	Provisioned for 1:n mode; Bit 5 = 1

K2 Bit 5 (Provisioned) (Ring Mode)

This function edits the 5th bit of the K2 byte. In Ring mode, this bit controls the type of path code used.

The following options are available:

Options	Description
SHT / OTO	Short Path Code; Bit 5 = 0
LNG / OTN	Long Path Code; Bit 5 = 1. When selected, both the Transmit Default and Transmit Illegal button settings are configured for LNG/OTN.

K2 Bits 1-4 (Linear Mode - SDH)

This function edits the first four bits of the K2 byte. In Linear mode, the first four bits indicate which working channel is bridged onto the protection channel during a traffic switching event.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000

#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K2 byte. In Ring mode, the first four bits are the Source Node Identification. (The Source Node ID is set to the Node's own ID.)

The following options are available:

Options	**Description**
#0	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011

#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Linear Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	**Description**
(000) Unused	Not used, Bit pattern 000
(001) Unused	Not used, Bit pattern 001

(010) Unused	Not used, Bit pattern 010
(100) Unused	Not used, Bit pattern 100
(100) Uni-direct	Provisioned for Unidirectional switching, Bit pattern 10
(101) Bi-direct	Provisioned for Bidirectional switching, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Ring Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	**Description**
(000) Idle	Idle, Bit pattern 000
(001) Br	Bridged, Bit pattern 001
(010) Br&Sw	Bridged and switched, Bit pattern 010. This is the Transmit Default button setting.
(100) Ex Tr	Extra traffic on protection channel, Bit pattern 100
(100) Unused	Not used, Bit pattern 10
(101) Unused	Not used, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Full Byte (Linear Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Full Byte (Ring Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

OC-48 Transmit Error Alarm

This function determines the type of error transmitted by the unit. The purpose of generating an error with unit is to stress the network element that is receiving the error by testing if it can detect the incoming error and then report error statistics such as error counts and rates. The following options are available:

Error to Insert

Select an error to insert. Choose one of the following options.

Options	Descriptions
None	No errors are generated. Turns errors off.
B1 Error	Generates a BIP-8 (Bit Interleaved Parity, 8-bit) error over the Section layer. Bits in the B1 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
B2 Error	Generates a BIP-8 error over the Line layer. Bits in the B2 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
B3 Error	Generates a BIP-8 error over the STS Path layer. Bits in the B3 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct

	performance monitoring such as error counts and rates.
REI-L Error	Generates a Remote Error Indicator over the Line layer. An REI-L is a count of B2 errors received at the far end. When the system transmits this error, it simulates a downstream NE sending an error count back to the source of its incoming SONET signal. The system uses the M1 byte of the Line OH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and rates. (This type of error was formerly called a Line Far End Block Error - FEBE-L.)
REI-P Error	Generates a Remote Error Indicator over the Path layer. An REI-P is a count of B3 errors received at the far end. When the system transmits this error, it simulates an NE sending an error count back to the source of its incoming SONET signal. The system uses the G1 byte of the Path OH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and error rates. (This type of error was formerly called a Path Far End Block Error - FEBE-P.)
BIT Error	Generates bit errors. This type of simulation allows an NE (in this case, the downstream equipment)

	to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and error rates.
TC-IEC	Generates a Tandem Connection Incoming Error Count over the Path layer. A TC-IEC is a count of B3 errors received by TCM equipment at the far end. Bits 1-4 of the N1 byte are the IEC bits.
TC-REI	Generates a Tandem Connection Remote Error Indicator over the Path layer between TCM equipment. Bit 5 of the N1 byte is used for this error.
TC-OEI	Generates a Tandem Connection Outgoing Error Indicator over the Path layer between TCM equipment. Bit 6 of the N1 byte is used for this error.

Error Insert Rate

The Error to Insert function determines the type of error transmitted. The Error Insert Rate function sets the error rate for the selected error. The unit starts transmitting errors after the insertion rate is selected.

The following options are available:

Option	Descriptions
Off	Turns error transmission off.
1e-X	X is a value from 3 to 10; for example, 1e-3 through 1e-10. X will vary based on the type of error selected.
Maximum	Generates errors at the maximum rate listed below.

If this error is inserted...	Then this range of rates is available...
B1 error	1e-5 to 1e-10; maximum rate is 2.57e-5
B2 error	1e-3 to 1e-10; maximum rate is 1.25e-3
B3 error	1e-5 to 1e-10; maximum rate is 2.66e-5
REI-L error (FEBE-L)	1e-4 to 1e-10; maximum rate is 8.29e-

	4
REI-P error (FEBE-P)	1e-5 to 1e-10; maximum rate is 2.66e-5
BIT error	1e-3 to 1e-10; maximum rate is 1e-3
TC-IEC error	1e-5 to 1e-10; maximum rate is 2.66e-5
TC-REI error	1e-6 to 1e-10; maximum rate is 3.33e-6
TC-OEI error	1e-6 to 1e-10; maximum rate is 3.33e-6

For information about inserting errors, select *Insert Errors* in the Common Tasks section of the online help.

Alarm Generated (SDH)

This function configures the unit to generate an alarm in the transmit SDH signal. Alarm generation by the unit is one way to test if downstream SDH equipment reacts properly to the alarm it receives in the incoming SDH signal.

The following alarms are available:

Option	Description
None	No alarms are generated. Turns alarms off.
LOS	Loss of Signal. An all-zeros pattern is transmitted to simulate a loss of signal or loss of optical power. This forces the downstream SONET equipment to (1) generate an AIS alarm to its downstream network elements (NE), and (2) generate an RDI alarm to its upstream NEs.
LOF	Loss of Frame. An all-zeros pattern is inserted into the A1 and A2 framing bytes of the Section OH. This simulates the absence of a valid framing pattern. This forces the downstream SONET equipment to generate an AIS alarm to its downstream network elements (NE), and generate an RDI alarm to its upstream NEs.
LOP-P	STS Path Loss of Pointer. This simulates a loss of a valid STS Pointer. When the downstream NE receives an LOP-P, it generates a DSn AIS alarm

	to its downstream equipment and an RDI-P alarm to its upstream equipment.
AIS-L	Line Alarm Indication Signal. The transmission of an AIS-L to a downstream NE forces that NE to send an AIS-P alarm to the next downstream NE. The NE will also send an RDI-L alarm to its upstream equipment. An AIS-L simulates an alarm generated by Line terminating equipment (LTE).
RDI-L	Line Remote Defect Indicator. This generates an RDI-L condition using the K2 byte of the Line OH. This simulates a downstream NE (in this case the NIC) at the Line layer, reporting a failure to an upstream NE. The downstream NE (NIC 10G) has encountered a downstream failure and is alerting upstream SONET equipment. To do this, the NIC 10G changes the pattern of the K2 byte. The NE receiving the RDI-L alarm should detect a change to the K2 byte on the incoming SONET signal. This forces the NE to generate a Remote Alarm Indicator (RAI) to its upstream NEs.
AIS-P	Path Alarm Indication Signal. The transmission of an AIS-P to a downstream NE forces that NE to send an AIS alarm to the next downstream NE. The NE will also send an RDI alarm to its upstream equipment. An AIS-P simulates an alarm generated by Path terminating equipment (PTE).
RDI-P	Path Remote Defect Indicator. This generates an RDI-P condition using the

	G1 byte of the Path OH. This simulates a downstream NE (in this case, the NIC), at the Path layer, reporting a failure to an upstream NE. To do this, the system changes the pattern of the G1 byte in the Path OH. The NE receiving the RDI-P alarm should detect a change to the G1 byte on the incoming SONET signal.
UNEQ-P	Path Unequipped Alarm. An all-zeros pattern is inserted into the C2 byte of the Path OH. The C2 byte is the STS Path Signal Label. (This type of error is used between Path terminating equipment-PTE) When a PTE receives this alarm, it will generate an AIS to downstream NEs.
TC-RDI	Tandem Connection-Remote Defect Indicator. Generates an alarm to upstream equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 8 in multiframe 73 of the N1 byte.
TC-ODI	Tandem Connection-Outgoing Defect Indicator. Generates an alarm to upstream TCM equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 7 in multiframe 74 of the N1 byte.
TC-AIS	Tandem Connection-Alarm Indication Signal. Generates an AIS alarm to downstream TCM equipment by setting Bits 1-4 of the N1 byte to 1110.
TC-UNEQ	Tandem Connection-Unequipped. Generates an all-zeros pattern is inserted into the N1 byte of the Path OH.

TC-LOF	Tandem Connection-Loss of Frame. Generates a loss of a valid multiframe pattern to downstream equipment.

After selecting an alarm, the alarm continues until one of the following occurs:

- The alarm is turned off using the **None** option.
- A **mapping** change occurs.

For more information about inserting alarms, select *Insert Alarms* in the Common Tasks section of the online help.

Receive

OC-48 Receive

The OC-48 Receive screen contains the following functions:

- Receive Settings 1 (SET 1)
- Receive Settings 2 (SET 2)
- Receive Section Overhead (SOH)
- Receive Path Overhead (POH)
- Receive Signal Status (SIG)

OC-48 Receive Settings 1

This function configures the OC-48 Receive mapping, which maps a pattern into the OC-48 interface.

Options marked with an asterisk (*) indicate that the function is coupled with the Transmit settings if Setting Control is set to "Coupled."

The OC-48 Receive Settings 1 screen contains the following options.

Option	Description
*Settings Control	If **Coupled** is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If **Independent** is selected, settings established on the Receive screen will only affect Receive mode.
*Mapping	Sets mapping to STS-48c. Note: STS-12 A/D mappings and below are available in systems that also contain an OC-1/3/12 circuit

	pack.
STS-12 Dropped	Selects a specific STS-12 signal as the foreground (or source) channel in the OC-48 signal. The source channel can be used to transmit alarms, errors, or patterns. The four STS-12 signals are multiplexed into a single OC-48 signal. The following options are available: • **1:** Selects STS-12 #1 to transmit as the source channel. • **2:** Selects STS-12 #2 to transmit as the source channel. • **3:** Selects STS-12 #3 to transmit as the source channel. • **4:** Selects STS-12 #4 to transmit as the source channel. **Note:** This function is not available in systems that do not contain an OC-1/3/12 circuit pack.
Payload Pattern	Selects the type of pattern that the unit expects to receive on the incoming SONET signal. **Note:** This function is automatically coupled to its equivalent Transmit function. The following options are available: Live (user data is received; no pattern is used), User Defined (range from 1 bit to 32 bits and is entered using a touch screen keypad), PRBS 2^15-1, PRBS 2^15-1 Inverted, PRBS 2^23-1, PRBS 2^23-1 Inverted, PRBS 2^31-1, and PRBS 2^31-1 Inverted.
Trigger Out	Allows the protocol processor to respond to an external "pulse" received. The following options can be

	selected: None, LOF, LOP, B1, B2, B3, BIT, Frame, RDI-L, RDI-P, REI-L, REI-P, or Ptr Increment, Ptr Decrement, New Ptr with NDF, or New Ptr without NDF.

OC-48 Receive Settings 2

This function configures the unit's OC-48 receive parameters. The SET 2 screen contains the following options.

Options	Description
PLM Alarm Reporting	This function enables PLM-P alarm reporting. An STS Payload Label Mismatch (PLM-P) alarm occurs when the incoming Higher-Order Path Signal Label (C2 byte) does not match the expected Higher-Order Path Signal Label (C2 byte). The following options are available: • **Enabled**: PLM-P alarms are recognized and reported. • **Disabled**: PLM-P alarms are ignored.
Expected Path Signal Label	Configure to receive a specific value for the C2 byte. The following options are available: • **Unequipped (00)**: The expected C2 byte is 00000000. • **Equipped (01)**: The expected C2 byte is 00000001. • **VT Structured STS (02)**: The expected C2 byte is 00000010. • **Lock VT Mode (03)**: The expected C2 byte is 00000011. • **Async Mapping for DS3 (04)**: The expected C2 byte is 00000100.

	• **Async Mapping for DS4NA (12)**: The expected C2 byte is 00010010. • **Mapping for ATM (13)**: The expected C2 byte is 00010011. • **Mapping for DQDB (14)**: The expected C2 byte is 00010100. • **Async Mapping for FDDI (15)**: The expected C2 byte is 00010101. • **HDLC Over SONET Mapping (16)**: The expected C2 byte is 00010110. • **Mapping for 10G WAN IEEE802.3 (1A):** The expected C2 byte is 00011010. • **User Defined**: Allows an 8-bit Path Signal Label, from 00h to FFh, to be entered for the C2 byte value.
TIM Alarm Reporting	An STS Path Trace Identifier Mismatch (TIM-P) alarm occurs when the incoming J1 trace does not match the expected J1 trace. A Section Trace Identifier Mismatch (TIM-S) alarm occurs when the incoming J0 trace does not match the expected J0 trace. The following options are available: • **Enabled**: TIM alarms are recognized and reported. • **Disabled**: TIM alarms are ignored.
Expected J0	Defines the expected J0 trace received on the incoming SONET signal. A TIM-S alarm occurs if the incoming J0 trace does not match the expected J0 trace. The J0 byte is part of the Section OH and is known as the Section trace, or J0 trace. The J0 trace is a pattern that can be created

	for repeated transmission. The pattern is a string of ASCII characters. • **Default (64 byte):** Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte):** Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones:** Selects an All Ones pattern as the J0 trace pattern. • **All Zeros:** Selects an All Zeros pattern as the J0 trace pattern. • **Default (16 byte):** Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte):** Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters , appended with a CRC-7.
Expected J1	Defines the expected J1 trace received on the incoming SONET signal. A TIM-P alarm occurs if the incoming J1 trace does not match the expected J1 trace. The J1 byte is part of the Path OH and is known as the

	Path trace, or J1 trace. The J1 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The following options are available: • **Default (64 byte):** Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte):** Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones:** Selects an All Ones pattern as the J1 trace pattern. • **All Zeros:** Selects an All Zeros pattern as the J1 trace pattern. • **Default (16 byte):** Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte):** Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters , appended with a CRC-7.
SS Bits Alarm Reporting	Disables or enables SS bits reporting. This function is used in conjunction with the Expected SS Bits function. If enabled, and an SS Bits mismatch is

	detected on the received signal, the duration in seconds will appear under the Results Scan function.
Expected SS Bits	Selects one of the following as the expected SS Bits value: • 00 (SONET) • 01 (Undefined) • 10 (SDH) • 11 (Undefined)
TC Error/Alarm Processing	Enables or disables Tandem Connection Monitoring (TCM) mode. This function is used in conjunction with the Expected TC Trace function. The **TC Summary LED** turns red if a TCM error or alarm is reported. Select the TC Summary text for more details. • **Enable:** Turns on TCM error and alarm reporting mode. • **Disable:** Turns off TCM error and alarm reporting mode. (**Note:** Disable this option if you are not performing TCM testing. This will prevent false error and alarm reporting.)
Expected TC Trace	Defines the expected TC trace received on the incoming signal. For SONET, this is in the Z5 byte. For SDH, this is in the N1 byte. The following options are available: • **Default:** Selects the 16-byte Digital Lightwave ASCII message at the expected TC trace pattern. • **User Defined:** Selects a 16-byte user-defined ASCII message as the expected TC trace pattern. The message is entered and saved using a

	screen keypad.

OC-48 Receive SOH

The OC-48 Receive SOH screen contains the following options:

Function	Description
Showing	Selects a specific SOH slot to monitor on the incoming OC-48 signal. For an OC-48 signal, slots 1-48 can be viewed. The following bytes appear for the selected SOH slot: Section Overhead bytes (A1, A2, Z0, B1, E1, F1, D1, D2, and D3), Line Overhead bytes (B2, K1, K2, D4-D12, Z1, Z2, and E2), Pointer bytes (H1, H2, and H3), and J0 Trace byte.
Section Overhead	Displays the Overhead bytes for a specific Regenerator Section OH slot on the incoming SDH OC-48 signal. This is a read-only function.
Line Overhead	Displays the Overhead bytes for a specific Multiplex Section OH slot on the incoming SDH OC-48 signal. This is a read-only function.
J0	Displays the J0 trace received on the incoming SDH signal. This is a read-only function.

OC-48 Receive POH

The OC-48 Receive POH screen contains the following functions:

Function	Description
STS-12 Dropped	Selects a specific STS-12 signal to monitor in the OC-48 signal. The system receives an OC-48 signal that is demuxed into four STS-12 signals and then processed by the system.

	The following options are available: • **1**: Selects STS-12 #1 as the dropped and monitored channel. • **2**: Selects STS-12 #2 as the dropped and monitored channel. • **3**: Selects STS-12 #3 as the dropped and monitored channel. • **4**: Selects STS-12 #4 as the dropped and monitored channel.
Path Overhead	Displays the Overhead bytes for a specific Path OH slot on the incoming OC-48 signal. This is a read-only function. The following Path Overhead bytes appear: B3, C2, G1, F2, H4, Z3, Z4, and Z5.
J1 Trace	Displays the J1 trace received on the incoming SONET signal. This is a read-only function.
TC Trace	Displays the TC trace received on the incoming SONET signal. This is a read-only function.

OC-48 Receive Signal Status

This function displays the following measurements of the incoming SONET signal:

- Frequency in MHz.
- Line Frequency offset received in Hz and ppm
- Optical Power in dBm
- Update Signal Calibration - Calibrating the system's optical power should be done carefully. To keep unauthorized users from changing calibration settings, the Update Signal Calibration button on the protocol processor's Receive SIG screen is unavailable by default. To change the setting, a user with Admin or Calibrate privileges must enable the calibration mode.

  To enable protocol processor calibration:

1. From the **System** tab, select **Misc**.
2. From **Local Settings**, select **Enable Calibration**.

The user must have Admin or Calibrate privileges to enable the calibration mode.

3. See Calibrate Optical Power for specific calibration instructions before proceeding.

Results

OC-48 Results

All monitored activity that the system receives is eventually reported to the Results screen. This screen provides several layers of granularity for analyzing the incoming signal, pattern, errors, and alarms.

The main functions under Results are:

- Scan
- Err
- Alarm
- PTR
- Event
- APS
- Large LEDs
- Graph

Results - SCAN

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected. This function displays a list of received errors and alarms. For **alarms**, the duration is reported as a count in seconds. For **errors**, an error count is reported.

When no activity is occurring, the screen displays, "No errors or alarms."

Results - Errors

The unit can monitor and report errors on the incoming SONET signal. The **Errors** function provides a detailed analysis of the incoming error as described below.

The errors reported are a result of:

- Incoming errors that are generated by the SONET network, or
- Errors being intentionally generated by the system when it is used in a loopback environment

The following errors can be monitored:

- B1 (Section BIP-8, also known as a Section Coding Violation - CV-S)
- B2 (Line BIP-8, also known as a Line Coding Violation - CV-L)
- B3 (Path BIP-8, also known as an STS Path Coding Violation - CV-P)
- REI-L (Line Remote Error Indicator; also known as a Line Far End Block Error - FEBE-L)
- REI-P (Path Remote Error Indicator; also known as a Path Far End Block Error - FEBE-P)
- BIT (BIT errors reported in the payload)
- NDF-P (Path New Data Flag counts)
- TC-IEC (Tandem Connection-Incoming Error Count)
- TC-REI (Tandem Connection-Remote Error Indicator)
- TC-OEI (Tandem Connection-Outgoing Error Indicator)

The following parameters are measured for these incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format
- Error-free seconds using an 8-digit format
- Errored seconds
- Severely Errored seconds
- Unavailable errored seconds

Results - Alarms

The unit can monitor and report alarms and their duration on the incoming SONET signal. The **Alarms** function lists the duration of the alarm in seconds.

The following alarms can be monitored:

- Clock Sync
- LOS (Loss of Signal)
- LOF (Loss of Frame)
- SEF (Severely Errored Frame)
- TIM-S (Section Trace Identifier Mismatch for the J0 byte)
- AIS-L (Line Alarm Indication Signal)
- RDI-L (Line Remote Defect Indicator)
- APS (Automatic Protection Switching)
- AIS-P (Path Alarm Indication Signal)
- LOP-P (Path Loss of Pointer)

- UNEQ-P (Unequipped STS Payload)
- RDI-P (Path Remote Defect Indicator)
- TIM-P (STS Path Trace Identifier Mismatch for the J1 byte)
- PLM-P (STS Payload Label Mismatch)
- Pattern Sync
- CONCAT (Concatenated)
- TC-RDI (Tandem Connection-Remote Defect Indicator)
- TC-ODI (Tandem Connection-Outgoing Defect Indicator)
- TC-AIS (Tandem Connection-Alarm Indication Signal)
- TC-UNEQ (Tandem Connection-Unequipped Signal)
- TC-TIM (Tandem Connection-Trace Identifier Mismatch)
- TC-LOF (Tandem Connection-Loss of Frame)

Results - PTR

This function monitors and reports received AU Pointer statistics. A count of the following Pointer statistics appear:

- Positive Justification: Indicates the Positive Pointer Justification count.
- Negative Justification: Indicates the Negative Pointer Justification count.
- Pointer Justification Seconds: Indicates the duration of a Pointer adjustment.
- NDF Count: Indicates the New Data Flag count.
- Receive Pointer Bytes (in Hex) and Value (in decimal): Valid Pointers range from 0 to 782.

Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

Results APS

The APS Results monitor incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 16 byte sequences can appear on the touch screen.

The following information appears in the APS report for the last 16 K1 and K2 byte sequences received:

- The HEX value of the K1 byte.
- The HEX value of the K2 byte.
- The number of frames received that contain the K1 and K2 bytes.
- The elapsed time of the frames that contain the K1 and K2 bytes.

Per GR-253-CORE, only the upper 12 bits of the K1/K2 bytes (K1 bits 1-8 and the K2 bits 1-4) are used for APS operation. K2 bit 5 sets the APS mode type (1+1, 1:1) and cannot be changed during operation. K2 bits 6-8 are for alarms. Any changes to the lower four bits of the K2 byte do not affect APS operation. The Results APS table only starts and displays a new entry item if the upper 12 K1/K2 bits stabilize on a new value for a minimum of three consecutive frames.

Results - Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	**Then this indicates ...**
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

For a list of available LEDs in the OC-48 protocol processor, see OC-48 LEDs.

Results - Graphs

Use the Graphs button to view error and alarm results for the OC-48 protocol processor. These graphs show the test history for either the current test or the previous test. You can configure the graph function to display any combination of OC-48 alarms and errors.

To use the Results Graph functions, see the Using Graphs section.

Test

Test Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- SET 1
- Service Disruption
- RTD (Round Trip Delay)

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Service Disruption

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is

logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The service disruption measurements show a granular accuracy of 1 frame duration. See the chart at the bottom of this page for time per frame durations for each protocol processor.

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

  For **E4**, **E3**, **E1**, **DS3** and **DS1** processors, the Protection Switch Criteria is limited to: Loss of Pattern Sync and Bit Errors.

  For **SONET** and **SDH** processors the Protection Switch Criteria include: B1, SEF / OOF, AIS-L / MS-AIS, AIS-P / AU-AIS, AIS-V / TU-AIS, and PRBS (Loss of Pattern Sync and Bit Errors).

  For **OTN** processors the Protection Switch Criteria include: OOF, OTU:AIS, OTU:BIP8, ODU:AIS, ODU:BIP8, and PRBS (Loss of Pattern Sync and Bit Errors).

- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **State** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

  - **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

Continuous APS - Constantly monitors for service disruption events, and updates the seconds and frames reported.

Stop APS - Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)** - Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.
- **Protection Switch Time (Frames)** - Indicates the number of errored frames received during the service disruption event.
- **History Recent Milli Seconds** - Shows the time durations for the last ten measurements recorded.
- **History Recent Frames** - Shows the frame durations for the last ten measurements recorded.

A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing Service Disruption.

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
SONET / SDH	0.125 ms (125 µs)	16383 frames (2047.875 ms)
OTU 1	0.049 ms (49 µs)	16383 frames (802.302 ms)
OTU 2	0.012 ms (12 µs)	16383 frames (199.732 ms)
E4	0.021 ms (21 µs)	255 frames (5.361 ms)
E3	0.045 ms (45 µs)	255 frames (11.397 ms)
E1	0.125 ms (125 µs)	4095 frames (511.875 ms)
DS3	0.106 ms (106 µs)	255 frames (27.133 ms)
DS1	0.125 ms (125 µs)	4095 frames (511.875 ms)

Click this link for Ethernet Service Disruption specifics.

Test - RTD (Round-Trip Delay)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **State:** Starts and stops round-trip delay mode.

  Single Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in frame counts and milliseconds. Frame counts indicates the number of frames received before the AIS frame is received by the unit. Milliseconds indicates how long it took for the AIS frame to travel out and return to the unit.

  Continuous Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and continuously transmitted through your network. The current frame count and duration appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.

  Stop Round-Trip Delay - Stops round-trip delay activity. The State returns to Inactive.
- **Round Trip Delay Time (milliSec):** Indicates the duration in seconds that it took for the known frame to return to the unit.
- **Round Trip Delay Time (Frames):** Indicates the number of frames received during the measurement.
- **Consecutive Good Time Required:** This function allows you to enter the duration (in milliseconds) of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 0.125 to 2047.875 milliseconds and is entered using a keypad.
- **Consecutive Good Frames Required**: This function allows you to enter the number of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 1 to 16383 frames and is entered using a keypad.

For more information about round-trip delay, select *Round-Trip Delay* in the Common Tasks section of the online help.

Performance Monitoring

OC-48 Performance Monitoring

Performance Monitoring provides greater detail about GR-253 incoming Section, Line, STS Path, and Bit errors.

The following functions are available on the OC-48 Performance Monitoring screen:

- Section
- Line
- STS Path
- Bit

OC-48 Performance Monitoring - Section

This function displays a detailed breakdown of incoming B1 errors (Section BIP-8, also known as Coding Violations).

The following statistics are reported:

Statistics	Description
Near End Coding Violations (CV)	This is an error count of incoming B1 errors.
Near End Errored Seconds (ES)	This reports the duration of the incoming B1 errors in seconds. This statistic also reports the percentage of errored seconds compared to the duration of error-free seconds.
Error-Free Seconds (EFS)	This reports the duration of the incoming B1 error free seconds. This statistic also reports the percentage of error-free seconds compared to the duration of errored seconds.
Near End Severely Errored Seconds (SES)	This reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal. An SES is reported when 8554 or more B1 errors occur in one second, or when a Severely Errored Frame (SEF) alarm, Loss of Frame (LOF) alarm, or Loss of Signal (LOS) alarm occurs.

OC-48 Performance Monitoring - Line

This function displays a detailed breakdown of incoming B2 (Line BIP-8, also known as Coding Violations) and Line Remote Error Indicator (REI-L) errors.

The following statistics are reported:

Statistics	Description
Near End Coding Violations (CV)	This is an error count of incoming B2 errors.
Near End Errored Seconds (ES)	This reports the duration of the incoming B2 errors (in seconds). This statistic also reports the percentage of errored seconds compared to the duration of error-free seconds.
Error-free Seconds (EFS)	This reports the duration of the incoming B1 error free seconds. This statistic also reports the percentage of error-free seconds compared to the duration of errored seconds.
Near End Severely Errored Seconds (SES)	This reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal. An SES is reported when 9835 or more B2 errors occur in one second, or when a Severely Errored Frame (SEF) alarm, Loss of Frame (LOF) alarm, Loss of Signal (LOS) alarm, or Line Alarm Indication Signal (AIS-L) alarm occurs.
Near End Unavailable Seconds (UAS)	This reports the number of seconds that the Line layer was considered unavailable. A Line is unavailable when 10 consecutive seconds that qualify as SES-L seconds occur.
Far End Coding Violations (CV-LFE or REI-L)	This is an error count of the number of B2 errors detected by the far-end Line Terminating Equipment (LTE). These errors are reported back to the NIC 10G using the M1 byte of the Line overhead. The M1 byte is also known as the Line Remote Error Indicator - REI-L. (A CV-LFE was formerly known as a Line FEBE.)
Far End Errored Seconds (ES-LFE)	This is a counter that indicates the number of seconds that an REI-L alarm is reported.

Far End Severely Errored Seconds (SES-LFE)	This reports the duration when 9835 or more REI-L errors are present at the far-end LTE, or when a Line Remote Defect Indicator (RDI-L) alarm is present.
Far End Unavailable Seconds (UAS-LFE)	This is a counter that indicates the number of seconds that an SES-LFE error was present at the far-end LTE. At least 10 consecutive errored seconds of SES-LFE errors must be present before a UAS-LFE is declared.

OC-48 Performance Monitoring - Path

This function displays a detailed breakdown of incoming B3 (Path BIP-8, also known as Path Coding Violations) and STS Path Remote Error Indicator (REI-P) errors.

The following statistics are reported:

Statistics	**Description**
Near End Coding Violations (CV-P)	This is an error count of incoming B3 errors.
Near End Errored Seconds (ES-P)	This reports the duration of the incoming B3 errors (in seconds). This statistic also reports the percentage of errored seconds compared to the duration of error-free seconds.
Error-Free Seconds (EFS-P)	This reports the duration of the incoming B1 error free seconds. This statistic also reports the percentage of error-free seconds compared to the duration of errored seconds.
Near End Severely Errored Seconds (SES-P)	This reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal. An SES is reported when 2400 or more B3 errors occur in one second, or when an AIS-P alarm, UNEQ-P alarm, LOS alarm, LOF alarm, AIS-L alarm, or LOP-P alarm occurs.
Near End Unavailable Seconds	This reports the number of seconds

(UAS-P)	that the STS Path layer was considered unavailable. A Path is unavailable when 10 consecutive seconds that qualify as SES-P seconds occur.
Far End Coding Violations (CV-PFE or REI-P)	This is an error count of the number of B3 errors detected by the far-end STS Path Terminating Equipment (PTE). These errors are reported back to the NIC 10G using the G1 byte of the STS Path overhead. The G1 byte is also known as the STS Path Remote Error Indicator - REI-P. (A CV-PFE was formerly known as an STS Path FEBE.)
Far End Errored Seconds (ES-PFE)	This is a counter that indicates the number of seconds that an REI-P alarm is reported.
Far End Severely Errored Seconds (SES-PFE)	This reports the duration when 2400 or more REI-P errors are present at the far-end LTE, or when a Line Remote Defect Indicator (RDI-P) alarm is present.
Far End Unavailable Seconds (UAS-PFE)	This is a counter that indicates the number of seconds that an SES-PFE error was present at the far-end LTE. At least 10 consecutive errored seconds of SES-PFE errors must be present before a UAS-PFE is declared.

OC-48 Performance Monitoring - BIT

This provides a detailed breakdown for BIT errors detected and logged by the OC-48 protocol processor.

The following statistics are reported:

Statistics	Description
CV	Code violations by count.
ES	Errored seconds by count, rate percentage, and objective percentage.

EFS	Error-free seconds by count, rate percentage, and objective percentage.
SES	Severely Errored Seconds by count, rate percentage, and objective percentage.
UAS	Unavailable seconds by count, rate percentage, and objective percentage.

OC-48 - LEDs

This section defines the SONET LEDs that appear on the touch screen's LED area and when the **Large LEDs** tab is selected.

LED	**Description**
AIS-L	Line Alarm Indication Signal. Indicates if an alarm is being received from upstream Line terminating equipment. This is an alarm LED.
AIS-P	STS Path Alarm Indication Signal. Indicates if an alarm is being received from upstream Path terminating equipment. This is an alarm LED.
APS	Automatic Protection Switching. Indicates that the K1 and K2 bytes on the incoming SONET signal have changed.
B1	Section BIP-8 Code Violation. Indicates an error in the SONET frame. B1 errors are parity errors. The B1 byte carries the parity information, so a B1 error is a Section error that applies not only to the Section OH, but the entire frame. Any error in the frame will result in a B1 error. This is an error LED.
B2	Line Overhead BIP-8 Code Violation. Indicates that parity errors were detected at the Line layer of the incoming SONET signal. This is calculated over the Line OH, Path OH,

	and payload of each STS-1. This is an error LED.
B3	Path Overhead BIP-8 Code Violations. Indicates that parity errors were detected at the Path layer of the incoming SONET signal. This is calculated over the Path OH and payload of each STS-1. This is an error LED.
BIT ERR	BIT Error. Indicates a Bit error was detected in the payload. This is an error LED.
CLK	Clock. Indicates the timing source for the SONET transmit signal. The timing source is set using the **Clock Reference** function. This is a status indicator.
LINE	Line Status. Indicates if errors or alarms are being received from upstream Line terminating equipment. This is a status LED.
LOF	Loss of Frame. Indicates that a frame alignment problem with the incoming SONET signal has been detected. An LOF is reported if a severely errored framing (SEF) defect continues for 3 milliseconds or longer. This is an alarm LED.
LOP-P	Loss of STS Pointer. Indicates that an invalid Pointer has been received or a Pointer loss has been detected on the incoming SONET signal. This is an alarm LED.
LOS	Loss of Signal. Indicates that a valid SONET signal is not being received. If an all zeros pattern exists for 100 milliseconds or longer on the incoming SONET signal, then an LOS is reported. This is an alarm LED.
PAT SYNC	Pattern Sync. Indicates a loss of pattern synchronization. This is an alarm LED.

PATH	Path Status. Indicates if errors or alarms are being received from upstream Path terminating equipment. This is a status LED.
PLM-P	STS Payload Label Mismatch. Indicates that a mismatch has been detected for the Path Signal Label. This is an alarm LED. Note: This function will be available in a future release.
PTR ADJ	Pointer Adjustment. Indicates that a Pointer Adjustment has been received. This LED flashes red during a Pointer Adjustment event. It is an event LED.
RDL-L	Line Remote Defect Indicator. Indicates that a downstream defect has occurred along the Line layer. (An RDI is also known as a Far-End Remote Failure, FERF). This is an alarm LED.
RDI-P	STS Path Remote Defect Indicator. Indicates that a remote alarm is being received from downstream Path terminating equipment. The G1 byte of the SONET Path Overhead is used for this indicator. This is an alarm LED.
REI-L	Line Remote Error Indicator. Indicates that an error is occurring at downstream Line terminating equipment. An REI is also known as a Far-End Block Error (FEBE). The M0 and M1 bytes of the SONET Line Overhead are used for this indicator. This is an error LED.
REI-P	Path Remote Error Indicator. Indicates that an error count is being received from downstream Path terminating equipment. An REI is also known as a Far-End Block Error (FEBE). This is an error LED.
RX	Receive Signal. Indicates the value of the received optical signal in dBm. For OC-48, the optimum input range is from -5 dBm to -24 dBm. A value of -30 dBm or below indicates no signal. This

	is a status LED.
SECTION	Section Status. Indicates current error, alarm, and event activity for the Section layer on the incoming SONET signal. This is a status LED.
SEF	Severely Errored Frame. Declared when four or more consecutive errored frames are detected on the incoming SONET signal. This is an alarm LED.
SS MisMatch	Displays when the expected SS bit setting does not match what is received. SS Bits Alarm Reporting must be enabled for this alarm to generate. This is an alarm LED.
TC-AIS	Tandem Connection-Alarm Indication Signal. Indicates if IEC bits 1110 are being received from upstream TCM equipment. (Bits 1-4 of the N1 byte are the IEC bits.) This is an alarm LED.
TC-IEC	Tandem Connection-Incoming Error Count. Indicates a B3 error count is being received from downstream TCM equipment. Bits 1-4 of the N1 byte are used for this indicator. This is an error LED.
TC-LOF	Tandem Connection-Loss of Frame. Indicates the loss of a valid multiframe pattern from upstream TCM equipment. This is an alarm LED.
TC-ODI	Tandem Connection-Outgoing Defect Indicator. Indicates that the unit is sending an ODI alarm to upstream TCM equipment. Bit 7 in multiframe 74 of the N1 byte is used for this indicator. This is an alarm LED.
TC-OEI	Tandem Connection-Outgoing Error Indication. Indicates that the unit is sending an OEI error to upstream TCM equipment. Bit 6 of the N1 byte is used for this indicator. This is an error LED.
TC-RDI	Tandem Connection-Remote Defect Indication. Indicates that a defect has

	occurred at the downstream TCM equipment. The unit is receiving an alarm. Bit 8 in multiframe 73 of the N1 byte is used for this indicator. This is an alarm LED.
TC-REI	Tandem Connection-Remote Error Indication. Indicates that an error has occurred at the downstream TCM equipment. The unit is receiving an error. Bit 5 of the N1 byte is used for this indicator. This is an error LED.
TC SUMMARY	Tandem Connection Summary. Indicates if a TCM error or alarm has been detected. If this LED is red, click on the LED text (TC Summary) to display the TC LEDs.
TC-UNEQ	Tandem Connection-Unequipped. Indicates that a 00h pattern has been detected in the N1 byte of a Tandem Connection. This is an alarm LED.
UNEQ-P	Unequipped STS Payload. Indicates that a 00h pattern has been detected in the C2 byte. This byte is being received from Path terminating equipment. This is an alarm LED.

OSA Tab

OSA Overview

This section of the online help system has topics that discuss:

- OSA Specific Tasks
- OSA Screen and Function Descriptions
- OSA Frequency and Wavelength Tables
- OSA Connector Panels
- OSA Technical Specifications

Specific Tasks

OSA Specific Tasks

This section includes tasks that are specific to the OSA protocol processor. For general tasks, refer to the Common Tasks section.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view Specific Tasks for this protocol processor.

Autoscan

Autoscan performs a spectrum sweep and detects the active channels. By automatically scanning channels, this function reduces the time needed to manually enter a channel range using the User Defined span function.

To use Autoscan:

1. Select **Spectrum**.
2. Select **SET**.
3. Select **Autoscan**.
4. The range of active channels appear in the graph. In addition, the beginning and ending channels appear for the **Start** and **Stop** functions.
5. If necessary, configure the X- and Y-axis parameters using the **Wavelength Settings** and **Power Settings** functions.

Comparing Graphs

Two spectrum graphs (snapshots) can be selected and displayed simultaneously to view differences between power levels.

To compare graphs:

1. Select **Spectrum**.
2. Select **Compare**.
3. Select **Graph Selection** to select the first graph used in the comparison. Select **Color Choice** to assign a color to the first graph.
4. Select **Graph Selection 2** to select the second graph to compare. Select **Color Choice** to assign a color to the second graph.
5. Select **Operation** to determine the action that the comparison graph displays. The following operations are available:
    - Add: The comparison graph displays the sum of the two graphs.
    - Subtract: The comparison graph displays the difference of the two graphs.
    - Overlay: The comparison graph is superimposed on a previous graph. This is helpful when monitoring power differences over a period of time.
6. Select **Color Choice** to assign a color to the comparison graph.
7. The graphs appear on the screen.

Configuring an OSA Alarm

You can configure specific thresholds for each channel. When a threshold is exceeded, an alarm is generated and logged. The functions appearing on the Alarm screen allow you to add and remove channels to monitor. Alarm results can be viewed using the Channel Results screen.

To configure an OSA alarm:

1. Select **Channel**.
2. Select **Alarm**.
3. Select one or all channels using **Channel Number**.
4. Set the SNR, drift, low power, and high power threshold values.
5. Select **Add**. The channels appear in the table.

To remove a channel from the alarm list:

1. Select a channel number (**Channel #** column) from the table.
2. Select **Remove**.

To remove all channels from the alarm list:

- Select **Remove All**.

Configuring Channel Settings

The Channel Settings screen determines how channel functions appear in C-band and L-band tables by narrowing the range of channels available.

The unit has a default channel table consisting of:

- 80 channels
- A channel spacing of 50 GHz (0.05 THz)
- A C-band channel range from 1525 nm to 1561 nm
- An L-band channel range from 1570 nm to 1603 nm

To change the parameters of the channels displayed in tables:

1. Select **Channel**.
2. Select **Set**.
3. Select **First Channel** to set the starting channel. Channels range from 1 to 80.
4. Select **Channel Count** to set the number of channels. The channel count ranges from 1 to 80. However, the maximum channel count that can be entered varies based on the First Channel value.
5. Select **Channel Spacing** to change the channel spacing to one of three Gigahertz values. The default is 50 GHz.

Configuring Spectrum Settings

The Spectrum Settings screen determines how spectrum information is represented and displayed on your screen. After customizing a view, it can be saved using the Snapshot function. The newly created view is entirely local and does not change data on the unit.

Use the Spectrum Settings to:

- Select a wavelength channel-band to monitor
- Perform an autoscan to quickly determine the available channels
- Define units of measure for the X- and Y-axis
- Narrow the range of interest by specifying the starting and ending channel range

To configure Spectrum graph settings:

1. Select **Spectrum**.
2. Select **SET**.

3. Use the **Wavelength Settings** to configure the graph's X-axis and channel range.
    - Select **Span** to display C-band or L-band channel ranges.

If you switch between channel bands when only one light source is present, you must reboot the unit.

For example, if you have a C-band light source attached to the unit, switch to L-band, which is not present, and then switch back to C-band, a reboot is required.

If a light source is available for both C- and L-band, the reboot is not necessary.

If an Autoscan is performed, User Defined appears as the Span value. Use **Start** and **Stop** to set the beginning and ending channels that appear on the graph.

    - Select **X Unit of Measure** to set the unit of measure to nanometers or terahertz.
    - Select **Center** to center the graph on a specific channel.

4. User **Power Settings** to configure the graph's Y-axis and displayed power level range.
    - Select **Reference Level** to set the uppermost limit for the Y-axis.
    - Select **dB/Division** to set the vertical scale (divisions) of the Y-axis.
5. After configuring the Wavelength Settings and Power Settings, the new parameters appear for the graph.
6. Select **Scan Rate (sec)** to set the graph's refresh rate.
7. Select **Snapshot** to save the new graph parameters.
8. If you changed channel bands using the Span function when only one light source is available, perform the following to reboot the unit:
    - Turn the unit off.
    - Wait approximately 10 seconds, and turn the unit on.
    - While the unit boots, it performs an internal diagnostic test. When complete, the user interface appears on the screen.

Fine-Tuning Channels

Using the **OSA Graph screen**, you can select a single channel, which will be your reference channel, and then compare and fine-tune the remaining channels based on the reference channel's values.

1. Select **Reference Channel** and enter a channel that appears in the table above the graph.
2. Select **Deviation** and to set the type of deviation (power, SNR, or wavelength/frequency deviation) to monitor.
3. A bar chart appears showing the other channels' deviations compared to the reference channel.

Overlapping Graphs

Graphs can be displayed over a period of time using the Spectrum Overlap functions.

To overlap graphs:

1. Select **Spectrum**.
2. Select **Overlap**.
3. Select **Graph Type** and set the graph format.
4. Select **High Color Choice** (Max.) and **Low Color Choice** (Min.) to assign colors to each graph type.
5. As the unit completes a spectrum sweep, power levels, based on the Graph Type setting, appear in the graph. Subsequent spectrum sweeps will appear on the graph and be superimposed on the previous graph. This provides a visual comparison of the spectrum sweep.

Snapshot and View

The Snapshot and View functions allow you to save or restore graph parameters for the Spectrum Settings graph and the Channel Settings graph.

To select a snapshot:

1. Select **View** from the Spectrum Settings screen or Channel Settings screen. The Select View window appears.
2. Select a snapshot. The snapshot's parameters appear in the graph.

To save a snapshot:

1. Select **Snapshot**. The Snapshot Configuration window appears.
2. Select **Snapshot Name**. A keypad appears allowing you to enter a unique 24-character name for the snapshot.
3. Select **Enter** (on the keypad) to save the snapshot name.
4. Select **Add** to add the new snapshot to the Snapshot Configuration list.
5. Select **OK** to save the new snapshot.

To delete a snapshot

1. Select **Snapshot**. The Snapshot Configuration window appears.
2. Select a snapshot from the Snapshot Configuration list.
   (Select the snapshot number that appears in the View column.)
3. Select **Remove**. The snapshot is deleted and appears as **<Empty>** in the list.
4. Select **OK** to close the window.

Using Zoom

You can increase or decrease an OSA graph's view magnification using the Zoom In and Zoom Out functions. You can observe greater detail, regarding a particular point on the graph, by zooming-in. Zooming-out restores the graph to its initial settings.

Zoom In

To zoom in on a specific area of the graph using a touch screen:

- Drag your finger diagonally across the screen to select and magnify an area of the graph.

To zoom in on a specific area of the graph using the Remote Control Application:

1. Right-click and drag your mouse pointer across an area of the graph.
2. Release the mouse button.

Zoom Out

To zoom out and restore the graph's initial view magnification using a touch screen:

- Press your finger twice (double click) on the graph.

To zoom out and restore the graph's initial view magnification using the Remote Control Application:

- Select **Zoom Out**.

Viewing Broadband Power

To view the power levels across the entire bandwidth:

1. Select **Spectrum**.
2. Select **SET**.
3. Select **Span**.
4. Select **C-Band** or **L-Band**.
5. The aggregate broadband power value appears in the upper left corner of the screen.

Related Topic:

Viewing Channel Power

Viewing Channel Power

1. Select **Channel**.
2. Select **Set**.
3. The Channel Power screen appears and contains a channel list table (based on the Channel Set configuration) and channel power graph.

   The power level for each channel appears in the **Ch Pwr** column. The graph provides a visual display of the peak power for all channels in the list.
4. Select **View** to view a full-screen Channel Power table.

Related Topic:

Viewing Broadband Power

Viewing Alarms (Channel Results)

The Channel Results table displays a list of all channels reporting alarms. The alarm thresholds are based on settings configured using the Channel Alarm screen.

To view results:

1. Select **Channel**.
2. Select **Results**
3. The Channel Results table appears. If an alarm condition exists, the following is reported:

   - Channel number, which indicates the C-band or L-band channel reporting the alarm
   - Alarm type, which indicates the type of alarm reported (for example, Drift, SNR, Power High, and Power Low)
   - Current alarm value:

- For Drift alarms, the channel's current drift value appears in picometers (pm).
- For Power High or Power Low alarms, the channel's current power level (dBm) appears.
- For SNR alarms, the channel's current signal-to-noise ratio (dB) appears.

These statistics are cleared when the unit is restarted.

Viewing Signal-to-Noise Ratio

1. Select **Channel**.
2. Select **Set**.
3. The Channel Power screen appears and contains a channel list table (based on the Channel Set configuration) and channel power graph.

   The SNR for each channel appears in the **S/N** column. The graph provides a visual display of the peak power for all channels in the list.

Zoom In

To zoom in on a specific area of an OSA graph using a touch screen:

- Drag your finger diagonally across the screen to select and magnify an area of the graph.

To zoom in on a specific area of the graph using the Remote Control Application:

1. Right-click and drag your mouse pointer across an area of the graph.
2. Release the mouse button.

Zoom Out

To zoom out and restore an OSA graph's initial view magnification using a touch screen:

- Press your finger twice (double click) on the graph.

To zoom out and restore the graph's initial view magnification using the Remote Control Application:

- Select **Zoom Out**.

Screen and Functions Descriptions

OSA Screen Functions and Descriptions Overview

The following function screens are available through the OSA protocol processor tab.

- OSA Spectrum
- OSA Channel
- OSA Test

Spectrum
OSA Spectrum

The Spectrum screen contains the following:

- View
- Set
- Compare
- Overlap

Spectrum View

The View screen displays the channel graph in a large, easy-to-read format. The graph's parameters are configured using the Spectrum Settings screen.

Spectrum Set

The Spectrum Settings screen configures the Spectrum graph's parameters for the X- and Y-axis.

The data view that appears on your screen is local and relative to your configuration. Changes you make using the Spectrum Settings do not changing data on the unit.

The following functions appear on the spectrum Set screen:

Function	Description
X Unit of Measure	Determines the unit of measure for the X-axis. Wavelength values (in nanometers) or ITU frequency values (in terahertz) can appear across the bottom of the spectrum graph.
Center	Centers the graph on a specific point on the X-axis. This can be used to contract the graph view and narrow

	the range of channels displayed. When the graph is centered on a point, the starting and ending wavelengths across the X-axis are contracted and automatically adjust to the new view.
Span	Indicates the type of wavelength channel band currently selected. • C-Band. • L-Band. • User Defined. Sets a beginning and ending wavelength using **Start** and **Stop** to select a specific range. **Important:** If you switch between channel bands when only one light source is present, you must reboot the unit. For example, if you have a C-band light source attached to the unit, switch to L-band, which is not present, and then switch back to C-band, a reboot is required. If a light source is available for both C- and L-band, the reboot is not necessary.
Start	Sets the beginning wavelength or frequency to display on the graph's X-axis.
Stop	Sets the ending wavelength or frequency to display on the graph's X-axis.
Reference Level	Sets the uppermost limit for the Y-axis. The graph's Y-axis indicates power in dBm.
dB/Division	Sets the vertical scale, or divisions, of the graph's Y-axis.
Scan Rate (sec)	Sets the graph's refresh rate. The default scan rate is 0.25 seconds.
View	Displays a list of the current (Live) or saved graphs (snapshots). When a snapshot is selected, the data points associated with that graph appear in the graph display.

	Note: The View button can be selected after a snapshot has been saved.
Snapshot	Assigns a unique 24-character label to a specific data point on the graph. A maximum of 16 snapshots can be saved.
Zoom Out	Adjusts the graph's view by allowing you to decrease the view magnification. This restores the graph's view as defined by the **X Unit of Measure**, **Center**, and **Span** functions. **Note:** If using a remote GUI, a double-click will zoom out. If using a touch screen, double-press using your finger to zoom out.
Zoom In (using cursor tracing)	Increases view magnification allowing you to zoom in on a specific area of the graph. **Note:** If using a remote GUI, define an area of the graph using your mouse pointer to select an area to magnify. If using a touch screen, drag your finger diagonally across the screen to zoom-in on a specific area.

Spectrum Compare

The Spectrum Compare screen allows you to examine live and/or stored graphs together, and then perform comparison operations on the two graphs.

The following functions appear on the screen.

Function	**Description**
Graph Selection	Selects the first graph used for comparison. The default is Live, which displays the current spectrum data.
Color Choice	Selects the line color used for the first

	graph.
Graph 2 Selection	Selects the second graph used for comparison.
Color Choice	Selects the line color used for the second graph.
Operation	Selects graph formatting and determines how the information is displayed. • **Add:** Displays the sum of the two graphs. • **Subtract:** Displays the difference of the two graphs. • **Overlay:** The previous graphs remains on the screen and the current graph is placed on top of the earlier graph. This is helpful when monitoring power differences over a period of time.
Color Choice	Selects the line color used for the operation graph.
Zoom Out	Adjusts the graph's view by allowing you to decrease the view magnification. This restores the graph's original view. **Note:** If using a remote GUI, a double-click will zoom out. If using a touch screen, double-press using your finger to zoom out.
Zoom In (using cursor tracing)	Increases view magnification allowing you to zoom in on a specific area of the graph. **Note:** If using a remote GUI, define an area of the graph using your mouse pointer to select an area to magnify. If using a touch screen, drag your finger diagonally across the screen to zoom-in on a specific area.

Spectrum Overlap

The Spectrum Overlap screen displays graphs over a period of time. This allows you to place a new spectrum graph over a previous spectrum graph, and provides a visual comparison of the spectrum sweep.

The following appears on this screen.

Function	Description
Graph Type	Selects one of the following graph formats: • **Min:** Displays only the spectrum's low power limits. • **Max:** Displays only the spectrum's high power limits. • **Min/Max:** Displays both the spectrum's high and low power limits.
High Color Choice	Selects the graph's line color for the Max power limits.
Low Color Choice	Selects the graph's line color for the Min power limits.
Zoom Out	Adjusts the graph's view by allowing you to decrease the view magnification. **Note:** If using a remote GUI, a double-click will zoom out. If using a touch screen, double-press using your finger to zoom out.
Zoom In (using cursor tracing)	Increases view magnification allowing you to zoom in on a specific area of the graph. **Note:** If using a remote GUI, define an area of the graph using your mouse pointer to select an area to magnify. If using a touch screen, drag your finger diagonally across the screen to zoom-in on a specific area.

Channel
OSA Channel

The Channel screen contains the following functions:

- View
- Set
- Alarm
- Graph
- Result

Channel View

The View screen displays the following channel statistics in a large, easy-to-read format.

- Channel Number (#)
- Grid: Indicates the channel value based on the frequency/wavelength table.
- Frequency or Wavelength: Indicates the actual channel value in THz or nm.
- Deviation: Indicates the difference between the Grid value and the frequency or wavelength value.
- Channel Power
- Signal-to-Noise Ratio

Channel Set

The Channel Settings screen allows you to select either a live graph or a snapshot and compare the channel information between the chart and the graph. The graph will handle zooming and the table will only display the subset of information displayed in the graph.

Function	Description
Channel Set Table	Displays a subset of channels that appear in the Channel Set graph (located along the bottom of the screen). The following channel information appears in the table: • Channel Number (#) and Type (C-band or L-band) • Grid: Indicates the channel value based on the

	frequency/wavelength table. • Frequency or Wavelength: Indicates the actual channel value in THz or nm. • Deviation: Indicates the difference between the Grid value and the frequency or wavelength value. • Channel Power • Signal-to-Noise Ratio
First Channel	Selects a specific channel as the first channel in the range of channels displayed in the table.
Channel Count	Selects a range of channels.
Channel Spacing	Sets the channel spacing for the table and graph. The following options are available: • 50 (GHz) • 100 (GHz) • 200 (GHz)
View	Displays a list of the current (Live) or saved graphs. When selected, the data points associated with the graph appear in the graph display.
Snapshot	Saves a scan and assigns a unique 24-character label to a specific data point on the graph. A maximum of 16 snapshots can be saved.
Zoom Out	Adjusts the graph's view by allowing you to decrease the view magnification. This restores the graph's view as defined by the Spectrum Set's **X Unit of Measure**, **Center**, and **Span** functions. **Note:** If using a remote GUI, a double-click will zoom out. If using a touch screen, double-press using your finger to zoom out.
Zoom In (using cursor tracing)	Increases view magnification allowing you to zoom in on a specific area of

	the graph. **Note:** If using a remote GUI, define an area of the graph using your mouse pointer to select an area to magnify. If using a touch screen, drag your finger diagonally across the screen to zoom-in on a specific area.

Channel Alarm

Use the Alarm functions to set the criteria, or thresholds, that will trigger alarms. All active alarms appear in the table.

The following functions appear on this screen.

Function	Description
Channel Number	Selects a channel to monitor. If **All** is selected, then all 80 channels (C- or L-bands) are added to the Alarm table.
SNR Threshold	Sets a limit on the channel's signal-to-noise ratio. An alarm is generated if the SNR exceeds this value. The maximum value is 30.0 dB. The minimum value is 0.0 dB.
Drift Threshold	Determines how far the channel's signal can drift before an alarm is generated. The maximum value is 216.0 nm. The minimum value is 0.0 nm.
Power Low Threshold	Determines the lower power limit. An alarm is generated if the signal exceeds this value. The maximum value is -1.0 dBm. The minimum value is -60.0 dBm.
Power High Threshold	Determines the upper power limit. An alarm is generated if the signal exceeds this value. The maximum value is 0.0 dBm. The minimum value is -60.0 dBm.
Add	Adds one or more channels to the alarm table. Only the channels listed

	in the table are monitored.
Remove	Removes a channel from the alarm table.
Remove All	Removes all channels from the alarm table.
Channel Alarm Table	Displays all channels selected that are selected for alarm monitoring. The table displays: • Channel number • Signal-to-Noise ratio • Drift • Low Power • High Power

Channel Graph

The Graph screen allows you to select a single channels, which will be your reference channel, and then compare and fine-tune the remaining channels based on the reference channel's values.

To use the Graph screen:

1. Select **Reference Channel** and enter a channel that appears in the table above the graph.
2. Select **Deviation** and to set the type of deviation (power, SNR, or wavelength/frequency deviation) to monitor.
3. A bar chart appears showing the other channels' deviations compared to the reference channel.

The following appears on the Graph screen:

Function	**Description**
Channel Graph Table	Displays a subset of channels that appear in the Channel Set graph. The following channel information appears in the table: • Channel Number (#) • Grid: Indicates the channel value based on the frequency/wavelength table.

	• Frequency or Wavelength: Indicates the actual channel value in THz or nm. • Deviation: Indicates the difference between the Grid value and the frequency or wavelength value. • Channel Power • Signal-to-Noise Ratio
Reference Channel	Sets the reference channel.
Deviations	Selects a deviation based on power (dBm), SNR (dB), or wavelength/frequency deviation. The wavelength/frequency deviation is the difference between the expected channel value (Grid) and the actual channel value.
Zoom In (using cursor tracing)	Increases view magnification allowing you to zoom in on a specific area of the graph. **Note:** If using a remote GUI, define an area of the graph using your mouse pointer to select an area to magnify. If using a touch screen, drag your finger diagonally across the screen to zoom-in on a specific area.
Zoom Out	Adjusts the graph's view by allowing you to decrease the view magnification. If using a remote GUI, a double-click will zoom out. **Note:** If using a remote GUI, a double-click will zoom out. If using a touch screen, double-press using your finger to zoom out.

Channel Result

The Channel Result screen displays a list of channels currently reporting alarms. When the unit is restarted, the Result table is cleared.

The following information is reported:

- C-band or L-band channel number
- Alarm type
- Alarm value

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

C Band L Band Channel Tables

OSA Default Frequencies and Wavelengths

The following tables list the OSA's default C-Band frequencies and wavelengths.

- 80-channel table with 50 GHz spacing
- 40-channel table with 100 GHz spacing
- 20-channel table with 200 GHz spacing

The following tables list the OSA's default L-Band frequencies and wavelengths.

- 80-channel table with 50 GHz spacing
- 40-channel table with 100 GHz spacing
- 20-channel table with 200 GHz spacing

80-Channel C-Band Table with 50 GHz Spacing

Channel Number	Frequency Code (THz)	Wavelength (nm)

1	196.00	1529.55
2	195.95	1529.94
3	195.90	1530.33
4	195.85	1530.72
5	195.80	1531.12
6	195.75	1531.31
7	195.70	1531.90
8	195.65	1532.29
9	195.60	1532.68
10	195.55	1533.07
11	195.50	1533.47
12	195.45	1533.86
13	195.40	1534.25
14	195.35	1534.64
15	195.30	1535.04
16	195.25	1535.43
17	195.20	1535.82
18	195.15	1536.22
19	195.10	1536.61
20	195.05	1537.00
21	195.00	1537.40
22	194.95	1537.79
23	194.90	1538.19
24	194.85	1538.58
25	194.80	1538.98
26	194.75	1539.37
27	194.70	1539.77
28	194.65	1540.16
29	194.60	1540.56
30	194.55	1540.95
31	194.50	1541.35
32	194.45	1541.75
33	194.40	1542.14
34	194.35	1542.54
35	194.30	1542.94
36	194.25	1543.33

37	194.20	1543.73
38	194.15	1544.13
39	194.10	1544.53
40	194.05	1544.92
41	194.00	1545.32
42	193.95	1545.72
43	193.90	1546.12
44	193.85	1546.52
45	193.80	1546.92
46	193.75	1547.32
47	193.70	1547.72
48	193.65	1548.11
49	193.60	1548.51
50	193.55	1548.91
51	193.50	1549.32
52	193.45	1549.72
53	193.40	1550.12
54	193.35	1550.52
55	193.30	1550.92
56	193.25	1551.32
57	193.20	1551.72
58	193.15	1552.12
59	193.10	1552.52
60	193.05	1552.93
61	193.00	1553.33
62	192.95	1553.73
63	192.90	1554.13
64	192.85	1554.54
65	192.80	1554.94
66	192.75	1555.34
67	192.70	1555.75
68	192.65	1556.15
69	192.60	1556.55
70	192.55	1556.96
71	192.50	1557.36
72	192.45	1557.77

73	192.40	1558.17
74	192.35	1558.58
75	192.30	1558.98
76	192.25	1559.39
77	192.20	1559.79
78	192.15	1560.20
79	192.10	1560.61
80	192.05	1561.01

40-Channel C-Band Table with 100 GHz Spacing

Channel Number	Frequency Code (THz)	Wavelength (nm)
1	196.00	1529.55
2	195.90	1530.33
3	195.80	1531.12
4	195.70	1531.90
5	195.60	1532.68
6	195.50	1533.47
7	195.40	1534.25
8	195.30	1535.04
9	195.20	1535.82
10	195.10	1536.61
11	195.00	1537.40
12	194.90	1538.19
13	194.80	1538.98
14	194.70	1539.77
15	194.60	1540.56
16	194.50	1541.35
17	194.40	1542.14
18	194.30	1542.94
19	194.20	1543.73
20	194.10	1544.53
21	194.00	1545.32
22	193.90	1546.12
23	193.80	1546.92
24	193.70	1547.72

25	193.60	1548.51
26	193.50	1549.32
27	193.40	1550.12
28	193.30	1550.92
29	193.20	1551.72
30	193.10	1552.52
31	193.00	1553.33
32	192.90	1554.13
33	192.80	1554.94
34	192.70	1555.75
35	192.60	1556.55
36	192.50	1557.36
37	192.40	1558.17
38	192.30	1558.98
39	192.20	1559.79
40	192.10	1560.61

20-Channel C-Band Table with 200 GHz Spacing

Channel Number	Frequency Code (THz)	Wavelength (nm)
1	196.00	1529.55
2	195.80	1531.12
3	195.60	1532.68
4	195.40	1534.25
5	195.20	1535.82
6	195.00	1537.40
7	194.80	1538.98
8	194.60	1540.56
9	194.40	1542.14
10	194.20	1543.73
11	194.00	1545.32
12	193.80	1546.92
13	193.60	1548.51
14	193.40	1550.12
15	193.20	1551.72
16	193.00	1553.33
17	192.80	1554.94

18	192.60	1556.55
19	192.40	1558.17
20	192.20	1559.79

80-Channel L-Band Table with 50 GHz Spacing

Channel Number	Frequency Code (THz)	Wavelength (nm)
1	190.90	1570.42
2	190.85	1570.83
3	190.80	1571.24
4	190.75	1571.65
5	190.70	1572.06
6	190.65	1572.48
7	190.60	1572.89
8	190.55	1573.30
9	190.50	1573.71
10	190.45	1574.13
11	190.40	1574.54
12	190.35	1574.95
13	190.30	1575.37
14	190.25	1575.78
15	190.20	1576.20
16	190.15	1576.61
17	190.10	1577.03
18	190.05	1577.44
19	190.00	1577.86
20	185.95	1578.27
21	189.90	1578.69
22	189.85	1579.10
23	189.80	1579.52
24	189.75	1579.93
25	189.70	1580.35
26	189.65	1580.77
27	189.60	1581.18
28	189.55	1581.60
29	189.50	1582.02
30	189.45	1582.44
31	189.40	1582.85

32	189.35	1583.27
33	189.30	1583.69
34	189.25	1584.11
35	189.20	1584.53
36	189.15	1584.95
37	189.10	1585.36
38	189.05	1585.78
39	189.00	1586.20
40	188.95	1586.62
41	188.90	1587.04
42	188.85	1587.46
43	188.80	1587.88
44	188.75	1588.30
45	188.70	1588.73
46	188.65	1589.15
47	188.60	1589.57
48	188.55	1589.99
49	188.50	1590.41
50	188.45	1590.83
51	188.40	1591.26
52	188.35	1591.68
53	188.30	1592.10
54	188.25	1592.52
55	188.20	1592.95
56	188.15	1593.37
57	188.10	1593.79
58	188.05	1594.22
59	188.00	1594.64
60	187.95	1595.06
61	187.90	1595.49
62	187.85	1595.91
63	187.80	1596.34
64	187.75	1596.76
65	187.70	1597.19
66	187.65	1597.62
67	187.60	1598.04

68	187.55	1598.47
69	187.50	1598.89
70	187.45	1599.32
71	187.40	1599.75
72	187.35	1600.17
73	187.30	1600.60
74	187.25	1601.03
75	187.20	1601.46
76	187.15	1601.88
77	187.10	1602.31
78	187.05	1602.74
79	187.00	1603.17
80	186.95	1603.60

40-Channel L-Band Table with 100 GHz Spacing

Channel Number	Frequency Code (THz)	Wavelength (nm)
1	190.90	1570.42
2	190.80	1571.24
3	190.70	1572.06
4	190.60	1572.89
5	190.50	1573.71
6	190.40	1574.54
7	190.30	1575.37
8	190.20	1576.20
9	190.10	1577.03
10	190.00	1577.86
11	189.90	1578.69
12	189.80	1579.52
13	189.70	1580.35
14	189.60	1581.18
15	189.50	1582.02
16	189.40	1582.85
17	189.30	1583.69
18	189.20	1584.53
19	189.10	1585.36
20	189.00	1586.20
21	188.90	1587.04

22	188.80	1587.88
23	188.70	1588.73
24	188.60	1589.57
25	188.50	1590.41
26	188.40	1591.26
27	188.30	1592.10
28	188.20	1592.95
29	188.10	1593.79
30	188.00	1594.64
31	187.90	1595.49
32	187.80	1596.34
33	187.70	1597.19
34	187.60	1598.04
35	187.50	1598.89
36	187.40	1599.75
37	187.30	1600.60
38	187.20	1601.46
39	187.10	1602.31
40	187.00	1603.17

20-Channel L-Band Table with 200 GHz Spacing

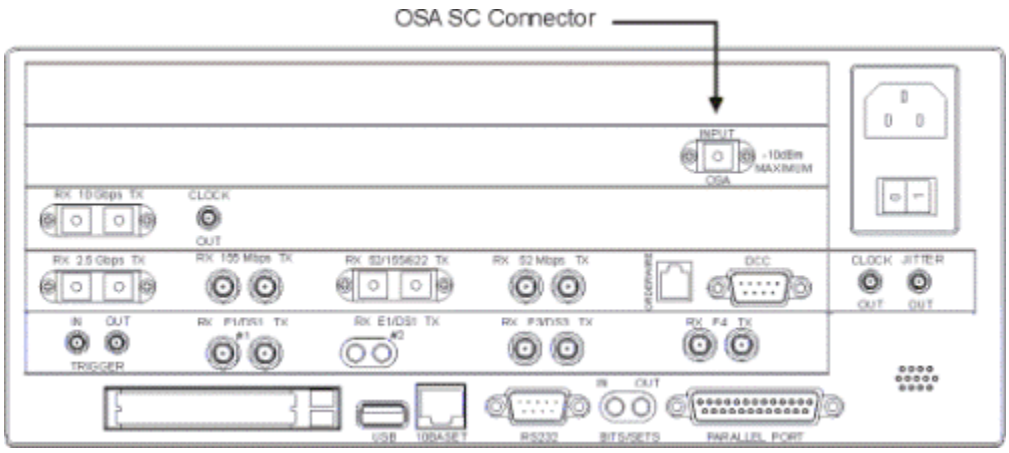
Channel Number	Frequency Code (THz)	Wavelength (nm)
1	190.90	1570.42
2	190.70	1572.06
3	190.50	1573.71
4	190.30	1575.37
5	190.10	1577.03
6	189.90	1578.69
7	189.70	1580.35
8	189.50	1582.02
9	189.30	1583.69
10	189.10	1585.36
11	188.90	1587.04
12	188.70	1588.73
13	188.50	1590.41
14	188.30	1592.10
15	188.10	1593.79

16	187.90	1595.49
17	187.70	1597.19
18	187.50	1598.89
19	187.30	1600.60
20	187.10	1602.31

OSA Connector Panels

The following example shows the location of the OSA connector on a NIC 10G.

The following example shows the location of the OSA connector on a NIC Plus.



OSA Technical Specifications

Parameters	**Specifications**
Wavelength Range	C and L band 1529 nm – 1561 nm (C-band) 1570 nm – 1603 nm (L-band)
Channel Number	160
Channel Spacing	50 GHz / 0.2 nm

Wavelength Accuracy	0.015 nm
Dynamic Range	60 dB
Channel Input Power Range	-50 dBm to -10 dBm
Channel Power Repeatability	+/- 0.2 dB
Channel Power Accuracy	+/- 0.5 dB
Polarization Dependance Loss	< 0.3 dB
Power Resolution	0.1 dB
Noise Floor	-60 dBm
Peak to Valley	25 dB
OSNR	30 dB +/- 1.0
Response Time	< 20 ms
Detectors	512 array
Operating Temperature	-5º to 70º C
Optical Connectors	SC

OTN Tab

OTN Overview

NIC test sets that are licensed for OTN (Optical Transport Network) provide testing functionality for G.709 (OTU-1 and OTU-2) networks in addition to the SONET/SDH protocols.

The legacy **OMR** (Optical Multi-Rate) circuit pack was the first Digital Lightwave module to offer OTN. The **NGMR** (Next Generation Multi-Rate) circuit pack, which succeeds the OMR circuit pack, can also be licensed for OTN as well as some additional features. Please select the appropriate OTN circuit pack based on the current configuration of your NIC product, or click Common OTN Features to view help topics that common to both OTN processors.

This section of the online help system discusses the following topics:

- OTN Features available on the **NGMR** circuit pack
- OTN Features available on the **OMR** circuit pack
- Common OTN Features

OTN-NGMR

OTN (NGMR) Overview

The **NGMR** (Next Generation Multi-Rate) circuit pack succeeds the OMR circuit pack, in that it too can be licensed to offer OTN Interface testing for **OTU-1 (2.666 GHz)** and **OTU-2 (10.709 GHz)**, and it can also be licensed for some additional Next-Generation Telecom features not available on the OMR circuit pack.

These features include **802.3 10G LAN over OTU-2** for both **11.049 GHz** and **11.095 GHz**, also **ODTU-12 Add/Drop multiplexing**, and **GFP** mappings for OTU-1 and OTU-2, as well as hot-swappable SFP and XFP lasers.

To use Next Generation Multi-Rate functionalities your unit must contain the NGMR circuit pack and be licensed accordingly.

The OTN (NGMR) Online Help is divided into the following sections:

- OTN (NGMR) Specific Tasks
- OTN (NGMR) Screen and Function Descriptions
- Packet Tab (Available for testing GFP mappings, and 10G LAN over OTU-2 interface)

OTN (NGMR) Specific Tasks

OTN (NGMR) Specific Tasks

This section includes tasks that are specific to the OTN protocol processor (G.709 compliant) available on new **NGMR** (Next Generation Multi-Rate) circuit pack.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view Specific Tasks for this protocol processor.

This section of the online help system discusses the following topics:

- Configuring the OTN Mode on NGMR
- NGMR Configuring Mappings and Payloads
- ODTU-12 Add/Drop Mapping
- GFP Mappings for OTN
- 10G Ethernet LAN over OTU-2 (11.049G and 11.095G)
- OTN Optical Power Display on NGMR

Configuring the OTN Mode on NGMR

The NGMR circuit pack supports testing and verification of OTN rates OTU-1 (2.666 Gbps) and OTU-2 (10.709 Gbps) per ITU-T standard G.709.

To configure the OTN mode:

1. Select the **OTN** protocol processor tab.
2. Select the **Transmit** button.
3. Select the **Set** tab along the left side of the screen and choose **SET 1**.
4. Select the **Interface** button. The Select Interface window appears.
5. Select one of the following licensable options:

    - **G.709 2.5G (2.666 GHz)** - Provides OTU-1 testing
    - **G.709 10G (10.709 GHz)** - Provides OTU 2 testing
    - **802.3 1G LAN (1.25 GHz)** - Provides 1 Gigabit Ethernet LAN testing
    - **802.3 10G LAN (10.3125 GHz)** - Provides 10 Gigabit Ethernet LAN testing

- **802.3 10G LAN in G.709 11G (11.049 GHz)** - Provides 11.049 Gigabit Ethernet LAN testing over OTU-2
- **802.3 10G LAN in G.709 11G (11.095 GHz)** - Provides 11.095 Gigabit Ethernet LAN testing over OTU-2

The wavelengths of these interfaces is determined by the specifications of the SFP or XFP module being used.

OTU-1 and OTU-2 interfaces can be configured for Unframed BERT, PRBS Patterns, NULL Client, Synchronous and Asynchronous SDH/SONET mappings, as well as GFP mappings.

OTU-2 can be configured for ODTU-12 mapping, which allows an ODU-1 to be multiplexed up to and demultiplexed out of an OTU-2 interface. The ODU-1 mapping can then be configured for PRBS Patterns, NULL Client, Synchronous and Asynchronous SDH/SONET mappings, as well as GFP mappings.

The 802.3 LAN interface rates allow for Ethernet testing at different rates, without the need for separate circuit packs.

Configuring OTN Mappings and Payloads

The ITU G.709 standard allows the mapping of a pattern directly into an OTN payload. Use the procedures in this section to select the OTN mapping payload.

To configure an OTN mapping:

1. Select the **Transmit** button and choose the **Set** tab from the left side of the screen.
2. Select **Set 1**.
3. Select the **Mapping** button. The Select Mapping screen appears.
4. Select the desired mapping.

   - OTU-1 and OTU-2 interfaces can be configured for Unframed BERT, PRBS Patterns, NULL Client, Synchronous and Asynchronous SDH/SONET mappings, as well as GFP mappings.
   - OTU-2 can be configured for ODTU-12 mapping, which allows an ODU-1 to be multiplexed up to and demultiplexed out of an OTU-2 interface. The ODU-1 mapping can then be configured for PRBS Patterns, NULL Client, Synchronous and Asynchronous SDH/SONET mappings, as well as GFP mappings.

To configure an OTN payload:

1. Select the **Transmit** button and choose the **Set** tab from the left side of the screen.
2. Select **Set 1**.
3. Select the **Payload Pattern** button. The Select Payload Pattern screen appears.

The Payload Pattern button will be active contingent on the OTN mapping settings.

Use the following table as a guide for configuring payload settings.

If Mapping is set to:	**Then:**
PRBS	Select one of the following test patterns to insert into the payload: **PRBS 9; PRBS 9 Inverted; PRBS 11; PRBS 11 Inverted; PRBS 15, PRBS 15 Inverted; PRBS 20; PRBS 20 Inverted; PRBS 23; PRBS 23 Inverted; PRBS 31; PRBS 31 Inverted**; or a **User Defined** pattern (32-bit value). (Use the functions that appear on the OTN screen to insert errors/alarms or change OTN overhead bytes.)
Null Client	The OTN payload is filled with an **All Zeros pattern**. (Use the functions that appear on the OTN screen to insert errors/alarms or change OTN overhead bytes.)
Unframed BERT	Select PRBS pattern to fill the unframed OTN signal. (Use the functions that appear on the OTN screen to insert errors/alarms or change OTN overhead bytes.) The User Defined Payload Pattern is not available when Unframed BERT mode is selected.
SONET/SDH Synchronous	The OTN payload is configured for SONET/SDH Synchronous mapping. Refer to the SONET or SDH Online Help sections for configuring settings on the SONET/SDH tab.
SONET/SDH Asynchronous	The OTN payload is configured for SONET/SDH Asynchronous mapping. Refer to the SONET or SDH Online Help sections for configuring settings on the

	SONET/SDH tab.
GFP	The OTN payload is filled with GFP *(Generic Frame Protocol)* payload. The Packet tab becomes enabled, allowing the GFP payload to be configured. Refer to the GFP Online Help section for configuring GFP.
ODTU-12 *(only available for OTU-2)*	OTU-2 is configured for ODTU-12 mapping. This allows an ODU-1 to be multiplexed up to and demultiplexed out of the OTU-2 interface. The ODU-1 mapping can then be configured for any of the mappings listed above.

ODTU-12 Add/Drop Mapping

The OTU-2 Interface Rate can be configured for ODTU-12 Add/Drop mapping, which allows four ODU-1s to be multiplexed up to and demultiplexed out of an OTU-2 interface.

This is a licensable option. Please contact Tech Support, or your DLI sales representative, to enable this option on your NIC unit.

The ODU-1 mapping can then be configured for PRBS Patterns, NULL Client, Synchronous and Asynchronous SDH/SONET mappings, as well as GFP mappings.

Select ODU-1 Added from Transmit > SET 1 screen, to configure which one of the four ODU-1 payloads will be configured for the specified ODU-1 mapping.

Select ODU-1 Dropped from Receive > SET 1 screen, to configure which one of the four ODU-1 payloads to test. The information contained in the other three ODU-1 payloads will be discarded.

(ODTU-12 is pronounce "O D T U One Two", not "O D T U Twelve")

GFP Mappings for OTN

The OTN Protocol Processor on the NGMR circuit pack can be configured for GFP mappings (Complying with ITU-T G.7041) .

This is a licensable option. Please contact Tech Support, or your DLI sales representative, to enable this option on your NIC unit.

Both OTU-1 and OTU-2 interface rates can be mapped for GFP.

- For **OTU-1**, select **G.709 2.5G (2.666GHz)** from the **Interface** menu, then select **GFP** from the **Mapping** menu. For GFP-Bulk mode, the max data-rate at 100% BW is **2.488320 GHz**.
- For **OTU-2**, select **G.709 10G (10.709GHz)** from the **Interface** menu, then select **GFP** from the **Mapping** menu. For GFP-Bulk mode, the max data-rate at 100% BW is **9.995277 GHz**.
- For **ODU-1 multiplexed up to OTU-2**, select **G.709 10G (10.709GHz)** from the **Interface** menu, then select **ODTU-12** from the **Mapping** menu, then select **GFP** from the **ODU-1 Mapping** menu. For GFP-Bulk mode, the max data-rate at 100% BW is **2.488320 GHz**.

  For **GFP-Framed** and **GFP-Transparent** modes, the maximum data rate is limited to **1 Gbps**; which can be distributed on one, or to up to four independent GFP streams from the Packet tab.

10GigE FEC (11.049G/11.095G)

The NGMR board can be configured so that 802.3 10G Ethernet LAN streams can be transported over OTU-2 (G.709 compliant) infrastructures. Two different frequency rates are offered, **11.049G** and **11.095G**

This is a licensable option. Please contact Tech Support, or your DLI sales representative, to enable this option on your NIC unit.

Use the Interface menu in the OTN tab to select either of the following rates.

- **802.3 10G LAN in G.709 11G (11.049 GHz)** - Provides 11.049 Gigabit Ethernet LAN testing over OTU-2
- **802.3 10G LAN in G.709 11G (11.095 GHz)** - Provides 11.095 Gigabit Ethernet LAN testing over OTU-2

The main difference between the two rates is that the 11.095 GHz signal fills the fixed-stuff (FS) bytes, as defined in the G.709 standard; where as the 11.049 GHz signal does not utilize the stuff bytes.

After establishing an OTU-2 interface rate mapped with 10G LAN, you will notice that all of the common OTN features remain enabled with the exception of Mapping and Payload Pattern.

Since the mapping defaults to 802.3 10GLAN SYNC, the Ethernet Payload and Streams are intended to be configured and tested from the **Packet tab**.

The Interface menu also provides the following 1G LAN and 10G LAN Ethernet Interface rates.

- **802.3 1G LAN (1.25 GHz)** - Provides 1 Gigabit Ethernet LAN testing
- **802.3 10G LAN (10.3125 GHz)** - Provides 10 Gigabit Ethernet LAN testing

When these Interface rates are selected, the majority of the OTN and SONET/SDH settings are disabled with the exception of the Laser button, Clock Reference, and Line Frequency Offset.

After setting the LAN interface rate, select the **Packet tab** to configure and test the Ethernet processor and Streams settings.

RX Optical Power Measurements and TX Wavelengths on NGMR units

The NGMR circuit packs utilizes hot-swappable SFP (2.5G and down) and XFP (10G and up) laser technology, which are equipped with their own internal diagnostics tools. The internal diagnostics of these modules provide the transmit laser wavelength, and are capable of measuring the received optical power levels.

This information is then fed to the user interface, and is displayed on the screen just below the Laser button.

When these laser modules are hot-swapped, the laser's transmit wavelength will automatically update.

WARNING: Always turn the TX Laser off before hot-swapping SFP or XFP modules.

OTN (NGMR) Screen and Function Descriptions

OTN (NGMR) Screen Functions and Descriptions Overview

The following function screens are available through the OTN protocol processor tab on the NGMR board.

- Transmit
- Receive
- Results
- Test
- LEDs

Transmit

OTN Transmit Screens and Functions

The transmit section allows you to configure the transmit signal parameters used in OTN operations.

The following transmit functionalities are available through the OTN Transmit screen:

- SET1
- SET2
- OTN OH
- ERROR ALARM

Set

OTN Transmit - Set / SET 1

Use the SET 1 screen to configure OTN transmit parameters. The following describes the functions that appear on this screen.

Functions	Description
Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Passthru Mode	Activates or deactivates passthru mode, allowing an incoming OTN signal to pass through the unit

	without altering the data in the signal. The following options are available: **On** and **Off**.
Interface	Sets the OTN transmit interface rate and configures the laser wavelength. The following options are available: **G.707/GR-253:** OTN is disabled and the SDH/SONET frame is defined by the configuration settings on the SDH/SONET tab. • G.707 is the ITU standard for SDH networks. GR-253 is the Telcordia standard for SONET networks. **G.709 2.5G (2.666 GHz)** - Provides OTU 1 testing, including asynchronous and synchronous SDH/SONET capability, and GFP testing capability **G.709 10G (10.709 GHz)** - Provides OTU 2 testing, including asynchronous and synchronous SDH/SONET capability, GFP testing capability, and OTDU-12 mapping capability **802.3 1G LAN (1.25 GHz)** - Provides 1 Gigabit Ethernet LAN testing **802.3 10G LAN (10.3125 GHz)** - Provides 10 Gigabit Ethernet LAN testing **802.3 10G LAN in G.709 11G (11.049 GHz)** - Provides 11.049 Gigabit Ethernet LAN testing over OTU-2 **802.3 10G LAN in G.709 11G (11.095 GHz)** - Provides 11.095

	Gigabit Ethernet LAN testing over OTU-2 The wavelengths of these interfaces is determined by the specifications of the SFP or XFP module being used. OTU-1 and OTU-2 interfaces can be configured for Unframed BERT, PRBS Patterns, NULL Client, Synchronous and Asynchronous SDH/SONET mappings, and can be licensed for GFP mappings. OTU-2 can be licensed for ODTU-12 mapping, which allows an ODU-1 to be multiplexed up to and demultiplexed out of an OTU-2 interface. The ODU-1 mapping can then be configured for PRBS Patterns, NULL Client, Synchronous and Asynchronous SDH/SONET mappings, as well as GFP mappings. The 802.3 LAN interface rates allow for Ethernet testing at different rates, without the need for separate circuit packs. The 1G LAN and 10G LAN options are licensable features
Clock Reference	Determines the timing source for the transmit signal. Select one of the following: **Internal.** Derives the transmit data's timing source from the unit's internal clock. The *CLK:INT* displays when configured for Internal clocking. **Recovered (RX Clock).** Derives the transmit timing source from the

	clock signal on the receive interface. If this option is selected, but a signal is not available, then this function defaults to Internal. The *CLK:REC* displays when configured for Recovered clocking. Note: The Recovered clock option is not available in Asynchronous mappings. **BITS/SETS.** • **BITS**: Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 Mbps. If this option is selected, but BITS clocking is not available, then this function defaults to Internal. The *CLK:BITS 1.5MHz* displays when configured for BITS clocking. • **SETS**: Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 Mbps. If this option is selected, but SETS clocking is not available, then this function defaults to Internal. The *CLK:SETS 2.0MHz* displays when configured for SETS clocking. **External 8 KHz - 75 Ohm TTL.** Derives timing from an external 8 KHz 75 Ohm TTL timing source attached to the Clock In connector. The *CLK:Ext 8 KHz* displays when configured. **External 1.544 MHz - 75 Ohm TTL.** Derives timing from an

	external 1.544 MHz 75 Ohm TTL timing source attached to the Clock In connector. The *CLK:Ext 1.5 MHz* displays when configured. **External 2.048 MHz - 75 Ohm TTL.** Derives timing from an external 2.048 MHz 75 Ohm TTL timing source attached to the Clock In connector. The *CLK:Ext 2 MHz* displays when configured. **External 10.0 MHz - 75 Ohm TTL.** Derives timing from an external 10.0 MHz 75 Ohm TTL timing source attached to the Clock In connector. The *CLK:Ext 10 MHz* displays when configured.
Mapping **Note:** The Mapping function is not available when the Interface is configured for G.707/GR-253.	Selects the type of signals that are combined and inserted into the OTN transmit signal. **Unframed BERT:** Transmits an Unframed BERT signal in the OTN frame. **SDH Synchronous:** The Optical Channel Payload Unit (OPU) of the OTN frame is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. **SDH Asynchronous:** The Optical Channel Payload Unit (OPU) of the OTN frame is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. **SONET Synchronous:** The Optical Channel Payload Unit (OPU) of the OTN frame is synchronized with the rest of the

	OTN frame, and the payload data is defined by the configuration settings on the SONET tab. **SONET Asynchronous:** The Optical Channel Payload Unit (OPU) of the OTN frame is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. **PRBS:** The OTN frame is configured with a PRBS pattern. **Null Client:** The OTN frame is configured with an All Zeros payload pattern. **GFP:** The OTN frame is configured with a GFP Payload. **ODTU-12:** The Optical Channel Payload Unit (OPU) of the OTU 2 interface is configured with four ODU 1 mapping signals. The foreground ODU 1 can be configured with SONET/SDH Sync/Async mappings, GFP, PRBS, or Null Client mapping options. GFP and ODTU-12 mapping options are licensable features
Payload Pattern	Selects a test pattern to insert into the payload of an OTN signal, when the Mapping is set to **PRBS** or **Unframed BERT**. Select one of the following: **PRBS 9**; **PRBS 9 Inverted**; **PRBS 11**; **PRBS 11 Inverted**; **PRBS 15**, **PRBS 15 Inverted**; **PRBS 20**; **PRBS 20 Inverted**; **PRBS 23**; **PRBS 23 Inverted**; **PRBS 31**; **PRBS 31 Inverted**; or

	a **User Defined** pattern (32-bit value) The User Defined Payload Pattern is unsupported when Unframed BERT mode is selected.
Line Frequency Offset	Adjusts the offset of the signal frequency of the transmitted SDH/SONET signal. The frequency can be adjusted in parts per million (PPM). The offset value is entered using an on-screen keypad. The frequency offset ranges from -100.0 ppm to 100.0 ppm in increments of 0.1 ppm. The default value is 0 (Off). The Line Frequency Offset setting is only available when the Clock Reference is set to Internal timing.
OPU Frequency Offset	Sets the Optical Channel Payload Unit (OPU) frequency offset. The offset can be adjusted in ppm ranging from -65.66 ppm to 65.66 ppm. The OPU Frequency Offset setting is only available for Asynchronous mappings.
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. **Off.** The unit's laser will be off when the unit is turned on. **On.** The unit's laser will be on when the unit is turned on. **Restore Previous State.** When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.

ODU-1 Mapping **Note:** The ODU-1 Mapping function is only available when the 10G Mapping is configured for ODTU-12	Selects the type of signals that are inserted into the foreground ODU-1 Mapping of the ODTU-12 transmit signal. **Unframed BERT:** Transmits an Unframed BERT signal in the foreground ODU-1 Mapping. **SDH Synchronous:** The Optical Channel Payload Unit (OPU) of the foreground ODU-1 Mapping is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. **SDH Asynchronous:** The Optical Channel Payload Unit (OPU) of the foreground ODU-1 Mapping is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. **SONET Synchronous:** The Optical Channel Payload Unit (OPU) of the foreground ODU-1 Mapping is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. **SONET Asynchronous:** The Optical Channel Payload Unit (OPU) of the foreground ODU-1 Mapping is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. **PRBS:** The foreground ODU-1 Mapping is configured with a

	PRBS pattern. **Null Client:** The foreground ODU-1 Mapping is configured with an All Zeros pattern. **GFP:** The foreground ODU-1 Mapping is configured with a GFP Payload.
ODU-1 Added **Note:** The ODU-1 Added function is only available when the 10G Mapping is configured for ODTU-12	Selects which or the four ODU-1 channels will be the foreground channel.
ODU-1 OPU Frequency Offset **Note:** The ODU-1 OPU Frequency Offset function is only available when the 10G Mapping is configured for ODTU-12	Sets the ODU-1 OPU frequency offset. The offset can be adjusted in ppm ranging from -65.66 ppm to 65.66 ppm. The ODU-1 OPU Frequency Offset setting is only available when the 10G Mapping is configured for ODTU-12, and the ODU-1 Mapping is configured for SONET/SDH Asynchronous payload.

OTN Transmit - Set / SET 2

Use the Settings 2 screen to configure OTN transmit parameters. The following describes the functions that appear on this screen.

Functions	Description
Trigger In	Allows the protocol processor to insert an error or restart an error test. The Trigger In setting is not available when the mapping is set to SONET or SDH.
Scramble	Scrambles the OTN frame as defined

	by G.709. The default value is Enable.
Forward Error Correction	Disables or enables Forward Error Correction (FEC). The default value is Enable. The Forward Error Correction setting is not available when the mapping is set to Unframed BERT.

OTN Overhead

OTN Transmit - Overhead (OTN OH)

The OTN OH screen allows you to configure the following overhead signals:

OTU

ODU-A

ODU-B

TCM

OPU

OH INTRUDE

OTN Transmit - OTN OH / OTU

The following overhead options are available from the OTU screen.

Option	Description
OA1	Edits the first three bytes of the Frame Alignment Signal (FAS) OH. The default byte value is 1111 0110 (0xF6).
OA2	Edits the second three bytes of the FAS OH. The default byte value is 0010 1000 (0x28).
MFAS	Edits the Multiframe Alignment Signal OH byte. This byte is located in row1, column 7 of the OTU OH.
TTI	Trail Trace Identifier. The TTI OH byte defines the 64-byte TTI string. The TTI is part of the OTU Section

	Monitoring (SM) OH. See SAPI, DAPI and Specific trace settings below.
BIP-8	Edits the OTU SM error detection code signal. It is a single byte that uses a Bit Interleaved Parity-8 code.
BEI/BDI/IAE/RES	The Backward Error Indication (BEI) subfield is a four-bit signal sent in the upstream direction to indicate that an error has been detected. The Backward Defect Indication (BDI) subfield is a single bit sent in the upstream direction to indicate that a signal fail status has been detected. This bit is set to 1 to indicate a BDI. The Incoming Alignment Error (IAE) subfield is a single bit used to indicate a frame alignment error. This bit is set to 1 to indicate an IAE. Two bytes of the Section Monitoring overhead are reserved for future use.
GCC0-1 and GCC0-2	General Communication Channel 0, Byte 1 and Byte 2.
RES-1 and RES-2	Two bytes of the OTU overhead are reserved for future use.
SAPI	Source Access Point Identifier. The SAPI is the first part of the multi-frame Trail Trace Identifier (TTI) structure. A 15-character string can be entered for the SAPI.
DAPI	Destination Access Point Identifier. The DAPI is part of the multi-frame TTI structure. A 15-character string can be entered for the DAPI.
Specific	Operator Specific. This is part of the TTI structure. A 32-character string can be entered for this value.

OTN Transmit - OTN OH / ODU-A

The Transmit Optical Channel Data Unit (ODU) overhead bytes and messages can be edited using three separate screens on the unit: ODU-A, ODU-B, and TCM.

Use screen A of the Optical Channel Data Unit (ODU) Overhead to edit the Path Monitoring overhead and the Fault Type and Fault Location (FTFL) overhead bytes and messages. The FTFL is a 256-byte message that is divided into two parts: the Forward FTFL and the Backward FTFL.

Forward FTFL

The Forward FTFL consists of bytes 0 to 127 of the FTFL message.

Option	Description
Fault	Byte 0 is the Fault Identification field. It provides a fault status and uses the following codes: 0000 0000: No Fault 0000 0001: Signal Fail 0000 0010: Signal Degrade 0000 0011 through 1111 1111 are reserved for future use.
OI	Bytes 1 through 9 are used for the Operator Identifier field.
OS	Bytes 10 through 127 are used for the Operator Specific field.

Backward FTFL

The Backward FTFL consists of bytes 128 to 255 of the FTFL message.

Option	Description
Fault	Byte 128 is the Fault Identification field. It provides a fault status and uses the following codes: 0000 0000: No Fault 0000 0001: Signal Fail 0000 0010: Signal Degrade 0000 0011 through 1111 1111 are reserved for future use.
OI	Bytes 129 through 137are used for the Operator Identifier field.
OS	Bytes 138 through 255 are used for the Operator Specific field.

ODU Path Monitoring Overhead

Option	Description
TTI	The ODU Trail Trace Identifier (TTI) is a single byte used for Path Monitoring to identify the 64-byte TTI signal message.

BIP-8	A single byte used to define the Error Detection Code signal, which is a Bit Interleaved Parity-8 (BIP-8) code.
BEI/BDI/STAT	The Backward Error Indication (BEI) subfield is a four-bit signal sent in the upstream direction to indicate that an error has been detected. The Backward Defect Indication (BDI) subfield is a single bit sent in the upstream direction to indicate that a signal fail status has been detected. This bit is set to 1 to indicate a BDI. The Status (STAT) bits are three bits used to indicate the use of a maintenance signal.
SAPI	Source Access Point Identifier. The SAPI is the first part of the multi-frame Trail Trace Identifier (TTI) structure. A 15-character string can be entered for the SAPI.
DAPI	Destination Access Point Identifier. The DAPI is part of the multi-frame TTI structure. A 15-character string can be entered for the DAPI.
Specific	Operator Specific. This is part of the TTI structure. A 32-character string can be entered for this value.

OTN Transmit - OTN OH / ODU-B

The Transmit Optical Channel Data Unit (ODU) overhead bytes and messages can be edited using three separate screens on the unit: ODU-A, ODU-B, and TCM.

Use screen B of the ODU overhead to edit the following bytes.

Option	Description
RES-1 through RES-9	Nine bytes of the ODU overhead are reserved for future use. These bytes are set to all zeros.
EXP-1 and EXP-2	Two bytes of the ODU overhead are

	reserved for experimental use.
GCC1-1 and GCC1-2	General Communications Channel 1, Byte 1 and Byte 2.
GCC2-1 and GCC2-2	General Communications Channel 2, Byte 1 and Byte 2.
APS/PCC-1 through APS/PCC-4	Automatic Protection Switching and Protection Communication Channel, Byte 1, Byte 2, Byte 3, and Byte 4.

OTN Transmit - OTN OH / TCM

The Transmit Optical Channel Data Unit (ODU) overhead bytes and messages can be edited using three separate screens on the unit: ODU-1, ODU-2, and TCM.

The ODU overhead contains six Tandem Connection Monitoring (TCM) fields. The following overhead bytes can be edited for each TCM field.

Option	Description
TCM Selection	Selects a specific TCM field (TCM1 through TCM6).
BIP-8	One byte of the ODU TCM overhead is used to identify an Error Detection Code signal, which is a BIP-8 signal.
BEI/BDI/STAT	The Backward Error Indication (BEI) subfield is a four-bit signal sent in the upstream direction to indicate that an error has been detected. The Backward Defect Indication (BDI) subfield is a single bit sent in the upstream direction to indicate that a signal fail status has been detected. This bit is set to 1 to indicate a BDI. The Status (STAT) bits are three bits used to indicate the use of a maintenance signal.
SAPI	Source Access Point Identifier. The SAPI is the first part of the multi-frame Trail Trace Identifier (TTI) structure. A 15-character string can be entered for the SAPI.

DAPI	Destination Access Point Identifier. The DAPI is part of the multi-frame TTI structure. A 15-character string can be entered for the DAPI.
Specific	Operator Specific. This is part of the TTI structure. A 32-character string can be entered for this value.

OTN Transmit - OTN OH / OPU

Use this screen to edit the Optical Channel Payload Unit (OPU) bytes.

Option	Description
RES-1 through RES-3 and RES-5 through RES-8	Seven bytes of the OPU overhead are reserved for future use. These bytes are set to all zeros.
PT (PSI-0)	Payload Type. This byte identifies the type of signal mapped into an OPU.
Positive Adjust	Positive Justification Opportunity byte.
Negative Adjust	Negative Justification Opportunity byte.

The OPU Positive and Negative Adjust buttons are only available for Asynchronous mappings.

OTN Transmit - OTN OH / INTRUDE

When the unit is in Passthru Mode, the Intrude option allows you intrude on selected byte data in a return signal.

To intrude upon a byte:

1. Select the **OTN** tab.
2. Select **Transmit** and **Set 1**.
3. Verify the **Passthru Mode** setting is set to **On**.
4. Select **OTN OH**.
5. Select the **Intrude** button. The Intrude screen appears displaying byte buttons.
6. Select the button that represents the byte you want to intrude upon. The button turns red while intruding on the byte.

The Passthru mode feature cannot be tested with the unit looped back to itself.

OTN Transmit - A/D OH

When OTU-2 is the configured for ODTU-12 Add/Drop mapping, then the A/D OH section becomes available.

The A/D OH settings apply to the additional layer of overhead bytes for the ODU-1 payload getting multiplexed up to and out of OTU-2.

OTN Transmit - Error Alarm

Use this screen to configure and transmit OTN errors and alarms.

For information on inserting errors and alarms see the online help topics, Inserting Errors and Inserting Alarms in the Common Tasks section.

The following options are available on the OTN Errors and Alarms screen.

Option	Description
Error to Insert	Allows the user to select an error that is transmitted by the OTN signal. Selecting the **Error to Insert** button opens the Select Error Insert list. Available errors include: • FEC:UNCOR, FEC:COR, FRAME, MFAS, OTU:BIP8, OTU:BEI, ODU:BIP8, ODU:BEI, BIT, TCM1:BIP8 – TCM6:BIP8, and TCM1:BEI – TCM6:BEI, More (Note that FEC Correctable & Uncorrectable errors are inserted after the FEC wrapper is created.)

	Selecting **More** opens the Select Alarms to Burst list. Available alarms to burst include: • OTU:IAE, OTU:BDI, ODU:BDI, TCM1:BDI - TCM6:BDI
Error Insert Rate	Sets the insertion rate of the OTN Transmit error from 1e-3 through 1e-10. A user-defined rate is also available.
Error Burst Size	Sets the duration, either in Frames or MilliSec, for the alarm selected from the Alarms to Burst list to be inserted. This option is not available unless an Alarm to Burst has been selected from the Error to Insert function.
Error Burst Period	Sets the elapsed time (in MilliSec) or Frame count between alarm insertion bursts. This is a repeating action.
Alarm Generated	Generates a specific alarm that is transmitted by the OTN signal. The following alarms are available: • LOS, LOF, OOF, LOM, OOM, OTU:AIS, OTU:IAE, OTU:BDI, ODU:AIS, ODU:LCK, ODU:OCI, ODU:BDI, TCM1:BDI – TCM6:BDI, and None.

Receive

Receive Screens and Functions

The receive section allows you to configure the receive settings for the parameters used in OTN operations.

The following receive functionalities are available through the OTN Receive screen:

- SET1
- SET2
- SET3
- OTN OH
- A/D OH
- SIG

Set

OTN Receive - Set / SET 1

Use the SET 1 screen to configure OTN receive parameters. The following describes the functions that appear on this screen.

Functions	Description
Settings Control	If **Coupled** is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If **Independent** is selected, settings established on the Receive screen will only affect Receive mode.
Interface	Sets the OTN receive interface rate and configures the laser wavelength. The following options are available: **G.707/GR-253**: OTN is disabled and the SDH/SONET frame is defined by the configuration settings on the SDH/SONET tab. • G.707 is the ITU standard for SDH networks. GR-253 is the Telcordia standard for SONET networks. **G.709 2.5G (2.666 GHz)** - Provides OTU 1 testing, including asynchronous and synchronous SDH/SONET capability, and GFP testing capability **G.709 10G (10.709 GHz)** - Provides OTU 2 testing, including asynchronous and synchronous SDH/SONET capability, GFP testing capability, and OTDU-12 mapping capability **802.3 1G LAN (1.25 GHz)** - Provides 1 Gigabit Ethernet LAN testing

	802.3 10G LAN (10.3125 GHz) - Provides 10 Gigabit Ethernet LAN testing **802.3 10G LAN in G.709 11G (11.049 GHz)** - Provides 11.049 Gigabit Ethernet LAN testing over OTU-2 **802.3 10G LAN in G.709 11G (11.095 GHz)** - Provides 11.095 Gigabit Ethernet LAN testing over OTU-2 The wavelengths of these interfaces is determined by the specifications of the SFP or XFP module being used. OTU-1 and OTU-2 interfaces can be configured for Unframed BERT, PRBS Patterns, NULL Client, Synchronous and Asynchronous SDH/SONET mappings, and can be licensed for GFP mappings. OTU-2 can be licensed for ODTU-12 mapping, which allows an ODU-1 to be multiplexed up to and demultiplexed out of an OTU-2 interface. The ODU-1 mapping can then be configured for PRBS Patterns, NULL Client, Synchronous and Asynchronous SDH/SONET mappings, as well as GFP mappings. The 802.3 LAN interface rates allow for Ethernet testing at different rates, without the need for separate circuit packs. The 1G LAN and 10G LAN options are licensable features
Mapping **Note:** The Mapping function is not available when the Interface is configured for G.707/GR-253.	Selects the type of signals that are expected in the OTN receive signal. **Unframed BERT:** Expects an Unframed BERT signal in the OTN frame. **SDH Synchronous:** The Optical Channel Payload Unit (OPU) of the OTN frame is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. **SDH Asynchronous:** The Optical Channel Payload Unit (OPU) of the OTN frame is Asynchronous with the rest of the OTN frame, and the payload data is defined

	by the configuration settings on the SDH tab. This mapping is only available for OTU 1. **SONET Synchronous:** The Optical Channel Payload Unit (OPU) of the OTN frame is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. **SONET Asynchronous:** The Optical Channel Payload Unit (OPU) of the OTN frame is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. This mapping is only available for OTU 1. **PRBS:** Expects a PRBS pattern into the OTN frame. **Null Client:** Expects an All Zeros pattern into the OTN frame. **GFP:** Expects an OTN frame configured with a GFP Payload. **ODTU-12:** The Optical Channel Payload Unit (OPU) of the OTU 2 interface is configured with four ODU 1 mapping signals. The foreground ODU 1 can be configured with SONET/SDH Sync/Async mappings, GFP, PRBS, or Null Client mapping options. GFP and ODTU-12 mapping options are licensable features
Payload Pattern	Selects an expected test pattern in the payload of an OTN signal, when the Mapping is set to **PRBS** or **Unframed BERT**. Select one of the following: **PRBS 9**; **PRBS 9 Inverted**; **PRBS 11**; **PRBS 11 Inverted**; **PRBS 15**, **PRBS 15 Inverted**; **PRBS 20**; **PRBS 20 Inverted**; **PRBS 23**; **PRBS 23 Inverted**; **PRBS 31**; **PRBS 31 Inverted**; **User Defined** pattern (32-bit value); or **Live** The User Defined Payload Pattern is unsupported when Unframed BERT mode is selected. When the actual patten being received does not match the expected payload pattern, then a pattern

	mismatch (Pat Sync) alarm occurs.
Power Low Threshold	Sets the threshold for which the Power Low alarm occurs. When the received optical power level (in dBm) is lower than the power low threshold setting, the Power Low alarm will occur. The threshold value is entered using an on-screen keypad, and can range from -10.0 dBm to -100.0 dBm in increments of 0.1 dBm. The default value is -100.0 (Disabled).
Out of Frequency Threshold	Sets the out of frequency threshold (when enabled).
Scramble	Enables/disables the scramble option.
Forward Error Correction	Enables/disables forward error correction (FEC).
Trigger Out	Selects an event allowing the protocol processor to respond to a received external "pulse".
ODU-1 Mapping **Note:** The ODU-1 Mapping function is only available when the 10G Mapping is configured for ODTU-12	Selects the type of signal expected in the foreground ODU-1 Mapping of the ODTU-12 receive signal. **Unframed BERT:** Expects an Unframed BERT signal in the foreground ODU-1 Mapping. **SDH Synchronous:** The Optical Channel Payload Unit (OPU) of the foreground ODU-1 Mapping is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. **SDH Asynchronous:** The Optical Channel Payload Unit (OPU) of the foreground ODU-1 Mapping is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. **SONET Synchronous:** The Optical Channel Payload Unit (OPU) of the foreground ODU-1 Mapping is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. **SONET Asynchronous:** The Optical Channel Payload Unit (OPU) of the foreground ODU-1 Mapping is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on

	the SONET tab. **PRBS:** The expected foreground ODU-1 Mapping is configured with a PRBS pattern. **Null Client:** The expected foreground ODU-1 Mapping is an All Zeros payload pattern. **GFP:** The expected foreground ODU-1 Mapping is configured with a GFP Payload.
ODU-1 Dropped **Note:** The ODU-1 Dropped function is only available when the 10G Mapping is configured for ODTU-12	Selects which or the four ODU-1 channels will be the demultiplexed (dropped) channel.

OTN Receive - Set / SET 2

Use the SET 2 screen to enable and disable the following alarm reporting:

- OTU SM (SAPI and DAPI) Trace Identifier Mismatch (TIM) Alarm Reporting
- ODU PM (SAPI and DAPI) Trace Identifier Mismatch (TIM) Alarm Reporting
- Tandem Connection Monitoring #1 (TCM #1) Alarm Reporting (with or without TIM Alarm Reporting)
- Tandem Connection Monitoring #2 (TCM #2) Alarm Reporting (with or without TIM Alarm Reporting)
- Tandem Connection Monitoring #3 (TCM #3) Alarm Reporting (with or without TIM Alarm Reporting)
- Tandem Connection Monitoring #4 (TCM #4) Alarm Reporting (with or without TIM Alarm Reporting)
- Tandem Connection Monitoring #5 (TCM #5) Alarm Reporting (with or without TIM Alarm Reporting)
- Tandem Connection Monitoring #6 (TCM #6) Alarm Reporting (with or without TIM Alarm Reporting)
- OPU Payload Label Mismatch (PLM) Alarm Reporting

OTN Receive - Set / SET 3

Use the SET 3 screen to enable and disable the following ODTU-12 A/D alarm reporting:

- A/D ODU PM (SAPI and DAPI) Trace Identifier Mismatch (TIM) Alarm Reporting
- A/D Tandem Connection Monitoring #1 (TCM #1) Alarm Reporting (with or without TIM Alarm Reporting)
- A/D Tandem Connection Monitoring #2 (TCM #2) Alarm Reporting (with or without TIM Alarm Reporting)
- A/D Tandem Connection Monitoring #3 (TCM #3) Alarm Reporting (with or without TIM Alarm Reporting)
- A/D Tandem Connection Monitoring #4 (TCM #4) Alarm Reporting (with or without TIM Alarm Reporting)
- A/D Tandem Connection Monitoring #5 (TCM #5) Alarm Reporting (with or without TIM Alarm Reporting)
- A/D Tandem Connection Monitoring #6 (TCM #6) Alarm Reporting (with or without TIM Alarm Reporting)
- A/D OPU Payload Label Mismatch (PLM) Alarm Reporting

These settings are only available when the 10G Mapping is configured for ODTU-12

OTN Overhead

OTN Receive - OTN OH

The OTN Receive Overhead screen contains the following read-only functions.

Function	Options
OTU Overhead	Displays the Optical Channel Transport Unit (OTU) overhead bytes on the incoming signal. This is a read-only function.
ODU-A Overhead	Displays the first screen of the Optical Channel Data Unit (ODU) Overhead bytes on the incoming signal. This is a read-only function.
ODU-B Overhead	Displays the second screen of the Optical Channel Data Unit (ODU) Overhead bytes on the incoming signal. This is a read-only function.
TCM Overhead	Displays the Tandem Connection Monitoring (TCM) Overhead on the incoming signal. This is a read-only function.
OPU Overhead	Displays the Optical Channel Payload Unit (OPU)

	Overhead bytes on the incoming signal. This is a read-only function.
Received SAPI Trace	Displays the Source Access Point Identifier (SAPI) trace received on the incoming signal for OTU, ODU,and TCM1-TCM6 OH bytes.
Expected SAPI Trace	The Expected SAPI Trace is a User Defined setting that can be compared to the received SAPI Trace. When a specific OH section's TIM Alarm Reporting is Enabled, then that section's SAPI alarm will increment if the received SAPI Trace is different than the Expected SAPI Trace setting.
Received DAPI Trace	Displays the Destination Access Point Identifier (DAPI) trace received on the incoming signal for OTU, ODU,and TCM1-TCM6 OH bytes.
Expected DAPI Trace	The Expected DAPI Trace is a User Defined setting that can be compared to the received DAPI Trace. When a specific OH section's TIM Alarm Reporting is Enabled, then that section's DAPI alarm will increment if the received DAPI Trace is different than the Expected DAPI Trace setting.

OTN Receive - A/D OH

When OTU-2 is the configured for ODTU-12 Add/Drop mapping, then the A/D OH section becomes available.

The A/D OH settings apply to the additional layer of overhead bytes for the ODU-1 payload getting multiplexed up to and out of OTU-2.

OTN Receive - Signal Status (SIG)

Displays the following measurements of the incoming OTN signal:

- Line Frequency in Hz
- Line Frequency Offset Received in Hz and PPM
- Optical Power source in dBm
- OPU Justify Frequency Offset in PPM

Frequency measurements are only made then the OTN Mapping is configured for SONET/SDH Asynchronous

When the 10G Mapping is configured for ODTU-12, this setting will display a constant -17.65 PPM Justify Rate

- A/D OPU Justify Frequency Offset in PPM

Frequency measurements are only made then the ODU 1 Mapping is configured for SONET/SDH Asynchronous

This is only available when the 10G Mapping is configured for ODTU-12

Results

OTN Results Screens and Functions

All monitored activity that the system receives is reported to the Results screen. This screen provides several layers of granularity for analyzing the incoming signal, pattern, errors, and alarms.

The Results screen provides different ways of viewing received statistics. From the left side of the Result screen, select one of the following tabs:

- Error & Alarm
- Event Log
- Large LED
- Graphs

Error / Alarm

OTN Results - Error & Alarm

The Err screens provides the following options:

- Scan
- Errors
- Add/Drop Errors
- Alarms
- Add/Drop Alarms
- Counts

OTN Results - Error & Alarm - Scan

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

- For **alarms**, the duration is reported as a count in seconds.
- For **errors**, an error count is reported.
- The message **No Errors or Alarms** appears if no events are received by the unit.

OTN Results - Error & Alarm - Errors

The system can monitor and report errors on the incoming OTN signal. The **Errors** function provides a detailed analysis of the incoming error as described below.

The errors reported are a result of:

- Incoming errors that are generated by the OTN network, or
- Errors being intentionally generated by the system when it is used in a loopback environment

The following errors can be monitored:

- **FRAME**
- **MFAS**
- **FEC:Uncorrected**
- **FEC:Corrected**
- **OTU:BIP8**
- **OTU:BEI**
- **ODU:BIP8**
- **ODU:BEI**
- **BIT**
- **TCM1:BIP8 – TCM6:BIP8**
- **TCM1:BEI – TCM6:BEI**

The following parameters are measured for these incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format

OTN Results - Error & Alarm - Add/Drop Errors

The system can monitor and report errors on the incoming ODTU-12 Mapping. The **Add/Drop Errors** function provides a detailed analysis of the incoming error as described below.

The errors reported are a result of:

- Incoming errors that are generated by the OTN network, or
- Errors being intentionally generated by the system when it is used in a loopback environment

The following errors can be monitored:

- **Add/Drop Frame**
- **Add/Drop MFAS**
- **Add/Drop ODU:BIP8**
- **Add/Drop ODU:BEI**
- **Add/Drop BIT**
- **Add/Drop TCM1:BIP8 – Add/Drop TCM6:BIP8**
- **Add/Drop TCM1:BEI – Add/Drop TCM6:BEI**

The following parameters are measured for these incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format

OTN Results - Error & Alarm - Alarms

The system can monitor and report alarms and their duration on the incoming OTN signal. The **Alarms** function lists the duration of the alarm in seconds.

The following alarms can be monitored:

- **LOS**
- **Power Hot**
- **Power Warm**
- **Power Low**
- **Frequency Wide**
- **LOF**
- **OOF**
- **LOM**

- **OOM**
- **OTU:AIS**
- **OTU:IAE**
- **OTU:BDI**
- **OTU:SAPI**
- **OTU:DAPI**
- **ODU:AIS**
- **ODU:LCK**
- **ODU:OCI**
- **ODU:BDI**
- **ODU:SAPI**
- **ODU:DAPI**
- **TCM1:BDI – TCM6:BDI**
- **TCM1:SAPI – TCM6:SAPI**
- **TCM1:DAPI – TCM6:DAPI**
- **OPU:PLM**
- **Paused**
- **Pat Sync**

OTN Results - Error & Alarm - Add/Drop Alarms

The system can monitor and report alarms and their duration on the incoming ODTU-12 Mapping. The **Add/Drop Alarms** function lists the duration of the alarm in seconds.

The following alarms can be monitored:

- **Add/Drop Pat Sync**
- **Add/Drop LOF**
- **Add/Drop OOF**
- **Add/Drop LOM**
- **Add/Drop OOM**
- **Add/Drop ODU:AIS**
- **Add/Drop ODU:LCK**
- **Add/Drop ODU:OCI**
- **Add/Drop ODU:BDI**
- **Add/Drop ODU:SAPI**
- **Add/Drop ODU:DAPI**
- **Add/Drop TCM1:BDI – A/D TCM6:BDI**
- **Add/Drop TCM1:SAPI – A/D TCM6:SAPI**
- **Add/Drop TCM1:DAPI – A/D TCM6:DAPI**
- **Add/Drop OPU:PLM**

OTN Results - Error & Alarm - Counts

The Count screen displays the following statistics:

Count	Description
Positive Justification	Reports the total number of Positive OPU Justification counts.
Negative Justification	Reports the total number of Negative OPU Justification counts.
Justification Seconds	Reports the total duration of OPU Justifications in seconds.
Add/Drop Positive Justification	Reports the total number of Positive ODU-1 OPU Justification counts.
Add/Drop Negative Justification	Reports the total number of Negative ODU-1 OPU Justification counts.
Add/Drop Justification Seconds	Reports the total duration of ODU-1 OPU Justifications in seconds.

Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

Results Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

For a list of available LEDs in the OTN protocol processor, see OTN LEDs.

OTN Results - Graph

This function allows incoming counts and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

For more information about graphs, select *Using Graphs* in the Common Tasks section of the online help.

Test

Test Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- SET 1
- Service Disruption
- RTD (Round Trip Delay)

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.

- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

OTN Test - Service Disruption

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The service disruption measurements show a granular accuracy of 1 frame duration.

- For OTU 1 one frame duration is roughly .049 ms (49 µs)
- For OTU 2 one frame duration is roughly .012 ms (12 µs)
- For SONET and SDH one frame is roughly .125 ms (125 µs)

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged. Protection Switch Criteria options include: OOF, OTU-AIS, OTU-BIP8, ODU-AIS, ODU-BIP8, and BIT.
- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The range for OTU 1 is 0.049 to 802.302 milliseconds and is entered using a keypad. The range for OTU 2 is 0.012 to 199.732 milliseconds and is entered using a keypad.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection

Switch measurements stop accumulating. The range is 1 to 16383 frames and is entered using a keypad.

- **State** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

  - **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

  - **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.

  - **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)** - Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.
- **Protection Switch Time (Frames)** - Indicates the number of errored frames received during the service disruption event.

For instruction on monitoring service disruption activity, select Measuring Service Disruption Activity in the Common Tasks section of the online help.

OTN Test - Round-Trip Delay (RTD)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **State:** Starts and stops round-trip delay mode.

  Single Round-Trip Delay - If selected, an ODU-BIP8 alarm is inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in frame counts and milliseconds. Frame counts indicates the number of frames received before the ODU-BIP8 frame is received by the unit. Milliseconds indicates how long it took for the ODU-BIP8 frame to travel out and return to the unit.

  Continuous Round-Trip Delay - If selected, an ODU-BIP8 alarm is inserted

into a frame and continuously transmitted through your network. The current frame count and duration appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.

Stop Round-Trip Delay - Stops round-trip delay activity. The State returns to Inactive.

- **Round-trip Delay Time (Frames):** Indicates the number of frames received during the measurement.
- **Round-trip Delay Time (Seconds):** Indicates the duration in seconds that it took for the known frame to return to the unit.
- **Consecutive Good Time Required:** This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before round-trip measurements stop accumulating. The range for OTU 1 is 0.049 to 802.302 milliseconds and is entered using a keypad. The range for OTU 2 is 0.012 to 199.732 milliseconds and is entered using a keypad.
- **Consecutive Good Frames Required:** This function allows you to enter the number of consecutive error-free frames to occur before round-trip measurements stop accumulating. The range is 1 to 16383 frames and is entered using a keypad.

For more information about round-trip delay, select *Round-Trip Delay* in the Common Tasks section of the online help.

OTN LED Quick Status Area

This section defines the OTN LEDs that appear on the touch screen's LED area or the Large LED screen when the Large LED button is selected from the Results screen.

LED	Description
TX	Indicates current OTN transmit interface setting. If the OTN interface is configured for G.709, the laser value appears.
RX	Displays the received optical power in dBm. This is a status LED.
E/A	Indicates the current error/alarm configured for transmission in the OTN signal. This is a status indicator.
Test Paused	If red, indicates that the current test has been paused.
CLK	Indicates the value of the Transmit Clock Reference function. This is a status indicator.
All Tests	Displays a general status summary for all circuit packs (which appear as protocol processor tabs) installed in the unit.
OTU	Optical Channel Transport Unit. Indicates current error, alarm,

	and event activity for the OTU. This is a status LED.
LOS	Loss of Signal. Indicates that a valid OTN signal is not being received. This is an alarm LED.
LOF	Loss of Frame. Indicates that a frame alignment problem with the incoming signal has been detected. This is an alarm LED.
UNICOR	FEC Uncorrected. This is an error LED.
LOM	Loss of Multiframe. This is an alarm LED.
BIP8	OTU Section Monitoring error detection code. This is an error LED.
BDI	OTU Section Monitoring Backward Defect Indication. This is an alarm LED.
AIS	OTU Alarm Indication Signal. This is an alarm LED.
OOF	Out of Frame. Indicates that four consecutive frames have been received with invalid or errored framing patterns. This is an alarm LED.
COR	FEC Corrected. This is an error LED.
OOM	Out of Multiframe. This is an alarm LED.
BEI	OTU Section Monitoring Backward Error Indication. This is an error LED.
IAE	OTU Section Monitoring Incoming Alignment Error. This is an alarm LED.
ODU	Optical Channel Data Unit. Indicates current error, alarm, and event activity for the ODU. This is a status LED.
BIP8	ODU Path Monitoring error detection code. This is an error LED.
AIS	ODU Alarm Indication Signal. This is an alarm LED.
OCI	ODU Open Connection Indication. This is an alarm LED.
BEI	ODU Path Monitoring Backward Error Indication. This is an error LED.
LCK	ODU Lock Indication. This is an alarm LED.
BDI	ODU Path Monitoring Backward Defect Indication. This is an alarm LED.
TCM Summary	Tandem Connection Monitoring Summary. Indicates if a TCM error or alarm has been detected. If this LED is red, select the LED text (TCM Summary) to display the LEDs for TCM1 to TCM6.
TCM BIP8*	Error detection LED for the selected TCM.
TCM BEI*	Backward Error Indication LED for the selected TCM. This is an

	error LED.
TCM BDI*	Backward Defect Indication LED for the selected TCM. This is an alarm LED.
PAT SYNC	Loss of Pattern Synchronization. Displays the status of loss of Pattern Synchronization on any active details channel.
BIT ERR	Indicates a Bit error has been received on the active detail channel.
*** Select TCM Summary text to display these LEDs.**	

OTN-OMR

OTN (OMR) Overview

The legacy **OMR** (Optical Multi-Rate) circuit pack was the first Digital Lightwave module to offer OTN. Please select the appropriate OTN circuit pack based on the current configuration of your NIC product, or click Common OTN Features to view help topics that common to both OTN processors.

NIC test sets that are licensed for OTN (Optical Transport Network) provide testing functionality for G.709 **OTU-1 (2.666 GHz)** and **OTU-2 (10.709 GHz)** networks in addition to the SONET/SDH protocols.

The OTN (OMR) Online Help is divided into the following sections:

- OTN (OMR) Specific Tasks
- OTN (OMR) Screen and Functions Overview

OTN (OMR) Specific Tasks
OTN (OMR) Specific Tasks

This section includes tasks that are specific to the OTN protocol processor available on the legacy **OMR** (Optical Multi-Rate) circuit pack.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view Specific Tasks for this protocol processor.

- Configuring the OTN Mode on OMR
- OMR Configuring Mappings and Payloads
- Calibrating OTN Optical Power

Configuring the OTN Mode on OMR

The OMR circuit pack supports testing and verification of OTN, G.709 (OTU-1 and OTU-2) optical networks. Configure the unit for OTN operation, using G.709 mapping with a line rate of 10.709 Gbps or 2.666 Gbps.

To configure the OTN mode:

1. Select the **OTN** protocol processor tab.
2. Select the **Transmit** button.
3. Select the **Set** tab along the left side of the screen and choose **SET 1**.
4. Select the **Interface** button. The Select Interface window appears.
5. Select one of the following:

    - **G.709 2.5G (2.666 GHZ) 1310.000 nm** - Provides OTU 1 testing, including asynchronous and synchronous SDH/SONET capability using 1310.000 nm laser type.
    - **G.709 2.5G (2.666 GHZ) 1550.000 nm** - Provides OTU 1 testing, including asynchronous and synchronous SDH/SONET capability using 1550.000 nm laser type.
    - **G.709 10G (10.709 GHz) 1550.000 nm** - Provides OTU 2 testing, including synchronous SDH/SONET capability using 1550.000 nm laser type. Note: Asynchronous capability is currently unsupported by OTU 2.

Configuring OTN Mappings and Payloads

The ITU G.709 standard allows the mapping of a pattern directly into an OTN payload. Use the procedures in this section to select the OTN mapping payload.

To configure an OTN mapping:

1. Select the **Transmit** button and choose the **Set** tab from the left side of the screen.
2. Select **Set 1**.
3. Select the **Mapping** button. The Select Mapping screen appears.
4. Select the desired mapping.

To configure an OTN payload:

1. Select the **Transmit** button and choose the **Set** tab from the left side of the screen.
2. Select **Set 1**.
3. Select the **Payload Pattern** button. The Select Payload Pattern screen appears.

The Payload Pattern button will be active contingent on the OTN mapping settings.

Use the following table as a guide for configuring payload settings.

If Mapping is set to:	**Then:**
PRBS	Select one of the following test patterns to insert into the payload: **PRBS 9; PRBS 9 Inverted; PRBS 11; PRBS 11 Inverted; PRBS 15, PRBS 15 Inverted; PRBS 20; PRBS 20 Inverted; PRBS 23; PRBS 23 Inverted; PRBS 31; PRBS 31 Inverted**; or a **User Defined** pattern (32-bit value). (Use the functions that appear on the OTN screen to insert errors/alarms or change OTN overhead bytes.)
Null Client	The OTN payload is filled with an All Zeros pattern. (Use the functions that appear on the OTN screen to insert errors/alarms or change OTN overhead bytes.)
Unframed BERT	Select PRBS pattern to fill the unframed OTN signal. (Use the functions that appear on the OTN screen to insert errors/alarms or change OTN overhead bytes.) The User Defined Payload Pattern is not available when Unframed BERT mode is selected.
SONET/SDH Synchronous	The Optical Channel Payload Unit (OPU) of the OTN frame is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET/SDH tab. Refer to the SONET or SDH sections in the Online Help Guide or the NIC Reference Guide for configuring settings on the SONET/SDH tab.
SONET/SDH Asynchronous	The Optical Channel Payload Unit (OPU) of the OTN frame is Asynchronous with the rest of the OTN frame, and the

	payload data is defined by the configuration settings on the SONET/SDH tab. Refer to the SONET or SDH sections in the Online Help Guide or the NIC Reference Guide for configuring settings on the SONET/SDH tab. Asynchronous mappings are only available for OTU 1.

Calibrating OTN Optical Power

The following procedures describe optical power calibration. While performing this task, you will measure, record, and enter the power readings for various interfaces.

Before You Begin

- Read these procedures before trying to calibrate the system.

WARNING: Power the system off before removing the optical connector dust caps to clean the unit's fiber optic ports.

- Before performing optical power calibration, use a fiber-optics cleaning kit to clean the fiber-optic ports on the unit, the optical power meter, the optical attenuator, and the fiber cables. Dirty optical fibers will affect optical measurements.
- The following equipment is required for optical calibration:
  - Two three-foot singlemode, fiber-optic cables
  - Variable optical attenuator
  - Optical power meter
  - Fiber-optics cleaning kit
  - Pencil and paper to record optical power measurements

Calibrating Optical Interfaces

For calibrating OTU-2 interface see the SONET or SDH calibration procedures for OC-192 or STM-64. Use the Contents tab on the left side of the online help window to locate and open the appropriate topic. Calibration procedures are located under Specific Tasks.

For calibrating OTU-1 interface see the SONET or SDH calibration procedures for OC-48 or STM-16. Use the Contents tab on the left side of the online help window to locate and open the appropriate topic. Calibration procedures are located under Specific Tasks.

OTN (OMR) Screen and Functions Overview

OTN (OMR) Screen Functions and Descriptions Overview

The following function screens are available through the OTN protocol processor tab.

- LEDs
- Transmit
- Receive
- Results
- Test

Transmit

OTN Transmit Screens and Functions

The transmit section allows you to configure the transmit signal parameters used in OTN operations.

The following transmit functionalities are available through the OTN Transmit screen:

- SET1
- SET2
- OTN OH
- ERROR ALARM

OTN Overhead

OTN Transmit - Overhead (OTN OH)

The OTN OH screen allows you to configure the following overhead signals:

OTU

ODU-A

ODU-B

TCM

OPU

OH INTRUDE

OTN Transmit - OTN OH / OTU

The following overhead options are available from the OTU screen.

Option	Description
OA1	Edits the first three bytes of the Frame Alignment Signal (FAS) OH. The default byte value is 1111 0110 (0xF6).
OA2	Edits the second three bytes of the FAS OH. The default byte value is 0010 1000 (0x28).
MFAS	Edits the Multiframe Alignment Signal OH byte. This byte is located in row1, column 7 of the OTU OH.
TTI	Trail Trace Identifier. The TTI OH byte defines the 64-byte TTI string. The TTI is part of the OTU Section Monitoring (SM) OH. See SAPI, DAPI and Specific trace settings below.
BIP-8	Edits the OTU SM error detection code signal. It is a single byte that uses a Bit Interleaved Parity-8 code.
BEI/BDI/IAE/RES	The Backward Error Indication (BEI) subfield is a four-bit signal sent in the upstream direction to indicate that an error has been detected. The Backward Defect Indication (BDI) subfield is a single bit sent in the upstream direction to indicate that a signal fail status has been detected. This bit is set to 1 to indicate a BDI. The Incoming Alignment Error (IAE) subfield is a single bit used to indicate a frame alignment error. This bit is set to 1 to indicate an IAE. Two bytes of the Section Monitoring overhead are

	reserved for future use.
GCC0-1 and GCC0-2	General Communication Channel 0, Byte 1 and Byte 2.
RES-1 and RES-2	Two bytes of the OTU overhead are reserved for future use.
SAPI	Source Access Point Identifier. The SAPI is the first part of the multi-frame Trail Trace Identifier (TTI) structure. A 15-character string can be entered for the SAPI.
DAPI	Destination Access Point Identifier. The DAPI is part of the multi-frame TTI structure. A 15-character string can be entered for the DAPI.
Specific	Operator Specific. This is part of the TTI structure. A 32-character string can be entered for this value.

OTN Transmit - OTN OH / ODU-A

The Transmit Optical Channel Data Unit (ODU) overhead bytes and messages can be edited using three separate screens on the unit: ODU-A, ODU-B, and TCM.

Use screen A of the Optical Channel Data Unit (ODU) Overhead to edit the Path Monitoring overhead and the Fault Type and Fault Location (FTFL) overhead bytes and messages. The FTFL is a 256-byte message that is divided into two parts: the Forward FTFL and the Backward FTFL.

Forward FTFL

The Forward FTFL consists of bytes 0 to 127 of the FTFL message.

Option	Description
Fault	Byte 0 is the Fault Identification field. It provides a fault status and uses the

	following codes: 0000 0000: No Fault 0000 0001: Signal Fail 0000 0010: Signal Degrade 0000 0011 through 1111 1111 are reserved for future use.
OI	Bytes 1 through 9 are used for the Operator Identifier field.
OS	Bytes 10 through 127 are used for the Operator Specific field.

Backward FTFL

The Backward FTFL consists of bytes 128 to 255 of the FTFL message.

Option	Description
Fault	Byte 128 is the Fault Identification field. It provides a fault status and uses the following codes: 0000 0000: No Fault 0000 0001: Signal Fail 0000 0010: Signal Degrade 0000 0011 through 1111 1111 are reserved for future use.
OI	Bytes 129 through 137are used for the Operator Identifier field.
OS	Bytes 138 through 255 are used for the Operator Specific field.

ODU Path Monitoring Overhead

Option	Description
TTI	The ODU Trail Trace Identifier (TTI) is a single byte used for Path Monitoring to identify the 64-byte TTI signal message.
BIP-8	A single byte used to define the Error Detection Code signal, which is a Bit Interleaved Parity-8 (BIP-8) code.
BEI/BDI/STAT	The Backward Error Indication (BEI) subfield is a four-bit signal sent in the upstream direction to indicate that an

	error has been detected. The Backward Defect Indication (BDI) subfield is a single bit sent in the upstream direction to indicate that a signal fail status has been detected. This bit is set to 1 to indicate a BDI. The Status (STAT) bits are three bits used to indicate the use of a maintenance signal.
SAPI	Source Access Point Identifier. The SAPI is the first part of the multi-frame Trail Trace Identifier (TTI) structure. A 15-character string can be entered for the SAPI.
DAPI	Destination Access Point Identifier. The DAPI is part of the multi-frame TTI structure. A 15-character string can be entered for the DAPI.
Specific	Operator Specific. This is part of the TTI structure. A 32-character string can be entered for this value.

OTN Transmit - OTN OH / ODU-B

The Transmit Optical Channel Data Unit (ODU) overhead bytes and messages can be edited using three separate screens on the unit: ODU-A, ODU-B, and TCM.

Use screen B of the ODU overhead to edit the following bytes.

Option	Description
RES-1 through RES-9	Nine bytes of the ODU overhead are reserved for future use. These bytes are set to all zeros.
EXP-1 and EXP-2	Two bytes of the ODU overhead are reserved for experimental use.
GCC1-1 and GCC1-2	General Communications Channel 1, Byte 1 and Byte 2.
GCC2-1 and GCC2-2	General Communications Channel 2, Byte 1 and Byte 2.
APS/PCC-1 through APS/PCC-4	Automatic Protection Switching and

	Protection Communication Channel, Byte 1, Byte 2, Byte 3, and Byte 4.

OTN Transmit - OTN OH / TCM

The Transmit Optical Channel Data Unit (ODU) overhead bytes and messages can be edited using three separate screens on the unit: ODU-A, ODU-B, and TCM.

The ODU overhead contains six Tandem Connection Monitoring (TCM) fields. The following overhead bytes can be edited for each TCM field.

Option	Description
TCM Selection	Selects a specific TCM field (TCM1 through TCM6).
BIP-8	One byte of the ODU TCM overhead is used to identify an Error Detection Code signal, which is a BIP-8 signal.
BEI/BDI/STAT	The Backward Error Indication (BEI) subfield is a four-bit signal sent in the upstream direction to indicate that an error has been detected. The Backward Defect Indication (BDI) subfield is a single bit sent in the upstream direction to indicate that a signal fail status has been detected. This bit is set to 1 to indicate a BDI. The Status (STAT) bits are three bits used to indicate the use of a maintenance signal.
SAPI	Source Access Point Identifier. The SAPI is the first part of the multi-frame Trail Trace Identifier (TTI) structure. A 15-character string can be entered for the SAPI.
DAPI	Destination Access Point Identifier. The DAPI is part of the multi-frame TTI structure. A 15-character string can be entered for the DAPI.
Specific	Operator Specific. This is part of the TTI structure. A 32-character string

	can be entered for this value.

OTN Transmit - OTN OH / OPU

Use this screen to edit the Optical Channel Payload Unit (OPU) bytes.

Option	Description
RES-1 through RES-3 and RES-5 through RES-8	Seven bytes of the OPU overhead are reserved for future use. These bytes are set to all zeros.
PT (PSI-0)	Payload Type. This byte identifies the type of signal mapped into an OPU.
Positive Adjust	Positive Justification Opportunity byte.
Negative Adjust	Negative Justification Opportunity byte.

The OPU Positive and Negative Adjust buttons are only available for Asynchronous mappings.

OTN Transmit - OTN OH / INTRUDE

When the unit is in Passthru Mode, the Intrude option allows you intrude on selected byte data in a return signal.

To intrude upon a byte:

1. Select the **OTN** tab.
2. Select **Transmit** and **Set 1**.
3. Verify the **Passthru Mode** setting is set to **On**.
4. Select **OTN OH**.
5. Select the **Intrude** button. The Intrude screen appears displaying byte buttons.
6. Select the button that represents the byte you want to intrude upon. The button turns red while intruding on the byte.

The Passthru mode feature cannot be tested with the unit looped back to itself.

OTN Transmit - Error Alarm

Use this screen to configure and transmit OTN errors and alarms.

For information on inserting errors and alarms see the online help topics, Inserting Errors and Inserting Alarms in the Common Tasks section.

The following options are available on the OTN Errors and Alarms screen.

Option	Description
Error to Insert	Allows the user to select an error that is transmitted by the OTN signal. Selecting the **Error to Insert** button opens the Select Error Insert list. Available errors include: • FEC:UNCOR, FEC:COR, FRAME, MFAS, OTU:BIP8, OTU:BEI, ODU:BIP8, ODU:BEI, BIT, TCM1:BIP8 – TCM6:BIP8, and TCM1:BEI – TCM6:BEI, More (Note that FEC Correctable & Uncorrectable errors are inserted after the FEC wrapper is created.) Selecting **More** opens the Select Alarms to Burst list. Available alarms to burst include: • OTU:IAE, OTU:BDI, ODU:BDI, TCM1:BDI - TCM6:BDI
Error Insert Rate	Sets the insertion rate of the OTN Transmit error from 1e-3 through 1e-10. A user-defined rate is also available.
Error Burst Size	Sets the duration, either in Frames or MilliSec, for the alarm selected from the Alarms to Burst list to be inserted. This option is not available unless an Alarm to Burst has been selected from the Error to Insert function.
Error Burst Period	Sets the elapsed time (in MilliSec) or Frame count between alarm insertion bursts. This is a repeating action.

Alarm Generated	Generates a specific alarm that is transmitted by the OTN signal. The following alarms are available: • LOS, LOF, OOF, LOM, OOM, OTU:AIS, OTU:IAE, OTU:BDI, ODU:AIS, ODU:LCK, ODU:OCI, ODU:BDI, TCM1:BDI – TCM6:BDI, and None.

OTN Transmit - Set / SET 1

Use the SET 1 screen to configure OTN transmit parameters. The following describes the functions that appear on this screen.

Functions	Description
Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Passthru Mode	Activates or deactivates passthru mode, allowing an incoming OTN signal to pass through the unit without altering the data in the signal. The following options are available: **On** and **Off**.
Interface	Sets the OTN transmit interface rate and configures the laser wavelength. The following options are available: **G.707/GR-253:** OTN is disabled and the SDH/SONET frame is defined by the configuration settings on the SDH/SONET tab. G.707 is the ITU standard for SDH networks. GR-253 is the Telcordia standard for SONET networks. **G.709 2.5G (2.666 GHZ) 1310.000 nm:** Provides OTU 1 testing, including asynchronous and synchronous SDH/SONET capability using 1310.000 nm laser type.

	G.709 2.5G (2.666 GHZ) 1550.000 nm: Provides OTU 1 testing, including asynchronous and synchronous SDH/SONET capability using 1550.000 nm laser type. **G.709 10G (10.709 GHz) 1550.000 nm:** Provides OTU 2 testing, including synchronous SDH/SONET capability using 1550.000 nm laser type. Note: Asynchronous capability is unsupported by OTU 2.
Clock Reference	Determines the timing source for the transmit signal. Select one of the following: **Internal.** Derives the transmit data's timing source from the unit's internal clock. The *CLK:INT* displays when configured for Internal clocking. **Recovered (RX Clock).** Derives the transmit timing source from the clock signal on the receive interface. If this option is selected, but a signal is not available, then this function defaults to Internal. The *CLK:REC* displays when configured for Recovered clocking. Note: The Recovered clock option is not available in Asynchronous mappings. **BITS/SETS.** • **BITS**: Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 Mbps. If this option is selected, but BITS clocking is not available, then this function defaults to Internal. The *CLK:BITS 1.5MHz* displays when configured for BITS clocking. • **SETS**: Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 Mbps. If this option is selected, but SETS clocking is not available, then this function defaults to Internal. The *CLK:SETS 2.0MHz* displays when configured for SETS clocking. **External 8 KHz - 75 Ohm TTL.** Derives timing from an external 8 KHz 75 Ohm TTL timing source attached to the Clock In connector. The *CLK:Ext 8*

	KHz displays when configured. **External 1.544 MHz - 75 Ohm TTL.** Derives timing from an external 1.544 MHz 75 Ohm TTL timing source attached to the Clock In connector. The *CLK:Ext 1.5 MHz* displays when configured. **External 2.048 MHz - 75 Ohm TTL.** Derives timing from an external 2.048 MHz 75 Ohm TTL timing source attached to the Clock In connector. The *CLK:Ext 2 MHz* displays when configured. **External 10.0 MHz - 75 Ohm TTL.** Derives timing from an external 10.0 MHz 75 Ohm TTL timing source attached to the Clock In connector. The *CLK:Ext 10 MHz* displays when configured.
Mapping **Note:** The Mapping function is not available when the Interface is configured for G.707/GR-253.	Selects the type of signals that are combined and inserted into the OTN transmit signal. **Unframed BERT:** Transmits an Unframed BERT signal in the OTN frame. **SDH Synchronous:** The Optical Channel Payload Unit (OPU) of the OTN frame is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. **SDH Asynchronous:** The Optical Channel Payload Unit (OPU) of the OTN frame is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. This mapping is only available for OTU 1. **SONET Synchronous:** The Optical Channel Payload Unit (OPU) of the OTN frame is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. **SONET Asynchronous:** The Optical Channel Payload Unit (OPU) of the OTN frame is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. This mapping is only

	available for OTU 1. **PRBS:** Inserts a PRBS pattern into the OTN frame. **Null Client:** Inserts an All Zeros payload pattern into the OTN frame.
Payload Pattern	Selects a test pattern to insert into the payload of an OTN signal, when the Mapping is set to **PRBS** or **Unframed BERT**. Select one of the following: **PRBS 9**; **PRBS 9 Inverted**; **PRBS 11**; **PRBS 11 Inverted**; **PRBS 15**, **PRBS 15 Inverted**; **PRBS 20**; **PRBS 20 Inverted**; **PRBS 23**; **PRBS 23 Inverted**; **PRBS 31**; **PRBS 31 Inverted**; or a **User Defined** pattern (32-bit value) The User Defined Payload Pattern is unsupported when Unframed BERT mode is selected.
Line Frequency Offset	Adjusts the offset of the signal frequency of the transmitted SDH/SONET signal. The frequency can be adjusted in parts per million (PPM). The offset value is entered using an on-screen keypad. The frequency offset ranges from -100.0 ppm to 100.0 ppm in increments of 0.1 ppm. The default value is 0 (Off). The Line Frequency Offset setting is only available when the Clock Reference is set to Internal timing.
OPU Frequency Offset	Sets the Optical Channel Payload Unit (OPU) frequency offset. The offset can be adjusted in ppm ranging from -65.66 ppm to 65.66 ppm. The OPU Frequency Offset setting is only available for Asynchronous mappings.
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. **Off.** The unit's laser will be off when the unit is turned on. **On.** The unit's laser will be on when the unit is turned on.

	Restore Previous State. When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.

OTN Transmit - Set / SET 2

Use the Settings 2 screen to configure OTN transmit parameters. The following describes the functions that appear on this screen.

Functions	Description
Trigger In	Allows the protocol processor to insert an error or restart an error test. The Trigger In setting is not available when the mapping is set to SONET or SDH.
Scramble	Scrambles the OTN frame as defined by G.709. The default value is Enable.
Forward Error Correction	Disables or enables Forward Error Correction (FEC). The default value is Enable. The Forward Error Correction setting is not available when the mapping is set to Unframed BERT.

Receive

Receive Screens and Functions

The receive section allows you to configure the receive settings for the parameters used in OTN operations.

The following receive functionalities are available through the OTN Receive screen:

- SET1
- SET2
- OTN OH
- SIG

OTN Receive - Set / SET 1

Use the SET 1 screen to configure OTN receive parameters. The following describes the functions that appear on this screen.

Functions	Description
Settings Control	If **Coupled** is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If **Independent** is selected, settings established on the Receive screen will only affect Receive mode.
Interface	Sets the OTN receive interface rate and configures the laser wavelength. The following options are available: **G.707/GR-253**: OTN is disabled and the SDH/SONET frame is defined by the configuration settings on the SDH/SONET tab. G.707 is the ITU standard for SDH networks. GR-253 is the Telcordia standard for SONET networks. **G.709 2.5G (2.666 GHZ) 1310.000 nm**: Provides OTU 1 testing, including asynchronous and synchronous SDH/SONET capability using 1310.000 nm laser type. **G.709 2.5G (2.666 GHZ) 1550.000 nm**: Provides OTU 1 testing, including asynchronous and synchronous SDH/SONET capability using 1550.000 nm laser type. **G.709 10G (10.709 GHz) 1550.000 nm**: Provides OTU 2 testing, including synchronous SDH/SONET capability using 1550.000 nm laser type. Note: Asynchronous capability is unsupported by OTU 2.
Mapping **Note:** The Mapping function is not available when the Interface is configured for G.707/GR-253.	Selects the type of signals that are expected in the OTN receive signal. **Unframed BERT:** Expects an Unframed BERT signal in the OTN frame. **SDH Synchronous:** The Optical Channel Payload

	Unit (OPU) of the OTN frame is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. **SDH Asynchronous:** The Optical Channel Payload Unit (OPU) of the OTN frame is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. This mapping is only available for OTU 1. **SONET Synchronous:** The Optical Channel Payload Unit (OPU) of the OTN frame is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. **SONET Asynchronous:** The Optical Channel Payload Unit (OPU) of the OTN frame is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. This mapping is only available for OTU 1. **PRBS:** Expects a PRBS pattern into the OTN frame. **Null Client:** Expects an All Zeros payload pattern into the OTN frame.
Payload Pattern	Selects a test pattern to insert into the payload of an OTN signal, when the Mapping is set to **PRBS** or **Unframed BERT**. Select one of the following: **PRBS 9**; **PRBS 9 Inverted**; **PRBS 11**; **PRBS 11 Inverted**; **PRBS 15**, **PRBS 15 Inverted**; **PRBS 20**; **PRBS 20 Inverted**; **PRBS 23**; **PRBS 23 Inverted**; **PRBS 31**; **PRBS 31 Inverted**; **User Defined** pattern (32-bit value); or **Live** The User Defined Payload Pattern is unsupported when Unframed BERT mode is selected.
Power Low Threshold	Sets the threshold for which the Power Low alarm occurs. When the received optical power level (in dBm) is lower than the power low threshold setting, the Power Low alarm will occur. The threshold value is entered using an on-screen

	keypad, and can range from -10.0 dBm to -100.0 dBm in increments of 0.1 dBm. The default value is -100.0 (Disabled).
Out of Frequency Threshold	Sets the out of frequency threshold (when enabled).
Scramble	Enables/disables the scramble option.
Forward Error Correction	Enables/disables forward error correction (FEC).
Trigger Out	Selects an event allowing the protocol processor to respond to a received external "pulse".

OTN Receive - Set / SET 2

Use the SET 2 screen to enable and disable the following alarm reporting:

- OTU SAPI and DAPI Trace Identifier Mismatch (TIM) Alarm Reporting
- ODU SAPI and DAPI Trace Identifier Mismatch (TIM) Alarm Reporting
- Tandem Connection Monitoring #1 (TCM #1) Alarm Reporting (with or without TIM Alarm Reporting)
- Tandem Connection Monitoring #2 (TCM #2) Alarm Reporting (with or without TIM Alarm Reporting)
- Tandem Connection Monitoring #3 (TCM #3) Alarm Reporting (with or without TIM Alarm Reporting)
- Tandem Connection Monitoring #4 (TCM #4) Alarm Reporting (with or without TIM Alarm Reporting)
- Tandem Connection Monitoring #5 (TCM #5) Alarm Reporting (with or without TIM Alarm Reporting)
- Tandem Connection Monitoring #6 (TCM #6) Alarm Reporting (with or without TIM Alarm Reporting)
- OPU Payload Label Mismatch (PLM) Alarm Reporting

OTN Receive - OTN OH

The OTN Receive Overhead screen contains the following read-only functions.

Function	Options
OTU Overhead	Displays the Optical Channel Transport Unit (OTU) overhead bytes on the incoming signal. This is a read-only function.

ODU-A Overhead	Displays the first screen of the Optical Channel Data Unit (ODU) Overhead bytes on the incoming signal. This is a read-only function.
ODU-B Overhead	Displays the second screen of the Optical Channel Data Unit (ODU) Overhead bytes on the incoming signal. This is a read-only function.
TCM Overhead	Displays the Tandem Connection Monitoring (TCM) Overhead on the incoming signal. This is a read-only function.
OPU Overhead	Displays the Optical Channel Payload Unit (OPU) Overhead bytes on the incoming signal. This is a read-only function.
Received SAPI Trace	Displays the Source Access Point Identifier (SAPI) trace received on the incoming signal for OTU, ODU,and TCM1-TCM6 OH bytes.
Expected SAPI Trace	The Expected SAPI Trace is a User Defined setting that can be compared to the received SAPI Trace. When a specific OH section's TIM Alarm Reporting is Enabled, then that section's SAPI alarm will increment if the received SAPI Trace is different than the Expected SAPI Trace setting.
Received DAPI Trace	Displays the Destination Access Point Identifier (DAPI) trace received on the incoming signal for OTU, ODU,and TCM1-TCM6 OH bytes.
Expected DAPI Trace	The Expected DAPI Trace is a User Defined setting that can be compared to the received DAPI Trace. When a specific OH section's TIM Alarm Reporting is Enabled, then that section's DAPI alarm will increment if the received DAPI Trace is different than the Expected DAPI Trace setting.

OTN Receive - Signal Status (SIG)

Displays the following measurements of the incoming OTN signal:

- Line Frequency in Hz
- Line Frequency Offset Received in Hz and PPM
- Optical Power source in dBm
- OPU Justify Frequency Offset in PPM

Frequency measurements are only made then the OTN Mapping is configured for SONET/SDH Asynchronous

- Update Signal Calibration - Calibrating the system's optical power should be done carefully. To keep unauthorized users from changing calibration settings, the Update Signal Calibration button on the protocol processor's Receive SIG screen is unavailable by default. To change the setting, a user with Admin or Calibrate privileges must enable the calibration mode.

To enable protocol processor calibration:

1. From the **System** tab, select **Misc**.
2. From **Local Settings**, select **Enable Calibration**.

The user must have Admin or Calibrate privileges to enable the calibration mode.

3. See Calibrating OTN Optical Power for specific calibration instructions before proceeding.
4. After setting the Zero power reading and dBm power readings select the **Save** button to update the signal calibration.

Results

OTN Results Screens and Functions

All monitored activity that the system receives is reported to the Results screen. This screen provides several layers of granularity for analyzing the incoming signal, pattern, errors, and alarms.

The Results screen provides different ways of viewing received statistics. From the left side of the Result screen, select one of the following tabs:

- Error & Alarm
- Event Log
- Large LED
- Graphs

OTN Results - Error & Alarm

The Err screens provides the following options:

- Scan
- Errors
- Alarms
- Counts

OTN Results - Error & Alarm - Scan

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

- For **alarms**, the duration is reported as a count in seconds.
- For **errors**, an error count is reported.
- The message **No Errors or Alarms** appears if no events are received by the unit.

OTN Results - Error & Alarm - Errors

The system can monitor and report errors on the incoming OTN signal. The **Errors** function provides a detailed analysis of the incoming error as described below.

The errors reported are a result of:

- Incoming errors that are generated by the OTN network, or
- Errors being intentionally generated by the system when it is used in a loopback environment

The following errors can be monitored:

- **FRAME**
- **MFAS**
- **FEC:Uncorrected**
- **FEC:Corrected**
- **OTU:BIP8**
- **OTU:BEI**
- **ODU:BIP8**
- **ODU:BEI**
- **BIT**
- **TCM1:BIP8 – TCM6:BIP8**
- **TCM1:BEI – TCM6:BEI**

The following parameters are measured for these incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format

OTN Results - Error & Alarm - Alarms

The system can monitor and report alarms and their duration on the incoming OTN signal. The **Alarms** function lists the duration of the alarm in seconds.

The following alarms can be monitored:

- **LOS**
- **Power Hot**
- **Power Warm**
- **Power Low**
- **Frequency Wide**
- **LOF**
- **OOF**
- **LOM**
- **OOM**
- **OTU:AIS**
- **OTU:IAE**
- **OTU:BDI**
- **OTU:SAPI**
- **OTU:DAPI**
- **ODU:AIS**
- **ODU:LCK**
- **ODU:OCI**
- **ODU:BDI**
- **ODU:SAPI**
- **ODU:DAPI**
- **TCM1:BDI – TCM6:BDI**
- **TCM1:SAPI – TCM6:SAPI**
- **TCM1:DAPI – TCM6:DAPI**
- **OPU:PLM**
- **Paused**
- **Pat Sync**

OTN Results - Error & Alarm - Counts

The Count screen displays the following statistics:

Count	Description
Positive Justification	Reports the total number of Positive OPU Justification counts.
Negative Justification	Reports the total number of Negative OPU Justification counts.
Justification Seconds	Reports the total duration of OPU Justifications in seconds.

Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

Results Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	**Then this indicates ...**
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

For a list of available LEDs in the OTN protocol processor, see OTN LEDs.

OTN Results - Graph

This function allows incoming counts and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

For more information about graphs, select *Using Graphs* in the Common Tasks section of the online help.

Test

OTN Test Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- SET 1
- Service Disruption
- RTD

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

OTN Test - Service Disruption

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The service disruption measurements show a granular accuracy of 1 frame duration.

- For OTU 1 one frame duration is roughly .049 ms (49 µs)
- For OTU 2 one frame duration is roughly .012 ms (12 µs)
- For SONET and SDH one frame is roughly .125 ms (125 µs)

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged. Protection Switch Criteria options include: OOF, OTU-AIS, OTU-BIP8, ODU-AIS, ODU-BIP8, and BIT.
- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The range for OTU 1 is 0.049 to 802.302 milliseconds and is entered using a keypad. The range for OTU 2 is 0.012 to 199.732 milliseconds and is entered using a keypad.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The range is 1 to 16383 frames and is entered using a keypad.
- **State** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

    - **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

    - **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.

    - **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)** - Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.
- **Protection Switch Time (Frames)** - Indicates the number of errored frames received during the service disruption event.

For instruction on monitoring service disruption activity, select Measuring Service Disruption Activity in the Common Tasks section of the online help.

OTN Test - Round-Trip Delay (RTD)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **State:** Starts and stops round-trip delay mode.

  Single Round-Trip Delay - If selected, an ODU-BIP8 alarm is inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in frame counts and milliseconds. Frame counts indicates the number of frames received before the ODU-BIP8 frame is received by the unit. Milliseconds indicates how long it took for the ODU-BIP8 frame to travel out and return to the unit.

  Continuous Round-Trip Delay - If selected, an ODU-BIP8 alarm is inserted into a frame and continuously transmitted through your network. The current frame count and duration appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.

  Stop Round-Trip Delay - Stops round-trip delay activity. The State returns to Inactive.
- **Round-trip Delay Time (Frames):** Indicates the number of frames received during the measurement.
- **Round-trip Delay Time (Seconds):** Indicates the duration in seconds that it took for the known frame to return to the unit.
- **Consecutive Good Time Required:** This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before round-trip measurements stop accumulating. The range for OTU 1 is 0.049 to 802.302 milliseconds and is entered using a keypad. The range for OTU 2 is 0.012 to 199.732 milliseconds and is entered using a keypad.
- **Consecutive Good Frames Required:** This function allows you to enter the number of consecutive error-free frames to occur before round-trip measurements stop accumulating. The range is 1 to 16383 frames and is entered using a keypad.

For more information about round-trip delay, select *Round-Trip Delay* in the Common Tasks section of the online help.

OTN LED Quick Status Area

This section defines the OTN LEDs that appear on the touch screen's LED area or the Large LED screen when the Large LED button is selected from the Results screen.

LED	Description
TX	Indicates current OTN transmit laser wavelength setting. If OTN is disabled SONET or SDH protocol mode appears.
RX	Displays the received optical power in dBm. This status indicator will flash when the optical power level is too high for the receiver.
E/A	Indicates the current error/alarm configured for transmission in the OTN signal. This is a status indicator.
Test Paused	If red, indicates that the current test has been paused from the Test screen.
CLK	Indicates the value of the Transmit Clock Reference function. This is a status indicator.
All Tests button	Displays a general status summary screen for all circuit packs (which appear as protocol processor tabs) installed in the unit. See All Test Status for details on how this page is used.
OTU	Optical Channel Transport Unit. Indicates current error, alarm, and event activity for the OTU. This is a status LED.
LOS	Loss of Signal. Indicates that a valid OTN signal is not being received. This is an alarm LED.
LOF	Loss of Frame. Indicates that a frame alignment problem with the incoming signal has been detected. This is an alarm LED.
UNCOR	FEC Uncorrected. This is an error LED.
LOM	Loss of Multiframe. This is an alarm LED.
BIP8	OTU Section Monitoring Bit Interleaved Parity error detection code. This is an error LED.
BDI	OTU Section Monitoring Backward Defect Indication. This is an alarm LED.
AIS	OTU Alarm Indication Signal. This is an alarm LED.
OOF	Out of Frame. Indicates that four consecutive frames have been received with invalid or errored framing patterns. This is an alarm LED.
COR	FEC Corrected. This is an error LED.
OOM	Out of Multiframe. This is an alarm LED.
BEI	OTU Section Monitoring Backward Error Indication. This is an error LED.

IAE	OTU Section Monitoring Incoming Alignment Error. This is an alarm LED.
ODU	Optical Channel Data Unit. Indicates current error, alarm, and event activity for the ODU. This is a status LED.
BIP8	ODU Path Monitoring Bit Interleaved Parity error detection code. This is an error LED.
AIS	ODU Alarm Indication Signal. This is an alarm LED.
OCI	ODU Open Connection Indication. This is an alarm LED.
BEI	ODU Path Monitoring Backward Error Indication. This is an error LED.
LCK	ODU Lock Indication. This is an alarm LED.
BDI	ODU Path Monitoring Backward Defect Indication. This is an alarm LED.
TCM Summary	Tandem Connection Monitoring Summary. Indicates if a TCM error or alarm has been detected. If this LED is red, click the LED text (TCM Summary) to display a detailed LED window with all of the errors and alarms for TCM:1 to TCM:6.
TCM BIP8*	Bit Interleaved Parity error detection LED for the selected TCM. This is an error LED.
TCM BEI*	Backward Error Indication LED for the selected TCM. This is an error LED.
TCM BDI*	Backward Defect Indication LED for the selected TCM. This is an alarm LED.
PAT SYNC	Loss of Pattern Synchronization. Displays the status of loss of Pattern Synchronization on any active details channel. This LED is not displayed if the Mapping is set to SONET or SDH, or if the Receive Payload Pattern is set to Live.
BIT ERR	Indicates a payload Bit error has been received on the active detail channel. This LED is not displayed if the Mapping is set to SONET or SDH, or if the Receive Payload Pattern is set to Live.
*** Select TCM Summary text to display these LEDs.**	

OTN-Common

Common OTN Features for both the OMR and NGMR

This section includes tasks that are common to both OTN protocol processors.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view all of the common Tasks for OTN.

- Enabling OTN FEC Mode
- Monitoring OTN SAPI and DAPI Traces
- OTN Abbreviations

Enabling OTN FEC Mode

1. Select the **OTN** tab.
2. Select **Transmit** and **Set**.
3. Select the **SET 2** button from the Transmit/Set window.
4. Select **Forward Error Correction** and then **Enable**.

If the Transmit and Receive Settings Control is set to Couple, FEC is automatically changed under the Receive settings. If Settings Control is set to **Independent**, then FEC mode can be changed for the receive signal by selecting **Receive**, **SET 1**, and changing the **Forward Error Correction** setting.

Disabling both **Forward Error Correction** and **Scrambling** at the same time may cause a Loss of Frame condition due to a lack of sufficient zero to one transitions for valid data/clock recovery.

Monitoring OTN SAPI and DAPI Traces

1. Select the **Receive** button from the **OTN** tab.
2. Select the **OTN OH** tab along the left side of the screen.
3. Select one of the following OTN sections:

   OTU, **ODU-A**, or **TCM**,

4. The incoming SAPI, DAPI, and Operator Specific traces are decoded from the OTN Overhead, and appear in ASCII format at the bottom of the screen.
5. Expected SAPI or DAPI trace values can also be defined, and the NIC can be setup to display **Trace Identifier Mismatch** (TIM) alarms if the incoming SAPI or DAPI traces do not match what is expected.
6. OTU, ODU, and TCM TIM alarms can be individually enabled from the SET 2 window.

   SAPI and DAPI TIM alarms occur when the incoming trace does not match the expected trace, and the TIM Alarm Reporting has been enabled

for that trace. There are no LEDS associated with TIM alarms; however TIM alarm durations appear on the Results Scan and Alarm screens .

OTN Abbreviations

Below is a list of Abbreviations used in OTN

Abbr.	**Definition**
BDI	Backward Defect Indication
BEI	Backward Error Indication
DAPI	Destination Access Point Identifier
FAS	Frame Alignment Signal
FTFL	Fault Type and Fault Location
MFAS	Multi Frame Alignment Signal
ODU	Optical Data Unit
OTN	Optical Transport Network
OTU	Optical Transport Unit
SAPI	Source Access Point Identifier
SM	Section Monitoring
TTI	Trail Trace Identifier

Packet Tab

Packet Tab Overview

The Packet tab is virtual protocol processor on the NGMR circuit pack that becomes enabled when either one of the SONET/SDH or OTN interface settings is set to **1G LAN**, **10G LAN** or **11G LAN** (**10G LAN over OTU-2**) Ethernet, or if OC-192/STM-64 is mapped for **10G WAN**, or if one of the SONET/SDH or OTN (G.709 compliant) mappings is set to **GFP**.

From the Packet tab, users can perform high-speed packet-level testing on up to four independent GFP (Complying with ITU-T G.7041) or Ethernet Complying with IEEE 802.3) streams for traffic generation and analysis, including RFC-2544 (throughput, frame loss, latency, and Back to Back Burst) testing, and Service Disruption testing.

The following **GFP** and **LAN/WAN Ethernet** topics are discussed in this section of the online help system:

- GFP Specific Tasks
- GFP Screens Functions and Descriptions

- LAN/WAN Specific Tasks
- LAN/WAN Ethernet Screens Functions and Descriptions

GFP Specific Tasks

GFP (Generic Frame Protocol) Specific Tasks Overview

This section includes tasks that are specific to GFP payloads for OTN and SONET/SDH mappings (including VCAT).

For a description of specific screens and their functionality, refer to GFP Screen Functions and Descriptions Overview.

For a list of general tasks, see Common Tasks located in the Getting Started section.

Please use the **Contents** tab and window (left side of the Help screen) to select, open, and view Specific Tasks for this protocol processor.

- Configuring GFP Packet Streams
- Transmitting GFP Packet Streams
- Inserting GFP Errors and Alarms
- Viewing GFP Error and Alarm Results
- GFP payloads for SONET mappings (including VCAT)
- GFP payloads for SDH mappings (including VCAT)
- GFP mapping for OTU-1 and OTU-2 OTN interfaces

Configuring GFP Packet Streams
(Specifically for GFP Mappings and GFP-F or GFP-T modes)

The Config > Set (Stream Control) screen provides the tools required to configure or edit any or all of the four packet streams.

To configure a packet stream:

1. Select the **Packet** tab, select either **GFP Framed Ethernet** or **GFP Transparent** mode. *(After configuring the GFP payload setting from the SONET/SDH tab, or GFP mapping from the OTN tab)*
2. Select **Config** and choose **Set**.
3. Select a stream (1, 2, 3, or 4) from the Stream Profile table. The Traffic Stream Profile table appears.
4. From the Traffic Stream Profile table, set the parameters for the packet stream.
5. Select **Save**. The stream configuration parameters display in the Stream Profile table.

Use the vertical scroll bar at the bottom of the Stream Profile table to view hidden columns.

To use the **Order Columns** feature :

1. Select the **Columns** button, to display the **Rearrange Columns** dialog box.
2. In the **Rearrange Columns** dialog box, select the **Columns** button to display the **Select Next Column** dialog box.
3. In the **Select Next Column** dialog box, select a button for the associated description to appear in the top row of the display. The **Select Next Column** dialog box disappears and your selection appears in the top row of **Rearrange Columns** dialog box display window.
4. Again, in the **Rearrange Columns** dialog box, select the **Columns** button to redisplay the **Select Next Column** dialog box.

5. In the **Select Next Column** dialog box, select another button for the associated description to appear in order immediately following the previous row entry. The **Select Next Column** dialog box again disappears.
6. Repeat Steps 4 and 5 to select the chosen order for all remaining entries in the **Select Next Column** dialog box.
7. There are two choices for submitting the selected column display order: (1) Selecting the **Apply** button retains the column display order settings until the next time the unit's power is cycled; (2) Selecting the **Save** button retains the column display order settings indefinitely.

The **Columns** settings entered locally on the touch screen panel and those entered via a remote connection are completely independent of each other. The remote settings are saved on the remotely connected PC, while the local settings are saved in the unit. The **Clear** button can be used to clear the entries in the **Rearrange Columns** dialog box display window, should you want to rearrange the existing order in the display window. The **Cancel** button can be used to cancel out of the operation without changing the existing column display order. Clicking on the **Apply** button when no items are listed in the display window will set up the default columns display order.

Enabling VLAN Tagging

Enabling VLAN tagging allows the user to create a 4-byte VLAN identifier value to be inserted into the packet stream.

To enable VLAN tagging:

1. Select **Config** and choose **Set**.
2. From the **Stream Profile** table, select the packet stream (**1**, **2**, **3**, or **4**) that you want to enable VLAN tagging on. The Traffic Stream Profile dialog box appears.
3. From the Traffic Stream Profile dialog box, select **VLAN Tag** and choose **Yes**.
4. Select **VLAN ID** and enter an ID value to the stream.
5. Select **VLAN QOS** and enter a user priority value.
6. Select **Save**.

Transmitting GFP Packet Streams

(Specifically for GFP Mappings and GFP-F or GFP-T modes)

The Config > Set (Stream Control) screen provides the tools required to configure or edit any or all of the four packet streams.

To start transmission of all packet streams:

1. Select the **Packet** tab, select either **GFP Framed Ethernet** or **GFP Transparent** mode. *(After configuring the GFP payload setting from the SONET/SDH tab, or GFP mapping from the OTN tab)*
2. Select **Config** and choose **Set**.
3. Select **Tx Mode** to turn all streams On or Off.

Important: "Tx Mode" and individual stream TX on/off buttons are not available when IP Reflection is enabled.

4. The stream transmission status displays in the TX State column of the Stream Profile table.
5. Packets begin or stop transmitting as soon as the Tx Mode is selected. Count statistics continually increment in the Count Statistics table while the streams are active.

To start transmission of specific packet streams:

1. Select the **Packet** tab, select either **GFP Framed Ethernet** or **GFP Transparent** mode.
2. Select **Config** and choose **Set**.
3. From the **Stream Profile** table, select the packet stream (**1**, **2**, **3**, or **4**) that you want to transmit. The Traffic Stream Profile dialog box appears.
4. From the Traffic Stream Profile dialog box, select **TX Enable** to turn the stream On or Off.
5. Select **Save**. The Traffic Stream Profile dialog box closes and the stream transmission status displays in the TX State column of the Stream Profile table.
6. The packet begins or stops transmitting as soon as the TX Enable command is saved. Count statistics continually increment in the Count Statistics table while the stream is active.

Inserting GFP Errors and Alarms
(Specifically for GFP Mappings)

To determine if receiving equipment can detect an error on an incoming signal, you can configure the system to insert specific errors and alarms into an Ethernet stream.

To insert multiple errors:

1. Select the **Packet** tab, select either **GFP Bulk, GFP Framed Ethernet** or **GFP Transparent** mode. *(After configuring the GFP payload setting from the SONET/SDH tab, or GFP mapping from the OTN tab)*
2. Select **Config** and choose **Set**.
3. From the **Stream Profile** table, select the packet stream (**1**, **2**, **3**, or **4**) that you want to inject errors into. The Traffic Stream Profile dialog box appears.
4. Select **TX Enable** to turn the transmission status **On** and choose **Save**.
5. Select **Error / Alarm** from the tabs along the left side of the Config Screen.
6. Select **Error Type** and choose an error type from the Select Error Type dialog box.
7. Select **Error Rate** and choose an error rate from the Select Error Rate to Insert dialog box.
8. Errors immediately start injecting into the packet stream when the error rate is selected.
9. View various result statistics by selecting the **Results** function.

To stop error transmission select **Error Rate** and choose **Off**.

To insert a single error:

1. Select the **Packet** tab, select either **GFP Bulk, GFP Framed Ethernet** or **GFP Transparent** mode.

> Important: Traffic generation on at least one stream must be enabled to inject errors.

2. Select **Error / Alarm** from the tabs along the left side of the Config Screen.
3. Select **Error Type** and choose an error type from the Select Error Type dialog box.

> Important: DO NOT set an Error Rate when inserting a single error.

4. If you want to clear any previously collected data, select **Restart** from the common function button at the bottom of the screen before inserting the error.
5. Select the **Error Insert** common function button at the bottom of the screen.
6. View various result statistics by selecting the **Results** function.

To insert an Alarm:

1. Select the **Packet** tab, select either **GFP Bulk, GFP Framed Ethernet** or **GFP Transparent** mode.

> Important: Traffic generation on at least one stream must be enabled to inject errors.

2. Select **Error Alarm** from the tabs along the left side of the Config Screen.
3. Select **Alarm Generated** and choose an alarm type from the Select Alarm dialog box.

> Important: Once an alarm is selected, then alarm will continuously insert until turned off.

4. If you want to clear any previously collected data, select **Restart** from the common function button at the bottom of the screen before inserting the error.
5. View various result statistics by selecting the **Results** function.

Viewing GFP Error and Alarm Results
(Specifically for GFP Mappings)

After inserting error and alarms into a packet stream the receiving equipment detects the event and reports it. The Results screen provides different result reports.

To view error or alarm results:

1. From the **Packet** tab, select **Results**.
2. Select one of the following:
    - Scan - Displays a list of errors and alarms along with their count and duration.
    - ERR - Displays a list of errors along with their count, errored seconds, average and current rates.
    - ALARM - Displays a list of alarms along with the number of seconds spent in the alarm condition.
    - Count - Displays Packet and VLAN count statistics.
    - Strm Rslt - Displays Stream ID specific statistics.
    - Event - Displays a summary of error alarm activity.
    - Large LEDs - Displays easy to read LEDs of error alarm activity.

Configuring an RFC-2544 Test

RFC 2544 benchmark tests provides a specific set of tests that can be used to measure and report the performance characteristics of network devices. Test results provide data used to evaluate these devices. The steps below provide preliminary stream configuration instructions.

Note that if the Flow Control box is checked (Rx Enabled), it will automatically default to unchecked when an RFC test is activated. This is to ensure test validity and accuracy.

To configure the an RFC test:

1. Select **RFC Tests** and choose **Conf**.
2. Select **Stream ID** and choose the packet stream (**1**, **2**, **3**, or **4**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.
4. Select **Dest Port** and choose the port that will receive the test signal.

   Note that if a port is in IP Reflection Mode, or is already in an active RFC test, this setting will be unavailable.

5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

   To assign a user-defined frame size:

   a. Select a **Packet Size** button (for example, 64). A keypad appears.
   b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
   c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.

8. Select the type of RFC test that you wish to run by choosing its tab from along the left side of the RFC Tests screen. Complete any necessary configurations these tabs.

    - To run a **Thru Put** test see **Throughput Testing**
    - To run a **Frame Loss** test see **Frame Loss Testing**
    - To run a **B2B Burst** test see **Back-to-Back Burst Testing**

RFC-2544 - Throughput Testing

Throughput testing is an RFC 2544 benchmark test that calculates your network's throughput rate. The fastest throughput speed is indicated by the rate at which the transmission and reception of the Ethernet test stream is accomplished without packet loss.

For example, the Throughput test starts by transmitting a stream at 100% using a packet size of 64 bytes. If it fails (i.e., an unacceptable number of packets are lost), the stream transmission rate falls back a certain percentage and is transmitted again. This process continues until the test passes without losing packets. The test then tries to zero in on the best throughput rate based on the Resolution Rate. he final rate appears as the Passing Rate.

Once this is completed, the packet size is increased to 128 bytes, and the test is repeated until a passing rate is achieved. Subsequent tests are performed using default packet sizes of 256, 512, 1024, 1280, and 1518 bytes, or any user-defined sizes.

When performing a throughput test, you can adjust the following parameters to fine-tune your test results:

- Accept Lost Rate – Defines the percentage of frames that can be lost without being considered a failure.
- Resolution Rate – Sets the level of precision for the test. The finer the resolution, the longer it takes to complete the test.

A Throughput test cannot be performed if another RFC Test is running.

To configure the Throughput test:

configure the Frame Loss test:

1. Select **RFC Tests** and choose **Conf**.
2. Select **Stream ID** and choose the packet stream (**1**, **2**, **3**, or **4**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.
4. Select **Dest Port** and choose the port that will receive the test signal.

5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

   To assign a user-defined frame size:

   a. Select a **Packet Size** button (for example, 64). A keypad appears.
   b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
   c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.

8. Select **Thru Put** from the tabs along the left side of the RFC Tests screen.
9. Select **Accept Lost Rate** and enter an acceptable packet loss rate ranging from 0% to 100%. This value serves as a threshold. The default rate is 0%, which means that even one lost packet is a failure.
10. Select **Resolution Rate**, and enter a value ranging from 1% to 100%. The lower the rate, the more precise the measurement. The default rate is 1%.

To start the Throughput test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.
2. The unit immediately starts transmitting a test stream using the configured parameters, starting with the smallest packet size. The packets are looped through the network and returned to the unit. If no packet loss is reported, results are posted for the first packet size and the unit starts transmitting a stream containing packets for the next size byte frame. (For example, the first packet size transmitted is 64-bytes followed by 128-bytes and so on.)

   If packet loss is detected in a byte transmission, the stream is re-transmitted at a reduced rate. This process continues until results are within the Resolution Rate percentage.

3. View Throughput test results on the statistics table at the bottom of the screen.
4. Select **Print**. The File Browser window appears, which allows you to name and save results to a file using the .thru extension. (The file can be printed or saved locally on the unit, or remotely on a PC if using the Remote Control Application software.)
5. To save and print Throughput test results see Saving and Printing Statistics and Port Settings.

RFC-2544 - Frame Loss Testing

Frame Loss testing is an RFC 2544 benchmark test. Its purpose is to determine the number of packets lost, by looping a stream through the network at varying transmit packet rates. The Frame Loss screen allows you to select a specific packet size to use in the Ethernet stream.

A Frame Loss test cannot be performed if another RFC Test is running.

To configure the Frame Loss test:

1. Select **RFC Tests** and choose **Conf**.
2. Select **Stream ID** and choose the packet stream (**1**, **2**, **3**, or **4**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.
4. Select **Dest Port** and choose the port that will receive the test signal.
5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.
7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

   To assign a user-defined frame size:

a. Select a **Packet Size** button (for example, 64). A keypad appears.
b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.

8. Select **Frame Loss** from the tabs along the left side of the RFC Tests screen.

To start the Frame Loss test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.
2. The unit immediately starts transmitting a test stream at 10% of the maximum byte-size rate. When multiple frame sizes are selected, the transmission starts at the lowest size.

   A status message appears at the bottom of the screen indicating the current frame size and stream rate that is being transmitted. For example, Processing size 64 Rate 10.00. When this completes, the number of frames transmitted and the number of frames received appears in the Frame Loss table. This process continues until 100% of the maximum byte-size rate is reached (at 10% increments).

   After transmitting at 100%, the entire test is repeated using the next larger frame size, for example, 128, 256, 512, 1024, 1280, and 1518 bytes.

3. View Frame Loss test results on the statistics table at the bottom of the screen. The table displays the frame loss test results for a specified packet size. The results represent the nine rates determined by the BW Ceiling and BW Floor settings.

   To change the packet size and view its results:

   ▸ Choose the **Packet Size** button (for example, 256). The Frame Loss table displays the transmit and receive statistics for the selected packet size.

   OR

   ▸ Select the **First**, **Prev**, **Next**, or **Last** button to move through the frame sizes.

Important: The status message that appears at the bottom of the screen always indicates which frame size and stream rate is currently being transmitted and not the report statistics selected.

4. Select **Print**. The File Browser window appears, which allows you to name and save results to a file using the .loss extension. (The file can be printed

or saved locally on the unit, or remotely on a PC if using the Remote Control Application software.)

5. To save and print test results see Saving and Printing Statistics and Port Settings.

RFC-2544 - B2B Burst Testing

This is an RFC 2544 benchmark test. Back-to-Back Burst test is used to determine the buffering capability of the Device Under Test (DUT). This is done by sending a burst of frames to the unit, and then counting how many frames are forwarded by the unit.

During the test a burst of fixed length frames with the minimum inter-frame gap between them is sent through the packet stream. The trial duration must be between 2 and 10 seconds. The RFC standard recommends (but does not required) that this trial should be repeated at least 50 times with the average value reported.

If the unit successfully transmits all the frames that it receives, the frame burst size is increased and the test is repeated. If this stage of the test fails, the frame burst size is halved and the test is repeated until the unit successfully transmits the frame burst. The default frame burst sizes used are 64, 128, 256, 512, 1024, 1280, and 1518 bytes.

A Back-to-Back Burst test cannot be performed if another RFC Test is running.

To configure the B2B Burst test:

1. Select **RFC Tests** and choose **Conf**.

   The **BW Ceiling** and **BW Floor** settings do not apply to the Back-to-Back Burst test.

2. Select **Stream ID** and choose the packet stream (**1**, **2**, **3**, or **4**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.

   This value determines how long each trial runs. Valid values range from 2 to 10 seconds.

4. Select **Dest Port** and choose the port that will receive the test signal.

6. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

   To assign a user-defined frame size:

   a. Select a **Packet Size** button (for example, 64). A keypad appears.
   b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
   c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.

8. Select **B2B Burst** from the tabs along the left side of the RFC Tests screen.
9. Select **Resolution (in frames)**. A keypad appears.
10. Enter a precision level for the test. The value is the number of frames in the longest burst that the DUT will handle without the loss of any frames.
11. Select # **Of Repetitions**. A keypad appears.
12. Enter the number of times the trial length should be repeated. The RFC recommended repetition is 50.

To start the Back-to-Back test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.
2. The unit immediately starts sending a burst of frames with the minimum inter-frame gap between them. If all frames are received, the burst size is increased and the test repeated. If all frames are not received, the burst size is lowered and the test repeated until the longest burst the DUT can handle (without loss of frames) is determined.
3. View B2B Burst test results on the statistics table at the bottom of the screen.
   - Frame Size (bytes) – Indicates the tested frame size.
   - Max Possible Number of Frames – Indicates the number of frames transmitted without errors.
   - Avg Observed B2B Frames – Indicates the data stream's average frame count.

4. Select **Print**. The File Browser window appears, which allows you to name and save results to a file using the .b2b extension. (The file can be printed or saved locally on the unit, or remotely on a PC if using the Remote Control Application software.)
5. To save and print test results see Saving and Printing Statistics and Port Settings.

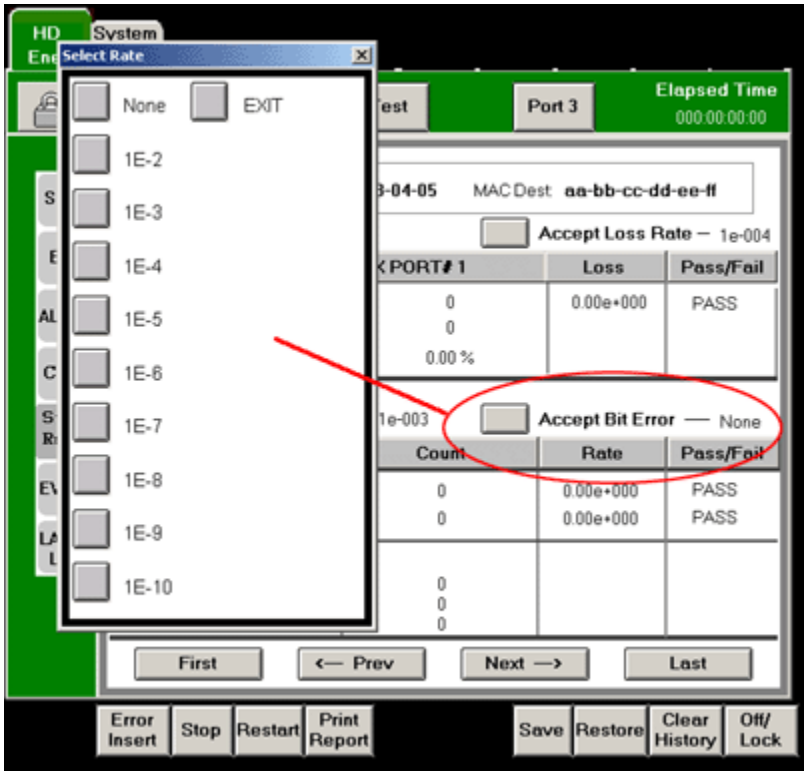
Timed Test - Using Acceptance Criteria

The NIC unit has the capability to run a timed test (a test with Ethernet streams enabled for a certain time period) specifying user-defined acceptance criteria for Pass/Fail results.

To Set Up the Test

1. Set up the port on which the test will be initiated. This includes the ports Interface, stream parameters. A test can be performed on a single port or port-to-port basis.
2. Enable the stream(s) to be used for the test.
3. Under the Results > Strm Rslt tab, configure the acceptance criteria options. These include Acceptable Loss Rate, Acceptable Out of Sequence rate, and Acceptable Bit Error rate. These values are set up on a stream-by-stream basis.
4. Under the Test tab, select the desired duration for the test. Note that if "Continuous" is used, the test will continue to operate until manually interrupted.
5. Restart the port that will be used for the timed test using the Restart button at the bottom of the screen.
6. When the time duration of the test is reached, the Ethernet streams will automatically stop counting received packets and the Pass/Fail acceptance results are displayed under the Results > Strm Rslt tab.

A typical screen is shown below with two of the three parameters (Accept Loss Rate and Accept Out of Seq) already set and the third (Accept Bit Error) ready to be set by using the pop-up Select Rate window.



User-Defined Acceptance Criteria

Accept Loss Rate: A user-specified threshold value for determining the acceptable Packet Loss rate for a timed test. Test results are displayed as the calculated loss rate and a Pass/Fail status.

Accept Out of Seq: A user-specified threshold value for determining the acceptable Out of Sequence packet rate for a timed test. Test results are displayed as an error count, rate, and Pass/Fail status.

Accept Bit Error: A user-specified threshold value for determining the acceptable bit error rate for a timed test. Test results are displayed as an error count, rate, and Pass/Fail status.

Measuring Service Disruption

The system can measure service disruption switching intervals in your network by monitoring for a specific event, such as FCS errors, that cause a service disruption switch. When an event occurs, the duration is logged in milliseconds. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The Ethernet service disruption tests show a granularity accuracy of 0.1 ms (100 µs).

To measure Ethernet service disruption activity:

1. Select the **Test** tab and choose **Service Disrptn** from the tabs along the left-side of the screen.
2. Select **Consecutive Good Time Required** and enter a time interval ranging from 10 milliseconds to 1638.3 milliseconds. This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.
3. Select **Consecutive Bad Time Required** and enter a time interval ranging from 0.1 milliseconds to 1638.3 milliseconds. This function allows you to enter the time-duration (in milliseconds) of consecutive errored frames to elapse before Protection Switch measurements begin to accumulate.
4. From the **Action** box, select **State**. The Select APS Action dialog box appears.
5. Select **Single APS** or **Continuous APS** to begin measuring. The test set will begin monitoring the incoming signal for the event. If it occurs, the protection switch state and time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for consecutive good and bad time parameters.
6. In the **Protection Switch Time (MilliSecs)** table, view the duration, in seconds, that it took for the service disruption to occur.
7. In the History Recent MilliSeconds table, view a history of events. The complete summary of events can be viewed by selecting the **System** tab and choosing **Service Disruption**.

To stop monitoring Service Disruption measurement activity:

1. Select the **Test** tab and choose **Service Disrptn** from the tabs along the left-side of the screen.
2. From the **Action** box, select **State** and choose **Stop APS**.

PING Functionality

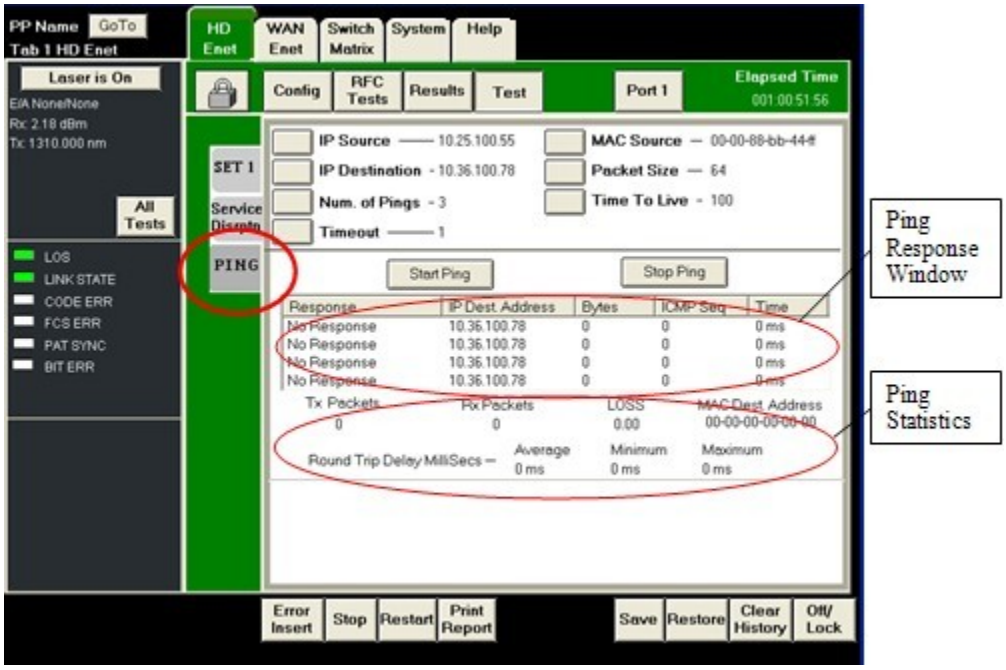
PING is a utility used to determine whether a specific IP address is accessible. It works by sending a packet to the specified address and waits for a reply. PING is used primarily to troubleshoot Internet connections.

A PING packet is an IP packet requesting that a copy of the contents be echoed back to the sender. This packet type is called an ICMP Echo Request. When a

site is “pinged”, an echo request is sent, and the destination site that receives it responds back. The response packet is called an ICMP Echo Reply.

The Ping utility is essentially a system administrator's tool that is used to see if a computer is operating and also to see if network connections are intact. Ping uses the Internet Control Message Protocol (ICMP) Echo function which is detailed in RFC 792.

The PING screen selection is implemented under the Test Tab.



Saving and Printing Statistics and Port Settings

The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and Stream Test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.

The following reports are available:

- Settings - (.set extension) Reports the Stream Settings for the selected Port .
- Statistics - (.stat extension) Reports all Steam Tx/Rx Packet counts, Errors, and Alarms.
- Events - (.evt extension) Reports a summary of Events, such as alarm and error activity.
- APS (.aps extension) Reports Service Disruption statistics.

- RFC Thru Put - (.thru extension) Reports the Throughput test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).
- RFC Frame Loss - (.loss extension) Reports the Frame Loss test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).
- RFC B2B Burst - (.b2b extension) Reports the Back to Back Burst test settings and a summary of the test results for each packet size (Max Possible Number of Frames, and Average Observed B2B Frames).

To save or print RFC test results:

1. Configure and run Packet Stream transmissions or run an RFC test such as Throughput, Frame Loss, B2B Burst.
2. Select the **Print Report** common function button located at the bottom of the screen. The Report Setup dialog box appears.
3. Choose one of the following:
    - From Destination Printer:

        ▶ Select one or multiple reports to print directly to a printer. If printing a report from the NIC unit, make sure that a printer is attached to the unit's parallel or serial port.

    - From Destination File:

        ▶ Select one or multiple reports to print to a file. The File Browser dialog box appears.

        The Comma Delimiter option can be applied to the Settings To File and Statistics To File reports.

        ▶ Enter a file name and select **OK**.

        Important: Files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC. The NIC unit saves the files to its default D:\DLI... drive on the test unit.

        ▶ For instructions on retrieving saved files see Printing or Viewing Saved Files.

4. Click the **Input** button to enter any User Comments that you wish to appear in the printed or saved report file. Press the **Clear** button to clear the User Comments.
5. Select **OK**.

GFP Screen and Function Description

GFP Screen Functions and Descriptions Overview

This section describes the various screens and functions that control GFP-B, GFP-F and GFP-T configurations and operations:

- Config
- RFC Tests
- Results
- Test
- GFP LEDs

Config

Config Screens and Functions

(Specifically for GFP Mappings)

The Config screen contains the following functions:

- Set (GFP-Bulk Fill)
- Set (GFP-F or GFP-T)
- Traffic Stream Profile (GFP-F or GFP-T)
- Error Alarm

Config - Set screen

(Specifically for GFP Mappings and GFP-Bulk Fill mode)

The Config > Set (Stream Control) screen allows you to define the GFP parameters that will be used to generate a traffic flow or stream into the network.

The following functions appear on the Config > Set screen when the GFP Mode is set to **GFP BULK FILL**:

Function	Description
Mode	Selects which GFP Mode to test. • GFP Bulk Fill • GFP Framed Ethernet • GFP Transparent Important: GFP-T is only available when the mapping or VCG data rate for SONET, SDH or OTN is equal to or greater than 1Gbps.
PFI	Allows the user to enable or disable the optional Payload FCS Identifier (pFCS) bytes. **0 = pFCS Off**: When the pFCS (payload Frame Check Sequence) is turned off, then GFP frame does not utilize the 4 additional bytes after the payload for pFCS error analysis. **1 = pFCS On**: When the pFCS (payload Frame Check Sequence) is turned on, then GFP frame does adds 4 additional bytes after the payload for pFCS error analysis. The pFCS Error Type can only be inserted when pFCS is turned on.
EXI	Allows the user to enable or disable the Extension Header Identifier mode. **0 = Null Extension Header**: Disables the Extension Header **1= Linear Frame**: Enables and defines the Extension Header as Linear Extension Header Important: The EXI mode has to be set for **Linear** for the CID setting to be enabled.
RX Pattern	Selects the type of pattern that the

	unit expects to receive on the incoming GFP frames. The payload can be set to: • **PRBS 31** • **User Defined** (range from 1 bit to 32 bits and is entered using a touch screen keypad)
TX Pattern	Sets the type of data used for the transmit GFP payload. The payload can be set to: • **PRBS 31** • **User Defined** (range from 1 bit to 32 bits and is entered using a touch screen keypad)
Length	Sets the frame size (bytes). The frame size is entered as a decimal value, entered using a keypad, ranging from 60 to 9000. The default value is 64 bytes.
Rate	Sets the bandwidth percentage (from 0.01% to 100%) of the SONET, SDH or OTN mapping or VCG data rate.
CID	Sets the transmitted Channel ID value, ranging from 0 to 255, in the Extension Header. The default value is 0. Important: The EXI mode has to be set for **Linear** for this setting to be enabled.
PTI Important: This setting is internally managed by the circuit pack and is not displayed on the GUI.	Payload Type Identifier For all GFP modes this setting is set to **000**. See inserting **LOCS** and **LOCCS** alarms for their affect on the PTI.
UPI	Displays the User Payload Identifier value. (Read only) For Bulk mode this setting is set to

	1111 1110 (0xFE) which is defined as Reserved for proprietary use, which in this case is labelled as an O.181 Test Signal. See inserting **LOCS** and **LOCCS** alarms for their affect on the UPI.
Count Statistics Table	The Count Statistics Table displays the following information for both transmitted (TX) and received (RX) packets: • **Type** - Defines which row of statistics is designated for Transmit counts (TX) and which row is designated for Receive counts (RX) • **Packets** - Displays the total number of packets sent and received since the test was started • **Pkts/sec** - Displays the current rate of packets sent and received in packets per second • **Bytes** - Displays the total number of bytes sent and received since the test was started • **Mbit/sec** - Displays the current rate of packets sent and received in Megabits per second • **%BW** - Displays the current percentage of bandwidth of packets sent and received

Config - Set screen

(Specifically for GFP Mappings and GFP-F or GFP-T modes)

The Config > Set (Stream Control) screen allows you to define the GFP parameters that will be used to generate a traffic flow or stream into the network. Up to four different streams can be generated simultaneous.

The following functions appear on the Config > Set screen when the GFP Mode is set to **GFP Framed Ethernet** or **GFP Transparent:**

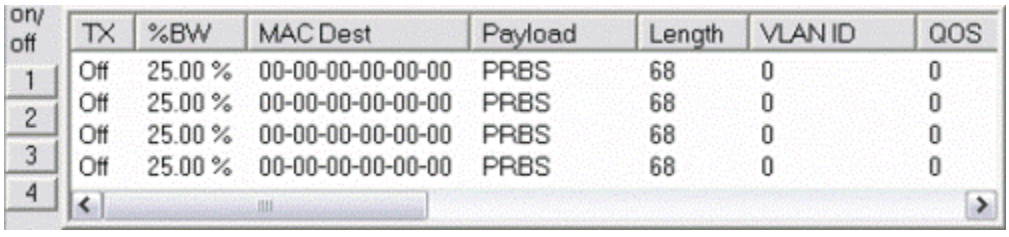
Function	Description
Mode	Selects which GFP Mode to test. • GFP Bulk Fill • GFP Framed Ethernet • GFP Transparent Important: GFP-T is only available when the mapping or VCG data rate for SONET, SDH or OTN is equal to or greater than 1Gbps.
PFI	Allows the user to enable or disable the optional Payload FCS Identifier (pFCS) bytes. **0 = pFCS Off**: When the pFCS (payload Frame Check Sequence) is turned off, then GFP frame does not utilize the 4 additional bytes after the payload for pFCS error analysis. **1 = pFCS On**: When the pFCS (payload Frame Check Sequence) is turned on, then GFP frame does adds 4 additional bytes after the payload for pFCS error analysis. The pFCS Error Type can only be inserted when pFCS is turned on.

EXI	Allows the user to enable or disable the Extension Header Identifier mode. **0 = Null Extension Header**: Disables the Extension Header **1= Linear Frame**: Enables and defines the Extension Header as Linear Extension Header Important: The EXI mode has to be set for **Linear** for the CID setting to be enabled.
CID	Sets the transmitted Channel ID value, ranging from 0 to 255, in the Extension Header. The default value is 0. Important: The EXI mode has to be set for **Linear** for this setting to be enabled.
PTI Important: This setting is internally managed by the circuit pack and is not displayed on the GUI.	Payload Type Identifier For all GFP modes this setting is set to **000**. See inserting **LOCS** and **LOCCS** alarms for their affect on the PTI.
UPI Important: This setting is internally managed by the circuit pack and is not displayed on the GUI.	User Payload Identifier: For GFP Framed Ethernet mode this setting is set to **0000 0001** (0x01) which is defined as "Frame-Mapped Ethernet". For GFP Transparent mode this setting is set to **0000 0110** (0x06) which is defined as "Transparent Gb Ethernet". See inserting **LOCS** and **LOCCS** alarms for their affect on the UPI.

Col (Columns)	Rearrange order of columns displayed in the Stream Profile Table
Reflect Important: This setting is only supported in GFP-Transparent	Allows the user to start IP Packet Reflection Mode for DLI Packets or All Non-Routing Packets.
TX Mode	Starts and stops the transmission of ALL streams. The status of the stream transmission is displayed in the “TX” column of the Stream Profile table. Selecting TX Mode while all streams are “Off” will turn all streams “On”. If at least one stream is “On”, selecting TX Mode will turn all streams “Off”.
Stream Profile Table	The Stream Profile Table contains four packet streams that can be configured. Selecting a stream from the profile table opens the Traffic Stream Profile dialog box from which the stream parameters are configured. A total of four streams can be configured and saved for each port. Use the horizontal scroll bar at the bottom of the table to view hidden columns for the stream settings. See below for more information on the Stream Profile Table.

Count Statistics Table	The Count Statistics Table displays the following information for both transmitted (TX) and received (RX) packets: • **TX/RX** - Defines which row of statistics is designated for Transmit counts (TX) and which row is designated for Receive counts (RX) • **Packets** - Displays the total number of packets sent and received since the test was started • **Pkts/sec** - Displays the current rate of packets sent and received in packets per second • **Bytes** - Displays the total number of bytes sent and received since the test was started • **Mbit/sec** - Displays the current rate of packets sent and received in Megabits per second • **%BW** - Displays the current percentage of bandwidth of packets sent and received

Information about the configuration of the streams are displayed in the Stream Profile Table.



At the left, there are four (4) buttons to turn on and off each individual stream. The other columns of information can be seen by using the scroll bar at the bottom or by rearranging the columns. These are the columns (note that the sequence may be different, depending upon how the user has arranged the columns):

TX	Indicates whether that stream 1-4 is being transmitted
%BW	Percentage of bandwidth selected on that stream
MAC Dest	Destination MAC address
Payload	Payload Pattern selected
Length	Frame Length
VLAN ID	VLAN ID selected
VLAN QOS	VLAN QOS selected
IP Dest	Destination IP address
UDP Port Dest	UDP Destination Port
MAC Src	Source MAC address
IP Src	Source IP address
UDP Port Src	UDP Source Port
VLAN Tag	VLAN Tag (yes or no)
IP TOS	IP Type of Service
IP TTL	IP Time to Live
IP FRAG	Select whether to allow or disallow fragments

Traffic Stream Profile Configuration

(Specifically for GFP Mappings)

A packet stream's profile defines the type, size, content, destination address, and source addresses for the frame

The **Traffic Stream Profile** dialog box is used to set the stream profile parameters when the GFP mode is set to **GFP Framed Ethernet** or **GFP Transparent**. To access this dialog box, select any of the four streams in the Stream Profile Table.

The stream protocol is set to UDP/IP by default.

Parameter	**Description**

Stream ID #	Displays which of the four Streams the settings are being modified for. Displays which of the four Streams the settings are being modified for. The title bar of this Traffic Stream Profile window also shows which Stream ID # is currently selected
MAC Src Address	Sets a MAC source (origination) address for generated traffic. The address is a 12-digit (6-byte) HEX value that is entered using a keypad. The address is entered into 6 separate fields, 2 characters each. There are no restrictions on value entered but all a value must be entered in all fields.
MAC Dest Address	Sets a MAC destination address for generated traffic. The address is a 12-digit (6-byte) HEX value that is entered using a keypad. The address is entered into 6 separate fields, 2 characters each. There are no restrictions on value entered but all a value must be entered in all fields.
IP Src Address	Sets the IP address of the source (origination). The address is entered in decimal notation using a keypad. There are no restrictions on value entered but the format must be correct, i.e: xxx.xxx.xxx.xxx. If three digits are entered in a field, a period will be automatically added. If only one or two digits are entered, you must enter a period manually.

IP Dest Address	Sets the IP address of the destination. The address is entered in decimal notation using a keypad. There are no restrictions on value entered but the format must be correct, i.e: xxx.xxx.xxx.xxx. If three digits are entered in a field, a period will be automatically added. If only one or two digits are entered, you must enter a period manually.
UDP Src Port	Selects a User Data Protocol source port number (0 to 65535).
UDP Dest Port	Selects a User Data Protocol destination port number (0 to 65535). Note: Stream Counts are only displayed when UDP Dest Port is 312.
Frame Length	Sets the frame size (bytes). The frame size is entered as a decimal value, entered using a keypad, ranging from 64 to 9600. The default value is 64 bytes.

Rate	Sets the bandwidth percentage used. The value can be set using a bandwidth percent or Mbit/sec. Valid values are: • The %Bandwidth range is from 0.01% to 100% • For GFP-F, the Mbit/sec range is dependant on the mapping or VCG data rate for SONET, SDH or OTN • For GFP-T, the Mbit/sec range is from 0.1 to 1000 Mbps. If the word "Pending" is shown, then the Mbit/Sec option will not be available until at least on stream is turned on, so that GFP can calculate the proper constraints for the data rate.
Payload	Sets the type of data used for the transmit stream's payload. The payload can be set to: • **PRBS 31** • **PRBS 31 Inv** • **User Defined** (range from 1 bit to 32 bits and is entered using a touch screen keypad)
VLAN Tag	Enables VLAN tagging for the frame. The VLAN tag is a 4-byte tag that is inserted into the frame.
VLAN ID	Assigns a VLAN ID to the frame. This identifies to which VLAN the frame belongs. IDs are entered as a decimal value from 0 to 4095. (VLAN tagging must be enabled to use this parameter.)
VLAN QOS	Sets the user priority level. Levels range from 0 to 7.

IP TOS	Sets the IP Type of Service. TOS is a 2-character HEX value.
IP TTL	IP Time to Live. TTL is a decimal value from 0 to 255.
IP Fragment Flag	Select whether to allow or disallow fragments
Prev	Moves to the stream with the next lower number. If currently looking at stream #1, selecting “Prev” will bring up stream #4. Note that changes made will not be saved until “Save All” is selected.
Next	Moves to the stream with the next higher number. If currently looking at stream #4, selecting “Next” will bring up stream #1. Note that changes made will not be saved until “Save All” is selected.
Save All	Saves all changes made and closes the Traffic Stream Profile window.
Exit	Closes the Traffic Stream Profile window without saving changes.

Config - Errors and Alarms

(Specifically for GFP Mappings)

The Error and Alarm screen allows the user to configure errors and alarms for insertion into a stream to simulate various defects and anomalies. Simulating defects can determine if the receiving equipment can detect and report an error in the incoming signal.

Note that error insertion is disabled when in IP Reflection Mode.

Option	**Description**
Error Type	Selects the type of error to transmit

	into a stream. Selecting one of the following will not send an error immediately but will only select the type of error to send when the “Send Error” button is pressed or when a rate is selected. The following types are available: • **Bit Error (Stream #n)** - Generates bit errors in the payload for the specified stream number. • **Sequence Error (Stream #n)** - Generates Sequence errors in the payload for the specified stream number. • **Corr cHec** - Generates a Correctable Core Header Error Control, which is a CRC-16 error • **Uncorr cHec** - Generates a Uncorrectable Core Header Error Control, which is a CRC-16 error • **Corr tHec** - Generates a Correctable Type Header Error Control, which is a CRC-16 error • **Uncorr tHec** - Generates a Uncorrectable Type Header Error Control, which is a CRC-16 error • **Corr eHec** - Generates a Correctable Extension Header Error Control, which is a CRC-16 error • **Uncorr eHec** - Generates a Uncorrectable Extension Header Error Control, which is a CRC-16 error • **pFCS** - Generates an invalid payload Frame Check Sequence error • **IP Checksum** - Generates an invalid IP header checksum

	• **Line Code** - Generates line code errors
Error Rate	Selects the error rate to be transmitted for the selected error type. Once the error rate is selected, the system begins transmitting errors. Select one of the following: • **1E-<x>** - *X* is an exponential value from 2 to 10. Selecting one of these sets the error rate to 1 x 10^{-x} (The smaller the exponential the higher the error rate.) • **User Defined** – Enter the desired error rate in increments of 0.1. For example, with user defined, error rates are not limited to 1 x 10^{-x} but more exact choices are available such as 2.6 x 10^{-4} or 7.1 x 10^{-3}
Alarm Generated	Selects an alarm to be transmitted. Once selected the system begins sending the alarm condition. Select one of the following: • **None** - Turns alarm generation off. • **LFD** - Generates a constant Loss of Frame Delineation alarm. • **LOCS** - Generates a constant Loss of Client Signal alarm. (sets the PTI to 100 and UPI to 0000 0001) • **LOCCS** - Generates a constant Loss of Client Character Synchronization alarm. (sets the PTI to 100 and the UPI to 0000 0010)

RFC Tests

RFC Tests - Screen Functions and Descriptions Overview

The RFC Tests screen contains the following functions:

- Conf
- Thru Put
- Frame Loss
- B2B Burst

RFC Tests - Configuration (Conf)

RFC testing provides a specific set of tests that can be used to measure and report the performance characteristics of network devices. The RFC Tests Conf screen provides the preliminary stream configuration settings. After these settings are made the user selects the type of RFC test to initiate by choosing its tab along the left side of the RFC Tests screen.

The following options appear on the Conf screen:

Option	Description
Stream ID	Allows the user to select one of the four streams for the RFC test.
Trial Duration	Determines how long the test runs for each packet size. This duration is used each time the test fails. Valid duration values are 1-600 seconds. The default value is 240 seconds.
Dest MAC Address	Reflects the destination MAC address for the selected Stream. The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Allows the user to select the destination port that will receive the test signals. If a port is in IP Reflection Mode, or is already in an active RFC test, it will not appear in the Select Port window.

Restore to RFC Standard Setting	Returns frame sizes to default RFC test standards when user-defined sizes have been set.
Enable/Disable check boxes	Allows the user to select the packet sizes that will be used for the RFC tests.
Packet Sizes	Displays the packet sizes. Selecting a Packet Size button allows the user to assign a user-defined frame size to the packet. Valid value ranges are 64 - 9600.
BW Ceiling	Sets the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100. IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.
BW Floor	Sets the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99. IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

RFC Tests - Through Put Test (Thru Put)

This is an RFC 2544 benchmark test that calculates your network's throughput rate. The fastest throughput speed is indicated by the rate at which the transmission and reception of the Ethernet test stream is accomplished without packet loss.

The following options appear on the Thru Put screen:

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test. The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails. The Trial Duration is configured from the RFC Tests - Conf screen.
BW Ceiling	Displays the setting for the high-end of the bandwidth test range. The BW Ceiling is configured from the RFC Tests - Conf screen.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test. The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal. The Dest Port is configured from the RFC Tests - Conf screen.
BW Floor	Displays the setting for the low-end of the bandwidth test range. The BW Floor is configured from the RFC Tests - Conf screen.
Accept Lost Rate	Sets a packet loss rate threshold. The test fails if packet loss exceeds this value. Valid values are 0-100%. The default is 0%, which means that even one lost packet is a failure.
Resolution Rate	Sets a level of precision for the test. The default resolution is 1%. The finer the resolution (for example, 1%),

	the longer it takes to complete the test; the less precise the test (for example, 10%), the faster the test completes but with less accuracy.
Statistics Table	Reports the test results. The following statistics are displayed: **Size** - Indicates the transmitted test packet size. **Rate** - Reports the passing rate (percentage) for the specific packet size. **TX Packets** - Reports the number of packets transmitted in the stream for the frame. **RX Packets** - Reports the number of packets received by the test set. **Latency Min/Max/Avg** - Reports how long it takes for the test frames to traverse the network and return to the unit. The values that appear are in milliseconds. If the test set is looped to itself with a short patch cable, the latency may appear as 0 ms.
Start/Stop Test	Starts and stops the Through Put test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

RFC Tests - Frame Loss Test

This is an RFC 2544 benchmark test. Its purpose is to determine the number of frames lost by looping a stream (with a specified frame size) through the network at varying transmit frame rates. Select Frame Loss Testing for test procedures.

The following options appear on the Frame Loss screen:

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test. The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails. The Trial Duration is configured from the RFC Tests - Conf screen.
BW Ceiling	Displays the setting for the high-end of the bandwidth test range. The BW Ceiling is configured from the RFC Tests - Conf screen.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test. The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal. The Dest Port is configured from the RFC Tests - Conf screen.
BW Floor	Displays the setting for the low-end of the bandwidth test range. The BW Floor is configured from the RFC Tests - Conf screen.
Packet Size buttons	Determines which packet size results appear in the statistics table. Selecting a packet size button displays its results.
Statistics Table	Displays the frame loss test results for a specified packet size. The results display the nine rates

	determined by the BW Ceiling and BW Floor settings. The following statistics are displayed: **Rate %** - Indicates the percentage of bandwidth transmitted using the bandwidth ceiling and floor settings. **Transmit Frames** - Reports the total number of frames transmitted. **Receive Frames** - Reports the total number of frames received. **Loss %** - Reports the percentage of frame loss that occurred during the test. This calculation is the received frames divided by transmitted frames.
First, Prev, Next, Last	Allows the user to scroll through packet sizes to view their test results.
Start/Stop Test	Starts and stops the Frame Loss test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

RFC Tests - Back-To-Back Burst Test (B2B Burst)

This is an RFC 2544 benchmark test. Back-to-Back Burst test is used to determine the buffering capability of the Device Under Test (DUT). This is done by sending a burst of frames to the unit, and then counting how many frames are forwarded by the unit.

During the test a burst of fixed length frames with the minimum inter-frame gap between them is sent through the packet stream. The trial duration must be between 2 and 10 seconds. The RFC standard recommends (but does not required) that this trial should be repeated at least 50 times with the average value reported.

If the unit successfully transmits all the frames that it receives, the frame burst size is increased and the test is repeated. If this stage of the test fails, the frame burst size is halved and the test is repeated until the unit successfully transmits the frame burst. The default frame burst sizes used are 64, 128, 256, 512, 1024, 1280, and 1518 bytes.

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test. The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails. The Trial Duration is configured from the RFC Tests - Conf screen. Important: The trial duration must be between 2 and 10 seconds.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test. The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal. The Dest Port is configured from the RFC Tests - Conf screen.
Resolution (in frame:)	Sets the level of precision for the B2B test, by frames. The value is the number of frames in the longest burst that the DUT will handle without the loss of any frames. Valid values are 1-812.
# Of Repetitions	Enter the number of times the trial length should be repeated. The RFC recommended repetition is 50, however valid values are 1-100.
Statistics Table	Reports the test results. The system recovery results are displayed by Frame Size (bytes) tested as follows: • Max Possible Number of

	Frames - The frame rate (resolution) used as the throughput rate. • Avg Observed B2B Frames - Average frame count for each type of data stream tested.
Start/Stop Test	Starts and stops the Back-to-Back Burst test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

The **BW Ceiling** and **BW Floor** settings do not apply to the Back-to-Back Burst test.

Results

Results Screens and Functions

(Specifically for GFP Mappings)

Test activity and event history can be viewed using the various functions of the Results screen.

The Results screen contains the following functions:

- Scan - Displays a list of errors and alarms along with their count and duration.
- ERR - Displays a list of errors along with their count, errored seconds, average and current rates.
- ALARM - Displays a list of alarms along with the number of seconds spent in the alarm condition.
- Count - Displays Packet and VLAN count statistics.
- Strm Rslt - Displays Stream ID specific statistics.
- Event - Displays a summary of error alarm activity.
- Large LEDs - Displays easy to read LEDs of error alarm activity.

Results - Scan Screen

(Specifically for GFP Mappings)

This function displays a list of received errors and alarms.

For **alarms**, the duration is reported as a count in seconds.

For **errors**, an error count is reported.

The message *No Errors or Alarms* appears if no events are received by the system.

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

Results - ERR (Errors) Screen

(Specifically for GFP Mappings)

The Err screen reports error statistics on the incoming signal.

The following statistics appear:

Statistic	Description
Error	Displays the error type recognized and recorded by the unit.
Count	Displays the number of errors.
Errored Seconds	Displays the number of errored seconds.
Average	Displays the average error rate using an N.NNe-N format.
Current	Displays the current error rate using an N.NNe-N format.

The following error types can be monitored:

- **Undersized**
- **Invalid FCS**
- **Invalid IP**
- **Stream #1 Seq**
- **Stream #1 Bit**
- **Stream #2 Seq**
- **Stream #2 Bit**
- **Stream #3 Seq**
- **Stream #3 Bit**
- **Stream #4 Seq**
- **Stream #4 Bit**
- **Runts**
- **Corr cHEC**
- **Uncorr cHEC**
- **Corr tHEC**

- **Uncorr tHEC**
- **Corr eHEC**
- **Uncorr eHEC**
- **Invalid Superblock** (GFP-T mode only)
- **Superblock FCS** (GFP-T mode only)
- **payload FCS**

Results - Alarm Screen

(Specifically for GFP Mappings)

The Alarm screen reports the various alarms detected by the receiving equipment.

The following statistics appear:

Statistic	Description
Alarm Description	Displays the alarm type recognized and recorded by the unit.
Seconds	Displays the number of seconds the alarm spent in the alarm condition.

The following alarm types can be monitored:

- **CP Power Loss**
- **Paused**
- **Stream #1 Pat Sync**
- **Stream #2 Pat Sync**
- **Stream #3 Pat Sync**
- **Stream #4 Pat Sync**
- **LFD**
- **LOCS**
- **LOCCS**

Results - Count Screen

(Specifically for GFP Mappings)

The Count screen displays Packets, VLAN, and Packet Size statistics by type and count.

To view packet results, select the **Packets** button. The following statistics appear:

Packets	Description

Transmit Packets	Reports the total number of packets sent.
Received Packets	Reports the total number of packets received.
Received Jumbo Packets	Reports the total number of jumbo packets received. Jumbo packets are those from 1519 – 9600 bytes in size.
Transmit Bytes	Reports the total number of bytes sent.
Received Bytes	Reports the total number of bytes received.
IP Packets	Internet Protocol. Reports the total number of IP packets received.
ICMP Packets	Internet Control Message Protocol. Reports the total number of ICMP packets received.
TCP Packets	Reports the total number of TCP packets received.
UDP Packets	User Data Protocol. Reports the total number of UDP packets received.
IGMP Packets	Internet Group Management Protocol. Reports the total number of IGMP packets received.
TX Super Blocks	Reports the total number of 64B/65B coded Super Blocks transmitted. GFP-T mode only
RX Super Blocks	Reports the total number of 64B/65B coded Super Blocks received. GFP-T mode only

To view VLAN results, select the **VLAN** button. The following statistics appear:

VLAN	**Description**
VLAN Tagged Frames	Reports the total number of frames received that are identified as VLAN frames. The 4-byte VLAN tag is inserted in the Ethernet frame between the Source MAC Address field and the

	Length/Type field.
Quality of Service Entry	Displays separate data rows for QOS entries 1-7. Reports the number of frames received for each user priority level value. A total of 8 different counters appear in the table.

To view Packet Size results, select the **Packet Sizes** button. The following statistics appear:

Packet Sizes	Description
Packet Byte Size Only displayed when GFP is configured for Transparent mode.	Reports the count and percentage of each packet size range found: 64; 65-127; 128-255; 256-511; 512-1023; 1024-1518; 1519-Max (Jumbo Packets).

Results - Strm Rslt (Stream Results) Screen

(Specifically for GFP Mappings)

The Stream Results screen displays statistics for a specified incoming packet stream. The screen allows you to scroll through the different packet streams and view their individual results.

The following statistics appear:

Statistic	Description
Selected Stream Entry	Displays the stream ID number and its MAC source and MAC destination addresses to which the Total Stream Statistics data on the stream control screen belongs.
Total Stream Statistics Table	Provides transmit and receive statistics by Count and %BW. • Count - Displays the total number for the criteria. • %BW - Displays the total percent of bandwidth used by the stream.
Transmit Statistics	Provides statistic totals, by count

	and/or percent of bandwidth, for the following criteria: • Packets Transmitted • Bytes Transmitted • %BW Transmitted
Receive Statistics	Provides statistic totals, by count and/or percent of bandwidth, for the following criteria: • Packets Received • Bytes Received • %BW Received • Out of Sequence Packets - Each sent packet is marked with a sequence number. This count is incremented when a packet arrives that has a sequence number different than one plus the sequence number of the previous packet. • Bit Errors Received
Latency Values (in microseconds)	Displays minimum, average, and maximum latency (delay) values over time. A latency measurement is taken every quarter-second (0.25 sec.) during stream transmission. These values are updated (realtime) as new latency measurements are logged. If the unit is looped on itself, the latency may appear as 0 µs.
User-Defined Acceptance Criteria (Refer to "Timed Test Using Acceptance Criteria")	**Accept Loss Rate:** A user-specified threshold value for determining the acceptable Packet Loss rate for a timed test. Test results are displayed as the calculated loss rate and a Pass/Fail status. **Accept Out of Seq:** A user-specified threshold value for determining the

	acceptable Out of Sequence packet rate for a timed test. Test results are displayed as an error count, rate, and Pass/Fail status. **Accept Bit Error:** A user-specified threshold value for determining the acceptable bit error rate for a timed test. Test results are displayed as an error count, rate, and Pass/Fail status.
First, Prev, Next, Last	Allows the user to scroll through the four packet streams and view their individual results. Selecting **First** immediately moves the stream statistics to Stream 1; selecting **Last** immediately moves the stream statistics to Stream 4; selecting **Prev** or **Next** moves the stream statistics to/from one stream to the next.

Results - Event Screen

(Specifically for GFP Mappings)

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

Results - Large LEDs Screen

(Specifically for GFP Mappings)

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

For a list of available LEDs for GFP, see GFP LEDs.

Test

Test - Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- Set 1
- Service Disruption

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Service Disruption

The unit can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The Ethernet service disruption tests show a granular accuracy of .1 ms (100 µs).

Test Service Disruption functions include:

- **Consecutive Good Time Required**: This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The range is 10 to 1638.3 milliseconds and is entered using a keypad.
- **Consecutive Bad Time Required**: This function allows you to enter the time-duration (in milliseconds) of consecutive errored frames to elapse before Protection Switch measurements begin to accumulate. The range is 10 to 1638.3 milliseconds and is entered using a keypad.
- **State**: Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

  - **Single APS**: Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

  - **Continuous APS**: Constantly monitors for service disruption events, and updates the seconds and frames reported.

  - **Stop APS:** Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)**: Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.

For more information about monitoring service disruption activity, select *Measuring Service Disruption Activity* in the Specific Tasks section of the online help.

LED Quick Status Area
(Specifically for GFP Mappings)

When the **Packet** tab is selected for a GFP payload, the following status LEDs may appear in the LED Quick Status Area, depending on the selected GFP mode.

The LED indicates the instantaneous state of the specific condition. The text to the right of the LED is used as a “history” indicator. White text indicates that the specific error, alarm or condition has not been present during the current test. Red text indicates that the specific error, alarm or condition has been present during the current test.

Indicator, LED or Control	Description
TX:	Displays the maximum transmit data-rate for 100% TX bandwidth, based on the mapping or VCG for the SONET, SDH or OTN Interface.
RX:	Displays the maximum receive data-rate for 100% RX bandwidth, based on the mapping or VCG for the SONET, SDH or OTN Interface.
E/A	Error/Alarm Indicator. Indicates the type of error inserted and/or alarm generated.
Test Paused	If red, indicates that the current test has been paused.
All Tests (button)	This is a short-cut button to the general "All Test Status" summary LED screen for all circuit packs installed in the unit.
LFD	Loss of Frame Delineation alarm status LED
LOCS	Loss of Client Signal alarm status LED Indicates the received PTI value is 100, and the UPI value is 0000 0001.
LOCCS	Loss of Client Character Synchronization alarm status LED Indicates the received PTI value is 100, and the UPI value is 0000 0010.
cHEC	Core-Header Error Check error status

	LED Indicates that one or more Correctable or Uncorrectable cHEC errors were detected.
eHEC	Extension-Header Error Check error status LED Indicates that one or more Correctable or Uncorrectable eHEC errors were detected.
tHEC	Type-Header Error Check error status LED Indicates that one or more Correctable or Uncorrectable tHEC errors were detected.
pFCS	Payload-Frame Check Sequence error status LED
sFCS	Superblock-Frame Check Sequence error status LED GFP-T mode only
FCS	Frame Check Sequence error status LED
PAT SYNC	Pattern Synchronization alarm status LED Indicates a loss of pattern synchronization in at least one of the 4 streams. This is an alarm LED.
BIT ERR	Bit error status LED Indicates a detected BIT error in at least one of the 4 streams.
SEQ ERR	Sequence error status LED Indicates a sequence error detected in at least one of the 4 streams.

The following describes the LED colors:

If the LED color is ...	**Then this indicates ...**

Green with **white** text	The specific function is active and OK.
Red with **white** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **white** text	No activity from this specific function.

LAN/WAN Specific Tasks

LAN/WAN Ethernet Specific Tasks Overview

This section includes tasks that are specific to 1Gbps, 10Gbps and 11Gbps (10G LAN over G.709 OTU-2) Ethernet Interfaces, as well as the 10Gbps WAN mapping for OC-192/STM-64 Interface.

For a description of specific screens and their functionality, refer to LAN/WAN Screen Functions and Descriptions Overview.

For a list of general tasks, see Common Tasks located in the Getting Started section.

Please use the **Contents** tab and window (left side of the Help screen) to select, open, and view Specific Tasks for this protocol processor.

The following subjects will also be available soon:

- 802.3 1G LAN
- 802.3 10G/11G LAN (10 Gbps optical LAN mode)
- 802.3 10G/11G LAN (10 Gbps Seed A/B mode)
- OC-192/STM-64 10G WAN mapping

Configuring LAN/WAN Packet Streams
(Specifically for LAN/WAN Ethernet testing)

The Config > Set (Stream Control) screen provides the tools required to configure or edit any or all of the four packet streams.

To configure a packet stream:

1. Select the **Packet** tab. *(After configuring the desired LAN/WAN setting from the OTN, SONET or SDH tab)*
2. Select **Config** and choose **Set**.

3. Select a stream (1, 2, 3, or 4) from the Stream Profile table. The Traffic Stream Profile table appears.
4. From the Traffic Stream Profile table, set the parameters for the packet stream.
5. Select **Save**. The stream configuration parameters display in the Stream Profile table.

Use the vertical scroll bar at the bottom of the Stream Profile table to view hidden columns.

To use the **Order Columns** feature :

1. Select the **Columns** button, to display the **Rearrange Columns** dialog box.
2. In the **Rearrange Columns** dialog box, select the **Columns** button to display the **Select Next Column** dialog box.
3. In the **Select Next Column** dialog box, select a button for the associated description to appear in the top row of the display. The **Select Next Column** dialog box disappears and your selection appears in the top row of **Rearrange Columns** dialog box display window.
4. Again, in the **Rearrange Columns** dialog box, select the **Columns** button to redisplay the **Select Next Column** dialog box.
5. In the **Select Next Column** dialog box, select another button for the associated description to appear in order immediately following the previous row entry. The **Select Next Column** dialog box again disappears.
6. Repeat Steps 4 and 5 to select the chosen order for all remaining entries in the **Select Next Column** dialog box.
7. There are two choices for submitting the selected column display order: (1) Selecting the **Apply** button retains the column display order settings until the next time the unit's power is cycled; (2) Selecting the **Save** button retains the column display order settings indefinitely.

The **Columns** settings entered locally on the touch screen panel and those entered via a remote connection are completely independent of each other. The remote settings are saved on the remotely connected PC, while the local settings are saved in the unit. The **Clear** button can be used to clear the entries in the **Rearrange Columns** dialog box display window, should you want to rearrange the existing order in the display window. The **Cancel** button can be used to cancel out of the operation without changing the existing column display order. Clicking on the **Apply** button when no items are listed in the display window will set up the default columns display order.

Enabling VLAN Tagging

Enabling VLAN tagging allows the user to create a 4-byte VLAN identifier value to be inserted into the packet stream.

To enable VLAN tagging:

1. Select **Config** and choose **Set**.
2. From the **Stream Profile** table, select the packet stream (**1**, **2**, **3**, or **4**) that you want to enable VLAN tagging on. The Traffic Stream Profile dialog box appears.
3. From the Traffic Stream Profile dialog box, select **VLAN Tag** and choose **Yes**.
4. Select **VLAN ID** and enter an ID value to the stream.
5. Select **VLAN QOS** and enter a user priority value.
6. Select **Save**.

Initiating LAN/WAN Auto Negotiation
(Specifically for LAN/WAN Ethernet testing)

Negotiation is an Ethernet handshaking mechanism that looks at the incoming signal and determines the link speed and duplex mode (full-duplex or half-duplex). The Negotiate button enables or disables negotiation mode.

When auto negotiation is first enabled, it attempts to negotiate the link with a remote device. After successful negotiation, negotiation will not be performed again unless the remote device initiates an auto negotiation sequence.

By disabling auto negotiation, the test set can simulate older Ethernet equipment that does not support auto negotiation logic.

Negotiate is only available for 1Gbps Optical LAN.

To enable auto negotiation:

1. Select the **SONET/SDH** tab, choose **1G LAN** from the Interface menu, then select the **Packet** tab.
2. Select **Config** and choose **Set**.
3. Select **Negotiate** and choose **Enabled**.

- When first enabled, the Status displays "Enabled". Upon successful negotiation with a remote device, the Status displays the negotiated Interface Rate and Duplex mode.

To disable auto negotiation:

1. Select **Config** and choose **Set**.
2. Select **Negotiate** and choose **Disable**.
    - When disabled, the Status displays "Disabled".

Transmitting LAN/WAN Packet Streams
(Specifically for LAN/WAN Ethernet testing)

The Config > Set (Stream Control) screen provides the tools required to configure or edit any or all of the four packet streams.

To start transmission of all packet streams:

1. Select the **Packet** tab. *(After configuring the desired LAN/WAN setting from the OTN, SONET or SDH tab)*
2. Select **Config** and choose **Set**.
3. Select **Tx Mode** to turn all streams On or Off.

Important: "Tx Mode" and individual stream TX on/off buttons are not available when IP Reflection is enabled.

4. The stream transmission status displays in the TX State column of the Stream Profile table.
5. Packets begin or stop transmitting as soon as the Tx Mode is selected. Count statistics continually increment in the Count Statistics table while the streams are active.

To start transmission of specific packet streams:

1. Select the **Packet** tab. *(After configuring the desired LAN/WAN setting from the OTN, SONET or SDH tab)*
2. Select **Config** and choose **Set**.
3. From the **Stream Profile** table, select the packet stream (**1**, **2**, **3**, or **4**) that you want to transmit. The Traffic Stream Profile dialog box appears.
4. From the Traffic Stream Profile dialog box, select **TX Enable** to turn the stream On or Off.
5. Select **Save**. The Traffic Stream Profile dialog box closes and the stream transmission status displays in the TX State column of the Stream Profile table.

6. The packet begins or stops transmitting as soon as the TX Enable command is saved. Count statistics continually increment in the Count Statistics table while the stream is active.

Inserting a Pause into a Stream

Pausing frames is a means of flow control that specifies how long the transmitting device should remain quite. The flow control gives limited ability to regulate a (high bandwidth) source by sending pause frames to the source. Inserting a pause into a stream causes the source to stop sending frames for a specified amount of time, allowing the (low bandwidth) receiver to catch up and process queued frames.

To start insert a pause in a packet stream:

1. Select **Config** and choose **Set**.
2. Select **Pause**. The Enter Pause Quanta keypad appears.

Important: Pause is not available when **IP Reflection** is enabled.

Important: **Flow Control** must be enabled in order to count received Pause Packets.

4. Enter a pause value and select **OK**. Valid pause values are 0-65535.

Inserting LAN/WAN Errors
(Specifically for LAN/WAN Ethernet testing)

To determine if receiving equipment can detect an error on an incoming signal, you can configure the system to insert specific errors into an Ethernet stream.

Note that error insertion is disabled when in IP Reflection Mode.

To insert multiple errors:

1. Select the **Packet** tab. *(After configuring the desired LAN/WAN setting from the OTN, SONET or SDH tab)*
2. Select **Config** and choose **Set**.
3. From the **Stream Profile** table, select the packet stream (**1**, **2**, **3**, or **4**) that you want to inject errors into. The Traffic Stream Profile dialog box appears.
4. Select **TX Enable** to turn the transmission status **On** and choose **Save**.
5. Select **Error / Alarm** from the tabs along the left side of the Config Screen.
6. Select **Error Type** and choose an error type from the Select Error Type dialog box.

7. Select **Error Rate** and choose an error rate from the Select Error Rate to Insert dialog box.
8. Errors immediately start injecting into the packet stream when the error rate is selected.
9. View various result statistics by selecting the **Results** function.

To stop error transmission select **Error Rate** and choose **Off**.

To insert a single error:

1. Select the **Packet** tab, select either **GFP Bulk, GFP Framed Ethernet** or **GFP Transparent** mode.

> Important: Traffic generation on at least one stream must be enabled to inject errors.

2. Select **Error / Alarm** from the tabs along the left side of the Config Screen.
3. Select **Error Type** and choose an error type from the Select Error Type dialog box.

> Important: DO NOT set an Error Rate when inserting a single error.

4. If you want to clear any previously collected data, select **Restart** from the common function button at the bottom of the screen before inserting the error.
5. Select the **Error Insert** common function button at the bottom of the screen.
6. View various result statistics by selecting the **Results** function.

Viewing LAN/WAN Error and Alarm Results
(Specifically for LAN/WAN Ethernet testing)

After inserting error and alarms into a packet stream the receiving equipment detects the event and reports it. The Results screen provides different result reports.

To view error or alarm results:

1. From the **Packet** tab, select **Results**.
2. Select one of the following:
    - Scan - Displays a list of errors and alarms along with their count and duration.
    - ERR - Displays a list of errors along with their count, errored seconds, average and current rates.

- ALARM - Displays a list of alarms along with the number of seconds spent in the alarm condition.
- Count - Displays Packet and VLAN count statistics.
- Strm Rslt - Displays Stream ID specific statistics.
- Event - Displays a summary of error alarm activity.
- Large LEDs - Displays easy to read LEDs of error alarm activity.

Configuring an RFC-2544 Test

RFC 2544 benchmark tests provides a specific set of tests that can be used to measure and report the performance characteristics of network devices. Test results provide data used to evaluate these devices. The steps below provide preliminary stream configuration instructions.

Note that if the Flow Control box is checked (Rx Enabled), it will automatically default to unchecked when an RFC test is activated. This is to ensure test validity and accuracy.

To configure the an RFC test:

1. Select **RFC Tests** and choose **Conf**.
2. Select **Stream ID** and choose the packet stream (**1**, **2**, **3**, or **4**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.
4. Select **Dest Port** and choose the port that will receive the test signal.

   Note that if a port is in IP Reflection Mode, or is already in an active RFC test, this setting will be unavailable.

5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

   To assign a user-defined frame size:

   a. Select a **Packet Size** button (for example, 64). A keypad appears.
   b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
   c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.

8. Select the type of RFC test that you wish to run by choosing its tab from along the left side of the RFC Tests screen. Complete any necessary configurations these tabs.

   - To run a **Thru Put** test see **Throughput Testing**
   - To run a **Frame Loss** test see **Frame Loss Testing**
   - To run a **B2B Burst** test see **Back-to-Back Burst Testing**

RFC-2544 - Throughput Testing

Throughput testing is an RFC 2544 benchmark test that calculates your network's throughput rate. The fastest throughput speed is indicated by the rate at which the transmission and reception of the Ethernet test stream is accomplished without packet loss.

For example, the Throughput test starts by transmitting a stream at 100% using a packet size of 64 bytes. If it fails (i.e., an unacceptable number of packets are lost), the stream transmission rate falls back a certain percentage and is transmitted again. This process continues until the test passes without losing packets. The test then tries to zero in on the best throughput rate based on the Resolution Rate. he final rate appears as the Passing Rate.

Once this is completed, the packet size is increased to 128 bytes, and the test is repeated until a passing rate is achieved. Subsequent tests are performed using default packet sizes of 256, 512, 1024, 1280, and 1518 bytes, or any user-defined sizes.

When performing a throughput test, you can adjust the following parameters to fine-tune your test results:

- Accept Lost Rate – Defines the percentage of frames that can be lost without being considered a failure.
- Resolution Rate – Sets the level of precision for the test. The finer the resolution, the longer it takes to complete the test.

A Throughput test cannot be performed if another RFC Test is running.

To configure the Throughput test:

configure the Frame Loss test:

1. Select **RFC Tests** and choose **Conf**.
2. Select **Stream ID** and choose the packet stream (**1**, **2**, **3**, or **4**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.
4. Select **Dest Port** and choose the port that will receive the test signal.
5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.
7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

   To assign a user-defined frame size:

   a. Select a **Packet Size** button (for example, 64). A keypad appears.
   b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
   c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.

8. Select **Thru Put** from the tabs along the left side of the RFC Tests screen.
9. Select **Accept Lost Rate** and enter an acceptable packet loss rate ranging from 0% to 100%. This value serves as a threshold. The default rate is 0%, which means that even one lost packet is a failure.
10. Select **Resolution Rate**, and enter a value ranging from 1% to 100%. The lower the rate, the more precise the measurement. The default rate is 1%.

To start the Throughput test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.

2. The unit immediately starts transmitting a test stream using the configured parameters, starting with the smallest packet size. The packets are looped through the network and returned to the unit. If no packet loss is reported, results are posted for the first packet size and the unit starts transmitting a stream containing packets for the next size byte frame. (For example, the first packet size transmitted is 64-bytes followed by 128-bytes and so on.)

   If packet loss is detected in a byte transmission, the stream is re-transmitted at a reduced rate. This process continues until results are within the Resolution Rate percentage.

3. View Throughput test results on the statistics table at the bottom of the screen.
4. Select **Print**. The File Browser window appears, which allows you to name and save results to a file using the .thru extension. (The file can be printed or saved locally on the unit, or remotely on a PC if using the Remote Control Application software.)
5. To save and print Throughput test results see Saving and Printing Statistics and Port Settings.

RFC-2544 - Frame Loss Testing

Frame Loss testing is an RFC 2544 benchmark test. Its purpose is to determine the number of packets lost, by looping a stream through the network at varying transmit packet rates. The Frame Loss screen allows you to select a specific packet size to use in the Ethernet stream.

A Frame Loss test cannot be performed if another RFC Test is running.

To configure the Frame Loss test:

1. Select **RFC Tests** and choose **Conf**.
2. Select **Stream ID** and choose the packet stream (**1**, **2**, **3**, or **4**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.
4. Select **Dest Port** and choose the port that will receive the test signal.
5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

   IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.
7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

   To assign a user-defined frame size:

   a. Select a **Packet Size** button (for example, 64). A keypad appears.
   b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
   c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.

8. Select **Frame Loss** from the tabs along the left side of the RFC Tests screen.

To start the Frame Loss test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.
2. The unit immediately starts transmitting a test stream at 10% of the maximum byte-size rate. When multiple frame sizes are selected, the transmission starts at the lowest size.

   A status message appears at the bottom of the screen indicating the current frame size and stream rate that is being transmitted. For example, Processing size 64 Rate 10.00. When this completes, the number of frames transmitted and the number of frames received appears in the Frame Loss table. This process continues until 100% of the maximum byte-size rate is reached (at 10% increments).

   After transmitting at 100%, the entire test is repeated using the next larger frame size, for example, 128, 256, 512, 1024, 1280, and 1518 bytes.

3. View Frame Loss test results on the statistics table at the bottom of the screen. The table displays the frame loss test results for a specified packet size. The results represent the nine rates determined by the BW Ceiling and BW Floor settings.

   To change the packet size and view its results:

   Choose the **Packet Size** button (for example, 256). The Frame Loss table displays the transmit and receive statistics for the selected packet size.

OR

Select the **First**, **Prev**, **Next**, or **Last** button to move through the frame sizes.

Important: The status message that appears at the bottom of the screen always indicates which frame size and stream rate is currently being transmitted and not the report statistics selected.

4. Select **Print**. The File Browser window appears, which allows you to name and save results to a file using the .loss extension. (The file can be printed or saved locally on the unit, or remotely on a PC if using the Remote Control Application software.)
5. To save and print test results see Saving and Printing Statistics and Port Settings.

RFC-2544 - B2B Burst Testing

This is an RFC 2544 benchmark test. Back-to-Back Burst test is used to determine the buffering capability of the Device Under Test (DUT). This is done by sending a burst of frames to the unit, and then counting how many frames are forwarded by the unit.

During the test a burst of fixed length frames with the minimum inter-frame gap between them is sent through the packet stream. The trial duration must be between 2 and 10 seconds. The RFC standard recommends (but does not required) that this trial should be repeated at least 50 times with the average value reported.

If the unit successfully transmits all the frames that it receives, the frame burst size is increased and the test is repeated. If this stage of the test fails, the frame burst size is halved and the test is repeated until the unit successfully transmits the frame burst. The default frame burst sizes used are 64, 128, 256, 512, 1024, 1280, and 1518 bytes.

A Back-to-Back Burst test cannot be performed if another RFC Test is running.

To configure the B2B Burst test:

1. Select **RFC Tests** and choose **Conf**.

   The **BW Ceiling** and **BW Floor** settings do not apply to the Back-to-Back Burst test.

2. Select **Stream ID** and choose the packet stream (**1**, **2**, **3**, or **4**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.

   This value determines how long each trial runs. Valid values range from 2 to 10 seconds.

4. Select **Dest Port** and choose the port that will receive the test signal.

6. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

   To assign a user-defined frame size:

   a. Select a **Packet Size** button (for example, 64). A keypad appears.
   b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
   c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.

8. Select **B2B Burst** from the tabs along the left side of the RFC Tests screen.
9. Select **Resolution (in frames)**. A keypad appears.
10. Enter a precision level for the test. The value is the number of frames in the longest burst that the DUT will handle without the loss of any frames.
11. Select **# Of Repetitions**. A keypad appears.
12. Enter the number of times the trial length should be repeated. The RFC recommended repetition is 50.

To start the Back-to-Back test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.
2. The unit immediately starts sending a burst of frames with the minimum inter-frame gap between them. If all frames are received, the burst size is increased and the test repeated. If all frames are not received, the burst size is lowered and the test repeated until the longest burst the DUT can handle (without loss of frames) is determined.
3. View B2B Burst test results on the statistics table at the bottom of the screen.
   - Frame Size (bytes) – Indicates the tested frame size.
   - Max Possible Number of Frames – Indicates the number of frames transmitted without errors.
   - Avg Observed B2B Frames – Indicates the data stream's average frame count.

4. Select **Print**. The File Browser window appears, which allows you to name and save results to a file using the .b2b extension. (The file can be printed or saved locally on the unit, or remotely on a PC if using the Remote Control Application software.)
5. To save and print test results see Saving and Printing Statistics and Port Settings.

Timed Test - Using Acceptance Criteria

The NIC unit has the capability to run a timed test (a test with Ethernet streams enabled for a certain time period) specifying user-defined acceptance criteria for Pass/Fail results.

To Set Up the Test

1. Set up the port on which the test will be initiated. This includes the ports Interface, stream parameters. A test can be performed on a single port or port-to-port basis.
2. Enable the stream(s) to be used for the test.
3. Under the Results > Strm Rslt tab, configure the acceptance criteria options. These include Acceptable Loss Rate, Acceptable Out of Sequence rate, and Acceptable Bit Error rate. These values are set up on a stream-by-stream basis.
4. Under the Test tab, select the desired duration for the test. Note that if "Continuous" is used, the test will continue to operate until manually interrupted.
5. Restart the port that will be used for the timed test using the Restart button at the bottom of the screen.
6. When the time duration of the test is reached, the Ethernet streams will automatically stop counting received packets and the Pass/Fail acceptance results are displayed under the Results > Strm Rslt tab.

A typical screen is shown below with two of the three parameters (Accept Loss Rate and Accept Out of Seq) already set and the third (Accept Bit Error) ready to be set by using the pop-up Select Rate window.

User-Defined Acceptance Criteria

Accept Loss Rate: A user-specified threshold value for determining the acceptable Packet Loss rate for a timed test. Test results are displayed as the calculated loss rate and a Pass/Fail status.

Accept Out of Seq: A user-specified threshold value for determining the acceptable Out of Sequence packet rate for a timed test. Test results are displayed as an error count, rate, and Pass/Fail status.

Accept Bit Error: A user-specified threshold value for determining the acceptable bit error rate for a timed test. Test results are displayed as an error count, rate, and Pass/Fail status.

Measuring Service Disruption

The system can measure service disruption switching intervals in your network by monitoring for a specific event, such as FCS errors, that cause a service disruption switch. When an event occurs, the duration is logged in milliseconds. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The Ethernet service disruption tests show a granularity accuracy of 0.1 ms (100 µs).

To measure Ethernet service disruption activity:

1. Select the **Test** tab and choose **Service Disrptn** from the tabs along the left-side of the screen.
2. Select **Consecutive Good Time Required** and enter a time interval ranging from 10 milliseconds to 1638.3 milliseconds. This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.
3. Select **Consecutive Bad Time Required** and enter a time interval ranging from 0.1 milliseconds to 1638.3 milliseconds. This function allows you to enter the time-duration (in milliseconds) of consecutive errored frames to elapse before Protection Switch measurements begin to accumulate.
4. From the **Action** box, select **State**. The Select APS Action dialog box appears.
5. Select **Single APS** or **Continuous APS** to begin measuring. The test set will begin monitoring the incoming signal for the event. If it occurs, the protection switch state and time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for consecutive good and bad time parameters.
6. In the **Protection Switch Time (MilliSecs)** table, view the duration, in seconds, that it took for the service disruption to occur.

7. In the History Recent MilliSeconds table, view a history of events. The complete summary of events can be viewed by selecting the **System** tab and choosing **Service Disruption**.

To stop monitoring Service Disruption measurement activity:

1. Select the **Test** tab and choose **Service Disrptn** from the tabs along the left-side of the screen.
2. From the **Action** box, select **State** and choose **Stop APS**.

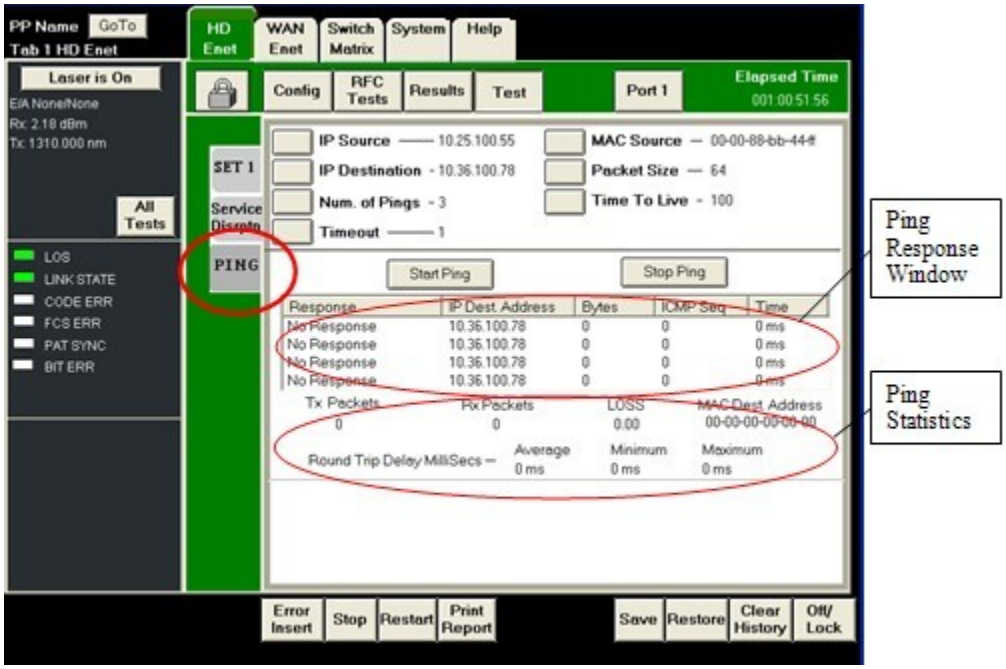
PING Functionality

PING is a utility used to determine whether a specific IP address is accessible. It works by sending a packet to the specified address and waits for a reply. PING is used primarily to troubleshoot Internet connections.

A PING packet is an IP packet requesting that a copy of the contents be echoed back to the sender. This packet type is called an ICMP Echo Request. When a site is “pinged”, an echo request is sent, and the destination site that receives it responds back. The response packet is called an ICMP Echo Reply.

The Ping utility is essentially a system administrator's tool that is used to see if a computer is operating and also to see if network connections are intact. Ping uses the Internet Control Message Protocol (ICMP) Echo function which is detailed in RFC 792.

The PING screen selection is implemented under the Test Tab.



Saving and Printing Statistics and Port Settings

The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and Stream Test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.

The following reports are available:

- Settings - (.set extension) Reports the Stream Settings for the selected Port .
- Statistics - (.stat extension) Reports all Steam Tx/Rx Packet counts, Errors, and Alarms.
- Events - (.evt extension) Reports a summary of Events, such as alarm and error activity.
- APS (.aps extension) Reports Service Disruption statistics.
- RFC Thru Put - (.thru extension) Reports the Throughput test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).
- RFC Frame Loss - (.loss extension) Reports the Frame Loss test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).
- RFC B2B Burst - (.b2b extension) Reports the Back to Back Burst test settings and a summary of the test results for each packet size (Max Possible Number of Frames, and Average Observed B2B Frames).

To save or print RFC test results:

1. Configure and run Packet Stream transmissions or run an RFC test such as Throughput, Frame Loss, B2B Burst.
2. Select the **Print Report** common function button located at the bottom of the screen. The Report Setup dialog box appears.
3. Choose one of the following:
    - From Destination Printer:

        ▶ Select one or multiple reports to print directly to a printer. If printing a report from the NIC unit, make sure that a printer is attached to the unit's parallel or serial port.

    - From Destination File:

        ▶ Select one or multiple reports to print to a file. The File Browser dialog box appears.

The Comma Delimiter option can be applied to

the Settings To File and Statistics To File reports.

▶ Enter a file name and select **OK**.

Important: Files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC. The NIC unit saves the files to its default D:\DLI... drive on the test unit.

▶ For instructions on retrieving saved files see Printing or Viewing Saved Files.

4. Click the **Input** button to enter any User Comments that you wish to appear in the printed or saved report file. Press the **Clear** button to clear the User Comments.
5. Select **OK**.

LAN/WAN Screen and Function Description

LAN/WAN Ethernet Screen Functions and Descriptions Overview

This section describes the various screens and functions that control the configurations and operations of the 1Mbps, 10Mbps and 11Mbps Ethernet Interfaces, as well as the 10Gbps WAN mapping for OC-192/STM-64 Interface:

- Config
- RFC Tests
- Results
- Test
- LEDs

Config

Config Screens and Functions

(Specifically for LAN/WAN Ethernet testing)

The Config screen contains the following functions:

- Set
- Traffic Stream Profile
- Error Alarm

Config - Set screen

(Specifically for LAN/WAN Ethernet testing)

The Config > Set (Stream Control) screen allows you to define the Ethernet parameters that will be used to generate a traffic flow or stream into the network. Up to four different streams can be generated simultaneous.

The following functions appear on the Config > Set screen when the Mode is set to **10 Gbps Optical LAN/WAN** or **1Gbps Optical LAN:**

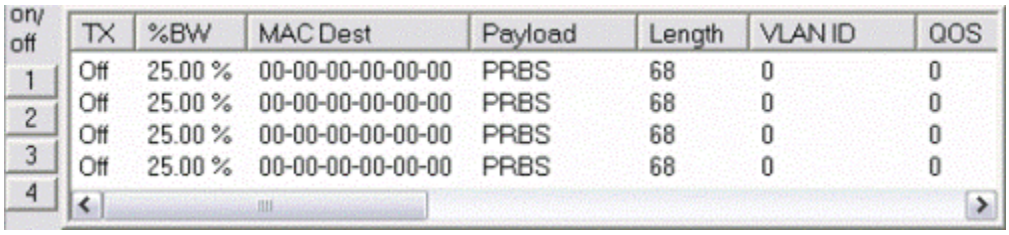
Function	Description
Mode	Selects which Mode to test. For 10G/11G LAN interface rates the options are • 10 Gbps Optical LAN • 10 Gbps Seed A/B For 10G WAN mapping and 1G LAN interface, there are no Mode settings.

Negotiate	Allows the user to enable or disable the Auto Negotiation function. **Enabled** - Enabling auto negotiation allows the system to look at the incoming signal and automatically determine the link speed and duplex mode of the port's remote device and adjust accordingly. **Disabled** - Disabling auto negotiation allows the test set to simulate older Ethernet equipment that does not support auto negotiation logic. This setting is only available for 1Gbps Optical LAN.
Status	Displays the Negotiation status information. This setting is only available for 1Gbps Optical LAN.
Col (Columns)	Rearrange order of columns displayed in the Stream Profile Table
Reflect	Allows the user to start IP Packet Reflection Mode for DLI Packets or All Non-Routing Packets.
Flow Control	Enable or Disable Flow Control Important: Flow Control must be enabled in order to count Pause Packets.
TX Mode	Starts and stops the transmission of ALL streams. The status of the stream transmission is displayed in the “TX” column of the Stream Profile table. Selecting TX Mode while all streams are “Off” will turn all streams “On”. If at least one stream is “On”, selecting TX Mode will turn all streams “Off”.

Pause	Allows the user to generate Pause frames and set Pause Quanta value, Valid values are 1-65535. Important: Flow Control must be enabled in order to count Pause Packets. Important: Send Pause is not available when IP Reflection is enabled.
Stream Profile Table	The Stream Profile Table contains four packet streams that can be configured. Selecting a stream from the profile table opens the Traffic Stream Profile dialog box from which the stream parameters are configured. A total of four streams can be configured and saved for each port. Use the horizontal scroll bar at the bottom of the table to view hidden columns for the stream settings. See below for more information on the Stream Profile Table.

Count Statistics Table	The Count Statistics Table displays the following information for both transmitted (TX) and received (RX) packets: • **TX/RX** - Defines which row of statistics is designated for Transmit counts (TX) and which row is designated for Receive counts (RX) • **Packets** - Displays the total number of packets sent and received since the test was started • **Pkts/sec** - Displays the current rate of packets sent and received in packets per second • **Bytes** - Displays the total number of bytes sent and received since the test was started • **Mbit/sec** - Displays the current rate of packets sent and received in Megabits per second • **%BW** - Displays the current percentage of bandwidth of packets sent and received

Information about the configuration of the streams are displayed in the Stream Profile Table.



At the left, there are four (4) buttons to turn on and off each individual stream. The other columns of information can be seen by using the scroll bar at the bottom or by rearranging the columns. These are the columns (note that the sequence may be different, depending upon how the user has arranged the columns):

TX	Indicates whether that stream 1-4 is being transmitted
%BW	Percentage of bandwidth selected on that stream
MAC Dest	Destination MAC address
Payload	Payload Pattern selected
Length	Frame Length
VLAN ID	VLAN ID selected
VLAN QOS	VLAN QOS selected
IP Dest	Destination IP address
UDP Port Dest	UDP Destination Port
MAC Src	Source MAC address
IP Src	Source IP address
UDP Port Src	UDP Source Port
VLAN Tag	VLAN Tag (yes or no)
IP TOS	IP Type of Service
IP TTL	IP Time to Live
IP FRAG	Select whether to allow or disallow fragments

Traffic Stream Profile Configuration

(Specifically for LAN/WAN Ethernet testing)

A packet stream's profile defines the type, size, content, destination address, and source addresses for the frame

The **Traffic Stream Profile** dialog box is used to set the stream profile parameters. To access this dialog box, select any of the four streams in the Stream Profile Table.

The stream protocol is set to UDP/IP by default.

Parameter	**Description**

Stream ID #	Displays which of the four Streams the settings are being modified for. Displays which of the four Streams the settings are being modified for. The title bar of this Traffic Stream Profile window also shows which Stream ID # is currently selected
MAC Src Address	Sets a MAC source (origination) address for generated traffic. The address is a 12-digit (6-byte) HEX value that is entered using a keypad. The address is entered into 6 separate fields, 2 characters each. There are no restrictions on value entered but all a value must be entered in all fields.
MAC Dest Address	Sets a MAC destination address for generated traffic. The address is a 12-digit (6-byte) HEX value that is entered using a keypad. The address is entered into 6 separate fields, 2 characters each. There are no restrictions on value entered but all a value must be entered in all fields.
IP Src Address	Sets the IP address of the source (origination). The address is entered in decimal notation using a keypad. There are no restrictions on value entered but the format must be correct, i.e: xxx.xxx.xxx.xxx. If three digits are entered in a field, a period will be automatically added. If only one or two digits are entered, you must enter a period manually.

IP Dest Address	Sets the IP address of the destination. The address is entered in decimal notation using a keypad. There are no restrictions on value entered but the format must be correct, i.e: xxx.xxx.xxx.xxx. If three digits are entered in a field, a period will be automatically added. If only one or two digits are entered, you must enter a period manually.
UDP Src Port	Selects a User Data Protocol source port number (0 to 65535).
UDP Dest Port	Selects a User Data Protocol destination port number (0 to 65535). Note: Stream Counts are only displayed when UDP Dest Port is 312.
Frame Length	Sets the frame size (bytes). The frame size is entered as a decimal value, entered using a keypad, ranging from 64 to 9600. The default value is 64 bytes.

Rate	Sets the bandwidth percentage used. The value can be set using a bandwidth percent or Mbit/sec. Valid values are: • For 1 Gbps Optical LAN - 0.01 to 100%BW or 0.1 to 1000 Mb/s • For 10Gbps Optical LAN - 0.01 to 100%BW or 1 to 100000 Mb/s • For 10Gbps Optical WAN - 0.01 to 100%BW or 0.9 to 9294.2 Mb/s If the word "Pending" is shown, then the Mbit/Sec option will not be available until at least on stream is turned on, so that GFP can calculate the proper constraints for the data rate.
Payload	Sets the type of data used for the transmit stream's payload. The payload can be set to: • **PRBS 31** • **User Defined** (range from 1 bit to 32 bits and is entered using a touch screen keypad)
VLAN Tag	Enables VLAN tagging for the frame. The VLAN tag is a 4-byte tag that is inserted into the frame.
VLAN ID	Assigns a VLAN ID to the frame. This identifies to which VLAN the frame belongs. IDs are entered as a decimal value from 0 to 4095. (VLAN tagging must be enabled to use this parameter.)
VLAN QOS	Sets the user priority level. Levels range from 0 to 7.
IP TOS	Sets the IP Type of Service. TOS is a 2-character HEX value.

IP TTL	IP Time to Live. TTL is a decimal value from 0 to 255.
IP Fragment Flag	Select whether to allow or disallow fragments
Prev	Moves to the stream with the next lower number. If currently looking at stream #1, selecting “Prev” will bring up stream #4. Note that changes made will not be saved until “Save All” is selected.
Next	Moves to the stream with the next higher number. If currently looking at stream #4, selecting “Next” will bring up stream #1. Note that changes made will not be saved until “Save All” is selected.
Save All	Saves all changes made and closes the Traffic Stream Profile window.
Exit	Closes the Traffic Stream Profile window without saving changes.

Config - Errors and Alarms

(Specifically for LAN/WAN Ethernet testing)

The Error and Alarm screen allows the user to configure errors and alarms for insertion into a stream to simulate various defects and anomalies. Simulating defects can determine if the receiving equipment can detect and report an error in the incoming signal.

Note that error insertion is disabled when in IP Reflection Mode.

Option	**Description**
Error Type	Selects the type of error to transmit into a stream. Selecting one of the following will not send an error

	immediately but will only select the type of error to send when the “Send Error” button is pressed or when a rate is selected. The following types are available: • **Line Code** - Generates line code errors • **FCS -** Generates an invalid Frame Check Sequence • **IP Checksum** - Generates an invalid IP header checksum • **Bit Error (Stream #n)** - Generates bit errors in the payload for the specified stream number. • **Sequence Error (Stream #n)** - Generates Sequence errors in the payload for the specified stream number.
Error Rate	Selects the error rate to be transmitted for the selected error type. Once the error rate is selected, the system begins transmitting errors. Select one of the following: • **1E-<x>** - *X* is an exponential value from 2 to 10. Selecting one of these sets the error rate to 1 x 10^{-x} (The smaller the exponential the higher the error rate.) • **User Defined** – Enter the desired error rate in increments of 0.1. For example, with user defined, error rates are not limited to 1 x 10^{-x} but more exact choices are available such as 2.6 x 10^{-4} or 7.1 x 10^{-3}
Reply to Local Fault	When enabled, the test interface will respond to Local Fault alarms by

	generating Remote Faults This setting is only available for 10Gbps Optical LAN/WAN.

RFC Tests

RFC Tests - Screen Functions and Descriptions Overview

The RFC Tests screen contains the following functions:

- Conf
- Thru Put
- Frame Loss
- B2B Burst

RFC Tests - Configuration (Conf)

RFC testing provides a specific set of tests that can be used to measure and report the performance characteristics of network devices. The RFC Tests Conf screen provides the preliminary stream configuration settings. After these settings are made the user selects the type of RFC test to initiate by choosing its tab along the left side of the RFC Tests screen.

The following options appear on the Conf screen:

Option	Description
Stream ID	Allows the user to select one of the four streams for the RFC test.
Trial Duration	Determines how long the test runs for each packet size. This duration is used each time the test fails. Valid duration values are 1-600 seconds. The default value is 240 seconds.
Dest MAC Address	Reflects the destination MAC address for the selected Stream. The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Allows the user to select the destination port that will receive the

	test signals. If a port is in IP Reflection Mode, or is already in an active RFC test, it will not appear in the Select Port window.
Restore to RFC Standard Setting	Returns frame sizes to default RFC test standards when user-defined sizes have been set.
Enable/Disable check boxes	Allows the user to select the packet sizes that will be used for the RFC tests.
Packet Sizes	Displays the packet sizes. Selecting a Packet Size button allows the user to assign a user-defined frame size to the packet. Valid value ranges are 64 - 9600.
BW Ceiling	Sets the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100. IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.
BW Floor	Sets the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99. IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

RFC Tests - Through Put Test (Thru Put)

This is an RFC 2544 benchmark test that calculates your network's throughput rate. The fastest throughput speed is indicated by the rate at which the transmission and reception of the Ethernet test stream is accomplished without packet loss.

The following options appear on the Thru Put screen:

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test. The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails. The Trial Duration is configured from the RFC Tests - Conf screen.
BW Ceiling	Displays the setting for the high-end of the bandwidth test range. The BW Ceiling is configured from the RFC Tests - Conf screen.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test. The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal. The Dest Port is configured from the RFC Tests - Conf screen.
BW Floor	Displays the setting for the low-end of the bandwidth test range. The BW Floor is configured from the RFC Tests - Conf screen.
Accept Lost Rate	Sets a packet loss rate threshold.

	The test fails if packet loss exceeds this value. Valid values are 0-100%. The default is 0%, which means that even one lost packet is a failure.
Resolution Rate	Sets a level of precision for the test. The default resolution is 1%. The finer the resolution (for example, 1%), the longer it takes to complete the test; the less precise the test (for example, 10%), the faster the test completes but with less accuracy.
Statistics Table	Reports the test results. The following statistics are displayed: **Size** - Indicates the transmitted test packet size. **Rate** - Reports the passing rate (percentage) for the specific packet size. **TX Packets** - Reports the number of packets transmitted in the stream for the frame. **RX Packets** - Reports the number of packets received by the test set. **Latency Min/Max/Avg** - Reports how long it takes for the test frames to traverse the network and return to the unit. The values that appear are in milliseconds. If the test set is looped to itself with a short patch cable, the latency may appear as 0 ms.
Start/Stop Test	Starts and stops the Through Put test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

RFC Tests - Frame Loss Test

This is an RFC 2544 benchmark test. Its purpose is to determine the number of frames lost by looping a stream (with a specified frame size) through the network at varying transmit frame rates. Select Frame Loss Testing for test procedures.

The following options appear on the Frame Loss screen:

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test. The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails. The Trial Duration is configured from the RFC Tests - Conf screen.
BW Ceiling	Displays the setting for the high-end of the bandwidth test range. The BW Ceiling is configured from the RFC Tests - Conf screen.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test. The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal. The Dest Port is configured from the RFC Tests - Conf screen.
BW Floor	Displays the setting for the low-end of the bandwidth test range. The BW Floor is configured from the RFC Tests - Conf screen.
Packet Size buttons	Determines which packet size results

	appear in the statistics table. Selecting a packet size button displays its results.
Statistics Table	Displays the frame loss test results for a specified packet size. The results display the nine rates determined by the BW Ceiling and BW Floor settings. The following statistics are displayed: **Rate %** - Indicates the percentage of bandwidth transmitted using the bandwidth ceiling and floor settings. **Transmit Frames** - Reports the total number of frames transmitted. **Receive Frames** - Reports the total number of frames received. **Loss %** - Reports the percentage of frame loss that occurred during the test. This calculation is the received frames divided by transmitted frames.
First, Prev, Next, Last	Allows the user to scroll through packet sizes to view their test results.
Start/Stop Test	Starts and stops the Frame Loss test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

RFC Tests - Back-To-Back Burst Test (B2B Burst)

This is an RFC 2544 benchmark test. Back-to-Back Burst test is used to determine the buffering capability of the Device Under Test (DUT). This is done by sending a burst of frames to the unit, and then counting how many frames are forwarded by the unit.

During the test a burst of fixed length frames with the minimum inter-frame gap between them is sent through the packet stream. The trial duration must be between 2 and 10 seconds. The RFC standard recommends (but does not required) that this trial should be repeated at least 50 times with the average value reported.

If the unit successfully transmits all the frames that it receives, the frame burst size is increased and the test is repeated. If this stage of the test fails, the frame burst size is halved and the test is repeated until the unit successfully transmits the frame burst. The default frame burst sizes used are 64, 128, 256, 512, 1024, 1280, and 1518 bytes.

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test. The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails. The Trial Duration is configured from the RFC Tests - Conf screen. Important: The trial duration must be between 2 and 10 seconds.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test. The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal. The Dest Port is configured from the RFC Tests - Conf screen.
Resolution (in frame:)	Sets the level of precision for the B2B test, by frames. The value is the number of frames in the longest burst that the DUT will handle without the loss of any frames. Valid values are 1-812.
# Of Repetitions	Enter the number of times the trial length should be repeated. The RFC recommended repetition is 50,

	however valid values are 1-100.
Statistics Table	Reports the test results. The system recovery results are displayed by Frame Size (bytes) tested as follows: • Max Possible Number of Frames - The frame rate (resolution) used as the throughput rate. • Avg Observed B2B Frames - Average frame count for each type of data stream tested.
Start/Stop Test	Starts and stops the Back-to-Back Burst test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

The **BW Ceiling** and **BW Floor** settings do not apply to the Back-to-Back Burst test.

Results

Results Screens and Functions

(Specifically for LAN/WAN Ethernet testing)

Test activity and event history can be viewed using the various functions of the Results screen.

The Results screen contains the following functions:

- Scan - Displays a list of errors and alarms along with their count and duration.
- ERR - Displays a list of errors along with their count, errored seconds, average and current rates.
- ALARM - Displays a list of alarms along with the number of seconds spent in the alarm condition.
- Count - Displays Packet and VLAN count statistics.
- Strm Rslt - Displays Stream ID specific statistics.
- Event - Displays a summary of error alarm activity.
- Large LEDs - Displays easy to read LEDs of error alarm activity.

Results - Scan Screen

(Specifically for LAN/WAN Ethernet testing)

This function displays a list of received errors and alarms.

For **alarms**, the duration is reported as a count in seconds.

For **errors**, an error count is reported.

The message *No Errors or Alarms* appears if no events are received by the system.

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

Results - ERR (Errors) Screen

(Specifically for LAN/WAN Ethernet testing)

The Err screen reports error statistics on the incoming signal.

The following statistics appear:

Statistic	Description
Error	Displays the error type recognized and recorded by the unit.
Count	Displays the number of errors.
Errored Seconds	Displays the number of errored seconds.
Average	Displays the average error rate using an N.NNe-N format.
Current	Displays the current error rate using an N.NNe-N format.

The following error types can be monitored:

- **Code**
- **Undersized**
- **Invalid FCS**
- **Invalid IP**
- **Stream #1 Seq**
- **Stream #1 Bit**
- **Stream #2 Seq**
- **Stream #2 Bit**
- **Stream #3 Seq**
- **Stream #3 Bit**

- **Stream #4 Seq**
- **Stream #4 Bit**
- **Runts**

Results - Alarm Screen

(Specifically for LAN/WAN Ethernet testing)

The Alarm screen reports the various alarms detected by the receiving equipment.

The following statistics appear:

Statistic	Description
Alarm Description	Displays the alarm type recognized and recorded by the unit.
Seconds	Displays the number of seconds the alarm spent in the alarm condition.

The following alarm types can be monitored:

- **CP Power Loss**
- **Paused**
- **LOS**
- **Link Down**
- **Local Fault**
- **Remote Fault**
- **Stream #1 Pat Sync**
- **Stream #2 Pat Sync**
- **Stream #3 Pat Sync**
- **Stream #4 Pat Sync**

Results - Strm Rslt (Stream Results) Screen

(Specifically for LAN/WAN Ethernet testing)

The Stream Results screen displays statistics for a specified incoming packet stream. The screen allows you to scroll through the different packet streams and view their individual results.

The following statistics appear:

Statistic	Description
Selected Stream Entry	Displays the stream ID number and its MAC source and MAC destination addresses to which the Total Stream Statistics data on the stream control screen belongs.
Total Stream Statistics Table	Provides transmit and receive statistics by Count and %BW. • Count - Displays the total number for the criteria. • %BW - Displays the total percent of bandwidth used by the stream.
Transmit Statistics	Provides statistic totals, by count and/or percent of bandwidth, for the following criteria: • Packets Transmitted • Bytes Transmitted • %BW Transmitted
Receive Statistics	Provides statistic totals, by count and/or percent of bandwidth, for the following criteria: • Packets Received • Bytes Received • %BW Received • Out of Sequence Packets - Each sent packet is marked with a sequence number. This count is incremented when a packet arrives that has a sequence number different than one plus the sequence number of the previous packet. • Bit Errors Received
Latency Values (in microseconds)	Displays minimum, average, and maximum latency (delay) values over time. A latency measurement is taken

	every quarter-second (0.25 sec.) during stream transmission. These values are updated (realtime) as new latency measurements are logged. If the unit is looped on itself, the latency may appear as 0 µs.
User-Defined Acceptance Criteria (Refer to "Timed Test Using Acceptance Criteria")	**Accept Loss Rate:** A user-specified threshold value for determining the acceptable Packet Loss rate for a timed test. Test results are displayed as the calculated loss rate and a Pass/Fail status. **Accept Out of Seq:** A user-specified threshold value for determining the acceptable Out of Sequence packet rate for a timed test. Test results are displayed as an error count, rate, and Pass/Fail status. **Accept Bit Error:** A user-specified threshold value for determining the acceptable bit error rate for a timed test. Test results are displayed as an error count, rate, and Pass/Fail status.
First, Prev, Next, Last	Allows the user to scroll through the four packet streams and view their individual results. Selecting **First** immediately moves the stream statistics to Stream 1; selecting **Last** immediately moves the stream statistics to Stream 4; selecting **Prev** or **Next** moves the stream statistics to/from one stream to the next.

Results - Event Screen

(Specifically for LAN/WAN Ethernet testing)

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

Results - Count Screen

(Specifically for LAN/WAN Ethernet testing)

The Count screen displays Packets, VLAN, and Packet Size statistics by type and count.

To view packet results, select the **Packets** button. The following statistics appear:

Packets	Description
Transmit Packets	Reports the total number of packets sent.
Received Packets	Reports the total number of packets received.
Received Jumbo Packets	Reports the total number of jumbo packets received. Jumbo packets are those from 1519 – 9000 bytes in size.
Transmit Bytes	Reports the total number of bytes sent.
Received Bytes	Reports the total number of bytes received.
Pause Packets Received	Reports the total number of Pause frames received. Important: Flow Control must be enabled in order to count Pause Packets.
Pause Quantas Taken	Reports the total number of quantas received. A quanta is a 512-bit timing increment used by a Pause frame. The number of quanta (N x 512-bits) indicate the duration of the pause. Important: Flow Control must be

	enabled in order to count Pause Packets.
Pause End Packets	Reports the number of times that a Pause condition ended allowing data transmission to resume. The pause condition ends when the Pause frame's time parameter is set to 0. Important: Flow Control must be enabled in order to count Pause Packets.
IP Packets	Internet Protocol. Reports the total number of IP packets received.
ICMP Packets	Internet Control Message Protocol. Reports the total number of ICMP packets received.
TCP Packets	Reports the total number of TCP packets received.
UDP Packets	User Data Protocol. Reports the total number of UDP packets received.
IGMP Packets	Internet Group Management Protocol. Reports the total number of IGMP packets received.
Broadcast Packets	Reports the total number of Broadcast packets received.
Multicast Packets	Reports the total number of Multicast packets received.
Unicast Packets	Reports the total number of Unicast packets received.

To view VLAN results, select the **VLAN** button. The following statistics appear:

VLAN	**Description**
VLAN Tagged Frames	Reports the total number of frames received that are identified as VLAN frames. The 4-byte VLAN tag is inserted in

	the Ethernet frame between the Source MAC Address field and the Length/Type field.
Quality of Service Entry	Displays separate data rows for QOS entries 1-7. Reports the number of frames received for each user priority level value. A total of 8 different counters appear in the table.

To view Packet Size results, select the **Packet Sizes** button. The following statistics appear:

Packet Sizes	Description
Packet Byte Size	Reports the count and percentage of each packet size range found: 64; 65-127; 128-255; 256-511; 512-1023; 1024-1518; 1519-Max (Jumbo Packets).

Results - Large LEDs Screen

(Specifically for LAN/WAN Ethernet testing)

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

For a list of available LEDs for LAN/WAN, see LAN/WAN LEDs.

Test
Test - Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- Set 1
- Service Disruption
- PING

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Service Disruption

The unit can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The Ethernet service disruption tests show a granular accuracy of .1 ms (100 µs).

Test Service Disruption functions include:

- **Consecutive Good Time Required**: This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The range is 10 to 1638.3 milliseconds and is entered using a keypad.
- **Consecutive Bad Time Required**: This function allows you to enter the time-duration (in milliseconds) of consecutive errored frames to elapse

before Protection Switch measurements begin to accumulate. The range is 10 to 1638.3 milliseconds and is entered using a keypad.

- **State**: Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

  - **Single APS**: Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

  - **Continuous APS**: Constantly monitors for service disruption events, and updates the seconds and frames reported.

  - **Stop APS:** Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)**: Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.

For more information about monitoring service disruption activity, select *Measuring Service Disruption Activity* in the Specific Tasks section of the online help.

Test - PING

This section provides a brief overview of the PING functions that are available on the Test screen.

See the PING Functionality page for detailed descriptions on using the PING feature.

Function	Description
IP Source	This is the IP Source address that is used for the PING operation.
IP Destination	This is the IP Destination target address that is used for the PING operation.
Num. of PINGs	This is the number of PING attempts.
Timeout	This is the amount of time (in seconds) that the unit will wait for a

	PING reply. Valid values are 1-5 (secs.) in one-second intervals. The default value is 1.
MAC Source	This is the MAC Source address that is used for the PING operation.
Packet Size	This is the size of the PING packet used for the PING operation. Valid values are 64-9600 (bytes). The default value is 64.
Time To Live	One of the parameters on a PING packet (and any packet) is called "Time to live", or TTL. TTL is an IP header field designed to keep packets from running in loops, essentially forever, through a network (this can happen when there is a route change, and the routers involved don't all know the same information as new information is being replicated and updated). The TTL is usually set to somewhere between 64 and 255, and is reduced by 1 every time it passes through a server. If the TTL should ever reach 0, that packet has expired. The router that it is passing through will then send it back to the source. Valid values are 1-255 . The default value is 128.
Start PING	This begins the Ping Operation. When “Start PING” button is selected, the unit will send an ARP request to the target Destination IP address to determine what the MAC address is. When the ARP reply is received, the target MAC address will be displayed in the “MAC Dest Address” field.

	The specified number of PING requests will be sent, with the last 4 responses displayed in the PING Response Window. The statistics of the PING operation are displayed in the PING Statistics section.

LED Quick Status Area
(Specifically for LAN/WAN Ethernet testing)

When the **Packet** tab is selected for 10 Gbps Optical LAN/WAN or 1Gbps Optical LAN, the following status LEDs may appear in the LED Quick Status Area.

The LED indicates the instantaneous state of the specific condition. The text to the right of the LED is used as a “history” indicator. White text indicates that the specific error, alarm or condition has not been present during the current test. Red text indicates that the specific error, alarm or condition has been present during the current test.

Indicator, LED or Control	Description
Laser On/Laser Off Control	Pressing the button will toggle the status of the laser. If no SFP or XFP module is installed, the button will state “No Laser”.
RX:	Displays the received optical power in dBm.
TX:	Indicates current transmit laser wavelength.
E/A	Error/Alarm Indicator. Indicates the type of error inserted and/or alarm generated.
Test Paused	If red, indicates that the current test has been paused.
All Tests (button)	This is a short-cut button to the general "All Test Status" summary LED screen for all circuit packs installed in the unit.
LOS	Loss of Signal alarm status LED. When red, indicates that a valid signal is not being received. If an all zeros pattern exists for 100 milliseconds or longer on the incoming signal, then an LOS is reported.

Link State	Indicates the port's connection status. If green, the port is receiving a valid signal.
Code	Indicates an error (an invalid 10B code) was detected on the incoming Ethernet stream.
FCS ERR	Frame Check Sequence error status LED
RF	Remote Fault status LED
LF	Local Fault status LED
PAT SYNC	Pattern Synchronization alarm status LED Indicates a loss of pattern synchronization in at least one of the 4 streams. This is an alarm LED.
BIT ERR	Bit error status LED Indicates a detected BIT error in at least one of the 4 streams.
SEQ ERR	Sequence error status LED Indicates a sequence error detected in at least one of the 4 streams.

The following describes the LED colors:

If the LED color is ...	**Then this indicates ...**
Green with **white** text	The specific function is active and OK.
Red with **white** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **white** text	No activity from this specific function.

SDH Tab

SDH Overview

The test options available under the SDH tab can vary from one NIC test set to another, depending on which Multi-Rate Circuit Pack in installed in the test set.

The legacy **OMR** (Optical Multi-Rate) circuit pack was the first Digital Lightwave module to offer SDH Interface testing from STM-0 up to STM-64, as well as OTN, and Dual DS3, etc.

The **NGMR** (Next Generation Multi-Rate) circuit pack, which succeeds the OMR circuit pack, can also offer SDH Interface testing from STM-0 up to STM-64, as well as OTN, and can be licensed for some additional features not available on the OMR circuit pack.

If you are unsure which Multi-Rate circuit pack is your NIC test set, then select Differences Between Multi-Rate Circuit Packs to learn more.

Please select the appropriate SDH online help section based on the current configuration of your NIC product:

- SDH Features available on the **NGMR** circuit pack
- SDH Features available on the **OMR** circuit pack

SDH-NGMR

SDH Next Generation Multirate (NGMR) Overview

The **NGMR** (Next Generation Multi-Rate) circuit pack succeeds the OMR circuit pack, in that it too can offer SDH Interface testing from STM-0 up to STM-64, as well as OTN, but it can be licensed for some additional Next-Generation Telecom features not available on the OMR circuit pack.

These features include High and Low Order **VCAT**, **LCAS**, **GFP**, **1G LAN** and **10G LAN / WAN / FEC (10G LAN over OTU-2)**, **ODTU-12 Add/Drop multiplexing**, as well as hot-swappable SFP and XFP lasers.

To use Next Generation Multi-Rate functionalities your unit must contain the NGMR circuit pack and be licensed accordingly.

The SDH NGMR Online Help is divided into the following sections:

- NGMR Specific Tasks
- NGMR Screen and Function Descriptions
- Packet Tab (Available for testing GFP mappings, and 1G/10G LAN/WAN Interfaces)

NGMR Specific Tasks

SDH Specific Tasks Overview

This section includes tasks that are specific to the SDH protocol processor. For general tasks, refer to the Common Tasks section.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view Specific Tasks for this protocol processor.

- Testing SDH Jitter
- How to Set Up and Use VCAT Features
- How to Set Up and Use LCAS
- GFP Payloads for SDH mappings
- How to Set Up and Use 1G and 10G Ethernet LAN
- Configuring APS (K1 and K2) Commands
- Decoding APS (K1 and K2) Values
- Using M.2120 / M.2110 PM

SDH Jitter

Testing Jitter on a Multirate Unit Overview

NIC units that have the Jitter module and are licensed for Optical Multirate, and contain the Multirate circuit pack can set up jitter interfaces from the Multirate (SONET/SDH) tab.

- Attaching Optical Cables
- Configuring Jitter for a Multirate Unit

The Jitter TX laser remains ON when the optical interface is changed to a non-jitter SONET/SDH signal, allowing the Jitter laser and Optical Multirate laser to remain on at the same time.

Attaching Optical Cables

Before starting jitter tests on a NIC Multirate test set you must disconnect the cables from the Multirate TX or RX connector on the NIC connector panel and reconnect them to the Jitter TX or RX connector.

For instructions on connecting cables, see the **Common Tasks** section of Getting Started, located in the NIC Online Help.

Configuring Jitter for a Multirate Test Set

1. Select the **SDH/SONET** tab.
2. Select **Transmit** and choose **Set 1**.
3. Select **Interface**. The Select Type of Interface dialog box appears
4. Select the desired Jitter Interface for testing.
5. Configure all other necessary SDH parameter settings.
6. From the **Jitter** tab, select **Transmit**.
7. Turn the laser **On**.
8. Select **Receive** and choose **SIG**. Ensure that a valid signal is being received for the configured line rate.

When testing Jitter, the Multirate lasers are disabled and the Jitter laser is used.

The Jitter TX laser remains ON when the optical interface is changed to a non-jitter SONET/SDH signal, allowing the Jitter laser and Optical Multirate laser to remain on at the same time.

Attenuate the received optical power level if necessary so that the power level going into the Jitter RX laser is less than -10 dBm.

VCAT

How to Set Up and Use VCAT Features

NIC test sets licensed for VCAT functionality allow Digital Lightwave® customers to test NextGeneration optical networks utilizing VCAT (Virtual Concatenation) for more efficient data transfer.

This is a licensable option. Please contact Tech Support, or your DLI sales representative, to enable this option on your NIC unit.

VCAT features are accessed under the SONET or SDH tab, in Transmit, Receive, and Results sections.

- Configuring VCAT Mapping
- Adding and Editing VCAT Channels
- Inserting VCAT Delays
- Inserting VCAT Errors and Alarms
- Viewing VCAT Alarm and Error LEDs
- Viewing VCAT Alarm and Error Results

After configuring a VCAT group, see How to Set Up and Use LCAS for LCAS configuration and information.

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- Adding and Editing VCAT Channels
- Inserting VCAT Delays
- Inserting VCAT Errors and Alarms
- Viewing VCAT Alarm and Error LEDs
- Viewing VCAT Alarm and Error Results

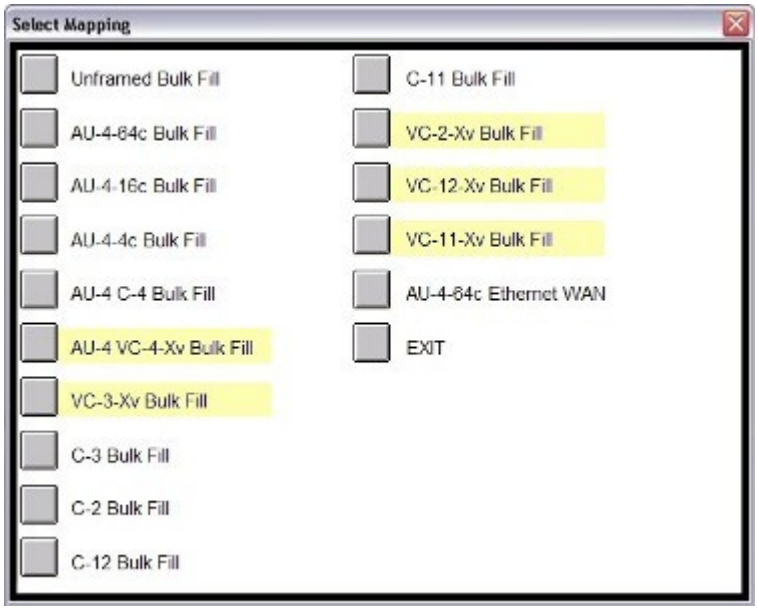
After configuring a VCAT group, see How to Set Up and Use LCAS for LCAS configuration and information.

Configuring VCAT Mappings

The following procedures describe how to configure the NIC for VCAT mapping in SDH and SONET. The NIC unit must be equipped with High-Order or Low-Order VCAT test options.

VCAT Mappings in SDH mode:

1. Select the **SONET** or **SDH** tab.
2. Select **Transmit**, and then select the **Set 1** side tab.
3. Select **Mapping** and the following window will appear:



(Highlights do not appear in the NIC screen.)

4. Choose any of the following selections as applicable:

Higher-Order Mappings

- AU-4 VC-4-Xv Bulk Fill (Not applicable when using STM-0, STM-0e, STM-1 or STM-1e Interface)
- AU-3 VC-3-Xv Bulk Fill (Not applicable when using STM-0 or STM-0e Interface)

Lower-Order Mappings

- VC-3-Xv Bulk Fill (when AU-Type is AU-4)
- VC-2-Xv Bulk Fill
- VC-12-Xv Bulk Fill
- VC-11-Xv Bulk Fill

5. Select **AU-Type** and choose **AU-3** or **AU-4**; if available for the selected mapping..

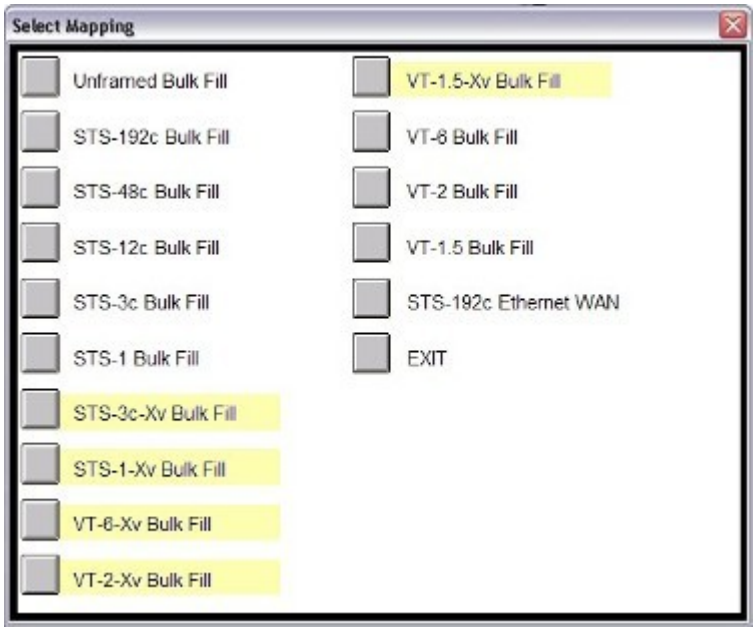
6. The mapping will be displayed as AU-3 or AU-4, followed by the selected VC mapping. The above mapping choices plus the selection of AU-3 or AU-4 make it possible to do any of the following mappings:

    - AU-4 VC-4-Xv Bulk Fill
    - AU-4 VC-3-Xv Bulk Fill
    - AU-4 VC-2-Xv Bulk Fill
    - AU-4 VC-12-Xv Bulk Fill
    - AU-4 VC-11-Xv Bulk Fill
    - AU-3 VC-3-Xv Bulk Fill
    - AU-3 VC-2-Xv Bulk Fill
    - AU-3 VC-12-Xv Bulk Fill
    - AU-3 VC-11-Xv Bulk Fill

7. Select **Payload**, and choose the desired Payload Pattern (including PRBS or **GFP** if licensed) to be used as the test pattern for the entire VCG (Virtual Concatenation Group).
8. Once the mapping is configured for VCAT, see Adding and Editing VCAT Channels.

VCAT Mappings in SONET mode:

1. Select the **SONET** tab.
2. Select **Transmit**, and then select the **Set 1** side tab.
3. Select **Mapping** and the following window will appear:



(Highlights do not appear in the NIC screen.)

4. Choose any of the following selections as applicable:

   STS Mappings

   - STS-3c-Xv Bulk Fill (Not applicable when using OC-1, EC-1, OC-3 or EC-3 Interface)
   - STS-1-Xv Bulk Fill (Not applicable when using OC-1 or EC-1 Interface)

   VT Mappings

   - VT-6-Xv Bulk Fill
   - VT-2-Xv Bulk Fill
   - VT-1.5-Xv Bulk Fill

5. Select **Payload**, and choose the desired Payload Pattern (including PRBS or **GFP** if licensed) to be used as the test pattern for the entire VCG (Virtual Concatenation Group).
6. Once the mapping is configured for VCAT, see Adding and Editing VCAT Channels.

Adding and Editing VCAT Channels

Adding VCAT Channels

The following procedure describe how to add VCAT channels, to form a VCG (Virtual Concatenation Group). Before channels can be added, the NIC must be configured for VCAT Mapping. See Configuring VCAT Mapping.

1. Select **SDH** or **SONET** tab.

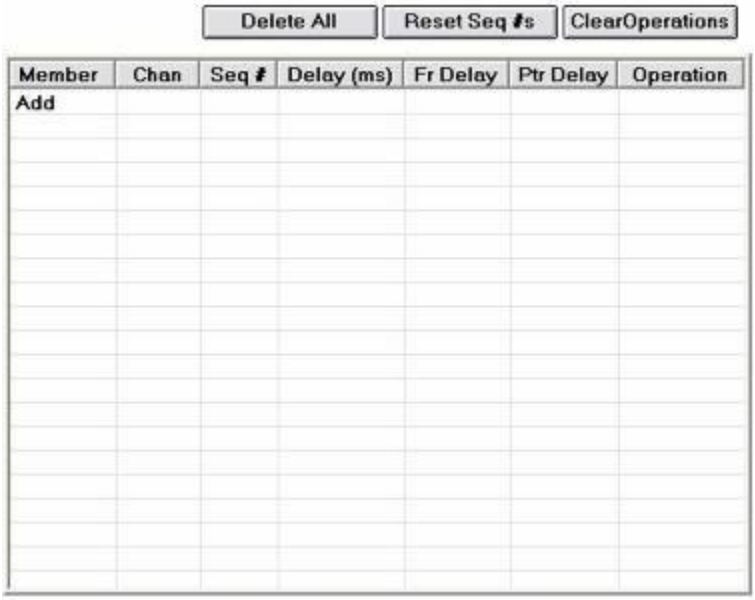
This procedure is the same in SDH or SONET. The channel numbers will appear differently depending upon the protocol in use. SDH was used for the examples in this document.

2. Select **Transmit** or **Receive**.

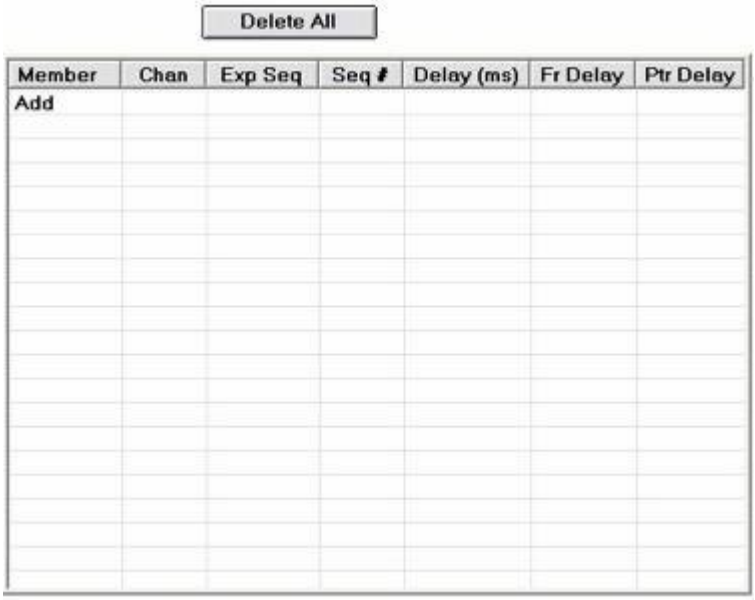
All functions of setting up VCAT channels can be added through either Transmit or Receive, even functions that involve the Transmit only. If “Settings Control” (Under Transmit or Receive “Set 1”) is Coupled, both Transmit and Receive will be configured.

3. Select the **VCAT** side-tab. The VCAT Table will be displayed.

   This is the **Transmit** VCAT Table:



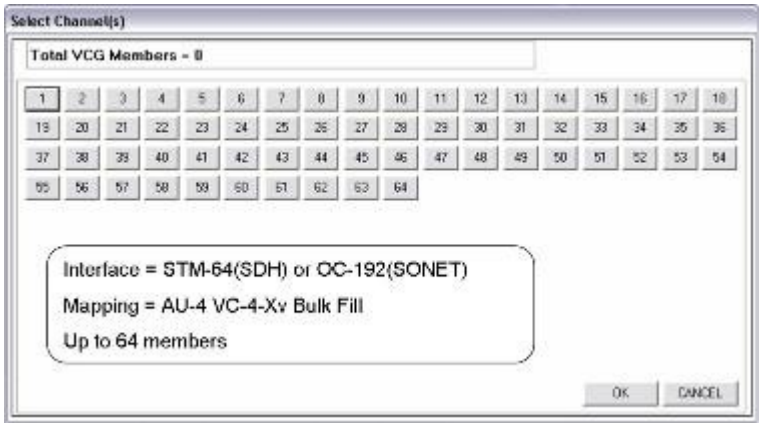
This is the **Receive** VCAT Table:

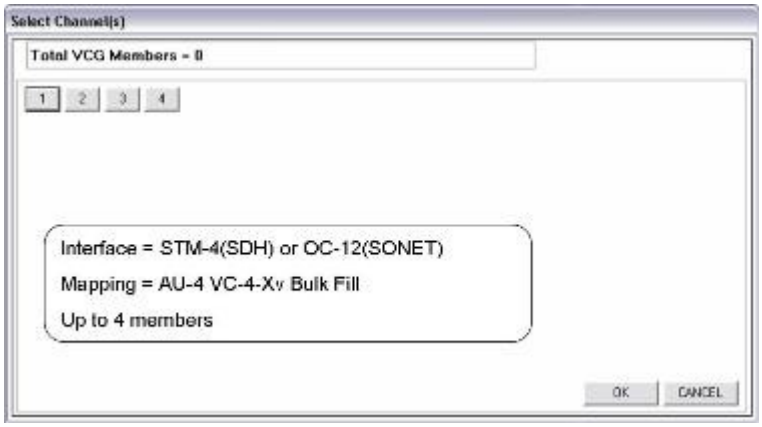


Adding Channels in High-Order Mappings

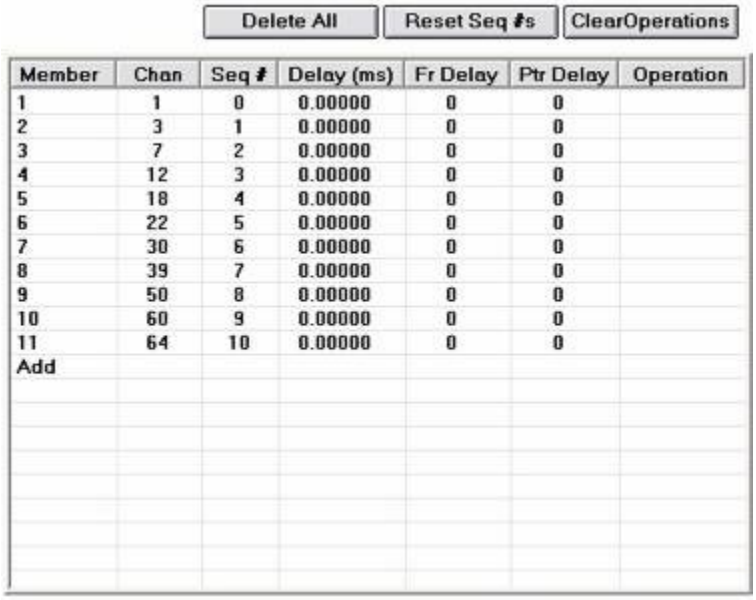
1. Select **Add**. The Select Channel(s) window will appear.

   Depending upon the Interface and Mapping selected the number of available channels will be different. The following are examples:





2. Select any channel. **Total VCG Members** will change from 0 to 1.
3. Continue to select additional members as required.
4. When you select a member, the member button become disabled, to indicate that the channel has been selected.
5. This window will alert you when the maximum number of members has been selected.
6. Select **OK**.
7. The Select Channel(s) window will close, and the newly added channels will appear in the VCAT Table, as in this example:



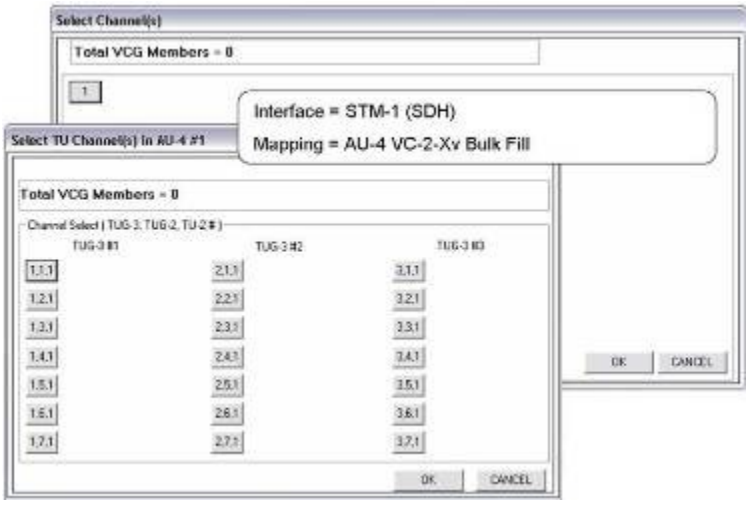
Member	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operation
1	1	0	0.00000	0	0	
2	3	1	0.00000	0	0	
3	7	2	0.00000	0	0	
4	12	3	0.00000	0	0	
5	18	4	0.00000	0	0	
6	22	5	0.00000	0	0	
7	30	6	0.00000	0	0	
8	39	7	0.00000	0	0	
9	50	8	0.00000	0	0	
10	60	9	0.00000	0	0	
11	64	10	0.00000	0	0	
Add						

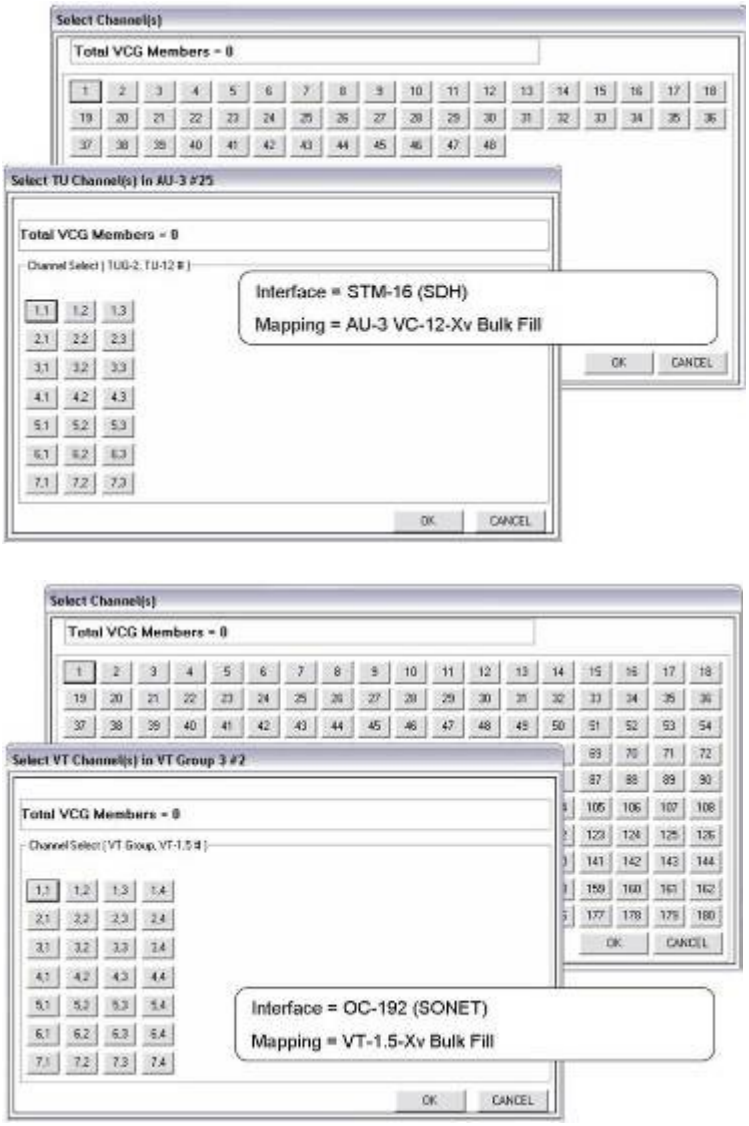
Adding Channels in Low-Order Mappings

The basic procedure for low-order mappings is the same as high-order mappings except that there is two-stage channel-selection process.

1. Select Add. The Select Channel(s) window will appear.

Depending upon the Interface and Mapping selected the number of available channels will be different. The following are examples:





2. Select any channel from the Select Channel(s) menu. The Select TU Channel(s) window, for SDH mapping, or Select VT Channel(s) window, for SONET mapping will appear.
3. Select TU or VT channels as required.
4. Continue to select additional channels as required.
5. Select OK.
6. The Select Channel(s) window will close and the new channels will appear in the VCAT Table, as in these examples:

SDH Example (*STM-64, AU-3 VC-11-Xv mapping*):

M...	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operation
1	AU# 1 1,2	0	0.00000	0	0	
2	AU# 1 3,3	1	0.00000	0	0	
3	AU# 1 4,4	2	0.00000	0	0	
4	AU# 1 5,3	3	0.00000	0	0	
5	AU# 1 5,4	4	0.00000	0	0	
6	AU#117 3,3	5	0.00000	0	0	
7	AU#117 5,4	6	0.00000	0	0	
8	AU#117 6,3	7	0.00000	0	0	
9	AU#117 7,1	8	0.00000	0	0	
Add						

SONET Example (*OC-192, VT-1.5-Xv mapping*):

M...	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operation
1	STS# 1 1,2	0	0.00000	0	0	
2	STS# 1 3,3	1	0.00000	0	0	
3	STS# 1 4,4	2	0.00000	0	0	
4	STS# 1 5,3	3	0.00000	0	0	
5	STS# 1 5,4	4	0.00000	0	0	
6	STS#117 3,3	5	0.00000	0	0	
7	STS#117 5,4	6	0.00000	0	0	
8	STS#117 6,3	7	0.00000	0	0	
9	STS#117 7,1	8	0.00000	0	0	
Add						

Insert a channel before an existing channel in the VCAT Table

1. Select a Member row. The Select for Member <#> dialog box appears.
2. Select Add Channel (Before). The Select Channel to Insert dialog box appears.
3. Select the desired channel.
4. Both dialog boxes automatically close and a new channel is inserted above the previously selected line, automatically renumbering the Member column.

After configuring a VCAT group, see How to Set Up and Use LCAS for LCAS configuration and information.

Editing VCAT Channel Configurations

Changing a Channel Assignment

1. Select the **Member** row to be changed. The Select for Member <#> dialog box appears.
2. Selected **Change Channel #**.
3. Select the desired Channel as described above.
4. The window will close and the selected member will be changed to the requested channel.

Deleting VCAT Channels

Deleting a Channel

1. Select the **Member** row to be deleted. The **Select for Member <#>** dialog box appears.
2. Select **Delete Channel**.
3. The window will close and the selected channel will be deleted.

Deleting All Channels

1. Select **Delete All** (located above the VCAT Table).
2. All members will be deleted.

Inserting VCAT Delays

The NIC can insert delay on any of the VCAT channels individually.

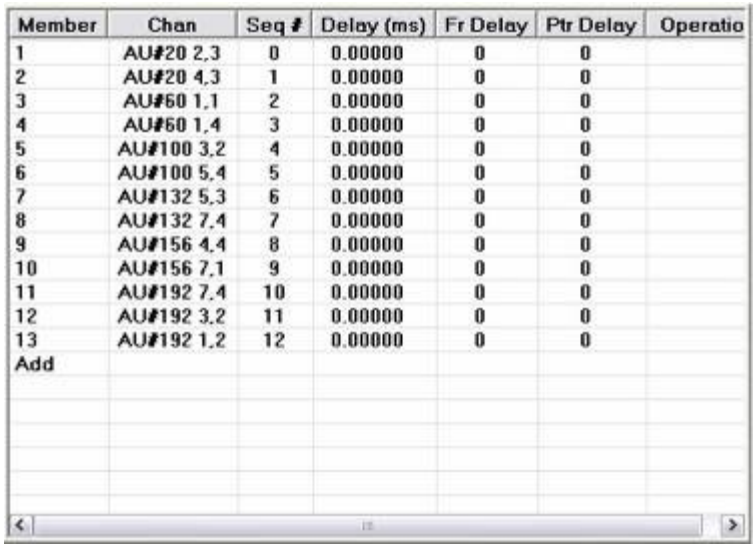
1. Select **SDH** or **SONET** tab.

This procedure is the same in SDH or SONET. The channel numbers will appear differently depending upon the protocol in use. SDH was used for the examples in this document.

2. Select **Transmit**.

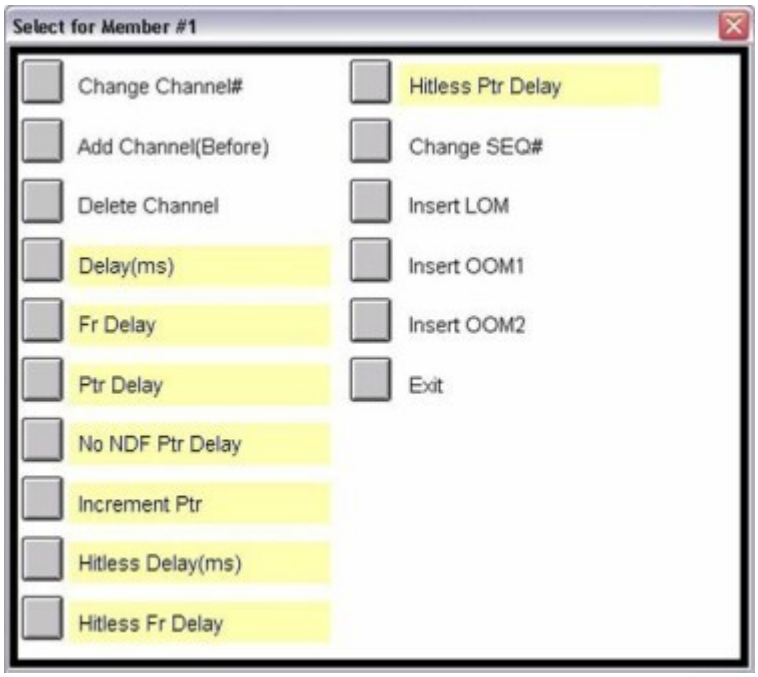
The delay can actually be inserted from the Receive screen as well but the Receive VCAT Table will not display the inserted delay. The Receive VCAT Table displays measured delay.

3. Select the **VCAT** side-tab. The VCAT Table will be displayed.



Member	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operatio
1	AU#20 2,3	0	0.00000	0	0	
2	AU#20 4,3	1	0.00000	0	0	
3	AU#60 1,1	2	0.00000	0	0	
4	AU#60 1,4	3	0.00000	0	0	
5	AU#100 3,2	4	0.00000	0	0	
6	AU#100 5,4	5	0.00000	0	0	
7	AU#132 5,3	6	0.00000	0	0	
8	AU#132 7,4	7	0.00000	0	0	
9	AU#156 4,4	8	0.00000	0	0	
10	AU#156 7,1	9	0.00000	0	0	
11	AU#192 7,4	10	0.00000	0	0	
12	AU#192 3,2	11	0.00000	0	0	
13	AU#192 1,2	12	0.00000	0	0	
Add						

4. Select the desired **Member** row to insert delay. The Select for Member <#> dialog box appears.
5. The highlighted items in the image below are the options for delay insertion.



(Highlights do not appear in the NIC screen.)

6. Select the desired delay type as detailed below.

    - **Delay(ms)** - Inserts Combined Delay, the amount of time to delay this member as compared to the earliest member, entered in

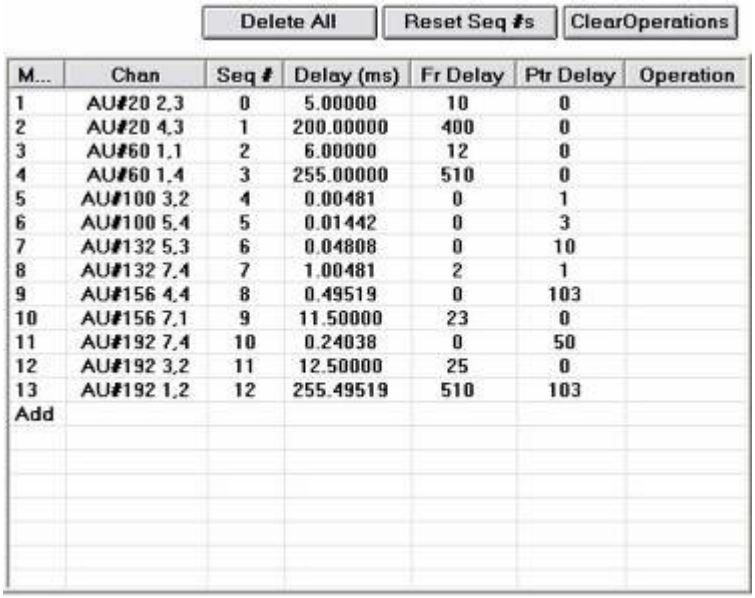
milliseconds (ms). Acceptable values are 0 to 255.99984, other values for Low-Order mappings.

- **Fr Delay** - Inserts Frame Delay, the number of frames to delay this member as compared to the earliest member, entered in number of frames. Acceptable values are 0 to 2047, other values for Low-Order mappings.
- **Ptr Delay** - Changes the pointer value of the selected member, creating a very small delay. Acceptable values are 0 to 782 for High-Order mappings, other values for Low-Order mappings.
- **No NDF Ptr Delay** - Changes the pointer value without New Data Flag (NDF).
- **Increment Ptr** - Increase pointer value by 1.
- **Hitless Delay(ms)** - Inserts Combined Delay on the selected member, entered in milliseconds (ms) without causing a Loss of Multiframe (LOM) alarm. Acceptable values are 0 to 255.99984, other values for Low-Order mappings.
- **Hitless Fr Delay** - Inserts Frame Delay on the selected member, entered in number of frames, without causing a Loss of Multiframe (LOM) alarm. Acceptable values are 0 to 2047, other values for Low-Order mappings.
- **Hitless Ptr Display** - Changes the pointer value of the selected member, creating a very small delay, without causing a Loss of Multiframe (LOM) alarm. Acceptable values are 0 to 782, other values for Low-Order mappings.

7. Once the error type is selected, a window with numeric keypad will appear. The title, max. value and min. value will differ depending upon the delay type selected. The following example is for Delay(ms).

8. Enter the desired delay value.

9. Press **OK**. The numeric keypad will disappear and the requested delay will be displayed in the VCAT Table. See example below.



M...	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operation
1	AU#20 2,3	0	5.00000	10	0	
2	AU#20 4,3	1	200.00000	400	0	
3	AU#60 1,1	2	6.00000	12	0	
4	AU#60 1,4	3	255.00000	510	0	
5	AU#100 3,2	4	0.00481	0	1	
6	AU#100 5,4	5	0.01442	0	3	
7	AU#132 5,3	6	0.04808	0	10	
8	AU#132 7,4	7	1.00481	2	1	
9	AU#156 4,4	8	0.49519	0	103	
10	AU#156 7,1	9	11.50000	23	0	
11	AU#192 7,4	10	0.24038	0	50	
12	AU#192 3,2	11	12.50000	25	0	
13	AU#192 1,2	12	255.49519	510	103	
Add						

To Reset Delays on All Members:

1. Select the **Clear Operations** button.
2. All delay values will be set to zero, and the VCAT Table Delay columns will be blank for all members.

Inserting VCAT Errors and Alarms

When the NIC unit is configured for VCAT, errors and alarms can be sent from the Transmit/Error Alarm menu. Section and Line errors and alarms (SONET) and RS and MS errors and alarms (SDH) are sent just as in non-VCAT mappings. Path errors and alarms are sent only on the selected VCAT member.

To select VCAT Channel:

1. Select the **SDH** or **SONET** tab.
2. Select **Transmit**, and then select the **Set 1** side tab.
3. Select **VCAT Channel** and choose which channel in which you would like to send errors or alarms.
4. The selected channel will be displayed in the menu, as in this example:

5. Select **Transmit** > **Error Alarm**.
6. The transmitted path errors and alarms will now be inserted in to the selected VCAT member.

For more information and specific procedure on sending errors and alarms, see SDH/SONET Transmit specific tasks.

VCAT-Specific Alarms

There are three VCAT-specific alarms:

- LOM - Loss of Multiframe alarm
- OOM1 - Out of Multiframe alarm 1
- OOM2 - Out of Multiframe alarm 2

These alarms can be sent on individual VCAT members, even on multiple members simultaneously.

How to Send VCAT-Specific Alarms

1. Select **SDH** or **SONET** tab.

This procedure is the same in SDH or SONET. The channel numbers will appear differently depending upon the protocol in use. SDH was used for the examples in this document.

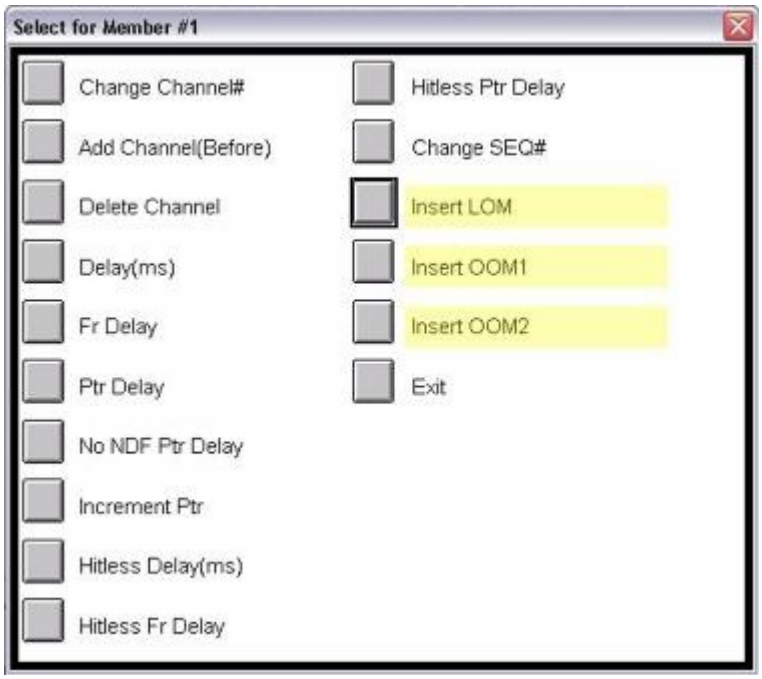
2. Select **Transmit**.

The alarms can actually be inserted from the Receive screen as well but the Receive VCAT Table will not display the selected alarm type.

3. Select the **VCAT** side-tab. The VCAT Table will be displayed.

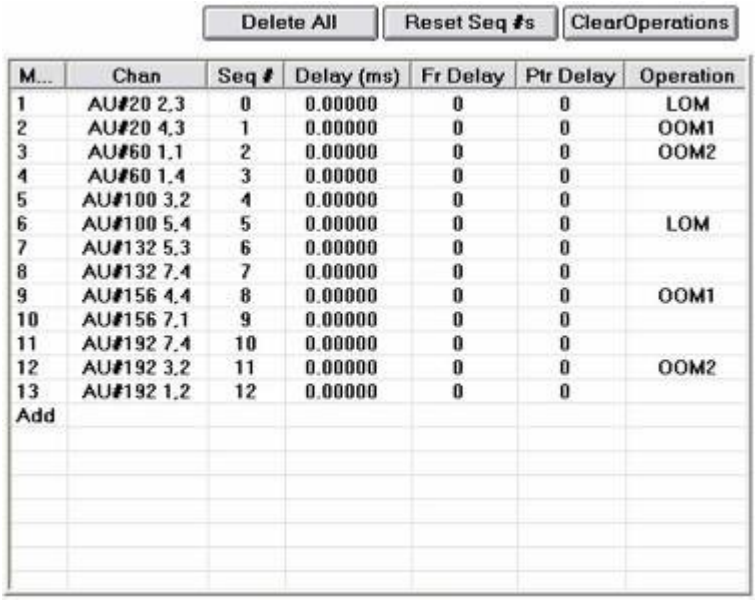
Member	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operatio
1	AU#20 2,3	0	0.00000	0	0	
2	AU#20 4,3	1	0.00000	0	0	
3	AU#60 1,1	2	0.00000	0	0	
4	AU#60 1,4	3	0.00000	0	0	
5	AU#100 3,2	4	0.00000	0	0	
6	AU#100 5,4	5	0.00000	0	0	
7	AU#132 5,3	6	0.00000	0	0	
8	AU#132 7,4	7	0.00000	0	0	
9	AU#156 4,4	8	0.00000	0	0	
10	AU#156 7,1	9	0.00000	0	0	
11	AU#192 7,4	10	0.00000	0	0	
12	AU#192 3,2	11	0.00000	0	0	
13	AU#192 1,2	12	0.00000	0	0	
Add						

4. Select the desired **Member** row to insert alarms. The Select for Member <#> dialog box appears.
5. Highlighted items are the options for alarm insertion.



(Highlights do not appear in the NIC screen.)

6. Select **alarm type**.
7. The window will disappear and the selected alarm type will appear in the VCAT Table under Operation as in this example:



M...	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operation
1	AU#20 2,3	0	0.00000	0	0	LOM
2	AU#20 4,3	1	0.00000	0	0	OOM1
3	AU#60 1,1	2	0.00000	0	0	OOM2
4	AU#60 1,4	3	0.00000	0	0	
5	AU#100 3,2	4	0.00000	0	0	
6	AU#100 5,4	5	0.00000	0	0	LOM
7	AU#132 5,3	6	0.00000	0	0	
8	AU#132 7,4	7	0.00000	0	0	
9	AU#156 4,4	8	0.00000	0	0	OOM1
10	AU#156 7,1	9	0.00000	0	0	
11	AU#192 7,4	10	0.00000	0	0	
12	AU#192 3,2	11	0.00000	0	0	OOM2
13	AU#192 1,2	12	0.00000	0	0	
Add						

To Stop Sending Errors / Alarms on One Member:

1. Select the desired **Member** row to stop sending alarm.
2. The following window will appear. (LOM is used only as an example.)

3. Select **Stop <alarm type>**.
4. The window will disappear and Operation for that member in the VCAT Table will be blank.

To Stop Sending Errors / Alarms on All Members:

1. Select the **Clear Operations** button.
2. The VCAT Table Operation column will be blank for all members.

Viewing VCAT Summary LEDs

The LED statuses indicate the current condition and history of a test that is currently running. For VCAT, the LEDs can be viewed in four levels:

- **VCAT summary LED**. A summary LED for all VCAT members.

- **VCAT Summary**. A screen which shows a single LED for each VCAT member.
- **VCAT LEDs**. An individual LED panel for each VCAT member displaying all applicable alarm and error conditions for that VCAT member only.
- **VCAT LEDs (Summary)**. An LED panel containing all possible error/alarm conditions with each LED indicating “summary” of all VCAT members.

Note that Low-Order SDH configuration was used in the following examples, but VCAT Alarm and Status LEDs are the same for High-Order, and for SONET.

VCAT Summary LED

When SONET/SDH is configured for VCAT, an interactive VCAT LED appears at the bottom of the LED Quick Status Area.

The LED + the text “VCAT” serve as a summary indicator for all VCAT members.

- Green LED +White “VCAT” = No VCAT member has detected any errors or alarms during the current test.
- Green LED + Red “VCAT” = History indictor. At least one VCAT member has detected errors or alarms during the current test.
- Red LED = Red “VCAT” = At least one VCAT member is detecting errors or alarms right now.

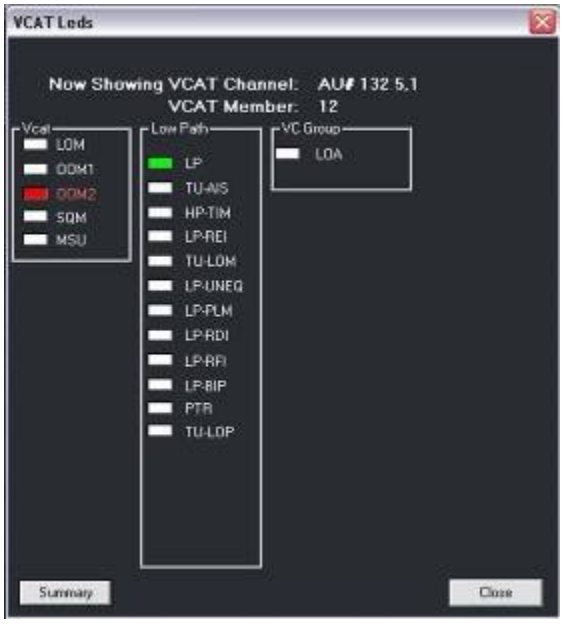
VCAT Summary

Selecting the text “**VCAT**” next to the Summary LED and the VCAT Summary screen will appear.

Each block provides a summary for a single VCAT member. In this case, white text indicates that no errors or alarms have been detected in the current test on the VCAT member. Red Text indicates the detection of a least error or alarm on the VCAT member during the current test.

VCAT LEDs

Select any block in the VCAT Summary window and the VCAT LEDs window will appear.



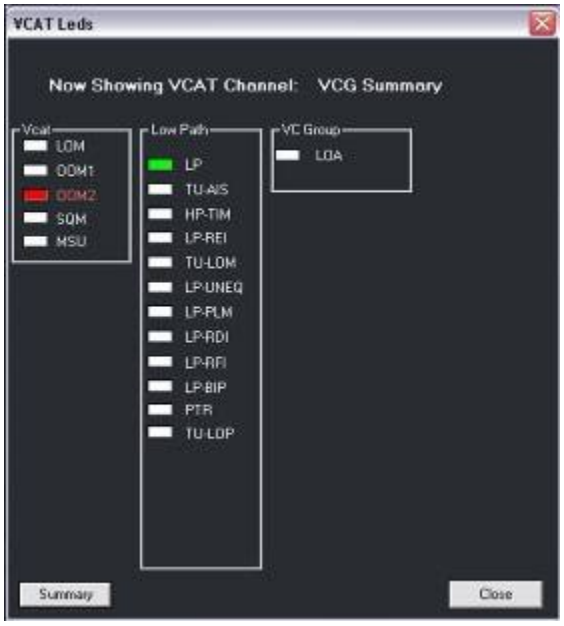
The VCAT LEDs window provides full information regarding all alarm and error conditions for the selected VCAT member. As in the Summary LED, the LED itself plus the text serve as indicators.

- Green LED +White text = This error or alarm has not been detected during the current test.
- Green LED + Red text = This error or alarm has been detected during the current test but is not present at this time.
- Red LED = Red text = This error or alarm is being detected right now.

Select **Close** to return to the VCAT Summary window.

VCAT LEDs (Summary)

Select **Summary** on the VCAT LEDs window. The window and all LEDs will change from reporting the condition of just one VCAT member to a summary function.



Each LED indicates whether that error or alarm has been or is being detected on any VCAT member.

- Green LED +White text = This error or alarm has not been detected during the current test on any VCAT member.
- Green LED + Red text = This error or alarm has been detected during the current test on any VCAT member but is not present at this time.
- Red LED = Red text = This error or alarm is being detected right now on any VCAT member.

Viewing VCAT Alarm and Error Results

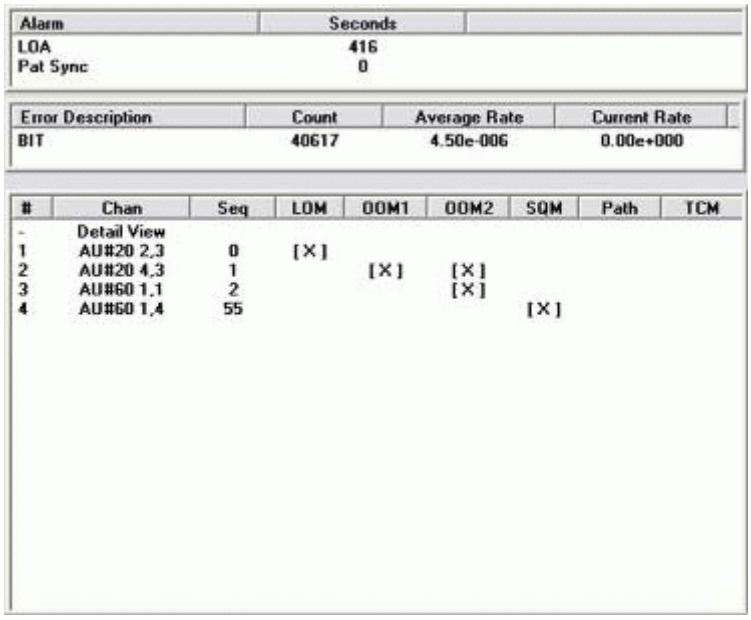
The VCAT Results screen allows you to view VCAT-specific Alarm and Error results.

1. Select the **SDH** or **SONET** tab.
2. Select **Results**, then the **VCAT** side-tab. The VCAT Results screen will be displayed.

Error and alarm information is presented in two ways:

- **Overall View** – Displays information common to all members of the VCAT Group (VCG)
- **Detail View** – Displays full information about any one member, within the (VCG)

Overall View



Alarm	Seconds
LOA	416
Pat Sync	0

Error Description	Count	Average Rate	Current Rate
BIT	40617	4.50e-006	0.00e+000

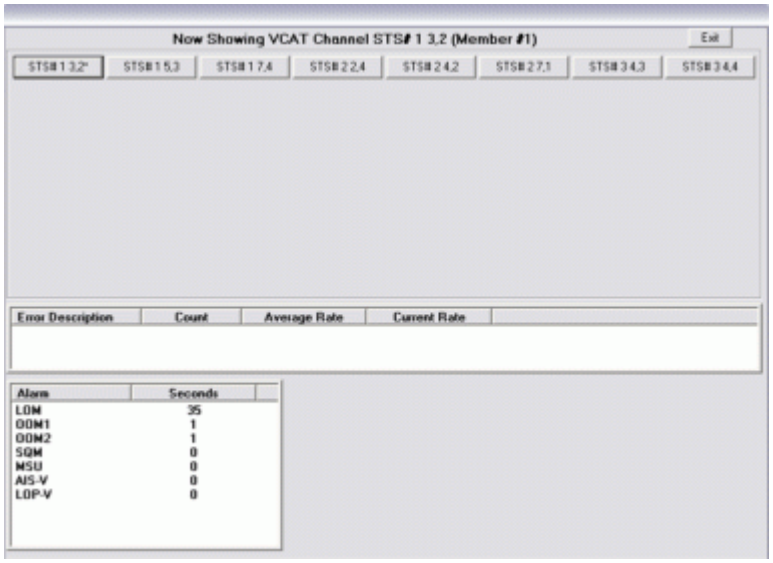
#	Chan	Seq	LOM	OOM1	OOM2	SQM	Path	TCM
-	Detail View							
1	AU#20 2,3	0	[X]					
2	AU#20 4,3	1		[X]	[X]			
3	AU#60 1,1	2			[X]			
4	AU#60 1,4	55				[X]		

- **Alarm Description** – Provides alarm statistics that are common to the entire VCG.
- **Error Description** – Provides error statistics that are common to the entire VCG.
- **Detail** – Provides the Trouble Scan View of any Member/Channel that has detected an alarm condition during the current test. The Member is listed and an **[X]** is placed in the column for the error/alarm type.

Detail View

To drill-down to channel-specific details:

1. Select any **Member** or **Detail View** text in the **Detail** box. The VCAT Detail View window appears.



The Detail View window will initially display either member #1 or the last member viewed, no matter whether the user clicked “detail view” or one of the members to bring up the window.

2. Select a **VCAT channel** to view its alarm and error statistics.
3. Select another **VCAT channel** as required, to view its alarm and error statistics.
4. Select **Exit** to close the VCAT Detail View window.

LCAS

How to Set Up and Use LCAS

NIC test sets licensed for LCAS (**Link Capacity Adjustment Scheme**) functionality allow Digital Lightwave® customers to test NextGeneration optical networks utilizing LCAS for dynamic bandwidth allocation and protection against failures. LCAS functions work with VCAT (**Virtual Concatenation**) to increase or decrease the number of VCAT Group (VCG) members in use, and therefore bandwidth, dynamically or to automatically protect data integrity by disabling failed VCG members.

This is a licensable option. Please contact Tech Support, or your DLI sales representative, to enable this option on your NIC unit.

LCAS is only available if the NIC unit is licensed for both VCAT and LCAS.

To enable LCAS, a VCAT mapping has to be selected, and at least one member must be added to the VCAT Group.

The LCAS Transmit, Receive, and Results function screens are only displayed when LCAS is enabled. The LCAS option will then be displayed on the TX and RX SET1 screens.

LCAS works only with VCAT mappings, however VCAT can operate without LCAS. LCAS does not add or delete members from the VCG. The LCAS simulation will support from 0 to N members, where N is defined by the total number of members in the VCG.

For detailed instructions on configuring and using LCAS, see these links:

- Configuring LCAS
- Adding and Removing LCAS Channels
- Viewing VCAT/LCAS Summary LEDs

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For detailed instructions on configuring and using LCAS, see these links:

- Configuring LCAS
- Adding and Removing LCAS Channels
- Viewing VCAT/LCAS Summary LEDs

Configuring LCAS

The following procedures describe how to configure the NIC for LCAS testing in SDH and SONET. The NIC unit must be equipped with LCAS Test Option plus High-Order or Low-Order VCAT.

LCAS configuration is virtually identical in SONET and SDH.

Configuring VCAT (preliminary step):

Before LCAS can be configured, there must be a least one member in the VCAT Table. To configure VCAT and add channels, see these links:

- Configuring VCAT Mapping
- Adding and Editing VCAT Channels

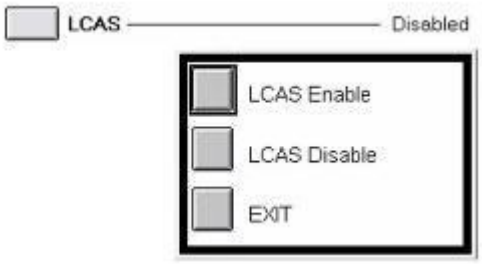
Unlike VCAT which is bidirectional, LCAS operates on a unidirectional, or one-way basis. The transmission of an LCAS system is designated “Source” and the receive is designated “Sink”.

LCAS is configured between a source and a sink uni-directionally

regardless of how the other direction is configured. The other direction may be configured as LCAS as well but as far as testing purposes, there is no correlation between the two.

Enabling LCAS:

1. Under the **SDH** or **SONET** tab, select **Transmit** or **Receive**.
2. Select **Set** and choose **Set 1**.
3. Select **LCAS** and then choose **LCAS Enable**.

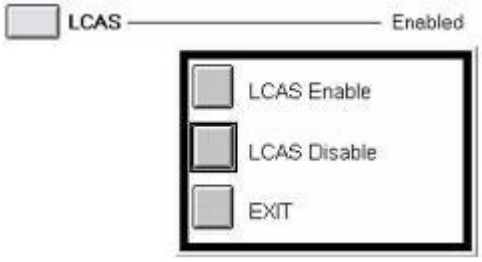


*If the **LCAS** option is not displayed on the **Set 1** screen, then either no members have been added to the VCAT group or the unit is not licensed for LCAS.*

4. Once LCAS is enabled, no members can be added to or deleted from the VCAT Table. The “Add” and “Delete All” buttons will be unavailable.
5. For adding and removing channels, see Adding and Removing LCAS Channels.

Disabling LCAS:

1. Under the **SDH** or **SONET** tab, select **Transmit** or **Receive**.
2. Select **Set** and choose **Set 1**.
3. Select **LCAS** and then choose **LCAS Disable**.



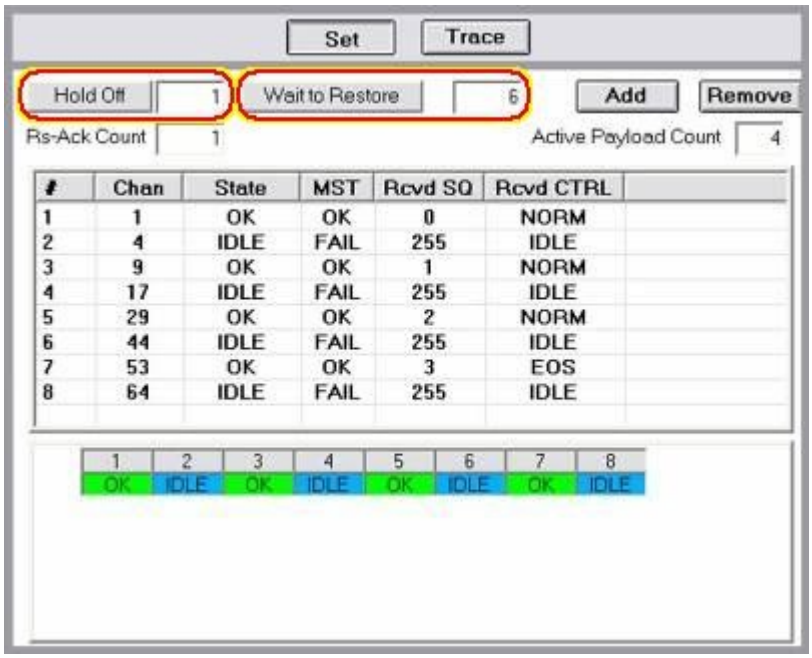
Configuring Hold Off and Wait to Restore

In the event of a VCG member failure, the Sink will send a failure message to the Source.

- **Hold Off** puts a delay between the detection of the failure and sending the message.

- **Wait to Restore** puts a delay between the clearing of the alarm and when an “OK” message is sent to the source.

1. From the **SDH** or **SONET** tab, select **Receive**.
2. Select LCAS Sk (LCAS Sink) side tab from the Receive screen.
3. The LCAS Settings table will appear, listing all of the members within the receive VCG.



4. Select **Hold Off** or **Wait to Restore**. The **Enter User Data** key pad will appear.

5. Enter **0** to **10** (seconds) for the required delay.
6. Select OK.

Adding and Removing LCAS Channels

The following procedure describes how to add LCAS channels to the data stream from the selection of available VCG (Virtual Concatenation Group) members configured in VCAT. The NIC unit must be equipped with LCAS Test Option plus High-Order or Low-Order VCAT.

LCAS configuration is virtually identical in SONET and SDH.

Configuring VCAT (preliminary step):

Before adding LCAS channels, there must be a least one member in the VCAT Table and LCAS must be enabled. To configure VCAT and add channels, see these links:

- Configuring VCAT Mapping
- Adding and Editing VCAT Channels
- Configuring LCAS

Unlike VCAT which is bidirectional, LCAS operates on a unidirectional, or one-way basis. The transmission of an LCAS system is designated “Source” and the receive is designated “Sink”.

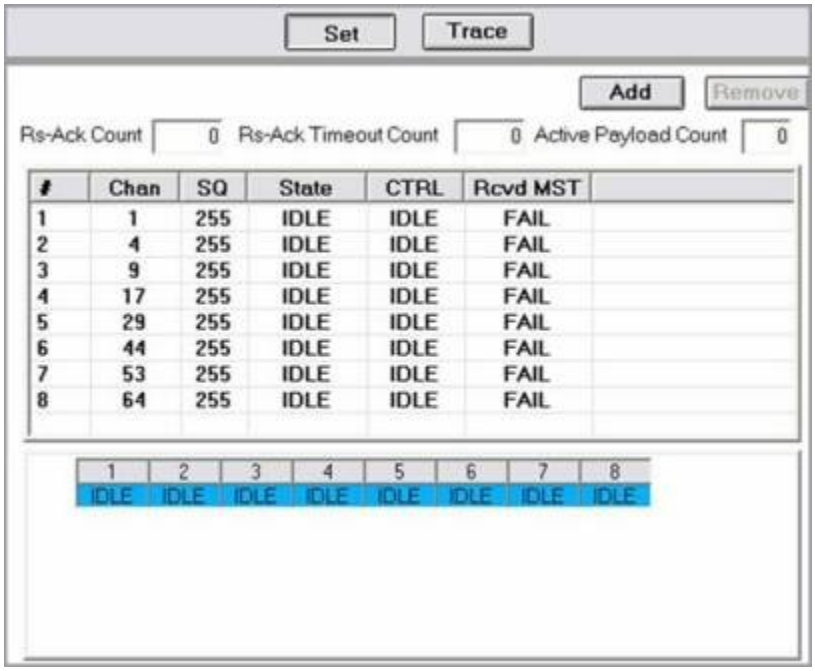
LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other direction may be configured as LCAS as well but as far as testing purposes, there is no correlation between the two.

The Source and the Sink are not coupled. Thus adding members to the LCAS Source does not automatically add members to the LCAS Sink, and visa-versa.

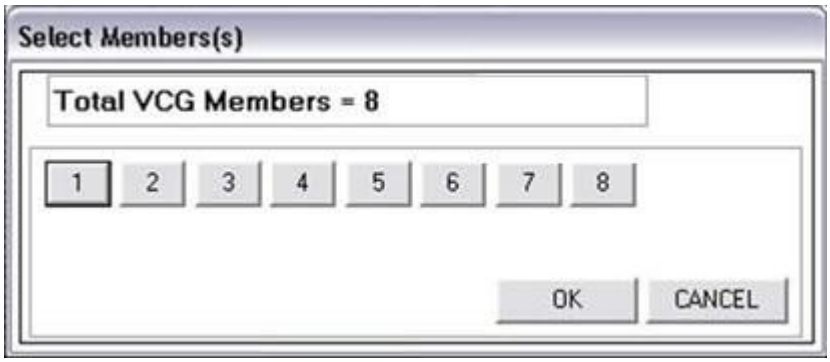
Adding LCAS Members to Source

1. From the **SDH** or **SONET** tab, select **Transmit**.
2. Select

(LCAS Source) side tab from the Transmit screen. .
3. The LCAS Settings table will appear, listing all of the members within the receive VCG.



4. Select **Add**. The Select Member(s) window will appear.



5. The **Select Member(s)** window contains one button for each VCG member.

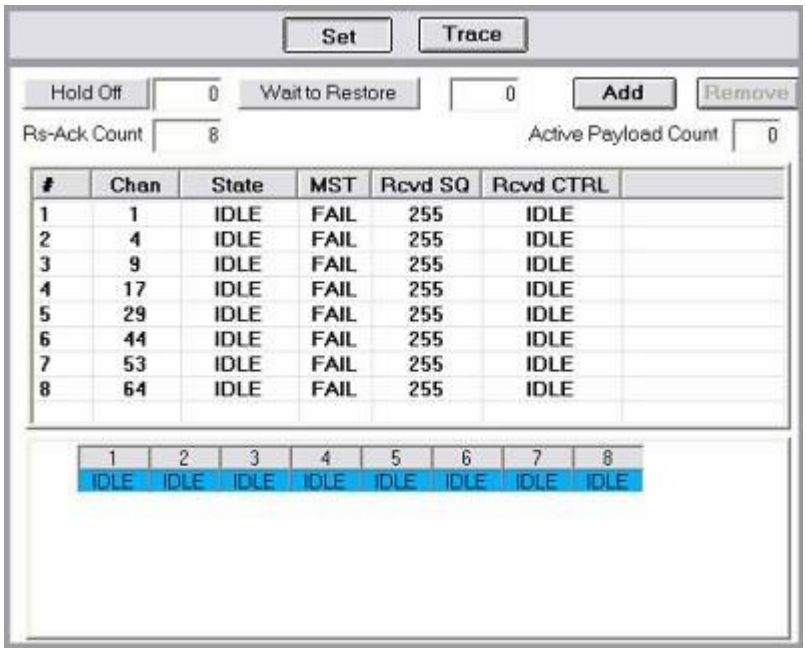
    - If the member is available to be added into the LCAS data stream, the number on the button will be black (enabled).
    - If the member is already a part of the data stream, the number will be gray (disabled) and the button cannot be selected.

6. Select the required **members** and press **OK**.

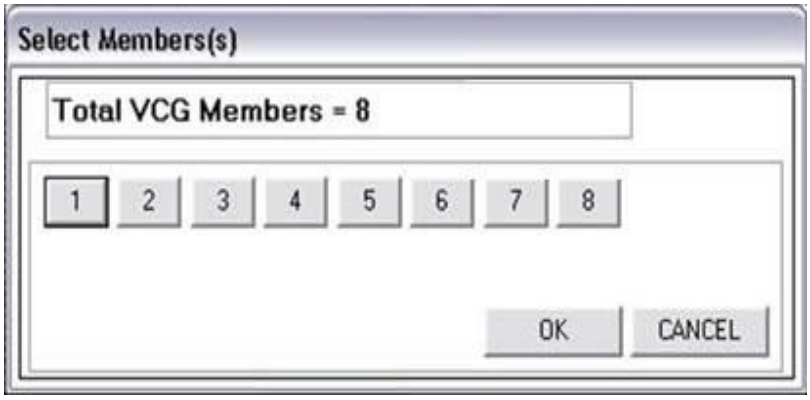
Refer to the LCAS Transmit Settings for Source Member's State-LED status descriptions

Adding LCAS Members to Sink

1. From the **SDH** or **SONET** tab, select **Receive**.
2. Select LCAS Sk (LCAS Sink) side tab from the Receive screen.
3. The LCAS Settings table will appear, listing all of the members within the receive VCG.



4. Select **Add**. The Select Member(s) window will appear.



5. The **Select Member(s)** window contains one button for each VCG member. Refer the VCG for channel information for each member.

    - If the member is available to be added into the LCAS data stream, the number on the button will be black (button enabled).

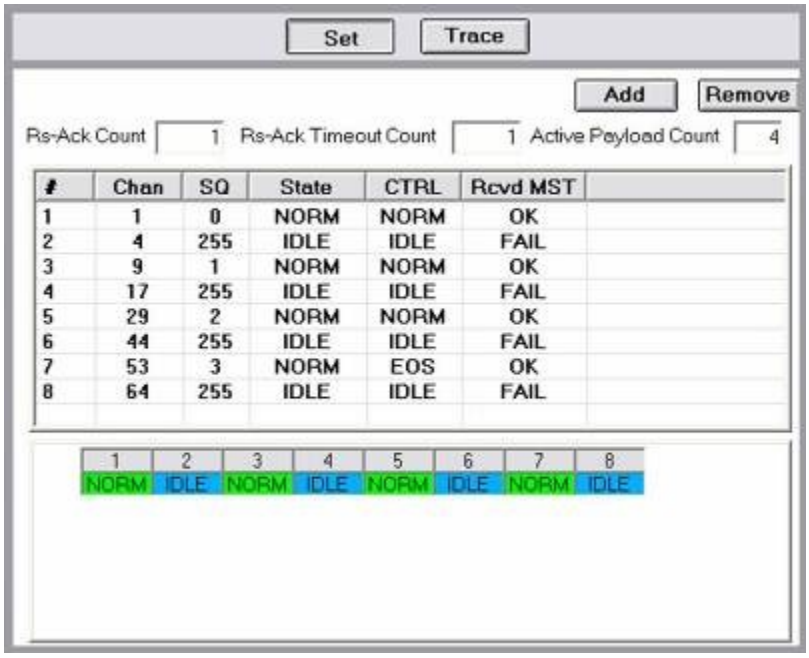
- If the member is already a part of the data stream, the number will be gray (button disabled) and the button cannot be selected.

6. Select the required **members** and press **OK**.

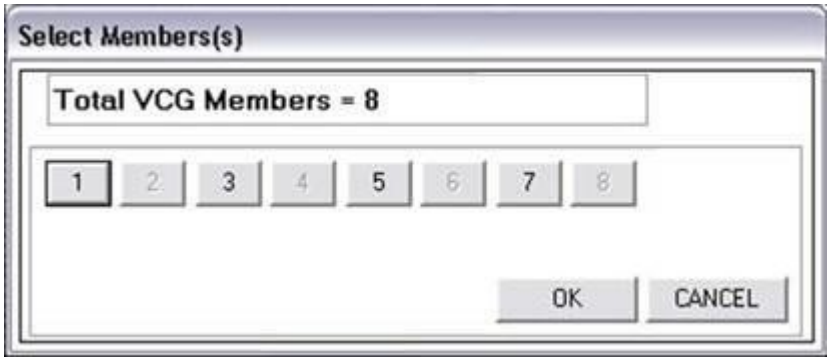
Refer to the LCAS Receive Settings for Sink Member's State-LED status descriptions

Removing LCAS Members from Source

1. From the **SDH** or **SONET** tab, select **Transmit**.
2. Select LCAS So (LCAS Source) side tab from the Transmit screen. .
3. The LCAS Settings table will appear, listing all of the members within the receive VCG.



4. Select **Remove**. The Select Member(s) window will appear.



5. The **Select Member(s)** window contains one button for each VCG member.

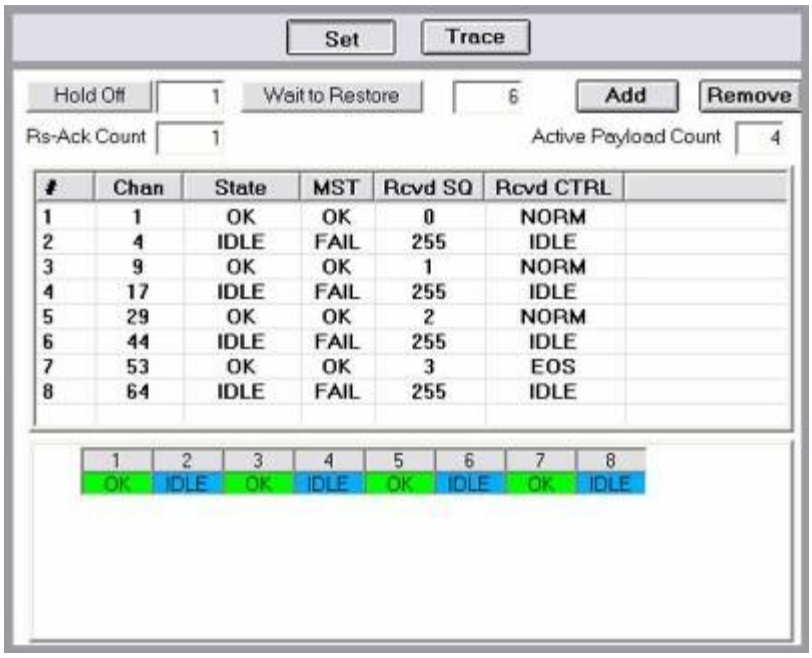
    - If the member is active, the number on the button will be black (enabled) and the button can be selected to remove that member.
    - If the member is not active, the number will be gray (disabled) and the button cannot be selected.

6. Select the **members** to remove and press **OK**.

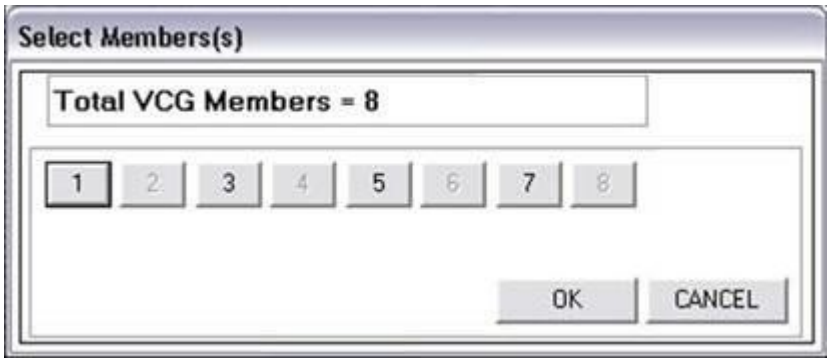
Removing LCAS Members from Sink

1. From the **SDH** or **SONET** tab, select **Receive**.
2. Select

(LCAS Sink) side tab from the Receive screen.
3. The LCAS Settings table will appear, listing all of the members within the receive VCG.



4. Select **Remove**. The Select Member(s) window will appear.



5. The **Select Member(s)** window contains one button for each VCG member.

    - If the member is active, the number on the button will be black (enabled) and the button can be selected to remove that member.
    - If the member is not active, the number will be gray (disabled) and the button cannot be selected.

6. Select the **members** to remove and press **OK**.

Viewing VCAT/LCAS Summary LEDs

Refer to the LCAS Transmit Settings for Source Member's State-LED status descriptions

Refer to the LCAS Receive Settings for Sink Member's State-LED status descriptions

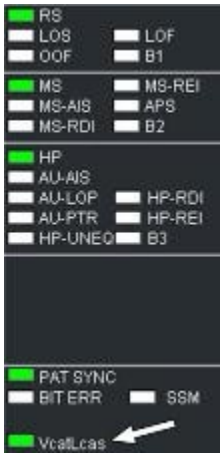
LCAS Summary LEDs are combined with VCAT Summary LEDs. The LED statuses indicate the current condition and history of a test that is currently running. For VCAT/LCAS, the Summary LEDs can be viewed in four levels:

- **VCAT summary LED**. A summary LED for all VCAT/LCAS members.
- **VCAT Summary**. A screen which shows a single LED for each VCAT/LCAS member.
- **VCAT LEDs**. An individual LED panel for each VCAT/LCAS member displaying all applicable alarm and error conditions for that VCAT/LCAS member only.
- **VCAT LEDs (Summary)**. An LED panel containing all possible error/alarm conditions with each LED indicating “summary” of all VCAT/LCAS members.

Note that Low-Order SDH configuration was used in the following examples, but VCAT Alarm and Status LEDs are the same for High-Order, and for SONET.

Summary LED

When configured for VCAT and LCAS, an interactive **VcatLcas** LED appears at the bottom of the LED Quick Status Area.



The LED + the text “VcatLcas” serve as a summary indicator for all VCAT members.

- Green LED +White “VcatLcas” = No VCAT member has detected any errors or alarms during the current test.
- Green LED + Red “VcatLcas” = History indictor. At least one VCAT member has detected errors or alarms during the current test.
- Red LED = Red “VcatLcas” = At least one VCAT member is detecting errors or alarms right now.

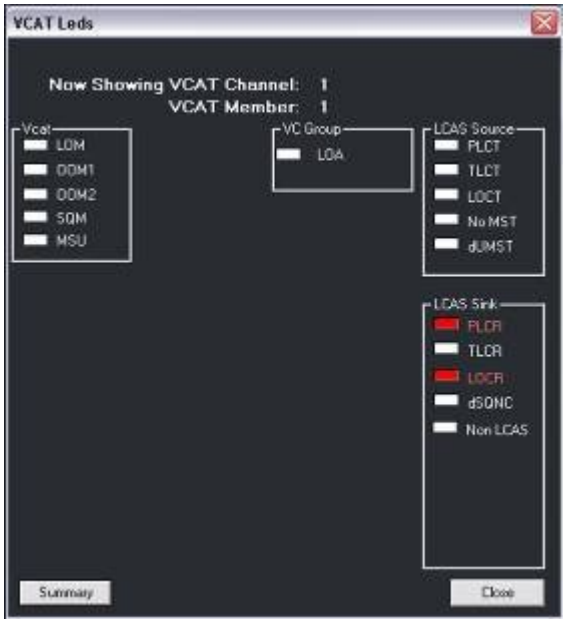
VCAT Summary

Selecting the text **“VcatLcas”** next to the Summary LED and the VCAT Summary screen will appear.

Each block provides a summary for a single VCAT/LCAS member. In this case, white text indicates that no errors or alarms have been detected in the current test on the VCAT/LCAS member. Red Text indicates the detection of a least error or alarm on the VCAT/LCAS member during the current test.

VCAT/LCAS LEDs

Select any block in the VCAT Summary window and the VCAT/LCAS LEDs window will appear.



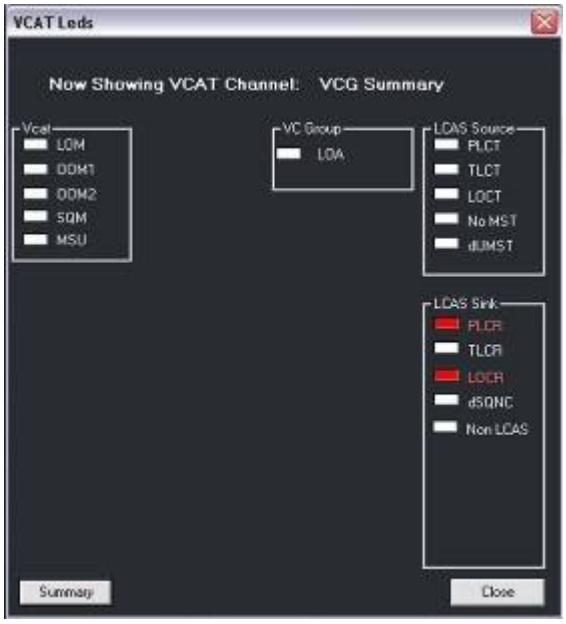
The VCAT/LCAS LEDs window provides full information regarding all alarm and error conditions for the selected VCAT/LCAS member. As in the Summary LED, the LED itself plus the text serve as indicators.

- Green LED +White text = This error or alarm has not been detected during the current test.
- Green LED + Red text = This error or alarm has been detected during the current test but is not present at this time.
- Red LED = Red text = This error or alarm is being detected right now.

Select **Close** to return to the VCAT Summary window.

VCAT/LCAS LEDs (Summary)

Select **Summary** on the VCAT/LCAS LEDs window. The window and all LEDs will change from reporting the condition of just one VCAT/LCAS member to a summary function.



Each LED indicates whether that error or alarm has been or is being detected on any VCAT/LCAS member.

- Green LED +White text = This error or alarm has not been detected during the current test on any VCAT/LCAS member.
- Green LED + Red text = This error or alarm has been detected during the current test on any VCAT/LCAS member but is not present at this time.
- Red LED = Red text = This error or alarm is being detected right now on any VCAT/LCAS member.

Refer to LCAS Results for detailed LCAS Results statistics

GFP Payloads for SDH mappings

The SDH Protocol Processor on the NGMR circuit pack can be configured for GFP payloads (Complying with ITU-T G.7041).

This is a licensable option. Please contact Tech Support, or your DLI sales representative, to enable this option on your NIC unit.

To enable GFP, first configure the desired SDH **Interface** rate and **Mapping** from the SDH tab. Next, select the **Payload** menu, and choose **GFP**.

The following SDH mappings support the GFP payload:

SDH Mapping	Max GFP-Bulk data rate	Supports

	(100% BW)	GFP-T?
AU-4-64c	9584.640 Mbps	No
AU-4-16c	2396.160 Mbps	Yes
AU-4-4c	599.040 Mbps	No
AU-4 C-4	149.760 Mbps	No
AU-3 C-3	48.384 Mbps	No

VCAT Mapping	Max GFP-Bulk data rate (max VCG members)	Minimum # of VCG members for GFP-T?
VC-4c-Xv	3594.240 Mbps	7
VC-3c-Xv	1161.216 Mbps	21
VC-2c-Xv	434.176 Mbps	N/A
VC-12c-Xv	139.264 Mbps	N/A
VC-11c-Xv	102.400 Mbps	N/A

For **GFP-Framed** and **GFP-Transparent** modes, the maximum data rate is limited to **1 Gbps**; which can be distributed on one, or to up to four independent GFP streams from the Packet tab.

802.3 1G and 10G LAN

The NGMR board can be configured so that 1 Gigabit and 10 Gigabit Ethernet LAN streams can be tested.

This is a licensable option. Please contact Tech Support, or your DLI sales representative, to enable this option on your NIC unit.

Use the Interface menu in the SONET or SDH tab to select either of the following rates.

- **802.3 1G LAN (1250.0 MHz)** - Provides 1.250 Gigabit Ethernet LAN testing
- **802.3 10G LAN (10312.5 MHz)** - Provides 10.3125 Gigabit Ethernet LAN

After establishing a 1G or 10G interface rate, you will notice that the mapping option is set to LAN, and most of the common SONET or SDH features become disabled with the exception of the Laser button, Clock Reference, and Line Frequency Offset, and a couple other select settings.

After setting the LAN interface rate, select the **Packet tab** to configure and test the Ethernet processor and Streams settings.

Configuring APS (K1 and K2) Commands

The following only applies to SONET and SDH protocol processors.

Automatic Protection Switching (APS) is a function that allows an LTE to switch to a backup (or protection) channel in case errors or failures occur on the working channel. APS commands can be configured for either Linear- or Ring-based SONET and SDH networks and are transmitted using the K1 and K2 bytes of the Line Overhead.

You can test your network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response by configuring the K1 and K2 bytes.

You can create up to 16 different K1 and K2 byte configurations (known as byte sequences) to measure and stress your equipment's APS switching capabilities.

To configure K1 and K2 byte values:

1. Select a protocol processor mode.
2. Select the **Transmit** button.
3. Select the **APS** button. The initial APS screen appears containing a table of the K1 and K2 byte sequences that can be transmitted. A total of 16 K1 and K2 byte sequences can appear in the table.
4. Select a byte sequence button (for example,

).

   The **Apply Maintenance to Entry** screen appears. It contains functions used to configure and set the measurement criteria of the K1 and K2 bytes.

5. Use the **APS Mode** function to configure APS commands for **Linear** protection switching mode or **Ring** APS signaling mode.
6. Edit the K1 byte.

   The K1 byte is a request for switch action. There are three functions that allow you to edit the K1 byte:

   - Use the **K1 Full Byte** function to set all eight bits of the K1 byte at once.
   - Use the **K1 Bits 1-4** function to set the first four bits of the K1 byte.
   - Use the **K1 Bits 5-8** function to set the last four bits of the K1 byte.

7. Edit the K2 byte.

   The K2 byte provides additional information about SONET network architecture and alarm conditions. There are four functions that allow you to edit the K2 byte:

   - Use the **K2 Full Byte** function to set all eight bits of the K2 byte at once.
   - Use the **K2 Bits 1-4** function to set the first four bits of the K2 byte.
   - Use the **K2 Bit 5 (provisioned)** function to set the fifth bit of the K2 byte.
   - Use the **K2 Bits 6-8** function to set the last three bits of the K2 byte.

8. Select **Duration in Frames** to determine how many frames will be transmitted containing the newly configured K1 and K2 bytes.
9. Select **Update**. The initial APS screen appears on the touch screen.
10. To configure additional K1 and K2 bytes, repeat steps 3-8 as described above. Otherwise, proceed to the next section to transmit K1 and K2 bytes.

To transmit K1 and K2 bytes:

1. Make sure that K1 and K2 byte sequences are configured as described above.
2. Select **Start** to transmit the K1 and K2 bytes.

To stop transmitting K1 and K2 bytes:

1. Select a protocol processor mode.
2. Select the **Transmit** button.
3. Select the **APS** button. The initial APS screen appears.
4. Select **Stop**.

Related Topic:

Decoding APS (K1 and K2) Values

Decoding APS (K1 and K2) Values

The APS function monitors incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 15 byte sequences can appear on the screen. You can choose to view APS activity in either K1 and K2 Hex values or decode them.

To view received K1 and K2 values:

1. Select the **Results** button.
2. Select **APS** from the tabs along the left side of the Results screen.
3. Select **APS View Mode**, and choose whether to decode the K1/K2 byte's value in either **Linear or Ring** Mode.
4. From the APS Results screen, you can decode a **specific** K1/K2 byte's value or decode the values for **all** K1/K2 bytes.

To decode a specific K1/K2 byte value:

- Select **APS Summary**.

  The results table displays the K1 byte HEX value, K2 byte HEX value, number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

  a. Select the desired **Item** row. The APS Decode dialog box appears with the K1 and K2 byte values decoded.
  b. You can scroll through the Items by selecting the **Prev** and **Next** buttons at the bottom of the APS Decode dialog box. Choose **Cancel** when finished.

To decode all K1/K2 byte values:

- Select **APS Decode**.

  The results table splits into two horizontal tables: the top table displaying K1 byte results; the bottom table displaying K2 byte results.

  The K1 table decodes the values for bits 1-4 and bits 5-8. The K2 table decodes the values for bits 1-4, bit 5, and bits 6-8.

  Also displayed in the tables are the number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

Setting Thresholds for M.2120 Performance Events

The M.2120 screen provides a detailed breakdown for errors meeting the ITU-T M.2120 standard. The results table displays errors detected and logged by the SDH protocol processor by using threshold error performance criteria with respect to either a 15-minute (TR15) or 24-hour (TR24) evaluation period. Error thresholds can be set directly from the M.2120 screen.

Threshold Report 15-Minute (TR15) and Reset Threshold Report 15-Minute (RTR15)

When evaluating TR15, performance events are counted separately, second by second, over each 15-minute fixed window period. A threshold can be crossed at any second within the 15-minute period. As soon as a threshold is crossed a 'fail' message is displayed in the Cur15 column. The performance events continue to be counted to the end of the 15-minute period, at which time the current performance event counts are stored in the historical registers and the current performance event registers are reset to zero. After resetting the registers to zero the 'pass' or 'fail' result moves to the Prev15 column and the performance evaluation continues and records the new result in the Cur15 column.

If the event is in the fail state, the value of the counter is compared to the reset threshold (RTR15) at the end of each period. If the count is less than or equal to the reset threshold, and there has been no unavailable time during that period, a RTR15 is generated and the state changes back to acceptable. If there has been unavailable time during the period or the count crosses the RTR15 threshold then the event remains in the fail state.

Threshold Report 24-Hour (TR24)

The TR24 filter is a 24-hour fixed window. The start and end time for the 24-hour window must occur on a 15-minute window boundary. TR24s occur as soon as the 24-hour threshold is reached or exceeded. The resultant pass or fail state displays the Cur24 column and records to the Prev24 column as the next evaluation period begins. There is no RTR24 for the 24-hour evaluation period.

To set an evaluation threshold:

1. From the **SDH** tab, select **Perf Monitor**.
2. Select **M.2120** from the tabs along the left side of the Perf Monitor screen.
3. Select the desired performance event for an error type (for example, from the B2 error type, select the SES row). The Select Threshold dialog box appears.
4. Select **TR15**. A keypad appears.
5. Set the error threshold for the 15-minute evaluation period and choose **OK**.
6. Reselect the event row to display the Select Threshold dialog box and choose **RTR15**.

Setting a RTR15 is optional.

7. Set the error reset error threshold and choose **OK**.

8. Reselect the event row to display the Select Threshold dialog box and choose **TR24**.
9. Set the error threshold for the 24-hour evaluation period and choose **OK**.

NGMR Screen Functions and Descriptions

SDH (NGMR) Screen Functions and Descriptions Overview

This section of the online help system describes the various functions, buttons, and tabs that control SDH configuration and operation.

The following screens and functions are discussed:

- Transmit
- Receive
- Results
- Test
- Perf Monitor
- LEDs

Transmit

SDH Transmit Screens and Functions

The Transmit functions allow you to define the parameters used for SDH transmitting operations.

The following parameter setting options are available from the Transmit screen:

- Set > Set 1
- Set > Set 2
- Set > Set 3
- SOH
- POH
- PTR
- APS
- VCAT (Only appears when the test set is configured for VCAT.)
- LCAS So (Only appears when the LCAS is enabled)
- Error Alarm

SDH Transmit - Set / Set 1

The SDH Transmit Settings 1 screen configures the unit's transmit parameters. It contains the following functions:

Function	Description
Settings Controls	If **Coupled** is selected, settings

	changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Pass Thru Mode	Activates or deactivates passthru mode, allowing an incoming STM signal to pass through the unit without altering the data in the signal. The following options are available: **On** and **Off**.
Interface	Selects the optical or electrical interface. The following options are available: **STM-64**, **STM-16, STM-4**, **STM-1**, **STM-0**, **STM-1E**, and **STM-0E**. If the test set is licensed for Jitter operation, the following options are also available: **STM-1-Jitter**, **STM-4-Jitter**, **STM-16-Jitter**, and **STM-64-Jitter**. If the test set is licensed for 1G or 10G LAN, the following options are also available: **802.3 1G LAN (1.250 GHz), 802.3 10G LAN (10.3125 GHz)**
Mapping	Defines the type of signals that are combined to create an SDH signal. For example, four AU-4-16c's can be mapped into an STM-64 signal. Mapping options are dependent on the selected Interface. The following options may be available: • **Unframed Bulk Fill** • **AU-4-64c Bulk Fill** • **AU-4-16c Bulk Fill**

	• **AU-4-4c Bulk Fill** • **AU-4 C-4 Bulk Fill** • **C-3 Bulk Fill (AU-3 or AU-4)** • **C-2 Bulk Fill (AU-3 or AU-4)** • **C-12 Bulk Fill (AU-3 or AU-4)** • **C-11 Bulk Fill (AU-3 or AU-4)** If the test set is licensed for VCAT, the following options are also available: • **VC-4-Xv Bulk Fill (AU-4)** • **VC-3-Xv Bulk Fill (AU-3 or AU-4)** • **VT-2-Xv Bulk Fill (AU-3 or AU-4)** • **VT-12-Xv Bulk Fill (AU-3 or AU-4)** • **VT-11-Xv Bulk Fill (AU-3 or AU-4)** If the test set is licensed for 10G WAN, the following options are also available: • **AU-4-64c Ethernet WAN**
AU-<#> Added	Displays the mapped signal. When available, select the **AU-<#> Added** button to enter the number of the specific AU channel to set as the *foreground* (source) channel. The default setting is 1. The source channel can be used to transmit alarms, errors, or patterns.
Background AU-<#> Pattern	Allows the user to select the type of pattern to be inserted into the remaining *background* channels for the SDH signal. Select one of the following:

	User-Defined (32 bit value), PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv.
Payload Pattern	Allows the user to select a test pattern to transmit over the SDH signal. This command is automatically coupled to its equivalent Receive command. Select one of the following: **User-Defined (32 bit value), PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv.** If the test set is licensed for GFP, then **GFP** mapping option is also available.
Clock Reference	Allows the user to select the timing source for the SDH transmit signal. Select one of the following: **Internal, Recovered, Bits/Sets, External 8 KHz, External 1.544 MHz, External 2.048 MHz, External 10 MHz.** The External clocks are **75 Ohm TTL.**

SDH Transmit - Set / Set 2

The SDH Transmit Settings 2 screen contains the following functions:

Function	**Description**

Line Frequency Offset	Adjusts the offset of the signal frequency of the transmitted SDH signal. The frequency can be adjusted in parts per million (ppm). Use the data calculator to enter the offset frequency. The frequency offset ranges from -100.0 to 100.0 in increments of 0.1 A **0 (zero)** value equals **Off**.
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. The following options are available: • **Off** - The unit's laser will be off when the unit is turned on. • **On** - The unit's laser will be on when the unit is turned on. • **Restore Previous State** - When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.
SS Bits in the H1 Label	This function allows bits 5 and 6, which are the SS bits, of the H1 Pointer byte to be set to support a SONET or SDH Transport OH. Changes to the Transport OH are another way to stress an SDH network by simulating errors, alarms, and other stress conditions. The following options are available: **SONET (00)**, **SDH (10)**, or **Undefined**.

HP Signal Label	The Higher-Order Path Signal Label is part of the HPOH and identifies the type of traffic contained in the Virtual Container (VC). The C2 byte is used to indicate the content of the SPE, including the status of the mapped payload. The following options are available: • **00 (Unequipped)** • **01 (Equipped)** • **02 (TUG Structured)** • **03 (Lock TU Mode)** • **04 (Async 34M/45M Mapping)** • **12 (Async 140M Mapping)** • **13 (ATM Mapping)** • **14 (DQDB Mapping)** • **15 (FDDI Mapping)** • **1A (10G WAN IEEE802.3ae)** • **1B (GFP Mapping)** • **FE (O.181 Test Signal)** • **FF (VC-AIS)** • **User Defined** (any eight bit pattern 0 to FF). This option is coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will change in the Overhead screen as well.

LP Signal Label	Bits 5 through 7 of the V5 byte are allocated for a LP Signal Label to indicate the content of the LP SPE, including the status of the LP mapped payload. The following options are available: • **00 (Unequipped)** • **01 (Equipped)** • **02 (Asynchronous)** • **03 (Bit Synchronous)** • **04 (Byte Synchronous)** • **06 (O.181 Test Signal Mapping)** • **07 (VC-AIS)** • **User Defined** - Any 3-bit value 0h to 7h This option is only available for C-2, C-12, and C-11 mappings.
Synchronization Status (S1)	Allows the user to set the S1 byte to one of the following: • **00 (Quality Unknown)**: Sets byte value to 00000000. • **02 (Rec. G.811)**: Sets byte value to 00000010. • **04 (Rec. G.812 Transit)**: Sets byte value to 00000100. • **08 (Rec. G.812 Local)**: Sets byte value to 00001000. • **0B (Sync Eqip Timing Src)**: Sets byte value to 00001011. • **0F (Do Not Use for Sync)** • **User Defined** (any eight bit pattern 0 to FF)
Trigger In	Determines how the protocol processor responds when an external pulse is received. Each protocol processor can be configured to respond to an external pulse received using the Trigger In connector. The following options are available: • **Restart**: The protocol processor will

	restart when an external pulse is received. • **Error Insert**: The protocol processor will insert an error (as defined by the Output Trigger function) when an external pulse is received. • **None**: The protocol processor will do nothing when an external pulse is received.
TC Overhead Processing	Enables Tandem Connection Monitoring (TCM) transmit mode. • **Path Enable**: For SDH, the unit uses its TCM circuitry and the N1 byte to generate errors and alarms between TCM equipment. For SONET, the unit uses the Z5 byte. • **VT Enable**: For SDH, the unit uses its TCM circuitry and the N2 byte to generate errors and alarms between TCM equipment. For SONET, the unit uses the Z6 byte. • **Disable**: TCM mode is disabled, and the N1/N2 and Z5/Z6 bytes follow normal operation.

SDH Transmit - Set / Set 3

The SDH Transmit Settings 3 screen contains the following functions:

Function	Description
Orderwire Add	Allows you to add or drop an orderwire circuit. The following options are available: **None, E1, E2, F1, HP-F2,** and **HP-F3**

Datacom Channel Add	Adds a DCC Channel into the STM payload. Select one of the following: • **None** • **RS DCC Port** • **RS PRBS 2^7-1** • **RS PRBS 2^7- 1 Inv** • **MS DCC Port** • **MS PRBS 2^7-1** • **MS PRBS 2^7-1 Inv**

SDH Transmit - SOH

The Transmit SOH screen contains the following options:

Function	Description
Showing	Select **Showing** to choose an Overhead slot within the SDH signal. The overhead bytes that appear on the SOH screen are associated with this slot.
MS and RS Overhead bytes	Allows the user to select an Overhead byte to edit its value.
J0 Trace	The J0 byte is part of the MS Overhead and is known as the Section trace or J0 trace. The J0 trace is a 64-byte pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The J0 trace can be configured to send the system's default pattern or a customized pattern.

	The following options are available: • **Default (64 byte)** - Selects the 64-byte Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)** - Selects a 64-byte user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones** - Selects an All Ones pattern as the J0 trace pattern. • **All Zeros** - Selects an All Zeros pattern as the J0 trace pattern. • **Default (16 byte)** - Selects the 16-byte Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)** - Selects a 16-byte user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.

The Transmit POH screen contains the following options:

Function	Description
AU-<#> Added	Allows the user to enter the number of the specific AU channel to set as the *foreground* (source) channel. The default setting is 1. When a VCAT mapping is chosen, this setting changes to VCAT Channel.
HP and LP Overhead Bytes	Path Overhead Bytes include: B3, J1, C2, G1, F2, H4, F3, K3, and N1. VT Overhead Bytes include: V5, J2, N2, and K4. **Note**: This option will be disabled if Passthru mode is enabled.
J1 Trace	Selects a default or customized pattern to be used as the J1 trace. Select one of the following patterns: • **Default (64 byte)**: Selects the Digital Lightwave ASCII message as the J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)**: Selects a user-defined ASCII message as the J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones**: Selects an All Ones pattern as the J1 trace pattern. • **All Zeros**: Selects an All Zeros pattern as the J1 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the J1 trace

	pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.
TC Trace	The TC Trace is a 16-byte pattern that can be created for repeated transmission between TCM equipment. The pattern is a string of ASCII characters and can be configured to send the unit's default pattern or a customized pattern. Enable TCM mode (using TC Overhead Processing) before sending the TC Trace. Select one of the following patterns: • **Default**: Selects the 16-byte Digital Lightwave ASCII message as the TC trace pattern. • **All Ones** - Selects an All Ones pattern as the TC Trace pattern. • **All Zeros** - Selects an All Zeros pattern as the TC Trace pattern. • **User Defined**: Selects a 16-byte user-defined ASCII message as the TC trace pattern. The message is entered and saved using a touch screen keyboard.

SDH Transmit - PTR

The Transmit PTR screen contains the following options:

Function	Description
NDF Flag	The NDF Flag allows you to specify whether the NDF bits are set when a new Pointer is present in the generated signal. The following options are available: **Yes** (On): Generates an NDF when a new Pointer is transmitted. **No** (Off): Disables NDF functionality.
Pointer Value	The Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the Virtual Container. The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from 0 to 782. After entering the new Pointer Value, the Pointer automatically moves to the new position.
Frequency Offset	Adjusts the rate at which AU Pointer adjustments are needed in the Administrative Unit (AU). Enter a frequency type ranging from -100.0 ppm to +100.0 ppm. This function is disabled by entering 0.
Pointer Action	Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. **Single options** - Inserts a single Pointer movement with each selection of the INC Pointer or DEC Pointer button. The Pointer value changes by one. **Increment/Decrement option** - Determines the type of Pointer

	activity that occurs when the INC Pointer and DEC Pointer buttons are selected. **Continuous options** - Inserts a continuous Pointer movement with the selection of the INC Pointer or DEC Pointer button. The movement continues until the Stop Sequence button is selected.
Burst Count	This function allows you to determine the number of Pointer location movements to occur when the INC Pointer or DEC Pointer buttons are pressed. The Pointer burst count ranges from 1 to 8.
Ms between Bursts	Allows the user to set the number of Milliseconds between bursts. Valid valued are 34 - 10000.
INC Pointer / DEC Pointer	Alternates the Pointer insertion from increment to decrement with a 200-msec delay in between.

APS

Transmit APS

This is an Automatic Protection Switching (APS) function used to configure transmit APS activity. APS is a feature that allows the LTE to switch to a backup line in case of errors or failures on the main line. APS commands can be configured for either Linear- or Ring-based networks and are transmitted using bytes K1 and K2 of the Line overhead.

You can test the network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response.

The following options are available on the APS screen:

- **New Item** - Opens the Apply Maintenance to Entry window, from which you configure K1 and K2 bytes.
- **Start** - Begins transmission of the K1 and K2 byte configuration.
- **Clear** - Clears the table.

The following Apply Maintenance to Entry window APS Transmit functions are available:

APS Mode - Linear

This function configures the system to transmit APS functions for a Linear (span) network.

- K1 Full Byte (Linear Mode)
- K1 Bits 1-4 (Linear Mode)
- K1 Bits 5-8 (Linear Mode)
- K2 Full Byte (Linear Mode)
- K2 Bit 5 (Provisioned) (Linear Mode)
- K2 Bits 1-4 (Linear Mode)
- K2 Bits 6-8 (Linear Mode)

APS Mode - Ring

This function configures the system to transmit APS functions for a Ring network.

- K1 Full Byte (Ring Mode)
- K1 Bits 1-4 (Ring Mode)
- K1 Bits 5-8 (Ring Mode)
- K2 Full Byte (Ring Mode)
- K2 Bit 5 (Provisioned) (Ring Mode)
- K2 Bits 1-4 (Ring Mode)
- K2 Bits 6-8 (Ring Mode)

Duration in Frames

The Duration in Frames function determines the number of frames transmitted that contain specific K1 and K2 bytes. These bytes are configured using the functionality located on the transmit APS screen.

Frame count is entered using a keypad. Values ranging from 1 to 65535 frames can be entered.

K1 Bits 1-4 (Linear Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description
(0000) NR	No Request, Bit pattern 0000

(0001) Non Rev	Do not revert, Bit pattern 0001
(0010) RR	Reverse Request (Ring), Bit pattern 0010
(0011) Unused	Not Used, Bit pattern 0011
(0100) EXER	Exerciser (Ring), Bit pattern 0100
(0101) Unused	Not used, Bit pattern (0101)
(0110) WTR	Wait to restore, Bit pattern (0110)
(0111) Unused	Not used, Bit pattern (0111)
(1000) MS	Manual switch, Bit Pattern 1000
(1001) Unused	Not used, Bit pattern (1001)
(1010) SD-LP	Signal degrade low priority, Bit pattern (1010)
(1011) SD-HP	Signal degrade high priority, Bit pattern (1011)
(1100) SF-LP	Signal fail low priority, Bit pattern (1100)
(1101) SF-HP	Signal fail high priority, Bit pattern (1101)
(1110) FS	Forced switch, Bit pattern (1110)
(1111) LP	Lockout of protection, Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	**Description**
(0000) NR	No request, Bit pattern 0000
(0001) RR-R	Reverse request (Ring), Bit pattern 0001
(0010) RR-S	Reverse request (Span), Bit pattern 0010
(0011) EXER-R	Exerciser (Ring), Bit pattern 0011
(0100) EXER-S	Exerciser (Span), Bit pattern 0100

(0101) WTR	Wait to restore, Bit pattern (0101)
(0110) MS-R	Manual switch (Ring), Bit pattern (0110)
(0111) MS-S	Manual switch (Span), Bit pattern (0111)
(1000) SD-R	Signal degrade (Ring), Bit Pattern 1000
(1001) SD-S	Signal degrade (Span), Bit pattern (1001)
(1010) SD-P	Signal degrade (Path), Bit pattern (1010). This is the Transmit Default button setting.
(1011) SD-R	Signal degrade (Ring), Bit pattern (1011)
(1100) SF-S	Signal fail (Span), Bit pattern (1100)
(1101) FS-R	Forced switch (Ring), Bit pattern (1101)
(1110) FS-S	Forced switch (Span), Bit pattern (1110)
(1111) LP-S	Lockout of protection (Span), Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 5-8 (Linear Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Linear mode, these bits indicate the channel number. For example, Code 0 is the Null Channel, Codes 1-14 are the working channels, and Code 15 is an extra traffic channel.

The following options are available:

Options	**Description**
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011

#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Bits 5-8 (Ring Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Ring mode, these bits contain the Destination Code Identification.

The following options are available:

Options	**Description**

Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Full Byte (Linear Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K1 Full Byte (Ring Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Bit 5 (Provisioned) (Linear Mode)

This function edits the 5th bit of the K2 byte. In Linear mode. This bit controls the type of protection switching architecture used.

The following options are available:

Options	Description
1+1	Provisioned for 1+1 mode; Bit 5 = 0
1 : n	Provisioned for 1:n mode; Bit 5 = 1

K2 Bit 5 (Provisioned) (Ring Mode)

This function edits the 5th bit of the K2 byte. In Ring mode, this bit controls the type of path code used.

The following options are available:

Options	Description
SHT / OTO	Short Path Code; Bit 5 = 0
LNG / OTN	Long Path Code; Bit 5 = 1. When selected, both the Transmit Default and Transmit Illegal button settings are configured for LNG/OTN.

K2 Bits 1-4 (Linear Mode - SDH)

This function edits the first four bits of the K2 byte. In Linear mode, the first four bits indicate which working channel is bridged onto the protection channel during a traffic switching event.

The following options are available:

Options	Description

Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K2 byte. In Ring mode, the first four bits are the Source Node Identification. (The Source Node ID is set to the Node's own ID.)

The following options are available:

Options	Description
#0	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100

#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Linear Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Unused	Not used, Bit pattern 000
(001) Unused	Not used, Bit pattern 001
(010) Unused	Not used, Bit pattern 010
(100) Unused	Not used, Bit pattern 100
(100) Uni-direct	Provisioned for Unidirectional switching, Bit pattern 10
(101) Bi-direct	Provisioned for Bidirectional switching, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Ring Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Idle	Idle, Bit pattern 000
(001) Br	Bridged, Bit pattern 001
(010) Br&Sw	Bridged and switched, Bit pattern 010. This is the Transmit Default button setting.
(100) Ex Tr	Extra traffic on protection channel, Bit pattern 100
(100) Unused	Not used, Bit pattern 10
(101) Unused	Not used, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Full Byte (Linear Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Full Byte (Ring Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

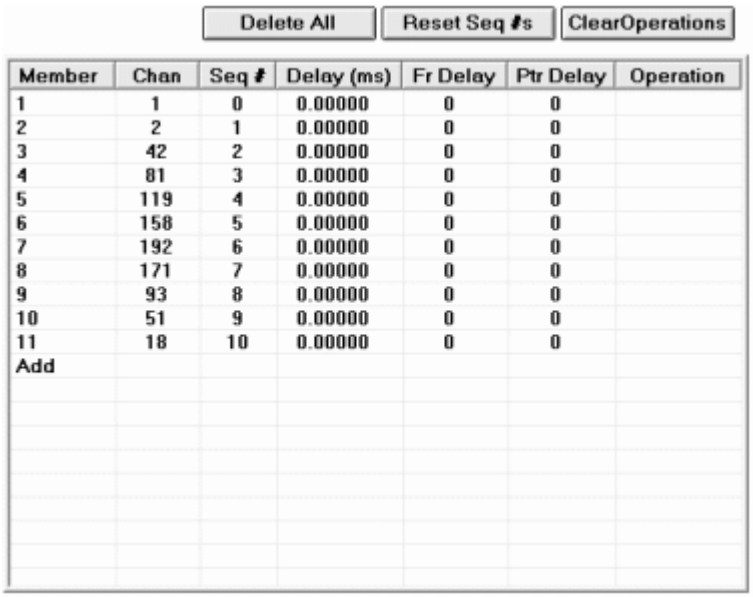
Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

Transmit - VCAT

The Transmit VCAT function allows you to add and configure VCAT channels for transmitting operations.

For instructions on configuring VCAT see How to Set Up and Use VCAT Features.

VCAT channels created and various other parameters are displayed in the VCAT Table.



The Transmit VCAT contains three function buttons, as defined below:

Function Button	Description
Delete All	Deletes all channels from the VCAT table.
Reset Seq #s	Restores the sequence numbers to default on all channels in the VCAT Table. The first channel in the table will be 0, followed by 1, 2, 3, etc.
Clear Operations	Resets all delays to 0 and stops all other operations. See definition of "operations" below.

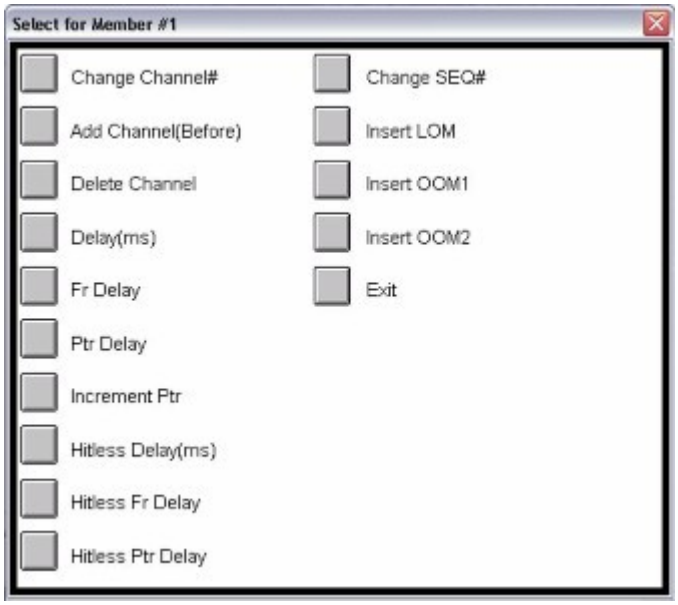
Definitions of VCAT Table columns:

Function	Description
Add	Click on Add to select members for the VCAT Group (VCG). A Select Channel screen appears which shows all possible channel member available to choose from. When a channel has been selected, the channel button will gray-out to indicate that it is already selected. If the Setting Control are set to

	Coupled, then members added to the Transmit VCG will also be added to the Receive VCG.
Member	Sequential list indicating the order in which the payload will be transmitted into the VCAT channels, regardless of the number indicated by "Seq-SQM".
Chan	Channel Number. Displays the VCAT Member's channel number. For High-Order mappings, the number will just be the AU#(for SDH) or STS#(for SONET). For Low-Order mappings SDH mappings, the address will be displayed in the following format: AU# N K,L,M, with N indicating the AU#, and the others indicating TUG-3, TUG-2 and TU# as applicable. For Low-Order SONET mappings, the address will be displayed in the following format: STS# N K,L, with N indicating the STS#, and the others indicating VT group# and VT# as applicable.
Seq # or Seq-SQM	The default and normal condition for Sequence Indicator is from 0 to N. Changing the Sequence Indicator manually will create a Sequence Mismatch (SQM) at the receiver. This column indicates the Sequence Indicator Number not the actual order that the payload is transmitted, as displayed in the "Member" column. The "Seq#" label changes to "Seq-SQM" when inserting a Sequence Mismatch.
Delay (ms)	Combined Delay. The amount of time to delay this member as compared to the earliest member. This delay is calculated based on the combined

	time for the specified frame and pointer delays, and is expressed in milliseconds. 1 ms = 8 frames.
Fr Delay	Frame Delay. The number of frames to delay this member as compared to the earliest member. This delay is the same as indicated in Delay (ms), expressed in frames. 1 frame = .125 ms.
Ptr Delay	Pointer Delay. Sets the pointer value for this member, creating a very small delay.
Operation	Indicates whether an alarm condition has been turned on for this member, either Out of Multiframe (OOM1 or OOM2) or Loss of Multiframe (LOM).

Click on any row of the VCAT Table to bring up the "Select for Member #N" menu as seen here:



The first three menu items (Change Channel#, Add Channel and Delete Channel) specifically apply to the Transmit VCAT Table. However, If "Settings Control" is set for "Coupled" (see Transmit or Receive "Set" tab), the changes will apply to both Transmit and Receive VCAT Tables. If "Settings Control" is set for independent, the change will apply only to the Receive VCAT Table.

This menu is used to setup the selected member with any of the following menu functions.

Function	Description
Change Channel #	Selects which channel (time slot) will be used by this member.
Add Channel (before)	Adds one additional member in the next slot above the selected member. Selecting this menu item will bring up another menu where channel number is selected.
Delete Channel	Deletes the selected channel (member).
Delay (ms)	Inserts Combined Frame and Pointer Delays on the selected member, entered in milliseconds (ms).
Fr Delay	Inserts Frame Delay on the selected member entered in number of frames.
Ptr Delay	Changes the pointer value of the selected member, creating a very small delay.
Increment Ptr	Increases pointer value of the selected member by a value of 1.
Hitless Delay (ms)	Inserts Combined Delay on the selected member, entered in milliseconds (ms) without causing a Loss of Multiframe (LOM) alarm.
Hitless Fr Delay	Inserts Frame Delay on the selected member entered in number of frames) without causing a Loss of Multiframe (LOM) alarm.
Hitless Ptr Delay	Changes the pointer value of the selected member, creating a very small delay) without causing a Loss of Multiframe (LOM) alarm.
Change SEQ#	Changes the Sequence Indicator, not the actual order that the payload is transmitted, as displayed in the "Member" column. Changing the Sequence Indicator manually will create a Sequence Mismatch (SQM) at the receiver.
Insert LOM	Inserts Loss of Multiframe alarm
Insert OOM1	Inserts Out of Multiframe alarm 1
Insert OOM2	Inserts Out of Multiframe alarm 2
Exit	Closes the window without changing

	the setup of the member

Transmit - LCAS So

For detailed information about LCAS, and instructions on configuring LCAS, see How to Set Up and Use LCAS Features.

Definition of Source (So) and Sink (Sk)

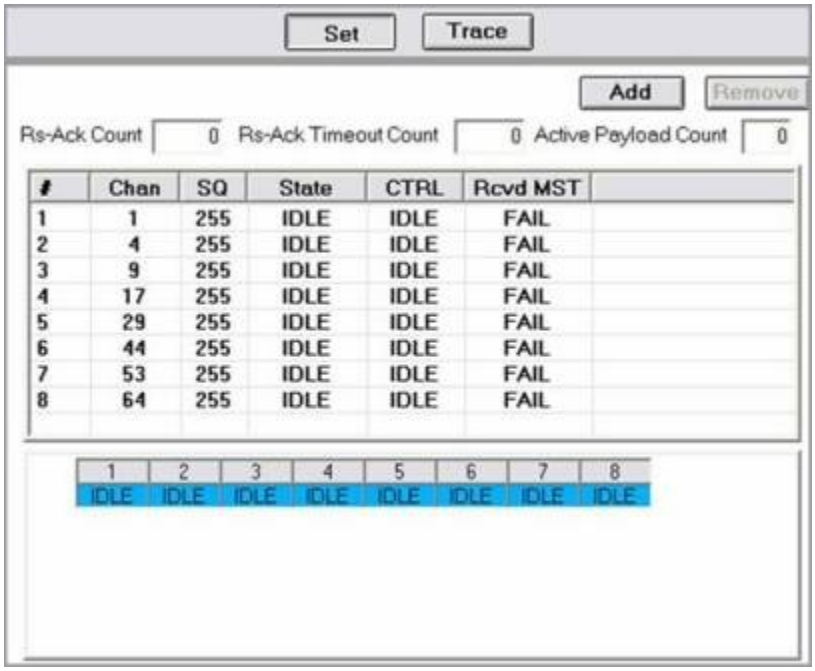
The Source functionality is available from the Transmit - LCAS So screen, and the Sink functionality is available from the Receive - LCAS Sk screen.

Unlike VCAT, which is bi-directional, LCAS operates on a one-way basis. The transmit of an LCAS system is designated “Source” and the receive is designated “Sink”. LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other direction may be configured as LCAS as well but there is no correlation between the two.

LCAS Transmit Settings

Access LCAS Transmit features by the selecting

(LCAS Source) side tab from the Transmit screen. The LCAS Settings table will appear, listing all of the members within the transmit VCG.



The transmit LCAS settings table is used to configure LCAS Source functions.

The following functions are found in the transmit LCAS settings table

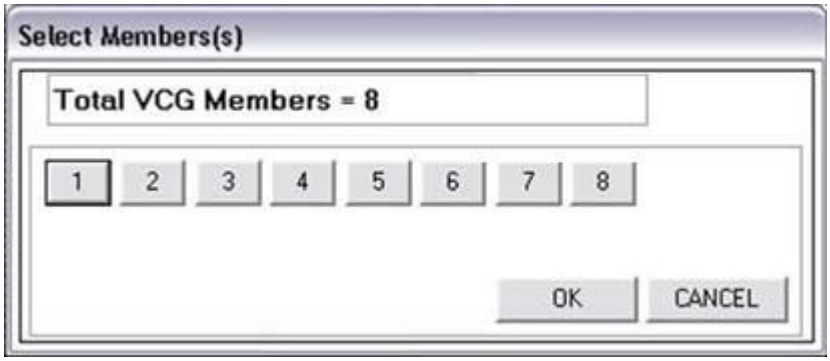
Function	Description
Set (button)	Selects the LCAS Settings Table
Trace (button)	Selects the LCAS Trace Table
Add (button)	Adds selected VCG members to the LCAS data stream
Remove (button)	Removes selected VCG members from the LCAS data stream
Rs-Ack Count	Number of Resequence - Acknowledge messages received
Rs-Ack Timeout Count	Number of times when no Resequence - Acknowledge was received before the timeout period
Active Payload Count	Number of VCG members that make up the payload
#	Member number, sequential
Chan	Channel. Displays the VCAT Member's channel number. For SDH High-Order mappings, the number will just be the AU#. For SONET STS mappings, the number will just be

	the STS#. For SDH Low-Order mappings, the address will be displayed in the following format: AU# N K,L,M, with N indicating the AU#, and the others indicating TUG-3, TUG-2 and TU# as applicable. For SONET VT mappings, the address will be displayed in the following format: STS# N K,L, with N indicating the STS#, and the others indicating VT group# and VT# as applicable.
SQ	Sequence number. If this member is not active, the sequence number will an invalid number (255 for high-order mapping, lower values for low-order mapping). For active members, the sequence number will be 0, 1, 2, etc.
State	Indicates the state of this VCG member. The possible states are: **IDLE**: This member is not in use. **NORM**: This member is part of the payload. **DNU**: Do Not Use. Failure state. **ADD**: Source has requested to add this member to the payload. Waiting for Sink response. **REMOVE**: Source has requested to remove this member from the payload. Waiting for Sink response.
CTRL	Control message sent from Source to Sink. Possible values are: **ADD**: Member to be added to the VCG **NORM**: Normal LCAS transmission **EOS**: End of Sequence, highest member in group **IDLE**: Member is part of the VCG or to be removed **DNU**: Do not use, Sink reports failure

Rcvd MST	Member Status received from Sink (Sk)
Member State-LED	The State-LED provides a visual indication of which LCAS State or condition the VCG member is in. The possible states are: IDLE This VCG member has not been added to LCAS. NORM This member is part of the payload. DNU Do Not Use. Failure state. ADD Source has requested to add this member to the payload. Waiting for Sink response. REM Source has requested to remove this member from the payload. Waiting for Sink response.

Add and Remove

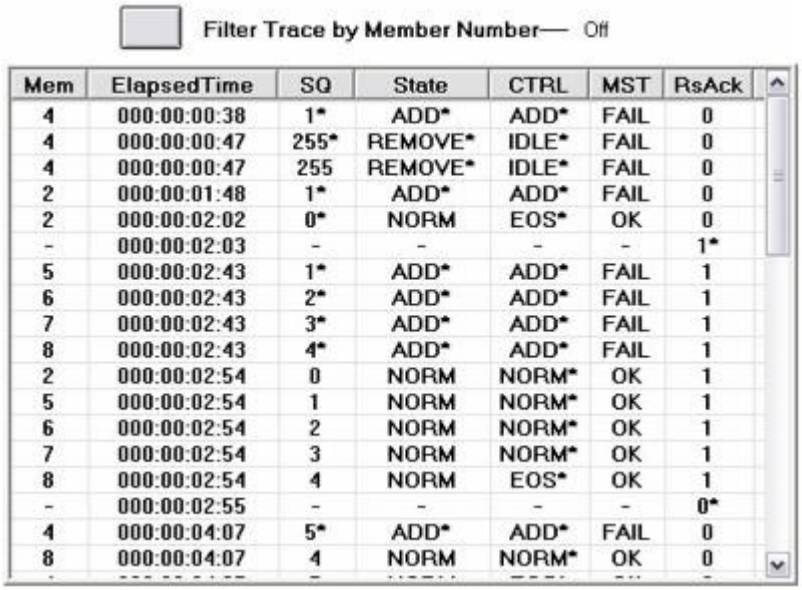
Press **Add** or **Remove** to select which VCG members are to be added or removed from the LCAS data stream.



- When adding or removing members, the button becomes disabled to indicate that the member has already been added or removed.

LCAS Transmit Trace

Press **Trace** to display the LCAS Trace Table.



Mem	ElapsedTime	SQ	State	CTRL	MST	RsAck
4	000:00:00:38	1*	ADD*	ADD*	FAIL	0
4	000:00:00:47	255*	REMOVE*	IDLE*	FAIL	0
4	000:00:00:47	255	REMOVE*	IDLE*	FAIL	0
2	000:00:01:48	1*	ADD*	ADD*	FAIL	0
2	000:00:02:02	0*	NORM	EOS*	OK	0
-	000:00:02:03	-	-	-	-	1*
5	000:00:02:43	1*	ADD*	ADD*	FAIL	1
6	000:00:02:43	2*	ADD*	ADD*	FAIL	1
7	000:00:02:43	3*	ADD*	ADD*	FAIL	1
8	000:00:02:43	4*	ADD*	ADD*	FAIL	1
2	000:00:02:54	0	NORM	NORM*	OK	1
5	000:00:02:54	1	NORM	NORM*	OK	1
6	000:00:02:54	2	NORM	NORM*	OK	1
7	000:00:02:54	3	NORM	NORM*	OK	1
8	000:00:02:54	4	NORM	EOS*	OK	1
-	000:00:02:55	-	-	-	-	0*
4	000:00:04:07	5*	ADD*	ADD*	FAIL	0
8	000:00:04:07	4	NORM	NORM*	OK	0

- The Trace table displays an event log history of changes in the LCAS configuration since the last time the test was restarted.

Function	Description
Filter Trace by Member Number	Select **User Defined** to specify an individual member number. Only the activity of the selected member will be displayed. Select **Off** to display the activity of all members.

SDH Transmit - Error Alarm

The test unit can transmit errors and alarms to simulate various defects and anomalies to determine if the receiving equipment can detect an error or alarm in the incoming signal.

For information on inserting errors and alarms see the online help topics, Inserting Errors and Inserting Alarms in the Common Tasks section.

The following options are available one the Error Alarm screen:

- Error to Insert
- Error Insert Rate
- Alarm Generated

Error to Insert

This SDH Transmit function determines the type of error transmitted by the system.

The purpose of generating an error with system is to stress the network element that is receiving the error by testing if it can detect the incoming error and then report error statistics such as error counts and rates.

The following options are available:

Option	Description
None	No errors are generated. Turns errors off.
Frame	Inserts a frame alignment error in the A1 and A2 bytes.
B1 Error	Generates a BIP-8 (Bit Interleaved Parity, 8-bit) error over the Regenerator Section layer. Bits in the B1 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
B2 Error	Generates a BIP-8 error over the Multiplex Section layer. Bits in the B2 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
MS-REI	Generates a Remote Error Indicator over the Multiplex Section layer. An MS-REI is a count of B2 errors received at the far end. When the system transmits this error, it simulates a downstream NE

	sending an error count back to the source of its incoming SDH signal. The system uses the M1 byte of the MSOH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and rates. (This type of error was formerly called a Line Far End Block Error - FEBE-L.)
B3 Error	Generates a BIP-8 error over the Higher-Order Path layer. Bits in the B3 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
HP-REI	Generates a Remote Error Indicator over the Higher-Order Path layer. An HP-REI is a count of B3 errors received at the far end. When the system transmits this error, it simulates an NE sending an error count back to the source of its incoming SDH signal. The system uses the G1 byte of the HPOH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and error rates.
LP-BIP	Generates a BIP-2 error over the Lower-Order Path layer. Bits in the V5 byte are toggled to create an

	error.
LP-REI	Generates a Remote Error Indicator over the Lower-Order Path layer. An LP-REI is a count of LP-BIP errors received at the far end. When the system transmits this error, it simulates an NE sending an error count back to the source of its incoming SDH signal. The system uses the V5 byte of the LPOH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and error rates.
HP-TC-IEC Only appears when the TC Overhead Processing is configured for "**HP Enable**".	Generates a Tandem Connection Incoming Error Count over the Higher-Order Path layer. A TC-IEC is a count of B3 errors received by TCM equipment at the far end. Bits 1-4 of the N1 byte are the IEC bits.
HP-TC-REI Only appears when the TC Overhead Processing is configured for "**HP Enable**".	Generates a Tandem Connection Remote Error Indicator over the Higher-Order Path layer between TCM equipment. Bit 5 of the N1 byte is used for this error.
HP-TC-OEI Only appears when the TC Overhead Processing is configured for "**HP Enable**".	Generates a Tandem Connection Outgoing Error Indicator over the Higher-Order Path layer between TCM equipment. Bit 6 of the N1 byte is used for this error.
LP-TC-BIP Only appears when the TC Overhead Processing is configured for "**LP Enable**".	Generates a Tandem Connection Bit Interleaved Parity error over the Lower-Order Path layer. Bits 1-2 of the N2 byte are the BIP bits.
LP-TC-REI Only appears when the TC Overhead Processing is configured for "**LP Enable**".	Generates a Tandem Connection Remote Error Indicator over the Lower-Order Path layer between TCM equipment. A LP-TC-REI is a count of LP-TC-BIP errors received

	by TCM equipment at the far end. Bit 5 of the N2 byte is used for this error.
LP-TC-OEI Only appears when the TC Overhead Processing is configured for "**LP Enable**".	Generates a Tandem Connection Outgoing Error Indicator over the Lower-Order Path layer between TCM equipment. Bit 6 of the N2 byte is used for this error.
BIT Error	Generates bit errors. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and error rates.

Error Insert Rate

This SDH Transmit function sets the error rate for the selected error. The system starts transmitting errors after the insertion rate is selected.

For information about inserting errors, see Inserting Errors in the Common Tasks section of the online help.

The following Error Insert Rate options are available:

Option	Description
Off	Turns error transmission off.
Maximum	Generates errors at the maximum rate listed below.
1e - *X*	*X* is a value from 3 to 10; for example, 1e-3 through 1e-10. *X* will vary based on the type of error selected.
User Defined	Allows the user to enter a custom error. Valid values are 1e-6 to 1e-10.

Alarm Generated

This function configures the system to generate an alarm in the transmit SDH signal. Alarm generation by the system is one way to test if downstream SDH equipment reacts properly to the alarm it receives in the incoming SDH signal.

For information about generating alarms, see Inserting Alarms in the Common Tasks section of the online help.

The following alarms are available:

Alarm	Description
None	No alarms are generated. Turns alarms off.
LOS	Loss of Signal. An all-zeros pattern is transmitted to simulate a loss of signal or loss of optical power. This forces the downstream SDH equipment to (1) generate an AIS alarm to its downstream network elements (NE), and (2) generate an RDI alarm to its upstream NEs.
LOF	Loss of Frame. An all-zeros pattern is inserted into the A1 and A2 framing bytes of the Section OH. This simulates the absence of a valid framing pattern. This forces the downstream SDH equipment to generate an AIS alarm to its downstream network elements (NE)and generate an RDI alarm to its upstream NEs.
MS-AIS	Multiplex Section Alarm Indication Signal. The transmission of an MS-AIS to a downstream NE forces that NE to send an AU-AIS alarm to the next downstream NE. The NE will also send an MS-RDI alarm to its upstream equipment. An MS-AIS simulates an alarm generated by Line terminating equipment (LTE).
MS-RDI	Multiplex Section Remote Defect Indicator. This generates an MS-RDI condition using the K2 byte of the

	Line OH. This simulates a downstream NE at the Line layer, reporting a failure to an upstream NE. The downstream NE has encountered a downstream failure and is alerting upstream SDH equipment. To do this, the system changes the pattern of the K2 byte. The NE receiving the MS-RDI alarm should detect a change to the K2 byte on the incoming SDH signal. This forces the NE to generate a Remote Alarm Indicator (RAI) to its upstream NEs.
AU-LOP	Administrative Unit Loss of Pointer. This simulates a loss of a valid Pointer. When the downstream NE receives an AU-LOP, it generates a DSn AIS alarm to its downstream equipment and an HP-RDI alarm to its upstream equipment.
AU-AIS	Administrative Unit Alarm Indication Signal. The transmission of an AU-AIS to a downstream NE forces that NE to send an AIS alarm to the next downstream NE. The NE will also send an RDI alarm to its upstream equipment. An AU-AIS simulates an alarm generated by Path terminating equipment (PTE).
HP-RDI	Higher-Order Path Remote Defect Indicator. This generates an HP-RDI condition using the G1 byte of the Higher-Order Path OH. This simulates a downstream NE at the Path layer, reporting a failure to an upstream NE. To do this, the system changes the pattern of the G1 byte in the HPOH. The NE receiving the HP-RDI alarm

	should detect a change to the G1 byte on the incoming SDH signal.
HP-UNEQ	Higher-Order Path Unequipped Alarm. An all-zeros pattern is inserted into the C2 byte of the HPOH. The C2 byte is the HP Signal Label. (This type of error is used between Higher-Order Path terminating equipment-PTE) When a PTE receives this alarm, it will generate an AIS to downstream NEs.
HP-TC-RDI Only appears when the TC Overhead Processing is configured for "**HP Enable**".	Tandem Connection-Remote Defect Indicator. Generates an alarm to upstream equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 8 in multiframe 73 of the N1 byte.
HP-TC-ODI Only appears when the TC Overhead Processing is configured for "**HP Enable**".	Tandem Connection-Outgoing Defect Indicator. Generates an alarm to upstream TCM equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 7 in multiframe 74 of the N1 byte.
HP-TC-AIS Only appears when the TC Overhead Processing is configured for "**HP Enable**".	Tandem Connection-Alarm Indication Signal. Generates an AIS alarm to downstream TCM equipment by setting Bits 1-4 of the N1 byte to 1110.
HP-TC-UNEQ Only appears when the TC Overhead Processing is configured for "**HP Enable**".	Tandem Connection-Unequipped. An all-zeros pattern is inserted into the N1 byte of the Path OH.
HP-TC-LOF Only appears when the TC Overhead Processing is configured for "**HP Enable**".	Tandem Connection-Loss of Frame. Generates a loss of a valid multiframe pattern to downstream equipment.

Receive

SDH Receive Screens and Functions

The Receive function allows you to define the parameters used in SDH receiving operations.

The following parameter setting options are available from the Receive screen:

- Set > Set 1
- Set > Set 2
- Set > Set 3
- SOH
- POH
- SIG
- VCAT (Only appears when the test set is configured for VCAT)
- LCAS Sk (Only appears when the LCAS is enabled)

SDH Receive - Set / Set 1

The SDH Receive Settings 1 screen configures the unit's receive parameters. It contains the following functions:

Function	Description
Settings Control	If **Coupled** is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If **Independent** is selected, settings established on the Receive screen will only affect Receive mode.

Interface	Selects the optical or electrical interface. The following options are available: **STM-64**, **STM-16, STM-4**, **STM-1**, **STM-0**, **STM-1E**, and **STM-0E**. If the test set is licensed for Jitter operation, the following options are also available: **STM-1-Jitter**, **STM-4-Jitter**, **STM-16-Jitter**, and **STM-64-Jitter**. If the test set is licensed for 1G or 10G LAN, the following options are also available: **802.3 1G LAN (1.250 GHz), 802.3 10G LAN (10.3125 GHz)**

Mapping	Defines the type of signals that are combined to create an SDH signal. For example, four AU-4-16c's can be mapped into an STM-64 signal. Mapping options are dependent on the selected Interface. The following options may be available: • **Unframed Bulk Fill** • **AU-4-64c Bulk Fill** • **AU-4-16c Bulk Fill** • **AU-4-4c Bulk Fill** • **AU-4 C-4 Bulk Fill** • **C-3 Bulk Fill (AU-3 or AU-4)** • **C-2 Bulk Fill (AU-3 or AU-4)** • **C-12 Bulk Fill (AU-3 or AU-4)** • **C-11 Bulk Fill (AU-3 or AU-4)** If the test set is licensed for VCAT, the following options are also available: • **VC-4-Xv Bulk Fill (AU-4)** • **VC-3-Xv Bulk Fill (AU-3 or AU-4)** • **VT-2-Xv Bulk Fill (AU-3 or AU-4)** • **VT-12-Xv Bulk Fill (AU-3 or AU-4)** • **VT-11-Xv Bulk Fill (AU-3 or AU-4)** If the test set is licensed for 10G WAN, the following options are also available: • **AU-4-64c Ethernet WAN**
AU Type	Selects an Administrative Unit type to include AU-3 or AU-4.

AU-<#> Dropped	Select the foreground Administrative Unit to be dropped. The options that appear will depend on your current configuration. The default setting is 1.
TUG-3 Dropped	Select the foreground TUG-3 to be dropped. TUG-3 will only display for LP mappings, if the AU type is set as AU-4.
TUG-2 Dropped	Select the foreground TUG-2 to be dropped. TUG-2 is only available for LP mappings C-12 and C-11.
TU-<#> Dropped	Select the foreground Tributary Unit to be dropped. This setting is only available for LP mappings.
Payload Pattern	Selects the type of pattern that the unit expects to receive on the incoming SDH signal. The following options are available: • **Live** (user data is received; no pattern is used) • **User Defined** (range from 1 bit to 32 bits and is entered using a touch screen keypad) • **PRBS 9**, **PRBS 9 Inv**, **PRBS 11**, **PRBS 11 Inv**, **PRBS 15**, **PRBS 15 Inv**, **PRBS 20**, **PRBS 20 Inv**, **PRBS 23**, **PRBS 23 Inv**, **PRBS 31**, **PRBS 31 Inv** If the test set is licensed for GFP, then **GFP** mapping option is also available.
Power Low Threshold	Sets the power threshold. If the power drops below the threshold, the Power Low alarm initiates. When the threshold is reached, the LOS alarm signals.

Out of Frequency Threshold	Sets the frequency threshold for the Line Frequency Offset. When the threshold is reached, the Frequency Wide alarm is triggered.
Trigger Out	Allows the user to select the way that the protocol processor will respond to an external "pulse" received.

SDH Receive - Set / Set 2

The SDH Receive Settings 2 screen configures the unit's receive parameters. It contains the following functions:

Function	Description
PLM Alarm Reporting	**Disable** or **Enable** Payload Label Mismatch reporting.

Expected HP Signal Label	Enter any eight bits for the Higher-Order Path Signal Label for byte C2 expected. Configure to receive a specific value for the C2 byte. The following options are available: • **00 (Unequipped)** • **01 (Equipped)** • **02 (TUG Structured)** • **03 (Lock TU Mode)** • **04 (Async 34M/45M Mapping)** • **12 (Async 140M Mapping)** • **13 (ATM Mapping)** • **14 (DQDB Mapping)** • **15 (FDDI Mapping)** • **1A (10G WAN IEEE802.3ae)** • **1B (GFP Mapping)** • **FE (O.181 Test Signal)** • **FF (VC-AIS)** • **User Defined** (any eight bit pattern 0 to FF) This option is coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will change in the Overhead screen as well.

Expected LP Signal Label	Select one of the following values for the expected Lower Order Path Signal: The following options are available: • **00 (Unequipped)** • **01 (Equipped)** • **02 (Asynchronous)** • **03 (Bit Synchronous)** • **04 (Byte Synchronous)** • **06 (O.181 Test Signal Mapping)** • **07 (VC-AIS)** • **User Defined** - Any 3-bit value 0h to 7h This option is only available for C-2, C-12, and C-11 mappings.
TIM Alarm Reporting	An HP Path Trace Identifier Mismatch (HP-TIM) alarm occurs when the incoming J1 trace does not match the expected J1 trace. A Regenerator Section Trace Identifier Mismatch (RS-TIM) alarm occurs when the incoming J0 trace does not match the expected J0 trace. The following options are available: • **Enabled** - TIM alarms are recognized and reported. • **Disabled** - TIM alarms are ignored.

Expected J0	Defines the expected J0 trace received on the incoming SDH signal. A RS-TIM alarm occurs if the incoming J0 trace does not match the expected J0 trace. The J0 byte is part of the Regenerator Section OH and is known as the Section trace, or J0 trace. The J0 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. • **Default (64 byte)** - Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)** - Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones** - Selects an All Ones pattern as the J0 trace pattern. • **All Zeros** - Selects an All Zeros pattern as the J0 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a

	CRC-7.

Expected HP J1	Defines the expected J1 trace received on the incoming SDH signal. A HP-TIM alarm occurs if the incoming J1 trace does not match the expected J1 trace. The J1 byte is part of the Higher-order Path OH and is known as the Path trace, or J1 trace. The J1 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters.The following options are available: • **Default (64 byte)** - Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)** - Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones** - Selects an All Ones pattern as the J1 trace pattern. • **All Zeros** - Selects an All Zeros pattern as the J1 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15

	characters, appended with a CRC-7.

Expected LP J2	Defines the expected J2 trace received on the incoming SDH signal. A LP-TIM alarm occurs if the incoming J2 trace does not match the expected J2 trace. The J2 byte is part of the Lower-order Path OH and is known as the Path trace, or J2 trace. The J2 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The following options are available: • **Default (64 byte)** - Selects the Digital Lightwave ASCII message as the expected J2 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)** - Selects a user-defined ASCII message as the expected J2 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones** - Selects an All Ones pattern as the J2 trace pattern. • **All Zeros** - Selects an All Zeros pattern as the J1 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the expected J2 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the expected J2 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15

	characters, appended with a CRC-7.
SS Bits Alarm Reporting	**Disables** or **Enables** SS bits reporting. This function is used in conjunction with the Expected SS Bits function. If enabled, and an SS Bits mismatch is detected on the received signal, the duration in seconds will appear under the

	Results Scan function.
Expected SS Bits	Selects one of the following as the expected SS Bits value: • **00 (SONET)** • **01 (Undefined)** • **10 (SDH)** • **11 (Undefined)**
TC Error/Alarm Processing	Enables or disables Tandem Connection Monitoring (TCM) mode. This function is used in conjunction with the Expected TC Trace function. The TC Summary LED turns red if a TCM error or alarm is reported. Select the TC Summary text for more details. • **HP Enable** - Turns on N1 byte for TCM error and alarm reporting mode. • **LP Enable** - Turns on the N2 byte for TCM error and alarm reporting mode. • **Disable** - Turns off TCM error and alarm reporting mode. Disable this option if you are not performing TCM testing. This will prevent false error and alarm reporting.

Expected TC Trace	Defines the expected TC trace received on the incoming signal. For SONET, this is in the Z5 byte. For SDH, this is in the N1 byte. The following options are available: • **Default** - Selects a 16-byte Digital Lightwave ASCII message at the expected TC trace pattern. • **All Ones (16 byte)** - Selects a 16-byte All Ones pattern as the TC trace pattern. • **All Zeros (16 byte)** - Selects a 16-byte All Zeros pattern as the TC trace pattern. • **User Defined** - Selects a 16-byte user-defined ASCII message as the expected TC trace pattern. The message is entered and saved using a screen keypad.

SDH Receive - Set / Set 3

The SDH Receive Settings 3 screen configures the unit's receive parameters. It contains the following functions:

Function	Description
Orderwire Drop	Allows you to drop an orderwire circuit for a protocol processor. The following options are available: **None**, **E1**, **E2**, **F1**, **HP-F2,** and **HP-F3**

Datacom Channel Drop	Defines specific bytes in the Section overhead that is used to send operation and maintenance information between the Section and Line equipment. The following options are available: • **None** • **RS DCC Port** • **RS PRBS 2^7-1** • **RS PRBS 2^7-1 (Inverted)** • **MS DCC Port** • **MS PRBS 2^7-1** • **MS PRBS 2^7-1 (Inverted)**
Monitor Mode	Expands the receive sensitivity for the 52M or 155M electrical interfaces. Use this setting for better clock and data recovery, when the received voltage levels are lower than normal. This setting is only supported on the **NGMR** circuit pack, and not the **OMR** circuit pack. Click here to determine which Multirate circuit pack is in your unit.

SDH Receive - SOH

The Receive SOH screen contains the following options:

Option	Description
Showing	Selects a specific SOH slot to monitor on the incoming SDH signal. The following bytes appear for the selected SOH slot:

	• Regenerator Section Overhead bytes (A1, A2, Z0, B1, E1, F1, D1, D2, and D3), • Multiplex Section Overhead bytes (B2, K1, K2, D4-D12, Z1, Z2, and E2), • Pointer bytes (H1, H2, and H3), • Higher-Order Path Overhead bytes (B3, C2, G1, F2, H4, Z3, Z4, and Z5), • J0 Trace byte, and J1 Trace byte.
J0	Displays the J0 trace received on the incoming SDH signal. This is a read-only function.

SDH Receive - POH

The Receive POH screen contains the following options:

Option	Description
AU-<#> Dropped	Allows the user to enter the number of the specific AU channel to monitor. The default setting is 1. When a VCAT mapping is chosen, this setting changes to VCAT Channel.
HP Overhead	Displays the Overhead bytes for a specific Higher-Order Path OH slot on the incoming SDH signal. This is a read-only function.
LP Overhead	Displays the Overhead bytes for a specific Lower-Order OH slot on the incoming SDH signal. This is a read-only function.
J1 Trace	Displays the J1 trace received on the incoming SDH signal. This is a read-only function.

J2 Trace	Displays the J2 trace received on the incoming SDH signal. This is a read-only function.
TC Trace	Displays the TC trace received on the incoming SDH signal. This is a read-only function.

SDH Receive - SIG

Displays the following measurements of the incoming SDH signal:

- Frequency in Hz
- Line Frequency Offset Received in Hz and ppm
- Optical power in dBm
- AU Pointer Frequency Offset in ppm
- TU Pointer Frequency Offset in ppm
- Update Signal Calibration - Calibrating the system's optical power should be done carefully. To keep unauthorized users from changing calibration settings, the Update Signal Calibration button on the protocol processor's Receive SIG screen is unavailable by default. To change the setting, a user with Admin or Calibrate privileges must enable the calibration mode.

To enable protocol processor calibration:

1. From the **System** tab, select **Misc**.
2. From **Local Settings**, select **Enable Calibration**.

The user must have Admin or Calibrate privileges to enable the calibration mode.

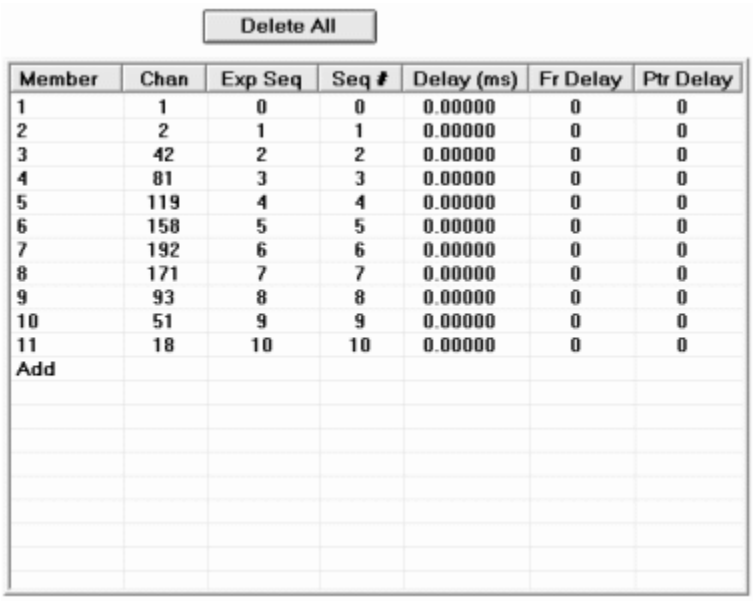
3. See Calibrating SDH/SONET Optical and Electrical Power for specific calibration instructions before proceeding.

Receive- VCAT

The Receive VCAT function allows you to setup the parameters of what the NIC expects to see on an incoming VCAT signal and to view certain parameters of the incoming signal.

For instructions on configuring VCAT see How to Set Up and Use VCAT Features.

VCAT channels created and various other parameters are displayed in the VCAT Table.



The Receive VCAT contains one function button, as defined below:

Function Button	Description
Delete All	Deletes all channels from the VCAT table.

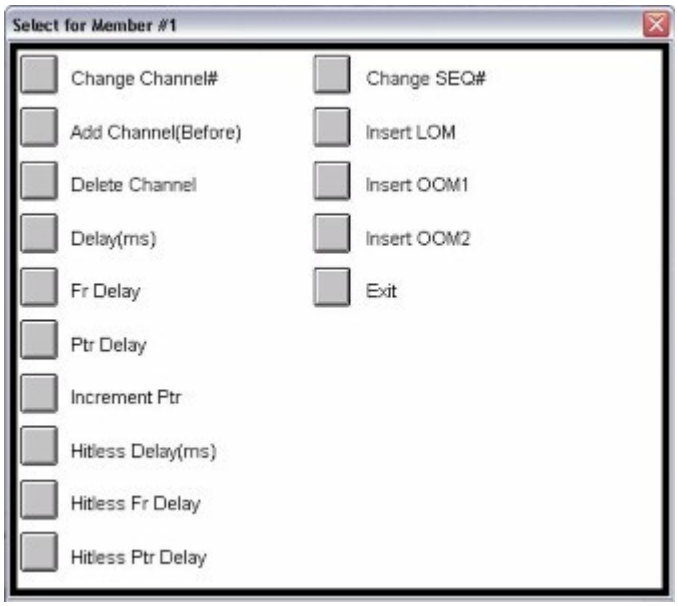
Definitions of VCAT Table columns:

Function	Description
Add	Click on Add to select members for the VCAT Group (VCG). A Select Channel screen appears which shows all possible channel member available to choose from. When a channel has been selected, the channel button will gray-out to indicate that it is already selected. If the Setting Control are set to Coupled, then members added to the Receive VCG will also be added to the Transmit VCG.
Member	Sequential list of VCG members.
Chan	Channel Number. Displays the VCAT

	Member's channel number. For High-Order mappings, the number will just be the AU#(for SDH) or STS#(for SONET). For Low-Order mappings SDH mappings, the address will be displayed in the following format: AU# N K,L,M, with N indicating the AU#, and the others indicating TUG-3, TUG-2 and TU# as applicable. For Low-Order SONET mappings, the address will be displayed in the following format: STS# N K,L, with N indicating the STS#, and the others indicating VT group# and VT# as applicable.
Exp Seq	Expected Sequence Number. This is the sequence of VCG members expected, based on the sequence of the Members column.
Seq #	This is the detected Sequence Number Indicator. If the detected Seq# differs from the Expected Sequence number, and a Sequence Mismatch alarm is reported.
Delay (ms)	Combined Delay. The amount of time this member is delayed as compared to the earliest member. This delay is the same as indicated in Frame and Pointer Delays, expressed in milliseconds. 1 ms = 8 frames.
Fr Delay	Frame Delay. The number of frames this member is delayed as compared to the earliest member. This delay is the same as indicated in Delay (ms), expressed in frames. 1 frame = .125 ms.
Ptr Delay	Pointer Delay. This indicates the pointer delay value detected on this member.

Click on any row of the VCAT Table to bring up the "Select for Member #N" menu as seen here:

For user convenience, the same transmit settings found on the Transmit VCAT screen are also available on the Receive VCAT screen.



Many of the options in the menu actually apply to Transmit settings. The first three menu items (Change Channel #, Add Channel and Delete Channel) specifically apply to the Receive VCAT Table. However, If "Settings Control" is set for "Coupled" (see Transmit or Receive "Set" tab), the changes will apply to both Transmit and Receive VCAT Tables. If "Settings Control" is set for independent, the change will apply only to the Receive VCAT Table.

This menu is used to setup the selected member with any of the following menu functions.

Function	Description
Change Channel #	Selects which channel (time slot) will be used by this member.
Add Channel (before)	Adds one additional member in the next slot above the selected member. Selecting this menu item will bring up another menu where channel number is selected.
Delete Channel	Deletes the selected channel (member).
Delay (ms)	Inserts Combined Frame and Pointer Delays on the selected member,

	entered in milliseconds (ms).
Fr Delay	Inserts Frame Delay on the selected member entered in number of frames.
Ptr Delay	Changes the pointer value of the selected member, creating a very small delay.
Increment Ptr	Increases pointer value of the selected member by a value of 1.
Hitless Delay (ms)	Inserts Combined Delay on the selected member, entered in milliseconds (ms) without causing a Loss of Multiframe (LOM) alarm.
Hitless Fr Delay	Inserts Frame Delay on the selected member entered in number of frames) without causing a Loss of Multiframe (LOM) alarm.
Hitless Ptr Delay	Changes the pointer value of the selected member, creating a very small delay) without causing a Loss of Multiframe (LOM) alarm.
Change SEQ #	Changes the Sequence Indicator, not the actual order that the payload is transmitted, as displayed in the "Member" column. Changing the Sequence Indicator manually will create a Sequence Mismatch (SQM) at the receiver.
Insert LOM	Inserts Loss of Multiframe alarm
Insert OOM1	Inserts Out of Multiframe alarm 1
Insert OOM2	Inserts Out of Multiframe alarm 2
Exit	Closes the window without changing the setup of the member

Receive - LCAS Sk

For detailed information about LCAS, and instructions on configuring LCAS, see How to Set Up and Use LCAS Features.

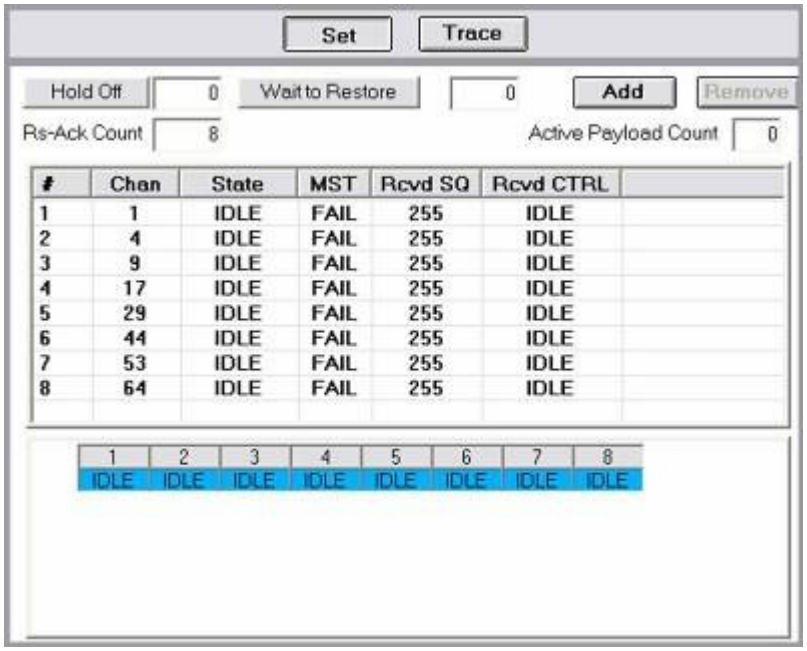
Definition of Source (So) and Sink (Sk)

The Source functionality is available from the Transmit - LCAS So screen, and the Sink functionality is available from the Receive - LCAS Sk screen.

Unlike VCAT, which is bi-directional, LCAS operates on a one-way basis. The transmit of an LCAS system is designated “Source” and the receive is designated “Sink”. LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other direction may be configured as LCAS as well but there is no correlation between the two.

LCAS Receive Settings

Access LCAS Receive features by the selecting LCAS Sk (LCAS Sink) side tab from the Receive screen. The LCAS Settings table will appear, listing all of the members within the receive VCG.



The receive LCAS settings table is used to configure LCAS Sink functions.

The following functions are found in the receive LCAS settings table

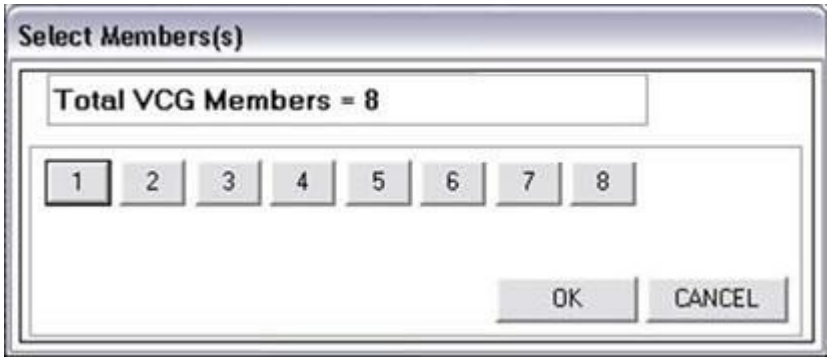
Function	Description
Set (button)	Selects the LCAS Settings Table

Trace (button)	Selects the LCAS Trace Table
Hold Off (button)	Delays sending a failure message back to the source, in seconds
Wait to Restore (button)	Delays sending an “OK” back to the source, in seconds
Add (button)	Adds selected VCG members to the LCAS data stream
Remove (button)	Removes selected VCG members from the LCAS data stream
Rs-Ack Count	Number of Resequence - Acknowledge messages received
Active Payload Count	Number of VCG members that make up the payload
#	Member number, sequential
Chan	Channel. Displays the VCAT Member’s channel number. For SDH High-Order mappings, the number will just be the AU#. For SONET STS mappings, the number will just be the STS#. For SDH Low-Order mappings, the address will be displayed in the following format: AU# N K,L,M, with N indicating the AU#, and the others indicating TUG-3, TUG-2 and TU# as applicable. For SONET VT mappings, the address will be displayed in the following format: STS# N K,L, with N indicating the STS#, and the others indicating VT group# and VT# as applicable.
State	Indicates the state of this VCG member. The possible states are: **IDLE**: This member is not in use. **OK**: This member is configured as part of the receive payload, and data is being received as expected. **Fail**: This member is configured as part of the receive payload, but no data is being received.
MST	Displays the Member Status, being sent to Source (So) from Sink (Sk)

Rcvd SQ	Sequence Number received from Sink (Sk)
Rcvd CTRL	Control message sent from Source to Sink. Possible values are: **ADD**: Member to be added to the VCG **NORM**: Normal LCAS transmission **EOS**: End of Sequence, highest member in group **IDLE**: Member is part of the VCG or to be removed **DNU**: Do not use, Sink reports failure
Member State-LED	The State-LED provides a visual indication of which LCAS State or condition the VCG member is in. The possible states are: IDLE This VCG member has not been added to LCAS. OK This member is configured as part of the receive payload, and data is being received as expected. FAIL This member is configured as part of the receive payload, but no data is being received.

Add and Remove

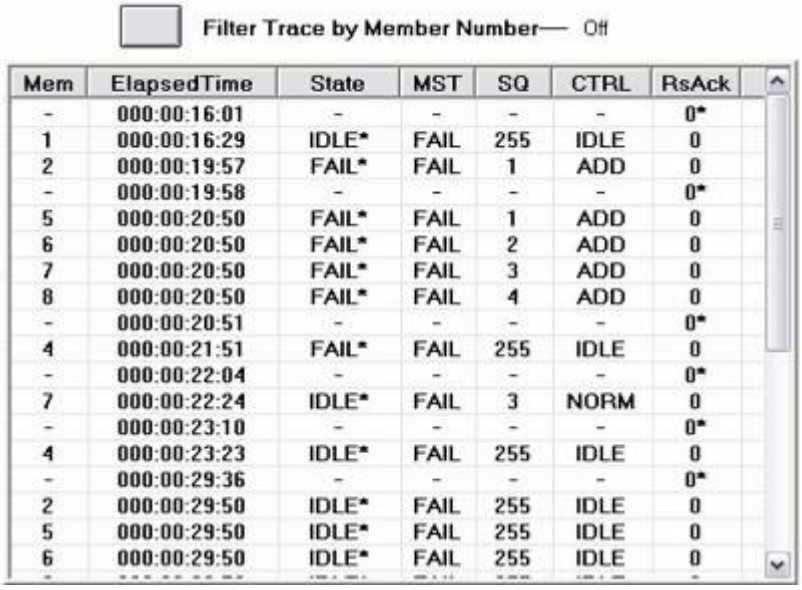
Press **Add** or **Remove** to select which VCG members are to be added or removed from the LCAS data stream.



- When adding or removing members, the button becomes disabled to indicate that the member has already been added or removed.

LCAS Receive Trace

Press **Trace** to display the LCAS Trace Table.



Mem	ElapsedTime	State	MST	SQ	CTRL	RsAck
-	000:00:16:01	-	-	-	-	0*
1	000:00:16:29	IDLE*	FAIL	255	IDLE	0
2	000:00:19:57	FAIL*	FAIL	1	ADD	0
-	000:00:19:58	-	-	-	-	0*
5	000:00:20:50	FAIL*	FAIL	1	ADD	0
6	000:00:20:50	FAIL*	FAIL	2	ADD	0
7	000:00:20:50	FAIL*	FAIL	3	ADD	0
8	000:00:20:50	FAIL*	FAIL	4	ADD	0
-	000:00:20:51	-	-	-	-	0*
4	000:00:21:51	FAIL*	FAIL	255	IDLE	0
-	000:00:22:04	-	-	-	-	0*
7	000:00:22:24	IDLE*	FAIL	3	NORM	0
-	000:00:23:10	-	-	-	-	0*
4	000:00:23:23	IDLE*	FAIL	255	IDLE	0
-	000:00:29:36	-	-	-	-	0*
2	000:00:29:50	IDLE*	FAIL	255	IDLE	0
5	000:00:29:50	IDLE*	FAIL	255	IDLE	0
6	000:00:29:50	IDLE*	FAIL	255	IDLE	0

- The Trace table displays an event log history of changes in the LCAS configuration since the last time the test was restarted.

Function	Description
Filter Trace by Member Number	Select **User Defined** to specify an individual member number. Only the activity of the selected member will be displayed. Select **Off** to display the activity of all members.

Results

SDH Results Screens and Functions

All monitored activity that the system receives is reported to the Results screen for viewing and analyzing. The Results screen provides information used for analyzing the incoming signal, pattern, errors, and alarms.

The following options are available from the Results screen:

- Scan / Error / Alarm
- PTR

- Event
- APS
- Large LED
- Graph
- VCAT (Only appears when the test set is configured for VCAT.)
- LCAS (Only appears when the LCAS is enabled.)

SDH Results - Error / Alarm

The Results ERR screen contains the following options:

- **Scan** - Select Scan to access a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected. This function displays a list of received errors and alarms. For alarms, the duration is reported as a count in seconds. For errors, an error count is reported.

  When no activity is occurring, the screen displays, "No errors or alarms."

- **Errors** - The unit can monitor and report errors on the incoming SDH signal. The Errors function provides a detailed analysis of the incoming error as described below. The reported errors are a result of incoming errors that are generated by the SDH network, or errors that are intentionally generated by the system when it is used in a loopback environment.

  The following errors can be monitored:

  - Frame
  - B1 (Section BIP-8, also known as a Section Coding Violation - CV-S)
  - B2 (Line BIP-8, also known as a Line Coding Violation - CV-L)
  - B3 (Path BIP-8, also known as an STS Path Coding Violation - CV-P)
  - HP-REI
  - LP-BIP
  - LP-REI
  - MS-REI
  - BIT (BIT errors reported in the payload)
  - AU-NDF
  - TU-NDF
  - TC-IEC (Tandem Connection-Incoming Error Count)
  - TC-REI (Tandem Connection-Remote Error Indicator)
  - TC-OEI (Tandem Connection-Outgoing Error Indicator)

  The following parameters are measured for the incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format
- Error-free seconds using an 8-digit format
- Errored seconds
- Severely Errored seconds
- Unavailable errored seconds

- **Alarms** - The system can monitor and report alarms and their duration on the incoming SDH signal. The alarms are shown in duration of the alarm in seconds.

  The following alarms can be monitored:

  - LOS (Loss of Signal)
  - Power Hot
  - Power Low
  - LOF (Loss of Frame)
  - OOF (Out of Frame)
  - RS-TIM (Regenerator Section Trace Identifier Mismatch for J0 byte)
  - MS-AIS (Multiplex Section Alarm Indication Signal)
  - MS-RDI (Multiplex Section Remote Defect Indicator)
  - APS-L (Automatic Protection Switching)
  - AU-AIS (Administrative Unit Alarm Indication Signal)
  - AU-LOP (Administrative Unit Loss of Pointer)
  - HP-UNEQ (Higher-Order Path Unequipped Payload)
  - HP-TIM (Higher Order Path Trace Identifier Mismatch for the J1 byte)
  - Frequency Wide
  - OPU Generic AIS
  - HP-PLM (Higher-Order Path Payload Label Mismatch)
  - Pattern Sync
  - TC-RDI (Tandem Connection-Remote Defect Indicator)
  - TC-ODI (Tandem Connection-Outgoing Defect Indicator)
  - TC-AIS (Tandem Connection-Alarm Indication Signal)
  - TC-UNEQ (Tandem Connection-Unequipped)
  - TC-TIM (Tandem Connection-Trace Identifier Mismatch)
  - TC-LOF (Tandem Connection-Trace Identifier Mismatch)
  - TU-LOP (Tributary Unit - Loss of Pointer)

- HP-RDI (Higher-Order Path Remote Defect Indicator)
- TU-AIS (Tributary Unit - Alarm Indication Signal)

SDH Results - PTR

This PTR function monitors and reports received Pointer statistics. A count of the following Pointer statistics appear:

- **Pointer Justification** - Indicates the Positive Pointer Justification count.
- **Negative Justification** - Indicates the Negative Pointer Justification count.
- **Positive Justification Seconds** - Indicates the duration of a Pointer adjustment.
- **NDF Coun**t - Indicates the New Data Flag count.
- **Rx Pointer Bytes (HEX)** and **Rx Pointer Value** (in decimal) - Valid Pointers range from 0 to 782.

When lower-order mapping is configured TU Pointer results also appear.

SDH Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

SDH Results - APS

The APS function monitors incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 15 byte sequences can appear on the screen.

The Results APS screen contains the following options:

Option	Description
APS Summary	When selected, the following information appears in the results table last 15 K1 and K2 byte sequences received: • The HEX value of the K1 byte. • The HEX value of the K2 byte. • The number of frames received that contain the K1 and K2 bytes. • The elapsed time of the frames that contain the K1 and K2 bytes. To view decoded values for a specific Item, select the Item number. The APS Decode dialog box appears displaying the Item's configuration.
APS Decode	When selected, the results table splits into two horizontal tables: the top table displaying K1 results; the bottom table displaying K2 results. The K1 table decodes the value for bits 1-4 and bits 5-8. The K2 table decodes the value for bits 1-4, bit 5, and bits 6-8. Also displayed in the tables are the number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes for the last 15 byte sequences received.
APS View Mode	Allows the user to view decoded values in either **Linear** Protection Switching Mode or **Ring** APS Signaling Mode.

Per GR-253-CORE, only the upper 12 bits of the K1/K2 bytes (K1 bits 1-8

and the K2 bits 1-4) are used for APS operation. K2 bit 5 sets the APS mode type (1+1, 1:n) and cannot be changed during operation. K2 bits 6-8 are for alarms. Any changes to the lower four bits of the K2 byte do not affect APS operation. The Results APS table only starts and displays a new entry item if the upper 12 K1/K2 bits stabilize on a new value for a minimum of three consecutive frames.

SDH Results - Large LED

This displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

For a list of available LEDs in the SDH protocol processor, see SDH LEDs.

SDH Results - Graph

The Graph function allows incoming errors and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

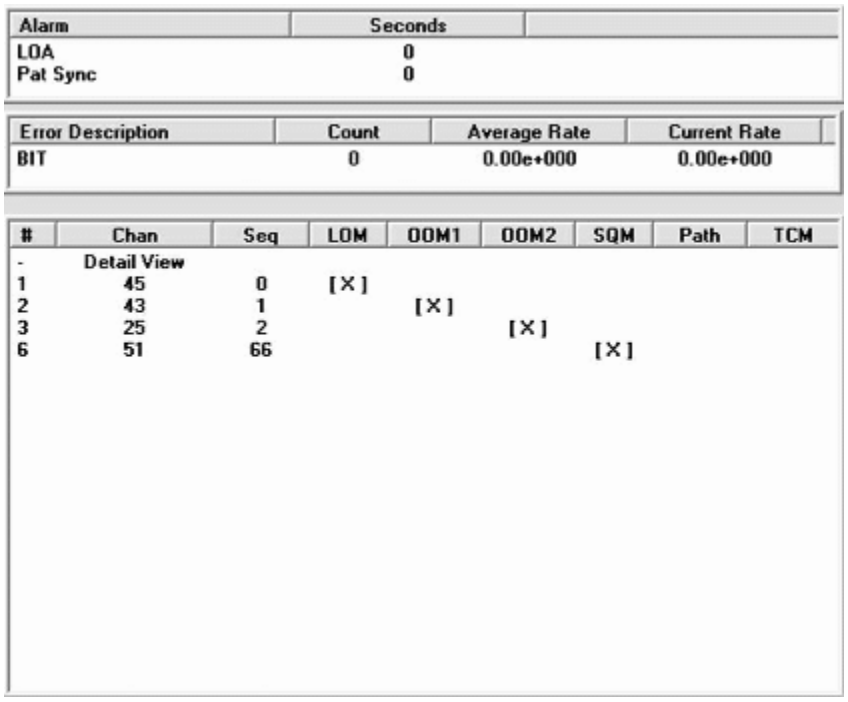
For more information about graphs, select Using Graphs in the Common Tasks section of the online help.

Results - VCAT

All monitored VCAT channel activity that the system receives is reported to the Results screen. The Results functionally provides several drill-down layers for analyzing the incoming signal, alarms, and errors.

For instructions on configuring VCAT see How to Set Up and Use VCAT Features.

The following screen displays Alarm and Error counts that are common to all channel and access to the detailed information on each channel.



The following is found on the Results screen:

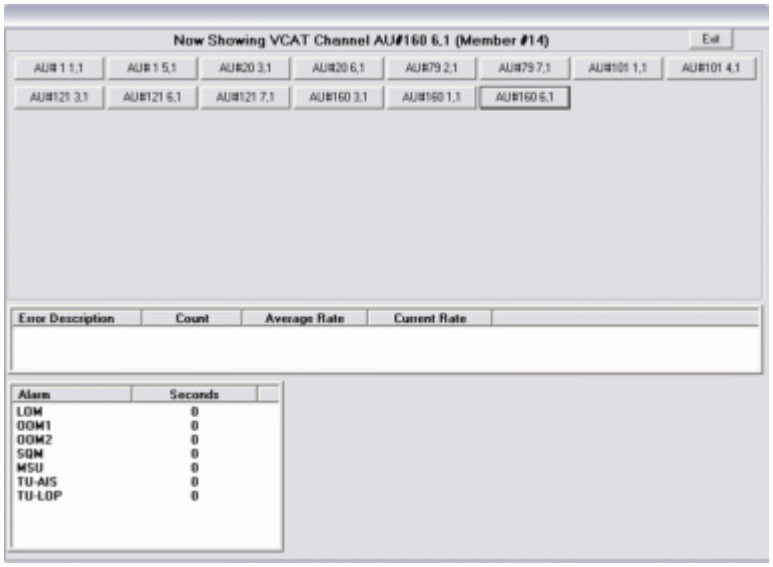
Options	Description
Alarm	The following statistics are displayed: **Alarm** - Displays the alarm types that are common to the entire VCG. • LOA – Loss of Alignment. Indicates that the receiver is unable to align all members of the VCG. • Patt Sync – Loss of synchronization of the payload pattern. **Seconds** - Displays the number of seconds that an alarm was present since the last time the restart button was pressed.

Error	The following statistics are displayed: **Error Description** - Displays the error types that are common to the entire VCG. • BIT – Payload Bit Errors **Count** - Displays the error count using an 11-digit format. **Average Rate** - Displays the average error rate over the full elapsed time. **Current Rate** - Displays the current error rate (the error rate in the last one second).
Detail View You can drill down to channel-specific details by selecting "Detail View" or any **Member** in the Detail View table. This opens the **VCAT Detail View** dialog box that allows you to select a specific channel and view its errors and alarms. See below.	The following statistics are displayed: # - Displays the Member number. **Chan** - Displays the Channel number. **Seq** - Displays the VC sequence number. **LOM** - Loss of Multiframe alignment. [X] indicates a LOM is detected on this channel. **OOM1** - Out of Multiframe alarm, level 1. [X] indicates an OOM1 is detected on this channel. **OOM2** - Out of Multiframe alarm, level 2. [X] indicates an OOM2 is detected on this channel. **SQM** - Sequence Number Mismatch. [X] indicates a SQM is detected on this channel. **Path** - Path summary indication. [X] indicates a Path error/alarm is

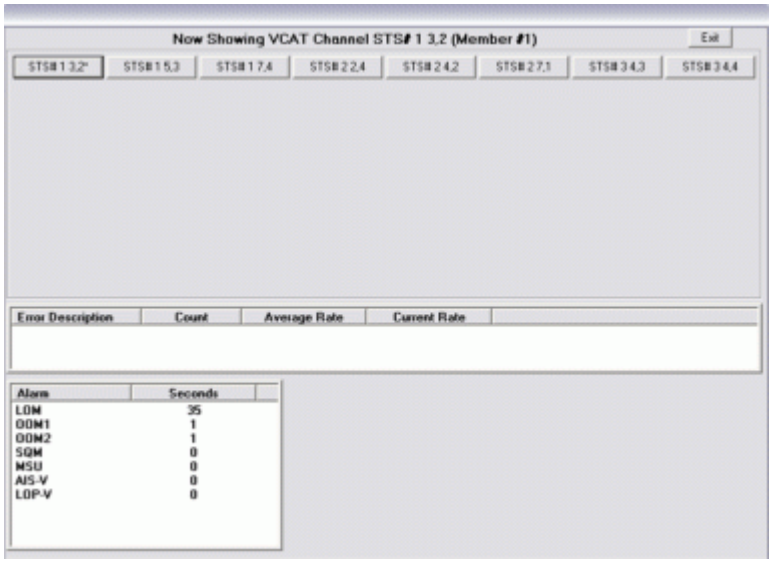
	detected on the channel. **TCM** - Tandem Connection Monitoring

Detail View

Touching "Detail View" or any member in the Detail View table brings up a window like this SONET example:



Or like this SDH example:



Select the desired channel at the top of the window and full error and alarm information will be displayed for that member.

Results - LCAS

For detailed information about LCAS, and instructions on configuring LCAS, see How to Set Up and Use LCAS Features.

Definition of Source (So) and Sink (Sk)

The Source functionality is available from the Transmit LCAS So screen, and the Sink functionality is available from the Receive LCAS Sk screen.

Unlike VCAT, which is bi-directional, LCAS operates on a one-way basis. The transmit of an LCAS system is designated “Source” and the receive is designated “Sink”. LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other direction may be configured as LCAS as well but there is no correlation between the two.

LCAS Results

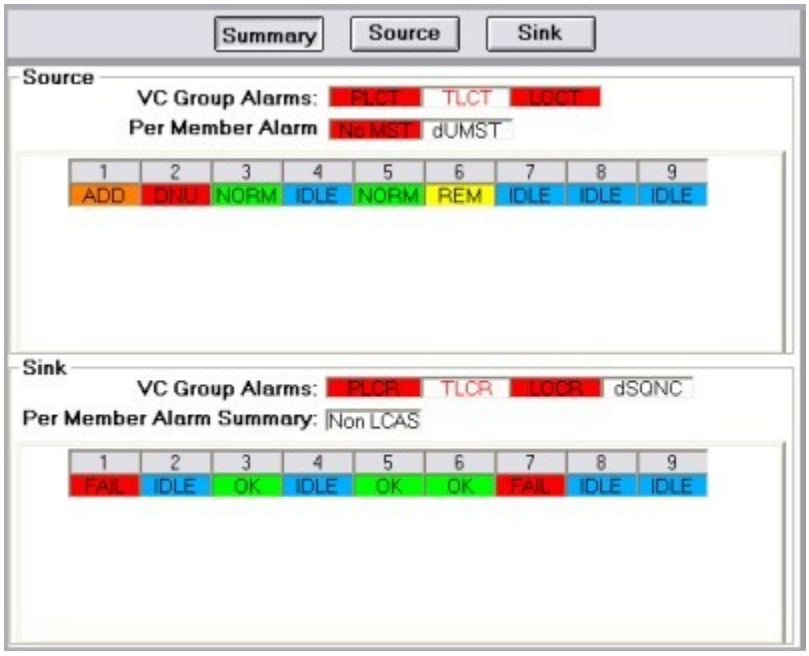
Access the LCAS Results measurements by the selecting

side tab from the Results screen. Select to view the Summary, Source or Sink results screen.

Summary Screen

Select “Summary” to display an overview of LCAS alarms. This screen shows a split view of the condition or status for both the transmit (Source) and receive (Sink) VCAT Group (VCG) members.

IDLE members are VCG members that have not been configured as part of the LCAS data stream.

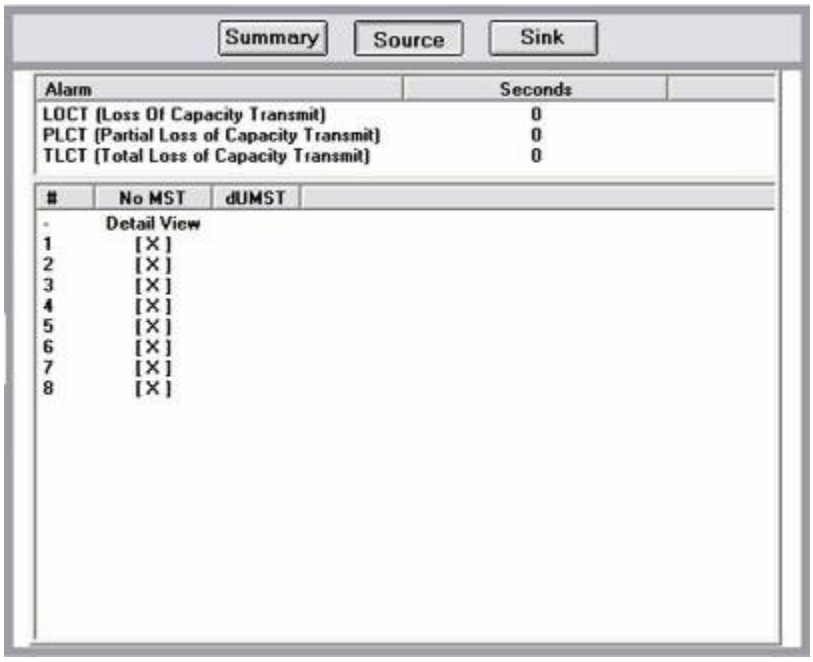


See below for definitions of all alarm conditions

- White boxes with black text indicate that the alarm condition has not been detected during the current test.
- A white box with red text is a history indication; the alarm condition has been detected during the current test but is not present at this time.
- A red box indicates a current alarm condition.

Source Screen

Select “Source” to display detailed LCAS Source alarms.

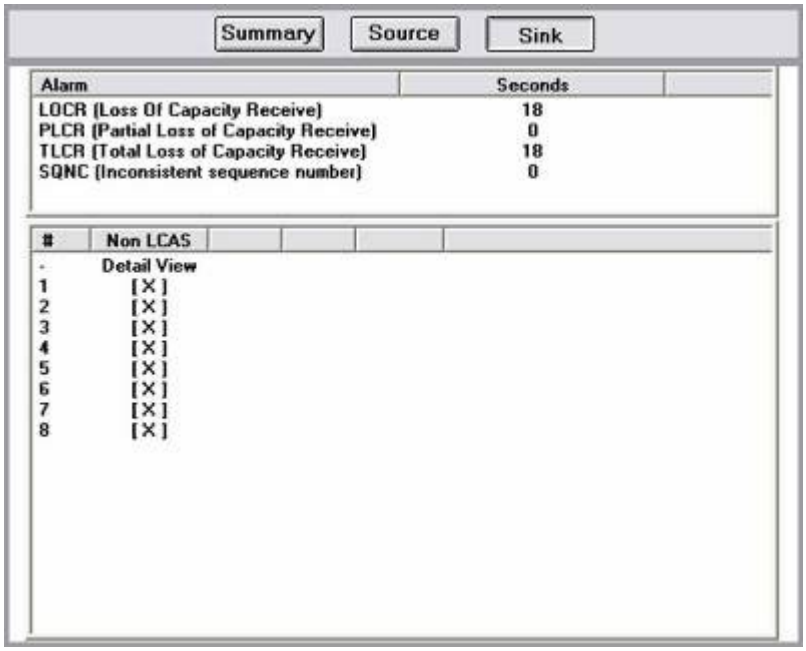


See below for definitions of all alarm conditions

- The Alarm View reports the duration of all alarm types in seconds.
- The Detail View – Provides the Trouble Scan View of any Member/Channel that has detected an alarm condition during the current test. The Member is listed and an [X] is placed in the column for the error/alarm type.

Sink Screen

Select “Sink” to display detailed LCAS Sink alarms.



See below for definitions of all alarm conditions

- The Alarm View reports the duration of all alarm types in seconds.
- The Detail View – Provides the Trouble Scan View of any Member/Channel that has detected an alarm condition during the current test. The Member is listed and an [X] is placed in the column for the error/alarm type.

Definitions

Source Conditions	Description
LOCT	Loss of Capacity Transmit
PLCT	Partial Loss of Capacity Transmit
TLCT	Total Loss of Capacity Transmit
No MST	Multiframe Status not received
dUMST	Unexpected Multiframe Status counts
Member State-LED (Summary)	The State-LED provides a visual indication of which LCAS State or condition the VCG member is in. The possible states are: IDLE This VCG member has not been added to LCAS. NORM This member is part of the payload.

	DNU Do Not Use. Failure state. ADD Source has requested to add this member to the payload. Waiting for Sink response. REM Source has requested to remove this member from the payload. Waiting for Sink response.

Sink Conditions	Description
LOCR	Loss of Capacity Receive
PLCR	Partial Loss of Capacity Receive
TLCR	Total Loss of Capacity Receive
SQNC	Inconsistent Sequence Number
Non LCAS	At least one member is not configured as LCAS
Member State-LED (Summary)	The State-LED provides a visual indication of which LCAS State or condition the VCG member is in. The possible states are: IDLE This VCG member has not been added to LCAS. OK This member is configured as part of the receive payload, and data is being received as expected. FAIL This member is configured as part of the receive payload, but no data is being received.

Test

Test Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- SET 1

- Service Disruption
- RTD (Round Trip Delay)

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Service Disruption

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The service disruption measurements show a granular accuracy of 1 frame duration. See the chart at the bottom of this page for time per frame durations for each protocol processor.

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

  For **E4**, **E3**, **E1**, **DS3** and **DS1** processors, the Protection Switch Criteria is limited to: Loss of Pattern Sync and Bit Errors.

For **SONET** and **SDH** processors the Protection Switch Criteria include: B1, SEF / OOF, AIS-L / MS-AIS, AIS-P / AU-AIS, AIS-V / TU-AIS, and PRBS (Loss of Pattern Sync and Bit Errors).

For **OTN** processors the Protection Switch Criteria include: OOF, OTU:AIS, OTU:BIP8, ODU:AIS, ODU:BIP8, and PRBS (Loss of Pattern Sync and Bit Errors).

- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **State** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

  - **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

  - **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.

  - **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)** - Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.
- **Protection Switch Time (Frames)** - Indicates the number of errored frames received during the service disruption event.
- **History Recent Milli Seconds** - Shows the time durations for the last ten measurements recorded.
- **History Recent Frames** - Shows the frame durations for the last ten measurements recorded.

A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing Service Disruption.

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
SONET / SDH	0.125 ms (125 µs)	16383 frames (2047.875 ms)
OTU 1	0.049 ms (49 µs)	16383 frames (802.302 ms)
OTU 2	0.012 ms (12 µs)	16383 frames (199.732 ms)
E4	0.021 ms (21 µs)	255 frames (5.361 ms)
E3	0.045 ms (45 µs)	255 frames (11.397 ms)
E1	0.125 ms (125 µs)	4095 frames (511.875 ms)
DS3	0.106 ms (106 µs)	255 frames (27.133 ms)
DS1	0.125 ms (125 µs)	4095 frames (511.875 ms)

Click this link for Ethernet Service Disruption specifics.

Test - RTD (Round-Trip Delay)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **State:** Starts and stops round-trip delay mode.

  Single Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in frame counts and milliseconds. Frame counts indicates the number of frames received before the AIS frame is received by the unit. Milliseconds indicates how long it took for the AIS frame to travel out and return to the unit.

Continuous Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and continuously transmitted through your network. The current frame count and duration appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.

Stop Round-Trip Delay - Stops round-trip delay activity. The State returns to Inactive.

- **Round Trip Delay Time (milliSec):** Indicates the duration in seconds that it took for the known frame to return to the unit.
- **Round Trip Delay Time (Frames):** Indicates the number of frames received during the measurement.
- **Consecutive Good Time Required:** This function allows you to enter the duration (in milliseconds) of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 0.125 to 2047.875 milliseconds and is entered using a keypad.
- **Consecutive Good Frames Required**: This function allows you to enter the number of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 1 to 16383 frames and is entered using a keypad.

For more information about round-trip delay, select *Round-Trip Delay* in the Common Tasks section of the online help.

Perf Monitor

SDH Performance Monitor Screens and Functions

Performance Monitoring provides greater detail about incoming Regenerator Section (RS), Multiplex Section (MS), Higher-Order Path (HP), BIT errors, and M.2120 / M.2110 compliant Performance Monitoring.

The following options are available:

- RS
- MS
- HP
- LP
- BIT
- M.2120 / M.2110

SDH Perf Monitor - RS

This provides a detailed breakdown for Regenerator Section errors detected and logged by the SDH protocol processor.

G.826 Near B1 Errors

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

SDH Perf Monitor - MS

The MS screen provides a detailed breakdown for Multiplexor section errors detected and logged by the SDH protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the **G.826/G.829** toggle button in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.829 results.

This section is broken down into the following areas:

Important: Select the G.826/G.829 button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.829 statistics. Toggling the Near B2 Errors output also toggles the Far MS REI Errors output.

G.826 and G.829 Near B2 Errors and Far MS REI Errors

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.

- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure
- G.826/G.829: Select the command button to toggle between G.826 and G.829 error statistics.

M.2101.1 Near B2 Errors and Far MS REI Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

SDH Perf Monitor - HP

The HP screen provides a detailed breakdown for Higher-Order Path errors detected and logged by the SDH protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the **G.826/G.828** toggle button in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.828 results.

This section is broken down into the following areas:

G.826 and G.828 Near B3 Errors and Far HP REI Errors

IMPORTANT: Select the G.826/G.828 button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.828 statistics. Toggling the Near B3 Errors output also toggles the Far HP REI Errors output.

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.

- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure
- G.826/G.828: Select the command button to toggle between G.826 and G.828 error statistics.

M.2101.1 Near B3 Errors and Far HP REI Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

SDH Perf Monitor - LP

The LP screen provides a detailed breakdown for Lower-Order Path errors detected and logged by the SDH protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the G.826/G.828 toggle button in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.828 results.

This section is broken down into the following areas:

IMPORTANT: Select the G.826/G.828 button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.828 statistics. Toggling the Near B2 Errors output also toggles the Far MS REI Errors output.

This section is broken down into the following areas:

G.826 and G.828 Near LP BIP Errors and Far LP REI Errors

- Errored Block (EB) count.
- Background Block Error (BBE) by count, rate percentage, and objective percentage.

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure.
- G.826/G.828: Select the command button to toggle between G.826 and G.828 error statistics.

M.2101.1 Near LP BIP Errors and Far LP REI Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

SDH Perf Monitor - BIT

The BIT screen provides a detailed breakdown for BIT errors detected and logged by the SDH protocol processor.

In addition to monitoring the errors, you can set allocation percentages and durations by selecting their respective buttons.

This section is broken down into the following areas:

G.821 BIT Errors

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.821 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

G.826 BIT Errors

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

M.2101.1 BIT Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

SDH Perf Monitor - M.2120 / M.2110

The M.2120 / M.2110 screen provides a detailed breakdown for errors detected and logged by the SDH protocol processor by using threshold error performance criteria with respect to either a 15-minute (TR15) or 24-hour (TR24) evaluation period.

Error thresholds can be set directly from the M.2120 / M.2110 screen.

The following statistics appear on the M.2120 / M.2110

Statistic	Description
Event	Lists the error type and error.
TR15	Threshold Report 15-minute evaluation period. A TR is an error performance report with respect to a 15-minute evaluation period. There are one TR15 and one Reset TR15 (RTR15) for each performance event. The start and end time for the 15-minute evaluation window must occur

	on the hour and at 15, 30, and 45 minutes with respect to the elapsed time for each test. The TR15 evaluation period occurs as soon as the 15-minute threshold is reached or exceeded. If the number of errors for an event cross the threshold during the 15-minute period the test records "fail"; if the errors do not exceed the threshold the test records "pass." The performance events continue to be counted to the end of the 15-minute period, at which time the current performance event counts are stored in the historical registers and the current performance event registers are reset to zero. After resetting the registers to zero the 'pass' or 'fail' result records in the Prev15 column and the performance evaluation continues and records the new result in the Cur15 column.
RTR15	Reset Threshold Report 15-minute evaluation period. There are one RTR15 and one TR15 for each performance event. The start and end time for the 15-minute evaluation window must occur on the hour and at 15, 30, and 45 minutes with respect to the elapsed time for each test. An RTR15 occurs at the end of a 15-minute period in which the count is less than or equal to the reset threshold and there has not been any unavailable time during that period. An RTR15 can only occur subsequent to a 15-minute period containing a TR15.
TR24	Threshold Report 24-hour evaluation period. There is one TR24 for each performance event. The start and end time for the 24-hour evaluation window must occur

	on a 15-minute window boundary. TR24s occur as soon as the 24-hour threshold is reached or exceeded.
Cur15	Displays the pass or fail state for the current 15-minute evaluation period. After the evaluation period ends the registers reset to zero and the pass/fail state records in the Prev15 column and the performance evaluation continues.
Prev15	Displays the pass or fail state for the previous 15-minute evaluation period. The history periods are used as a stack, i.e. the values held in each register are pushed down the stack one place at the end of each 15-minute period, and the oldest value at the bottom of the stack is discarded.
Cur24	Displays the pass or fail state for the current 24-hour evaluation period.
Prev24	Displays the pass or fail state for the previous 24-hour evaluation period.

SDH LED Quick Status Area

When the SDH protocol processor tab is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the **Large LED** screen.

The following acronyms will be used LED Description table below

RSOH = Regenerator Section Overhead
MSOH = Multiplex Section Overhead
HPOH = Higher Order Path Overhead
LPOH = Lower Order Path Overhead
AU = Administrative Unit
TU = Tributary Unit

LED	Description
TX	Indicates current transmit interface setting and laser wavelength. If the SDH interface is configured for G.709, then OTN appears.
RX	Displays the received optical power in dBm.
E/A	Indicates the current Error / Alarm configured for transmission.
Test Paused	If red, indicates that the current test has been paused.
CLK	Indicates the value of the Transmit Clock Reference function.
All Tests (button)	This is a short-cut button to the general "All Test Status" summary LED screen for all circuit packs installed in the unit.
RS	**RSOH Status LED**. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
LOS	**Loss of Signal**. Indicates that a valid SDH signal is not being received. If an all-zeros pattern exists for 100 milliseconds or longer on the incoming SDH signal, then an LOS is reported.
LOF	**Loss of Frame**. Indicates that a frame alignment problem with the incoming SDH signal has been detected. An LOF is reported if an Out Of Frame (OOF) defect continues for 3 milliseconds or longer. This is alarm LED.
OOF	**Out Of Frame**. Declared when four or more consecutive errored frames are detected on the incoming SDH signal. This is an alarm LED.
B1	**RSOH BIP-8 Code Violation**. Indicates an error in the SDH frame. B1 errors are parity errors. The B1 byte carries the parity information, so a B1 error is an RS error that applies not only to the RSOH, but the entire SDH frame. Any error in the frame will result in B1 error. This is an error LED.
MS	**MSOH Status LED**. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
MS-REI	**MSOH Remote Error Indication**. Indicates that an error is occurring at downstream Line terminating equipment. An REI is also known as a Far-End Block Error (FEBE). The M0 and M1 bytes of the MSOH are used for this indicator. This is an error LED.
MS-AIS	**MSOH Alarm Indication Signal**. Indicates if an alarm is

	being received from upstream MS terminating equipment. This is an alarm LED.
APS	**Automatic Protection Switching**. Indicates that the K1 and K2 bytes on the incoming SDH signal have changed.
MS-RDI	**MSOH Remote Defect Indication**. Indicates that a downstream defect has occurred along the MS layer. (An RDI is also known as a Far-End Remote Failure, FERF). This is an alarm LED.
B2	**MSOH BIP-8 Code Violation**. Indicates that parity errors were detected at the MS layer of the incoming SDH signal. This is calculated over the MSOH, HPOH, and payload of each STM-n. This is an error LED
HP	**HPOH Status LED**. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
AU-AIS	**AU Alarm Indication Signal**. Indicates if an alarm is being received from upstream HP terminating equipment. This is an alarm LED.
HP-RDI	**HPOH Remote Defect Indication**. Indicates that a remote alarm is being received from downstream HP terminating equipment. The G1 byte of the HPOH is used for this indicator. This is an alarm LED.
AU-LOP	**AU Loss of Pointer**. Indicates that an invalid Pointer has been received or a Pointer loss has been detected on the incoming SDH signal. This is an alarm LED.
HP-REI	**HPOH Remote Error Indication**. Indicates that an error count is being received from downstream HP terminating equipment. An REI is also known as a Far-End Block Error (FEBE). This is an error LED.
AU-PTR	**AU Pointer Adjustments**. Indicates Pointer offsets or adjustments between the payload and the STM-N frame are occurring. This is a status LED.
B3	**HPOH BIP-8 Code Violations**. Indicates that parity errors were detected at the HP layer of the incoming SDH signal. This is calculated over the HPOH and payload of each STM-N. This is an error LED.
HP-UNEQ	**HPOH Unequipped Payload**. Indicates that a 00h pattern has been detected in the C2 byte. This byte is being received from HP terminating equipment. This is an alarm LED.
LP	**LPOH Status LED**. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.

	This section is only available when C-2, C-12, or C-11 is mapped.
TU-AIS	**TU Alarm Indication Signal**. Indicates an all-ones characteristic or adapted information signal was detected on the TU. It is generated to replace the normal traffic signal when it contains a defect condition in order to prevent consequential downstream failures being declared or alarms being raised. This is an alarm LED.
TU-LOP	**TU Loss of Pointer**. Indicates that an invalid Pointer has been received or a TU Pointer loss has been detected on the incoming SDH signal. This is an alarm LED.
TU-PTR	**TU Pointer Adjustments**. Indicates Pointer offsets or adjustments between the VC payload and the STM-N frame are occurring. This is a status LED.
TU-LOM	**TU Loss of Multiframe Alignment**. Indicates a Loss of Multiframe Alignment in the TU. This is an alarm LED.
LP-RDI	**LPOH Remote Defect Indication**. Indicates that a remote alarm is being received from downstream LP terminating equipment. The V5 byte of the LPOH is used for this indicator. This is an alarm LED.
LP-RFI	**LPOH Remote Failure Indication**. Indicates a defect on the TU has persisted beyond the maximum time allocated to the transmission system protection mechanisms. When this occurs, the RFI is sent to the far end and initiates a LP protection switch. This is an alarm LED.
LP-REI	**LPOH Remote Error Indication**. Indicates to the transmitting node that an errored block has been detected at the LP receiving node. This is an error LED.
LP-UNEQ	**LPOH Unequipped Payload**. Indicates that an all-zeros patterns has been detected in the LP Signal Label of the V5 byte. This is an alarm LED.
LP-BIP	**LPOH BIP-2 Code Violations**. Indicates an error occurred during a parity check, which involves grouping all the bits in a block into units and then performing a parity check of each bit position in the group. This is calculated over the LPOH and payload of each VC. This is an error LED.
PAT SYNC	**Pattern Sync Mismatch**. Indicates a loss of pattern synchronization. This is an alarm LED.
BIT ERR	**BIT Error**. Indicates a Bit error was detected in the payload. This is an error LED.
TCM This LED only	**Tandem Connection Status LED**. Indicates if a TCM error or alarm has been detected.

appears when TCM Overhead Processing has to be enabled in the Receive settings.	If this LED is red, select the "TCM" text to display the TCM Summary LEDs.
VCAT This LED only appears for VCAT mappings, when one or more channels have been added to the Receive VCG.	**Virtual Concatenation**. Indicates if any of the errors or alarms within the received VCG. This is a status LED. If this LED is red, select the "VCAT" text to display the VCAT Summary LEDs.
LCV	**Line Code Violations**. Indicates that the 155M Electrical Interface received a CMI Line Encoding error. This is an error LED.
BPV	**Bi-Polar Violations**. Indicates that the 52M Electrical Interface received a B3ZS Line Encoding error. This is an error LED.
SSM	**Signal Status Mismatch** - Displays when the expected SS bits setting in the H1 byte do not match what is received. This is an alarm LED. SS Bits Alarm Reporting must be enabled for this alarm to occur..

SDH-OMR

SDH Optical Multirate (OMR) Overview

Optical Multirate (also called OMR or just Multirate) is an optional circuit pack that combines the functionality of OC-192/STM-64, OC-48/STM-16, and 622M - 52M SONET/SDH circuit packs on one circuit card. This feature offers multiple interface and mapping functionalities from one location.

To use Multirate functionalities your unit must contain the Optical Multirate circuit pack and be licensed appropriately.

The SDH Multirate Help is divided into the following sections:

- OMR Specific Tasks
- OMR Screen and Function Descriptions
- Dual DS3 (Two simulated DS3 Add/Drops for STM-16)

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OMR Specific Tasks

SDH Specific Tasks Overview

This section includes tasks that are specific to the SDH protocol processor. For general tasks, refer to the Common Tasks section.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view Specific Tasks for this protocol processor.

- Testing SDH Jitter
- Calibrating SDH Optical and Electrical Power
- Configuring APS (K1 and K2) Commands
- Decoding APS (K1 and K2) Values
- Using M.2120 / M.2110 PM
- Configuring Dual DS3 Mode

SDH Jitter

Testing Jitter on a Multirate Unit Overview

NIC units that have the Jitter module and are licensed for Optical Multirate, and contain the Multirate circuit pack can set up jitter interfaces from the Multirate (SONET/SDH) tab.

- Attaching Optical Cables

- Configuring Jitter for a Multirate Unit

The Jitter TX laser remains ON when the optical interface is changed to a non-jitter SONET/SDH signal, allowing the Jitter laser and Optical Multirate laser to remain on at the same time.

Attaching Optical Cables

Before starting jitter tests on a NIC Multirate test set you must disconnect the cables from the Multirate TX or RX connector on the NIC connector panel and reconnect them to the Jitter TX or RX connector.

For instructions on connecting cables, see the **Common Tasks** section of Getting Started, located in the NIC Online Help.

Configuring Jitter for a Multirate Test Set

1. Select the **SDH/SONET** tab.
2. Select **Transmit** and choose **Set 1**.
3. Select **Interface**. The Select Type of Interface dialog box appears
4. Select the desired Jitter Interface for testing.
5. Configure all other necessary SDH parameter settings.
6. From the **Jitter** tab, select **Transmit**.
7. Turn the laser **On**.
8. Select **Receive** and choose **SIG**. Ensure that a valid signal is being received for the configured line rate.

When testing Jitter, the Multirate lasers are disabled and the Jitter laser is used.

The Jitter TX laser remains ON when the optical interface is changed to a non-jitter SONET/SDH signal, allowing the Jitter laser and Optical Multirate laser to remain on at the same time.

Attenuate the received optical power level if necessary so that the power level going into the Jitter RX laser is less than -10 dBm.

Calibrating SDH/SONET Optical and Electrical Power

The following procedures describe optical and electrical power calibration. While performing this task, you will measure, record, and enter the power readings for various interfaces.

Before You Begin

- Read these procedures before trying to calibrate the system.
- Click here to determine which Multirate circuit pack is in your unit. Only the electrical interfaces can be field calibrated on the **NGMR** circuit pack

WARNING: Power the system off before removing the optical connector dust caps to clean the unit's fiber optic ports.

- Before performing optical power calibration, use a fiber-optics cleaning kit to clean the fiber-optic ports on the unit, the optical power meter, the optical attenuator, and the fiber cables. Dirty optical fibers will affect optical measurements.
- The following equipment is required for optical calibration:

  Two three-foot singlemode, fiber-optic cables

  Variable optical attenuator

  Optical power meter

  Fiber-optics cleaning kit

  Pencil and paper to record optical power measurements

Calibrating Optical Interfaces

For calibrating 10G interfaces see the SONET or SDH calibration procedures for OC-192 or STM-64. Use the Contents tab on the left side of the online help window to locate and open the appropriate topic. Calibration procedures are located under Specific Tasks.

For calibrating all other optical interfaces see the SONET or SDH calibration procedures for OC-48 or STM-16. Use the Contents tab on the left side of the online help window to locate and open the appropriate topic. Calibration procedures are located under Specific Tasks.

Calibrating Electrical Interfaces

For calibrating 155 Mbps electrical interfaces see the SONET or SDH calibration procedures for EC-3 or STM-1e. Use the Contents tab on the left side of the

online help window to locate and open the appropriate topic. Calibration procedures are located under Specific Tasks.

For calibrating 52 Mbps electrical interfaces see the SONET or SDH calibration procedures for EC-1 or STM-0e. Use the Contents tab on the left side of the online help window to locate and open the appropriate topic. Calibration procedures are located under Specific Tasks.

Configuring APS (K1 and K2) Commands

The following only applies to SONET and SDH protocol processors.

Automatic Protection Switching (APS) is a function that allows an LTE to switch to a backup (or protection) channel in case errors or failures occur on the working channel. APS commands can be configured for either Linear- or Ring-based SONET and SDH networks and are transmitted using the K1 and K2 bytes of the Line Overhead.

You can test your network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response by configuring the K1 and K2 bytes.

You can create up to 16 different K1 and K2 byte configurations (known as byte sequences) to measure and stress your equipment's APS switching capabilities.

To configure K1 and K2 byte values:

1. Select a protocol processor mode.
2. Select the **Transmit** button.
3. Select the **APS** button. The initial APS screen appears containing a table of the K1 and K2 byte sequences that can be transmitted. A total of 16 K1 and K2 byte sequences can appear in the table.
4. Select a byte sequence button (for example,

).

   The **Apply Maintenance to Entry** screen appears. It contains functions used to configure and set the measurement criteria of the K1 and K2 bytes.

5. Use the **APS Mode** function to configure APS commands for **Linear** protection switching mode or **Ring** APS signaling mode.
6. Edit the K1 byte.

   The K1 byte is a request for switch action. There are three functions that allow you to edit the K1 byte:

   - Use the **K1 Full Byte** function to set all eight bits of the K1 byte at once.

- Use the **K1 Bits 1-4** function to set the first four bits of the K1 byte.
- Use the **K1 Bits 5-8** function to set the last four bits of the K1 byte.

7. Edit the K2 byte.

   The K2 byte provides additional information about SONET network architecture and alarm conditions. There are four functions that allow you to edit the K2 byte:

   - Use the **K2 Full Byte** function to set all eight bits of the K2 byte at once.
   - Use the **K2 Bits 1-4** function to set the first four bits of the K2 byte.
   - Use the **K2 Bit 5 (provisioned)** function to set the fifth bit of the K2 byte.
   - Use the **K2 Bits 6-8** function to set the last three bits of the K2 byte.

8. Select **Duration in Frames** to determine how many frames will be transmitted containing the newly configured K1 and K2 bytes.
9. Select **Update**. The initial APS screen appears on the touch screen.
10. To configure additional K1 and K2 bytes, repeat steps 3-8 as described above. Otherwise, proceed to the next section to transmit K1 and K2 bytes.

To transmit K1 and K2 bytes:

1. Make sure that K1 and K2 byte sequences are configured as described above.
2. Select **Start** to transmit the K1 and K2 bytes.

To stop transmitting K1 and K2 bytes:

1. Select a protocol processor mode.
2. Select the **Transmit** button.
3. Select the **APS** button. The initial APS screen appears.
4. Select **Stop**.

Related Topic:

Decoding APS (K1 and K2) Values

Decoding APS (K1 and K2) Values

The APS function monitors incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 15 byte sequences can

appear on the screen. You can choose to view APS activity in either K1 and K2 Hex values or decode them.

To view received K1 and K2 values:

1. Select the **Results** button.
2. Select **APS** from the tabs along the left side of the Results screen.
3. Select **APS View Mode**, and choose whether to decode the K1/K2 byte's value in either **Linear or Ring** Mode.
4. From the APS Results screen, you can decode a **specific** K1/K2 byte's value or decode the values for **all** K1/K2 bytes.

To decode a specific K1/K2 byte value:

- Select **APS Summary**.

  The results table displays the K1 byte HEX value, K2 byte HEX value, number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

  a. Select the desired **Item** row. The APS Decode dialog box appears with the K1 and K2 byte values decoded.
  b. You can scroll through the Items by selecting the **Prev** and **Next** buttons at the bottom of the APS Decode dialog box. Choose **Cancel** when finished.

To decode all K1/K2 byte values:

- Select **APS Decode**.

  The results table splits into two horizontal tables: the top table displaying K1 byte results; the bottom table displaying K2 byte results.

  The K1 table decodes the values for bits 1-4 and bits 5-8. The K2 table decodes the values for bits 1-4, bit 5, and bits 6-8.

  Also displayed in the tables are the number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

Setting Thresholds for M.2120 Performance Events

The M.2120 screen provides a detailed breakdown for errors meeting the ITU-T M.2120 standard. The results table displays errors detected and logged by the SDH protocol processor by using threshold error performance criteria with respect to either a 15-minute (TR15) or 24-hour (TR24) evaluation period. Error thresholds can be set directly from the M.2120 screen.

Threshold Report 15-Minute (TR15) and Reset Threshold Report 15-Minute (RTR15)

When evaluating TR15, performance events are counted separately, second by second, over each 15-minute fixed window period. A threshold can be crossed at any second within the 15-minute period. As soon as a threshold is crossed a 'fail' message is displayed in the Cur15 column. The performance events continue to be counted to the end of the 15-minute period, at which time the current performance event counts are stored in the historical registers and the current performance event registers are reset to zero. After resetting the registers to zero the 'pass' or 'fail' result moves to the Prev15 column and the performance evaluation continues and records the new result in the Cur15 column.

If the event is in the fail state, the value of the counter is compared to the reset threshold (RTR15) at the end of each period. If the count is less than or equal to the reset threshold, and there has been no unavailable time during that period, a RTR15 is generated and the state changes back to acceptable. If there has been unavailable time during the period or the count crosses the RTR15 threshold then the event remains in the fail state.

Threshold Report 24-Hour (TR24)

The TR24 filter is a 24-hour fixed window. The start and end time for the 24-hour window must occur on a 15-minute window boundary. TR24s occur as soon as the 24-hour threshold is reached or exceeded. The resultant pass or fail state displays the Cur24 column and records to the Prev24 column as the next evaluation period begins. There is no RTR24 for the 24-hour evaluation period.

To set an evaluation threshold:

1. From the **SDH** tab, select **Perf Monitor**.
2. Select **M.2120** from the tabs along the left side of the Perf Monitor screen.
3. Select the desired performance event for an error type (for example, from the B2 error type, select the SES row). The Select Threshold dialog box appears.
4. Select **TR15**. A keypad appears.
5. Set the error threshold for the 15-minute evaluation period and choose **OK**.
6. Reselect the event row to display the Select Threshold dialog box and choose **RTR15**.

Setting a RTR15 is optional.

7. Set the error reset error threshold and choose **OK**.
8. Reselect the event row to display the Select Threshold dialog box and choose **TR24**.
9. Set the error threshold for the 24-hour evaluation period and choose **OK**.

Configuring Dual DS3 Mode

Through mapping, the Dual DS3 functionality provides the capability to monitor the two DS3s on Channels 1 and 4 and insert errors and alarms.

This is a licensable option. Please contact Tech Support, or your DLI sales representative, to enable this option on your NIC unit.

To configure Dual DS3 mode:

1. From the **SONET** or **SDH** tab, select **Transmit**.
2. Select **Set** from the tabs along the left side of the **Transmit** screen and choose **Set 1**.
3. Select **Interface** and choose **OC-48/STM-16**.
4. Select **Mapping** and choose **Dual DS3 Async**. The dual DS3 tabs become available.

Dual DS3 Screen and Function Descriptions

OMR Screen Functions and Descriptions

SDH (OMR) Screen Functions and Descriptions Overview

This section of the online help system describes the various functions, buttons, and tabs that control SDH configuration and operation.

The following screens and functions are discussed:

- Transmit
- Receive
- Results
- Test
- Perf Monitor
- LEDs

Transmit

SDH Transmit Screens and Functions

The Transmit functions allow you to define the parameters used for SDH transmitting operations.

The following parameter setting options are available from the Transmit screen:

- Set > Set 1
- Set > Set 2
- Set > Set 3
- SOH
- POH
- PTR
- APS
- Error Alarm

SDH Transmit - Set / Set 1

The SDH Transmit Settings 1 screen configures the unit's transmit parameters. It contains the following functions:

Function	Description
Settings Controls	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Pass Thru Mode	Activates or deactivates passthru mode, allowing an incoming STM signal to pass through the unit without altering the data in the signal. The following options are available: **On** and **Off**.
Interface	Selects the optical or electrical interface. The following options are available: **STM-64**, **STM-16, STM-4**, **STM-1**, **STM-0**, **STM-1E**, and **STM-0E**. If the test set is licensed for Jitter

	operation, the following options are also available: **STM-1-Jitter**, **STM-4-Jitter**, **STM-16-Jitter**, and **STM-64-Jitter**.
Mapping	Defines the type of signals that are combined to create an SDH signal. For example, four AU-4-16c's can be mapped into an STM-64 signal. Mapping options are dependent on the selected Interface. The following options may be available: • **Unframed Bulk Fill** • **AU-4-64c Bulk Fill** • **AU-4-16c Bulk Fill** • **AU-4-4c Bulk Fill** • **AU-4 C-4 Bulk Fill** • **C-3 Bulk Fill (AU-3 or AU-4)** • **C-2 Bulk Fill (AU-3 or AU-4)** • **C-12 Bulk Fill (AU-3 or AU-4)** • **C-11 Bulk Fill (AU-3 or AU-4)** If the test set is licensed for Dual DS3 and the **STM-16 Interface** is selected, then the **Dual DS3 Async (AU3)** mapping option is available.
AU-<#> Added	Displays the mapped signal. When available, select the **AU-<#> Added** button to enter the number of the specific AU channel to set as the *foreground* (source) channel. The default setting is 1. The source channel can be used to transmit alarms, errors, or patterns.
Background AU-<#> Pattern	Allows the user to select the type of pattern to be inserted into the remaining *background* channels for the SDH signal.

	Select one of the following: **User-Defined (32 bit value), PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv.**
Payload Pattern	Allows the user to select a test pattern to transmit over the SDH signal. This command is automatically coupled to its equivalent Receive command. Select one of the following: **User-Defined (32 bit value), PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv.**
Clock Reference	Allows the user to select the timing source for the SDH transmit signal. Select one of the following: **Internal, Recovered, Bits/Sets, External 8 KHz, External 1.544 MHz, External 2.048 MHz, External 10 MHz.** The External clocks are **75 Ohm TTL.**

SDH Transmit - Set / Set 2

The SDH Transmit Settings 2 screen contains the following functions:

Function	Description

Line Frequency Offset	Adjusts the offset of the signal frequency of the transmitted SDH signal. The frequency can be adjusted in parts per million (ppm). Use the data calculator to enter the offset frequency. The frequency offset ranges from -100.0 to 100.0 in increments of 0.1 A **0 (zero)** value equals **Off**.
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. The following options are available: • **Off** - The unit's laser will be off when the unit is turned on. • **On** - The unit's laser will be on when the unit is turned on. • **Restore Previous State** - When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.
SS Bits in the H1 Label	This function allows bits 5 and 6, which are the SS bits, of the H1 Pointer byte to be set to support a SONET or SDH Transport OH. Changes to the Transport OH are another way to stress an SDH network by simulating errors, alarms, and other stress conditions. The following options are available: **SONET (00)**, **SDH (10)**, or **Undefined**.

HP Signal Label	The Higher-Order Path Signal Label is part of the HPOH and identifies the type of traffic contained in the Virtual Container (VC). The C2 byte is used to indicate the content of the SPE, including the status of the mapped payload. The following options are available: • **00 (Unequipped)** • **01 (Equipped)** • **02 (TUG Structured)** • **03 (Lock TU Mode)** • **04 (Async 34M/45M Mapping)** • **12 (Async 140M Mapping)** • **13 (ATM Mapping)** • **14 (DQDB Mapping)** • **15 (FDDI Mapping)** • **1A (10G WAN IEEE802.3ae)** • **1B (GFP Mapping)** • **FE (O.181 Test Signal)** • **FF (VC-AIS)** • **User Defined** (any eight bit pattern 0 to FF). This option is coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will change in the Overhead screen as well.

LP Signal Label	Bits 5 through 7 of the V5 byte are allocated for a LP Signal Label to indicate the content of the LP SPE, including the status of the LP mapped payload. The following options are available: • **00 (Unequipped)** • **01 (Equipped)** • **02 (Asynchronous)** • **03 (Bit Synchronous)** • **04 (Byte Synchronous)** • **06 (O.181 Test Signal Mapping)** • **07 (VC-AIS)** • **User Defined** - Any 3-bit value 0h to 7h This option is only available for C-2, C-12, and C-11 mappings.
Synchronization Status (S1)	Allows the user to set the S1 byte to one of the following: • **00 (Quality Unknown)**: Sets byte value to 00000000. • **02 (Rec. G.811)**: Sets byte value to 00000010. • **04 (Rec. G.812 Transit)**: Sets byte value to 00000100. • **08 (Rec. G.812 Local)**: Sets byte value to 00001000. • **0B (Sync Eqip Timing Src)**: Sets byte value to 00001011. • **0F (Do Not Use for Sync)** • **User Defined** (any eight bit pattern 0 to FF)
Trigger In	Determines how the protocol processor responds when an external pulse is received. Each protocol processor can be configured to respond to an external pulse received using the Trigger In connector. The following options are available: • **Restart**: The protocol processor will

	restart when an external pulse is received. • **Error Insert**: The protocol processor will insert an error (as defined by the Output Trigger function) when an external pulse is received. • **None**: The protocol processor will do nothing when an external pulse is received.
TC Overhead Processing	Enables Tandem Connection Monitoring (TCM) transmit mode. • **Path Enable**: For SDH, the unit uses its TCM circuitry and the N1 byte to generate errors and alarms between TCM equipment. For SONET, the unit uses the Z5 byte. • **VT Enable**: For SDH, the unit uses its TCM circuitry and the N2 byte to generate errors and alarms between TCM equipment. For SONET, the unit uses the Z6 byte. • **Disable**: TCM mode is disabled, and the N1/N2 and Z5/Z6 bytes follow normal operation.

SDH Transmit - Set / Set 3

The SDH Transmit Settings 3 screen contains the following functions:

Function	Description
Orderwire Add	Allows you to add or drop an orderwire circuit. The following options are available: **None, E1, E2, F1, HP-F2,** and **HP-F3**

Datacom Channel Add	Adds a DCC Channel into the STM payload. Select one of the following: • **None** • **RS DCC Port** • **RS PRBS 2^7-1** • **RS PRBS 2^7- 1 Inv** • **MS DCC Port** • **MS PRBS 2^7-1** • **MS PRBS 2^7-1 Inv**

SDH Transmit - SOH

The Transmit SOH screen contains the following options:

Function	Description
Showing	Select **Showing** to choose an Overhead slot within the SDH signal. The overhead bytes that appear on the SOH screen are associated with this slot.
MS and RS Overhead bytes	Allows the user to select an Overhead byte to edit its value.
J0 Trace	The J0 byte is part of the MS Overhead and is known as the Section trace or J0 trace. The J0 trace is a 64-byte pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The J0 trace can be configured to send the system's default pattern or a customized pattern.

	The following options are available: • **Default (64 byte)** - Selects the 64-byte Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)** - Selects a 64-byte user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones** - Selects an All Ones pattern as the J0 trace pattern. • **All Zeros** - Selects an All Zeros pattern as the J0 trace pattern. • **Default (16 byte)** - Selects the 16-byte Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)** - Selects a 16-byte user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.

The Transmit POH screen contains the following options:

Function	Description
AU-<#> Added	Allows the user to enter the number of the specific AU channel to set as the *foreground* (source) channel. The default setting is 1.
HP and LP Overhead Bytes	Path Overhead Bytes include: B3, J1, C2, G1, F2, H4, F3, K3, and N1. VT Overhead Bytes include: V5, J2, N2, and K4. **Note**: This option will be disabled if Passthru mode is enabled.
J1 Trace	Selects a default or customized pattern to be used as the J1 trace. Select one of the following patterns: • **Default (64 byte)**: Selects the Digital Lightwave ASCII message as the J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)**: Selects a user-defined ASCII message as the J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones**: Selects an All Ones pattern as the J1 trace pattern. • **All Zeros**: Selects an All Zeros pattern as the J1 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII

	message as the J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.
TC Trace	The TC Trace is a 16-byte pattern that can be created for repeated transmission between TCM equipment. The pattern is a string of ASCII characters and can be configured to send the unit's default pattern or a customized pattern. Enable TCM mode (using TC Overhead Processing) before sending the TC Trace. Select one of the following patterns: • **Default**: Selects the 16-byte Digital Lightwave ASCII message as the TC trace pattern. • **All Ones** - Selects an All Ones pattern as the TC Trace pattern. • **All Zeros** - Selects an All Zeros pattern as the TC Trace pattern. • **User Defined**: Selects a 16-byte user-defined ASCII message as the TC trace pattern. The message is entered and saved using a touch screen keyboard.

SDH Transmit - PTR

The Transmit PTR screen contains the following options:

Function	Description
NDF Flag	The NDF Flag allows you to specify whether the NDF bits are set when a new Pointer is present in the generated signal. The following options are available: **Yes** (On): Generates an NDF when a new Pointer is transmitted. **No** (Off): Disables NDF functionality.
Pointer Value	The Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the Virtual Container. The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from 0 to 782. After entering the new Pointer Value, the Pointer automatically moves to the new position.
Frequency Offset	Adjusts the rate at which AU Pointer adjustments are needed in the Administrative Unit (AU). Enter a frequency type ranging from -100.0 ppm to +100.0 ppm. This function is disabled by entering 0.
Pointer Action	Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. **Single options** - Inserts a single Pointer movement with each selection of the INC Pointer or DEC Pointer button. The Pointer value changes by one. **Increment/Decrement option** - Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected.

	Continuous options - Inserts a continuous Pointer movement with the selection of the INC Pointer or DEC Pointer button. The movement continues until the Stop Sequence button is selected.
Burst Count	This function allows you to determine the number of Pointer location movements to occur when the INC Pointer or DEC Pointer buttons are pressed. The Pointer burst count ranges from 1 to 8.
Ms between Bursts	Allows the user to set the number of Milliseconds between bursts. Valid valued are 34 - 10000.
INC Pointer / DEC Pointer	Alternates the Pointer insertion from increment to decrement with a 200-msec delay in between.

APS

Transmit APS

This is an Automatic Protection Switching (APS) function used to configure transmit APS activity. APS is a feature that allows the LTE to switch to a backup line in case of errors or failures on the main line. APS commands can be configured for either Linear- or Ring-based networks and are transmitted using bytes K1 and K2 of the Line overhead.

You can test the network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response.

The following options are available on the APS screen:

- **New Item** - Opens the Apply Maintenance to Entry window, from which you configure K1 and K2 bytes.
- **Start** - Begins transmission of the K1 and K2 byte configuration.
- **Clear** - Clears the table.

The following Apply Maintenance to Entry window APS Transmit functions are available:

APS Mode - Linear

NIC Help

This function configures the system to transmit APS functions for a Linear (span) network.

- K1 Full Byte (Linear Mode)
- K1 Bits 1-4 (Linear Mode)
- K1 Bits 5-8 (Linear Mode)
- K2 Full Byte (Linear Mode)
- K2 Bit 5 (Provisioned) (Linear Mode)
- K2 Bits 1-4 (Linear Mode)
- K2 Bits 6-8 (Linear Mode)

APS Mode - Ring

This function configures the system to transmit APS functions for a Ring network.

- K1 Full Byte (Ring Mode)
- K1 Bits 1-4 (Ring Mode)
- K1 Bits 5-8 (Ring Mode)
- K2 Full Byte (Ring Mode)
- K2 Bit 5 (Provisioned) (Ring Mode)
- K2 Bits 1-4 (Ring Mode)
- K2 Bits 6-8 (Ring Mode)

Duration in Frames

The Duration in Frames function determines the number of frames transmitted that contain specific K1 and K2 bytes. These bytes are configured using the functionality located on the transmit APS screen.

Frame count is entered using a keypad. Values ranging from 1 to 65535 frames can be entered.

K1 Bits 1-4 (Linear Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description
(0000) NR	No Request, Bit pattern 0000
(0001) Non Rev	Do not revert, Bit pattern 0001
(0010) RR	Reverse Request (Ring), Bit pattern 0010
(0011) Unused	Not Used, Bit pattern 0011

(0100) EXER	Exerciser (Ring), Bit pattern 0100
(0101) Unused	Not used, Bit pattern (0101)
(0110) WTR	Wait to restore, Bit pattern (0110)
(0111) Unused	Not used, Bit pattern (0111)
(1000) MS	Manual switch, Bit Pattern 1000
(1001) Unused	Not used, Bit pattern (1001)
(1010) SD-LP	Signal degrade low priority, Bit pattern (1010)
(1011) SD-HP	Signal degrade high priority, Bit pattern (1011)
(1100) SF-LP	Signal fail low priority, Bit pattern (1100)
(1101) SF-HP	Signal fail high priority, Bit pattern (1101)
(1110) FS	Forced switch, Bit pattern (1110)
(1111) LP	Lockout of protection, Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	**Description**
(0000) NR	No request, Bit pattern 0000
(0001) RR-R	Reverse request (Ring), Bit pattern 0001
(0010) RR-S	Reverse request (Span), Bit pattern 0010
(0011) EXER-R	Exerciser (Ring), Bit pattern 0011
(0100) EXER-S	Exerciser (Span), Bit pattern 0100
(0101) WTR	Wait to restore, Bit pattern (0101)
(0110) MS-R	Manual switch (Ring), Bit pattern (0110)
(0111) MS-S	Manual switch (Span), Bit pattern (0111)
(1000) SD-R	Signal degrade (Ring), Bit Pattern 1000

(1001) SD-S	Signal degrade (Span), Bit pattern (1001)
(1010) SD-P	Signal degrade (Path), Bit pattern (1010). This is the Transmit Default button setting.
(1011) SD-R	Signal degrade (Ring), Bit pattern (1011)
(1100) SF-S	Signal fail (Span), Bit pattern (1100)
(1101) FS-R	Forced switch (Ring), Bit pattern (1101)
(1110) FS-S	Forced switch (Span), Bit pattern (1110)
(1111) LP-S	Lockout of protection (Span), Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 5-8 (Linear Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Linear mode, these bits indicate the channel number. For example, Code 0 is the Null Channel, Codes 1-14 are the working channels, and Code 15 is an extra traffic channel.

The following options are available:

Options	**Description**
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit

	pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Bits 5-8 (Ring Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Ring mode, these bits contain the Destination Code Identification.

The following options are available:

Options	**Description**
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.

#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Full Byte (Linear Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K1 Full Byte (Ring Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Bit 5 (Provisioned) (Linear Mode)

This function edits the 5th bit of the K2 byte. In Linear mode. This bit controls the type of protection switching architecture used.

The following options are available:

Options	Description
1+1	Provisioned for 1+1 mode; Bit 5 = 0
1 : n	Provisioned for 1:n mode; Bit 5 = 1

K2 Bit 5 (Provisioned) (Ring Mode)

This function edits the 5th bit of the K2 byte. In Ring mode, this bit controls the type of path code used.

The following options are available:

Options	Description
SHT / OTO	Short Path Code; Bit 5 = 0
LNG / OTN	Long Path Code; Bit 5 = 1. When selected, both the Transmit Default and Transmit Illegal button settings are configured for LNG/OTN.

K2 Bits 1-4 (Linear Mode - SDH)

This function edits the first four bits of the K2 byte. In Linear mode, the first four bits indicate which working channel is bridged onto the protection channel during a traffic switching event.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit

	pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K2 byte. In Ring mode, the first four bits are the Source Node Identification. (The Source Node ID is set to the Node's own ID.)

The following options are available:

Options	Description
#0	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Linear Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Unused	Not used, Bit pattern 000
(001) Unused	Not used, Bit pattern 001
(010) Unused	Not used, Bit pattern 010
(100) Unused	Not used, Bit pattern 100
(100) Uni-direct	Provisioned for Unidirectional switching, Bit pattern 10
(101) Bi-direct	Provisioned for Bidirectional switching, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Ring Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Idle	Idle, Bit pattern 000
(001) Br	Bridged, Bit pattern 001
(010) Br&Sw	Bridged and switched, Bit pattern 010. This is the Transmit Default button setting.
(100) Ex Tr	Extra traffic on protection channel, Bit pattern 100
(100) Unused	Not used, Bit pattern 10

(101) Unused	Not used, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Full Byte (Linear Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Full Byte (Ring Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

SDH Transmit - Error Alarm

The test unit can transmit errors and alarms to simulate various defects and anomalies to determine if the receiving equipment can detect an error or alarm in the incoming signal.

For information on inserting errors and alarms see the online help topics, Inserting Errors and Inserting Alarms in the Common Tasks section.

The following options are available one the Error Alarm screen:

- Error to Insert
- Error Insert Rate
- Alarm Generated

Error to Insert

This SDH Transmit function determines the type of error transmitted by the system.

The purpose of generating an error with system is to stress the network element that is receiving the error by testing if it can detect the incoming error and then report error statistics such as error counts and rates.

The following options are available:

Option	Description

None	No errors are generated. Turns errors off.
Frame	Inserts a frame alignment error in the A1 and A2 bytes.
B1 Error	Generates a BIP-8 (Bit Interleaved Parity, 8-bit) error over the Regenerator Section layer. Bits in the B1 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
B2 Error	Generates a BIP-8 error over the Multiplex Section layer. Bits in the B2 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
MS-REI	Generates a Remote Error Indicator over the Multiplex Section layer. An MS-REI is a count of B2 errors received at the far end. When the system transmits this error, it simulates a downstream NE sending an error count back to the source of its incoming SDH signal. The system uses the M1 byte of the MSOH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and rates. (This type of error was formerly called

	a Line Far End Block Error - FEBE-L.)
B3 Error	Generates a BIP-8 error over the Higher-Order Path layer. Bits in the B3 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
HP-REI	Generates a Remote Error Indicator over the Higher-Order Path layer. An HP-REI is a count of B3 errors received at the far end. When the system transmits this error, it simulates an NE sending an error count back to the source of its incoming SDH signal. The system uses the G1 byte of the HPOH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and error rates.
LP-BIP	Generates a BIP-2 error over the Lower-Order Path layer. Bits in the V5 byte are toggled to create an error.
LP-REI	Generates a Remote Error Indicator over the Lower-Order Path layer. An LP-REI is a count of LP-BIP errors received at the far end. When the system transmits this error, it simulates an NE sending an error count back to the source of its incoming SDH signal. The system uses the V5 byte of the LPOH to transmit the error count. This type of simulation allows an NE (in this case,

	the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and error rates.
HP-TC-IEC Only appears when the TC Overhead Processing is configured for "**HP Enable**".	Generates a Tandem Connection Incoming Error Count over the Higher-Order Path layer. A TC-IEC is a count of B3 errors received by TCM equipment at the far end. Bits 1-4 of the N1 byte are the IEC bits.
HP-TC-REI Only appears when the TC Overhead Processing is configured for "**HP Enable**".	Generates a Tandem Connection Remote Error Indicator over the Higher-Order Path layer between TCM equipment. Bit 5 of the N1 byte is used for this error.
HP-TC-OEI Only appears when the TC Overhead Processing is configured for "**HP Enable**".	Generates a Tandem Connection Outgoing Error Indicator over the Higher-Order Path layer between TCM equipment. Bit 6 of the N1 byte is used for this error.
LP-TC-BIP Only appears when the TC Overhead Processing is configured for "**LP Enable**".	Generates a Tandem Connection Bit Interleaved Parity error over the Lower-Order Path layer. Bits 1-2 of the N2 byte are the BIP bits.
LP-TC-REI Only appears when the TC Overhead Processing is configured for "**LP Enable**".	Generates a Tandem Connection Remote Error Indicator over the Lower-Order Path layer between TCM equipment. A LP-TC-REI is a count of LP-TC-BIP errors received by TCM equipment at the far end. Bit 5 of the N2 byte is used for this error.
LP-TC-OEI Only appears when the TC Overhead Processing is configured for "**LP Enable**".	Generates a Tandem Connection Outgoing Error Indicator over the Lower-Order Path layer between TCM equipment. Bit 6 of the N2 byte is used for this error.
BIT Error	Generates bit errors. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2)

	then conduct performance monitoring such as error counts and error rates.

Error Insert Rate

This SDH Transmit function sets the error rate for the selected error. The system starts transmitting errors after the insertion rate is selected.

For information about inserting errors, see Inserting Errors in the Common Tasks section of the online help.

The following Error Insert Rate options are available:

Option	Description
Off	Turns error transmission off.
Maximum	Generates errors at the maximum rate listed below.
1e - *X*	*X* is a value from 3 to 10; for example, 1e-3 through 1e-10. *X* will vary based on the type of error selected.
User Defined	Allows the user to enter a custom error. Valid values are 1e-6 to 1e-10.

Alarm Generated

This function configures the system to generate an alarm in the transmit SDH signal. Alarm generation by the system is one way to test if downstream SDH equipment reacts properly to the alarm it receives in the incoming SDH signal.

For information about generating alarms, see Inserting Alarms in the Common Tasks section of the online help.

The following alarms are available:

Alarm	Description
None	No alarms are generated. Turns alarms off.
LOS	Loss of Signal. An all-zeros pattern is transmitted to simulate a loss of signal or loss of optical power. This

	forces the downstream SDH equipment to (1) generate an AIS alarm to its downstream network elements (NE), and (2) generate an RDI alarm to its upstream NEs.
LOF	Loss of Frame. An all-zeros pattern is inserted into the A1 and A2 framing bytes of the Section OH. This simulates the absence of a valid framing pattern. This forces the downstream SDH equipment to generate an AIS alarm to its downstream network elements (NE)and generate an RDI alarm to its upstream NEs.
MS-AIS	Multiplex Section Alarm Indication Signal. The transmission of an MS-AIS to a downstream NE forces that NE to send an AU-AIS alarm to the next downstream NE. The NE will also send an MS-RDI alarm to its upstream equipment. An MS-AIS simulates an alarm generated by Line terminating equipment (LTE).
MS-RDI	Multiplex Section Remote Defect Indicator. This generates an MS-RDI condition using the K2 byte of the Line OH. This simulates a downstream NE at the Line layer, reporting a failure to an upstream NE. The downstream NE has encountered a downstream failure and is alerting upstream SDH equipment. To do this, the system changes the pattern of the K2 byte. The NE receiving the MS-RDI alarm should detect a change to the K2 byte on the incoming SDH signal. This forces the NE to generate a Remote Alarm Indicator (RAI) to its upstream NEs.
AU-LOP	Administrative Unit Loss of Pointer.

	This simulates a loss of a valid Pointer. When the downstream NE receives an AU-LOP, it generates a DSn AIS alarm to its downstream equipment and an HP-RDI alarm to its upstream equipment.
AU-AIS	Administrative Unit Alarm Indication Signal. The transmission of an AU-AIS to a downstream NE forces that NE to send an AIS alarm to the next downstream NE. The NE will also send an RDI alarm to its upstream equipment. An AU-AIS simulates an alarm generated by Path terminating equipment (PTE).
HP-RDI	Higher-Order Path Remote Defect Indicator. This generates an HP-RDI condition using the G1 byte of the Higher-Order Path OH. This simulates a downstream NE at the Path layer, reporting a failure to an upstream NE. To do this, the system changes the pattern of the G1 byte in the HPOH. The NE receiving the HP-RDI alarm should detect a change to the G1 byte on the incoming SDH signal.
HP-UNEQ	Higher-Order Path Unequipped Alarm. An all-zeros pattern is inserted into the C2 byte of the HPOH. The C2 byte is the HP Signal Label. (This type of error is used between Higher-Order Path terminating equipment-PTE) When a PTE receives this alarm, it will generate an AIS to downstream NEs.
HP-TC-RDI Only appears when the TC	Tandem Connection-Remote Defect Indicator. Generates an alarm to upstream equipment indicating that defects have been detected within

Overhead Processing is configured for "**HP Enable**".	the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 8 in multiframe 73 of the N1 byte.
HP-TC-ODI Only appears when the TC Overhead Processing is configured for "**HP Enable**".	Tandem Connection-Outgoing Defect Indicator. Generates an alarm to upstream TCM equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 7 in multiframe 74 of the N1 byte.
HP-TC-AIS Only appears when the TC Overhead Processing is configured for "**HP Enable**".	Tandem Connection-Alarm Indication Signal. Generates an AIS alarm to downstream TCM equipment by setting Bits 1-4 of the N1 byte to 1110.
HP-TC-UNEQ Only appears when the TC Overhead Processing is configured for "**HP Enable**".	Tandem Connection-Unequipped. An all-zeros pattern is inserted into the N1 byte of the Path OH.
HP-TC-LOF Only appears when the TC Overhead Processing is configured for "**HP Enable**".	Tandem Connection-Loss of Frame. Generates a loss of a valid multiframe pattern to downstream equipment.

Receive

SDH Receive Screens and Functions

The Receive function allows you to define the parameters used in SDH receiving operations.

The following parameter setting options are available from the Receive screen:

- Set > Set 1
- Set > Set 2
- Set > Set 3
- SOH
- POH
- SIG

SDH Receive - Set / Set 1

The SDH Receive Settings 1 screen configures the unit's receive parameters. It contains the following functions:

Function	Description
Settings Control	If **Coupled** is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If **Independent** is selected, settings established on the Receive screen will only affect Receive mode.
Interface	Selects the optical or electrical interface. The following options are available: **STM-64**, **STM-16, STM-4**, **STM-1**, **STM-0**, **STM-1E**, and **STM-0E**. If the test set is licensed for Jitter operation, the following options are also available: **STM-1-Jitter**, **STM-4-Jitter**, **STM-16-Jitter**, and **STM-64-Jitter**.

Mapping	Defines the type of signals that are combined to create an SDH signal. For example, four AU-4-16c's can be mapped into an STM-64 signal. Mapping options are dependent on the selected Interface. The following options may be available: • **Unframed Bulk Fill** • **AU-4-64c Bulk Fill** • **AU-4-16c Bulk Fill** • **AU-4-4c Bulk Fill** • **AU-4 C-4 Bulk Fill** • **C-3 Bulk Fill (AU-3 or AU-4)** • **C-2 Bulk Fill (AU-3 or AU-4)** • **C-12 Bulk Fill (AU-3 or AU-4)** • **C-11 Bulk Fill (AU-3 or AU-4)** If the test set is licensed for Dual DS3 and the **STM-16 Interface** is selected, then the **Dual DS3 Async (AU3)** mapping option is available.
AU Type	Selects an Administrative Unit type to include AU-3 or AU-4.
AU-<#> Dropped	Select the foreground Administrative Unit to be dropped. The options that appear will depend on your current configuration. The default setting is 1.
TUG-<#> Dropped	Select the foreground Tributary Unit to be dropped. No TUG will display unless AU-4 is set as the AU type.

Payload Pattern	Selects the type of pattern that the unit expects to receive on the incoming SDH signal. The following options are available: • **Live** (user data is received; no pattern is used) • **User Defined** (range from 1 bit to 32 bits and is entered using a touch screen keypad) • **PRBS 9**, **PRBS 9 Inv**, **PRBS 11**, **PRBS 11 Inv**, **PRBS 15**, **PRBS 15 Inv**, **PRBS 20**, **PRBS 20 Inv**, **PRBS 23**, **PRBS 23 Inv**, **PRBS 31**, **PRBS 31 Inv**
Power Low Threshold	Sets the power threshold. If the power drops below the threshold, the Power Low alarm initiates. When the threshold is reached, the LOS alarm signals.
Out of Frequency Threshold	Sets the frequency threshold for the Line Frequency Offset. When the threshold is reached, the Frequency Wide alarm is triggered.
Trigger Out	Allows the user to select the way that the protocol processor will respond to an external "pulse" received.

SDH Receive - Set / Set 2

The SDH Receive Settings 2 screen configures the unit's receive parameters. It contains the following functions:

Function	Description
PLM Alarm Reporting	**Disable** or **Enable** Payload Label Mismatch reporting.

Expected HP Signal Label	Enter any eight bits for the Higher-Order Path Signal Label for byte C2 expected. Configure to receive a specific value for the C2 byte. The following options are available: • **00 (Unequipped)** • **01 (Equipped)** • **02 (TUG Structured)** • **03 (Lock TU Mode)** • **04 (Async 34M/45M Mapping)** • **12 (Async 140M Mapping)** • **13 (ATM Mapping)** • **14 (DQDB Mapping)** • **15 (FDDI Mapping)** • **1A (10G WAN IEEE802.3ae)** • **1B (GFP Mapping)** • **FE (O.181 Test Signal)** • **FF (VC-AIS)** • **User Defined** (any eight bit pattern 0 to FF) This option is coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will change in the Overhead screen as well.

Expected LP Signal Label	Select one of the following values for the expected Lower Order Path Signal: The following options are available: • **00 (Unequipped)** • **01 (Equipped)** • **02 (Asynchronous)** • **03 (Bit Synchronous)** • **04 (Byte Synchronous)** • **06 (O.181 Test Signal Mapping)** • **07 (VC-AIS)** • **User Defined** - Any 3-bit value 0h to 7h This option is only available for C-2, C-12, and C-11 mappings.
TIM Alarm Reporting	An HP Path Trace Identifier Mismatch (HP-TIM) alarm occurs when the incoming J1 trace does not match the expected J1 trace. A Regenerator Section Trace Identifier Mismatch (RS-TIM) alarm occurs when the incoming J0 trace does not match the expected J0 trace. The following options are available: • **Enabled** - TIM alarms are recognized and reported. • **Disabled** - TIM alarms are ignored.

Expected J0	Defines the expected J0 trace received on the incoming SDH signal. A RS-TIM alarm occurs if the incoming J0 trace does not match the expected J0 trace. The J0 byte is part of the Regenerator Section OH and is known as the Section trace, or J0 trace. The J0 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. • **Default (64 byte)** - Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)** - Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones** - Selects an All Ones pattern as the J0 trace pattern. • **All Zeros** - Selects an All Zeros pattern as the J0 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a

	CRC-7.

Expected HP J1	Defines the expected J1 trace received on the incoming SDH signal. A HP-TIM alarm occurs if the incoming J1 trace does not match the expected J1 trace. The J1 byte is part of the Higher-order Path OH and is known as the Path trace, or J1 trace. The J1 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters.The following options are available: • **Default (64 byte)** - Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)** - Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones** - Selects an All Ones pattern as the J1 trace pattern. • **All Zeros** - Selects an All Zeros pattern as the J1 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15

	characters, appended with a CRC-7.

Expected LP J2	Defines the expected J2 trace received on the incoming SDH signal. A LP-TIM alarm occurs if the incoming J2 trace does not match the expected J2 trace. The J2 byte is part of the Lower-order Path OH and is known as the Path trace, or J2 trace. The J2 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The following options are available: • **Default (64 byte)** - Selects the Digital Lightwave ASCII message as the expected J2 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)** - Selects a user-defined ASCII message as the expected J2 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones** - Selects an All Ones pattern as the J2 trace pattern. • **All Zeros** - Selects an All Zeros pattern as the J1 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the expected J2 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the expected J2 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15

	characters, appended with a CRC-7.
SS Bits Alarm Reporting	**Disables** or **Enables** SS bits reporting. This function is used in conjunction with the Expected SS Bits function. If enabled, and an SS Bits mismatch is detected on the received signal, the duration in seconds will appear under the

	Results Scan function.
Expected SS Bits	Selects one of the following as the expected SS Bits value: • **00 (SONET)** • **01 (Undefined)** • **10 (SDH)** • **11 (Undefined)**
TC Error/Alarm Processing	Enables or disables Tandem Connection Monitoring (TCM) mode. This function is used in conjunction with the Expected TC Trace function. The TC Summary LED turns red if a TCM error or alarm is reported. Select the TC Summary text for more details. • **HP Enable** - Turns on N1 byte for TCM error and alarm reporting mode. • **LP Enable** - Turns on the N2 byte for TCM error and alarm reporting mode. • **Disable** - Turns off TCM error and alarm reporting mode. Disable this option if you are not performing TCM testing. This will prevent false error and alarm reporting.

Expected TC Trace	Defines the expected TC trace received on the incoming signal. For SONET, this is in the Z5 byte. For SDH, this is in the N1 byte. The following options are available: • **Default** - Selects a 16-byte Digital Lightwave ASCII message at the expected TC trace pattern. • **All Ones (16 byte)** - Selects a 16-byte All Ones pattern as the TC trace pattern. • **All Zeros (16 byte)** - Selects a 16-byte All Zeros pattern as the TC trace pattern. • **User Defined** - Selects a 16-byte user-defined ASCII message as the expected TC trace pattern. The message is entered and saved using a screen keypad.

SDH Receive - Set / Set 3

The SDH Receive Settings 3 screen configures the unit's receive parameters. It contains the following functions:

Function	Description
Orderwire Drop	Allows you to drop an orderwire circuit for a protocol processor. The following options are available: **None**, **E1**, **E2**, **F1**, **HP-F2,** and **HP-F3**

Datacom Channel Drop	Defines specific bytes in the Section overhead that is used to send operation and maintenance information between the Section and Line equipment. The following options are available: • **None** • **RS DCC Port** • **RS PRBS 2^7-1** • **RS PRBS 2^7-1 (Inverted)** • **MS DCC Port** • **MS PRBS 2^7-1** • **MS PRBS 2^7-1 (Inverted)**
Monitor Mode	Expands the receive sensitivity for the 52M or 155M electrical interfaces. Use this setting for better clock and data recovery, when the received voltage levels are lower than normal. This setting is only supported on the **NGMR** circuit pack, and not the **OMR** circuit pack. Click here to determine which Multirate circuit pack is in your unit.

SDH Receive - SOH

The Receive SOH screen contains the following options:

Option	Description
Showing	Selects a specific SOH slot to monitor on the incoming SDH signal. The following bytes appear for the selected SOH slot:

	• Regenerator Section Overhead bytes (A1, A2, Z0, B1, E1, F1, D1, D2, and D3), • Multiplex Section Overhead bytes (B2, K1, K2, D4-D12, Z1, Z2, and E2), • Pointer bytes (H1, H2, and H3), • Higher-Order Path Overhead bytes (B3, C2, G1, F2, H4, Z3, Z4, and Z5), • J0 Trace byte, and J1 Trace byte.
J0	Displays the J0 trace received on the incoming SDH signal. This is a read-only function.

SDH Receive - POH

The Receive POH screen contains the following options:

Option	Description
AU-<#> Dropped	Allows the user to enter the number of the specific AU channel to monitor. The default setting is 1.
HP Overhead	Displays the Overhead bytes for a specific Higher-Order Path OH slot on the incoming SDH signal. This is a read-only function.
LP Overhead	Displays the Overhead bytes for a specific Lower-Order OH slot on the incoming SDH signal. This is a read-only function.
J1 Trace	Displays the J1 trace received on the incoming SDH signal. This is a read-only function.
J2 Trace	Displays the J2 trace received on the incoming SDH signal. This is a read-only function.

TC Trace	Displays the TC trace received on the incoming SDH signal. This is a read-only function.

SDH Receive - SIG

Displays the following measurements of the incoming SDH signal:

- Frequency in Hz
- Line Frequency Offset Received in Hz and ppm
- Optical power in dBm
- AU Pointer Frequency Offset in ppm
- TU Pointer Frequency Offset in ppm
- Update Signal Calibration - Calibrating the system's optical power should be done carefully. To keep unauthorized users from changing calibration settings, the Update Signal Calibration button on the protocol processor's Receive SIG screen is unavailable by default. To change the setting, a user with Admin or Calibrate privileges must enable the calibration mode.

To enable protocol processor calibration:

1. From the **System** tab, select **Misc**.
2. From **Local Settings**, select **Enable Calibration**.

The user must have Admin or Calibrate privileges to enable the calibration mode.

3. See Calibrating SDH/SONET Optical and Electrical Power for specific calibration instructions before proceeding.

Results

SDH Results Screens and Functions

All monitored activity that the system receives is reported to the Results screen for viewing and analyzing. The Results screen provides information used for analyzing the incoming signal, pattern, errors, and alarms.

The following options are available from the Results screen:

- Scan / Error / Alarm
- PTR

- Event
- APS
- Large LED
- Graph

SDH Results - Error / Alarm

The Results ERR screen contains the following options:

- **Scan** - Select Scan to access a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected. This function displays a list of received errors and alarms. For alarms, the duration is reported as a count in seconds. For errors, an error count is reported.

  When no activity is occurring, the screen displays, "No errors or alarms."

- **Errors** - The unit can monitor and report errors on the incoming SDH signal. The Errors function provides a detailed analysis of the incoming error as described below. The reported errors are a result of incoming errors that are generated by the SDH network, or errors that are intentionally generated by the system when it is used in a loopback environment.

  The following errors can be monitored:

  - Frame
  - B1 (Section BIP-8, also known as a Section Coding Violation - CV-S)
  - B2 (Line BIP-8, also known as a Line Coding Violation - CV-L)
  - B3 (Path BIP-8, also known as an STS Path Coding Violation - CV-P)
  - HP-REI
  - LP-BIP
  - LP-REI
  - MS-REI
  - BIT (BIT errors reported in the payload)
  - AU-NDF
  - TU-NDF
  - TC-IEC (Tandem Connection-Incoming Error Count)
  - TC-REI (Tandem Connection-Remote Error Indicator)
  - TC-OEI (Tandem Connection-Outgoing Error Indicator)

  The following parameters are measured for the incoming errors:

  - Error count using an 11-digit format

- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format
- Error-free seconds using an 8-digit format
- Errored seconds
- Severely Errored seconds
- Unavailable errored seconds

- **Alarms** - The system can monitor and report alarms and their duration on the incoming SDH signal. The alarms are shown in duration of the alarm in seconds.

  The following alarms can be monitored:

  - LOS (Loss of Signal)
  - Power Hot
  - Power Low
  - LOF (Loss of Frame)
  - OOF (Out of Frame)
  - RS-TIM (Regenerator Section Trace Identifier Mismatch for J0 byte)
  - MS-AIS (Multiplex Section Alarm Indication Signal)
  - MS-RDI (Multiplex Section Remote Defect Indicator)
  - APS-L (Automatic Protection Switching)
  - AU-AIS (Administrative Unit Alarm Indication Signal)
  - AU-LOP (Administrative Unit Loss of Pointer)
  - HP-UNEQ (Higher-Order Path Unequipped Payload)
  - HP-RDI (Higher-Order Path Remote Defect Indicator)
  - HP-TIM (Higher Order Path Trace Identifier Mismatch for the J1 byte)
  - Frequency Wide
  - OPU Generic AIS
  - HP-PLM (Higher-Order Path Payload Label Mismatch)
  - Pattern Sync
  - TC-RDI (Tandem Connection-Remote Defect Indicator)
  - TC-ODI (Tandem Connection-Outgoing Defect Indicator)
  - TC-AIS (Tandem Connection-Alarm Indication Signal)
  - TC-UNEQ (Tandem Connection-Unequipped)
  - TC-TIM (Tandem Connection-Trace Identifier Mismatch)
  - TC-LOF (Tandem Connection-Trace Identifier Mismatch)
  - TU-LOP (Tributary Unit - Loss of Pointer)
  - TU-AIS (Tributary Unit - Alarm Indication Signal)

SDH Results - PTR

This PTR function monitors and reports received Pointer statistics. A count of the following Pointer statistics appear:

- **Pointer Justification** - Indicates the Positive Pointer Justification count.
- **Negative Justification** - Indicates the Negative Pointer Justification count.
- **Positive Justification Seconds** - Indicates the duration of a Pointer adjustment.
- **NDF Coun**t - Indicates the New Data Flag count.
- **Rx Pointer Bytes (HEX)** and **Rx Pointer Value** (in decimal) - Valid Pointers range from 0 to 782.

When lower-order mapping is configured TU Pointer results also appear.

SDH Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

SDH Results - APS

The APS function monitors incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 15 byte sequences can appear on the screen.

The Results APS screen contains the following options:

Option	Description

APS Summary	When selected, the following information appears in the results table last 15 K1 and K2 byte sequences received: • The HEX value of the K1 byte. • The HEX value of the K2 byte. • The number of frames received that contain the K1 and K2 bytes. • The elapsed time of the frames that contain the K1 and K2 bytes. To view decoded values for a specific Item, select the Item number. The APS Decode dialog box appears displaying the Item's configuration.
APS Decode	When selected, the results table splits into two horizontal tables: the top table displaying K1 results; the bottom table displaying K2 results. The K1 table decodes the value for bits 1-4 and bits 5-8. The K2 table decodes the value for bits 1-4, bit 5, and bits 6-8. Also displayed in the tables are the number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes for the last 15 byte sequences received.
APS View Mode	Allows the user to view decoded values in either **Linear** Protection Switching Mode or **Ring** APS Signaling Mode.

Per GR-253-CORE, only the upper 12 bits of the K1/K2 bytes (K1 bits 1-8 and the K2 bits 1-4) are used for APS operation. K2 bit 5 sets the APS mode type (1+1, 1:n) and cannot be changed during operation. K2 bits 6-8 are for alarms. Any changes to the lower four bits of the K2 byte do not affect APS

operation. The Results APS table only starts and displays a new entry item if the upper 12 K1/K2 bits stabilize on a new value for a minimum of three consecutive frames.

SDH Results - Large LED

This displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

For a list of available LEDs in the SDH protocol processor, see SDH LEDs.

SDH Results - Graph

The Graph function allows incoming errors and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

For more information about graphs, select Using Graphs in the Common Tasks section of the online help.

Test

Test Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- SET 1

- Service Disruption
- RTD (Round Trip Delay)

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Service Disruption

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The service disruption measurements show a granular accuracy of 1 frame duration. See the chart at the bottom of this page for time per frame durations for each protocol processor.

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

  For **E4**, **E3**, **E1**, **DS3** and **DS1** processors, the Protection Switch Criteria is limited to: Loss of Pattern Sync and Bit Errors.

For **SONET** and **SDH** processors the Protection Switch Criteria include: B1, SEF / OOF, AIS-L / MS-AIS, AIS-P / AU-AIS, AIS-V / TU-AIS, and PRBS (Loss of Pattern Sync and Bit Errors).

For **OTN** processors the Protection Switch Criteria include: OOF, OTU:AIS, OTU:BIP8, ODU:AIS, ODU:BIP8, and PRBS (Loss of Pattern Sync and Bit Errors).

- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **State** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

  - **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

  - **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.

  - **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)** - Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.
- **Protection Switch Time (Frames)** - Indicates the number of errored frames received during the service disruption event.
- **History Recent Milli Seconds** - Shows the time durations for the last ten measurements recorded.
- **History Recent Frames** - Shows the frame durations for the last ten measurements recorded.

A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing Service Disruption.

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
SONET / SDH	0.125 ms (125 µs)	16383 frames (2047.875 ms)
OTU 1	0.049 ms (49 µs)	16383 frames (802.302 ms)
OTU 2	0.012 ms (12 µs)	16383 frames (199.732 ms)
E4	0.021 ms (21 µs)	255 frames (5.361 ms)
E3	0.045 ms (45 µs)	255 frames (11.397 ms)
E1	0.125 ms (125 µs)	4095 frames (511.875 ms)
DS3	0.106 ms (106 µs)	255 frames (27.133 ms)
DS1	0.125 ms (125 µs)	4095 frames (511.875 ms)

Click this link for Ethernet Service Disruption specifics.

Test - RTD (Round-Trip Delay)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **State:** Starts and stops round-trip delay mode.

  Single Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in frame counts and milliseconds. Frame counts indicates the number of frames received before the AIS frame is received by the unit. Milliseconds indicates how long it took for the AIS frame to travel out and return to the unit.

Continuous Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and continuously transmitted through your network. The current frame count and duration appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.

Stop Round-Trip Delay - Stops round-trip delay activity. The State returns to Inactive.

- **Round Trip Delay Time (milliSec):** Indicates the duration in seconds that it took for the known frame to return to the unit.
- **Round Trip Delay Time (Frames):** Indicates the number of frames received during the measurement.
- **Consecutive Good Time Required:** This function allows you to enter the duration (in milliseconds) of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 0.125 to 2047.875 milliseconds and is entered using a keypad.
- **Consecutive Good Frames Required**: This function allows you to enter the number of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 1 to 16383 frames and is entered using a keypad.

For more information about round-trip delay, select *Round-Trip Delay* in the Common Tasks section of the online help.

Perf Monitor

SDH Performance Monitor Screens and Functions

Performance Monitoring provides greater detail about incoming Regenerator Section (RS), Multiplex Section (MS), Higher-Order Path (HP), BIT errors, and M.2120 / M.2110 compliant Performance Monitoring.

The following options are available:

- RS
- MS
- HP
- LP
- BIT
- M.2120 / M.2110

SDH Perf Monitor - RS

This provides a detailed breakdown for Regenerator Section errors detected and logged by the SDH protocol processor.

G.826 Near B1 Errors

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

SDH Perf Monitor - MS

The MS screen provides a detailed breakdown for Multiplexor section errors detected and logged by the SDH protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the **G.826/G.829** toggle button in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.829 results.

This section is broken down into the following areas:

Important: Select the G.826/G.829 button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.829 statistics. Toggling the Near B2 Errors output also toggles the Far MS REI Errors output.

G.826 and G.829 Near B2 Errors and Far MS REI Errors

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.

- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure
- G.826/G.829: Select the command button to toggle between G.826 and G.829 error statistics.

M.2101.1 Near B2 Errors and Far MS REI Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

SDH Perf Monitor - HP

The HP screen provides a detailed breakdown for Higher-Order Path errors detected and logged by the SDH protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the **G.826/G.828** toggle button in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.828 results.

This section is broken down into the following areas:

G.826 and G.828 Near B3 Errors and Far HP REI Errors

IMPORTANT: Select the G.826/G.828 button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.828 statistics. Toggling the Near B3 Errors output also toggles the Far HP REI Errors output.

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.

- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure
- G.826/G.828: Select the command button to toggle between G.826 and G.828 error statistics.

M.2101.1 Near B3 Errors and Far HP REI Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

SDH Perf Monitor - LP

The LP screen provides a detailed breakdown for Lower-Order Path errors detected and logged by the SDH protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the G.826/G.828 toggle button in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.828 results.

This section is broken down into the following areas:

IMPORTANT: Select the G.826/G.828 button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.828 statistics. Toggling the Near B2 Errors output also toggles the Far MS REI Errors output.

This section is broken down into the following areas:

G.826 and G.828 Near LP BIP Errors and Far LP REI Errors

- Errored Block (EB) count.
- Background Block Error (BBE) by count, rate percentage, and objective percentage.

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure.
- G.826/G.828: Select the command button to toggle between G.826 and G.828 error statistics.

M.2101.1 Near LP BIP Errors and Far LP REI Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

SDH Perf Monitor - BIT

The BIT screen provides a detailed breakdown for BIT errors detected and logged by the SDH protocol processor.

In addition to monitoring the errors, you can set allocation percentages and durations by selecting their respective buttons.

This section is broken down into the following areas:

G.821 BIT Errors

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.821 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

G.826 BIT Errors

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

M.2101.1 BIT Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

SDH Perf Monitor - M.2120 / M.2110

The M.2120 / M.2110 screen provides a detailed breakdown for errors detected and logged by the SDH protocol processor by using threshold error performance criteria with respect to either a 15-minute (TR15) or 24-hour (TR24) evaluation period.

Error thresholds can be set directly from the M.2120 / M.2110 screen.

The following statistics appear on the M.2120 / M.2110

Statistic	Description
Event	Lists the error type and error.
TR15	Threshold Report 15-minute evaluation period. A TR is an error performance report with respect to a 15-minute evaluation period. There are one TR15 and one Reset TR15 (RTR15) for each performance event. The start and end time for the 15-minute evaluation window must occur

	on the hour and at 15, 30, and 45 minutes with respect to the elapsed time for each test. The TR15 evaluation period occurs as soon as the 15-minute threshold is reached or exceeded. If the number of errors for an event cross the threshold during the 15-minute period the test records "fail"; if the errors do not exceed the threshold the test records "pass." The performance events continue to be counted to the end of the 15-minute period, at which time the current performance event counts are stored in the historical registers and the current performance event registers are reset to zero. After resetting the registers to zero the 'pass' or 'fail' result records in the Prev15 column and the performance evaluation continues and records the new result in the Cur15 column.
RTR15	Reset Threshold Report 15-minute evaluation period. There are one RTR15 and one TR15 for each performance event. The start and end time for the 15-minute evaluation window must occur on the hour and at 15, 30, and 45 minutes with respect to the elapsed time for each test. An RTR15 occurs at the end of a 15-minute period in which the count is less than or equal to the reset threshold and there has not been any unavailable time during that period. An RTR15 can only occur subsequent to a 15-minute period containing a TR15.
TR24	Threshold Report 24-hour evaluation period. There is one TR24 for each performance event. The start and end time for the 24-hour evaluation window must occur

	on a 15-minute window boundary. TR24s occur as soon as the 24-hour threshold is reached or exceeded.
Cur15	Displays the pass or fail state for the current 15-minute evaluation period. After the evaluation period ends the registers reset to zero and the pass/fail state records in the Prev15 column and the performance evaluation continues.
Prev15	Displays the pass or fail state for the previous 15-minute evaluation period. The history periods are used as a stack, i.e. the values held in each register are pushed down the stack one place at the end of each 15-minute period, and the oldest value at the bottom of the stack is discarded.
Cur24	Displays the pass or fail state for the current 24-hour evaluation period.
Prev24	Displays the pass or fail state for the previous 24-hour evaluation period.

SDH LED Quick Status Area

When the SDH protocol processor tab is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the **Large LED** screen.

The following acronyms will be used LED Description table below

RSOH = Regenerator Section Overhead
MSOH = Multiplex Section Overhead
HPOH = Higher Order Path Overhead
LPOH = Lower Order Path Overhead
AU = Administrative Unit
TU = Tributary Unit

LED	Description
TX	Indicates current transmit interface setting and laser wavelength. If the SDH interface is configured for G.709, then OTN appears.
RX	Displays the received optical power in dBm.
E/A	Indicates the current Error / Alarm configured for transmission.
Test Paused	If red, indicates that the current test has been paused.
CLK	Indicates the value of the Transmit Clock Reference function.
All Tests (button)	This is a short-cut button to the general "All Test Status" summary LED screen for all circuit packs installed in the unit.
RS	**RSOH Status LED**. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
LOS	**Loss of Signal**. Indicates that a valid SDH signal is not being received. If an all-zeros pattern exists for 100 milliseconds or longer on the incoming SDH signal, then an LOS is reported.
LOF	**Loss of Frame**. Indicates that a frame alignment problem with the incoming SDH signal has been detected. An LOF is reported if an Out Of Frame (OOF) defect continues for 3 milliseconds or longer. This is alarm LED.
OOF	**Out Of Frame**. Declared when four or more consecutive errored frames are detected on the incoming SDH signal. This is an alarm LED.
B1	**RSOH BIP-8 Code Violation**. Indicates an error in the SDH frame. B1 errors are parity errors. The B1 byte carries the parity information, so a B1 error is an RS error that applies not only to the RSOH, but the entire SDH frame. Any error in the frame will result in B1 error. This is an error LED.
MS	**MSOH Status LED**. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
MS-REI	**MSOH Remote Error Indication**. Indicates that an error is occurring at downstream Line terminating equipment. An REI is also known as a Far-End Block Error (FEBE). The M0 and M1 bytes of the MSOH are used for this indicator. This is an error LED.
MS-AIS	**MSOH Alarm Indication Signal**. Indicates if an alarm is

	being received from upstream MS terminating equipment. This is an alarm LED.
APS	**Automatic Protection Switching**. Indicates that the K1 and K2 bytes on the incoming SDH signal have changed.
MS-RDI	**MSOH Remote Defect Indication**. Indicates that a downstream defect has occurred along the MS layer. (An RDI is also known as a Far-End Remote Failure, FERF). This is an alarm LED.
B2	**MSOH BIP-8 Code Violation**. Indicates that parity errors were detected at the MS layer of the incoming SDH signal. This is calculated over the MSOH, HPOH, and payload of each STM-n. This is an error LED
HP	**HPOH Status LED**. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
AU-AIS	**AU Alarm Indication Signal**. Indicates if an alarm is being received from upstream HP terminating equipment. This is an alarm LED.
HP-RDI	**HPOH Remote Defect Indication**. Indicates that a remote alarm is being received from downstream HP terminating equipment. The G1 byte of the HPOH is used for this indicator. This is an alarm LED.
AU-LOP	**AU Loss of Pointer**. Indicates that an invalid Pointer has been received or a Pointer loss has been detected on the incoming SDH signal. This is an alarm LED.
HP-REI	**HPOH Remote Error Indication**. Indicates that an error count is being received from downstream HP terminating equipment. An REI is also known as a Far-End Block Error (FEBE). This is an error LED.
AU-PTR	**AU Pointer Adjustments**. Indicates Pointer offsets or adjustments between the payload and the STM-N frame are occurring. This is a status LED.
B3	**HPOH BIP-8 Code Violations**. Indicates that parity errors were detected at the HP layer of the incoming SDH signal. This is calculated over the HPOH and payload of each STM-N. This is an error LED.
HP-UNEQ	**HPOH Unequipped Payload**. Indicates that a 00h pattern has been detected in the C2 byte. This byte is being received from HP terminating equipment. This is an alarm LED.
LP	**LPOH Status LED**. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.

	This section is only available when C-2, C-12, or C-11 is mapped.
TU-AIS	**TU Alarm Indication Signal**. Indicates an all-ones characteristic or adapted information signal was detected on the TU. It is generated to replace the normal traffic signal when it contains a defect condition in order to prevent consequential downstream failures being declared or alarms being raised. This is an alarm LED.
TU-LOP	**TU Loss of Pointer**. Indicates that an invalid Pointer has been received or a TU Pointer loss has been detected on the incoming SDH signal. This is an alarm LED.
TU-PTR	**TU Pointer Adjustments**. Indicates Pointer offsets or adjustments between the VC payload and the STM-N frame are occurring. This is a status LED.
TU-LOM	**TU Loss of Multiframe Alignment**. Indicates a Loss of Multiframe Alignment in the TU. This is an alarm LED.
LP-RDI	**LPOH Remote Defect Indication**. Indicates that a remote alarm is being received from downstream LP terminating equipment. The V5 byte of the LPOH is used for this indicator. This is an alarm LED.
LP-RFI	**LPOH Remote Failure Indication**. Indicates a defect on the TU has persisted beyond the maximum time allocated to the transmission system protection mechanisms. When this occurs, the RFI is sent to the far end and initiates a LP protection switch. This is an alarm LED.
LP-REI	**LPOH Remote Error Indication**. Indicates to the transmitting node that an errored block has been detected at the LP receiving node. This is an error LED.
LP-UNEQ	**LPOH Unequipped Payload**. Indicates that an all-zeros patterns has been detected in the LP Signal Label of the V5 byte. This is an alarm LED.
LP-BIP	**LPOH BIP-2 Code Violations**. Indicates an error occurred during a parity check, which involves grouping all the bits in a block into units and then performing a parity check of each bit position in the group. This is calculated over the LPOH and payload of each VC. This is an error LED.
PAT SYNC	**Pattern Sync Mismatch**. Indicates a loss of pattern synchronization. This is an alarm LED.
BIT ERR	**BIT Error**. Indicates a Bit error was detected in the payload. This is an error LED.
TCM This LED only	**Tandem Connection Status LED**. Indicates if a TCM error or alarm has been detected.

appears when TCM Overhead Processing has to be enabled in the Receive settings.	If this LED is red, select the "TCM" text to display the TCM Summary LEDs.
LCV	**Line Code Violations**. Indicates that the 155M Electrical Interface received a CMI Line Encoding error. This is an error LED.
BPV	**Bi-Polar Violations**. Indicates that the 52M Electrical Interface received a B3ZS Line Encoding error. This is an error LED.
SSM	**Signal Status Mismatch** - Displays when the expected SS bits setting in the H1 byte do not match what is received. This is an alarm LED. SS Bits Alarm Reporting must be enabled for this alarm to occur..

Serial Tab

RS-232 / EIA-530 Serial Overview

The Serial Interfaces RS-232 and EIA/TIA-530, are recommended standard (RS) interfaces established by the Electronic Industries Association (EIA). The standard is used for interconnecting data terminal equipment (DTE) and data communications equipment (DCE), and defines the specific electrical, functional, and mechanical characteristics used in transmitting serial binary data, either synchronously or asynchronously, using a 25-pin DB connector.

To use RS-232 / EIA-530 functionalities your unit must contain the Serial circuit pack.

To assist you in performing tasks and understanding protocol functionalities, this Online Help is divided into the following sections:

- RS-232 / EIA-530 Serial Specific Tasks
- RS-232 / EIA-530 Serial Screen Functions and Descriptions

You can navigate through the topics by using the **Contents**, **Index**, or **Search** tabs in the box that appears on the left side of the Help window. In addition, links are strategically placed throughout the Help topics to give you quick access to pertinent information.

Serial Specific Tasks

RS-232 / EIA-530 Specific Tasks Overview

This section includes a series of tasks that are specific to the RS-232 / EIA-530 Serial protocol processor.

For a list of general tasks, see *Common Tasks*, located in the Getting Started section of the NIC unit's Online Help.

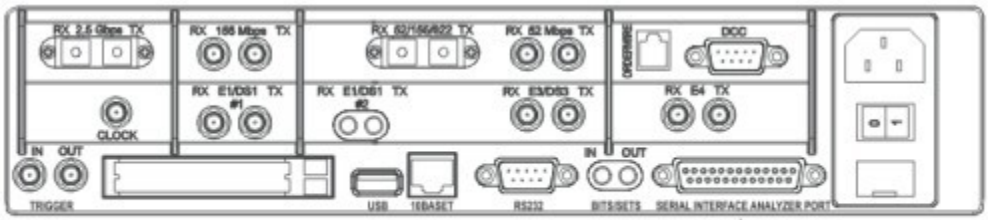
- Connecting External Equipment
- Self-Diagnostic Loopback Plug
- Configuring an Interface

- Configuring Emulation Settings
- Configuring Flow Control
- Working with Signal Controls
- Executing Tests
- Insert a Single Error
- Insert Multiple Errors
- Initiate a Delay Test

Connecting External Equipment

The RS-530's functionalities include bit error rate testing with performance, signal, and timing analysis by using a 25-pin female DB connector to connect an external device to the NIC unit. Units containing the RS-530 circuit pack have a serial interface port installed on the connector panel.

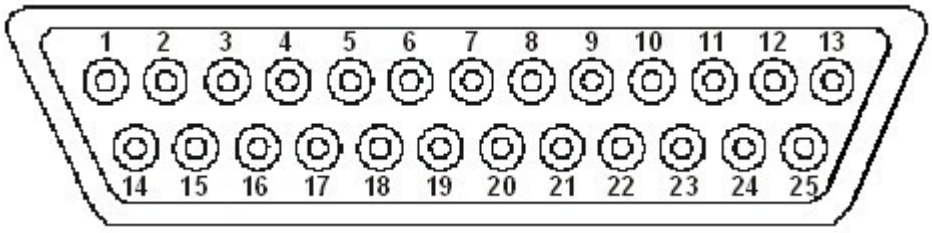
For NIC 10G and NIC 2.5G units the Parallel Port is replaced with the Serial Interface Analyzer Port, as shown in the NIC 2.5G connector panel below.



For NIC Plus units the Serial Interface Analyzer Port is placed in any available slot on the connector panel.

Serial Interface Analyzer Port

The figure and table below provide the pin number and associated pin assignments for the serial port.



In the chart and table below, the A column corresponds to single ended protocols (such as RS-232), and the A and B columns together are used for differential signalling protocols (such as EIA-530).

25 Pin D Type Connector Pin Assignments

25 Pin Designations						Description
A	B	EIA	CCITT	DTE	DCE	
1		Shield	-			Shield
7		AB	102			Signal Ground
2	14	BA	103	Out	In	Transmitted Data
3	16	BB	104	In	Out	Received Data
4	19	CA	105	Out	In	RTS
5	13	CB	106	In	Out	CTS
6	22	CC	107	In	Out	DSR
20	23	CD	108	Out	In	DTR
8	10	CF	109	In	Out	RLSD (DCD)
24	11	DA	113	Out	In	Transmit Signal Element Timing (DTE)
15	12	DB	114	In	Out	Transmit Signal Element Timing (DCE)
17	9	DD	115	In	Out	Receive Signal Element Timing (DCE)
18		LL	141	Out	In	Local Loopback
21		RL	140	Out	In	Remote Loopback
25		TM	142	In	Out	Test Mode

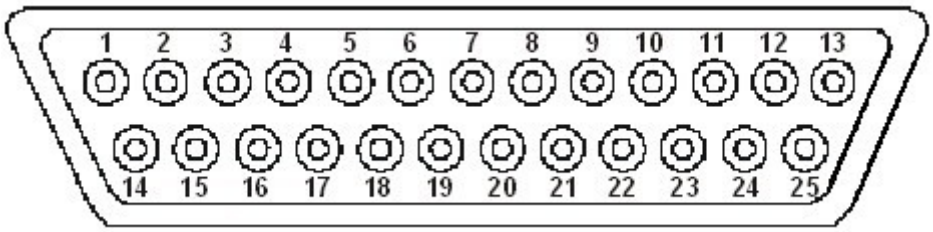
Pin #	Signal / Description	Pin #	Signal / Description
1	Protective Ground Shield (A)	14	TXD - Transmitted Data (B)
2	TXD - Transmitted Data (A)	15	DCE - Transmit Signal Element Timing (A)
3	RXD - Received Data (A)	16	RXD - Received Data (B)
4	RTS/RR - Request to Send/Receiver Ready (A)	17	DCE - Receive Signal Element Timing (A)
5	CTS - Clear to Send (A)	18	LL - Local Loopback (A)
6	DSR - Data Set Ready (A)	19	RTS/RR - Request to Send/Receiver Ready (B)
7	Signal Ground (A)	20	DTR - Data Terminal Ready
8	RLSD/DCD - Received Line Signal Detector/Data Carrier Detect (A)	21	RL - Remote Loopback (A)
9	DCE - Receive Signal Element Timing (B)	22	DSR - Data Set Ready (B)
10	RLSD/DCD - Received Line Signal Detector/Data Carrier Detect (B)	23	DTR - Data Terminal Ready (B)
11	DTE - Transmit Signal	24	DTE - Transmit Signal

	Element (B)		Element (A)
12	DCE - Transmit Signal Element Timing (B)	25	TM - Test Mode (A)
13	CTS - Clear to Send (B)		

Self-Diagnostic Loopback Plug

A self-diagnostic loopback plug connects serial inputs to serial outputs, allowing for port testing. When using the loopback plug make sure the pin assignments are in accordance with the following table.

Loopback Pin Assignment Table



Pin Number	Description
2 to 3	TX- to RX-
14 to 16	TX+ to RX+
5 to 4	RTS- to CTS+
13 to 19	RTS+ to CTS+
10 to 22 to 23	DCD+ to DSR+ to DTR+
6 to 8 to 20	DSR- to DCD- to DTR-
9 to 11	TX Timing Rtn to RX Timing Rtn
17 to 24	TX Timing Sig to RX Timing Sig

Configuring an Interface

The interface setting impacts framing, signaling, and other parameters necessary for connecting to a circuit under test.

1. Select the **Serial** protocol processor tab.

2. From the Serial screen select the **Transmit** button and **Set** tab.
3. Select the **Interface** button and choose the desired interface. The following interfaces are available:

- **RS-232** - Can be configured to act as DTE or DCE, operating in unbalanced mode with data transmission supported in asynchronous operation. Data analysis can be performed at speeds from 50 bps up to 128 Kbps.

  - Activates the **XON/XOFF** message-sending option on the Signal Control screen.
  - Allows **Out of Band** or **In Band** flow control.

- **EIA-530 Async** - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in asynchronous operation. Data analysis can be performed at speeds up to 120 Kbps.

  For EIA-530 interfaces, all signals are balanced with exception of Remote Loop (RL) and Local Loop (LL).

  - Activates the **XON/XOFF** message-sending option on the Signal Control screen.
  - Allows **Out of Band** or **In Band** flow control.

- **EIA-530 Sync** - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in synchronous operation. Data analysis can be performed at speeds up to 40 Mbps.

  - Allows **Interface** or **Internal** clock source.

- **EIA-530A Async** - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in asynchronous operation. Data analysis can be performed at speeds up to 120 Kbps.

  For EIA-530A interfaces, the Data Terminal Ready (DTR) signal changes to single ended.

  - Activates the **XON/XOFF** message- sending option on the Signal Control screen.
  - Allows **Out of Band** or **In Band** flow control

- **EIA-530A Sync** - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in

synchronous operation. Data analysis can be performed at speeds up to 40 Mbps.

- Allows **Interface** or **Internal** clock source.

The selected interface name appears in the Quick Status Area, located at the top left corner of the screen.

4. Select the **Payload Pattern** button and set the desired test pattern.
5. Select the Flow Control options (**Type**, **XON Code**, **XOFF Code**) and set the data flow parameters.
6. Select the **Clock Rate** button to set a Programmable value.
7. Select the **Clock Source** button and set as **Internal** or **Interface**.

    - **Internal** - Derives the transmit data's timing from the unit's internal clock.
    - **Interface** - Derives the transmit data's timing from the external timing source attached to the Datacom Interface connector.

Internal clock source is only available when an async interface is selected.

8. Select the **Operation Mode** button and set the protocol's transmit and receive operating mode.
9. Select the **Restart** common function button located at the bottom of the touch screen.

Configuring Emulation Settings

The **Emulation** button, located on the Transmit and Receive settings screens, allows you to configure the interface for emulating Data Terminal Equipment (DTE) or Data Communications Equipment (DCE).

To configure DTE emulation:

DTE emulation provides signal element timing information to the DCE.

1. Select the **Serial** protocol processor tab.
2. From the Serial screen select the **Transmit** button and **Set** tab.
3. Select the **Interface** button and choose the desired interface.
4. Select the **Emulation** button and choose **DTE** for connection to DCE.

The name of the selected emulation equipment type appears in the Quick Status Area, located at the top left corner of the screen.

5. Select the **Restart** common function button located at the bottom of the touch screen.

To configure DCE emulation:

DCE emulation provides signal element timing information to the DTE.

1. Select the **Serial** protocol processor tab.
2. From the Serial screen select the **Transmit** button and **Set** tab.
3. Select the **Interface** button and choose the desired interface.
4. Select the **Emulation** button and choose one of the following for connection to DTE:

    - **DCE-ST** - Data Communications Equipment-Send Timing. Provides transmit signal element timing information to the DTE.
    - **DCE-TT** - Data Communications Equipment-Terminal Timing. Terminal Timing. Provides transmit signal element timing information to the DCE. TT is the ST signal echoed back to the DCE by the DTE.

The name of the selected emulation equipment type appears in the Quick Status Area, located at the top left corner of the screen.

5. Select the **Restart** common function button located at the bottom of the touch screen.

Configuring Flow Control

The Flow Control box, located on the **Transmit Set** screen, allows you to set data flow parameters.

1. Select the **Serial** protocol processor tab.
2. From the Serial screen select the **Transmit** button and **Set** tab.
3. In the Flow Control box on the Set screen, select the **Type** button and choose one of the following:
    - **None**
    - **Out of Band** - In out-of-band flow control a specific sequence of signals must take place between the DCE and DTE in order for transmission to occur. When Out of Band is selected, the Signal Control screen allows you to Ignore a signal and still allow transmission to occur.

- **In Band** - When ON, the Serial protocol scans the incoming data for XON and XOFF characters and responds accordingly.

The In Band option is only available when an EIA-530 Async or RS-232 interface is selected.

4. Select the **XON Code** button to set the value for resuming transmission of data for asynchronous interfaces.
5. Select the **XOFF Code** button to set the value for halting transmission of data for asynchronous interfaces.
6. Select the **Restart** common function button located at the bottom of the touch screen.

Working with Signal Controls

The Signal Control screen allows you to monitor and change the status of one or multiple signal controls. Active signal controls display a green status box and are dependent on interface, emulation, and flow control settings.

When RX Data Only is selected for the Operation Mode setting, all output signals are disabled, making the Signal Control screen nonfunctional.

When the interface is emulating DTE the following control signals and switches display:

- rlsd (dcd)
- cts
- rts (rr)
- dsr
- TM
- dtr

When the interface is emulating DCE the following control signals and switches display:

- rts (rr)
- LL
- rlsd (dcd)
- dtr
- RL
- dsr

Changing the status of control signals is normally associated with out-of-band flow control, which allows the user to specify which signal controls must be in the On/Enabled (High logic) state for data transmission to take place. In either DTE or DCE emulation, transmission may be conditioned upon the enabling of any or all of the following signal controls: dtr, dsr, rts (rr), cts, rlsd (dcd). See the help topic *Signal Control* for information about signal control screen functionalities.

To change signal control statuses:

1. Select the **Serial** protocol processor tab.
2. From the Serial screen select the **Signal Control** button.
3. Determine the signal control you want to change and the type of change.

    - **Invert** - Select the Invert button to change a control signal from 0 to 1 (Off to On), or 1 to 0 (On to Off), depending on its current setting. The signal remains at this setting when the NIC unit is rebooted.
    - **Ignore** - Select the Ignore button to disregard a control signal during out-of-band flow control.
    - **Toggle** - Select the Toggle button to temporarily switch a control signal from 0 to1 (Off to On), or 1 to 0 (On to Off), depending on its current condition. The signal returns to its previous condition when the NIC unit is rebooted.

4. Select the signal control's checkbox for the desired action (Invert, Ignore, or Toggle) to activate the change.
5. The **Status** column displays a green box when the control signal is in 'High' logic (On/Enabled).

Executing Tests

The Serial protocol allows you to check equipment performance by setting up test parameters and initiating tests. To facilitate a self-diagnostic test use a Self-diagnostic Loopback Plug.

You can choose to:

- Insert a Single Error
- Insert Multiple Errors
- Initiate a Delay Test

The type of test that can be performed is directly related to the interface selection.

Insert a Single Error

1. Select the **Serial** protocol processor tab.
2. From the Serial screen select the **Transmit** button.

3. Configure the **Set** tab and **Async** tab options.
4. Select the **Error Alarm** tab.
5. Select the **Error to Insert** button and choose **Parity** or **Bit**.

   DO NOT set an **Error Insert Rate** when inserting a single error.

   Select the **Restart** button at the bottom of the touch screen to clear any previously collected data.

6. Select the **Error Insert** button at the bottom of the touch screen.
7. The LED status changes for the selected error type.
8. Choose the **Results** button to view event statistics from the various Results screens.
9. To print or record test statistics see the *Print Report* topic in Common Tasks, located in the NIC unit's online help.

Insert Multiple Errors

Inserting multiple errors not only allows you to initiate a continuous test, but it also allows you to set up a specific test duration and action to take when the duration ends. For example, you could set the test duration to run for five minutes, the action after test to repeat the test, and print the statistics to a file or printer.

To insert multiple errors:

1. Select the **Serial** protocol processor tab.
2. From the Serial screen select the **Transmit** button.
3. Configure the **Set** tab and **Async** tab options.
4. Select the **Error Alarm** tab.
5. Select the **Error to Insert** button and choose **Parity** or **Bit**.
6. Select the **Error Insert Rate** button and choose an insertion rate from the Error Rate dialog box. The unit starts transmitting errors.

   Select the **Restart** button at the bottom of the touch screen to clear any previously collected data.

7. The LED status changes for the selected error type.
8. Choose the **Results** button to view event statistics from the various Results screens.

To set up duration and after test actions:

1. Choose the Serial screen's **Test** button.

2. Select the **Duration** button and choose how long you want to run the test for.
3. Select the **Action After Test** button and choose the desired actions.
4. To print or record test statistics see the ***Print Report*** topic in Common Tasks, located in the NIC unit's online help.

Initiate a Delay Test

The Delay function reports the most recently measured time interval between the start and finish of specific events.

1. Select the **Serial** protocol processor tab.
2. From the Serial screen select the **Test** button and **Delay** tab.
3. Select the **Start Criteria** button and choose the start action criteria. The following start criteria measurement signals are available:
    - **DTR, DSR, RTS, CTS, DCD, TX Data, TX Pattern Sync** (Either the rising [off-to-on] or falling [on-to-off] edge of the signal can be selected.)

The start parameters that reference control signals are only valid for interfaces that use these signals.

4. Select the **Stop Criteria** button and choose the delay timing measurement stop-signal. The following stop criteria measurement signals are available:
    - **DTR, DSR, RTS, DCD, RX Data, RX Pattern Sync** (Either the rising [off-to-on] or falling [on-to-off] edge of the signal can be selected.

The stop parameters that reference control signals are only valid for interfaces that use these signals.

5. Select the **State** button and choose the delay test action from the following options:

    - **Stop Delay Test** - Stops delay activity. The State returns to Inactive.
    - **Single Delay Test** - The delay value is measured.
    - **Continuous Delay Test** - The delay value is measured continuously.

The Delay Time is recorded in milliSeconds; indicating the duration that it took for the known frame to return to the unit. The current delay value appears in the **Current** column. The fastest delay value appears in the **Minimum** column and the slowest delay value appears in the **Maximum** column.

Screen Functions and Descriptions

RS-232 / EIA-530 Screen Functions and Descriptions

The following function screens are available through the RS-232 / EIA-530 Serial protocol processor tab.

- Transmit
- Receive
- Results
- Test
- Signal Control
- LEDs

Transmit

Transmit Screens and Functions

The Transmit function allows you to define the parameters used for RS-530 transmitting operations.

The following parameter setting options are available from the Transmit screen:

- Set
- Async
- ERROR ALARM

Transmit - Settings (Set)

The Transmit Set screen allows you to configure transmit signal parameters for the Serial line interface in your test environment.

The Set screen contains the following parameters:

Parameter	Description
Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, **Payload Pattern** settings established on the Transmit screen will only affect Transmit mode. All other Transmit parameter settings will be coupled. **Independent** mode affects Payload Pattern settings only.

Interface	Selects the electrical interface. The following options are available: • **RS-232** - Can be configured to act as DTE or DCE, operating in unbalanced mode with data transmission supported in asynchronous timing. Data analysis can be performed at speeds from 50 bps up to 120 Kbps. • **EIA-530 Async** - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in asynchronous timing. Data analysis can be performed at speeds up to 120 Kbps. For EIA-530 interfaces, all signals are balanced with exception of Remote Loop (RL) and Local Loop (LL). • **EIA-530 Sync** - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in synchronous timing. Data analysis can be performed at speeds up to 15 Mbps. • **EIA-530A Async** - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in asynchronous timing. Data analysis can be performed at speeds up to 120 Kbps. For EIA-530A interfaces, the Data Terminal Ready (DTR) signal changes to single ended. • **EIA-530A Sync** - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in synchronous timing. Data analysis can be performed at speeds up to 15 Mbps.

Emulation	Selects the emulation type for the interface. The following options are available: • **DTE** - Data Terminal Equipment • **DCE-ST** - Data Communications Equipment-Send Timing. Provides transmit signal element timing information to the DTE. • **DCE-TT** - Data Communications Equipment-Terminal Timing. Provides transmit signal element timing information to the DCE. TT is the ST signal echoed back to the DCE by the DTE. When an RS-232 interface is selected operation is in unbalanced mode and data transmission is supported in asynchronous timing only. When an EIA-530 interface is selected operation is in balanced mode and data transmission is supported in synchronous or asynchronous timing.

Payload Pattern	Selects the signal pattern to be transmitted. The following options are available: • **QRSS** - 2^{20} -1 pattern modified to transmit a maximum of consecutive zeros data. Simulation of live data. Cannot be used in asynchronous timing mode. • **PRBS** - Pseudorandom Bit Patterns: PRBS 6, PRBS 6 INV, PRBS 9, PRBS 9 INV, PRBS 11, PRBS 11 INV, PRBS 15, PRBS 15 INV, PRBS 20, PRBS 20 INV, PRBS 23, PRBS 23 INV • **TL** - TL-1 through TL-6 • **DDS** - DDS-1 through DDS-6 • **All Ones** - 'MARK' fixed pattern • **All Zeros** - 'SPACE' fixed pattern • **User-defined** - 3 to 24 bit repeating pattern • **Fox** - A message that includes the numbers 0-9 and all uppercase letters. In asynchronous mode, the Fox message is transmitted according to the number of data bits specified in the character format.

Flow Control	The Flow Control box allows you to set the following parameters:
	
	• **Type** - Set to one of the following:
	  • ***None***
	  • ***Out of Band*** - In out-of-band flow control a specific sequence of signals must take place between the DCE and DTE in order for transmission to occur. When Out of Band is selected, the Signal Control screen allows you to Ignore a signal and still allow transmission to occur.
	  • ***In Band*** - When ON, the RS-530 scans the incoming data for XON and XOFF characters and responds accordingly.
	• **XON Code** - Sets XON value for resuming transmission of data.
	• **XOFF Code** - Sets XOFF value for halting

	transmission of data.
Clock Rate	Provides a **Programmable** option. Clock rate can be set in kHz. Must match the clock/baud rate between the DCE and DTE.
Clock Source	Determines the timing source for transmit signals. The following options are available: • **Internal** - Derives the transmit data's timing from the unit's internal clock. • **Interface** - Derives the transmit data's timing from an external timing source attached to the Datacom Interface connector.

Operation Mode	Monitors the Serial protocol's transmit and receive operation. When turned on, the protocol is placed in internal/external loopback mode. The following options are available: • **Normal (TX/RX)** - Unit operates in normal transmit and receive mode. • **RX Data Only** - Unit monitors all of the receive lines as is normal, but does not transmit anything out to the EIA-530/RS-232 interface. Selecting RX Data Only disables all output signals, making the Signal Control screen nonfunctional. • **Self Loop** - The internal interface's transmit side loops back to the receive side, which makes it a useful self-test. In addition, the incoming receive lines on the interface loop back out to the interface's transmit lines resulting in a loopback to the far-end device. The loopback lines for the internal interface are: • TXD connects to RXD • RTS connects to CTS • DTR connect to DSR

Transmit - Asynchronous (Async)

The Transmit Async screen allows you to configure character formatting for the asynchronous timing mode.

The Async screen contains the following parameters:

Parameter	Description
Stop Bits	Designates the stopping point for data transmission. Set to **1**, **1.5**, or **2**.
Data Bits	Sets the hexadecimal type. Select one of the following: • **5** - Baudot • **6** - BCDIC

	• **7** - ASCII • **8** - EBCDIC
Parity	Set to **Even**, **Odd**, or **None**.
Async Timeout	Sets the action taken if no data is received in asynchronous timing mode. Set to **On** or **Off**. If no data is received the **On** option forces a synchronization loss after 10 seconds.

Transmit - Error Alarm

The Transmit Error Alarm screen allows you to insert errors or alarms into a signal.

The Error Alarm screen contains the following options:

Option	**Description**
Error to Insert	Inserts an error that is transmitted by the Serial protocol processor. The options available include: • **None:** Turns off error insertion. • **Parity:** Transmits a parity error. This option is only available for asynchronous interfaces. An even or odd parity setting must have been configured from the Transmit Async screen. • **Bit:** Transmits a bit error which results in a frame synchronization bit error event. This also inserts a frame bit error into the received frame bit pattern.
Error Insert Rate	Allows you to set the error insertion rate or turn the setting off. The following error rate options are available: • **Off** • **1E-1** through **1E-6**

Receive

Receive Screens and Functions

The Receive function allows you to define the parameters used RS-530 receiving operations.

The following parameter settings options are available from the Receive screen:

- Set
- Async
- SIG

Receive - Settings (Set)

The Receive Set screen allows you to configure the receive signal parameters for the RS-530 test environment.

The Set screen contains the following parameters:

Parameter	Description
Settings Control	If **Coupled** is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If **Independent** is selected, **Payload Pattern** settings established on the Receive screen will only affect Receive mode. All other parameter settings will be coupled. **Independent** mode affects Pattern settings only.
Interface	Selects the electrical interface. The following options are available: • **RS-232** - Can be configured to act as DTE or DCE, operating in unbalanced mode with data transmission supported in asynchronous timing. Data analysis can be performed at speeds from 50 bps up to 120 Kbps. • **EIA-530 Async** - Can be configured to act as DTE or DCE, operating in balanced

	mode with data transmission supported in asynchronous timing. Data analysis can be performed at speeds up to 120 Kbps. For EIA-530 interfaces, all signals are balanced with exception of Remote Loop (RL) and Local Loop (LL). • **EIA-530 Sync** - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in synchronous timing. Data analysis can be performed at speeds up to 15 Mbps. • **EIA-530A Async** - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in asynchronous timing. Data analysis can be performed at speeds up to 120 Kbps. For EIA-530A interfaces, the Data Terminal Ready (DTR) signal changes to single ended. • **EIA-530A Sync** - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in synchronous timing. Data analysis can be performed at speeds up to 15 Mbps.
Termination	Sets the impedance for the interface. The following options are available: • **78 Ohm** • **100 Ohm** • **124 Ohm** • **Unterminated**
Emulation	Selects the emulation type for the interface. The following options are available: • **DTE** - Data Terminal Equipment • **DCE-ST** - Data Communications Equipment-Send Timing. • **DCE-TT** - Data Communications

	Equipment-Terminal Timing.
Payload Pattern	Selects the signal pattern to be received. The following options are available: • **QRSS** - 2^{20}-1 pattern modified to transmit a maximum of consecutive zeros data. Simulation of live data. Cannot be used in asynchronous timing mode. • **PRBS** - Pseudorandom Bit Patterns: PRBS 6, PRBS 6 INV, PRBS 9, PRBS 9 INV, PRBS 11, PRBS 11 INV, PRBS 15, PRBS 15 INV, PRBS 20, PRBS 20 INV, PRBS 23, PRBS 23 INV • **TL** - TL-1 through TL-6 • **DDS** - DDS-1 through DDS-6 • **All Ones** - 'MARK' fixed pattern • **All Zeros** - 'SPACE' fixed pattern • **User-defined** - 8 character repeating pattern • **Fox** - A message that includes the numbers 0-9 and all uppercase letters. In asynchronous mode, the Fox message is transmitted according to the number of data bits specified in the character format.
Pat Loss Threshold	Sets the threshold that determines when pattern loss will begin. Select one of the following: • **Synchronous timing mode**: ▸ **Low** - 100 bit errors in less than 1000 bits of data ▸ **Medium** - 250 bit errors in less than 1000 bits of data ▸ **High** - 20,000 bit errors in less than 100,000 bits of data • **Asynchronous timing mode**: ▸ **Low** - 30 character errors are counted in less than 60 received characters

	▸ **Medium** - 30 character errors are counted in less than 60 received characters ▸ **High** - 20,000 bit errors in less than 100,000 bits of data
Pat Acq Threshold	Pattern Acquisition Threshold. Sets the number of bytes, between 10 and 2048, that determine when pattern sync is reached.
Block Length	Sets the block length for incoming data. The allowable range is 100 to 1,000,000 bits.

Receive - Asynchronous (Async)

The Receive Async screen allows you to configure character formatting for the asynchronous timing mode.

The Async screen contains the following parameters:

Parameter	Description
Stop Bits	Designates the stopping point for receiving data. Set to **1**, **1.5**, or **2**.
Data Bits	Sets the hexadecimal type. Select one of the following: • **5** - Baudot • **6** - BCDIC • **7** - ASCII • **8** - EBCDIC
Parity	Set to **Even**, **Odd**, or **None**.
Async Timeout	Sets the action taken if no data is received in asynchronous timing mode. Set to **On** or **Off**. If no data is received the **On** option forces a synchronization loss after 20 seconds.

Receive - Signal Status (SIG)

The Receive SIG screen displays the following measurements for the incoming Serial signal:

- **Frequency** - Shows the current measured frequency of the incoming signal.
- **Line Frequency Offset Received** - Shows the difference, in ppm, between the incoming line frequency and the reference clock frequency.

Results

Results Screens and Functions

All monitored activity that the system receives is reported to the Results screen for viewing and analyzing. The Results screen provides several layers of granularity for analyzing the incoming signal, pattern, errors, and alarms.

The following options are available from the Results screen:

- STATS
- EVENT
- LARGE LED
- GRAPH

Results - Stats

The system can monitor and report errors on the incoming Serial signal. The Stats screen provides a detailed analysis of incoming errors that are generated by the network, or intentionally generated by the system when it is used in a loopback environment.

The Stats screen provides the following detailed analysis screens:

- Scan
    - Scan
    - Errors
    - Alarms
    - Counts
    - Perf (Performance Monitoring)
- Errors
- Alarms
- Counts
- Perf

Results Stats - Scan

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

For alarms, the duration is reported as a count in seconds. For errors, an error count is reported. The message "No Errors or Alarms" appears if no events are received by the system.

Results Stats - Errors

The Stats Errors screen allows you to view and monitor incoming Bit, Stop Bits, and Parity errors for the following parameters:

- **Count** - Using an 11-digit format.
- **Average Rate** - Using an N.NNe-N format.
- **Current Rate** - Using an N.NNe-N format.

Results Stats - Alarms

The Stats Alarms screen monitors and reports alarm duration (in seconds) on the incoming signal.

The following alarms can be monitored:

- Power Loss
- RX Clock Loss
- Pat Sync Loss
- Async Timeout

Results Stats - Counts

The Stats Counts screen allows you to view the following count statistics:

- RX Bits
- TX Bits
- RX Bit Rate
- TX Bit Rate

Results Stats - Performance Monitoring (Perf)

The Stats Perf screen provides a detailed breakdown of detected Payload Bit errors.

The following statistics are reported:

Statistic	Description
EB	Errored Blocks by count and seconds.
BBE	Background Block Errors by count and seconds.
ES	Errored Seconds by count, rate percentage, and objective percentage.
EFS	Error-Free Seconds by count, rate percentage, and objective percentage.
SES	Severely Errored Seconds by count, rate percentage, and objective percentage.
UAS	Unavailable Seconds by count, rate percentage, and objective percentage.

Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

Results - Large LED

The Large LED screen displays error and alarm indicators in a large, easy to read format. This is especially useful for viewing error and alarm status from a distance, such as across the room from a test bay.

LED colors are described below.

If the LED color is ...	This indicates ...
Green with **black** text	The specific function is active and OK.
Red with **red** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting **Restart**.
White with **black** text	No activity from this specific function.

Results - Graph

The Graph screen displays alarm and bit count results. The graphs show the test history for either the current test or the previous test. You can configure the graph function to display any combination of Serial alarms and bit counts.

To use the various graph features, see *Use Graphs* in the Common Tasks section of the NIC unit's online help.

Test
Test Screens and Functions

The Test function allows you to configure test parameters, such as how long the test will run, printing and recording events, and what action will take place after the test is complete.

The following options are available from the Test screen:

- SET 1
- Delay

Test - Settings 1 (SET 1)

Settings that are made from the SET 1 screen determine how long a protocol test runs and what activities occur at the end of the test.

The following options appear on the SET 1 screen:

- **Duration**
- **Action After Duration**
- **Pause Test/Resume Test**: Select this button to toggle the pausing and continuing mode of an active test. The button's label indicates the action that will happen when it is selected.

For more information about tests, see *Executing Tests* in the RS-530 Specific Tasks section or *Start a Test* in the Common Tasks section of the online help.

Test - Delay

The Delay function reports the most recently measured time interval between the start and finish of specific events.

The start and stop parameters that reference control signals are only valid for interfaces that use these signals.

Test Delay functions include:

- **Start Criteria**: Sets the delay timing measurement start signal. The following start criteria measurement signals are available:
    - **DTR**, **DSR**, **RTS**, **CTS**, **DCD**, **TX Data**, **TX Pattern Sync**

  Either the rising (off-to-on) or falling (on-to-off) edge of the signal can be selected.

- **Stop Criteria**: Sets the delay timing measurement stop signal. The following stop criteria measurement signals are available:
    - **DTR**, **DSR**, **RTS**, **DCD**, **RX Data**, **RX Pattern Sync**

  Either the rising (off-to-on) or falling (on-to-off) edge of the signal can be selected.

- **Action - State**: Starts and stops the delay test mode. Select one of the following:
    - **Stop Delay Test** - Stops delay activity. The State returns to Inactive.
    - **Single Delay Test** - If selected, the delay value is transmitted once through your network.
    - **Continuous Delay Test** - If selected, the delay value is continuously measured.

The Delay Time is recorded in milliseconds; indicating the duration in seconds that it took for the known frame to return to the unit. The current frame count and duration appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.

Signal Control

Signal Control Screens and Functions

The Signal Control screen allows you to query, enable, disable, and view the state of the following RS-530 signal control components:

- Flow Control
- Data and Clock
- Loopback

Signal Control Screens and Functions

The Signal Control screen allows you to query, enable, disable, and view the state of the following RS-530 signal control components:

- Flow Control
- Data and Clock
- Loopback

Signal Control - Flow Control

The Flow Control area of the Signal Control screen allows you query, monitor, and change the status of one or multiple signal controls.

When RX Data Only is selected for the Operation Mode setting, all output signals are disabled, making the Signal Control screen nonfunctional.

The following Flow Control options are available:

- **Send XON** - Only available when one of the following interfaces is selected: RS-232, EIA-530 Async, and EIA-530A Async. Selecting the **Send XON** button sends a message to the transmitting device signaling that the receiver is able to accept more data.
- **Send XOFF** - Only available when one of the following interfaces is selected: RS-232, EIA-530 Async, and EIA-530A Async. Selecting the **Send XOFF** button sends a message to the transmitting device signaling that the receiver is unable to accept more data.
- **Invert** - Select the Invert button to change a control signal from 0 to 1 (Off to On), or 1 to 0 (On to Off), depending on its current setting. The signal remains at this setting when the NIC unit is rebooted.
- **Ignore** - Select the Ignore button to disregard a control signal during out-of-band flow control.
- **Toggle** - Select the Toggle button to temporarily switch a control signal from 0 to 1 (Off to On), or 1 to 0 (On to Off), depending on its current condition. The signal returns to its previous condition when the NIC unit is rebooted.

- **Status** - Displays a green box when the control signal is in 'High' logic (Active/On).

You can apply Flow Control options to the following signal controls:

- **rlsd (dcd)** - Received Line Signal Detector/Data Carrier Detect
- **ri** - Ring Indicator
- **dsr** - Data Set Ready
- **dtr** - Data Terminal Ready
- **cts** - Clear to Send
- **rts (rr)** - Request to Send/Receiver Ready

Signal Control - Data and Clock

The Data and Clock area of the Signal Control screen allows you to invert data and clock settings, and check their status.

Use the **Invert** button to change a control signal from 0 to 1 (Off to On), or 1 to 0 (On to Off), depending on its current setting. The signal remains at this setting when the NIC unit is rebooted.

The **Status** indicator column displays a blinking green box when the control is in 'High' logic (Active/On).

When RX Data Only is selected for the Operation Mode setting, all output signals are disabled, making the Signal Control screen nonfunctional.

The following control signals can be monitored and inverted:

- **rxd** - Receive Data
- **rxc** - Receive Clock
- **txd** - Transmit Data
- **txc** - Transmit Clock

Signal Control - Loopback

The Loopback area of the Signal Control screen allows you to change the loopback and test mode controls, and check their status.

When RX Data Only is selected for the Operation Mode setting, all output signals are disabled, making the Signal Control screen nonfunctional.

You can perform the following actions on a loopback signal:

- **Invert** - Use the Invert button to change a control signal from 0 to 1 (Off to On), or 1 to 0 (On to Off), depending on its current setting. The signal remains at this setting when the NIC unit is rebooted.
- **Toggle** - Use the Toggle button to temporarily switch a control signal from 0 to 1 (Off to On), or 1 to 0 (On to Off), depending on its current condition. The signal returns to its previous condition when the NIC unit is rebooted.
- **Status** - Displays a green box when the control signal is a logic 'High' (active/on)

You can apply the action to the following signals:

- **Local Loopback (LL)** - Provides a way for DTE to check the functioning of the DTE/DCE interface and the transmit and receive sections of the local DCE.
- **Remote Loopback (RL)** - Allows end-to-end testing of a circuit from a central site or DTE for checking the transmission path up to and through the remote DCE to the DTE interface and the similar return transmission path.
- **Test Mode (TM)** - Provides indication from the DCE to the DTE that the DCE is in a test condition and verifies completion of a requested action.

Signal Control Function - Ignore

During out-of-band flow control, a certain sequence of signals must take place between the DCE and DTE in order for transmission to occur. The Ignore function allows you to select an input signal that is disregarded during out-of-band flow control.

The **Out of Band** flow control setting is selected from the **Transmit Set** screen, **Type** options.

The Ignore check boxes are *disabled* when **In Band** or **None** is selected for the flow control setting.

Emulating a DTE

When emulating a DTE, the following input signals can be ignored:

- **DCD (RLSD/DCD)** - When the DCD **Ignore** checkbox is selected the **DTR** toggle button appears allowing control of the output signal.

- **DSR** - When the DSR **Ignore** checkbox is selected the **RTS (RR)** toggle button appears allowing control of the output signal.
- **CTS** - When the CTS **Ignore** checkbox is selected the unit will not expect the CTS signal to become active in order for transmission to begin.

When an input signal is ignored, the associated output signal is automatically placed in the ON condition.

Emulating a DCE

When emulating a DCE, the following input signals can be ignored:

- **DTR** - When the DTR **Ignore** checkbox is selected the **DSR** toggle button appears allowing control of the output signal.
- **RTS (RR)** - When the RTS **Ignore** checkbox is selected the **CTS** toggle button appears allowing control of the output signal.

When an input signal is ignored, the associated output signal is automatically placed in the ON condition.

Signal Control Function - Toggle

The Toggle button temporarily switches a control signal from On to Off, or Off to On, depending on its current condition. The signal returns to its previous condition when the NIC unit is rebooted. In contrast to the Ignore function, toggle functionality is available regardless of the flow control setting.

The following output signals can be controlled by selecting the **Toggle** button:

If Flow Control setting is **In Band** or **Out of Band** and you are

emulating a DTE:	**emulating a DCE (RS-530):**	**emulating a DCE (RS-530A and RS-232):**
RL	DCD	DCD
LL	TM	RI
		TM

If Flow Control setting is **NONE** and you are

emulating a DTE:	**emulating a DCE (RS-530):**	**emulating a DCE (RS-530A and RS-232):**
DTR	DCD	DCD
RTS	DSR	RI
RR	CTS	DSR
LL	TM	CTS

When the RS-530 is emulating a DCE and LL is activated by the DTE, the RS-530 will enable a local loopback to the DTE until the DTE deactivates LL.

LED Quick Status Area

When the Serial protocol processor is selected, the following LEDs are displayed in the LED Quick Status Area of the touch screen.

LED	Description
E/A	Displays the error and/or alarm currently generated by the unit.
Test Paused	Indicates if a timed test has been paused using the Pause Test button from the Test screen.
RX CLOCK	Indicates if the receive clock is working.
ASYNC TIMEOUT	Indicates a loss of data from the asynchronous timing mode.
PAT SYNC	Indicates when pattern synchronization is established.
BIT ERR	Indicates a bit error was detected in the payload.
STOP BIT ERR	Indicates when a stop bit error is detected.
PARITY	Indicates when a parity error is detected.
MARK	Indicates when a mark is present at input.
SPACE	Indicates when a space is present at input.

SONET Tab

SONET Overview

The test options available under the SONET tab can vary from one NIC test set to another, depending on which Multi-Rate Circuit Pack in installed in the test set.

The legacy **OMR** (Optical Multi-Rate) circuit pack was the first Digital Lightwave module to offer SONET Interface testing from OC-1 up to OC-192, as well as OTN, and Dual DS3, etc.

The **NGMR** (Next Generation Multi-Rate) circuit pack, which succeeds the OMR circuit pack, can also offer SONET Interface testing from OC-1 up to OC-192, as well as OTN, and can be licensed for some additional features not available on the OMR circuit pack.

If you are unsure which Multi-Rate circuit pack is your NIC test set, then select Differences Between Multi-Rate Circuit Packs to learn more.

Please select the appropriate SONET online help section based on the current configuration of your NIC product:

- SONET Features available on the **NGMR** circuit pack
- SONET Features available on the **OMR** circuit pack

SONET-NGMR

SONET Next Generation Multirate (NGMR) Overview

The **NGMR** (Next Generation Multi-Rate) circuit pack succeeds the OMR circuit pack, in that it too can offer SONET Interface testing from OC-1 up to OC-192, as well as OTN, but it can be licensed for some additional Next-Generation Telecom features not available on the OMR circuit pack.

These features include STS and VT **VCAT**, **LCAS**, **GFP**, **1G LAN** and **10G LAN / WAN / FEC (10G LAN over OTU-2)**, **ODTU-12 Add/Drop multiplexing**, as well as hot-swappable SFP and XFP lasers.

To use Next Generation Multi-Rate functionalities your unit must contain the NGMR circuit pack and be licensed accordingly.

The SONET NGMR Online Help is divided into the following sections:

- NGMR Specific Tasks
- NGMR Screen and Function Descriptions
- Packet Tab (Available for testing GFP mappings, and 1G/10G LAN/WAN Interfaces)

NGMR Specific Tasks

SONET Specific Tasks Overview

This section includes tasks that are specific to the SONET protocol processor. For general tasks, refer to the Common Tasks section.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view Specific Tasks for this protocol processor.

- Testing SONET Jitter
- How to Set Up and Use VCAT Features
- How to Set Up and Use LCAS
- GFP Payloads for SONET mappings
- How to Set Up and Use 1G and 10G Ethernet LAN
- Configuring APS (K1 and K2) Commands
- Decoding APS (K1 and K2) Values

SONET Jitter

Testing Jitter on a Multirate Unit Overview

NIC units that have the Jitter module and are licensed for Optical Multirate, and contain the Multirate circuit pack can set up jitter interfaces from the Multirate (SONET/SDH) tab.

- Attaching Optical Cables
- Configuring Jitter for a Multirate Unit

The Jitter TX laser remains ON when the optical interface is changed to a non-jitter SONET/SDH signal, allowing the Jitter laser and Optical Multirate laser to remain on at the same time.

Attaching Optical Cables

Before starting jitter tests on a NIC Multirate test set you must disconnect the cables from the Multirate TX or RX connector on the NIC connector panel and reconnect them to the Jitter TX or RX connector.

For instructions on connecting cables, see the **Common Tasks** section of Getting Started, located in the NIC Online Help.

Configuring Jitter for a Multirate Test Set

1. Select the **SDH/SONET** tab.
2. Select **Transmit** and choose **Set 1**.
3. Select **Interface**. The Select Type of Interface dialog box appears
4. Select the desired Jitter Interface for testing.
5. Configure all other necessary SDH parameter settings.
6. From the **Jitter** tab, select **Transmit**.
7. Turn the laser **On**.
8. Select **Receive** and choose **SIG**. Ensure that a valid signal is being received for the configured line rate.

When testing Jitter, the Multirate lasers are disabled and the Jitter laser is used.

The Jitter TX laser remains ON when the optical interface is changed to a non-jitter SONET/SDH signal, allowing the Jitter laser and Optical Multirate laser to remain on at the same time.

Attenuate the received optical power level if necessary so that the power level going into the Jitter RX laser is less than -10 dBm.

VCAT

How to Set Up and Use VCAT Features

NIC test sets licensed for VCAT functionality allow Digital Lightwave® customers to test NextGeneration optical networks utilizing VCAT (Virtual Concatenation) for more efficient data transfer.

This is a licensable option. Please contact Tech Support, or your DLI sales representative, to enable this option on your NIC unit.

VCAT features are accessed under the SONET or SDH tab, in Transmit, Receive, and Results sections.

- Configuring VCAT Mapping
- Adding and Editing VCAT Channels
- Inserting VCAT Delays
- Inserting VCAT Errors and Alarms
- Viewing VCAT Alarm and Error LEDs
- Viewing VCAT Alarm and Error Results

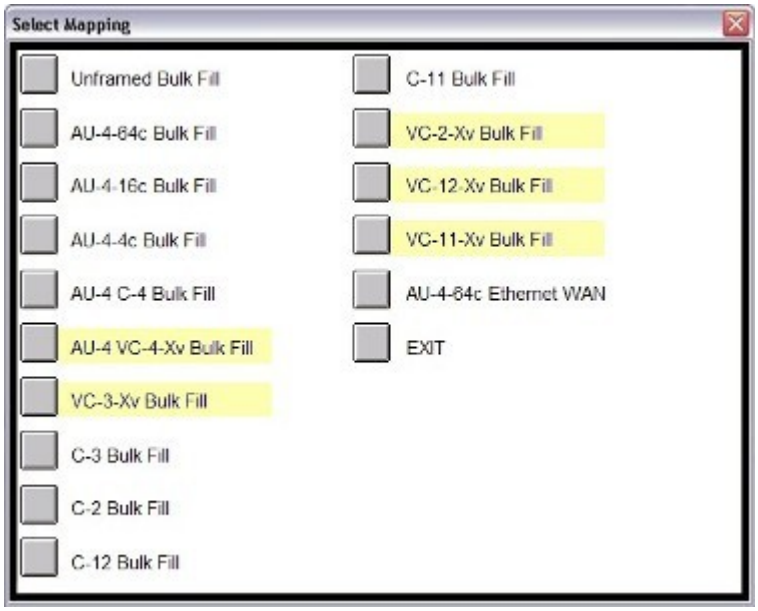
After configuring a VCAT group, see How to Set Up and Use LCAS for LCAS configuration and information.

Configuring VCAT Mappings

The following procedures describe how to configure the NIC for VCAT mapping in SDH and SONET. The NIC unit must be equipped with High-Order or Low-Order VCAT test options.

VCAT Mappings in SDH mode:

1. Select the **SONET** or **SDH** tab.
2. Select **Transmit**, and then select the **Set 1** side tab.
3. Select **Mapping** and the following window will appear:



(Highlights do not appear in the NIC screen.)

4. Choose any of the following selections as applicable:

Higher-Order Mappings

- AU-4 VC-4-Xv Bulk Fill (Not applicable when using STM-0, STM-0e, STM-1 or STM-1e Interface)
- AU-3 VC-3-Xv Bulk Fill (Not applicable when using STM-0 or STM-0e Interface)

Lower-Order Mappings

- VC-3-Xv Bulk Fill (when AU-Type is AU-4)
- VC-2-Xv Bulk Fill
- VC-12-Xv Bulk Fill
- VC-11-Xv Bulk Fill

5. Select **AU-Type** and choose **AU-3** or **AU-4**; if available for the selected mapping..

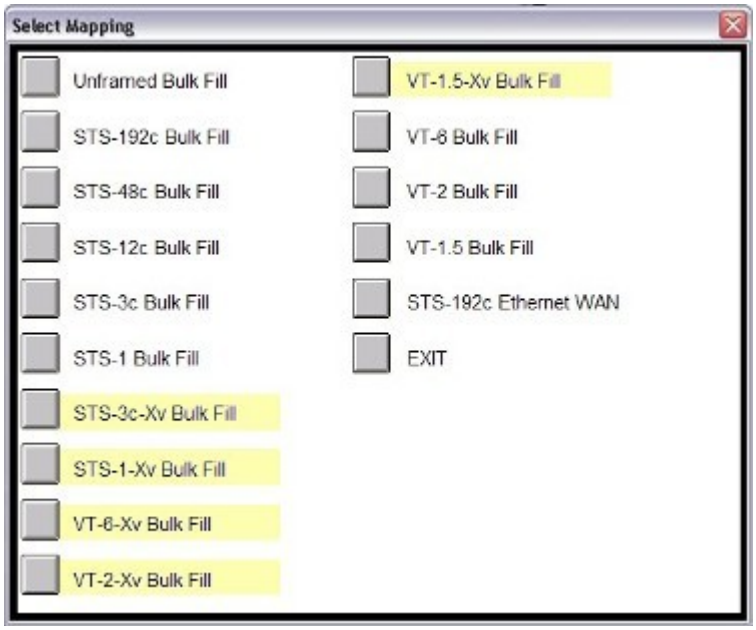
6. The mapping will be displayed as AU-3 or AU-4, followed by the selected VC mapping. The above mapping choices plus the selection of AU-3 or AU-4 make it possible to do any of the following mappings:

- AU-4 VC-4-Xv Bulk Fill
- AU-4 VC-3-Xv Bulk Fill
- AU-4 VC-2-Xv Bulk Fill
- AU-4 VC-12-Xv Bulk Fill
- AU-4 VC-11-Xv Bulk Fill
- AU-3 VC-3-Xv Bulk Fill
- AU-3 VC-2-Xv Bulk Fill
- AU-3 VC-12-Xv Bulk Fill
- AU-3 VC-11-Xv Bulk Fill

7. Select **Payload**, and choose the desired Payload Pattern (including PRBS or **GFP** if licensed) to be used as the test pattern for the entire VCG (Virtual Concatenation Group).
8. Once the mapping is configured for VCAT, see Adding and Editing VCAT Channels.

VCAT Mappings in SONET mode:

1. Select the **SONET** tab.
2. Select **Transmit**, and then select the **Set 1** side tab.
3. Select **Mapping** and the following window will appear:



(Highlights do not appear in the NIC screen.)

4. Choose any of the following selections as applicable:

   STS Mappings

   - STS-3c-Xv Bulk Fill (Not applicable when using OC-1, EC-1, OC-3 or EC-3 Interface)
   - STS-1-Xv Bulk Fill (Not applicable when using OC-1 or EC-1 Interface)

   VT Mappings

   - VT-6-Xv Bulk Fill
   - VT-2-Xv Bulk Fill
   - VT-1.5-Xv Bulk Fill

5. Select **Payload**, and choose the desired Payload Pattern (including PRBS or **GFP** if licensed) to be used as the test pattern for the entire VCG (Virtual Concatenation Group).
6. Once the mapping is configured for VCAT, see Adding and Editing VCAT Channels.

Adding and Editing VCAT Channels

Adding VCAT Channels

The following procedure describe how to add VCAT channels, to form a VCG (Virtual Concatenation Group). Before channels can be added, the NIC must be configured for VCAT Mapping. See Configuring VCAT Mapping.

1. Select **SDH** or **SONET** tab.

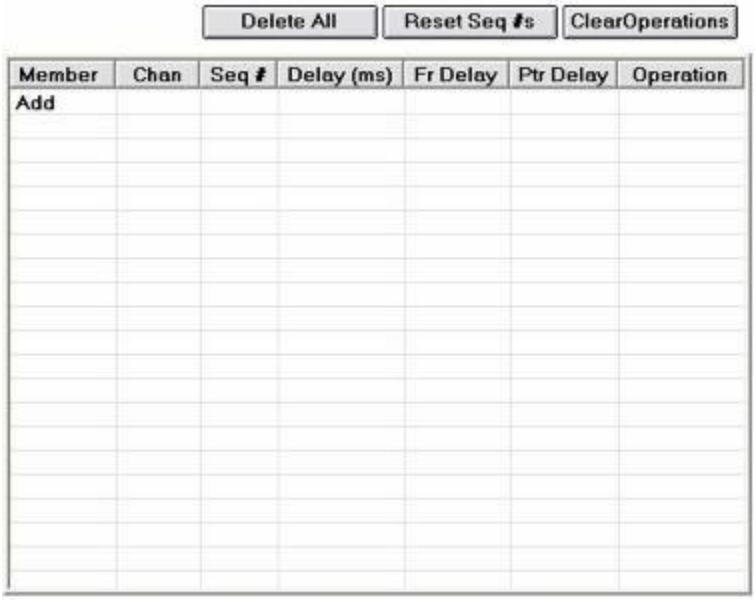
This procedure is the same in SDH or SONET. The channel numbers will appear differently depending upon the protocol in use. SDH was used for the examples in this document.

2. Select **Transmit** or **Receive**.

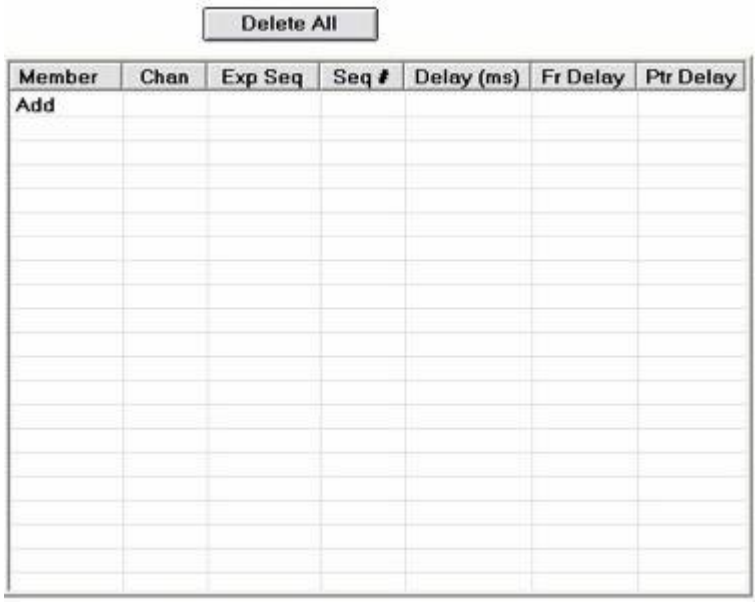
All functions of setting up VCAT channels can be added through either Transmit or Receive, even functions that involve the Transmit only. If "Settings Control" (Under Transmit or Receive "Set 1") is Coupled, both Transmit and Receive will be configured.

3. Select the **VCAT** side-tab. The VCAT Table will be displayed.

This is the **Transmit** VCAT Table:



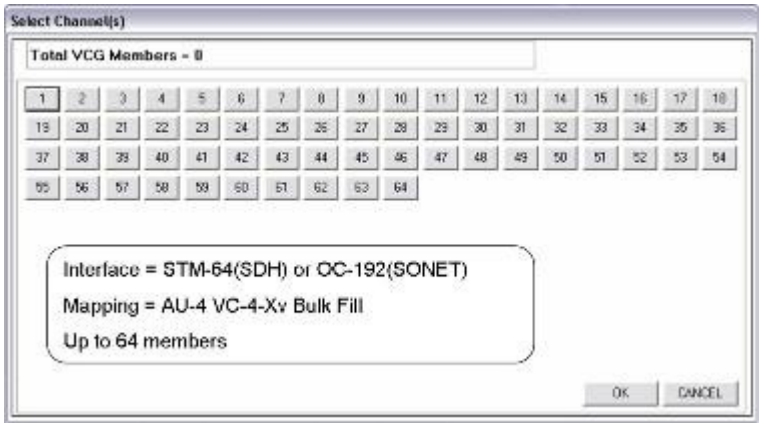
This is the **Receive** VCAT Table:

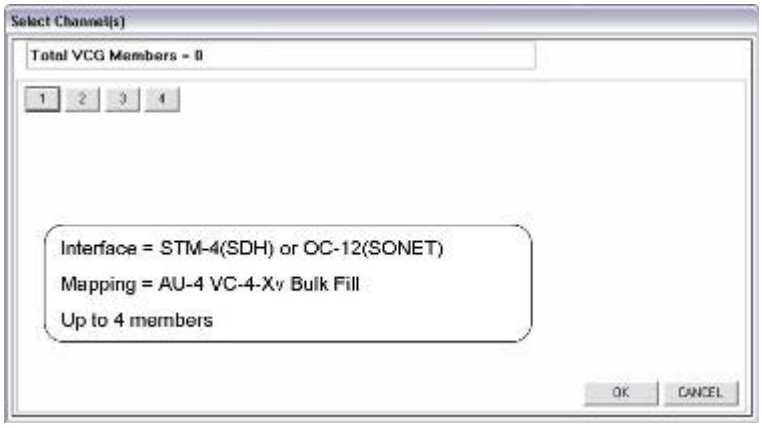


Adding Channels in High-Order Mappings

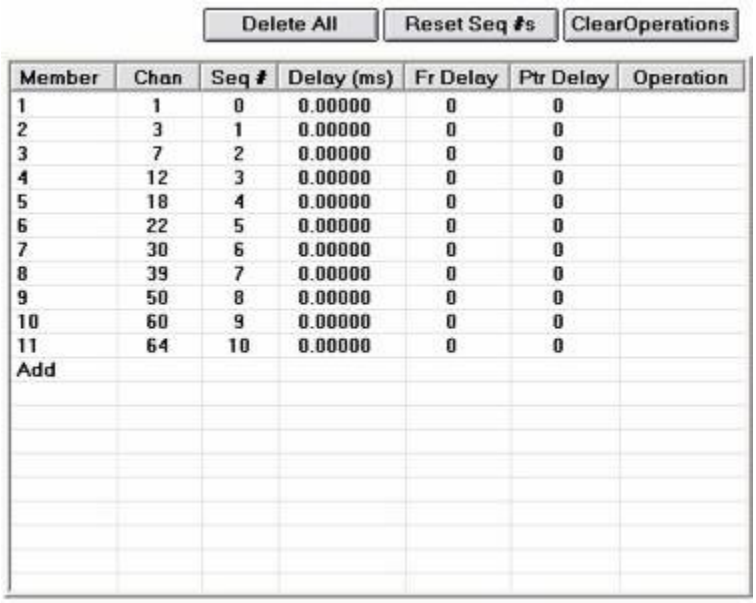
1. Select **Add**. The Select Channel(s) window will appear.

   Depending upon the Interface and Mapping selected the number of available channels will be different. The following are examples:





2. Select any channel. **Total VCG Members** will change from 0 to 1.
3. Continue to select additional members as required.
4. When you select a member, the member button become disabled, to indicate that the channel has been selected.
5. This window will alert you when the maximum number of members has been selected.
6. Select **OK**.
7. The Select Channel(s) window will close, and the newly added channels will appear in the VCAT Table, as in this example:



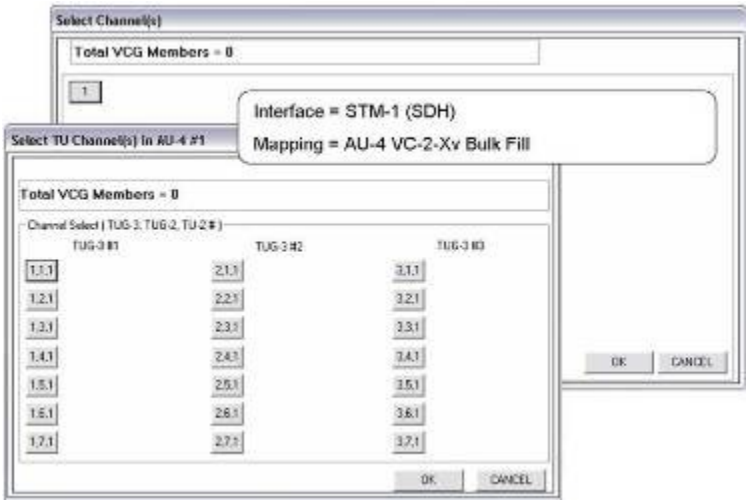
Member	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operation
1	1	0	0.00000	0	0	
2	3	1	0.00000	0	0	
3	7	2	0.00000	0	0	
4	12	3	0.00000	0	0	
5	18	4	0.00000	0	0	
6	22	5	0.00000	0	0	
7	30	6	0.00000	0	0	
8	39	7	0.00000	0	0	
9	50	8	0.00000	0	0	
10	60	9	0.00000	0	0	
11	64	10	0.00000	0	0	
Add						

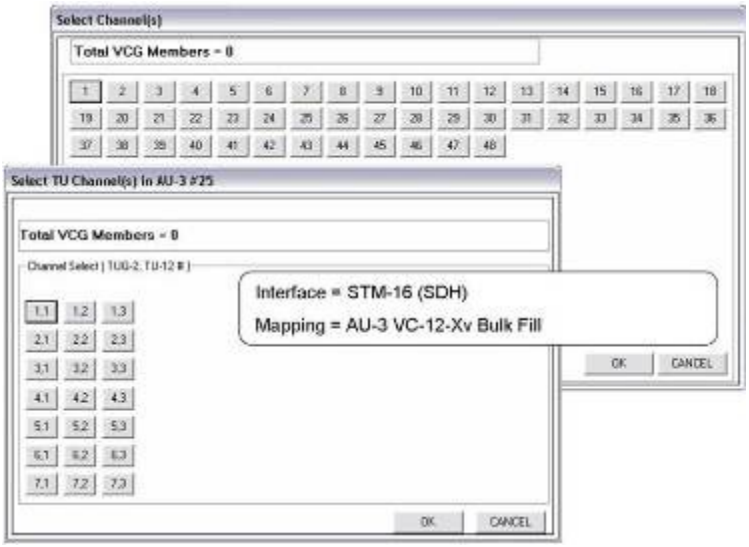
Adding Channels in Low-Order Mappings

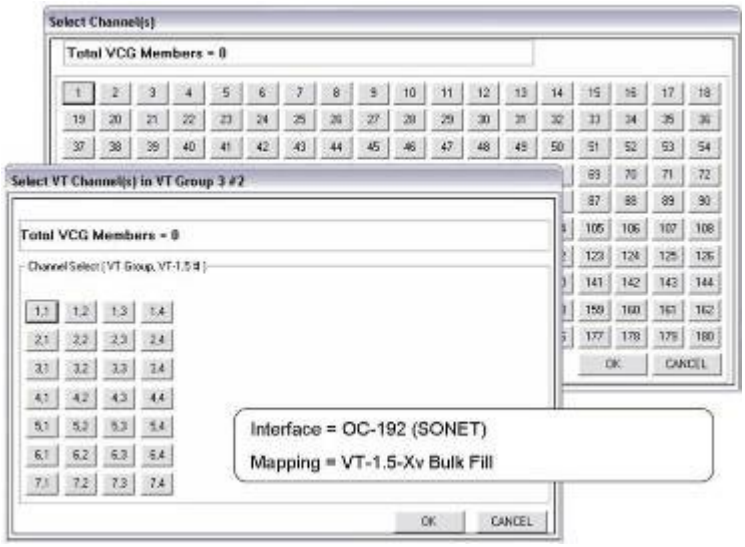
The basic procedure for low-order mappings is the same as high-order mappings except that there is two-stage channel-selection process.

1. Select Add. The Select Channel(s) window will appear.

   Depending upon the Interface and Mapping selected the number of available channels will be different. The following are examples:





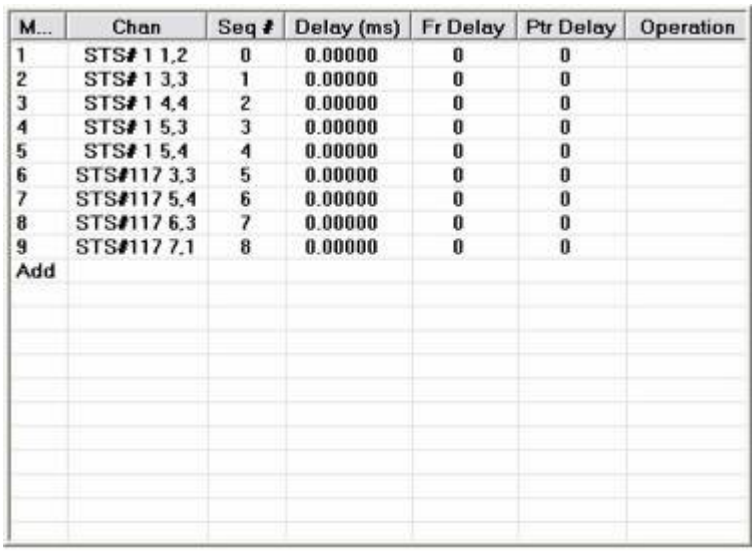


2. Select any channel from the Select Channel(s) menu. The Select TU Channel(s) window, for SDH mapping, or Select VT Channel(s) window, for SONET mapping will appear.
3. Select TU or VT channels as required.
4. Continue to select additional channels as required.
5. Select OK.
6. The Select Channel(s) window will close and the new channels will appear in the VCAT Table, as in these examples:

SDH Example (*STM-64, AU-3 VC-11-Xv mapping*):

M...	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operation
1	AU# 1 1,2	0	0.00000	0	0	
2	AU# 1 3,3	1	0.00000	0	0	
3	AU# 1 4,4	2	0.00000	0	0	
4	AU# 1 5,3	3	0.00000	0	0	
5	AU# 1 5,4	4	0.00000	0	0	
6	AU#117 3,3	5	0.00000	0	0	
7	AU#117 5,4	6	0.00000	0	0	
8	AU#117 6,3	7	0.00000	0	0	
9	AU#117 7,1	8	0.00000	0	0	
Add						

SONET Example (*OC-192, VT-1.5-Xv mapping*):



M...	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operation
1	STS# 1 1,2	0	0.00000	0	0	
2	STS# 1 3,3	1	0.00000	0	0	
3	STS# 1 4,4	2	0.00000	0	0	
4	STS# 1 5,3	3	0.00000	0	0	
5	STS# 1 5,4	4	0.00000	0	0	
6	STS#117 3,3	5	0.00000	0	0	
7	STS#117 5,4	6	0.00000	0	0	
8	STS#117 6,3	7	0.00000	0	0	
9	STS#117 7,1	8	0.00000	0	0	
Add						

Insert a channel before an existing channel in the VCAT Table

1. Select a Member row. The Select for Member <#> dialog box appears.
2. Select Add Channel (Before). The Select Channel to Insert dialog box appears.
3. Select the desired channel.
4. Both dialog boxes automatically close and a new channel is inserted above the previously selected line, automatically renumbering the Member column.

After configuring a VCAT group, see How to Set Up and Use LCAS for LCAS configuration and information.

Editing VCAT Channel Configurations

Changing a Channel Assignment

1. Select the **Member** row to be changed. The Select for Member <#> dialog box appears.
2. Selected **Change Channel** #.
3. Select the desired Channel as described above.
4. The window will close and the selected member will be changed to the requested channel.

Deleting VCAT Channels

Deleting a Channel

1. Select the **Member** row to be deleted. The **Select for Member <#>** dialog box appears.
2. Select **Delete Channel**.
3. The window will close and the selected channel will be deleted.

Deleting All Channels

1. Select **Delete All** (located above the VCAT Table).
2. All members will be deleted.

Inserting VCAT Delays

The NIC can insert delay on any of the VCAT channels individually.

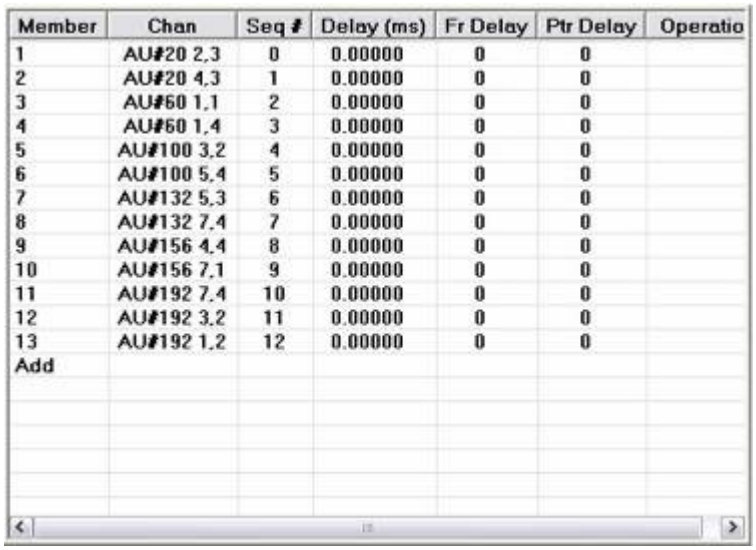
1. Select **SDH** or **SONET** tab.

This procedure is the same in SDH or SONET. The channel numbers will appear differently depending upon the protocol in use. SDH was used for the examples in this document.

2. Select **Transmit**.

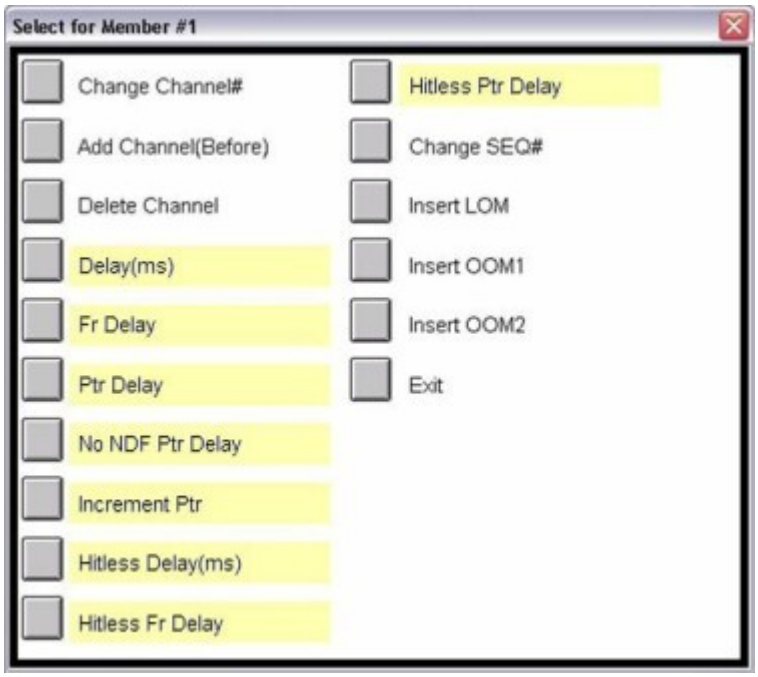
The delay can actually be inserted from the Receive screen as well but the Receive VCAT Table will not display the inserted delay. The Receive VCAT Table displays measured delay.

3. Select the **VCAT** side-tab. The VCAT Table will be displayed.



Member	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operatio
1	AU#20 2,3	0	0.00000	0	0	
2	AU#20 4,3	1	0.00000	0	0	
3	AU#60 1,1	2	0.00000	0	0	
4	AU#60 1,4	3	0.00000	0	0	
5	AU#100 3,2	4	0.00000	0	0	
6	AU#100 5,4	5	0.00000	0	0	
7	AU#132 5,3	6	0.00000	0	0	
8	AU#132 7,4	7	0.00000	0	0	
9	AU#156 4,4	8	0.00000	0	0	
10	AU#156 7,1	9	0.00000	0	0	
11	AU#192 7,4	10	0.00000	0	0	
12	AU#192 3,2	11	0.00000	0	0	
13	AU#192 1,2	12	0.00000	0	0	
Add						

4. Select the desired **Member** row to insert delay. The Select for Member <#> dialog box appears.
5. The highlighted items in the image below are the options for delay insertion.



(Highlights do not appear in the NIC screen.)

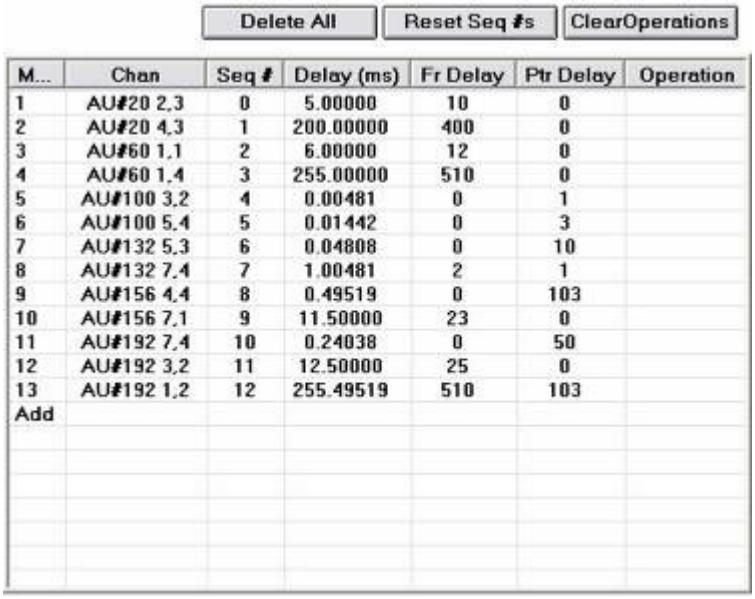
6. Select the desired delay type as detailed below.

    - **Delay(ms)** - Inserts Combined Delay, the amount of time to delay this member as compared to the earliest member, entered in milliseconds (ms). Acceptable values are 0 to 255.99984, other values for Low-Order mappings.
    - **Fr Delay** - Inserts Frame Delay, the number of frames to delay this member as compared to the earliest member, entered in number of frames. Acceptable values are 0 to 2047, other values for Low-Order mappings.
    - **Ptr Delay** - Changes the pointer value of the selected member, creating a very small delay. Acceptable values are 0 to 782 for High-Order mappings, other values for Low-Order mappings.
    - **No NDF Ptr Delay** - Changes the pointer value without New Data Flag (NDF).
    - **Increment Ptr** - Increase pointer value by 1.
    - **Hitless Delay(ms)** - Inserts Combined Delay on the selected member, entered in milliseconds (ms) without causing a Loss of Multiframe (LOM) alarm. Acceptable values are 0 to 255.99984, other values for Low-Order mappings.

- **Hitless Fr Delay** - Inserts Frame Delay on the selected member, entered in number of frames, without causing a Loss of Multiframe (LOM) alarm. Acceptable values are 0 to 2047, other values for Low-Order mappings.
- **Hitless Ptr Display** - Changes the pointer value of the selected member, creating a very small delay, without causing a Loss of Multiframe (LOM) alarm. Acceptable values are 0 to 782, other values for Low-Order mappings.

7. Once the error type is selected, a window with numeric keypad will appear. The title, max. value and min. value will differ depending upon the delay type selected. The following example is for Delay(ms).

8. Enter the desired delay value.
9. Press **OK**. The numeric keypad will disappear and the requested delay will be displayed in the VCAT Table. See example below.



M...	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operation
1	AU#20 2,3	0	5.00000	10	0	
2	AU#20 4,3	1	200.00000	400	0	
3	AU#60 1,1	2	6.00000	12	0	
4	AU#60 1,4	3	255.00000	510	0	
5	AU#100 3,2	4	0.00481	0	1	
6	AU#100 5,4	5	0.01442	0	3	
7	AU#132 5,3	6	0.04808	0	10	
8	AU#132 7,4	7	1.00481	2	1	
9	AU#156 4,4	8	0.49519	0	103	
10	AU#156 7,1	9	11.50000	23	0	
11	AU#192 7,4	10	0.24038	0	50	
12	AU#192 3,2	11	12.50000	25	0	
13	AU#192 1,2	12	255.49519	510	103	
Add						

To Reset Delays on All Members:

1. Select the **Clear Operations** button.
2. All delay values will be set to zero, and the VCAT Table Delay columns will be blank for all members.

Inserting VCAT Errors and Alarms

When the NIC unit is configured for VCAT, errors and alarms can be sent from the Transmit/Error Alarm menu. Section and Line errors and alarms (SONET) and RS and MS errors and alarms (SDH) are sent just as in non-VCAT mappings. Path errors and alarms are sent only on the selected VCAT member.

To select VCAT Channel:

1. Select the **SDH** or **SONET** tab.
2. Select **Transmit**, and then select the **Set 1** side tab.
3. Select **VCAT Channel** and choose which channel in which you would like to send errors or alarms.
4. The selected channel will be displayed in the menu, as in this example:

5. Select **Transmit** > **Error Alarm**.
6. The transmitted path errors and alarms will now be inserted in to the selected VCAT member.

For more information and specific procedure on sending errors and alarms, see SDH/SONET Transmit specific tasks.

VCAT-Specific Alarms

There are three VCAT-specific alarms:

- LOM - Loss of Multiframe alarm
- OOM1 - Out of Multiframe alarm 1
- OOM2 - Out of Multiframe alarm 2

These alarms can be sent on individual VCAT members, even on multiple members simultaneously.

How to Send VCAT-Specific Alarms

1. Select **SDH** or **SONET** tab.

This procedure is the same in SDH or SONET. The channel numbers will appear differently depending upon the protocol in use. SDH was used for the examples in this document.

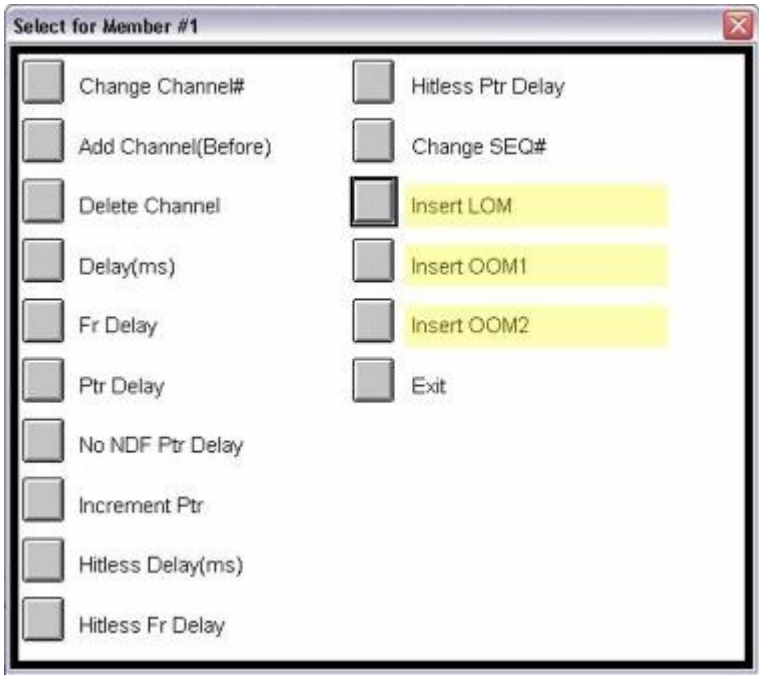
2. Select **Transmit**.

The alarms can actually be inserted from the Receive screen as well but the Receive VCAT Table will not display the selected alarm type.

3. Select the **VCAT** side-tab. The VCAT Table will be displayed.

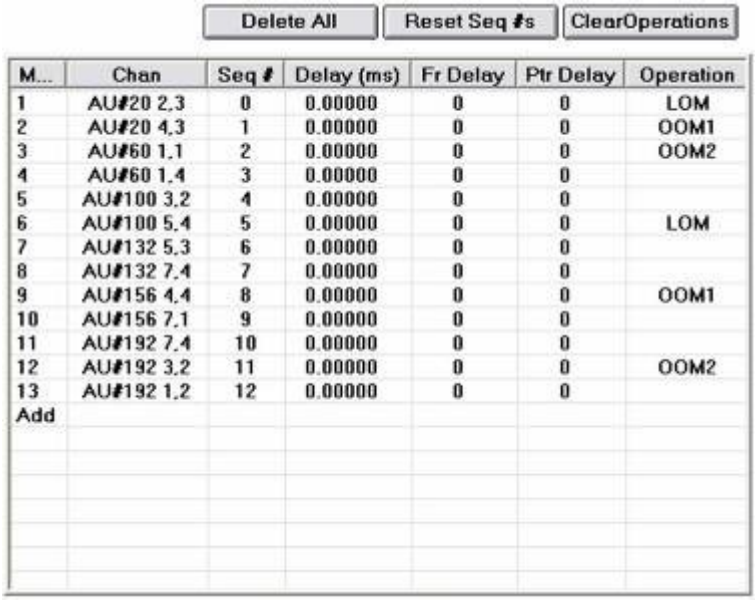
Member	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operatio
1	AU#20 2,3	0	0.00000	0	0	
2	AU#20 4,3	1	0.00000	0	0	
3	AU#60 1,1	2	0.00000	0	0	
4	AU#60 1,4	3	0.00000	0	0	
5	AU#100 3,2	4	0.00000	0	0	
6	AU#100 5,4	5	0.00000	0	0	
7	AU#132 5,3	6	0.00000	0	0	
8	AU#132 7,4	7	0.00000	0	0	
9	AU#156 4,4	8	0.00000	0	0	
10	AU#156 7,1	9	0.00000	0	0	
11	AU#192 7,4	10	0.00000	0	0	
12	AU#192 3,2	11	0.00000	0	0	
13	AU#192 1,2	12	0.00000	0	0	
Add						

4. Select the desired **Member** row to insert alarms. The Select for Member <#> dialog box appears.
5. Highlighted items are the options for alarm insertion.



(Highlights do not appear in the NIC screen.)

6. Select **alarm type**.
7. The window will disappear and the selected alarm type will appear in the VCAT Table under Operation as in this example:



M...	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operation
1	AU#20 2,3	0	0.00000	0	0	LOM
2	AU#20 4,3	1	0.00000	0	0	OOM1
3	AU#60 1,1	2	0.00000	0	0	OOM2
4	AU#60 1,4	3	0.00000	0	0	
5	AU#100 3,2	4	0.00000	0	0	
6	AU#100 5,4	5	0.00000	0	0	LOM
7	AU#132 5,3	6	0.00000	0	0	
8	AU#132 7,4	7	0.00000	0	0	
9	AU#156 4,4	8	0.00000	0	0	OOM1
10	AU#156 7,1	9	0.00000	0	0	
11	AU#192 7,4	10	0.00000	0	0	
12	AU#192 3,2	11	0.00000	0	0	OOM2
13	AU#192 1,2	12	0.00000	0	0	
Add						

To Stop Sending Errors / Alarms on One Member:

1. Select the desired **Member** row to stop sending alarm.
2. The following window will appear. (LOM is used only as an example.)

3. Select **Stop <alarm type>**.
4. The window will disappear and Operation for that member in the VCAT Table will be blank.

To Stop Sending Errors / Alarms on All Members:

1. Select the **Clear Operations** button.
2. The VCAT Table Operation column will be blank for all members.

Viewing VCAT Alarm and Error Results

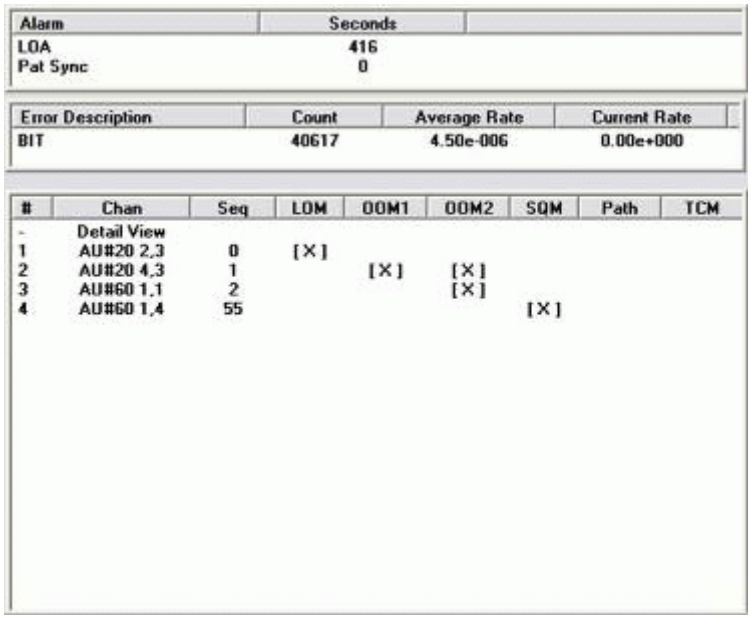
The VCAT Results screen allows you to view VCAT-specific Alarm and Error results.

1. Select the **SDH** or **SONET** tab.
2. Select **Results**, then the **VCAT** side-tab. The VCAT Results screen will be displayed.

Error and alarm information is presented in two ways:

- **Overall View** – Displays information common to all members of the VCAT Group (VCG)
- **Detail View** – Displays full information about any one member, within the (VCG)

Overall View



Alarm	Seconds
LOA	416
Pat Sync	0

Error Description	Count	Average Rate	Current Rate
BIT	40617	4.50e-006	0.00e+000

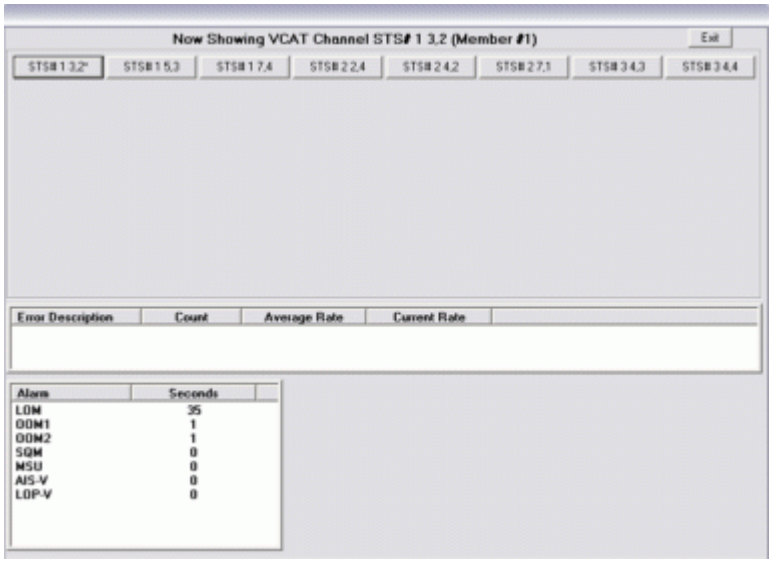
#	Chan	Seq	LOM	OOM1	OOM2	SQM	Path	TCM
-	Detail View							
1	AU#20 2,3	0	[X]					
2	AU#20 4,3	1		[X]	[X]			
3	AU#60 1,1	2			[X]			
4	AU#60 1,4	55				[X]		

- **Alarm Description** – Provides alarm statistics that are common to the entire VCG.
- **Error Description** – Provides error statistics that are common to the entire VCG.
- **Detail** – Provides the Trouble Scan View of any Member/Channel that has detected an alarm condition during the current test. The Member is listed and an **[X]** is placed in the column for the error/alarm type.

Detail View

To drill-down to channel-specific details:

1. Select any **Member** or **Detail View** text in the **Detail** box. The VCAT Detail View window appears.



The Detail View window will initially display either member #1 or the last member viewed, no matter whether the user clicked “detail view” or one of the members to bring up the window.

2. Select a **VCAT channel** to view its alarm and error statistics.
3. Select another **VCAT channel** as required, to view its alarm and error statistics.
4. Select **Exit** to close the VCAT Detail View window.

Viewing VCAT Summary LEDs

The LED statuses indicate the current condition and history of a test that is currently running. For VCAT, the LEDs can be viewed in four levels:

- **VCAT summary LED**. A summary LED for all VCAT members.
- **VCAT Summary**. A screen which shows a single LED for each VCAT member.
- **VCAT LEDs**. An individual LED panel for each VCAT member displaying all applicable alarm and error conditions for that VCAT member only.
- **VCAT LEDs (Summary)**. An LED panel containing all possible error/alarm conditions with each LED indicating “summary” of all VCAT members.

Note that Low-Order SDH configuration was used in the following examples, but VCAT Alarm and Status LEDs are the same for High-Order, and for SONET.

VCAT Summary LED

When SONET/SDH is configured for VCAT, an interactive VCAT LED appears at the bottom of the LED Quick Status Area.

The LED + the text “VCAT” serve as a summary indicator for all VCAT members.

- Green LED +White “VCAT” = No VCAT member has detected any errors or alarms during the current test.
- Green LED + Red “VCAT” = History indictor. At least one VCAT member has detected errors or alarms during the current test.
- Red LED = Red “VCAT” = At least one VCAT member is detecting errors or alarms right now.

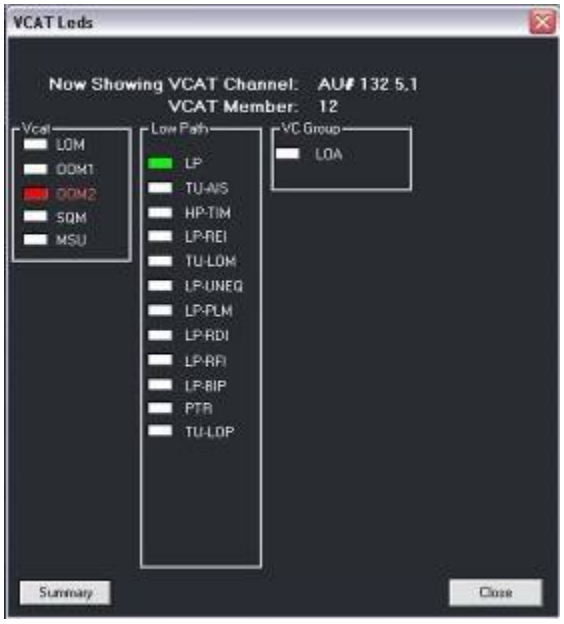
VCAT Summary

Selecting the text “**VCAT**” next to the Summary LED and the VCAT Summary screen will appear.

Each block provides a summary for a single VCAT member. In this case, white text indicates that no errors or alarms have been detected in the current test on the VCAT member. Red Text indicates the detection of a least error or alarm on the VCAT member during the current test.

VCAT LEDs

Select any block in the VCAT Summary window and the VCAT LEDs window will appear.



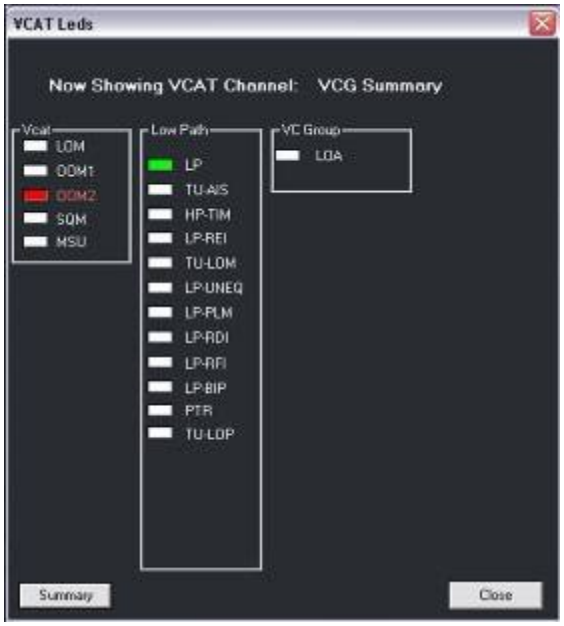
The VCAT LEDs window provides full information regarding all alarm and error conditions for the selected VCAT member. As in the Summary LED, the LED itself plus the text serve as indicators.

- Green LED +White text = This error or alarm has not been detected during the current test.
- Green LED + Red text = This error or alarm has been detected during the current test but is not present at this time.
- Red LED = Red text = This error or alarm is being detected right now.

Select **Close** to return to the VCAT Summary window.

VCAT LEDs (Summary)

Select **Summary** on the VCAT LEDs window. The window and all LEDs will change from reporting the condition of just one VCAT member to a summary function.



Each LED indicates whether that error or alarm has been or is being detected on any VCAT member.

- Green LED +White text = This error or alarm has not been detected during the current test on any VCAT member.
- Green LED + Red text = This error or alarm has been detected during the current test on any VCAT member but is not present at this time.
- Red LED = Red text = This error or alarm is being detected right now on any VCAT member.

LCAS

How to Set Up and Use LCAS

NIC test sets licensed for LCAS (**Link Capacity Adjustment Scheme**) functionality allow Digital Lightwave® customers to test NextGeneration optical networks utilizing LCAS for dynamic bandwidth allocation and protection against failures. LCAS functions work with VCAT (**Virtual Concatenation**) to increase or decrease the number of VCAT Group (VCG) members in use, and therefore bandwidth, dynamically or to automatically protect data integrity by disabling failed VCG members.

This is a licensable option. Please contact Tech Support, or your DLI sales representative, to enable this option on your NIC unit.

LCAS is only available if the NIC unit is licensed for both VCAT and LCAS.

To enable LCAS, a VCAT mapping has to be selected, and at least one member must be added to the VCAT Group.

The LCAS Transmit, Receive, and Results function screens are only displayed when LCAS is enabled. The LCAS option will then be displayed on the TX and RX SET1 screens.

LCAS works only with VCAT mappings, however VCAT can operate without LCAS. LCAS does not add or delete members from the VCG. The LCAS simulation will support from 0 to N members, where N is defined by the total number of members in the VCG.

For detailed instructions on configuring and using LCAS, see these links:

- Configuring LCAS
- Adding and Removing LCAS Channels
- Viewing VCAT/LCAS Summary LEDs

Configuring LCAS

The following procedures describe how to configure the NIC for LCAS testing in SDH and SONET. The NIC unit must be equipped with LCAS Test Option plus High-Order or Low-Order VCAT.

LCAS configuration is virtually identical in SONET and SDH.

Configuring VCAT (preliminary step):

Before LCAS can be configured, there must be a least one member in the VCAT Table. To configure VCAT and add channels, see these links:

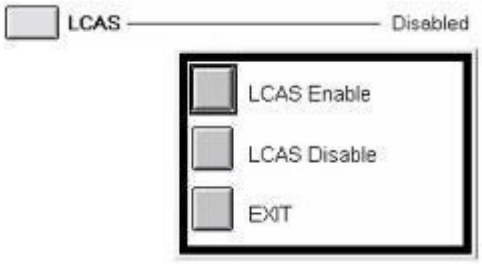
- Configuring VCAT Mapping
- Adding and Editing VCAT Channels

Unlike VCAT which is bidirectional, LCAS operates on a unidirectional, or one-way basis. The transmission of an LCAS system is designated “Source” and the receive is designated “Sink”.

LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other direction may be configured as LCAS as well but as far as testing purposes, there is no correlation between the two.

Enabling LCAS:

1. Under the **SDH** or **SONET** tab, select **Transmit** or **Receive**.
2. Select **Set** and choose **Set 1**.
3. Select **LCAS** and then choose **LCAS Enable**.



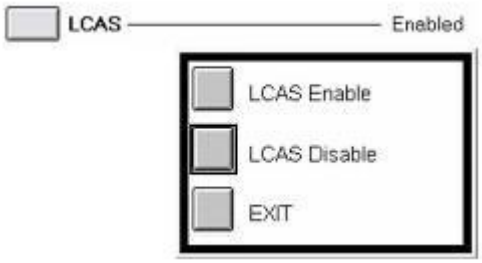
*If the **LCAS** option is not displayed on the **Set 1** screen, then either no members have been added to the VCAT group or the unit is not licensed for LCAS.*

4. Once LCAS is enabled, no members can be added to or deleted from the VCAT Table. The “Add” and “Delete All” buttons will be unavailable.
5. For adding and removing channels, see Adding and Removing LCAS Channels.

Disabling LCAS:

1. Under the **SDH** or **SONET** tab, select **Transmit** or **Receive**.
2. Select **Set** and choose **Set 1**.

3. Select **LCAS** and then choose **LCAS Disable**.

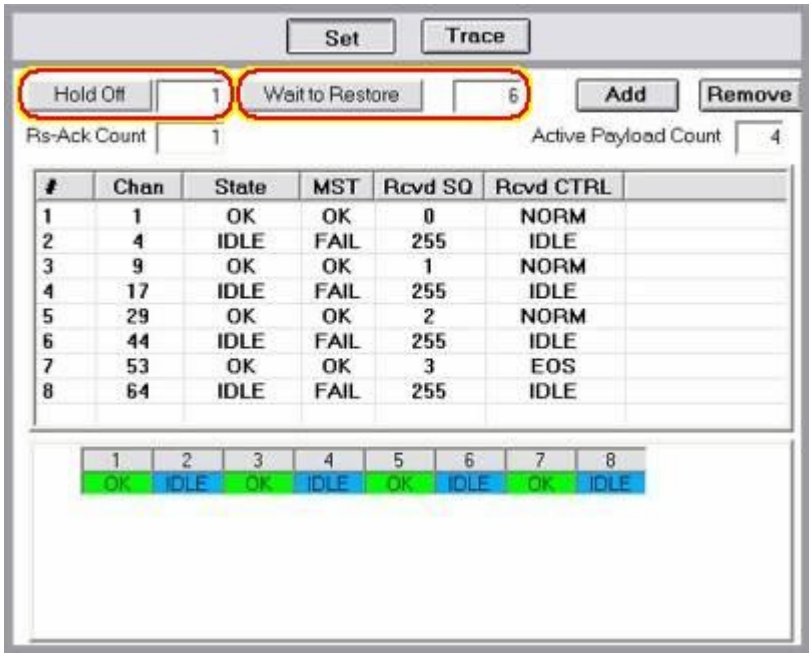


Configuring Hold Off and Wait to Restore

In the event of a VCG member failure, the Sink will send a failure message to the Source.

- **Hold Off** puts a delay between the detection of the failure and sending the message.
- **Wait to Restore** puts a delay between the clearing of the alarm and when an “OK” message is sent to the source.

1. From the **SDH** or **SONET** tab, select **Receive**.
2. Select LCAS Sk (LCAS Sink) side tab from the Receive screen.
3. The LCAS Settings table will appear, listing all of the members within the receive VCG.



4. Select **Hold Off** or **Wait to Restore**. The **Enter User Data** key pad will appear.

5. Enter **0** to **10** (seconds) for the required delay.
6. Select OK.

Adding and Removing LCAS Channels

The following procedure describes how to add LCAS channels to the data stream from the selection of available VCG (Virtual Concatenation Group) members configured in VCAT. The NIC unit must be equipped with LCAS Test Option plus High-Order or Low-Order VCAT.

LCAS configuration is virtually identical in SONET and SDH.

Configuring VCAT (preliminary step):

Before adding LCAS channels, there must be a least one member in the VCAT Table and LCAS must be enabled. To configure VCAT and add channels, see these links:

- Configuring VCAT Mapping
- Adding and Editing VCAT Channels
- Configuring LCAS

Unlike VCAT which is bidirectional, LCAS operates on a unidirectional, or one-way basis. The transmission of an LCAS system is designated “Source” and the receive is designated “Sink”.

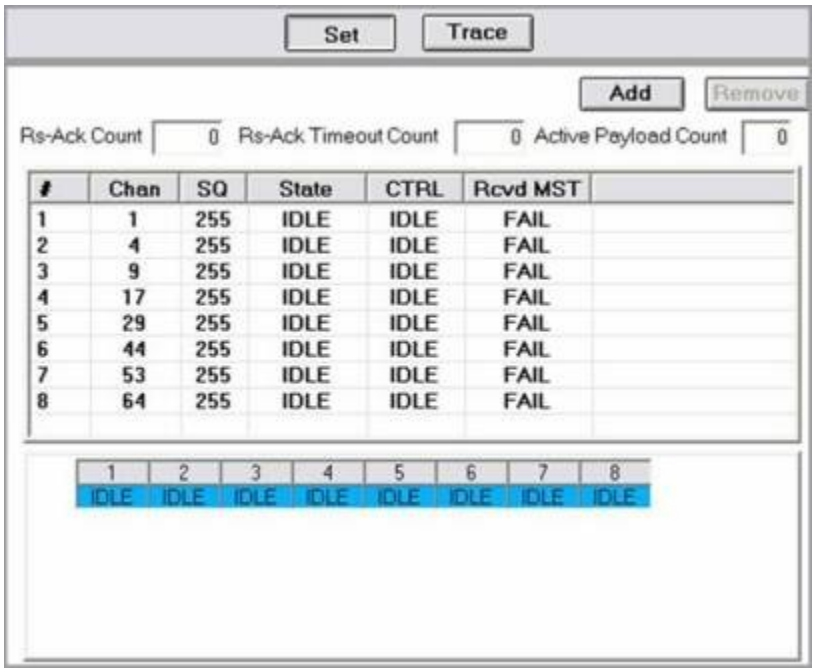
LCAS is configured between a source and a sink uni-directionally

regardless of how the other direction is configured. The other direction may be configured as LCAS as well but as far as testing purposes, there is no correlation between the two.

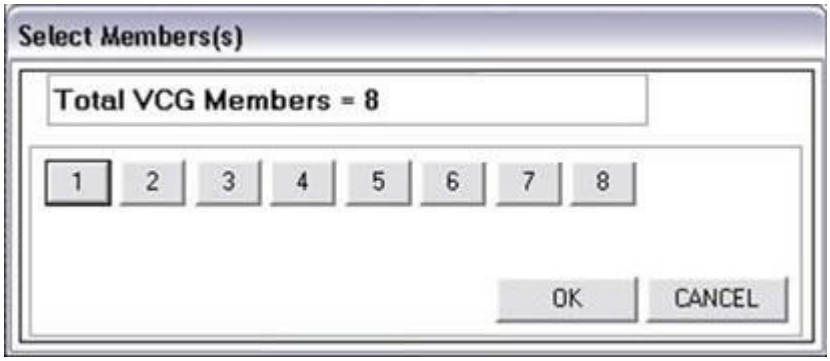
The Source and the Sink are not coupled. Thus adding members to the LCAS Source does not automatically add members to the LCAS Sink, and visa-versa.

Adding LCAS Members to Source

1. From the **SDH** or **SONET** tab, select **Transmit**.
2. Select LCAS So (LCAS Source) side tab from the Transmit screen. .
3. The LCAS Settings table will appear, listing all of the members within the receive VCG.



4. Select **Add**. The Select Member(s) window will appear.



5. The **Select Member(s)** window contains one button for each VCG member.

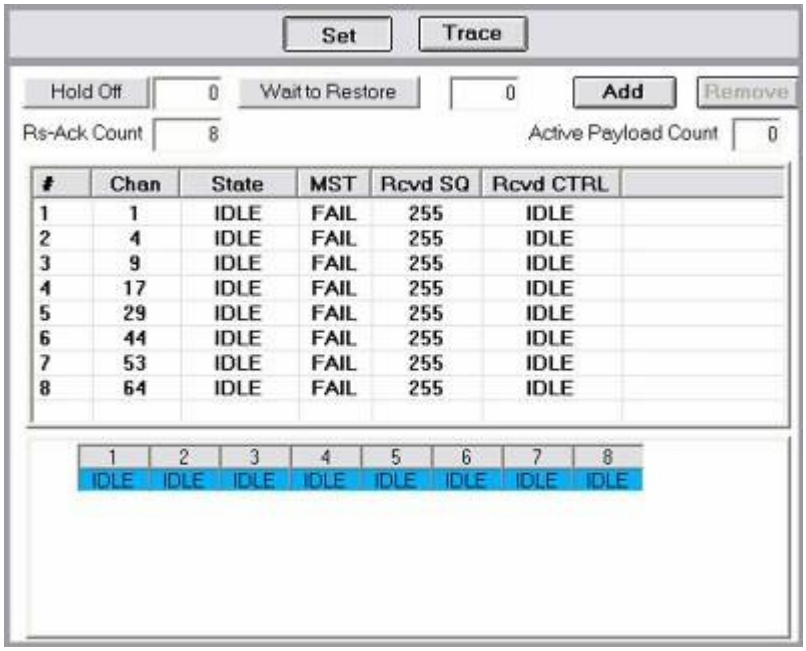
    - If the member is available to be added into the LCAS data stream, the number on the button will be black (enabled).
    - If the member is already a part of the data stream, the number will be gray (disabled) and the button cannot be selected.

6. Select the required **members** and press **OK**.

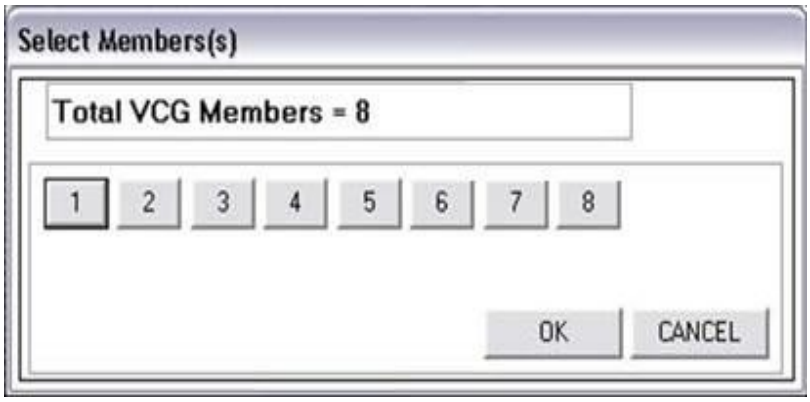
Refer to the LCAS Transmit Settings for Source Member's State-LED status descriptions

Adding LCAS Members to Sink

1. From the **SDH** or **SONET** tab, select **Receive**.
2. Select LCAS Sk (LCAS Sink) side tab from the Receive screen.
3. The LCAS Settings table will appear, listing all of the members within the receive VCG.



4. Select **Add**. The Select Member(s) window will appear.



5. The **Select Member(s)** window contains one button for each VCG member. Refer the VCG for channel information for each member.

    - If the member is available to be added into the LCAS data stream, the number on the button will be black (button enabled).
    - If the member is already a part of the data stream, the number will be gray (button disabled) and the button cannot be selected.

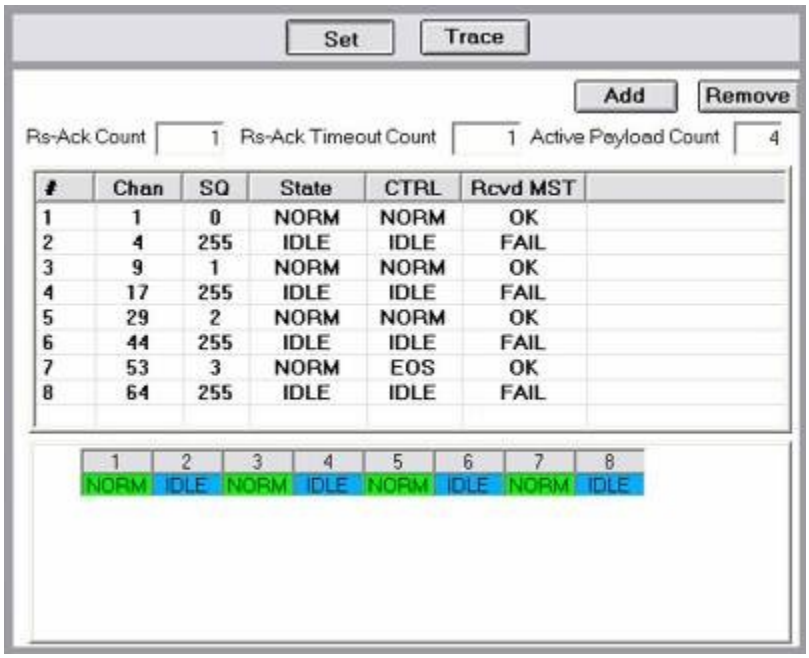
6. Select the required **members** and press **OK**.

Refer to the LCAS Receive Settings for Sink Member's State-LED status descriptions

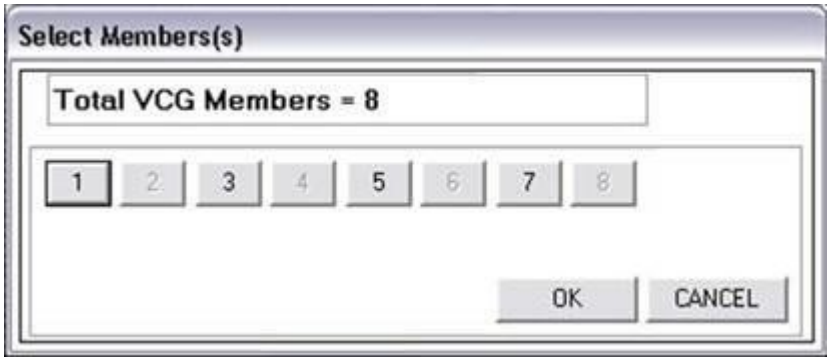
Removing LCAS Members from Source

1. From the **SDH** or **SONET** tab, select **Transmit**.
2. Select

(LCAS Source) side tab from the Transmit screen. .
3. The LCAS Settings table will appear, listing all of the members within the receive VCG.



4. Select **Remove**. The Select Member(s) window will appear.



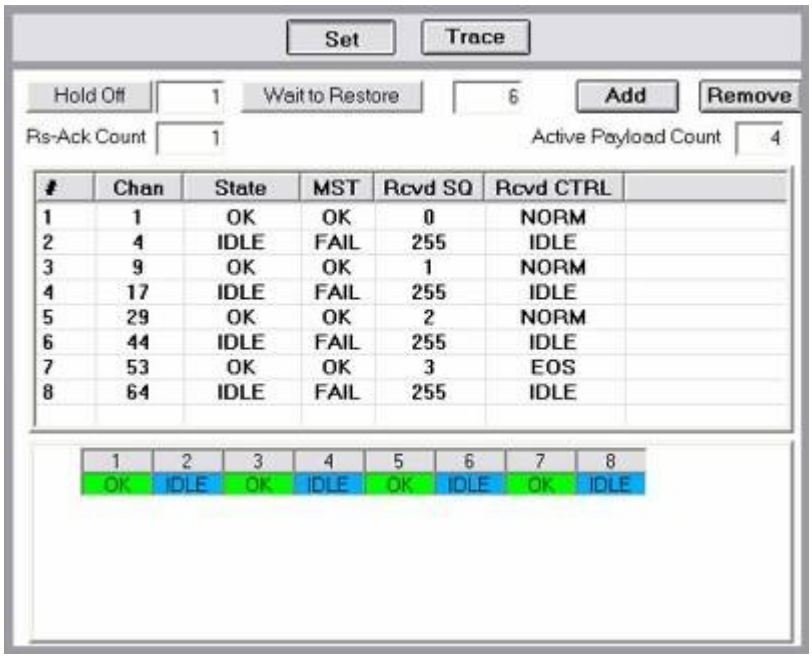
5. The **Select Member(s)** window contains one button for each VCG member.

    - If the member is active, the number on the button will be black (enabled) and the button can be selected to remove that member.
    - If the member is not active, the number will be gray (disabled) and the button cannot be selected.

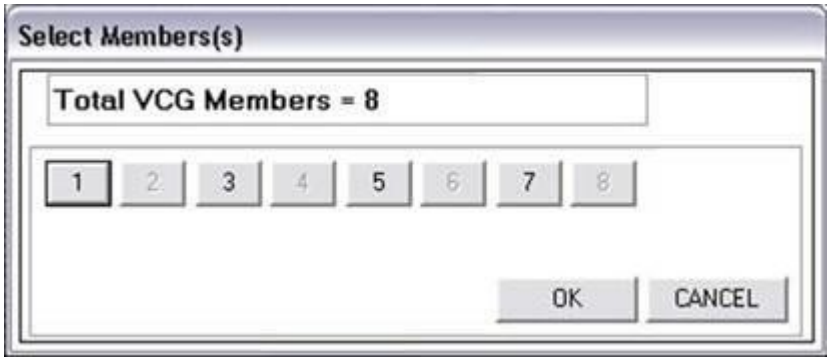
6. Select the **members** to remove and press **OK**.

Removing LCAS Members from Sink

1. From the **SDH** or **SONET** tab, select **Receive**.
2. Select LCAS Sk (LCAS Sink) side tab from the Receive screen.
3. The LCAS Settings table will appear, listing all of the members within the receive VCG.



4. Select **Remove**. The Select Member(s) window will appear.



5. The **Select Member(s)** window contains one button for each VCG member.

- If the member is active, the number on the button will be black (enabled) and the button can be selected to remove that member.
- If the member is not active, the number will be gray (disabled) and the button cannot be selected.

6. Select the **members** to remove and press **OK**.

Viewing VCAT/LCAS Summary LEDs

Refer to the LCAS Transmit Settings for Source Member's State-LED status descriptions

Refer to the LCAS Receive Settings for Sink Member's State-LED status descriptions

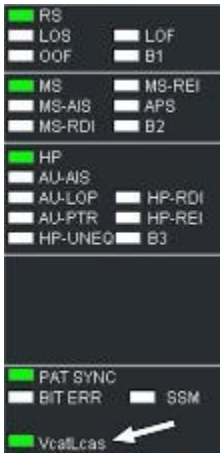
LCAS Summary LEDs are combined with VCAT Summary LEDs. The LED statuses indicate the current condition and history of a test that is currently running. For VCAT/LCAS, the Summary LEDs can be viewed in four levels:

- **VCAT summary LED**. A summary LED for all VCAT/LCAS members.
- **VCAT Summary**. A screen which shows a single LED for each VCAT/LCAS member.
- **VCAT LEDs**. An individual LED panel for each VCAT/LCAS member displaying all applicable alarm and error conditions for that VCAT/LCAS member only.
- **VCAT LEDs (Summary)**. An LED panel containing all possible error/alarm conditions with each LED indicating “summary” of all VCAT/LCAS members.

Note that Low-Order SDH configuration was used in the following examples, but VCAT Alarm and Status LEDs are the same for High-Order, and for SONET.

Summary LED

When configured for VCAT and LCAS, an interactive **VcatLcas** LED appears at the bottom of the LED Quick Status Area.



The LED + the text “VcatLcas” serve as a summary indicator for all VCAT members.

- Green LED +White “VcatLcas” = No VCAT member has detected any errors or alarms during the current test.
- Green LED + Red “VcatLcas” = History indictor. At least one VCAT member has detected errors or alarms during the current test.
- Red LED = Red “VcatLcas” = At least one VCAT member is detecting errors or alarms right now.

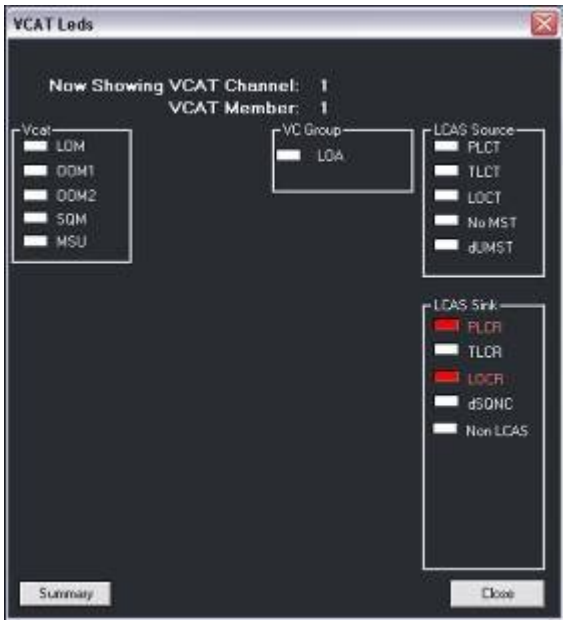
VCAT Summary

Selecting the text **“VcatLcas”** next to the Summary LED and the VCAT Summary screen will appear.

Each block provides a summary for a single VCAT/LCAS member. In this case, white text indicates that no errors or alarms have been detected in the current test on the VCAT/LCAS member. Red Text indicates the detection of a least error or alarm on the VCAT/LCAS member during the current test.

VCAT/LCAS LEDs

Select any block in the VCAT Summary window and the VCAT/LCAS LEDs window will appear.



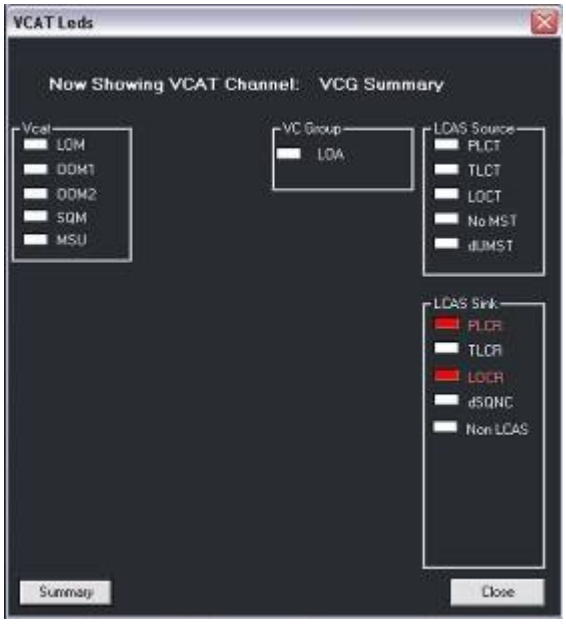
The VCAT/LCAS LEDs window provides full information regarding all alarm and error conditions for the selected VCAT/LCAS member. As in the Summary LED, the LED itself plus the text serve as indicators.

- Green LED +White text = This error or alarm has not been detected during the current test.
- Green LED + Red text = This error or alarm has been detected during the current test but is not present at this time.
- Red LED = Red text = This error or alarm is being detected right now.

Select **Close** to return to the VCAT Summary window.

VCAT/LCAS LEDs (Summary)

Select **Summary** on the VCAT/LCAS LEDs window. The window and all LEDs will change from reporting the condition of just one VCAT/LCAS member to a summary function.



Each LED indicates whether that error or alarm has been or is being detected on any VCAT/LCAS member.

- Green LED +White text = This error or alarm has not been detected during the current test on any VCAT/LCAS member.
- Green LED + Red text = This error or alarm has been detected during the current test on any VCAT/LCAS member but is not present at this time.
- Red LED = Red text = This error or alarm is being detected right now on any VCAT/LCAS member.

Refer to LCAS Results for detailed LCAS Results statistics

GFP Payloads for SONET mappings

The SONET Protocol Processor on the NGMR circuit pack can be configured for GFP payloads (Complying with ITU-T G.7041).

This is a licensable option. Please contact Tech Support, or your DLI sales representative, to enable this option on your NIC unit.

To enable GFP, first configure the desired SONET **Interface** rate and **Mapping** from the SONET tab. Next, select the **Payload** menu, and choose **GFP**.

The following SONET mappings support the GFP payload:

SONET Mapping	Max GFP-Bulk data rate (100% BW)	Supports GFP-T?
STS-192c	9584.640 Mbps	No
STS-48c	2396.160 Mbps	Yes
STS-12c	599.040 Mbps	No
STS-3c	149.760 Mbps	No
STS-1	48.384 Mbps	No

VCAT Mapping	Max GFP-Bulk data rate (max VCG members)	Minimum # of VCG members for GFP-T?
STS-3c-Xv	3594.240 Mbps	7
STS-1-Xv	1161.216 Mbps	21
VT-6-Xv	434.176 Mbps	N/A
VT-2-Xv	139.264 Mbps	N/A
VT-1.5-Xv	102.400 Mbps	N/A

For **GFP-Framed** and **GFP-Transparent** modes, the maximum data rate is limited to **1 Gbps**; which can be distributed on one, or to up to four independent GFP streams from the Packet tab.

802.3 1G and 10G LAN

The NGMR board can be configured so that 1 Gigabit and 10 Gigabit Ethernet LAN streams can be tested.

This is a licensable option. Please contact Tech Support, or your DLI sales representative, to enable this option on your NIC unit.

Use the Interface menu in the SONET or SDH tab to select either of the following rates.

- **802.3 1G LAN (1250.0 MHz)** - Provides 1.250 Gigabit Ethernet LAN testing
- **802.3 10G LAN (10312.5 MHz)** - Provides 10.3125 Gigabit Ethernet LAN

After establishing a 1G or 10G interface rate, you will notice that the mapping option is set to LAN, and most of the common SONET or SDH features become

disabled with the exception of the Laser button, Clock Reference, and Line Frequency Offset, and a couple other select settings.

After setting the LAN interface rate, select the **Packet tab** to configure and test the Ethernet processor and Streams settings.

Configuring APS (K1 and K2) Commands

The following only applies to SONET and SDH protocol processors.

Automatic Protection Switching (APS) is a function that allows an LTE to switch to a backup (or protection) channel in case errors or failures occur on the working channel. APS commands can be configured for either Linear- or Ring-based SONET and SDH networks and are transmitted using the K1 and K2 bytes of the Line Overhead.

You can test your network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response by configuring the K1 and K2 bytes.

You can create up to 16 different K1 and K2 byte configurations (known as byte sequences) to measure and stress your equipment's APS switching capabilities.

To configure K1 and K2 byte values:

1. Select a protocol processor mode.
2. Select the **Transmit** button.
3. Select the **APS** button. The initial APS screen appears containing a table of the K1 and K2 byte sequences that can be transmitted. A total of 16 K1 and K2 byte sequences can appear in the table.
4. Select a byte sequence button (for example,

).

   The **Apply Maintenance to Entry** screen appears. It contains functions used to configure and set the measurement criteria of the K1 and K2 bytes.

5. Use the **APS Mode** function to configure APS commands for **Linear** protection switching mode or **Ring** APS signaling mode.
6. Edit the K1 byte.

   The K1 byte is a request for switch action. There are three functions that allow you to edit the K1 byte:

   - Use the **K1 Full Byte** function to set all eight bits of the K1 byte at once.

- Use the **K1 Bits 1-4** function to set the first four bits of the K1 byte.
- Use the **K1 Bits 5-8** function to set the last four bits of the K1 byte.

7. Edit the K2 byte.

   The K2 byte provides additional information about SONET network architecture and alarm conditions. There are four functions that allow you to edit the K2 byte:

   - Use the **K2 Full Byte** function to set all eight bits of the K2 byte at once.
   - Use the **K2 Bits 1-4** function to set the first four bits of the K2 byte.
   - Use the **K2 Bit 5 (provisioned)** function to set the fifth bit of the K2 byte.
   - Use the **K2 Bits 6-8** function to set the last three bits of the K2 byte.

8. Select **Duration in Frames** to determine how many frames will be transmitted containing the newly configured K1 and K2 bytes.
9. Select **Update**. The initial APS screen appears on the touch screen.
10. To configure additional K1 and K2 bytes, repeat steps 3-8 as described above. Otherwise, proceed to the next section to transmit K1 and K2 bytes.

To transmit K1 and K2 bytes:

1. Make sure that K1 and K2 byte sequences are configured as described above.
2. Select **Start** to transmit the K1 and K2 bytes.

To stop transmitting K1 and K2 bytes:

1. Select a protocol processor mode.
2. Select the **Transmit** button.
3. Select the **APS** button. The initial APS screen appears.
4. Select **Stop**.

Related Topic:

Decoding APS (K1 and K2) Values

Decoding APS (K1 and K2) Values

The APS function monitors incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 15 byte sequences can

appear on the screen. You can choose to view APS activity in either K1 and K2 Hex values or decode them.

To view received K1 and K2 values:

1. Select the **Results** button.
2. Select **APS** from the tabs along the left side of the Results screen.
3. Select **APS View Mode**, and choose whether to decode the K1/K2 byte's value in either **Linear or Ring** Mode.
4. From the APS Results screen, you can decode a **specific** K1/K2 byte's value or decode the values for **all** K1/K2 bytes.

To decode a specific K1/K2 byte value:

- Select **APS Summary**.

  The results table displays the K1 byte HEX value, K2 byte HEX value, number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

  a. Select the desired **Item** row. The APS Decode dialog box appears with the K1 and K2 byte values decoded.
  b. You can scroll through the Items by selecting the **Prev** and **Next** buttons at the bottom of the APS Decode dialog box. Choose **Cancel** when finished.

To decode all K1/K2 byte values:

- Select **APS Decode**.

  The results table splits into two horizontal tables: the top table displaying K1 byte results; the bottom table displaying K2 byte results.

  The K1 table decodes the values for bits 1-4 and bits 5-8. The K2 table decodes the values for bits 1-4, bit 5, and bits 6-8.

  Also displayed in the tables are the number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

NGMR Screen Functions and Descriptions
SONET (NGMR) Screen Functions and Descriptions Overview

This section of the online help system describes the various functions, buttons, and tabs that control SONET configuration and operation.

The following screens and functions are discussed:

- Transmit
- Receive
- Results
- Test
- Perf Monitor
- LEDs

Transmit

SONET Transmit Screens and Functions

The Transmit functions allow you to define the parameters used for SONET transmitting operations.

The following parameter setting options are available from the Transmit screen:

- Set > Set 1
- Set > Set 2
- Set > Set 3
- SOH
- POH
- PTR
- APS
- VCAT (Only appears when the test set is configured for VCAT.)
- LCAS So (Only appears when the LCAS is enabled)
- Error Alarm

SONET Transmit - Set / Set 1

The SONET Transmit Settings 1 screen configures the unit's transmit parameters. It contains the following functions:

Function	Description
Settings Controls	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings

	established on the Transmit screen will only affect Transmit mode.
Pass Thru Mode	Activates or deactivates passthru mode, allowing an incoming STS signal to pass through the unit without altering the data in the signal. The following options are available: **On** and **Off**.
Interface	Selects the optical or electrical interface. The following options are available: **OC-192, OC-48, OC-12, OC-3, OC-1**, **EC-3**, and **EC-1** If the test set is licensed for Jitter operation, the following options are also available: **OC-3-Jitter**, **OC-12-Jitter**, **OC-48-Jitter,** and **OC-192-Jitter** If the test set is licensed for 1G or 10G LAN, the following options are also available: **802.3 1G LAN (1.250 GHz)**, **802.3 10G LAN (10.3125 GHz)**
Mapping	Defines the type of signals that are combined to create an SONET signal. For example, four STS-48c's can be mapped into an OC-192 signal. Mapping options are dependent on the selected Interface. The following options may be available: • **Unframed Bulk Fill** • **STS 192c Bulk Fill** • **STS-48c Bulk Fill** • **STS-12c Bulk Fill** • **STS-3c Bulk Fill** • **STS-1 Bulk Fill** • **VT-6 Bulk Fill**

	• **VT-2 Bulk Fill** • **VT-1.5 Bulk Fill** If the test set is licensed for VCAT, the following options are also available: • **STS-3c-Xv Bulk Fill** • **STS-1-Xv Bulk Fill** • **VT-6-Xv Bulk Fill** • **VT-2-Xv Bulk Fill** • **VT-1.5-Xv Bulk Fill** If the test set is licensed for 10G WAN, the following options are also available: • **STS-192c Ethernet WAN**
STS-<#> Added	Selects foreground STS# of the mapped signal. When available, select the **STS-<#> Added** button to enter the number of the specific STS channel to set as the *foreground* (source) channel. The default setting is 1. The source channel can be used to transmit alarms, errors, or patterns.
VT Added	Selects foreground VT# of the mapped signal. When available, select the **VT Added** button to enter the number of the specific VT channel to set as the *foreground* (source) channel. The default setting is 1. The source channel can be used to transmit alarms, errors, or patterns. This option appears when VT mapping is selected.
VCAT Channel Appears only when VCAT is	Allows the user to select a VCAT channel, from the specified VCAT group, for Error and Alarm insertion.

licensed, and a VCAT mapping is chosen.	
LCAS Appears only when LCAS is licensed, and the VCAT group has more then one member added.	**Enables** or **Disables** LCAS (Link Capacity Adjustment Scheme) mode.
Background STS-<#> Pattern	Allows the user to select the type of pattern to be inserted into the remaining *background* channels for the SONET signal. Select one of the following: **User-Defined (32 bit value), PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv.**
Payload Pattern	Allows the user to select a test pattern to transmit over the SONET signal. This command is automatically coupled to its equivalent Receive command. Select one of the following: **User-Defined (32 bit value), PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv.** If the test set is licensed for GFP, then **GFP** mapping option is also available.
Clock Reference	Allows the user to select the timing source for the SONET transmit signal. Select one of the following: **Internal, Recovered, Bits/Sets, External 8 KHz, External 1.544 MHz, External 2.048 MHz, External**

	10 MHz. The External clocks are **75 Ohm TTL.**

SONET Transmit - Set / Set 2

The SONET Transmit Settings 2 screen contains the following functions:

Function	Description
Line Frequency Offset	Adjusts the offset of the signal frequency of the transmitted SONET signal. The frequency can be adjusted in parts per million (ppm). Use the data calculator to enter the offset frequency. The frequency offset ranges from -100.0 to 100.0 in increments of 0.1 A **0 (zero)** value equals **Off**.
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. The following options are available: • **Off** - The unit's laser will be off when the unit is turned on. • **On** - The unit's laser will be on when the unit is turned on. • **Restore Previous State** - When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.
SS Bits in the H1 Label	This function allows bits 5 and 6, which are the SS bits, of the H1 Pointer byte to be set to support a SONET or SDH Transport OH. Changes to the Transport OH are another way to stress an SDH network by simulating errors, alarms, and other stress conditions. The following options are available: **SONET (00)**, **SDH (10)**, or **Undefined**.

Path Signal Label	The Path Signal Label is part of the POH and identifies the type of traffic contained in the SPE. The C2 byte is used to indicate the content of the SPE, including the status of the mapped payload. The following options are available: • **00 (Unequipped)** • **01 (Equipped)** • **02 (VT Structured STS)** • **03 (Lock VT Mode)** • **04 (Async DS3 Mapping)** • **12 (Async DS4NA Mapping)** • **13 (ATM Mapping)** • **14 (DQDB Mapping)** • **15 (Async FDDI Mapping)** • **16 (HDLC Over SONET)** • **1A (10G WAN IEEE802.3ae)** • **1B (GFP Mapping)** • **User Defined** (any eight bit pattern 0 to FF). This option is coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will change in the Overhead screen as well.

VT Signal Label	Bits 5 through 7 of the V5 byte are allocated for a VT Signal Label to indicate the content of the VT SPE, including the status of the VT mapped payload. The following options are available: • **(00) Unequipped** • **(01) Equipped** • **(02) Asynchronous** • **(03) Bit Synchronous** • **(04) Byte Synchronous** • **User Defined** - Any 3-bit value 0h to 7h This option is only available for VT-1.5, VT-2, and VT-6 mappings.
Synchronization Status (S1)	Allows the user to set the S1 byte to one of the following: • **00 (Sync Trace Unknown-STU)** • **01 (Stratum 1 Trace-PRS)** • **04 (Transit Node Clock-TNC)** • **07 (Stratum 2 Trace-ST2)** • **0A (Stratum 3 Trace-ST3)** • **0C (SONET Minimum Clk-SMC)** • **0D (Stratum 3E Trace-ST3E)** • **0F (Do Not Use for Sync-DUS)** • **User Defined** (any eight bit pattern 0 to FF)
Trigger In	Determines how the protocol processor responds when an external pulse is received. Each protocol processor can be configured to respond to an external pulse received using

	the Trigger In connector. The following options are available: • **Restart**: The protocol processor will restart when an external pulse is received. • **Error Insert**: The protocol processor will insert an error (as defined by the Output Trigger function) when an external pulse is received. • **None**: The protocol processor will do nothing when an external pulse is received.
TC Overhead Processing	Enables Tandem Connection Monitoring (TCM) transmit mode. • **Path Enable**: For SDH, the unit uses its TCM circuitry and the N1 byte to generate errors and alarms between TCM equipment. For SONET, the unit uses the Z5 byte. • **VT Enable**: For SDH, the unit uses its TCM circuitry and the N2 byte to generate errors and alarms between TCM equipment. For SONET, the unit uses the Z6 byte. • **Disable**: TCM mode is disabled, and the N1/N2 and Z5/Z6 bytes follow normal operation.

SONET Transmit - Set / Set 3

The SONET Transmit Settings 3 screen contains the following functions:

Function	Description
Orderwire Add	Allows you to add or drop an orderwire circuit. The following options are available: **None**, **E1**, **E2**, **F1**, **F2-P, Z3-P**
Datacom Channel Add	Defines specific bytes in the Section and Line overhead that is used to

	send operation and maintenance information between the Section and Line equipment. The following options are available: • **None** • **Section DCC Port** • **Section PRBS 2^7-1** • **Section PRBS 2^7- 1 Inv** • **Line DCC Port** • **Line PRBS 2^7-1** • **Line PRBS 2^7-1 Inv**

SONET Transmit - SOH

The Transmit SOH screen contains the following options:

Function	Description
Showing	Select **Showing** to choose an Overhead slot within the SONET signal. The overhead bytes that appear on the SOH screen are associated with this slot.
Section and Line Overhead bytes	Allows the user to select an Overhead byte to edit its value.
J0 Trace	The J0 byte is part of the Section Overhead and is known as the Section trace or J0 trace. The J0 trace is a 64-byte pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The J0 trace can be configured to send the system's default pattern or a customized pattern. The following options are available: • **Default (64 byte)** - Selects the 64-byte Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 62 characters appended with a CR and LF.

	• **User Defined (64 byte)** - Selects a 64-byte user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones** - Selects an All Ones pattern as the J0 trace pattern. • **All Zeros** - Selects an All Zeros pattern as the J0 trace pattern. • **Default (16 byte)** - Selects the 16-byte Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)** - Selects a 16-byte user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.

SONET Transmit - POH

The Transmit POH screen contains the following options:

Function	Description
STS-<#> Added	Allows the user to enter the number of the specific STS channel to set as the *foreground* (source) channel. The default setting is 1. When a VCAT mapping is chosen, this setting changes to VCAT Channel.
Path and VT Overhead Bytes	Path Overhead Bytes include: B3, J1,

	C2, G1, F2, H4, Z3, Z4, and Z5. VT Overhead Bytes include: V5, J2, Z6, and Z7. **Note**: This option will be disabled if Passthru mode is enabled.
J1 Trace	Selects a default or customized pattern to be used as the J1 trace. Select one of the following patterns: • **Default (64 byte)**: Selects the Digital Lightwave ASCII message as the J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)**: Selects a user-defined ASCII message as the J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones**: Selects an All Ones pattern as the J1 trace pattern. • **All Zeros**: Selects an All Zeros pattern as the J1 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.

TC Trace	The TC Trace is a 16-byte pattern that can be created for repeated transmission between TCM equipment. The pattern is a string of ASCII characters and can be configured to send the unit's default pattern or a customized pattern. Enable TCM mode (using TC Overhead Processing) before sending the TC Trace. Select one of the following patterns: • **Default**: Selects the 16-byte Digital Lightwave ASCII message as the TC trace pattern. • **All Ones** - Selects an All Ones pattern as the TC Trace pattern. • **All Zeros** - Selects an All Zeros pattern as the TC Trace pattern. • **User Defined**: Selects a 16-byte user-defined ASCII message as the TC trace pattern. The message is entered and saved using a touch screen keyboard.

SONET Transmit - PTR

The Transmit PTR screen contains the following options:

Function	Description
NDF Flag	The NDF Flag allows you to specify whether the NDF bits are set when a new Pointer is present in the generated signal. The following options are available: **Yes** (On): Generates an NDF when a

	new Pointer is transmitted. **No** (Off): Disables NDF functionality.
Pointer Value	The Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the Virtual Container. The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from 0 to 782. After entering the new Pointer Value, the Pointer automatically moves to the new position.
Frequency Offset	Adjusts the rate at which AU Pointer adjustments are needed in the Administrative Unit (AU). Enter a frequency type ranging from -100.0 ppm to +100.0 ppm. This function is disabled by entering 0.
Pointer Action	Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. **Single options** - Inserts a single Pointer movement with each selection of the INC Pointer or DEC Pointer button. The Pointer value changes by one. **Increment/Decrement option** - Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. **Continuous options** - Inserts a continuous Pointer movement with the selection of the INC Pointer or DEC Pointer button. The movement continues until the Stop Sequence button is selected.
Burst Count	This function allows you to determine the number of Pointer location

	movements to occur when the INC Pointer or DEC Pointer buttons are pressed. The Pointer burst count ranges from 1 to 8.
Ms between Bursts	Allows the user to set the number of Milliseconds between bursts. Valid valued are 34 - 10000.
INC Pointer / DEC Pointer	Alternates the Pointer insertion from increment to decrement with a 200-msec delay in between.

APS

Transmit APS

This is an Automatic Protection Switching (APS) function used to configure transmit APS activity. APS is a feature that allows the LTE to switch to a backup line in case of errors or failures on the main line. APS commands can be configured for either Linear- or Ring-based networks and are transmitted using bytes K1 and K2 of the Line overhead.

You can test the network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response.

The following options are available on the APS screen:

- **New Item** - Opens the Apply Maintenance to Entry window, from which you configure K1 and K2 bytes.
- **Start** - Begins transmission of the K1 and K2 byte configuration.
- **Clear** - Clears the table.

The following Apply Maintenance to Entry window APS Transmit functions are available:

APS Mode - Linear

This function configures the system to transmit APS functions for a Linear (span) network.

- K1 Full Byte (Linear Mode)
- K1 Bits 1-4 (Linear Mode)
- K1 Bits 5-8 (Linear Mode)
- K2 Full Byte (Linear Mode)
- K2 Bit 5 (Provisioned) (Linear Mode)
- K2 Bits 1-4 (Linear Mode)

- K2 Bits 6-8 (Linear Mode)

APS Mode - Ring

This function configures the system to transmit APS functions for a Ring network.

- K1 Full Byte (Ring Mode)
- K1 Bits 1-4 (Ring Mode)
- K1 Bits 5-8 (Ring Mode)
- K2 Full Byte (Ring Mode)
- K2 Bit 5 (Provisioned) (Ring Mode)
- K2 Bits 1-4 (Ring Mode)
- K2 Bits 6-8 (Ring Mode)

Duration in Frames

The Duration in Frames function determines the number of frames transmitted that contain specific K1 and K2 bytes. These bytes are configured using the functionality located on the transmit APS screen.

Frame count is entered using a keypad. Values ranging from 1 to 65535 frames can be entered.

K1 Bits 1-4 (Linear Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description
(0000) NR	No Request, Bit pattern 0000
(0001) Non Rev	Do not revert, Bit pattern 0001
(0010) RR	Reverse Request (Ring), Bit pattern 0010
(0011) Unused	Not Used, Bit pattern 0011
(0100) EXER	Exerciser (Ring), Bit pattern 0100
(0101) Unused	Not used, Bit pattern (0101)
(0110) WTR	Wait to restore, Bit pattern (0110)
(0111) Unused	Not used, Bit pattern (0111)
(1000) MS	Manual switch, Bit Pattern 1000
(1001) Unused	Not used, Bit pattern (1001)

(1010) SD-LP	Signal degrade low priority, Bit pattern (1010)
(1011) SD-HP	Signal degrade high priority, Bit pattern (1011)
(1100) SF-LP	Signal fail low priority, Bit pattern (1100)
(1101) SF-HP	Signal fail high priority, Bit pattern (1101)
(1110) FS	Forced switch, Bit pattern (1110)
(1111) LP	Lockout of protection, Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	**Description**
(0000) NR	No request, Bit pattern 0000
(0001) RR-R	Reverse request (Ring), Bit pattern 0001
(0010) RR-S	Reverse request (Span), Bit pattern 0010
(0011) EXER-R	Exerciser (Ring), Bit pattern 0011
(0100) EXER-S	Exerciser (Span), Bit pattern 0100
(0101) WTR	Wait to restore, Bit pattern (0101)
(0110) MS-R	Manual switch (Ring), Bit pattern (0110)
(0111) MS-S	Manual switch (Span), Bit pattern (0111)
(1000) SD-R	Signal degrade (Ring), Bit Pattern 1000
(1001) SD-S	Signal degrade (Span), Bit pattern (1001)
(1010) SD-P	Signal degrade (Path), Bit pattern (1010). This is the Transmit Default button setting.
(1011) SD-R	Signal degrade (Ring), Bit pattern (1011)
(1100) SF-S	Signal fail (Span), Bit pattern (1100)
(1101) FS-R	Forced switch (Ring), Bit pattern (1101)

(1110) FS-S	Forced switch (Span), Bit pattern (1110)
(1111) LP-S	Lockout of protection (Span), Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 5-8 (Linear Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Linear mode, these bits indicate the channel number. For example, Code 0 is the Null Channel, Codes 1-14 are the working channels, and Code 15 is an extra traffic channel.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit

	pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Bits 5-8 (Ring Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Ring mode, these bits contain the Destination Code Identification.

The following options are available:

Options	**Description**
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011

#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Full Byte (Linear Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	**Description**
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.

Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K1 Full Byte (Ring Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Bit 5 (Provisioned) (Linear Mode)

This function edits the 5th bit of the K2 byte. In Linear mode. This bit controls the type of protection switching architecture used.

The following options are available:

Options	Description
1+1	Provisioned for 1+1 mode; Bit 5 = 0

1 : n	Provisioned for 1:n mode; Bit 5 = 1

K2 Bit 5 (Provisioned) (Ring Mode)

This function edits the 5th bit of the K2 byte. In Ring mode, this bit controls the type of path code used.

The following options are available:

Options	Description
SHT / OTO	Short Path Code; Bit 5 = 0
LNG / OTN	Long Path Code; Bit 5 = 1. When selected, both the Transmit Default and Transmit Illegal button settings are configured for LNG/OTN.

K2 Bits 1-4 (Linear Mode - SDH)

This function edits the first four bits of the K2 byte. In Linear mode, the first four bits indicate which working channel is bridged onto the protection channel during a traffic switching event.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit

	pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K2 byte. In Ring mode, the first four bits are the Source Node Identification. (The Source Node ID is set to the Node's own ID.)

The following options are available:

Options	**Description**

#0	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Linear Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Unused	Not used, Bit pattern 000
(001) Unused	Not used, Bit pattern 001
(010) Unused	Not used, Bit pattern 010
(100) Unused	Not used, Bit pattern 100
(100) Uni-direct	Provisioned for Unidirectional switching, Bit pattern 10
(101) Bi-direct	Provisioned for Bidirectional switching, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Ring Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Idle	Idle, Bit pattern 000
(001) Br	Bridged, Bit pattern 001
(010) Br&Sw	Bridged and switched, Bit pattern 010. This is the Transmit Default button setting.
(100) Ex Tr	Extra traffic on protection channel, Bit pattern 100
(100) Unused	Not used, Bit pattern 10
(101) Unused	Not used, Bit pattern 101

(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Full Byte (Linear Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Full Byte (Ring Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description

Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

Transmit - VCAT

The Transmit VCAT function allows you to add and configure VCAT channels for transmitting operations.

For instructions on configuring VCAT see How to Set Up and Use VCAT Features.

VCAT channels created and various other parameters are displayed in the VCAT Table.

The Transmit VCAT contains three function buttons, as defined below:

Function Button	Description
Delete All	Deletes all channels from the VCAT table.
Reset Seq #s	Restores the sequence numbers to default on all channels in the VCAT Table. The first channel in the table will be 0, followed by 1, 2, 3, etc.
Clear Operations	Resets all delays to 0 and stops all other operations. See definition of "operations" below.

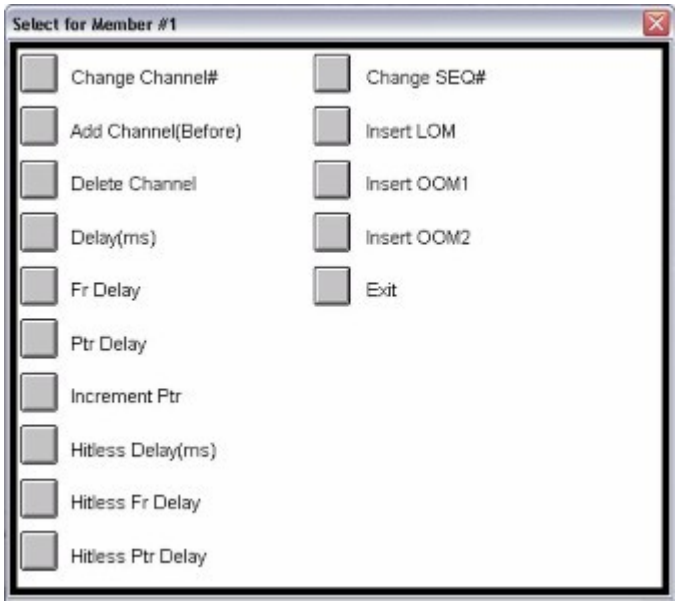
Definitions of VCAT Table columns:

Function	Description

Add	Click on Add to select members for the VCAT Group (VCG). A Select Channel screen appears which shows all possible channel member available to choose from. When a channel has been selected, the channel button will gray-out to indicate that it is already selected. If the Setting Control are set to Coupled, then members added to the Transmit VCG will also be added to the Receive VCG.
Member	Sequential list indicating the order in which the payload will be transmitted into the VCAT channels, regardless of the number indicated by "Seq-SQM".
Chan	Channel Number. Displays the VCAT Member's channel number. For High-Order mappings, the number will just be the AU#(for SDH) or STS#(for SONET). For Low-Order mappings SDH mappings, the address will be displayed in the following format: AU# N K,L,M, with N indicating the AU#, and the others indicating TUG-3, TUG-2 and TU# as applicable. For Low-Order SONET mappings, the address will be displayed in the following format: STS# N K,L, with N indicating the STS#, and the others indicating VT group# and VT# as applicable.
Seq # or Seq-SQM	The default and normal condition for Sequence Indicator is from 0 to N. Changing the Sequence Indicator manually will create a Sequence Mismatch (SQM) at the receiver. This column indicates the Sequence

	Indicator Number not the actual order that the payload is transmitted, as displayed in the "Member" column. The "Seq#" label changes to "Seq-SQM" when inserting a Sequence Mismatch.
Delay (ms)	Combined Delay. The amount of time to delay this member as compared to the earliest member. This delay is calculated based on the combined time for the specified frame and pointer delays, and is expressed in milliseconds. 1 ms = 8 frames.
Fr Delay	Frame Delay. The number of frames to delay this member as compared to the earliest member. This delay is the same as indicated in Delay (ms), expressed in frames. 1 frame = .125 ms.
Ptr Delay	Pointer Delay. Sets the pointer value for this member, creating a very small delay.
Operation	Indicates whether an alarm condition has been turned on for this member, either Out of Multiframe (OOM1 or OOM2) or Loss of Multiframe (LOM).

Click on any row of the VCAT Table to bring up the "Select for Member #N" menu as seen here:



The first three menu items (Change Channel#, Add Channel and Delete Channel) specifically apply to the Transmit VCAT Table. However, If "Settings Control" is set for "Coupled" (see Transmit or Receive "Set" tab), the changes will apply to both Transmit and Receive VCAT Tables. If "Settings Control" is set for independent, the change will apply only to the Receive VCAT Table.

This menu is used to setup the selected member with any of the following menu functions.

Function	**Description**
Change Channel #	Selects which channel (time slot) will be used by this member.
Add Channel (before)	Adds one additional member in the next slot above the selected member. Selecting this menu item will bring up another menu where channel number is selected.
Delete Channel	Deletes the selected channel (member).
Delay (ms)	Inserts Combined Frame and Pointer Delays on the selected member, entered in milliseconds (ms).
Fr Delay	Inserts Frame Delay on the selected member entered in number of frames.
Ptr Delay	Changes the pointer value of the selected member, creating a very small delay.

Increment Ptr	Increases pointer value of the selected member by a value of 1.
Hitless Delay (ms)	Inserts Combined Delay on the selected member, entered in milliseconds (ms) without causing a Loss of Multiframe (LOM) alarm.
Hitless Fr Delay	Inserts Frame Delay on the selected member entered in number of frames) without causing a Loss of Multiframe (LOM) alarm.
Hitless Ptr Delay	Changes the pointer value of the selected member, creating a very small delay) without causing a Loss of Multiframe (LOM) alarm.
Change SEQ#	Changes the Sequence Indicator, not the actual order that the payload is transmitted, as displayed in the "Member" column. Changing the Sequence Indicator manually will create a Sequence Mismatch (SQM) at the receiver.
Insert LOM	Inserts Loss of Multiframe alarm
Insert OOM1	Inserts Out of Multiframe alarm 1
Insert OOM2	Inserts Out of Multiframe alarm 2
Exit	Closes the window without changing the setup of the member

Transmit - LCAS So

For detailed information about LCAS, and instructions on configuring LCAS, see How to Set Up and Use LCAS Features.

Definition of Source (So) and Sink (Sk)

The Source functionality is available from the Transmit - LCAS So screen, and the Sink functionality is available from the Receive - LCAS Sk screen.

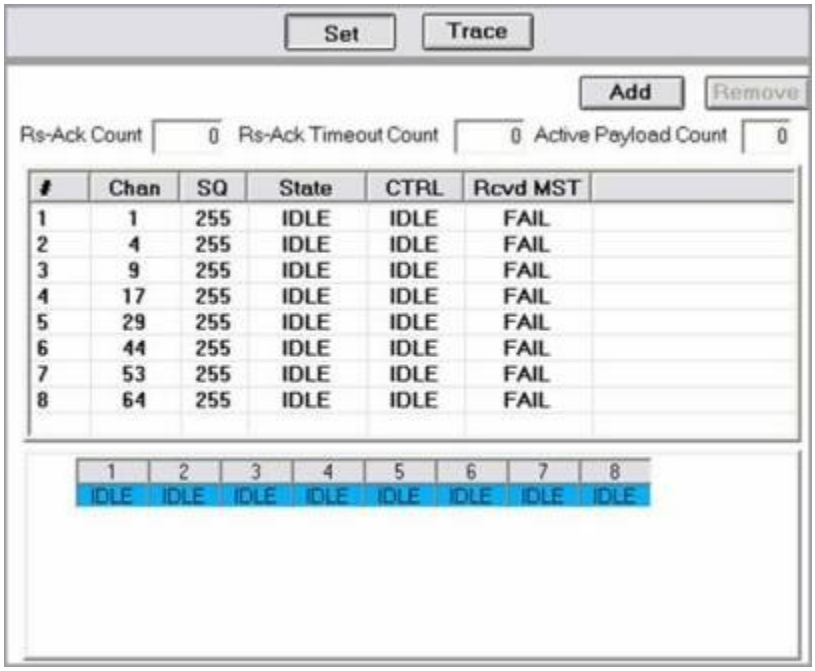
Unlike VCAT, which is bi-directional, LCAS operates on a one-way basis. The transmit of an LCAS system is designated “Source” and the receive is designated “Sink”. LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other

direction may be configured as LCAS as well but there is no correlation between the two.

LCAS Transmit Settings

Access LCAS Transmit features by the selecting

(LCAS Source) side tab from the Transmit screen. The LCAS Settings table will appear, listing all of the members within the transmit VCG.



The transmit LCAS settings table is used to configure LCAS Source functions.

The following functions are found in the transmit LCAS settings table

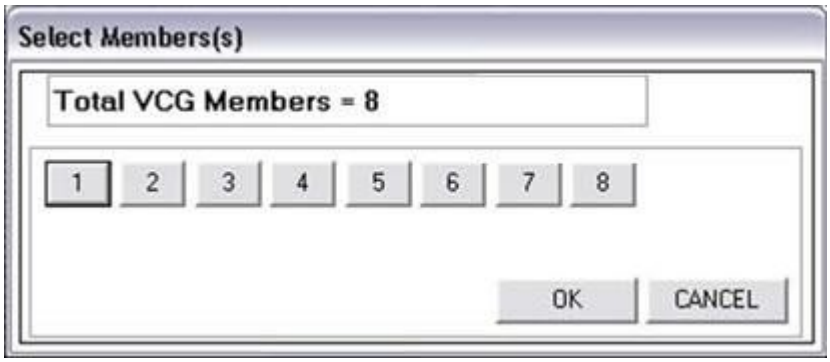
Function	Description
Set (button)	Selects the LCAS Settings Table
Trace (button)	Selects the LCAS Trace Table
Add (button)	Adds selected VCG members to the LCAS data stream
Remove (button)	Removes selected VCG members from the LCAS data stream
Rs-Ack Count	Number of Resequence - Acknowledge messages received
Rs-Ack Timeout Count	Number of times when no Resequence -

	Acknowledge was received before the timeout period
Active Payload Count	Number of VCG members that make up the payload
#	Member number, sequential
Chan	Channel. Displays the VCAT Member's channel number. For SDH High-Order mappings, the number will just be the AU#. For SONET STS mappings, the number will just be the STS#. For SDH Low-Order mappings, the address will be displayed in the following format: AU# N K,L,M, with N indicating the AU#, and the others indicating TUG-3, TUG-2 and TU# as applicable. For SONET VT mappings, the address will be displayed in the following format: STS# N K,L, with N indicating the STS#, and the others indicating VT group# and VT# as applicable.
SQ	Sequence number. If this member is not active, the sequence number will an invalid number (255 for high-order mapping, lower values for low-order mapping). For active members, the sequence number will be 0, 1, 2, etc.
State	Indicates the state of this VCG member. The possible states are: **IDLE**: This member is not in use. **NORM**: This member is part of the payload. **DNU**: Do Not Use. Failure state. **ADD**: Source has requested to add this member to the payload. Waiting for Sink response. **REMOVE**: Source has requested to remove this member from the payload. Waiting for Sink response.
CTRL	Control message sent from Source to Sink.

	Possible values are: **ADD**: Member to be added to the VCG **NORM**: Normal LCAS transmission **EOS**: End of Sequence, highest member in group **IDLE**: Member is part of the VCG or to be removed **DNU**: Do not use, Sink reports failure
Rcvd MST	Member Status received from Sink (Sk)
Member State-LED	The State-LED provides a visual indication of which LCAS State or condition the VCG member is in. The possible states are: IDLE This VCG member has not been added to LCAS. NORM This member is part of the payload. DNU Do Not Use. Failure state. ADD Source has requested to add this member to the payload. Waiting for Sink response. REM Source has requested to remove this member from the payload. Waiting for Sink response.

Add and Remove

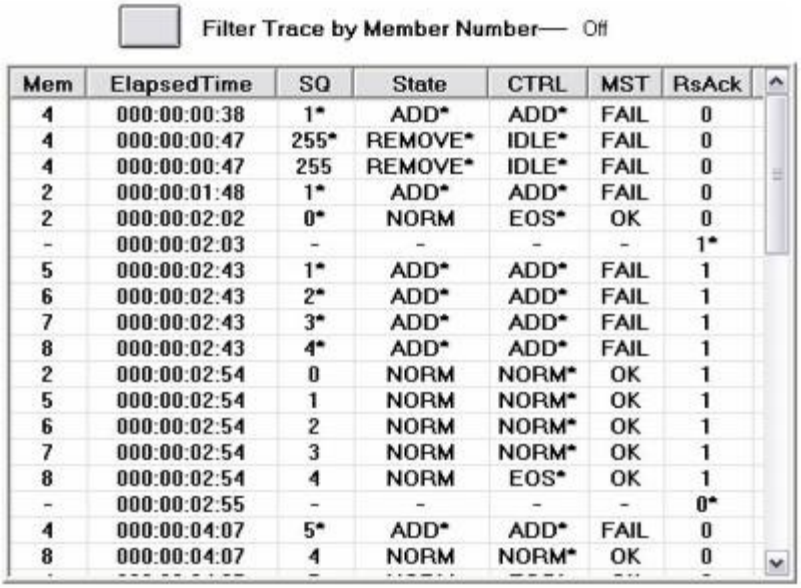
Press **Add** or **Remove** to select which VCG members are to be added or removed from the LCAS data stream.



- When adding or removing members, the button becomes disabled to indicate that the member has already been added or removed.

LCAS Transmit Trace

Press **Trace** to display the LCAS Trace Table.



Mem	ElapsedTime	SQ	State	CTRL	MST	RsAck
4	000:00:00:38	1*	ADD*	ADD*	FAIL	0
4	000:00:00:47	255*	REMOVE*	IDLE*	FAIL	0
4	000:00:00:47	255	REMOVE*	IDLE*	FAIL	0
2	000:00:01:48	1*	ADD*	ADD*	FAIL	0
2	000:00:02:02	0*	NORM	EOS*	OK	0
-	000:00:02:03	-	-	-	-	1*
5	000:00:02:43	1*	ADD*	ADD*	FAIL	1
6	000:00:02:43	2*	ADD*	ADD*	FAIL	1
7	000:00:02:43	3*	ADD*	ADD*	FAIL	1
8	000:00:02:43	4*	ADD*	ADD*	FAIL	1
2	000:00:02:54	0	NORM	NORM*	OK	1
5	000:00:02:54	1	NORM	NORM*	OK	1
6	000:00:02:54	2	NORM	NORM*	OK	1
7	000:00:02:54	3	NORM	NORM*	OK	1
8	000:00:02:54	4	NORM	EOS*	OK	1
-	000:00:02:55	-	-	-	-	0*
4	000:00:04:07	5*	ADD*	ADD*	FAIL	0
8	000:00:04:07	4	NORM	NORM*	OK	0

- The Trace table displays an event log history of changes in the LCAS configuration since the last time the test was restarted.

Function	Description
Filter Trace by Member Number	Select **User Defined** to specify an individual member number. Only the activity of the selected member will be displayed. Select **Off** to display the activity of all members.

SONET Transmit - Error Alarm

The test unit can transmit errors and alarms to simulate various defects and anomalies to determine if the receiving equipment can detect an error or alarm in the incoming signal.

For information on inserting errors and alarms see the online help topics, Inserting Errors and Inserting Alarms in the Common Tasks section.

The following options are available one the Error Alarm screen:

- Error to Insert
- Error Insert Rate
- Alarm Generated

Error to Insert

This SONET Transmit function determines the type of error transmitted by the system.

The purpose of generating an error with system is to stress the network element that is receiving the error by testing if it can detect the incoming error and then report error statistics such as error counts and rates.

The following options are available:

Option	Description
None	No errors are generated. Turns errors off.
Frame	Inserts a frame alignment error in the A1 and A2 bytes.
B1 Error	Generates a BIP-8 (Bit Interleaved Parity, 8-bit) error over the Section layer. Bits in the B1 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
B2 Error	Generates a BIP-8 error over the Line layer. Bits in the B2 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
REI-L	Generates a Remote Error Indicator over the Line layer. An REI-L is a

	count of B2 errors received at the far end. When the system transmits this error, it simulates a downstream NE sending an error count back to the source of its incoming SONET signal. The system uses the M1 byte of the Line OH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and rates. (This type of error was formerly called a Line Far End Block Error - FEBE-L.)
B3 Error	Generates a BIP-8 error over the STS Path layer. Bits in the B3 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
REI-P	Generates a Remote Error Indicator over the Path layer. An REI-P is a count of B3 errors received at the far end. When the system transmits this error, it simulates an NE sending an error count back to the source of its incoming SONET signal. The system uses the G1 byte of the Path OH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error

	counts and error rates. (This type of error was formerly called a Path Far End Block Error - FEBE-P.)
BIP-V	Generates a BIP-2 error over the VT layer. Bits in the V5 byte are toggled to create an error.
REI-V	Generates a Remote Error Indicator over the VT layer. An REI-V is a count of BIP-V errors received at the far end. When the system transmits this error, it simulates an NE sending an error count back to the source of its incoming SDH signal. The system uses the V5 byte of the VTOH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and error rates.
TC-IEC-P Only appears when the TC Overhead Processing is configured for "**Path Enable**".	Generates a Tandem Connection Incoming Error Count over the Path layer. A TC-IEC is a count of B3 errors received by TCM equipment at the far end. Bits 1-4 of the N1 byte are the IEC bits.
TC-REI-P Only appears when the TC Overhead Processing is configured for "**Path Enable**".	Generates a Tandem Connection Remote Error Indicator over the Path layer between TCM equipment. Bit 5 of the N1 byte is used for this error.
TC-OEI-P Only appears when the TC Overhead Processing is configured for "**Path Enable**".	Generates a Tandem Connection Outgoing Error Indicator over the Path layer between TCM equipment. Bit 6 of the N1 byte is used for this error.
TC-BIP-V Only appears when the TC	Generates a Tandem Connection Bit Interleaved Parity error over the VT layer. Bits 1-2 of the N2 byte are the BIP bits.

Overhead Processing is configured for "**VT Enable**".	
TC-REI-V Only appears when the TC Overhead Processing is configured for "**VT Enable**".	Generates a Tandem Connection Remote Error Indicator over the VT layer between TCM equipment. A TC-REI-V is a count of TC-BIP-V errors received by TCM equipment at the far end. Bit 5 of the N2 byte is used for this error.
TC-OEI-V Only appears when the TC Overhead Processing is configured for "**VT Enable**".	Generates a Tandem Connection Outgoing Error Indicator over the VT layer between TCM equipment. Bit 6 of the N2 byte is used for this error.
BIT Error	Generates bit errors. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and error rates.

Error Insert Rate

This SONET Transmit function sets the error rate for the selected error. The system starts transmitting errors after the insertion rate is selected.

For information about inserting errors, see Inserting Errors in the Common Tasks section of the online help.

The following Error Insert Rate options are available:

Option	Description
Off	Turns error transmission off.
Maximum	Generates errors at the maximum rate listed below.
1e - *X*	*X* is a value from 3 to 10; for example, 1e-3 through 1e-10. *X* will vary based on the type of error selected.
User Defined	Allows the user to enter a custom error. Valid values are 1e-6 to 1e-10.

Alarm Generated

This function configures the system to generate an alarm in the transmit SONET signal. Alarm generation by the system is one way to test if downstream SONET equipment reacts properly to the alarm it receives in the incoming SONET signal.

For information about generating alarms, see Inserting Alarms in the Common Tasks section of the online help.

The following alarms are available:

Alarm	Description
None	No alarms are generated. Turns alarms off.
LOS	Loss of Signal. An all-zeros pattern is transmitted to simulate a loss of signal or loss of optical power. This forces the downstream SONET equipment to (1) generate an AIS alarm to its downstream network elements (NE), and (2) generate an RDI alarm to its upstream NEs.
LOF	Loss of Frame. An all-zeros pattern is inserted into the A1 and A2 framing bytes of the Section OH. This simulates the absence of a valid framing pattern. This forces the downstream SONET equipment to generate an AIS alarm to its downstream network elements (NE)and generate an RDI alarm to its upstream NEs.
AIS-L	Line Alarm Indication Signal. The transmission of an AIS-L to a downstream NE forces that NE to send an AIS-P alarm to the next downstream NE. The NE will also send an RDI-L alarm to its upstream equipment. An AIS-L simulates an alarm generated by Line terminating equipment (LTE).

RDI-L	Line Remote Defect Indicator. This generates an RDI-L condition using the K2 byte of the Line OH. This simulates a downstream NE (in this case the NIC) at the Line layer, reporting a failure to an upstream NE. The downstream NE (NIC 10G) has encountered a downstream failure and is alerting upstream SONET equipment. To do this, the NIC 10G changes the pattern of the K2 byte. The NE receiving the RDI-L alarm should detect a change to the K2 byte on the incoming SONET signal. This forces the NE to generate a Remote Alarm Indicator (RAI) to its upstream NEs.
LOP-P	STS Path Loss of Pointer. This simulates a loss of a valid STS Pointer. When the downstream NE receives an LOP-P, it generates a DSn AIS alarm to its downstream equipment and an RDI-P alarm to its upstream equipment.
AIS-P	Path Alarm Indication Signal. The transmission of an AIS-P to a downstream NE forces that NE to send an AIS alarm to the next downstream NE. The NE will also send an RDI alarm to its upstream equipment. An AIS-P simulates an alarm generated by Path terminating equipment (PTE).

RDI-P	Path Remote Defect Indicator. This generates an RDI-P condition using the G1 byte of the Path OH. This simulates a downstream NE (in this case, the NIC), at the Path layer, reporting a failure to an upstream NE. To do this, the system changes the pattern of the G1 byte in the Path OH. The NE receiving the RDI-P alarm should detect a change to the G1 byte on the incoming SONET signal.
UNEQ-P	Path Unequipped Alarm. An all-zeros pattern is inserted into the C2 byte of the Path OH. The C2 byte is the STS Path Signal Label. (This type of error is used between Path terminating equipment - PTE) When a PTE receives this alarm, it will generate an AIS to downstream NEs.
TC-RDI-P Only appears when the TC Overhead Processing is configured for "**Path Enable**".	Tandem Connection-Remote Defect Indicator. Generates an alarm to upstream equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 8 in multiframe 73 of the N1 byte.
TC-ODI-P Only appears when the TC Overhead Processing is configured for "**Path Enable**".	Tandem Connection-Outgoing Defect Indicator. Generates an alarm to upstream TCM equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 7 in multiframe 74 of the N1 byte.
TC-AIS-P Only appears when the TC Overhead Processing is configured for "**Path Enable**".	Tandem Connection-Alarm Indication Signal. Generates an AIS alarm to downstream TCM equipment by setting Bits 1-4 of the N1 byte to 1110.

TC-UNEQ-P Only appears when the TC Overhead Processing is configured for "**Path Enable**".	Tandem Connection-Unequipped. An all-zeros pattern is inserted into the N1 byte of the Path OH.
TC-LOF-P Only appears when the TC Overhead Processing is configured for "**Path Enable**".	Tandem Connection-Loss of Frame. Generates a loss of a valid multiframe pattern to downstream equipment.

Receive

SONET Receive Screens and Functions

The Receive function allows you to define the parameters used in SONET receiving operations.

The following parameter setting options are available from the Receive screen:

- Set > Set 1
- Set > Set 2
- Set > Set 3
- SOH
- POH
- SIG
- VCAT (Only appears when the test set is configured for VCAT)
- LCAS Sk (Only appears when the LCAS is enabled)

SONET Receive - Set / Set 1

The SONET Receive Settings 1 screen configures the unit's receive parameters. It contains the following functions:

Function	Description
Settings Control	If **Coupled** is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If **Independent** is selected, settings established on the Receive screen will only affect Receive mode.

Interface	Selects the optical or electrical interface. The following options are available: **OC-192**, **OC-48**, **OC-12**, **OC-3**, **OC-1**, **EC-3**, **EC-1** If the test set is licensed for Jitter operation, the following options are also available: **OC-3-Jitter**, **OC-12-Jitter**, **OC-48-Jitter** If the test set is licensed for 1G or 10G LAN, the following options are also available: **802.3 1G LAN (1.250 GHz)**, **802.3 10G LAN (10.3125 GHz)**

Mapping	Defines the type of signals that are combined to create an SONET signal. For example, four STS-48c's can be mapped into an OC-192 signal. Mapping options are dependent on the selected Interface. The following options may be available: • **Unframed Bulk Fill** • **STS-192c Bulk Fill** • **STS-48c Bulk Fill** • **STS-12c Bulk Fill** • **STS-3c Bulk Fill** • **STS-1 Bulk Fill** • **VT-6 Bulk Fill** • **VT-2 Bulk Fill** • **VT-1.5 Bulk Fill** If the test set is licensed for VCAT, the following options are also available: • **STS-3c-Xv Bulk Fill** • **STS-1-Xv Bulk Fill** • **VT-6-Xv Bulk Fill** • **VT-2-Xv Bulk Fill** • **VT-1.5-Xv Bulk Fill** If the test set is licensed for 10G WAN, the following options are also available: • **STS 192c Ethernet WAN**

STS-<#> Dropped	Selects a specific signal to monitor in the SONET signal. The test set receives the SONET signal that is demuxed into dropped signals and then processed. The options that appear will depend on your current configuration. The default setting is 1.
VT Dropped	Selects a Virtual Tributary to dropped. This option appears when VT mapping is selected.
VCAT Channel Appears only when VCAT is licensed, and a VCAT mapping is chosen.	Allows the user to select a VCAT channel, from the specified VCAT group, for Error and Alarm insertion.
LCAS Appears only when LCAS is licensed, and the VCAT group has more then one member added.	**Enables** or **Disables** LCAS (Link Capacity Adjustment Scheme) mode.
Payload Pattern	Selects the type of pattern that the unit expects to receive on the incoming SONET signal. The following options are available: • **Live** (user data is received; no pattern is used) • **User Defined** (range from 1 bit to 32 bits and is entered using a touch screen keypad) • **PRBS 9**, **PRBS 9 Inv**, **PRBS 11**, **PRBS 11 Inv**, **PRBS 15**, **PRBS 15 Inv**, **PRBS 20**, **PRBS 20 Inv**, **PRBS 23**, **PRBS 23 Inv**, **PRBS 31**, **PRBS 31 Inv** If the test set is licensed for GFP, then **GFP** mapping option is also

	available.
Power Low Threshold	Sets the power threshold. If the power drops below the threshold, the Power Low alarm initiates. When the threshold is reached, the LOS alarm signals.
Out of Frequency Threshold	Sets the frequency threshold for the Line Frequency Offset. When the threshold is reached, the Frequency Wide alarm is triggered.
Trigger Out	Allows the user to select the way that the protocol processor will respond to an external "pulse" received.

SONET Receive - Set / Set 2

The SONET Receive Settings 2 screen configures the unit's receive parameters. It contains the following functions:

Function	**Description**
PLM Alarm Reporting	**Disable** or **Enable** Payload Label Mismatch reporting.
Expected Path Signal Label	Enter any eight bits for the Higher-Order Path Signal Label for byte C2 expected. Configure to receive a specific value for the C2 byte. The following options

	are available: • **00 (Unequipped)** • **01 (Equipped)** • **02 (VT Structured STS)** • **03 (Lock VT Mode)** • **04 (Async 34M/45M Mapping)** • **12 (Async DS4NA Mapping)** • **13 (ATM Mapping)** • **14 (DQDB Mapping)** • **15 (Async FDDI Mapping)** • **16 (HDLC Over SONET)** • **1A(10G WAN IEEE802.3ae)** • **User Defined** (any eight bit pattern 0 to FF) This option is not coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will not change the Transmit setting.
Expected VT Signal Label	Select one of the following values for the expected Lower Order Path Signal: • **00 (Unequipped)** • **01 (Equipped)** • **02 (Asynchronous)** • **03 (Bit Synchronous)** • **04 (Byte Synchronous)** • **User Defined** (any eight bit pattern 0 to FF) This option only appears when VT mapping is configured. It is not coupled with the V5 byte option in the Transmit Overhead screen. If it is changed in this screen, it will not change the Transmit setting.
TIM Alarm Reporting	An STS Path Trace Identifier Mismatch (TIM-P) alarm occurs when the incoming J1 trace does not match the expected J1 trace.

	A Section Trace Identifier Mismatch (TIM-S) alarm occurs when the incoming J0 trace does not match the expected J0 trace. The following options are available: • **Enabled** - TIM alarms are recognized and reported. • **Disabled** - TIM alarms are ignored.
Expected J0	Defines the expected J0 trace received on the incoming SONET signal. A TIM-S alarm occurs if the incoming J0 trace does not match the expected J0 trace. The J0 byte is part of the Section OH and is known as the Section trace, or J0 trace. The J0 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. • **Default (64 byte)** - Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)** - Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones** - Selects an All Ones pattern as the J0 trace pattern. • **All Zeros** - Selects an All Zeros pattern as the J0 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the expected J0

	trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.
Expected J1	Defines the expected J1 trace received on the incoming SONET signal. A TIM-P alarm occurs if the incoming J1 trace does not match the expected J1 trace. The J1 byte is part of the Higher-order Path OH and is known as the Path trace, or J1 trace. The J1 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The following options are available: • **Default (64 byte)** - Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)** - Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones** - Selects an All Ones pattern as the J1 trace pattern. • **All Zeros** - Selects an All Zeros pattern as the J1 trace pattern.

	• **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.
Expected J2	Defines the expected J2 trace received on the incoming SONET signal. A TIM-P alarm occurs if the incoming J2 trace does not match the expected J2 trace. The J2 byte is part of the Lower-order Path OH. The J2 trace is a pattern that can be created for repeated transmission. This 16-byte frame is identical to the 16-byte frame of the J1 and J0 bytes. The following options are available: • **Default (64 byte)** - Selects the Digital Lightwave ASCII message as the expected J2 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)** - Selects a user-defined ASCII message as the expected J2 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones** - Selects an All Ones pattern as the J2 trace pattern. • **All Zeros** - Selects an All

	Zeros pattern as the J1 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the expected J2 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the expected J2 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.
SS Bits Alarm Reporting	**Disables** or **Enables** SS bits reporting. This function is used in conjunction with the Expected SS Bits function. If enabled, and an SS Bits mismatch is detected on the received signal, the duration in seconds will appear under the Results Scan function.
Expected SS Bits	Selects one of the following as the expected SS Bits value: • **00 (SONET)** • **01 (Undefined)** • **10 (SDH)** • **11 (Undefined)**
TC Error/Alarm Processing	Enables or disables Tandem Connection Monitoring (TCM) mode. This function is used in conjunction with the Expected TC Trace function. The TC Summary LED turns red if a TCM error or alarm is reported. Select the TC Summary text for more details. • **Path Enable** - Turns on N1 byte for TCM error and alarm

	reporting mode. • **VT Enable** - Turns on the N2 byte for TCM error and alarm reporting mode. • **Disable** - Turns off TCM error and alarm reporting mode. Disable this option if you are not performing TCM testing. This will prevent false error and alarm reporting.
Expected TC Trace	Defines the expected TC trace received on the incoming signal. For SONET, this is in the Z5 byte. For SDH, this is in the N1 byte. The following options are available: • **Default** - Selects a 16-byte Digital Lightwave ASCII message at the expected TC trace pattern. • **All Ones (16 byte)** - Selects a 16-byte All Ones pattern as the TC trace pattern. • **All Zeros (16 byte)** - Selects a 16-byte All Zeros pattern as the TC trace pattern. • **User Defined** - Selects a 16-byte user-defined ASCII message as the expected TC trace pattern. The message is entered and saved using a screen keypad.

SONET Receive - Set / Set 3

The SONET Receive Settings 3 screen configures the unit's receive parameters. It contains the following functions:

Function	Description
Orderwire Drop	Allows you to drop an orderwire circuit for a protocol processor. The following options are available:

	None, **E1**, **E2**, **F1**, **F2-P, Z3-P**
Datacom Channel Drop	Defines specific bytes in the Section overhead that is used to send operation and maintenance information between the Section and Line equipment. The following options are available: • **None** • **Section DCC Port** • **Section PRBS 2^7-1** • **Section PRBS 2^7-1 (Inverted)** • **Line DCC Port** • **Line PRBS 2^7-1** • **Line PRBS 2^7-1 (Inverted)**
Monitor Mode	Expands the receive sensitivity for the 52M or 155M electrical interfaces. Use this setting for better clock and data recovery, when the received voltage levels are lower than normal. This setting is only supported on the **NGMR** circuit pack, and not the **OMR** circuit pack. Click here to determine which Multirate circuit pack is in your unit.

SONET Receive - SOH

The Receive SOH screen contains the following options:

Option	Description
Showing	Selects a specific SOH slot to monitor on the incoming SDH signal. The following bytes appear for the

	selected SOH slot: • Section Overhead bytes (A1, A2, Z0, B1, E1, F1, D1, D2, and D3), • Lower Path Overhead bytes (B2, K1, K2, D4-D12, Z1, Z2, and E2), • Pointer bytes (H1, H2, and H3), • Path Overhead bytes (B3, C2, G1, F2, H4, Z3, Z4, and Z5), • J0 Trace byte, and J1 Trace byte.
J0	Displays the J0 trace received on the incoming SDH signal. This is a read-only function.

SONET Receive - POH

The Receive POH screen contains the following options:

Option	Description
STS-<#> Dropped	Allows the user to enter the number of the specific STS channel to monitor. The default setting is 1. When a VCAT mapping is chosen, this setting changes to VCAT Channel.
Path Overhead	Displays the Overhead bytes for a specific Path OH slot on the incoming SONET signal. This is a read-only function.
VT Overhead	Displays the VT Overhead bytes for a specific VT Dropped channel. This is a read-only function.
J1 Trace	Displays the J1 trace received on the incoming SONET signal. This is a read-only function.
J2 Trace	Displays the J2 trace received on the incoming SONET signal. This is a read-only function.
TC Trace	Displays the TC trace received on the

	incoming SONET signal. This is a read-only function.

SONET Receive - SIG

Displays the following measurements of the incoming SONET signal:

- Frequency in Hz
- Line Frequency Offset Received in Hz and ppm
- Optical power in dBm
- STS Pointer Frequency Offset in ppm
- VT Pointer Frequency Offset in ppm
- Update Signal Calibration - Calibrating the system's optical power should be done carefully. To keep unauthorized users from changing calibration settings, the Update Signal Calibration button on the protocol processor's Receive SIG screen is unavailable by default. To change the setting, a user with Admin or Calibrate privileges must enable the calibration mode.

To enable protocol processor calibration:

1. From the **System** tab, select **Misc**.
2. From **Local Settings**, select **Enable Calibration**.

The user must have Admin or Calibrate privileges to enable the calibration mode.

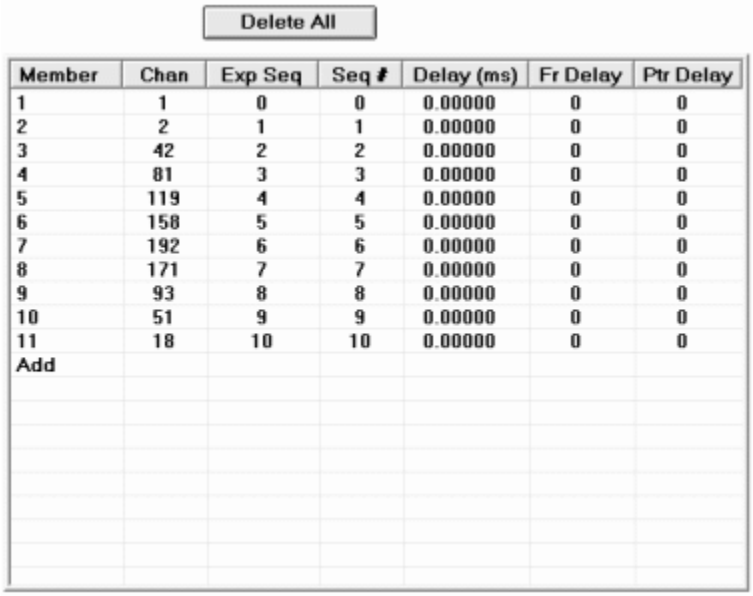
3. See Calibrating SDH/SONET Optical and Electrical Power for specific calibration instructions before proceeding.

Receive- VCAT

The Receive VCAT function allows you to setup the parameters of what the NIC expects to see on an incoming VCAT signal and to view certain parameters of the incoming signal.

For instructions on configuring VCAT see How to Set Up and Use VCAT Features.

VCAT channels created and various other parameters are displayed in the VCAT Table.



The Receive VCAT contains one function button, as defined below:

Function Button	Description
Delete All	Deletes all channels from the VCAT table.

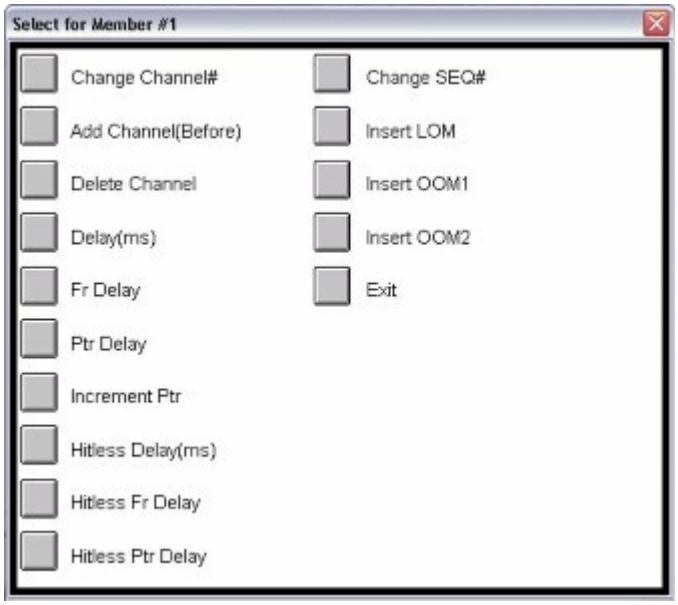
Definitions of VCAT Table columns:

Function	Description
Add	Click on Add to select members for the VCAT Group (VCG). A Select Channel screen appears which shows all possible channel member available to choose from. When a channel has been selected, the channel button will gray-out to indicate that it is already selected. If the Setting Control are set to Coupled, then members added to the Receive VCG will also be added to the Transmit VCG.
Member	Sequential list of VCG members.
Chan	Channel Number. Displays the VCAT Member's channel number. For High-Order mappings, the number will just be the AU#(for SDH)

	or STS#(for SONET). For Low-Order mappings SDH mappings, the address will be displayed in the following format: AU# N K,L,M, with N indicating the AU#, and the others indicating TUG-3, TUG-2 and TU# as applicable. For Low-Order SONET mappings, the address will be displayed in the following format: STS# N K,L, with N indicating the STS#, and the others indicating VT group# and VT# as applicable.
Exp Seq	Expected Sequence Number. This is the sequence of VCG members expected, based on the sequence of the Members column.
Seq #	This is the detected Sequence Number Indicator. If the detected Seq# differs from the Expected Sequence number, and a Sequence Mismatch alarm is reported.
Delay (ms)	Combined Delay. The amount of time this member is delayed as compared to the earliest member. This delay is the same as indicated in Frame and Pointer Delays, expressed in milliseconds. 1 ms = 8 frames.
Fr Delay	Frame Delay. The number of frames this member is delayed as compared to the earliest member. This delay is the same as indicated in Delay (ms), expressed in frames. 1 frame = .125 ms.
Ptr Delay	Pointer Delay. This indicates the pointer delay value detected on this member.

Click on any row of the VCAT Table to bring up the "Select for Member #N" menu as seen here:

For user convenience, the same transmit settings found on the Transmit VCAT screen are also available on the Receive VCAT screen.



Many of the options in the menu actually apply to Transmit settings. The first three menu items (Change Channel #, Add Channel and Delete Channel) specifically apply to the Receive VCAT Table. However, If "Settings Control" is set for "Coupled" (see Transmit or Receive "Set" tab), the changes will apply to both Transmit and Receive VCAT Tables. If "Settings Control" is set for independent, the change will apply only to the Receive VCAT Table.

This menu is used to setup the selected member with any of the following menu functions.

Function	Description
Change Channel #	Selects which channel (time slot) will be used by this member.
Add Channel (before)	Adds one additional member in the next slot above the selected member. Selecting this menu item will bring up another menu where channel number is selected.
Delete Channel	Deletes the selected channel (member).
Delay (ms)	Inserts Combined Frame and Pointer Delays on the selected member, entered in milliseconds (ms).
Fr Delay	Inserts Frame Delay on the selected member entered in number of

	frames.
Ptr Delay	Changes the pointer value of the selected member, creating a very small delay.
Increment Ptr	Increases pointer value of the selected member by a value of 1.
Hitless Delay (ms)	Inserts Combined Delay on the selected member, entered in milliseconds (ms) without causing a Loss of Multiframe (LOM) alarm.
Hitless Fr Delay	Inserts Frame Delay on the selected member entered in number of frames) without causing a Loss of Multiframe (LOM) alarm.
Hitless Ptr Delay	Changes the pointer value of the selected member, creating a very small delay) without causing a Loss of Multiframe (LOM) alarm.
Change SEQ #	Changes the Sequence Indicator, not the actual order that the payload is transmitted, as displayed in the "Member" column. Changing the Sequence Indicator manually will create a Sequence Mismatch (SQM) at the receiver.
Insert LOM	Inserts Loss of Multiframe alarm
Insert OOM1	Inserts Out of Multiframe alarm 1
Insert OOM2	Inserts Out of Multiframe alarm 2
Exit	Closes the window without changing the setup of the member

Receive - LCAS Sk

For detailed information about LCAS, and instructions on configuring LCAS, see How to Set Up and Use LCAS Features.

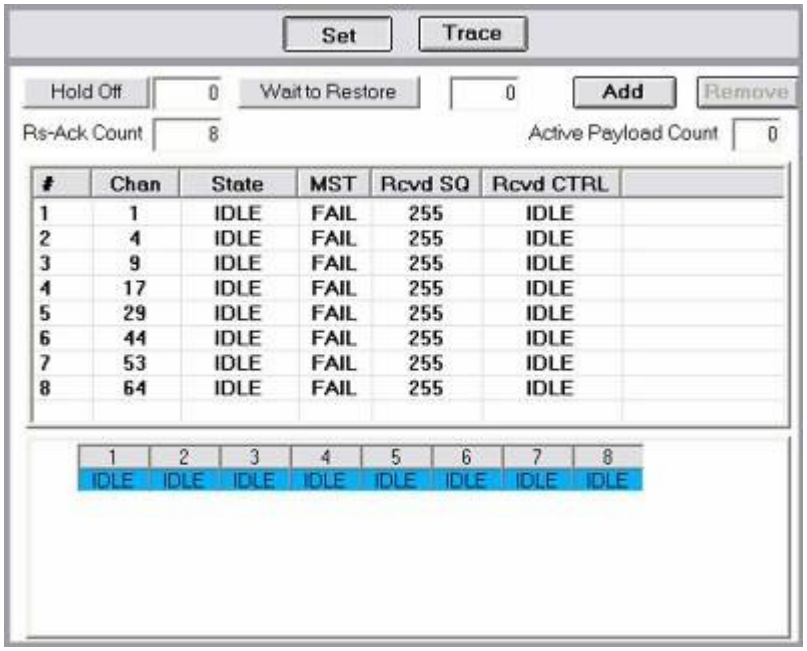
Definition of Source (So) and Sink (Sk)

The Source functionality is available from the Transmit - LCAS So screen, and the Sink functionality is available from the Receive - LCAS Sk screen.

Unlike VCAT, which is bi-directional, LCAS operates on a one-way basis. The transmit of an LCAS system is designated “Source” and the receive is designated “Sink”. LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other direction may be configured as LCAS as well but there is no correlation between the two.

LCAS Receive Settings

Access LCAS Receive features by the selecting LCAS Sk (LCAS Sink) side tab from the Receive screen. The LCAS Settings table will appear, listing all of the members within the receive VCG.



The receive LCAS settings table is used to configure LCAS Sink functions.

The following functions are found in the receive LCAS settings table

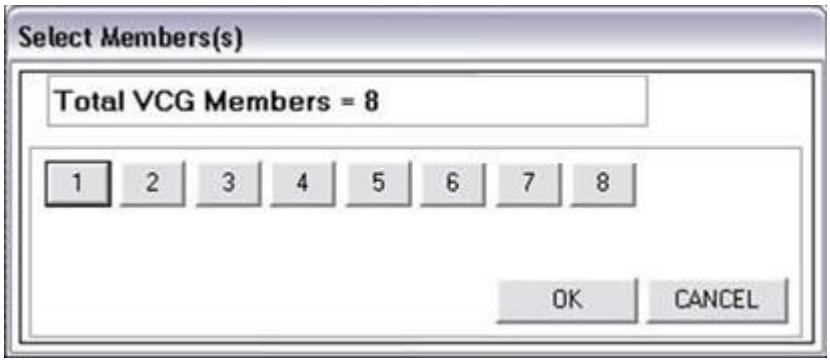
Function	Description
Set (button)	Selects the LCAS Settings Table
Trace (button)	Selects the LCAS Trace Table
Hold Off (button)	Delays sending a failure message back to the

	source, in seconds
Wait to Restore (button)	Delays sending an “OK” back to the source, in seconds
Add (button)	Adds selected VCG members to the LCAS data stream
Remove (button)	Removes selected VCG members from the LCAS data stream
Rs-Ack Count	Number of Resequence - Acknowledge messages received
Active Payload Count	Number of VCG members that make up the payload
#	Member number, sequential
Chan	Channel. Displays the VCAT Member’s channel number. For SDH High-Order mappings, the number will just be the AU#. For SONET STS mappings, the number will just be the STS#. For SDH Low-Order mappings, the address will be displayed in the following format: AU# N K,L,M, with N indicating the AU#, and the others indicating TUG-3, TUG-2 and TU# as applicable. For SONET VT mappings, the address will be displayed in the following format: STS# N K,L, with N indicating the STS#, and the others indicating VT group# and VT# as applicable.
State	Indicates the state of this VCG member. The possible states are: **IDLE**: This member is not in use. **OK**: This member is configured as part of the receive payload, and data is being received as expected. **Fail**: This member is configured as part of the receive payload, but no data is being received.
MST	Displays the Member Status, being sent to Source (So) from Sink (Sk)
Rcvd SQ	Sequence Number received from Sink (Sk)

Rcvd CTRL	Control message sent from Source to Sink. Possible values are: **ADD**: Member to be added to the VCG **NORM**: Normal LCAS transmission **EOS**: End of Sequence, highest member in group **IDLE**: Member is part of the VCG or to be removed **DNU**: Do not use, Sink reports failure
Member State-LED	The State-LED provides a visual indication of which LCAS State or condition the VCG member is in. The possible states are: IDLE This VCG member has not been added to LCAS. OK This member is configured as part of the receive payload, and data is being received as expected. FAIL This member is configured as part of the receive payload, but no data is being received.

Add and Remove

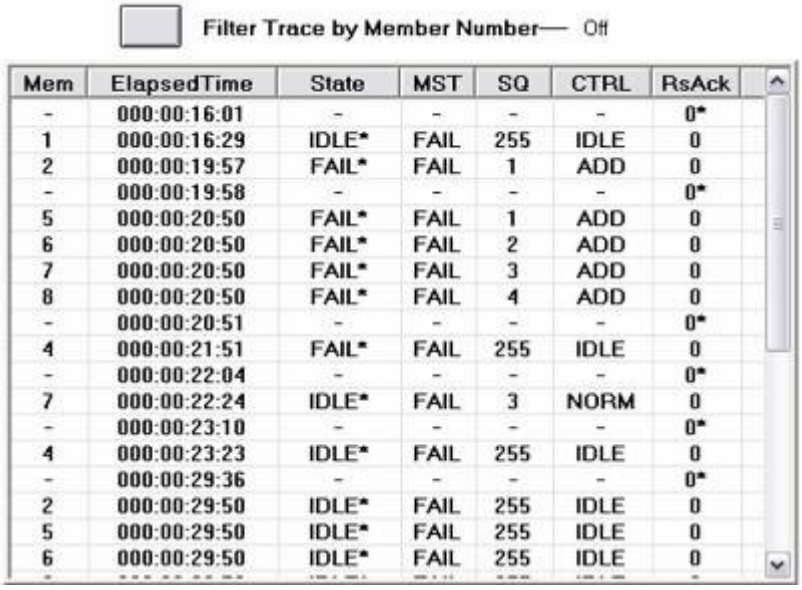
Press **Add** or **Remove** to select which VCG members are to be added or removed from the LCAS data stream.



- When adding or removing members, the button becomes disabled to indicate that the member has already been added or removed.

LCAS Receive Trace

Press **Trace** to display the LCAS Trace Table.



Mem	ElapsedTime	State	MST	SQ	CTRL	RsAck
-	000:00:16:01	-	-	-	-	0*
1	000:00:16:29	IDLE*	FAIL	255	IDLE	0
2	000:00:19:57	FAIL*	FAIL	1	ADD	0
-	000:00:19:58	-	-	-	-	0*
5	000:00:20:50	FAIL*	FAIL	1	ADD	0
6	000:00:20:50	FAIL*	FAIL	2	ADD	0
7	000:00:20:50	FAIL*	FAIL	3	ADD	0
8	000:00:20:50	FAIL*	FAIL	4	ADD	0
-	000:00:20:51	-	-	-	-	0*
4	000:00:21:51	FAIL*	FAIL	255	IDLE	0
-	000:00:22:04	-	-	-	-	0*
7	000:00:22:24	IDLE*	FAIL	3	NORM	0
-	000:00:23:10	-	-	-	-	0*
4	000:00:23:23	IDLE*	FAIL	255	IDLE	0
-	000:00:29:36	-	-	-	-	0*
2	000:00:29:50	IDLE*	FAIL	255	IDLE	0
5	000:00:29:50	IDLE*	FAIL	255	IDLE	0
6	000:00:29:50	IDLE*	FAIL	255	IDLE	0

- The Trace table displays an event log history of changes in the LCAS configuration since the last time the test was restarted.

Function	Description
Filter Trace by Member Number	Select **User Defined** to specify an individual member number. Only the activity of the selected member will be displayed. Select **Off** to display the activity of all members.

Results

SONET Results Screens and Functions

All monitored activity that the system receives is reported to the Results screen for viewing and analyzing. The Results screen provides information used for analyzing the incoming signal, pattern, errors, and alarms.

The following options are available from the Results screen:

- Scan / Error / Alarm
- PTR

- Event
- APS
- Large LED
- Graph
- VCAT (Only appears when the test set is configured for VCAT.)
- LCAS (Only appears when the LCAS is enabled.)

SONET Results - Error / Alarm

The Results Error / Alarm screen contains the following options:

- **Scan** - Select Scan to access a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected. This function displays a list of received errors and alarms. For alarms, the duration is reported as a count in seconds. For errors, an error count is reported.

  When no activity is occurring, the screen displays, "No errors or alarms."

- **Errors** - The unit can monitor and report errors on the incoming SDH signal. The Errors function provides a detailed analysis of the incoming error as described below. The reported errors are a result of incoming errors that are generated by the SDH network, or errors that are intentionally generated by the system when it is used in a loopback environment.

  The following errors can be monitored:

  - Frame
  - B1 (Section BIP-8, also known as a Section Coding Violation - CV-S)
  - B2 (Line BIP-8, also known as a Line Coding Violation - CV-L)
  - B3 (Path BIP-8, also known as a Path Coding Violation - CV-P)
  - REI-P (Remote Error Indication - Path)
  - BIP-V (Bit Interleaved Parity - Virtual Tributary)
  - REI-L (Remote Error Indication - Line)
  - REI-V (Remote Error Indication - Virtual Tributary)
  - BIT (BIT errors reported in the payload)
  - NDF-P (New Data Flag - Path)
  - NDF-V (New Data Flag - Virtual Tributary)
  - TC-IEC-P (Tandem Connection-Incoming Error Count)
  - TC-REI-P (Tandem Connection-Remote Error Indicator)
  - TC-OEI-P (Tandem Connection-Outgoing Error Indicator)

  The following parameters are measured for the incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format
- Error-free seconds using an 8-digit format
- Errored seconds
- Severely Errored seconds
- Unavailable errored seconds

- **Alarms** - The system can monitor and report alarms and their duration on the incoming SDH signal. The alarms are shown in duration of the alarm in seconds.

  The following alarms can be monitored:

  - LOS (Loss of Signal)
  - Power Hot
  - Power Low
  - Frequency Wide
  - OPU Generic AIS
  - LOF (Loss of Frame)
  - AIS-L (Alarm Indication Signal - Line)
  - APS-L (Automatic Protection Switching-Line)
  - SEF (Severely Errored Frame)
  - RDI-L (Remote Defect Indicator - Line)
  - Pat Sync (Pattern Synchronization)
  - PLM-P (Payload Label Mismatch - Path)
  - Concat (Concatenated)
  - AIS-P (Alarm Indication Signal - Path)
  - LOP-P (Loss of Pointer - Path)
  - UNEQ-P (Unequipped - Path)
  - RDI-P (Remote Defect Indicator - Path)
  - TIM-P (Trace Identifier Mismatch - Path)
  - TIM-S (Trace Identifier Mismatch - Section)
  - AIS-V (Alarm Indication Signal - Virtual Transport)
  - LOP-V (Loss of Pointer - VT)
  - LOM-V (Loss of Multiframe Alignment - VT)
  - UNEQ-V (Unequipped - Virtual Transport)

SONET Results - PTR

This PTR function monitors and reports received Pointer statistics. A count of the following Pointer statistics appear:

The following STS Pointer results appear:

- **Pointer Justification** - Indicates the Positive Pointer Justification count.
- **Negative Justification** - Indicates the Negative Pointer Justification count.
- **Positive Justification Seconds** - Indicates the duration of a Pointer adjustment.
- **NDF Coun**t - Indicates the New Data Flag count.
- **Rx Pointer Bytes (HEX)** and **Rx Pointer Value** (in decimal) - Valid Pointers range from 0 to 782.

When lower-order mapping is configured VT Pointer results also appear.

SONET Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

SONET Results - APS

The APS function monitors incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 15 byte sequences can appear on the screen.

The Results APS screen contains the following options:

Option	Description
APS Summary	When selected, the following information appears in the results

	table last 15 K1 and K2 byte sequences received: • The HEX value of the K1 byte. • The HEX value of the K2 byte. • The number of frames received that contain the K1 and K2 bytes. • The elapsed time of the frames that contain the K1 and K2 bytes. To view decoded values for a specific Item, select the Item number. The APS Decode dialog box appears displaying the Item's configuration.
APS Decode	When selected, the results table splits into two horizontal tables: the top table displaying K1 results; the bottom table displaying K2 results. The K1 table decodes the value for bits 1-4 and bits 5-8. The K2 table decodes the value for bits 1-4, bit 5, and bits 6-8. Also displayed in the tables are the number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes for the last 15 byte sequences received.
APS View Mode	Allows the user to view decoded values in either **Linear** Protection Switching Mode or **Ring** APS Signaling Mode.

Per GR-253-CORE, only the upper 12 bits of the K1/K2 bytes (K1 bits 1-8 and the K2 bits 1-4) are used for APS operation. K2 bit 5 sets the APS mode type (1+1, 1:n) and cannot be changed during operation. K2 bits 6-8 are for alarms. Any changes to the lower four bits of the K2 byte do not affect APS operation. The Results APS table only starts and displays a new entry item if the upper 12 K1/K2 bits stabilize on a new value for a minimum of three

consecutive frames.

SONET Results - Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

For a list of available LEDs in the SONET protocol processor, see SONET LEDs.

SONET Results - Graph

The Graph function allows incoming errors and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

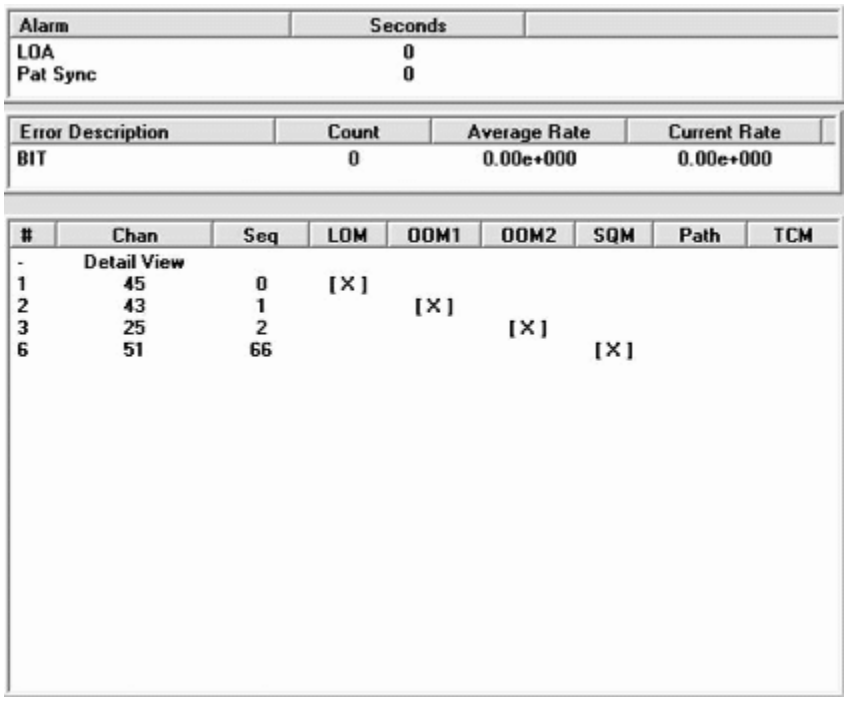
For more information about graphs, select Using Graphs in the Common Tasks section of the online help.

Results - VCAT

All monitored VCAT channel activity that the system receives is reported to the Results screen. The Results functionally provides several drill-down layers for analyzing the incoming signal, alarms, and errors.

For instructions on configuring VCAT see How to Set Up and Use VCAT Features.

The following screen displays Alarm and Error counts that are common to all channel and access to the detailed information on each channel.



The following is found on the Results screen:

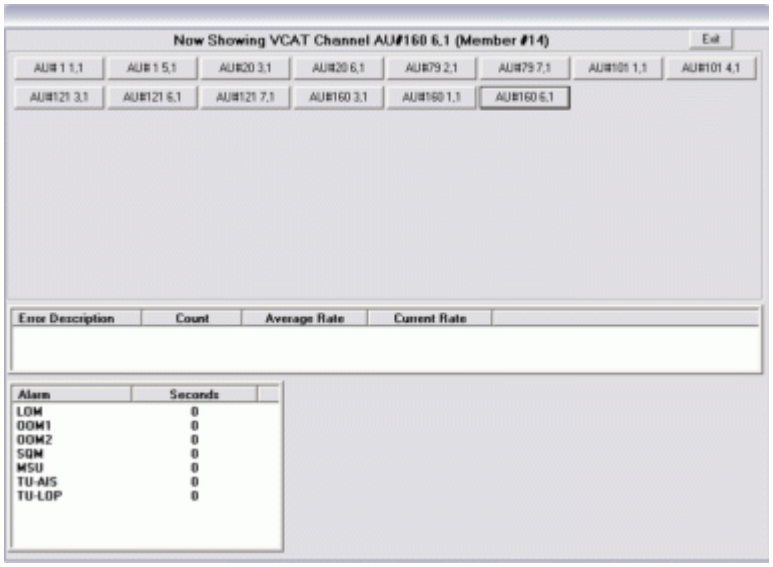
Options	Description
Alarm	The following statistics are displayed: **Alarm** - Displays the alarm types that are common to the entire VCG. • LOA – Loss of Alignment. Indicates that the receiver is unable to align all members of the VCG. • Patt Sync – Loss of synchronization of the payload pattern. **Seconds** - Displays the number of seconds that an alarm was present since the last time the restart button was pressed.

Error	The following statistics are displayed: **Error Description** - Displays the error types that are common to the entire VCG. • BIT – Payload Bit Errors **Count** - Displays the error count using an 11-digit format. **Average Rate** - Displays the average error rate over the full elapsed time. **Current Rate** - Displays the current error rate (the error rate in the last one second).
Detail View You can drill down to channel-specific details by selecting "Detail View" or any **Member** in the Detail View table. This opens the **VCAT Detail View** dialog box that allows you to select a specific channel and view its errors and alarms. See below.	The following statistics are displayed: # - Displays the Member number. **Chan** - Displays the Channel number. **Seq** - Displays the VC sequence number. **LOM** - Loss of Multiframe alignment. [X] indicates a LOM is detected on this channel. **OOM1** - Out of Multiframe alarm, level 1. [X] indicates an OOM1 is detected on this channel. **OOM2** - Out of Multiframe alarm, level 2. [X] indicates an OOM2 is detected on this channel. **SQM** - Sequence Number Mismatch. [X] indicates a SQM is detected on this channel. **Path** - Path summary indication. [X] indicates a Path error/alarm is

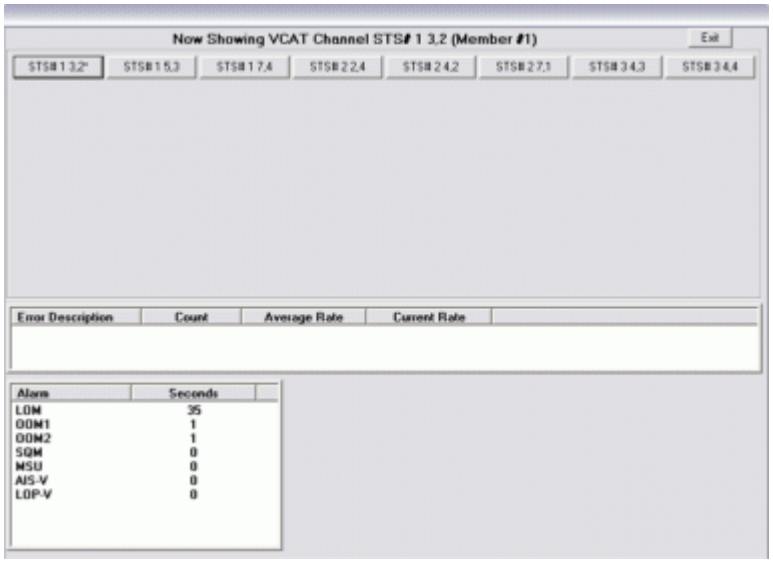
	detected on the channel. **TCM** - Tandem Connection Monitoring

Detail View

Touching "Detail View" or any member in the Detail View table brings up a window like this SONET example:



Or like this SDH example:



Select the desired channel at the top of the window and full error and alarm information will be displayed for that member.

Results - LCAS

For detailed information about LCAS, and instructions on configuring LCAS, see How to Set Up and Use LCAS Features.

Definition of Source (So) and Sink (Sk)

The Source functionality is available from the Transmit LCAS So screen, and the Sink functionality is available from the Receive LCAS Sk screen.

Unlike VCAT, which is bi-directional, LCAS operates on a one-way basis. The transmit of an LCAS system is designated “Source” and the receive is designated “Sink”. LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other direction may be configured as LCAS as well but there is no correlation between the two.

LCAS Results

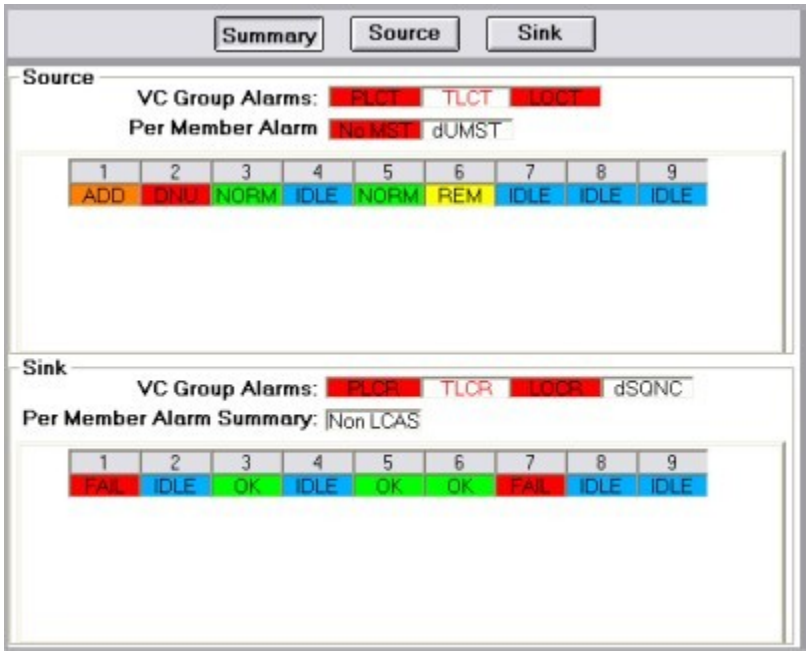
Access the LCAS Results measurements by the selecting

side tab from the Results screen. Select to view the Summary, Source or Sink results screen.

Summary Screen

Select “Summary” to display an overview of LCAS alarms. This screen shows a split view of the condition or status for both the transmit (Source) and receive (Sink) VCAT Group (VCG) members.

IDLE members are VCG members that have not been configured as part of the LCAS data stream.

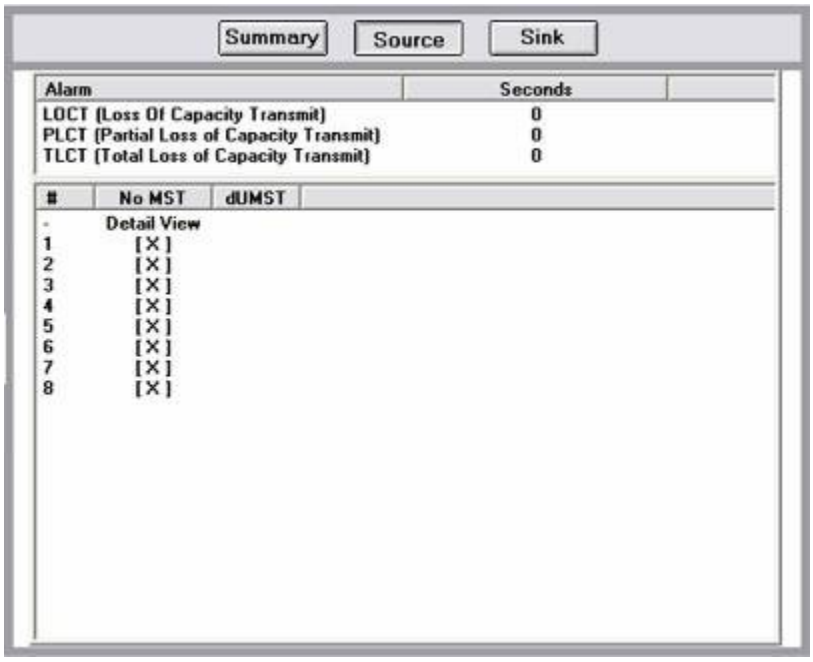


See below for definitions of all alarm conditions

- White boxes with black text indicate that the alarm condition has not been detected during the current test.
- A white box with red text is a history indication; the alarm condition has been detected during the current test but is not present at this time.
- A red box indicates a current alarm condition.

Source Screen

Select “Source” to display detailed LCAS Source alarms.

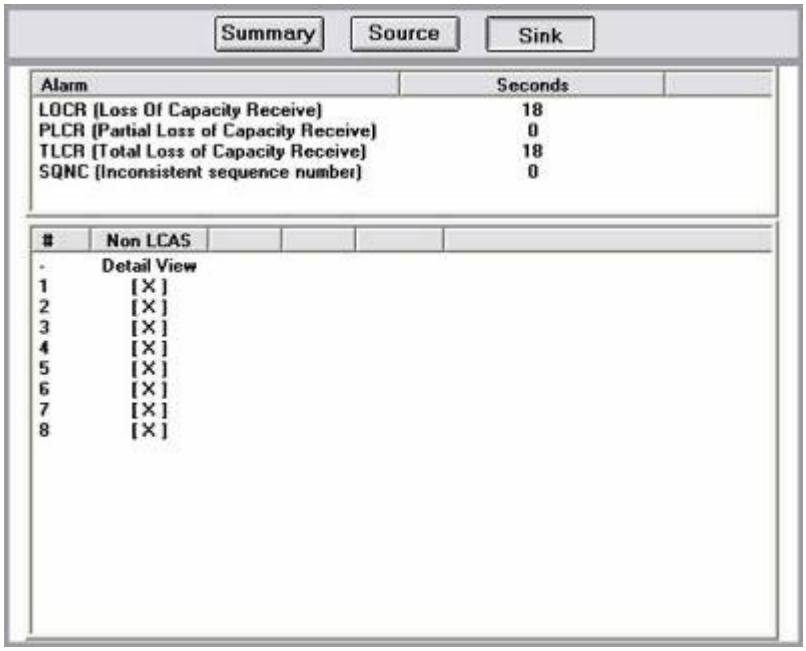


See below for definitions of all alarm conditions

- The Alarm View reports the duration of all alarm types in seconds.
- The Detail View – Provides the Trouble Scan View of any Member/Channel that has detected an alarm condition during the current test. The Member is listed and an [X] is placed in the column for the error/alarm type.

Sink Screen

Select “Sink” to display detailed LCAS Sink alarms.



See below for definitions of all alarm conditions

- The Alarm View reports the duration of all alarm types in seconds.
- The Detail View – Provides the Trouble Scan View of any Member/Channel that has detected an alarm condition during the current test. The Member is listed and an [X] is placed in the column for the error/alarm type.

Definitions

Source Conditions	Description
LOCT	Loss of Capacity Transmit
PLCT	Partial Loss of Capacity Transmit
TLCT	Total Loss of Capacity Transmit
No MST	Multiframe Status not received
dUMST	Unexpected Multiframe Status counts
Member State-LED (Summary)	The State-LED provides a visual indication of which LCAS State or condition the VCG member is in. The possible states are: IDLE This VCG member has not been added to LCAS. NORM This member is part of the payload.

	DNU Do Not Use. Failure state. ADD Source has requested to add this member to the payload. Waiting for Sink response. REM Source has requested to remove this member from the payload. Waiting for Sink response.

Sink Conditions	Description
LOCR	Loss of Capacity Receive
PLCR	Partial Loss of Capacity Receive
TLCR	Total Loss of Capacity Receive
SQNC	Inconsistent Sequence Number
Non LCAS	At least one member is not configured as LCAS
Member State-LED (Summary)	The State-LED provides a visual indication of which LCAS State or condition the VCG member is in. The possible states are: IDLE This VCG member has not been added to LCAS. OK This member is configured as part of the receive payload, and data is being received as expected. FAIL This member is configured as part of the receive payload, but no data is being received.

Test

Test Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- SET 1

- Service Disruption
- RTD (Round Trip Delay)

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Service Disruption

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The service disruption measurements show a granular accuracy of 1 frame duration. See the chart at the bottom of this page for time per frame durations for each protocol processor.

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

  For **E4**, **E3**, **E1**, **DS3** and **DS1** processors, the Protection Switch Criteria is limited to: Loss of Pattern Sync and Bit Errors.

For **SONET** and **SDH** processors the Protection Switch Criteria include: B1, SEF / OOF, AIS-L / MS-AIS, AIS-P / AU-AIS, AIS-V / TU-AIS, and PRBS (Loss of Pattern Sync and Bit Errors).

For **OTN** processors the Protection Switch Criteria include: OOF, OTU:AIS, OTU:BIP8, ODU:AIS, ODU:BIP8, and PRBS (Loss of Pattern Sync and Bit Errors).

- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **State** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

  - **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

  - **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.

  - **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)** - Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.
- **Protection Switch Time (Frames)** - Indicates the number of errored frames received during the service disruption event.
- **History Recent Milli Seconds** - Shows the time durations for the last ten measurements recorded.
- **History Recent Frames** - Shows the frame durations for the last ten measurements recorded.

A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing Service Disruption.

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
SONET / SDH	0.125 ms (125 µs)	16383 frames (2047.875 ms)
OTU 1	0.049 ms (49 µs)	16383 frames (802.302 ms)
OTU 2	0.012 ms (12 µs)	16383 frames (199.732 ms)
E4	0.021 ms (21 µs)	255 frames (5.361 ms)
E3	0.045 ms (45 µs)	255 frames (11.397 ms)
E1	0.125 ms (125 µs)	4095 frames (511.875 ms)
DS3	0.106 ms (106 µs)	255 frames (27.133 ms)
DS1	0.125 ms (125 µs)	4095 frames (511.875 ms)

Click this link for Ethernet Service Disruption specifics.

Test - RTD (Round-Trip Delay)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **State:** Starts and stops round-trip delay mode.

  Single Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in frame counts and milliseconds. Frame counts indicates the number of frames received before the AIS frame is received by the unit. Milliseconds indicates how long it took for the AIS frame to travel out and return to the unit.

Continuous Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and continuously transmitted through your network. The current frame count and duration appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.

Stop Round-Trip Delay - Stops round-trip delay activity. The State returns to Inactive.

- **Round Trip Delay Time (milliSec):** Indicates the duration in seconds that it took for the known frame to return to the unit.
- **Round Trip Delay Time (Frames):** Indicates the number of frames received during the measurement.
- **Consecutive Good Time Required:** This function allows you to enter the duration (in milliseconds) of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 0.125 to 2047.875 milliseconds and is entered using a keypad.
- **Consecutive Good Frames Required**: This function allows you to enter the number of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 1 to 16383 frames and is entered using a keypad.

For more information about round-trip delay, select *Round-Trip Delay* in the Common Tasks section of the online help.

Perf Monitor

SONET Performance Monitor Screens and Functions

Performance Monitoring provides greater detail about incoming Section, Line, Path, and BIT errors.

The following options are available:

- Sect
- Line
- Path
- VT Path
- BIT

SONET Perf Monitor - Sect

This Section screen provides a detailed breakdown for Section errors detected and logged by the SONET protocol processor.

Section Near End B1 Errors

- **CV** - Coding Violations. Error count of incoming B1 errors.
- **ES** - Errored Seconds. Reports the duration of the incoming B1 errors in seconds and the percentage of errored seconds compared to the duration of error free seconds.
- **EFS** - Error Free Seconds. Reports the duration of the incoming B1 error free seconds and the percentage of error free seconds compared to the duration of errored seconds.
- **SES** - Severely Errored Seconds. Reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal. An SES is reported when 8554 or more B1 errors occur in one second, or when a Severely Errored Frame (SEF) alarm, Loss of Frame (LOF) alarm, or Loss of Signal (LOS) alarm occurs.

SONET Perf Monitor - Line

The Line screen displays a detailed breakdown of incoming B2 (Line BIP-8, also known as Coding Violations) and Line Remote Error Indicator (REI-L) errors.

The following statistics are reported:

Line - Near End B2 Errors

- **CV** - Coding Violations. Reports an error count of incoming B2 errors.
- **ES** - Errored Seconds. Reports the duration of the incoming B2 errors in seconds and the percentage of errored seconds compared to the duration of error free seconds.
- **EFS** - Error Free Seconds. Reports the duration of the incoming B2 error free seconds and the percentage of error free seconds compared to the duration of errored seconds.
- **SES** - Severely Errored Seconds. Reports the duration of SES on the incoming SONET signal. An SES is reported when 9835 or more B2 errors occur in one second, or when a Severely Errored Frame (SEF) alarm, Loss of Frame (LOF) alarm, Loss of Signal (LOS) alarm, or Line Alarm Indication Signal (AIS-L) alarm occurs.
- **UAS** - Unavailable Seconds. Reports the number of seconds that the Line layer was considered unavailable. A Line is unavailable when 10 consecutive seconds that qualify as SES-L seconds occur.

Line - Far End REI Errors

- **CV** - Coding Violations. Reports an error count of the number of B2 errors detected by the far-end Line Terminating Equipment (LTE). These errors are reported back to the unit using the M1 byte of the Line overhead. The M1 byte is also known as the Line Remote Error Indicator - REI-L. (A CV-LFE was formerly known as a Line FEBE.)

- **ES** - Errored Seconds. This counter reports the number of seconds that an REI-L alarm is reported
- **EFS** - Error Free Seconds. Reports the duration of the incoming REI-L error free seconds and the percentage of error free seconds compared to the duration of errored seconds.
- **SES** - Severely Errored Seconds. Reports the duration when 9835 or more REI-L errors are present at the far-end LTE, or when a Line Remote Defect Indicator (RDI-L) alarm is present.
- **UAS** - Reports a count of the number of seconds that an SES-LFE error was present at the far-end LTE. At least 10 consecutive errored seconds of SES-LFE errors must be present before a UAS-LFE is declared.

SONET Perf Monitor - Path

The Path screen displays a detailed breakdown of incoming B3 (Path BIP-8, also known as Path Coding Violations) and STS Path Remote Error Indicator (REI-P) errors.

The following statistics are reported:

Path - Near End B3 Errors

- **CV** - Code Violations. This is an error count of incoming B3 errors.
- **ES** - Errored Seconds. This reports the duration of the incoming B3 errors (in seconds). This statistic also reports the percentage of errored seconds compared to the duration of error-free seconds.
- **EFS** - Error Free Seconds. This reports the duration of the incoming B1 error free seconds. This statistic also reports the percentage of error-free seconds compared to the duration of errored seconds.
- **SES** - Severely Errored Seconds. This reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal. An SES is reported when 2400 or more B3 errors occur in one second, or when an AIS-P alarm, UNEQ-P alarm, LOS alarm, LOF alarm, AIS-L alarm, or LOP-P alarm occurs.
- **UAS** - Unavailable Seconds. This reports the number of seconds that the STS Path layer was considered unavailable. A Path is unavailable when 10 consecutive seconds that qualify as SES-P seconds occur.

Path Far End REI Errors

- **CV** - Code Violations. This is an error count of the number of B3 errors detected by the far-end STS Path Terminating Equipment (PTE). These errors are reported back to the unit using the G1 byte of the STS Path

overhead. The G1 byte is also known as the STS Path Remote Error Indicator - REI-P. (A CV-PFE was formerly known as an STS Path FEBE.)
- **ES** - Errored Seconds. This is a counter that indicates the number of seconds that an REI-P alarm is reported.
- **EFS** - Error Free Seconds. Reports the duration of the incoming REI-P error free seconds and the percentage of error free seconds compared to the duration of errored seconds.
- **SES** - Severely Errored Seconds. This reports the duration when 2400 or more REI-P errors are present at the far-end LTE, or when a Line Remote Defect Indicator (RDI-P) alarm is present.
- **UAS** - Unavailable Seconds. This is a counter that indicates the number of seconds that an SES-PFE error was present at the far-end LTE. At least 10 consecutive errored seconds of SES-PFE errors must be present before a UAS-PFE is declared.

SONET Perf Monitor - VT Path

The VT Path screen displays a detailed breakdown of incoming Virtual Tributary path BIP (Section BIP-8, also known as Coding Violations) errors and Virtual Tributary path Remote Error Indicator (REI-P) errors.

The following statistics are reported:

Payload - BIT Errors

- **CV** - Code Violations. Reports the code violations by count.
- **ES** - Errored Seconds. Reports the errored seconds by count, rate, and objective percentage.
- **EFS** - Error Free Seconds. Reports the error free seconds by count, rate percentage, and objective percentage.
- **SES** - Severely Errored Seconds. Reports the error free seconds by count, rate percentage, and objective percentage.
- **UAS** - Unavailable Seconds. Reports the unavailable seconds by count, rate percentage, and objective percentage.

SONET Perf Monitor - BIT

Bit analysis provides a detailed breakdown for detected Payload Bit errors.

The following statistics are reported:

Payload - BIT Errors

- **CV** - Code Violations. Reports the code violations by count.
- **ES** - Errored Seconds. Reports the errored seconds by count, rate, and objective percentage.

- **EFS** - Error Free Seconds. Reports the error free seconds by count, rate percentage, and objective percentage.
- **SES** - Severely Errored Seconds. Reports the error free seconds by count, rate percentage, and objective percentage.
- **UAS** - Unavailable Seconds. Reports the unavailable seconds by count, rate percentage, and objective percentage.

SONET LED Quick Status Area

When the SONET protocol processor tab is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the **Large LED** screen.

LED	Description
TX	Indicates current transmit interface setting and laser wavelength. If the SONET interface is configured for G.709, then OTN appears.
RX	Displays the received optical power in dBm.
E/A	Indicates the current Error / Alarm configured for transmission.
Test Paused	If red, indicates that the current test has been paused.
CLK	Indicates the value of the Transmit Clock Reference function.
All Tests (button)	This is a short-cut button to the general "All Test Status" summary LED screen for all circuit packs installed in the unit.
Section	**Section Status LED**. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
LOS	**Loss of Signal**. Indicates that a valid SONET signal is not being received. If an all-zeros pattern exists for 100 milliseconds or longer on the incoming SONET signal, then an LOS is reported.
LOF	**Loss of Frame**. Indicates that a frame alignment problem with the incoming SONET signal has been detected. An LOF is reported if a severely errored framing (SEF) defect continues for 3 milliseconds or longer. This is alarm LED.
SEF	**Severely Errored Frame**. Declared when four or more consecutive errored frames are detected on the incoming SONET signal. This is an alarm LED.
B1	**Section Overhead BIP-8 Code Violation**. Indicates an error in the SONET frame. B1 errors are parity errors. The

	B1 byte carries the parity information, so a B1 error is a Section error that applies not only to the Section OH, but the entire frame. Any error in the frame will result in B1 error. This is an error LED.
Line	**Line Status LED**. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
REI-L	**Line Remote Error Indicator**. Indicates that an error is occurring at downstream Line terminating equipment. An REI is also known as a Far-End Block Error (FEBE). The M0 and M1 bytes of the SONET Line Overhead are used for this indicator. This is an error LED.
AIS-L	**Line Alarm Indication Signal**. Indicates if an alarm is being received from upstream Line terminating equipment. This is an alarm LED.
APS	**Automatic Protection Switching**. Indicates that the K1 and K2 bytes on the incoming SONET signal have changed.
RDI-L	**Line Remote Defect Indicator**. Indicates that a downstream defect has occurred along the Line layer. (An RDI is also known as a Far-End Remote Failure, FERF). This is an alarm LED.
B2	**Line Overhead BIP-8 Code Violation**. Indicates that parity errors were detected at the Line layer of the incoming SONET signal. This is calculated over the Line OH, Path OH, and payload of each STS-1. This is an error LED
Path	**STS Path Status LED**. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
AIS-P	**STS Path Alarm Indication Signal**. Indicates if an alarm is being received from upstream Path terminating equipment. This is an alarm LED.
RDI-P	**STS Path Remote Defect Indicator**. Indicates that a remote alarm is being received from downstream Path terminating equipment. The G1 byte of the SONET Path Overhead is used for this indicator. This is an alarm LED.
LOP-P	**STS Path Loss of Pointer**. Indicates that an invalid Pointer has been received or a Pointer loss has been detected on the incoming SONET signal. This is an alarm LED.
REI-P	**STS Path Remote Error Indicator**. Indicates that an error count is being received from downstream Path terminating equipment. An REI is also known as a Far-

	End Block Error (FEBE). This is an error LED.
PTR-P	**STS Path Pointer Adjustments**. Indicates Pointer offsets or adjustments between the STS payload and the OC-N frame are occurring. This is a status LED.
B3	**STS Path Overhead BIP-8 Code Violations**. Indicates that parity errors were detected at the Path layer of the incoming SONET signal. This is calculated over the Path OH and payload of each STS-1. This is an error LED.
UNEQ-P	**STS Path Unequipped Payload**. Indicates that a 00h pattern has been detected in the C2 byte. This byte is being received from Path terminating equipment. This is an alarm LED.
VT	**Virtual Tributary Status LED**. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED. This section is only available when VT-1.5, VT-2 or VT-6 is mapped.
AIS-V	**VT Alarm Indication Signal**. Indicates an all-ones characteristic or adapted information signal was detected on the VT. It is generated to replace the normal traffic signal when it contains a defect condition in order to prevent consequential downstream failures being declared or alarms being raised. This is an alarm LED.
LOP-V	**VT Loss of Pointer**. Indicates that an invalid Pointer has been received or a VT Pointer loss has been detected on the incoming SONET signal. This is an alarm LED.
PTR-V	**VT Pointer Adjustments**. Indicates Pointer offsets or adjustments between the VT payload and the OC-N frame are occurring. This is a status LED.
LOM-V	**VT Loss of Multiframe Alignment**. Indicates a Loss of Multiframe Alignment in the VT. This is an alarm LED.
RDI-V	**VT Remote Defect Indicator**. Indicates that a signal was returned to the transmitting VT Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect. This is an alarm LED.
RFI-V	**VT Remote Failure Indicator**. Indicates a defect on the VT at persisted beyond the maximum time allocated to the transmission system protection mechanisms. When this occurs, the RFI is sent to the far end and initiates a path protection switch. This is an alarm LED.
REI-V	**VT Remote Error Indicator**. Indicates to the transmitting node that an errored block has been detected at the VT receiving node. This is an error LED.

UNEQ-V	**VT Unequipped Payload**. Indicates that an all-zeros patterns has been detected in the VT Signal Label of the V5 byte. This is an alarm LED.
BIP-V	**VT Overhead BIP-2 Code Violations**. Indicates an error occurred during a parity check, which involves grouping all the bits in a block into units and then performing a parity check of each bit position in the group. This is calculated over the VT OH and payload of each VT. This is an error LED.
PAT SYNC	**Pattern Sync Mismatch**. Indicates a loss of pattern synchronization. This is an alarm LED.
BIT ERR	**BIT Error**. Indicates a Bit error was detected in the payload. This is an error LED.
TCM This LED only appears when TCM Overhead Processing has to be enabled in the Receive settings.	**Tandem Connection Status LED**. Indicates if a TCM error or alarm has been detected. If this LED is red, select the "TCM" text to display the TCM Summary LEDs.
VCAT This LED only appears for VCAT mappings, when one or more channels have been added to the Receive VCG.	**Virtual Concatenation.** Indicates if there are any errors or alarms within the received VCG. This is a status LED. If this LED is red, select the "VCAT" text to display the VCAT Summary LEDs.
VcatLcas This LED only appears for when LCAS is enabled.	**VCAT configured with LCAS**. Indicates if there are any errors or alarms within the received VCG or LCAS data stream. This is a status LED. If this LED is red, select the "VcatLcas" text to display the VCAT/LCAS Summary LEDs.
LCV	**Line Code Violations**. Indicates that the 155M Electrical Interface received a CMI Line Encoding error. This is an error LED.
BPV	**Bi-Polar Violations**. Indicates that the 52M Electrical Interface received a B3ZS Line Encoding error. This is an error LED.

SSM	**Signal Status Mismatch** - Displays when the expected SS bits setting in the H1 byte do not match what is received. This is an alarm LED. SS Bits Alarm Reporting must be enabled for this alarm to occur..

SONET-OMR

SONET Optical Multirate (OMR) Overview

Optical Multirate (also called OMR or just Multirate) is an optional circuit pack that combines the functionality of OC-192/STM-64, OC-48/STM-16, and 622M - 52M SONET/SDH circuit packs on one circuit card. This feature offers multiple interface and mapping functionalities from one location.

To use Multirate functionalities your unit must contain the Optical Multirate circuit pack and be licensed appropriately.

The SONET Multirate Online Help is divided into the following sections:

- OMR Specific Tasks
- OMR Screen and Function Descriptions
- Dual DS3 (Two simulated DS3 Add/Drops for OC-48)

OMR Screen Functions and Descriptions
SONET (OMR) Screen Functions and Descriptions Overview

This section of the online help system describes the various functions, buttons, and tabs that control SONET configuration and operation.

The following screens and functions are discussed:

- Transmit
- Receive
- Results
- Test
- Perf Monitor
- LEDs

Transmit

SONET Transmit Screens and Functions

The Transmit functions allow you to define the parameters used for SONET transmitting operations.

The following parameter setting options are available from the Transmit screen:

- Set > Set 1
- Set > Set 2
- Set > Set 3
- SOH
- POH
- PTR
- APS
- Error Alarm

SONET Transmit - Set / Set 1

The SONET Transmit Settings 1 screen configures the unit's transmit parameters. It contains the following functions:

Function	Description
Settings Controls	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Pass Thru Mode	Activates or deactivates passthru mode, allowing an incoming STS signal to pass through the unit without altering the data in the signal. The following options are available: **On** and **Off**.
Interface	Selects the optical or electrical interface. The following options are available: **OC-192, OC-48, OC-12, OC-3, OC-1**,

	EC-3, and **EC-1** If the test set is licensed for Jitter operation, the following options are also available: **OC-3-Jitter**, **OC-12-Jitter**, **OC-48-Jitter,** and **OC-192-Jitter**
Mapping	Defines the type of signals that are combined to create an SONET signal. For example, four STS-48c's can be mapped into an OC-192 signal. Mapping options are dependent on the selected Interface. The following options may be available: • **Unframed Bulk Fill** • **STS 192c Bulk Fill** • **STS-48c Bulk Fill** • **STS-12c Bulk Fill** • **STS-3c Bulk Fill** • **STS-1 Bulk Fill** • **VT-6 Bulk Fill** • **VT-2 Bulk Fill** • **VT-1.5 Bulk Fill** If the test set is licensed for Dual DS3 and the **OC-48 Interface** is selected, then the **Dual DS3 Async** mapping option is available.
STS-<#> Added	Selects foreground STS# of the mapped signal. When available, select the **STS-<#> Added** button to enter the number of the specific STS channel to set as the *foreground* (source) channel. The default setting is 1. The source channel can be used to transmit alarms, errors, or patterns.
VT Added	Selects foreground VT# of the mapped signal.

	When available, select the **VT Added** button to enter the number of the specific VT channel to set as the *foreground* (source) channel. The default setting is 1. The source channel can be used to transmit alarms, errors, or patterns. This option appears when VT mapping is selected.
Background STS-<#> Pattern	Allows the user to select the type of pattern to be inserted into the remaining *background* channels for the SONET signal. Select one of the following: **User-Defined (32 bit value), PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv.**
Payload Pattern	Allows the user to select a test pattern to transmit over the SONET signal. This command is automatically coupled to its equivalent Receive command. Select one of the following: **User-Defined (32 bit value), PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv.**
Clock Reference	Allows the user to select the timing source for the SONET transmit signal. Select one of the following: **Internal, Recovered, Bits/Sets, External 8 KHz, External 1.544 MHz, External 2.048 MHz, External**

	10 MHz. The External clocks are **75 Ohm TTL.**

SONET Transmit - Set / Set 2

The SONET Transmit Settings 2 screen contains the following functions:

Function	Description
Line Frequency Offset	Adjusts the offset of the signal frequency of the transmitted SONET signal. The frequency can be adjusted in parts per million (ppm). Use the data calculator to enter the offset frequency. The frequency offset ranges from -100.0 to 100.0 in increments of 0.1 A **0 (zero)** value equals **Off**.
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. The following options are available: • **Off** - The unit's laser will be off when the unit is turned on. • **On** - The unit's laser will be on when the unit is turned on. • **Restore Previous State** - When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.
SS Bits in the H1 Label	This function allows bits 5 and 6, which are the SS bits, of the H1 Pointer byte to be set to support a SONET or SDH Transport OH. Changes to the Transport OH are another way to stress an SDH network by simulating errors, alarms, and other stress conditions. The following options are available: **SONET (00)**, **SDH (10)**, or **Undefined**.

Path Signal Label	The Path Signal Label is part of the POH and identifies the type of traffic contained in the SPE. The C2 byte is used to indicate the content of the SPE, including the status of the mapped payload. The following options are available: • **00 (Unequipped)** • **01 (Equipped)** • **02 (VT Structured STS)** • **03 (Lock VT Mode)** • **04 (Async DS3 Mapping)** • **12 (Async DS4NA Mapping)** • **13 (ATM Mapping)** • **14 (DQDB Mapping)** • **15 (Async FDDI Mapping)** • **16 (HDLC Over SONET)** • **1A (10G WAN IEEE802.3ae)** • **1B (GFP Mapping)** • **User Defined** (any eight bit pattern 0 to FF). This option is coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will change in the Overhead screen as well.

VT Signal Label	Bits 5 through 7 of the V5 byte are allocated for a VT Signal Label to indicate the content of the VT SPE, including the status of the VT mapped payload. The following options are available: • **(00) Unequipped** • **(01) Equipped** • **(02) Asynchronous** • **(03) Bit Synchronous** • **(04) Byte Synchronous** • **User Defined** - Any 3-bit value 0h to 7h This option is only available for VT-1.5, VT-2, and VT-6 mappings.
Synchronization Status (S1)	Allows the user to set the S1 byte to one of the following: • **00 (Sync Trace Unknown-STU)** • **01 (Stratum 1 Trace-PRS)** • **04 (Transit Node Clock-TNC)** • **07 (Stratum 2 Trace-ST2)** • **0A (Stratum 3 Trace-ST3)** • **0C (SONET Minimum Clk-SMC)** • **0D (Stratum 3E Trace-ST3E)** • **0F (Do Not Use for Sync-DUS)** • **User Defined** (any eight bit pattern 0 to FF)
Trigger In	Determines how the protocol processor responds when an external pulse is received. Each protocol processor can be configured to respond to an external pulse received using

	the Trigger In connector. The following options are available: • **Restart**: The protocol processor will restart when an external pulse is received. • **Error Insert**: The protocol processor will insert an error (as defined by the Output Trigger function) when an external pulse is received. • **None**: The protocol processor will do nothing when an external pulse is received.
TC Overhead Processing	Enables Tandem Connection Monitoring (TCM) transmit mode. • **Path Enable**: For SDH, the unit uses its TCM circuitry and the N1 byte to generate errors and alarms between TCM equipment. For SONET, the unit uses the Z5 byte. • **VT Enable**: For SDH, the unit uses its TCM circuitry and the N2 byte to generate errors and alarms between TCM equipment. For SONET, the unit uses the Z6 byte. • **Disable**: TCM mode is disabled, and the N1/N2 and Z5/Z6 bytes follow normal operation.

SONET Transmit - Set / Set 3

The SONET Transmit Settings 3 screen contains the following functions:

Function	Description
Orderwire Add	Allows you to add or drop an orderwire circuit. The following options are available: • **None** • **E1** • **E2** • **F1**

	• **F2-P** • **Z3P**
Datacom Channel Add	Defines specific bytes in the Section and Line overhead that is used to send operation and maintenance information between the Section and Line equipment. The following options are available: • **None** • **Section DCC Port** • **Section PRBS 2^7-1** • **Section PRBS 2^7- 1 Inv** • **Line DCC Port** • **Line PRBS 2^7-1** • **Line PRBS 2^7-1 Inv**

SONET Transmit - SOH

The Transmit SOH screen contains the following options:

Function	**Description**
Showing	Select **Showing** to choose an Overhead slot within the SONET signal. The overhead bytes that appear on the SOH screen are associated with this slot.
Section and Line Overhead bytes	Allows the user to select an Overhead byte to edit its value.
J0 Trace	The J0 byte is part of the Section Overhead and is known as the Section trace or J0 trace. The J0 trace is a 64-byte pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The J0 trace can be configured to send the system's default pattern or a customized pattern. The following options are available:

	• **Default (64 byte)** - Selects the 64-byte Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)** - Selects a 64-byte user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones** - Selects an All Ones pattern as the J0 trace pattern. • **All Zeros** - Selects an All Zeros pattern as the J0 trace pattern. • **Default (16 byte)** - Selects the 16-byte Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)** - Selects a 16-byte user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.

SONET Transmit - POH

The Transmit POH screen contains the following options:

Function	Description
STS-<#> Added	Allows the user to enter the number of the specific STS channel to set as the *foreground* (source) channel. The default setting is 1.

Path and VT Overhead Bytes	Path Overhead Bytes include: B3, J1, C2, G1, F2, H4, Z3, Z4, and Z5. VT Overhead Bytes include: V5, J2, Z6, and Z7. **Note**: This option will be disabled if Passthru mode is enabled.
J1 Trace	Selects a default or customized pattern to be used as the J1 trace. Select one of the following patterns: • **Default (64 byte)**: Selects the Digital Lightwave ASCII message as the J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)**: Selects a user-defined ASCII message as the J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones**: Selects an All Ones pattern as the J1 trace pattern. • **All Zeros**: Selects an All Zeros pattern as the J1 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a

	CRC-7.
TC Trace	The TC Trace is a 16-byte pattern that can be created for repeated transmission between TCM equipment. The pattern is a string of ASCII characters and can be configured to send the unit's default pattern or a customized pattern. Enable TCM mode (using TC Overhead Processing) before sending the TC Trace. Select one of the following patterns: • **Default**: Selects the 16-byte Digital Lightwave ASCII message as the TC trace pattern. • **All Ones** - Selects an All Ones pattern as the TC Trace pattern. • **All Zeros** - Selects an All Zeros pattern as the TC Trace pattern. • **User Defined**: Selects a 16-byte user-defined ASCII message as the TC trace pattern. The message is entered and saved using a touch screen keyboard.

SONET Transmit - PTR

The Transmit PTR screen contains the following options:

Function	Description
NDF Flag	The NDF Flag allows you to specify whether the NDF bits are set when a new Pointer is present in the generated signal. The following

	options are available: **Yes** (On): Generates an NDF when a new Pointer is transmitted. **No** (Off): Disables NDF functionality.
Pointer Value	The Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the Virtual Container. The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from 0 to 782. After entering the new Pointer Value, the Pointer automatically moves to the new position.
Frequency Offset	Adjusts the rate at which AU Pointer adjustments are needed in the Administrative Unit (AU). Enter a frequency type ranging from -100.0 ppm to +100.0 ppm. This function is disabled by entering 0.
Pointer Action	Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. **Single options** - Inserts a single Pointer movement with each selection of the INC Pointer or DEC Pointer button. The Pointer value changes by one. **Increment/Decrement option** - Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. **Continuous options** - Inserts a continuous Pointer movement with the selection of the INC Pointer or DEC Pointer button. The movement continues until the Stop Sequence

	button is selected.
Burst Count	This function allows you to determine the number of Pointer location movements to occur when the INC Pointer or DEC Pointer buttons are pressed. The Pointer burst count ranges from 1 to 8.
Ms between Bursts	Allows the user to set the number of Milliseconds between bursts. Valid valued are 34 - 10000.
INC Pointer / DEC Pointer	Alternates the Pointer insertion from increment to decrement with a 200-msec delay in between.

APS

Transmit APS

This is an Automatic Protection Switching (APS) function used to configure transmit APS activity. APS is a feature that allows the LTE to switch to a backup line in case of errors or failures on the main line. APS commands can be configured for either Linear- or Ring-based networks and are transmitted using bytes K1 and K2 of the Line overhead.

You can test the network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response.

The following options are available on the APS screen:

- **New Item** - Opens the Apply Maintenance to Entry window, from which you configure K1 and K2 bytes.
- **Start** - Begins transmission of the K1 and K2 byte configuration.
- **Clear** - Clears the table.

The following Apply Maintenance to Entry window APS Transmit functions are available:

APS Mode - Linear

This function configures the system to transmit APS functions for a Linear (span) network.

- K1 Full Byte (Linear Mode)
- K1 Bits 1-4 (Linear Mode)
- K1 Bits 5-8 (Linear Mode)

- K2 Full Byte (Linear Mode)
- K2 Bit 5 (Provisioned) (Linear Mode)
- K2 Bits 1-4 (Linear Mode)
- K2 Bits 6-8 (Linear Mode)

APS Mode - Ring

This function configures the system to transmit APS functions for a Ring network.

- K1 Full Byte (Ring Mode)
- K1 Bits 1-4 (Ring Mode)
- K1 Bits 5-8 (Ring Mode)
- K2 Full Byte (Ring Mode)
- K2 Bit 5 (Provisioned) (Ring Mode)
- K2 Bits 1-4 (Ring Mode)
- K2 Bits 6-8 (Ring Mode)

Duration in Frames

The Duration in Frames function determines the number of frames transmitted that contain specific K1 and K2 bytes. These bytes are configured using the functionality located on the transmit APS screen.

Frame count is entered using a keypad. Values ranging from 1 to 65535 frames can be entered.

K1 Bits 1-4 (Linear Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description
(0000) NR	No Request, Bit pattern 0000
(0001) Non Rev	Do not revert, Bit pattern 0001
(0010) RR	Reverse Request (Ring), Bit pattern 0010
(0011) Unused	Not Used, Bit pattern 0011
(0100) EXER	Exerciser (Ring), Bit pattern 0100
(0101) Unused	Not used, Bit pattern (0101)
(0110) WTR	Wait to restore, Bit pattern (0110)
(0111) Unused	Not used, Bit pattern (0111)

(1000) MS	Manual switch, Bit Pattern 1000
(1001) Unused	Not used, Bit pattern (1001)
(1010) SD-LP	Signal degrade low priority, Bit pattern (1010)
(1011) SD-HP	Signal degrade high priority, Bit pattern (1011)
(1100) SF-LP	Signal fail low priority, Bit pattern (1100)
(1101) SF-HP	Signal fail high priority, Bit pattern (1101)
(1110) FS	Forced switch, Bit pattern (1110)
(1111) LP	Lockout of protection, Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	**Description**
(0000) NR	No request, Bit pattern 0000
(0001) RR-R	Reverse request (Ring), Bit pattern 0001
(0010) RR-S	Reverse request (Span), Bit pattern 0010
(0011) EXER-R	Exerciser (Ring), Bit pattern 0011
(0100) EXER-S	Exerciser (Span), Bit pattern 0100
(0101) WTR	Wait to restore, Bit pattern (0101)
(0110) MS-R	Manual switch (Ring), Bit pattern (0110)
(0111) MS-S	Manual switch (Span), Bit pattern (0111)
(1000) SD-R	Signal degrade (Ring), Bit Pattern 1000
(1001) SD-S	Signal degrade (Span), Bit pattern (1001)
(1010) SD-P	Signal degrade (Path), Bit pattern (1010). This is the Transmit Default button setting.
(1011) SD-R	Signal degrade (Ring), Bit pattern (1011)

(1100) SF-S	Signal fail (Span), Bit pattern (1100)
(1101) FS-R	Forced switch (Ring), Bit pattern (1101)
(1110) FS-S	Forced switch (Span), Bit pattern (1110)
(1111) LP-S	Lockout of protection (Span), Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 5-8 (Linear Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Linear mode, these bits indicate the channel number. For example, Code 0 is the Null Channel, Codes 1-14 are the working channels, and Code 15 is an extra traffic channel.

The following options are available:

Options	**Description**
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit

	pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Bits 5-8 (Ring Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Ring mode, these bits contain the Destination Code Identification.

The following options are available:

Options	**Description**
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010

#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Full Byte (Linear Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	**Description**
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.

Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K1 Full Byte (Ring Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Bit 5 (Provisioned) (Linear Mode)

This function edits the 5th bit of the K2 byte. In Linear mode. This bit controls the type of protection switching architecture used.

The following options are available:

Options	Description

1+1	Provisioned for 1+1 mode; Bit 5 = 0
1 : n	Provisioned for 1:n mode; Bit 5 = 1

K2 Bit 5 (Provisioned) (Ring Mode)

This function edits the 5th bit of the K2 byte. In Ring mode, this bit controls the type of path code used.

The following options are available:

Options	Description
SHT / OTO	Short Path Code; Bit 5 = 0
LNG / OTN	Long Path Code; Bit 5 = 1. When selected, both the Transmit Default and Transmit Illegal button settings are configured for LNG/OTN.

K2 Bits 1-4 (Linear Mode - SDH)

This function edits the first four bits of the K2 byte. In Linear mode, the first four bits indicate which working channel is bridged onto the protection channel during a traffic switching event.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010

#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K2 byte. In Ring mode, the first four bits are the Source Node Identification. (The Source Node ID is set to the Node's own ID.)

The following options are available:

Options	Description
#0	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Linear Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Unused	Not used, Bit pattern 000
(001) Unused	Not used, Bit pattern 001
(010) Unused	Not used, Bit pattern 010
(100) Unused	Not used, Bit pattern 100
(100) Uni-direct	Provisioned for Unidirectional switching, Bit pattern 10
(101) Bi-direct	Provisioned for Bidirectional switching, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Ring Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Idle	Idle, Bit pattern 000
(001) Br	Bridged, Bit pattern 001
(010) Br&Sw	Bridged and switched, Bit pattern 010. This is the Transmit Default button setting.
(100) Ex Tr	Extra traffic on protection channel, Bit pattern 100
(100) Unused	Not used, Bit pattern 10
(101) Unused	Not used, Bit pattern 101

(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Full Byte (Linear Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Full Byte (Ring Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description

Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

SONET Transmit - Error Alarm

The test unit can transmit errors and alarms to simulate various defects and anomalies to determine if the receiving equipment can detect an error or alarm in the incoming signal.

For information on inserting errors and alarms see the online help topics, Inserting Errors and Inserting Alarms in the Common Tasks section.

The following options are available one the Error Alarm screen:

- Error to Insert
- Error Insert Rate
- Alarm Generated

Error to Insert

This SONET Transmit function determines the type of error transmitted by the system.

The purpose of generating an error with system is to stress the network element that is receiving the error by testing if it can detect the incoming error and then report error statistics such as error counts and rates.

The following options are available:

Option	Description
None	No errors are generated. Turns errors off.
Frame	Inserts a frame alignment error in the

	A1 and A2 bytes.
B1 Error	Generates a BIP-8 (Bit Interleaved Parity, 8-bit) error over the Section layer. Bits in the B1 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
B2 Error	Generates a BIP-8 error over the Line layer. Bits in the B2 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
REI-L	Generates a Remote Error Indicator over the Line layer. An REI-L is a count of B2 errors received at the far end. When the system transmits this error, it simulates a downstream NE sending an error count back to the source of its incoming SONET signal. The system uses the M1 byte of the Line OH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and rates. (This type of error was formerly called a Line Far End Block Error - FEBE-L.)
B3 Error	Generates a BIP-8 error over the STS Path layer. Bits in the B3 byte

	are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
REI-P	Generates a Remote Error Indicator over the Path layer. An REI-P is a count of B3 errors received at the far end. When the system transmits this error, it simulates an NE sending an error count back to the source of its incoming SONET signal. The system uses the G1 byte of the Path OH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and error rates. (This type of error was formerly called a Path Far End Block Error - FEBE-P.)
BIP-V	Generates a BIP-2 error over the VT layer. Bits in the V5 byte are toggled to create an error.
REI-V	Generates a Remote Error Indicator over the VT layer. An REI-V is a count of BIP-V errors received at the far end. When the system transmits this error, it simulates an NE sending an error count back to the source of its incoming SDH signal. The system uses the V5 byte of the VTOH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming

	remote errors, and (2) then conduct performance monitoring such as error counts and error rates.
TC-IEC-P Only appears when the TC Overhead Processing is configured for "**Path Enable**".	Generates a Tandem Connection Incoming Error Count over the Path layer. A TC-IEC is a count of B3 errors received by TCM equipment at the far end. Bits 1-4 of the N1 byte are the IEC bits.
TC-REI-P Only appears when the TC Overhead Processing is configured for "**Path Enable**".	Generates a Tandem Connection Remote Error Indicator over the Path layer between TCM equipment. Bit 5 of the N1 byte is used for this error.
TC-OEI-P Only appears when the TC Overhead Processing is configured for "**Path Enable**".	Generates a Tandem Connection Outgoing Error Indicator over the Path layer between TCM equipment. Bit 6 of the N1 byte is used for this error.
TC-BIP-V Only appears when the TC Overhead Processing is configured for "**VT Enable**".	Generates a Tandem Connection Bit Interleaved Parity error over the VT layer. Bits 1-2 of the N2 byte are the BIP bits.
TC-REI-V Only appears when the TC Overhead Processing is configured for "**VT Enable**".	Generates a Tandem Connection Remote Error Indicator over the VT layer between TCM equipment. A TC-REI-V is a count of TC-BIP-V errors received by TCM equipment at the far end. Bit 5 of the N2 byte is used for this error.
TC-OEI-V Only appears when the TC Overhead Processing is configured for "**VT Enable**".	Generates a Tandem Connection Outgoing Error Indicator over the VT layer between TCM equipment. Bit 6 of the N2 byte is used for this error.
BIT Error	Generates bit errors. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and error rates.

Error Insert Rate

This SONET Transmit function sets the error rate for the selected error. The system starts transmitting errors after the insertion rate is selected.

For information about inserting errors, see Inserting Errors in the Common Tasks section of the online help.

The following Error Insert Rate options are available:

Option	Description
Off	Turns error transmission off.
Maximum	Generates errors at the maximum rate listed below.
1e - *X*	*X* is a value from 3 to 10; for example, 1e-3 through 1e-10. *X* will vary based on the type of error selected.
User Defined	Allows the user to enter a custom error. Valid values are 1e-6 to 1e-10.

Alarm Generated

This function configures the system to generate an alarm in the transmit SONET signal. Alarm generation by the system is one way to test if downstream SONET equipment reacts properly to the alarm it receives in the incoming SONET signal.

For information about generating alarms, see Inserting Alarms in the Common Tasks section of the online help.

The following alarms are available:

Alarm	Description
None	No alarms are generated. Turns alarms off.
LOS	Loss of Signal. An all-zeros pattern is transmitted to simulate a loss of signal or loss of optical power. This forces the downstream SONET equipment to (1) generate an AIS alarm to its downstream network elements (NE), and (2) generate an RDI alarm to its upstream NEs.

LOF	Loss of Frame. An all-zeros pattern is inserted into the A1 and A2 framing bytes of the Section OH. This simulates the absence of a valid framing pattern. This forces the downstream SONET equipment to generate an AIS alarm to its downstream network elements (NE)and generate an RDI alarm to its upstream NEs.
AIS-L	Line Alarm Indication Signal. The transmission of an AIS-L to a downstream NE forces that NE to send an AIS-P alarm to the next downstream NE. The NE will also send an RDI-L alarm to its upstream equipment. An AIS-L simulates an alarm generated by Line terminating equipment (LTE).
RDI-L	Line Remote Defect Indicator. This generates an RDI-L condition using the K2 byte of the Line OH. This simulates a downstream NE (in this case the NIC) at the Line layer, reporting a failure to an upstream NE. The downstream NE (NIC 10G) has encountered a downstream failure and is alerting upstream SONET equipment. To do this, the NIC 10G changes the pattern of the K2 byte. The NE receiving the RDI-L alarm should detect a change to the K2 byte on the incoming SONET signal. This forces the NE to generate a Remote Alarm Indicator (RAI) to its upstream NEs.
LOP-P	STS Path Loss of Pointer. This simulates a loss of a valid STS Pointer. When the downstream NE receives an LOP-P, it generates a DSn AIS alarm to its downstream equipment and an RDI-P alarm to its

	upstream equipment.
AIS-P	Path Alarm Indication Signal. The transmission of an AIS-P to a downstream NE forces that NE to send an AIS alarm to the next downstream NE. The NE will also send an RDI alarm to its upstream equipment. An AIS-P simulates an alarm generated by Path terminating equipment (PTE).
RDI-P	Path Remote Defect Indicator. This generates an RDI-P condition using the G1 byte of the Path OH. This simulates a downstream NE (in this case, the NIC), at the Path layer, reporting a failure to an upstream NE. To do this, the system changes the pattern of the G1 byte in the Path OH. The NE receiving the RDI-P alarm should detect a change to the G1 byte on the incoming SONET signal.
UNEQ-P	Path Unequipped Alarm. An all-zeros pattern is inserted into the C2 byte of the Path OH. The C2 byte is the STS Path Signal Label. (This type of error is used between Path terminating equipment - PTE) When a PTE receives this alarm, it will generate an AIS to downstream NEs.

TC-RDI-P Only appears when the test set is configured for TC Overhead Processing.	Tandem Connection-Remote Defect Indicator. Generates an alarm to upstream equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 8 in multiframe 73 of the N1 byte.
TC-ODI-P Only appears when the test set is configured for TC Overhead Processing.	Tandem Connection-Outgoing Defect Indicator. Generates an alarm to upstream TCM equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 7 in multiframe 74 of the N1 byte.
TC-AIS-P Only appears when the test set is configured for TC Overhead Processing.	Tandem Connection-Alarm Indication Signal. Generates an AIS alarm to downstream TCM equipment by setting Bits 1-4 of the N1 byte to 1110.
TC-UNEQ-P Only appears when the test set is configured for TC Overhead Processing.	Tandem Connection-Unequipped. An all-zeros pattern is inserted into the N1 byte of the Path OH.
TC-LOF-P Only appears when the test set is configured for TC Overhead Processing.	Tandem Connection-Loss of Frame. Generates a loss of a valid multiframe pattern to downstream equipment.

Receive

SONET Receive Screens and Functions

The Receive function allows you to define the parameters used in SONET receiving operations.

The following parameter setting options are available from the Receive screen:

- Set > Set 1
- Set > Set 2
- Set > Set 3
- SOH
- POH

- SIG

SONET Receive - Set / Set 1

The SONET Receive Settings 1 screen configures the unit's receive parameters. It contains the following functions:

Function	Description
Settings Control	If **Coupled** is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If **Independent** is selected, settings established on the Receive screen will only affect Receive mode.
Interface	Selects the optical or electrical interface. The following options are available: **OC-192**, **OC-48**, **OC-12**, **OC-3**, **OC-1**, **EC-3**, and **EC-1** If the test set is licensed for Jitter operation, the following options are also available: **OC-3-Jitter**, **OC-12-Jitter**, **OC-48-Jitter**, and **OC-192-Jitter**
Mapping	Defines the type of signals that are combined to create an SONET signal. For example, four STS-48c's can be mapped into an OC-192 signal. Mapping options are dependent on the selected Interface. The following options may be available: • **Unframed Bulk Fill** • **STS-192c Bulk Fill** • **STS-48c Bulk Fill** • **STS-12c Bulk Fill** • **STS-3c Bulk Fill** • **STS-1 Bulk Fill** • **VT-6 Bulk Fill**

	• **VT-2 Bulk Fill** • **VT-1.5 Bulk Fill** If the test set is licensed for Dual DS3 and the **OC-48 Interface** is selected, then the **Dual DS3 Async** mapping option is available.
STS-<#> Dropped	Selects a specific signal to monitor in the SONET signal. The test set receives the SONET signal that is demuxed into dropped signals and then processed. The options that appear will depend on your current configuration. The default setting is 1.
VT Dropped	Selects a Virtual Tributary to dropped. This option appears when VT mapping is selected.
Payload Pattern	Selects the type of pattern that the unit expects to receive on the incoming SONET signal. The following options are available: • **Live** (user data is received; no pattern is used) • **User Defined** (range from 1 bit to 32 bits and is entered using a touch screen keypad) • **PRBS 9**, **PRBS 9 Inv**, **PRBS 11**, **PRBS 11 Inv**, **PRBS 15**, **PRBS 15 Inv**, **PRBS 20**, **PRBS 20 Inv**, **PRBS 23**, **PRBS 23 Inv**, **PRBS 31**, **PRBS 31 Inv**
Power Low Threshold	Sets the power threshold. If the power drops below the threshold, the Power Low alarm initiates. When the threshold is reached, the LOS alarm signals.
Out of Frequency Threshold	Sets the frequency threshold for the

	Line Frequency Offset. When the threshold is reached, the Frequency Wide alarm is triggered.
Trigger Out	Allows the user to select the way that the protocol processor will respond to an external "pulse" received.

SONET Receive - Set / Set 2

The SONET Receive Settings 2 screen configures the unit's receive parameters. It contains the following functions:

Function	Description
PLM Alarm Reporting	**Disable** or **Enable** Payload Label Mismatch reporting.
Expected Path Signal Label	Enter any eight bits for the Higher-Order Path Signal Label for byte C2 expected. Configure to receive a specific value for the C2 byte. The following options are available: • **00 (Unequipped)** • **01 (Equipped)** • **02 (VT Structured STS)** • **03 (Lock VT Mode)** • **04 (Async 34M/45M Mapping)** • **12 (Async DS4NA Mapping)** • **13 (ATM Mapping)** • **14 (DQDB Mapping)** • **15 (Async FDDI Mapping)** • **16 (HDLC Over SONET)** • **1A(10G WAN IEEE802.3ae)** • **User Defined** (any eight bit pattern 0 to FF) This option is not coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will not change the Transmit setting.
Expected VT Signal Label	Select one of the following values for the expected Lower Order Path

	Signal: • **00 (Unequipped)** • **01 (Equipped)** • **02 (Asynchronous)** • **03 (Bit Synchronous)** • **04 (Byte Synchronous)** • **User Defined** (any eight bit pattern 0 to FF) This option only appears when VT mapping is configured. It is not coupled with the V5 byte option in the Transmit Overhead screen. If it is changed in this screen, it will not change the Transmit setting.
TIM Alarm Reporting	An STS Path Trace Identifier Mismatch (TIM-P) alarm occurs when the incoming J1 trace does not match the expected J1 trace. A Section Trace Identifier Mismatch (TIM-S) alarm occurs when the incoming J0 trace does not match the expected J0 trace. The following options are available: • **Enabled** - TIM alarms are recognized and reported. • **Disabled** - TIM alarms are ignored.
Expected J0	Defines the expected J0 trace received on the incoming SONET signal. A TIM-S alarm occurs if the incoming J0 trace does not match the expected J0 trace. The J0 byte is part of the Section OH and is known as the Section trace, or J0 trace. The J0 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. • **Default (64 byte)** - Selects the Digital Lightwave ASCII

	message as the expected J0 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)** - Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones** - Selects an All Ones pattern as the J0 trace pattern. • **All Zeros** - Selects an All Zeros pattern as the J0 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.
Expected J1	Defines the expected J1 trace received on the incoming SONET signal. A TIM-P alarm occurs if the incoming J1 trace does not match the expected J1 trace. The J1 byte is part of the Higher-order Path OH and is known as the Path trace, or J1 trace. The J1 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The following options are

	available: • **Default (64 byte)** - Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)** - Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones** - Selects an All Ones pattern as the J1 trace pattern. • **All Zeros** - Selects an All Zeros pattern as the J1 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.
Expected J2	Defines the expected J2 trace received on the incoming SONET signal. A TIM-P alarm occurs if the incoming J2 trace does not match the expected J2 trace. The J2 byte is part of the Lower-order Path OH. The J2 trace is a pattern that can be created for repeated transmission. This 16-

	byte frame is identical to the 16-byte frame of the J1 and J0 bytes. The following options are available: • **Default (64 byte)** - Selects the Digital Lightwave ASCII message as the expected J2 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)** - Selects a user-defined ASCII message as the expected J2 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones** - Selects an All Ones pattern as the J2 trace pattern. • **All Zeros** - Selects an All Zeros pattern as the J1 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the expected J2 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the expected J2 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.
SS Bits Alarm Reporting	**Disables** or **Enables** SS bits reporting. This function is used in conjunction with the Expected SS Bits function. If enabled, and an SS Bits mismatch is detected on the received signal, the duration in

	seconds will appear under the Results Scan function.
Expected SS Bits	Selects one of the following as the expected SS Bits value: • **00 (SONET)** • **01 (Undefined)** • **10 (SDH)** • **11 (Undefined)**
TC Error/Alarm Processing	Enables or disables Tandem Connection Monitoring (TCM) mode. This function is used in conjunction with the Expected TC Trace function. The TC Summary LED turns red if a TCM error or alarm is reported. Select the TC Summary text for more details. • **Path Enable** - Turns on N1 byte for TCM error and alarm reporting mode. • **VT Enable** - Turns on the N2 byte for TCM error and alarm reporting mode. • **Disable** - Turns off TCM error and alarm reporting mode. Disable this option if you are not performing TCM testing. This will prevent false error and alarm reporting.
Expected TC Trace	Defines the expected TC trace received on the incoming signal. For SONET, this is in the Z5 byte. For SDH, this is in the N1 byte. The following options are available: • **Default** - Selects a 16-byte Digital Lightwave ASCII message at the expected TC trace pattern. • **All Ones (16 byte)** - Selects a 16-byte All Ones pattern as

	the TC trace pattern. • **All Zeros (16 byte)** - Selects a 16-byte All Zeros pattern as the TC trace pattern. • **User Defined** - Selects a 16-byte user-defined ASCII message as the expected TC trace pattern. The message is entered and saved using a screen keypad.

SONET Receive - Set / Set 3

The SONET Receive Settings 3 screen configures the unit's receive parameters. It contains the following functions:

Function	Description
Orderwire Drop	Allows you to drop an orderwire circuit for a protocol processor. The following options are available: **None**, **E1**, **E2**, **F1**, **F2-P, Z3-P**
Datacom Channel Drop	Defines specific bytes in the Section overhead that is used to send operation and maintenance information between the Section and Line equipment. The following options are available: • **None** • **Section DCC Port** • **Section PRBS 2^7-1** • **Section PRBS 2^7-1 (Inverted)** • **Line DCC Port** • **Line PRBS 2^7-1** • **Line PRBS 2^7-1 (Inverted)**

Monitor Mode	Expands the receive sensitivity for the 52M or 155M electrical interfaces. Use this setting for better clock and data recovery, when the received voltage levels are lower than normal. This setting is only supported on the **NGMR** circuit pack, and not the **OMR** circuit pack. Click here to determine which Multirate circuit pack is in your unit.

SONET Receive - SOH

The Receive SOH screen contains the following options:

Option	Description
Showing	Selects a specific SOH slot to monitor on the incoming SDH signal. The following bytes appear for the selected SOH slot: • Section Overhead bytes (A1, A2, Z0, B1, E1, F1, D1, D2, and D3), • Lower Path Overhead bytes (B2, K1, K2, D4-D12, Z1, Z2, and E2), • Pointer bytes (H1, H2, and H3), • Path Overhead bytes (B3, C2, G1, F2, H4, Z3, Z4, and Z5), • J0 Trace byte, and J1 Trace byte.
J0	Displays the J0 trace received on the incoming SDH signal. This is a read-only function.

SONET Receive - POH

The Receive POH screen contains the following options:

Option	Description
STS-<#> Dropped	Allows the user to enter the number of the specific STS channel to monitor. The default setting is 1.
Path Overhead	Displays the Overhead bytes for a specific Path OH slot on the incoming SONET signal. This is a read-only function.
VT Overhead	Displays the VT Overhead bytes for a specific VT Dropped channel. This is a read-only function.
J1 Trace	Displays the J1 trace received on the incoming SONET signal. This is a read-only function.
J2 Trace	Displays the J2 trace received on the incoming SONET signal. This is a read-only function.
TC Trace	Displays the TC trace received on the incoming SONET signal. This is a read-only function.

SONET Receive - SIG

Displays the following measurements of the incoming SONET signal:

- Frequency in Hz
- Line Frequency Offset Received in Hz and ppm
- Optical power in dBm
- STS Pointer Frequency Offset in ppm
- VT Pointer Frequency Offset in ppm
- Update Signal Calibration - Calibrating the system's optical power should be done carefully. To keep unauthorized users from changing calibration settings, the Update Signal Calibration button on the protocol processor's Receive SIG screen is unavailable by default. To change the setting, a user with Admin or Calibrate privileges must enable the calibration mode.

To enable protocol processor calibration:

1. From the **System** tab, select **Misc**.
2. From **Local Settings**, select **Enable Calibration**.

The user must have Admin or Calibrate privileges to enable the calibration mode.

3. See Calibrating SDH/SONET Optical and Electrical Power for specific calibration instructions before proceeding.

Results

SONET Results Screens and Functions

All monitored activity that the system receives is reported to the Results screen for viewing and analyzing. The Results screen provides information used for analyzing the incoming signal, pattern, errors, and alarms.

The following options are available from the Results screen:

- Scan / Error / Alarm
- PTR
- Event
- APS
- Large LED
- Graph

SONET Results - Error / Alarm

The Results Error / Alarm screen contains the following options:

- **Scan** - Select Scan to access a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected. This function displays a list of received errors and alarms. For alarms, the duration is reported as a count in seconds. For errors, an error count is reported.

  When no activity is occurring, the screen displays, "No errors or alarms."

- **Errors** - The unit can monitor and report errors on the incoming SDH signal. The Errors function provides a detailed analysis of the incoming error as described below. The reported errors are a result of incoming errors that are generated by the SDH network, or errors that are intentionally generated by the system when it is used in a loopback environment.

  The following errors can be monitored:

  - Frame
  - B1 (Section BIP-8, also known as a Section Coding Violation - CV-S)
  - REI-V (Remote Error Indication - Virtual Tributary)
  - BIT (BIT errors reported in the payload)

- B2 (Line BIP-8, also known as a Line Coding Violation - CV-L)
- B3 (Path BIP-8, also known as a Path Coding Violation - CV-P)
- REI-P (Remote Error Indication - Path)
- BIP-V (Bit Interleaved Parity - Virtual Tributary)
- REI-L (Remote Error Indication - Line)
- NDF-P (New Data Flag - Path)
- NDF-V (New Data Flag - Virtual Tributary)
- TC-IEC-P (Tandem Connection-Incoming Error Count)
- TC-REI-P (Tandem Connection-Remote Error Indicator)
- TC-OEI-P (Tandem Connection-Outgoing Error Indicator)

The following parameters are measured for the incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format
- Error-free seconds using an 8-digit format
- Errored seconds
- Severely Errored seconds
- Unavailable errored seconds

- **Alarms** - The system can monitor and report alarms and their duration on the incoming SDH signal. The alarms are shown in duration of the alarm in seconds.

The following alarms can be monitored:

- LOS (Loss of Signal)
- Power Hot
- Power Low
- Frequency Wide
- OPU Generic AIS
- LOF (Loss of Frame)
- AIS-L (Alarm Indication Signal - Line)
- Concat (Concatenated)
- AIS-P (Alarm Indication Signal - Path)
- LOP-P (Loss of Pointer - Path)
- UNEQ-P (Unequipped - Path)
- RDI-P (Remote Defect Indicator - Path)
- TIM-P (Trace Identifier Mismatch - Path)
- TIM-S (Trace Identifier Mismatch - Section)

- APS-L (Automatic Protection Switching-Line)
- SEF (Severely Errored Frame)
- RDI-L (Remote Defect Indicator - Line)
- Pat Sync (Pattern Synchronization)
- PLM-P (Payload Label Mismatch - Path)
- AIS-V (Alarm Indication Signal - Virtual Transport)
- LOP-V (Loss of Pointer - VT)
- LOM-V (Loss of Multiframe Alignment - VT)
- UNEQ-V (Unequipped - Virtual Transport)

SONET Results - PTR

This PTR function monitors and reports received Pointer statistics. A count of the following Pointer statistics appear:

The following STS Pointer results appear:

- **Pointer Justification** - Indicates the Positive Pointer Justification count.
- **Negative Justification** - Indicates the Negative Pointer Justification count.
- **Positive Justification Seconds** - Indicates the duration of a Pointer adjustment.
- **NDF Coun**t - Indicates the New Data Flag count.
- **Rx Pointer Bytes (HEX)** and **Rx Pointer Value** (in decimal) - Valid Pointers range from 0 to 782.

When lower-order mapping is configured VT Pointer results also appear.

SONET Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

SONET Results - APS

The APS function monitors incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 15 byte sequences can appear on the screen.

The Results APS screen contains the following options:

Option	Description
APS Summary	When selected, the following information appears in the results table last 15 K1 and K2 byte sequences received: • The HEX value of the K1 byte. • The HEX value of the K2 byte. • The number of frames received that contain the K1 and K2 bytes. • The elapsed time of the frames that contain the K1 and K2 bytes. To view decoded values for a specific Item, select the Item number. The APS Decode dialog box appears displaying the Item's configuration.
APS Decode	When selected, the results table splits into two horizontal tables: the top table displaying K1 results; the bottom table displaying K2 results. The K1 table decodes the value for bits 1-4 and bits 5-8. The K2 table decodes the value for bits 1-4, bit 5, and bits 6-8. Also displayed in the tables are the number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that

	contain the K1 and K2 bytes for the last 15 byte sequences received.
APS View Mode	Allows the user to view decoded values in either **Linear** Protection Switching Mode or **Ring** APS Signaling Mode.

Per GR-253-CORE, only the upper 12 bits of the K1/K2 bytes (K1 bits 1-8 and the K2 bits 1-4) are used for APS operation. K2 bit 5 sets the APS mode type (1+1, 1:n) and cannot be changed during operation. K2 bits 6-8 are for alarms. Any changes to the lower four bits of the K2 byte do not affect APS operation. The Results APS table only starts and displays a new entry item if the upper 12 K1/K2 bits stabilize on a new value for a minimum of three consecutive frames.

SONET Results - Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	**Then this indicates ...**
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

For a list of available LEDs in the SONET protocol processor, see SONET LEDs.

SONET Results - Graph

The Graph function allows incoming errors and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

For more information about graphs, select Using Graphs in the Common Tasks section of the online help.

Test

Test Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- SET 1
- Service Disruption
- RTD (Round Trip Delay)

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Service Disruption

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service

disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The service disruption measurements show a granular accuracy of 1 frame duration. See the chart at the bottom of this page for time per frame durations for each protocol processor.

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

  For **E4**, **E3**, **E1**, **DS3** and **DS1** processors, the Protection Switch Criteria is limited to: Loss of Pattern Sync and Bit Errors.

  For **SONET** and **SDH** processors the Protection Switch Criteria include: B1, SEF / OOF, AIS-L / MS-AIS, AIS-P / AU-AIS, AIS-V / TU-AIS, and PRBS (Loss of Pattern Sync and Bit Errors).

  For **OTN** processors the Protection Switch Criteria include: OOF, OTU:AIS, OTU:BIP8, ODU:AIS, ODU:BIP8, and PRBS (Loss of Pattern Sync and Bit Errors).

- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **State** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

Single APS - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

Continuous APS - Constantly monitors for service disruption events, and updates the seconds and frames reported.

Stop APS - Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)** - Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.
- **Protection Switch Time (Frames)** - Indicates the number of errored frames received during the service disruption event.
- **History Recent Milli Seconds** - Shows the time durations for the last ten measurements recorded.
- **History Recent Frames** - Shows the frame durations for the last ten measurements recorded.

A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing Service Disruption.

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
SONET / SDH	0.125 ms (125 µs)	16383 frames (2047.875 ms)
OTU 1	0.049 ms (49 µs)	16383 frames (802.302 ms)
OTU 2	0.012 ms (12 µs)	16383 frames (199.732 ms)
E4	0.021 ms (21 µs)	255 frames (5.361 ms)
E3	0.045 ms (45 µs)	255 frames (11.397 ms)
E1	0.125 ms (125 µs)	4095 frames (511.875 ms)
DS3	0.106 ms (106 µs)	255 frames (27.133 ms)

DS1	0.125 ms (125 µs)	4095 frames (511.875 ms)

Click this link for Ethernet Service Disruption specifics.

Test - RTD (Round-Trip Delay)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **State:** Starts and stops round-trip delay mode.

  Single Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in frame counts and milliseconds. Frame counts indicates the number of frames received before the AIS frame is received by the unit. Milliseconds indicates how long it took for the AIS frame to travel out and return to the unit.

  Continuous Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and continuously transmitted through your network. The current frame count and duration appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.

  Stop Round-Trip Delay - Stops round-trip delay activity. The State returns to Inactive.
- **Round Trip Delay Time (milliSec):** Indicates the duration in seconds that it took for the known frame to return to the unit.
- **Round Trip Delay Time (Frames):** Indicates the number of frames received during the measurement.
- **Consecutive Good Time Required:** This function allows you to enter the duration (in milliseconds) of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 0.125 to 2047.875 milliseconds and is entered using a keypad.
- **Consecutive Good Frames Required**: This function allows you to enter the number of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 1 to 16383 frames and is entered using a keypad.

For more information about round-trip delay, select *Round-Trip Delay* in the Common Tasks section of the online help.

Perf Monitor

SONET Performance Monitor Screens and Functions

Performance Monitoring provides greater detail about incoming Section, Line, Path, and BIT errors.

The following options are available:

- Sect
- Line
- Path
- VT Path
- BIT

SONET Perf Monitor - Sect

This Section screen provides a detailed breakdown for Section errors detected and logged by the SONET protocol processor.

Section Near End B1 Errors

- **CV** - Coding Violations. Error count of incoming B1 errors.
- **ES** - Errored Seconds. Reports the duration of the incoming B1 errors in seconds and the percentage of errored seconds compared to the duration of error free seconds.
- **EFS** - Error Free Seconds. Reports the duration of the incoming B1 error free seconds and the percentage of error free seconds compared to the duration of errored seconds.
- **SES** - Severely Errored Seconds. Reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal. An SES is reported when 8554 or more B1 errors occur in one second, or when a Severely Errored Frame (SEF) alarm, Loss of Frame (LOF) alarm, or Loss of Signal (LOS) alarm occurs.

SONET Perf Monitor - Line

The Line screen displays a detailed breakdown of incoming B2 (Line BIP-8, also known as Coding Violations) and Line Remote Error Indicator (REI-L) errors.

The following statistics are reported:

Line - Near End B2 Errors

- **CV** - Coding Violations. Reports an error count of incoming B2 errors.
- **ES** - Errored Seconds. Reports the duration of the incoming B2 errors in seconds and the percentage of errored seconds compared to the duration of error free seconds.
- **EFS** - Error Free Seconds. Reports the duration of the incoming B2 error free seconds and the percentage of error free seconds compared to the duration of errored seconds.
- **SES** - Severely Errored Seconds. Reports the duration of SES on the incoming SONET signal. An SES is reported when 9835 or more B2 errors occur in one second, or when a Severely Errored Frame (SEF) alarm, Loss of Frame (LOF) alarm, Loss of Signal (LOS) alarm, or Line Alarm Indication Signal (AIS-L) alarm occurs.
- **UAS** - Unavailable Seconds. Reports the number of seconds that the Line layer was considered unavailable. A Line is unavailable when 10 consecutive seconds that qualify as SES-L seconds occur.

Line - Far End REI Errors

- **CV** - Coding Violations. Reports an error count of the number of B2 errors detected by the far-end Line Terminating Equipment (LTE). These errors are reported back to the unit using the M1 byte of the Line overhead. The M1 byte is also known as the Line Remote Error Indicator - REI-L. (A CV-LFE was formerly known as a Line FEBE.)
- **ES** - Errored Seconds. This counter reports the number of seconds that an REI-L alarm is reported
- **EFS** - Error Free Seconds. Reports the duration of the incoming REI-L error free seconds and the percentage of error free seconds compared to the duration of errored seconds.
- **SES** - Severely Errored Seconds. Reports the duration when 9835 or more REI-L errors are present at the far-end LTE, or when a Line Remote Defect Indicator (RDI-L) alarm is present.
- **UAS** - Reports a count of the number of seconds that an SES-LFE error was present at the far-end LTE. At least 10 consecutive errored seconds of SES-LFE errors must be present before a UAS-LFE is declared.

SONET Perf Monitor - Path

The Path screen displays a detailed breakdown of incoming B3 (Path BIP-8, also known as Path Coding Violations) and STS Path Remote Error Indicator (REI-P) errors.

The following statistics are reported:

Path - Near End B3 Errors

- **CV** - Code Violations. This is an error count of incoming B3 errors.
- **ES** - Errored Seconds. This reports the duration of the incoming B3 errors (in seconds). This statistic also reports the percentage of errored seconds compared to the duration of error-free seconds.
- **EFS** - Error Free Seconds. This reports the duration of the incoming B1 error free seconds. This statistic also reports the percentage of error-free seconds compared to the duration of errored seconds.
- **SES** - Severely Errored Seconds. This reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal. An SES is reported when 2400 or more B3 errors occur in one second, or when an AIS-P alarm, UNEQ-P alarm, LOS alarm, LOF alarm, AIS-L alarm, or LOP-P alarm occurs.
- **UAS** - Unavailable Seconds. This reports the number of seconds that the STS Path layer was considered unavailable. A Path is unavailable when 10 consecutive seconds that qualify as SES-P seconds occur.

Path Far End REI Errors

- **CV** - Code Violations. This is an error count of the number of B3 errors detected by the far-end STS Path Terminating Equipment (PTE). These errors are reported back to the unit using the G1 byte of the STS Path overhead. The G1 byte is also known as the STS Path Remote Error Indicator - REI-P. (A CV-PFE was formerly known as an STS Path FEBE.)
- **ES** - Errored Seconds. This is a counter that indicates the number of seconds that an REI-P alarm is reported.
- **EFS** - Error Free Seconds. Reports the duration of the incoming REI-P error free seconds and the percentage of error free seconds compared to the duration of errored seconds.
- **SES** - Severely Errored Seconds. This reports the duration when 2400 or more REI-P errors are present at the far-end LTE, or when a Line Remote Defect Indicator (RDI-P) alarm is present.
- **UAS** - Unavailable Seconds. This is a counter that indicates the number of seconds that an SES-PFE error was present at the far-end LTE. At least 10 consecutive errored seconds of SES-PFE errors must be present before a UAS-PFE is declared.

SONET Perf Monitor - VT Path

The VT Path screen displays a detailed breakdown of incoming Virtual Tributary path BIP (Section BIP-8, also known as Coding Violations) errors and Virtual Tributary path Remote Error Indicator (REI-P) errors.

The following statistics are reported:

Payload - BIT Errors

- **CV** - Code Violations. Reports the code violations by count.
- **ES** - Errored Seconds. Reports the errored seconds by count, rate, and objective percentage.
- **EFS** - Error Free Seconds. Reports the error free seconds by count, rate percentage, and objective percentage.
- **SES** - Severely Errored Seconds. Reports the error free seconds by count, rate percentage, and objective percentage.
- **UAS** - Unavailable Seconds. Reports the unavailable seconds by count, rate percentage, and objective percentage.

SONET Perf Monitor - BIT

Bit analysis provides a detailed breakdown for detected Payload Bit errors.

The following statistics are reported:

Payload - BIT Errors

- **CV** - Code Violations. Reports the code violations by count.
- **ES** - Errored Seconds. Reports the errored seconds by count, rate, and objective percentage.
- **EFS** - Error Free Seconds. Reports the error free seconds by count, rate percentage, and objective percentage.
- **SES** - Severely Errored Seconds. Reports the error free seconds by count, rate percentage, and objective percentage.
- **UAS** - Unavailable Seconds. Reports the unavailable seconds by count, rate percentage, and objective percentage.

SONET LED Quick Status Area

When the SONET protocol processor tab is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the **Large LED** screen.

LED	Description
TX	Indicates current transmit interface setting and laser wavelength. If the SONET interface is configured for G.709, then OTN appears.
RX	Displays the received optical power in dBm.
E/A	Indicates the current Error / Alarm configured for transmission.
Test Paused	If red, indicates that the current test has been paused.
CLK	Indicates the value of the Transmit Clock Reference

	function.
All Tests (button)	This is a short-cut button to the general "All Test Status" summary LED screen for all circuit packs installed in the unit.
Section	**Section Status LED**. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
LOS	**Loss of Signal**. Indicates that a valid SONET signal is not being received. If an all-zeros pattern exists for 100 milliseconds or longer on the incoming SONET signal, then an LOS is reported.
LOF	**Loss of Frame**. Indicates that a frame alignment problem with the incoming SONET signal has been detected. An LOF is reported if a severely errored framing (SEF) defect continues for 3 milliseconds or longer. This is alarm LED.
SEF	**Severely Errored Frame**. Declared when four or more consecutive errored frames are detected on the incoming SONET signal. This is an alarm LED.
B1	**Section Overhead BIP-8 Code Violation**. Indicates an error in the SONET frame. B1 errors are parity errors. The B1 byte carries the parity information, so a B1 error is a Section error that applies not only to the Section OH, but the entire frame. Any error in the frame will result in B1 error. This is an error LED.
Line	**Line Status LED**. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
REI-L	**Line Remote Error Indicator**. Indicates that an error is occurring at downstream Line terminating equipment. An REI is also known as a Far-End Block Error (FEBE). The M0 and M1 bytes of the SONET Line Overhead are used for this indicator. This is an error LED.
AIS-L	**Line Alarm Indication Signal**. Indicates if an alarm is being received from upstream Line terminating equipment. This is an alarm LED.
APS	**Automatic Protection Switching**. Indicates that the K1 and K2 bytes on the incoming SONET signal have changed.
RDI-L	**Line Remote Defect Indicator**. Indicates that a downstream defect has occurred along the Line layer. (An RDI is also known as a Far-End Remote Failure, FERF). This is an alarm LED.
B2	**Line Overhead BIP-8 Code Violation**. Indicates that parity errors were detected at the Line layer of the

	incoming SONET signal. This is calculated over the Line OH, Path OH, and payload of each STS-1. This is an error LED
Path	**STS Path Status LED**. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
AIS-P	**STS Path Alarm Indication Signal**. Indicates if an alarm is being received from upstream Path terminating equipment. This is an alarm LED.
RDI-P	**STS Path Remote Defect Indicator**. Indicates that a remote alarm is being received from downstream Path terminating equipment. The G1 byte of the SONET Path Overhead is used for this indicator. This is an alarm LED.
LOP-P	**STS Path Loss of Pointer**. Indicates that an invalid Pointer has been received or a Pointer loss has been detected on the incoming SONET signal. This is an alarm LED.
REI-P	**STS Path Remote Error Indicator**. Indicates that an error count is being received from downstream Path terminating equipment. An REI is also known as a Far-End Block Error (FEBE). This is an error LED.
PTR-P	**STS Path Pointer Adjustments**. Indicates Pointer offsets or adjustments between the STS payload and the OC-N frame are occurring. This is a status LED.
B3	**STS Path Overhead BIP-8 Code Violations**. Indicates that parity errors were detected at the Path layer of the incoming SONET signal. This is calculated over the Path OH and payload of each STS-1. This is an error LED.
UNEQ-P	**STS Path Unequipped Payload**. Indicates that a 00h pattern has been detected in the C2 byte. This byte is being received from Path terminating equipment. This is an alarm LED.
VT	**Virtual Tributary Status LED**. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED. This section is only available when VT-1.5, VT-2 or VT-6 is mapped.
AIS-V	**VT Alarm Indication Signal**. Indicates an all-ones characteristic or adapted information signal was detected on the VT. It is generated to replace the normal traffic signal when it contains a defect condition in order to prevent consequential downstream failures being declared or alarms being raised. This is an alarm LED.

LOP-V	**VT Loss of Pointer**. Indicates that an invalid Pointer has been received or a VT Pointer loss has been detected on the incoming SONET signal. This is an alarm LED.
PTR-V	**VT Pointer Adjustments**. Indicates Pointer offsets or adjustments between the VT payload and the OC-N frame are occurring. This is a status LED.
LOM-V	**VT Loss of Multiframe Alignment**. Indicates a Loss of Multiframe Alignment in the VT. This is an alarm LED.
RDI-V	**VT Remote Defect Indicator**. Indicates that a signal was returned to the transmitting VT Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect. This is an alarm LED.
RFI-V	**VT Remote Failure Indicator**. Indicates a defect on the VT at persisted beyond the maximum time allocated to the transmission system protection mechanisms. When this occurs, the RFI is sent to the far end and initiates a path protection switch. This is an alarm LED.
REI-V	**VT Remote Error Indicator**. Indicates to the transmitting node that an errored block has been detected at the VT receiving node. This is an error LED.
UNEQ-V	**VT Unequipped Payload**. Indicates that an all-zeros patterns has been detected in the VT Signal Label of the V5 byte. This is an alarm LED.
BIP-V	**VT Overhead BIP-2 Code Violations**. Indicates an error occurred during a parity check, which involves grouping all the bits in a block into units and then performing a parity check of each bit position in the group. This is calculated over the VT OH and payload of each VT. This is an error LED.
PAT SYNC	**Pattern Sync Mismatch**. Indicates a loss of pattern synchronization. This is an alarm LED.
BIT ERR	**BIT Error**. Indicates a Bit error was detected in the payload. This is an error LED.
TCM This LED only appears when TCM Overhead Processing has to be enabled in the Receive settings.	**Tandem Connection Status LED**. Indicates if a TCM error or alarm has been detected. If this LED is red, select the "TCM" text to display the TCM Summary LEDs.
SSM	**Signal Status Mismatch** - Displays when the expected SS bits setting in the H1 byte do not match what is

	received. This is an alarm LED. SS Bits Alarm Reporting must be enabled for this alarm to occur..

OMR Specific Tasks

SONET Specific Tasks Overview

This section includes tasks that are specific to the SONET protocol processor. For general tasks, refer to the Common Tasks section.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view Specific Tasks for this protocol processor.

- Testing SONET Jitter
- Calibrating SONET Optical and Electrical Power
- Configuring APS (K1 and K2) Commands
- Decoding APS (K1 and K2) Values
- Configuring Dual DS3 Mode

SONET Jitter

Testing Jitter on a Multirate Unit Overview

NIC units that have the Jitter module and are licensed for Optical Multirate, and contain the Multirate circuit pack can set up jitter interfaces from the Multirate (SONET/SDH) tab.

- Attaching Optical Cables
- Configuring Jitter for a Multirate Unit

The Jitter TX laser remains ON when the optical interface is changed to a non-jitter SONET/SDH signal, allowing the Jitter laser and Optical Multirate laser to remain on at the same time.

Attaching Optical Cables

Before starting jitter tests on a NIC Multirate test set you must disconnect the cables from the Multirate TX or RX connector on the NIC connector panel and reconnect them to the Jitter TX or RX connector.

For instructions on connecting cables, see the **Common Tasks** section of Getting Started, located in the NIC Online Help.

Configuring Jitter for a Multirate Test Set

1. Select the **SDH/SONET** tab.
2. Select **Transmit** and choose **Set 1**.
3. Select **Interface**. The Select Type of Interface dialog box appears
4. Select the desired Jitter Interface for testing.
5. Configure all other necessary SDH parameter settings.
6. From the **Jitter** tab, select **Transmit**.
7. Turn the laser **On**.
8. Select **Receive** and choose **SIG**. Ensure that a valid signal is being received for the configured line rate.

When testing Jitter, the Multirate lasers are disabled and the Jitter laser is used.

The Jitter TX laser remains ON when the optical interface is changed to a non-jitter SONET/SDH signal, allowing the Jitter laser and Optical Multirate laser to remain on at the same time.

Attenuate the received optical power level if necessary so that the power level going into the Jitter RX laser is less than -10 dBm.

Calibrating SDH/SONET Optical and Electrical Power

The following procedures describe optical and electrical power calibration. While performing this task, you will measure, record, and enter the power readings for various interfaces.

Before You Begin

- Read these procedures before trying to calibrate the system.
- Click here to determine which Multirate circuit pack is in your unit. Only the electrical interfaces can be field calibrated on the **NGMR** circuit pack

WARNING: Power the system off before removing the optical connector dust caps to clean the unit's fiber optic ports.

- Before performing optical power calibration, use a fiber-optics cleaning kit to clean the fiber-optic ports on the unit, the optical power meter, the optical attenuator, and the fiber cables. Dirty optical fibers will affect optical measurements.
- The following equipment is required for optical calibration:

  Two three-foot singlemode, fiber-optic cables

  Variable optical attenuator

  Optical power meter

  Fiber-optics cleaning kit

  Pencil and paper to record optical power measurements

Calibrating Optical Interfaces

For calibrating 10G interfaces see the SONET or SDH calibration procedures for OC-192 or STM-64. Use the Contents tab on the left side of the online help window to locate and open the appropriate topic. Calibration procedures are located under Specific Tasks.

For calibrating all other optical interfaces see the SONET or SDH calibration procedures for OC-48 or STM-16. Use the Contents tab on the left side of the online help window to locate and open the appropriate topic. Calibration procedures are located under Specific Tasks.

Calibrating Electrical Interfaces

For calibrating 155 Mbps electrical interfaces see the SONET or SDH calibration procedures for EC-3 or STM-1e. Use the Contents tab on the left side of the online help window to locate and open the appropriate topic. Calibration procedures are located under Specific Tasks.

For calibrating 52 Mbps electrical interfaces see the SONET or SDH calibration procedures for EC-1 or STM-0e. Use the Contents tab on the left side of the online help window to locate and open the appropriate topic. Calibration procedures are located under Specific Tasks.

Configuring APS (K1 and K2) Commands

The following only applies to SONET and SDH protocol processors.

Automatic Protection Switching (APS) is a function that allows an LTE to switch to a backup (or protection) channel in case errors or failures occur on the working channel. APS commands can be configured for either Linear- or Ring-based

SONET and SDH networks and are transmitted using the K1 and K2 bytes of the Line Overhead.

You can test your network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response by configuring the K1 and K2 bytes.

You can create up to 16 different K1 and K2 byte configurations (known as byte sequences) to measure and stress your equipment's APS switching capabilities.

To configure K1 and K2 byte values:

1. Select a protocol processor mode.
2. Select the **Transmit** button.
3. Select the **APS** button. The initial APS screen appears containing a table of the K1 and K2 byte sequences that can be transmitted. A total of 16 K1 and K2 byte sequences can appear in the table.
4. Select a byte sequence button (for example,

).

   The **Apply Maintenance to Entry** screen appears. It contains functions used to configure and set the measurement criteria of the K1 and K2 bytes.

5. Use the **APS Mode** function to configure APS commands for **Linear** protection switching mode or **Ring** APS signaling mode.
6. Edit the K1 byte.

   The K1 byte is a request for switch action. There are three functions that allow you to edit the K1 byte:

   - Use the **K1 Full Byte** function to set all eight bits of the K1 byte at once.
   - Use the **K1 Bits 1-4** function to set the first four bits of the K1 byte.
   - Use the **K1 Bits 5-8** function to set the last four bits of the K1 byte.

7. Edit the K2 byte.

   The K2 byte provides additional information about SONET network architecture and alarm conditions. There are four functions that allow you to edit the K2 byte:

   - Use the **K2 Full Byte** function to set all eight bits of the K2 byte at once.
   - Use the **K2 Bits 1-4** function to set the first four bits of the K2 byte.
   - Use the **K2 Bit 5 (provisioned)** function to set the fifth bit of the K2 byte.

- Use the **K2 Bits 6-8** function to set the last three bits of the K2 byte.

8. Select **Duration in Frames** to determine how many frames will be transmitted containing the newly configured K1 and K2 bytes.
9. Select **Update**. The initial APS screen appears on the touch screen.
10. To configure additional K1 and K2 bytes, repeat steps 3-8 as described above. Otherwise, proceed to the next section to transmit K1 and K2 bytes.

To transmit K1 and K2 bytes:

1. Make sure that K1 and K2 byte sequences are configured as described above.
2. Select **Start** to transmit the K1 and K2 bytes.

To stop transmitting K1 and K2 bytes:

1. Select a protocol processor mode.
2. Select the **Transmit** button.
3. Select the **APS** button. The initial APS screen appears.
4. Select **Stop**.

Related Topic:

Decoding APS (K1 and K2) Values

Decoding APS (K1 and K2) Values

The APS function monitors incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 15 byte sequences can appear on the screen. You can choose to view APS activity in either K1 and K2 Hex values or decode them.

To view received K1 and K2 values:

1. Select the **Results** button.
2. Select **APS** from the tabs along the left side of the Results screen.
3. Select **APS View Mode**, and choose whether to decode the K1/K2 byte's value in either **Linear or Ring** Mode.
4. From the APS Results screen, you can decode a **specific** K1/K2 byte's value or decode the values for **all** K1/K2 bytes.

To decode a specific K1/K2 byte value:

- Select **APS Summary**.

The results table displays the K1 byte HEX value, K2 byte HEX value, number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

a. Select the desired **Item** row. The APS Decode dialog box appears with the K1 and K2 byte values decoded.
b. You can scroll through the Items by selecting the **Prev** and **Next** buttons at the bottom of the APS Decode dialog box. Choose **Cancel** when finished.

To decode all K1/K2 byte values:

- Select **APS Decode**.

The results table splits into two horizontal tables: the top table displaying K1 byte results; the bottom table displaying K2 byte results.

The K1 table decodes the values for bits 1-4 and bits 5-8. The K2 table decodes the values for bits 1-4, bit 5, and bits 6-8.

Also displayed in the tables are the number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

Configuring Dual DS3 Mode

Through mapping, the Dual DS3 functionality provides the capability to monitor the two DS3s on Channels 1 and 4 and insert errors and alarms.

This is a licensable option. Please contact Tech Support, or your DLI sales representative, to enable this option on your NIC unit.

To configure Dual DS3 mode:

1. From the **SONET** or **SDH** tab, select **Transmit**.
2. Select **Set** from the tabs along the left side of the **Transmit** screen and choose **Set 1**.
3. Select **Interface** and choose **OC-48/STM-16**.
4. Select **Mapping** and choose **Dual DS3 Async**. The dual DS3 tabs become available.

Dual DS3 Screen and Function Descriptions

DualDS3

Configuring Dual DS3 Mode

Through mapping, the Dual DS3 functionality provides the capability to monitor the two DS3s on Channels 1 and 4 and insert errors and alarms.

This is a licensable option. Please contact Tech Support, or your DLI sales representative, to enable this option on your NIC unit.

To configure Dual DS3 mode:

1. From the **SONET** or **SDH** tab, select **Transmit**.
2. Select **Set** from the tabs along the left side of the **Transmit** screen and choose **Set 1**.
3. Select **Interface** and choose **OC-48/STM-16**.
4. Select **Mapping** and choose **Dual DS3 Async**. The dual DS3 tabs become available.

Dual DS3 Screen and Function Descriptions

Screen Functions and Descriptions

Dual DS3 Screen Functions and Descriptions Overview

This section of the online help system describes the various functions, buttons, and tabs that control Dual DS3 configuration and operation.

The following screens and functions are discussed:

- Transmit
- Receive
- Results
- Test
- Perf Monitor
- LEDs

Transmit

Dual DS3 Transmit Screens and Functions

The Transmit function allows you to define the parameters for using the Dual DS3 functionality.

The following parameter setting options are available from the Transmit screen:

- Set 1
- Set 2
- Error Alarm

Dual DS3 Transmit - Set 1

The Transmit Settings 1 screen configures the framing format for the transmit signal.

The Set 1 screen contains the following options:

Option	Description
Settings Control	This setting is automatically set to Coupled. When a setting is changed on the Transmit screen it also changes on the Receive screen.
Clock	Displays the clock source.
Framing	Configures the framing format used for the DS3 transmit signal. The following options are available: **Unframed** - Configures the system to transmit a DS3 signal using an unframed format. **M13** - Configures the DS3 protocol processor to transmit a signal in a an M13 framing format. **C-Bit** - Configures the DS3 protocol processor to transmit a signal in a C-bit framing format. This type of formatting allows for the use of FEAC codes.

Dual DS3 Transmit - Set 2

The Settings 2 screens allows the user to configure the payload pattern

Option	Description
Mapping	Mapping is automatically set to Bulk Filled.
Pass Thru Mode	Displays the status of Pass Thru Mode.
Payload Pattern	Sets a test pattern to transmit over the DS3 signal. The following options are available: PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, User Defined (1 bit to 32-bit)

Dual DS3 Transmit - Error Alarm

To determine if receiving equipment can detect errors and alarms on the incoming signal, the Transmit Error Alarm screen allows the user to insert errors and alarms to simulate various defects and anomalies.

For information on inserting errors and alarms see the online help topics, Inserting Errors and Inserting Alarms in the Common Tasks section.

The following options are available:

Option	Description
Error to Insert	Allows the user to select an error that will be transmitted for the DS3. The following options are available: • **Bit** - Transmits a bit error which results in a frame synchronization bit error event. This also inserts a frame bit error in the received frame bit pattern. • **Frame** - Results in a severely errored framing event, which occurs when two or more framing bit pattern errors occur within a 3-ms period.

	This option is only available when M13 or C-Bit framing is selected. • **P-Parity** - Results in an error in the P-bit channel (P1 and P2) that provides parity information for the preceding M-frame. This option is only available when M13 or C-Bit framing is selected. • **C-Parity** - Results in an error in the C-bit channel which is used to denote the presence or absence of stuffed bits. This option is only available when C-Bit framing is selected. • **FEBE** - Results in a error in one of the three C-Bits in the M-subframe designated as the Far End Block Error (FEBE) bit. This option is only available when C-Bit framing is selected.
Error Insert Rate	Allows the user to set the insertion rate for the selected DS3 transmit error. This function is not available if Error to Insert is set to None. The following options are available for this command: • **Off** - No errors are inserted for transmission. • **1e-X**, where X is a value from 3 to 9 • **User Defined** - Insert a customized error insertion rate. Valid values are 1e-3 to

	1e-9.
Alarm Generated	Generates a specific alarm on the transmit side of the DS3 protocol processor. The following options are available: LOS, OOF, AIS, Yellow, or Idle. OOF, Idle, and Yellow alarms are not available if DS3 Framing is set to unframed.

Receive

Dual DS3 Receive Screens and Functions

The Receive function allows you to define the parameters used in Dual DS3 receiving operations.

The following parameter setting options are available from the Receive screen:

- Set 1
- SIG

Dual DS3 Receive - Set 1

The Receive Settings 1 screen configures the unit's incoming signal parameters.

The following options are available:

Option	Description
Settings Control	This setting is automatically set to Coupled. When a setting is changed on the Receive screen it also changes on the Transmit screen.
Framing	Configures the framing format used for the DS3 received signal. An error occurs if the DS3 signal is not in the selected framing format. The following options are available: **Unframed** - Configures the system to transmit a DS3 signal using an unframed format.

	M13 - Configures the DS3 protocol processor to transmit a signal in a an M13 framing format. **C-Bit** - Configures the DS3 protocol processor to transmit a signal in a C-bit framing format. This type of formatting allows for the use of FEAC codes.
Mapping	Mapping is automatically set to Bulk Filled.
Payload Pattern	Sets the type of DS3 signal pattern that the system expects to receive. The following options are available: PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, User Defined (1 bit to 32-bit)

Dual DS3 Receive - SIG

The Receive screen displays the line frequency and line frequency offset of the incoming DS3 signal.

The following information is displayed:

- Line Frequency in MHz
- Line Frequency Offset Received in Hz and ppm

Results

Dual DS3 Results Screens and Functions

All monitored activity that the DS3 receives is reported to the Results screen for viewing and analyzing. The Results screen provides information used for analyzing the incoming signal errors and alarms.

The following options are available from the Results screen:

- Scan
- ERR
- Alarm
- Event
- Large LED

- Graph

Dual DS3 Results - Scan

The SCAN screen provides a list of received errors and alarms for the DS3 signal and the duration or count of each event. This function is effective in identifying a general area to investigate when an error or alarm is detected.

When no problems are detected, "No Errors or Alarms" is displayed.

Dual DS3 Results - ERR

The ERR screen reports statistical information on errors including the error count (11 digits), average error rate (in N.NNe-N format), and current error rate (in N.NNe-N format for the current second only).

The following errors are reported:

- **Frame Error** - Reports invalid frames.
- **P-Parity** - Reports errors in the P-bit channel (P1 and P2) that provides parity information for the preceding M-frame.
- **C-Parity** - Reports errors in the C-bit channel of the DS3 channel, which is used to denote the presence or absence of stuffed bits.
- **FEBE** - Far End Block Errors. Reports a count of E-Bit errors, which are SMFs in error at the far end, as determined by a CRC-4 error.
- **BIT** - Errors in the expected bit pattern of the payload.

Dual DS3 Results - Alarm

This function displays how long DS3 alarms were detected by the system.

Results for the following alarms display:

- **Clock** - Indicates an error in clock synchronization.
- **OOF** - Out of Frame. Reports when four consecutive frames are received with invalid (errored) framing patterns.
- **AIS** - Alarm Indication Signal. Reports an alarm indication signal occurrence on the line layer.
- **Idle** - Reports idle alarms.
- **Yellow** - Reports service-affect failure at a terminal.
- **Pat Sync** - Reports a loss of the pattern synchronization.

Dual DS3 Results - Event

The Event screen provides a detailed summary of alarm and error event and activity that have occurred and have been recorded by the unit.

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results.

Select **Resume** to list event activity.

Dual DS3 Results - Large LEDs

This Large LED screen displays the DS3 Quick Status LED error and alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

For a list of available LEDs in the Dual DS3 protocol processor, see Dual DS3 LEDs.

Dual DS3 Results - Graph

Use the Graphs button to view error and alarm results for the DS3 signal. These graphs show the test history for either the current test or the previous test. You can configure the graph function to display any combination of DS3 alarms and errors.

To use the Results Graph functions, see Using Graphs.

Perf Monitor

Dual DS3 Performance Monitor Screens and Functions

Performance Monitoring provides greater detail about incoming BIT and Path errors.

The following options are available:

- BIT
- Path

Dual DS3 Performance Monitor - BIT

The BIT screen provides a detailed breakdown for BIT errors detected and logged by the DS3 protocol processor.

The following statistics are reported on the BIT screen:

Statistics	Description
CV	Code Violation - Bit. This is an error count of incoming B2 errors.
ES	Errored Seconds. The number of seconds and percentage in which errors were detected in the monitored signal.
EFS	Error Free Seconds. The time, in seconds and percentage, in which there were no errors detected in the signal being monitored.
SES	Severely Errored Seconds. The number of seconds and percentage in which the signal has an extremely high error rate.
UAS	Unavailable Seconds. The time in seconds and percentage, in which the monitored signal was unavailable.

Dual DS3 Performance Monitor - Path

The Path screen displays a detailed breakdown of incoming P-Parity and C-Parity errors.

The following statistics are reported:

Statistic	Description
CV	Code Violation. This is an error count of incoming B2 errors.
ES	Errored Seconds. The number of seconds and percentage in which errors were detected in the monitored signal.

EFS	Error Free Seconds. The time, in seconds and percentage, in which there were no errors detected in the signal being monitored.
SES	Severely Errored Seconds. The number of seconds and percentage in which the signal has an extremely high error rate.
UAS	Unavailable Seconds. The time in seconds and percentage, in which the monitored signal was unavailable.

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Dual DS3 LED Quick Status Area

When the DS3 protocol processor is selected, the following LEDs are displayed in the LED Quick Status Area of the touch screen.

LED	Description
TX	Displays the DS3 transmit framing value.
RX	Displays the DS3 receive and the expected receive framing value.
E/A	Displays the error and/or alarm currently generated by the unit.
CLK	Indicates the timing source for the transmit signal. This value is

	specified by the Clock Reference function. Clock settings include: INT, BITS, SETS, or RCVD.
Test Paused	Indicates when a test has been paused from the Test Set 1 screen.
OOF	Out of Frame. Indicates that four consecutive frames have been received with invalid or errored framing patterns. This is an alarm LED.
Frame Err	Indicates if the DS3 protocol processor has received framing errors. This is an error LED.
AIS	Alarm Indication Signal. Indicates an Alarm Indication Signal occurred on the Line layer. This is an alarm LED.
Yellow	Indicates that a yellow alarm was received on the DS3 signal. This is an alarm LED.
P-Parity	Indicates an error in the P-bit channel (P1 and P2) that provides parity information for the preceding M-frame on the DS3 signal. This is an error LED.
C-Parity	Indicates an error in the C-bit channel of the DS3 channel, which is used to denote the presence or absence of stuffed bits. This is an error LED.
FEBE	Far End Block Error. Indicates a Bit error occurred on the far end of the DS3 signal. This is an error LED.
Idle	Indicates an idle alarm was received. This is an alarm LED.
Pat Sync	Pattern Synchronization. Indicates a loss of pattern synchronization. This is an alarm LED.
Bit Err	Bit Error. Indicates a bit error was detected in the payload. This is an error LED.

STM-0/1/4 Tab

STM-0/1/4 Overview

This STM-0/1/4 function is broken down into the following sections:

- STM-0/1/4 Specific Tasks
- STM-0/1/4 Screen and Function Descriptions

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

STM-0/1/4 Specific Tasks

STM-0/1/4 Specific Tasks

This section includes tasks that are specific to the STM-0/1/4 protocol processor. For a list of general tasks, see Common Tasks located in the Getting Started section.

- Calibrate STM-0/1/4 Optical Power
- Monitor STM-0/1/4 Section Overhead
- Monitor STM-0/1/4 Path Overhead
- Change STM-0/1/4 Section Overhead
- Change STM-0/1/4 Path Overhead
- Change Overhead Bytes in Passthru Mode
- Add a DCC Channel
- Start/Stop an STM-0/1/4 TU Scan
- Transmit APS Commands
- SDH Technical Specifications

Calibrate STM-0/1/4 Optical Power

The following procedures describe the unit's optical power calibration. While performing this task, you will measure, record, and enter power reading input for:

- Channel 1 calibration, which includes the Zero power reading input and the optical power readings for -10 dBm and -5 dBm.
- Channel 2 calibration, which includes the Zero power reading input and the optical power readings for -30 dBm and -10 dBm.

Before You Begin

Read these procedures before trying to calibrate the unit.

WARNING: Power the unit off before removing the optical connector dust caps to clean the unit's fiber optic ports.

Before performing optical power calibration, use a fiber-optics cleaning kit to clean the fiber-optic ports on the unit, the optical power meter, the optical attenuator, and the fiber cables. Dirty optical fibers will affect optical measurements.

The following equipment is required for unit optical calibration:

- Two three-foot singlemode, fiber-optic cables
- Variable optical attenuator
- Optical power meter
- Fiber-optics cleaning kit
- Pencil and paper to record optical power measurements

Procedures

How to Calibrate Optical Power for Channel 1

How to Calibrate Optical Power for Channel 2

Monitor STM-0/1/4 Section Overhead

The system can monitor and display the Section Overhead bytes (MS and RS OH) and AU pointer.

The Section Overhead consists of the Multiplex Section and Regenerator Section bytes. You can monitor the incoming signal and view individual bytes for any of the 12 slots in the STM signal.

To view incoming path overhead bytes:

1. Select **STM-0/1/4**.
2. Select **Receive**.
3. Select **SOH**. The Section Overhead bytes appear.
4. Select the **Showing** button to choose an STM slot from the Select Showing Slot Entry list.

   For example, if you select Slot 2 then second slot of SOH bytes are displayed.

The number of Slots available and the specific set of STM OH bytes displayed for each slot is dependent on the selecting Interface Rate and Mapping.

5. The Receive / SOH screen shows the RS OH, MS OH and J0 Trace for the selected slot, while the Receive / POH screen shows the STS Path OH and J1 trace for the selected STS, and the VT OH and J2 trace if VT mapped.

Monitor STM-0/1/4 Path Overhead

The system can monitor and display the Path Overhead bytes (HP and LP OH) and the J1 and J2 Trace bytes.

The Path Overhead consists of the Higher-Order and Lower-Order Overhead bytes. You can monitor the incoming signal and view individual bytes for any of the 12 slots in the STM signal.

To view incoming path overhead bytes:

1. Select **STM-0/1/4**.
2. Select **Receive**.
3. Select **POH**. The Path Overhead bytes appear.

Change STM-0/1/4 Section Overhead

The Section Overhead (SOH) function allows you to stress an STM network by directly editing the Multiplex Section (MS) and Regenerator Section OH bytes to simulate errors, alarms, and other stress conditions.

A specific slot can be selected, and its RS and MS Overhead bytes can be changed for transmission out of the system. By altering the OH bytes, this allows other STM-4 equipment to detect, and if necessary, react to these changes.

To change Section Overhead bytes:

1. Select **STM-0/1/4**.
2. Select **Transmit**.
3. Select **SOH**. The Section Overhead bytes appear.
4. Select the **Showing** button to choose an STM slot from the Select Showing Slot Entry list.

   For example, if you select Slot 2 then second slot of SOH bytes are displayed.

The number of Slots available and the specific set of STM OH bytes displayed for each slot is dependent on the selecting Interface Rate and Mapping.

5. Select an **RS** or **MS** OH byte button.

   A keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

   The byte can also appear in HEX or decimal notation. Select the **HEX** or **DEC** button on the keypad.

The bit value can also be erased from the keypad using the **Clear** button.

6. When editing is complete, select **OK** to save the new value. **Cancel** discards any changes made to the byte and restores the previous value.

Change STM-0/1/4 Path Overhead

The Path Overhead (POH) function allows you to stress an STM network by directly editing the Higher-Order and Lower-Order Path OH bytes to simulate errors, alarms, and other stress conditions.

A specific slot can be selected, and its Higher-Order and Lower-Order Overhead bytes can be changed for transmission out of the system. By altering the OH bytes, this allows other STM-4 equipment to detect, and if necessary, react to these changes.

To change Path Overhead bytes:

1. Select **STM-0/1/4**.
2. Select **Transmit**.
3. Select **POH**.
4. Select an **HP** or **LP** OH byte.

   A keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

The byte can also appear in HEX or decimal notation. Select the **HEX** or **DEC** button on the keypad.

The bit value can also be erased from the keypad using the **Clear** button.

5. When editing is complete, select **OK** to save the new value. **Cancel** discards any changes made to the byte and restores the previous value.

Change Overhead Bytes in Passthru Mode

Passthru mode allows an incoming STM-0/1/4 signals to pass through the unit without altering the data in the signal. However, the Regenerator Section, Multiplex Section, Higher Path, and Lower Path Overhead bytes can be changed to simulate errors, alarms, and other stress conditions such as Pointer Adjustments. This lets you verify if equipment in the SDH network can detect changed Overhead bytes.

To configure the unit for Passthru mode:

1. From the **STM-0/1/4** tab, select **Transmit**.
2. Select **SET 1**.
3. Select the **Passthru Mode** function. The **Select Passthru Mode** window appears.
4. Select **Intrusive** to enable Passthru mode.

To change SOH and POH bytes in Passthru mode:

1. Select **SOH** or **POH**. When Passthru mode is enabled:
   - By default, the OH bytes are passed-through (looped) the unit without being altered. (These bytes are currently disabled on the touch screen.)
   - However, the **Intrusive Overhead buttons** appear to the right of the OH bytes. These buttons allow you to select a specific which OH bytes to intrude on, allowing their values to be changed.
2. Select an **Intrusive Overhead button**. For example, select F1 Pass.

   The selected Intrusive Overhead button changes to indicate that a specific byte has been selected. For example, F1 Pass now appears as F1 Intrude. In addition, the OH byte is now enabled and displays its value.

3. Select the same OH byte (from the left side of the screen) that you selected for Passthru mode (on the right side of the touch screen). For example, select the F1 byte.

A keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

The byte can also appear in HEX or decimal notation by selecting the **HEX** or **DEC** button on the keypad.

4. When editing is complete, select **OK** to save the new value which will be transmitted out of the unit.
5. Repeat steps 2-4 to reconfigure other SOH or POH bytes.

When you intrude on any Regenerator Section OH byte, you automatically intrude on the B1 OH byte. The B1 byte is calculated over all OH bytes. If any OH bytes are changed while in Passthru mode, the transmitted B1 byte will be different from the initial byte value received.

For Multiplex Section OH, both the B1 and B2 bytes are automatically intruded. When these bytes are unintruded, the transmitted B1 and B2 bytes will be different from the initial byte values received.

For Higher Path and Lower Path OH, the B1, B2, and B3 bytes are automatically intruded. When these bytes are unintruded, the transmitted B1, B2, and B3 bytes will be different from the initial byte values received.

Add a DCC Channel

The system supports the addition of DCC Channels into the STM overhead. Adding a DCC channel defines specific bytes in the MS and RS overhead that are used to send operation and maintenance information between equipment.

To add a DataCom Channel:

1. Select **STM-0/1/4**.
2. Select **Transmit**.
3. Select **SET 1**.
4. Select **DataCom Channel Added**. A window with pattern options appears.
5. Select a pattern. Options include:
    - RS PRBS 2^7-1 and RS PRBS 2^7-1 (Inv)
    - RS DCC Port
    - MS PRBS 2^7-1 and MS PRBS 2^7-1 (Inv)
    - MS DCC Port
    - None

The system will add a DataCom channel into the STM overhead.

Start/Stop an STM-0/1/4 TU Scan

The TU Scan function inspects and then reports the contents of the 28 foreground TUG drops that are obtained within a multiplexed STM signal.

The information reported consists of items such as the framing and pattern activity detected on each TU channel drop.

The protocol processor must be receiving a valid signal, otherwise, the scan aborts. While a scan is in progress, you cannot access other functions.

To start a TU scan:

1. Select the **STM-0/1/4** protocol processor tab.
2. Select **Test**.
3. Select **TU Scan**.
4. Select **Start Scan**. Framing and pattern activity for each TU drop is displayed on the screen.

To stop the TU scan:

- Select the **Stop Scan** button.

SDH Technical Specifications

Tech Spec	Description
SDH	STM-0, STM-1, STM-4, STM-16, STM-0e, STM-1e
Line code	**STM-0/16:** NRZ, scrambled **STM-0e:** B3ZS **STM-1e:** CMI
Mapping	**STM-16:** AU-4-16c , AU-4-4c **STM-4/1/0:** AU-4-4c, AU-4/C-4, AU-4/C-3, AU-4/C-2, AU-4/C-12, AU-4/C-11, AU-3/C-3, AU-3/C-2, AU-3/C-12, AU-3/C-11
Line Rate	**TX:** N x 51.84 MHz Stratum III-compliant, Offset capability ± 100 ppm

	RX: N x 51.84 MHz ± 50 ppm (STM-16), ± 100 ppm (up to STM-4)
Input Signal Measurement	**Optical:** Optical power meter is 0 to -26 dBm, ± 1.5dBm. **Electrical:** Peak voltage range is ± 0.31 to ± 1.2vp. **Frequency measurement range:** N x 51.84 MHz ± 50 ppm (STM-16), N x 51.84 MHz ± 100 ppm (up to STM-4)
Synchronization	Internal, received SDH signal, SETS (2.048 Mbps), BITS (1.544 Mbps)
Impedance	Electrical: 75 ohm +5% unbalanced
Level (TX) Optical	**1310:** • STM-0/1/4: -5 dBm typical, singlemode, Intermediate Reach, 1260-1360 nm, 1308 nm typical • STM-16 (optional): Long Reach-compliant **1550:** • STM-0/1/4: 0 dBm typical, singlemode, Long Reach,1480-1580 nm, 1554 nm typical • STM-16: Long Reach-compliant **Dual 1310/1550:** • Comprised of 1310 nm and 1550 nm laser options listed above and additional 1dB power reduction • Level (Rx) STM-0/1/4: -7 to -26 dBm, -30 dBm typical min @ 10-10 BER @ 2^{23} -1 PRBS; • STM-16: -2 dBm to -26 dBm typical, Long Reach-compliant
Level (TX) Electrical	STM-0e/1e: 1.03 Vp +10%
Level (Rx) Optical	-7 to -26 dBm, -30 dBm typical

	minimum at 10^{-10} BER with 2^{23}-1 PRBS for STM-16
Connectors	**Optical:** FC-PC, SC, ST **Electrical:** STM-0e/STM1e: BNC 75 ohm
Error Measurement	B1, B2, B3, LP-BIP, MS-REI, HP-REI, LP-REI, BPV, BIT, AU-NDF, TU-NDF.
Datacom Channel (DCC)	TX and RX: Any 8-bit value in any byte D1 to D12 PRBS* 2^7-1 normal or inverted on D1-D3 or D4-D12; DCC connector on D1-D3 or D4-D12 *PRBS per ITU-T 0.151/0.152
Alarm Detection	Clock sync, pattern sync, LOF, LOS, OOF, MS-AIS, LOP, MS-RDI, AU-AIS, AU-LOP, HP-RDI, HP-UNEQ, RS-TIM, HP-TIM, HP-PLM, TU-AIS, TU-LOP, LP-RDI, LP-PLM, LP-UNEQ, LP-TIM
Alarm Generation	LOF, LOS, MS-AIS, LOP, MS-RDI, AU-AIS, AU-LOP, HP-RDI, HP-UNEQ, TU-AIS, TU-LOP, LP-RDI, LP-PLM, LP-UNEQ, LP-TIM
Patterns	**C4-16c, AU-4-4c, C-4, PRBS* (normal & inverted):** 2^{31}-1, 2^{23}-1, 2^{20}-1, 2^{15}-1, any 32-bit user pattern **C-3, C-2, C-12, C-11: PRBS (normal & inverted):** 2^{23}-1, 2^{20}-1, 2^{15}-1, 2^9-1, any 32-bit user pattern *PRBS per ITU-T 0.151/0.152.
APS Commands	Support of linear- and ring-mode commands for K1/K2 bytes (G.841)
Pointer Control	**AU:** New value, single adjustments (increment or decrement), burst 2-8 adjustments, increment-decrement, decrement-increment, NDF control, AU frequency, Offset: ± 100 ppm **TU:** New value, single adjustments (increment or decrement), NDF control, TU frequency offset is ± 100 ppm.

Control and Monitoring	**Overhead:** • Transmit and receive any 8-bit pattern in all slots for any overhead byte specified. • J0, J1, J2 Trace: Transmit and Receive **Section OH:** A1, A2, C1, D1-D12, E1, E2, F1, K1, K2, S1, M1 Z1, Z2 **HP OH:** C2, F2, G1, J1 (Trace), F3, K3, N1 **Receive monitor:** o Section OH: all bytes o LP OH: V5, J2 (Trace), N2, K4 **Drop & Insert (for terminated element):** E1, E3 • **Pass Through with Drop/Insert: SDH E3 passthru:** Drop/insert of a single E3 to/from the PDH circuit pack or E3 line interface while passing thru the other TU-3s in the signal • **SDH E1 passthru:** Drop/Insert of a single E1 for analysis while passing thru the other TU-12's in the signal • **SDH E3/E1 passthru:** Drop/insert of a single E3 for analysis while passing thru the other TU-3s in the signal
Error Injection	B1, B2, B3, LP-BIP, MS-REI, HP-REI, LP-REI, BPV, BIT
Error Injection Rate	BPV and BIT: Single, 10^{-9} to 10^{-3}, user-programmable Other errors: Single, 10^{-9} to maximum,

	user-programmable
Switch to Protect Measurement	Up to 125 milliseconds , 92 microseconds, resolution (STM-16 only).

Configuring and Transmitting STM-0/1/4 APS Commands

For STM-0/1/4 mode, the APS function appears on a multifunctional screen that displays both Transmit and Receive APS commands.

To configure K1 and K2 byte values:

1. Select **STM-0/1/4**.

2. Select **Transmit**.

3. Select **APS**. The initial APS screen appears containing a table of the K1 and K2 byte sequences that can be transmitted.

   The three columns (User Setup, Transmit, and Receive) on the screen display the current bit value for the K1 and K2 bytes. Any changes made to the K1 and K2 bytes are automatically updated in the User Setup column.

   The Transmit column displays the bit values transmitted when you select either **Transmit User**, **Transmit Default**, or **Transmit Illegal**. The Receive Column displays the bit values received for the K1 and K2 bytes.

4. Select **APS Mode** to configure APS commands for Linear protection switching mode or Ring APS signaling mode.

5. Edit the K1 byte. The K1 byte is a request for switch action. There are three functions that allow you to edit the K1 byte:

   - **K1 Full Byte** - Sets all eight bits of the K1 byte at once.

   - **K1 Bits 1-4** - Sets the first four bits of the K1 byte.

   - **K1 Bits 5-8** - Sets the last four bits of the K1 byte.

6. Edit the K2 byte. The K2 byte provides additional information about the SDH network architecture and alarm conditions. There are four functions that allow you to edit the K2 byte:

   - **K2 Full Byte** - Sets all eight bits of the K2 byte at once.

- **K2 Bits 1-4** - Sets the first four bits of the K2 byte.
- **K2 Bit 5 (provisioned)** - Sets the fifth bit of the K2 byte.
- **K2 Bits 6-8** - Sets the last three bits of the K2 byte.

7. Use the following options to transmit bit values:
    - Use the **Transmit User** button to transmit the bit values that appear in the User Setup column. When pressed, the User Setup values are transmitted and appear in the Transmit column. You can edit the transmitted K1 and K2 bytes directly from the SOH function screen.
    - Use the **Transmit Default** button to transmit the default bit values (10101010) for the K1 and K2 bytes. When pressed, the default bit values appear in the Transmit column.
    - Use the **Transmit Illegal** button to transmit the illegal bit values (11111111) for the K1 and K2 bytes. When pressed, the illegal bit values appear in the Transmit column.

Screen Functions and Descriptions

STM-0/1/4 Screen Functions and Descriptions Overview

The following function screens are available through the STM-0/1/4 protocol processor tab.

- STM-0/1/4 Transmit
- STM-0/1/4 Receive
- STM-0/1/4 Results
- STM-0/1/4 Test
- STM-0/1/4 Performance Monitoring
- STM-0/1/4 LEDs

Transmit
STM-0/1/4 Transmit Screen

This screen allows you to configure the transmit signal parameters for the STM line interface and the STM protocol processor to match the STM signal used in your test environment.

The STM-0/1/4 Transmit screen contains the following functions:

- SET 1

- SET 2
- SOH
- POH
- PTR
- APS
- Error Alarm

STM-0/1/4 Transmit Settings 1

The STM-0/1/4 Transmit Settings 1 screen contains the following options:

Options marked with an asterisk (*) indicate that the function is coupled with the Receive settings if Setting Control is set to "Coupled."

Option	**Description**
*Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Passthru Mode	Activates or deactivates pass-thru mode, allowing an incoming STM signal to pass through the unit without altering the data in the signal. The following options are available: • Off • Intrusive • Intrusive Add/Drop
*Interface	Selects the optical or electrical interface. The following options are available: **STM-0**, **STM-0e**, **STM-1**, **STM-1e**, and **STM-4**.

Clock Reference	Determines the timing source for the STM transmit signal. The following options are available:
	
	• **Internal.** Derives the transmit data's timing source from the unit's internal clock.
	• **Recovered (RX Clock).** Derives the transmit timing source from the clock signal on the receive interface. If this option is selected, but a signal is not available, then this function defaults to Internal.
	• **BITS/SETS.**
	  • BITS: Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 MHz. If this option is selected, but BITS clocking is not available, then this function defaults to Internal.
	  • SETS: Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 MHz. If this option is selected, but SETS clocking is not available, then this function defaults to Internal.

Line Freq Offset	Line Frequency Offset can be deactivated by setting it to "Off" or a customized amount between 100 and -100 can be entered.
SS Bits in H1 Label	Set to SONET (00) or SDH (10).

DataCom Channel Added	Adds a DCC Channel into the STM payload. Select one of the following: • None • RS PRBS 2^7-1 • RS PRBS 2^7-Inv • RS DCC Port • MS PRBS 2^7-1 • MS PRBS 2^7-1 Inv • MS DCC Port
*Order Wire Add	Allows you to add or drop an orderwire circuit. The following options are available: • None • E1 • E2
Laser Type	Configures the type of laser used by the unit. This function is only available for units containing dual lasers. The following options are available: • 1310 nm laser • 1550 nm laser

Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. • **Off.** The unit's laser will be off when the unit is turned on. • **On.** The unit's laser will be on when the unit is turned on. • **Restore Previous State.** When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.

STM-0/1/4 Transmit Settings 2 (SET 2)

This function selects the type of STM Transmit mapping and patterns used by the STM protocol processor. Mappings include E1, E3, C-11, C-12, C-2, C-3, C-4, and C-4c Bulk.

Options marked with an asterisk (*) indicate that the function is coupled with the Receive settings if Setting Control is set to "Coupled."

The following options are available:

Option	**Description**
*Mapping	E1, E3, C-11, C-12, C-2, C-3, C-4, and C-4c Bulk. **Note:** E1 and E3 mappings may be disabled depending on selections made in the Options, Protocol, and System settings.
*AU-Type	Select AU-3, AU-4, or AU-4-4c.
*Foreground AU Inserted	Select 1 to 48 Foreground AUs or All. **Note:** Default is **1** unless set to STM-1 or higher when AU-3, or set to STM-4 or higher when AU-4 is selected.
Background AU Pattern	Select 0 to 8 bits.
HP Signal Label	Set the C2 byte to: • Unequipped (00)

	• Equipped (01) • TUG Structured (02) • Lock TU Mode (03) • Asyn Mapping for 34368 KB (04) • Asyn Mapping for 139264 KB (12) • Map for ATM (13) • Map for DQDB (14) • Map for FDDI (15) • O.181 Test Signal Mapping (FE) • VC-AIS (FF) • User Defined (any eight bit pattern 0 to FF. **Note:** This option is coupled with the C2 byte option in the Path Overhead (POH) screen. If it is changed in this screen, it will change in the Overhead screen as well.
Synchronization Status (S1)	Sets the S1 byte to: • Quality Unknown: Sets byte value to 00000000. • Rec. G.811: Sets byte value to 00000010. • Rec. G.812 Transmit: Sets byte value to 00000100. • Rec. G.812 Local: Sets byte value to 00001000. • Sync Eqip Timing Src: Sets byte value to 00001011. • User Defined (any eight bit pattern 0 to FF.
*Foreground TUG-3 Inserted	Select 1 to 3 TUGs. Default is None.
*Foreground Trib# Inserted	Select 1 to 21 Foreground TUs or All. **Note:** Default is **None** if C-4, C-4c or AU-3 and C3 is selected.
Background TU Pattern	Select 0 to 8 bits. **Note:** Default is **None** if C-4, C-4c or AU-3 and C3 is selected.
LP Signal Label Inserted	Set the V5 byte to: • Unequipped (00) - 00000000

	• Equipped (01) - 00000001 • Asynchronous (02) - 00000010 • Bit Synchronous (03) - 00000011 • Byte Synchronous (04) - 00000100 • O.181 Test Signal Mapping (06) - 00000110 • VC-AIS (07) - 00000111 • User Defined - Any eight-bit pattern 00 to FF This option is disabled if mapping is set to C-4 Bulk, AU-4; or if mapping is set to E4.
*Foreground Pattern	Select User Defined, PRBS 9, PRBS 9 INV, PRBS 11, PRBS 11 INV, PRBS 15, PRBS 15 INV, PRBS 20, PRBS 20 INV, PRBS 23, PRBS 23 INV. **Note:** This option is not available if Container Contents is not set to *Bulk*.

STM-0/1/4 Transmit SOH

This function displays the Regenerator Section, Multiplex Section, Administrative Unit pointer overhead bytes, and J0 bytes that are transmitted for a selected STM. These bytes can be edited to determine if the equipment can detect problems due to any of these types of overhead errors.

The following options are available:

Option	**Description**
Showing	Select a Section Overhead slot. If you are mapped to: • STM-1: Select 1 through 3. • STM-4: Select 1 through 12.

	• STM-16: Select 1 through 48.
RS	Select a Regenerator Section overhead byte. RS bytes consists of the first nine bytes of the SOH. RS options are: • A1, A2 • Z0 • E1 • F1 • D1, D2, D3
MS and AU Pointer	Select Multiplex Section and Administrative Unit Pointer overhead bytes. These include: H1, H2, H3, K1, K2, D4 through D12, Z1, Z2, or E2.
J0 Trace	Select Default (16 byte), All Ones, All Zeros, or User Defined.

STM-0/1/4 Transmit POH

The STM Transmit Path Overhead consists of eight bytes that are responsible for monitoring performance and transporting the STM payload.

The system allows direct access and editing of the Higher-Order and Lower-Path Overhead bytes to simulate errors, alarms, and other stress conditions. This method of stressing the network is an alternative to using the error and alarm functions.

The following STM Path Overhead bytes can be edited.

Option	**Description**
B3	STS Path BIP-8. This can be an HP or LP OH byte used to generate B3 errors.
C2	STS Path Signal Label. This can be an HP or LP OH byte.
G1	Path Status. This can be an HP or LP OH byte used to generate REI-P errors.
F2	Path User Channel. This can be an HP or LP OH byte.
H4	Indicator. This can be an HP or LP OH

	byte.
F3	Path user channel byte. This byte is allocated for communication purposes between path elements and is payload dependent. This can be an HP or LP OH byte.
K3	Allocated for APS signalling for protection at the VC-4/3 path levels. This can be an HP or LP OH byte.
N1	Allocated to provide a Tandem Connection Monitoring function. This can be an HP or LP OH byte.
B3	Path bit interleaved parity code (Path BIP-8) byte. This is a parity code (even) used to determine if a transmission error has occurred over a path. Its value is calculated over all the bits of the previous virtual container before scrambling and placed in the B3 byte of the current frame. This can be an HP or LP OH byte.
Z3	Path Growth. This can be an HP or LP OH byte.
Z4	Path Growth. This can be an HP or LP OH byte.
Z5	Tandem Connection. This can be an HP or LP OH byte.
V5	Virtual Tributary Path Overhead byte. This is a LP OH byte.
N2	A LP OH byte allocated for Tandem Connection Monitoring for the VC2, VC-12, and VC-11 level.
K4	LP OH byte. Bits 1-4 are allocated for APS signalling for protection at the Lower-Order path level. Bits 5-7 are reserved for optional use. Bit 8 is reserved for future use and has no defined value.
J1 Trace	Opens the Select HP Trace (Higher-Order VC-N path trace byte.) This user-programmable byte repetitively transmits a 16-byte, E.64 format string

	plus 1 byte CRC-7. A 64 byte free format string is also permitted for this Access Point Identifier. This allows the receiving terminal in a path to verify its continued connection to the intended transmitting terminal.
J2 Trace	Opens the Select LP Trace, used to repetitively transmit a Lower-Order Access Path Identifier so that a path receiving terminal can verify its continued connection to the intended transmitter. A 16-byte frame is defined for the transmission of Path Access Point Identifiers. This 16-byte frame is identical to the 16-byte frame of the J1 and J0 bytes.

STM-0/1/4 Transmit PTR

The beginning of an STM payload is identified by a Pointer, located in the H1 and H2 Pointer bytes. A STM network can be stressed by adjusting Pointer parameters that appear on the PTR screen.

The functions associated with this screen provide a number of ways to stress the network by manipulating the SDH Pointer and payload.

What is a Pointer?

The beginning of a STM payload is identified by a Pointer. An AU Pointer is a reference marker indicating the beginning of the Virtual Container-4 (VC-4) or VC-3 virtual container in an AU-4 or AU-3. A TU Pointer provides a method of allowing flexible and dynamic alignment of VC-3 within the TU-3 frame, independent of the actual content of the VC-3.

The components of the H1 and H2 bytes are:

- The New Data Flag (NDF), which is the first four bits of the H1 byte. These bits are used to indicate if a new Pointer is present. If a new Pointer value is present, then the NDF bits are toggled.
- The SS bits (bits 5 and 6)
- The Pointer Value, which is the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes.

The following AU and TU Pointer options are available on the PTR screen.

Option	**Description**

NDF Flag	**Yes (On):** Generates an NDF when a new Pointer is transmitted. **No (Off):** Disables NDF functionality.
Pointer Value	The New Transmit Pointer Value function provides another method for stressing an SDH network to verify if the receiving SDH equipment can detect Pointer Value changes. The AU Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the Virtual Container (VC). The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. AU Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from 0 to 782. After entering the new value, the Pointer automatically moves to the new position.
Frequency Offset	Frequency Offset function adjusts the rate at which AU Pointer adjustments are needed in the Administrative Unit (AU). By slowing the rate, the SDH network is forced to increment the H1 and H2 Pointer bytes. This is known as positive frequency justification. By increasing the rate, the SDH network is forced to decrement the H1 and H2 Pointer bytes. This is known as negative frequency justification. This type of adjustment simulates network clocks that either run fast or slow. By adjusting the rate, this forces the SDH equipment to compensate by decrementing or incrementing the H1 and H2 Pointer bytes. The AU Frequency Offset function uses

	a keypad to enter a frequency offset ranging from -100.0 ppm to +100.0 ppm. For STM-64, this allows a line frequency range from 9,954,275,328 Hz to 9,952,284,672 Hz. For STM-16, this allows a line frequency range from 2,488,568,832 Hz to 2,488,071,168 Hz. This function is disabled by entering 0 for the frequency offset.
Pointer Action	This function allows you to set the AU/TU pointer action to single, increment/decrement, or continuous.
Burst Count	This function allows you to determine the number of Pointer location movements to occur when the Inc Pointer or Dec Pointer buttons are pressed. The Pointer burst count ranges from 1 to 8.

The **Increment** Pointer button starts a positive Pointer adjustment movement.

The **Decrement** Pointer button starts a negative Pointer adjustment movement.

The number of adjustments generated depends on the setting of the Burst Count function, which ranges from two to eight Pointer positions.

STM-0/1/4 Transmit APS

The Transmit APS function configures APS transmit activity. APS is a feature that allows the LTE to switch to a backup line in case of errors or failures on the main line. APS commands can be configured for either Linear- or Ring-based networks and are transmitted using bytes K1 and K2 of the Line overhead. You can test the network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response.

The following options are available by selecting the APS Mode button:

- Linear
- Ring

The three columns (User Setup, Transmit, and Receive) on the screen display the current bit value for the K1 and K2 bytes. Any changes made to the K1 and K2 bytes are automatically updated in the User Setup column. The **Transmit** column displays the bit values transmitted when you press either the Transmit

User button, the Transmit Default button, or the Transmit Illegal button. The **Receive Column** displays the bit values received for the K1 and K2 bytes.

Transmit User Button

This button transmits the bit values that appear in the User Setup column. When pressed, the User Setup values are transmitted and appear in the Transmit column. You can edit the transmitted K1 and K2 bytes directly from the Transport Overhead function menu.

Transmit Default Button

This button transmits the default bit values (10101010) for the K1 and K2 bytes. When pressed, the default bit values appear in the Transmit column:

Command	Linear Mode Bit Value	Ring Mode Bit Value
K1 Full Byte	10101010	10101010
K1 Bits 1-4	SD-LP	SD-P
K1 Bits 5-8	#10	#10
K2 Full Byte	10101010	10101010
K2 Bits 1-4	#10	#10
K2 Bit 5 (provisioned)	1:n	LNG/OTN
K2 Bits 6-8	(010)	Br & Sw

Transmit Illegal Button

This button transmits the illegal bit values (11111111) for the K1 and K2 bytes. When pressed, the illegal bit values appear in the Transmit column:

Command	Linear Mode Bit Value	Ring Mode Bit Value
K1 Full Byte	11111111	11111111
K1 bits 1-4	LP	LP-S
K1 Bits 5-8	EXTRA	#15
K2 Full Byte	11111111	11111111
K2 Bits 1-4	EXTRA	#15
K2 Bit 5 (provisioned)	1:n	LNG/OTN
K2 Bits 6-8	AIS-L	AIS-L

STM-0/1/4 Transmit Errors and Alarms

This function allows you to enter errors and alarms.

The following options are available on the STM-0/1/4 Errors and Alarms screen.

Option	Description
Error to Insert	Inserts an error that is transmitted by the STM-0/1/4 protocol processor. The options available include: B1, B2, B3, MS-REI, HP-REI, LP-BIP, and LP-REI.
Error Insert Rate	Sets the insertion rate of the STM-0/1/4 Transmit error from 1e-3 through 1e-9. A user-defined rate is also available.
Alarm Generated	Generates a specific alarm on the transmit side of the STM-0/1/4 protocol process. The following options are available: LOS, LOF, MS-AIS, AU-LOP, RS-RDI, AU-AIS, HP-RDI, HP-UNEQ, TU-AIS, TU-LOP, TU-UNEQ, LP-RDI, LP-RFI, and None.

Receive

STM-0/1/4 Receive

The Receive function contains several functions and options that configure the receive signal parameters. If the incoming signal does not match the expected parameters, errors, and alarms can be logged by the system.

The STM-0/1/4 Receive screen contains the following functions:

- Receive Settings 1 (SET 1)
- Receive Settings 2 (SET 2)
- Receive Section Overhead (SOH)
- Receive Path Overhead (POH)
- Receive Signal Status (SIG)

STM-0/1/4 Receive Settings 1

This function configures the unit's Receive parameters for your STM test environment.

Options marked with an asterisk (*) indicate that the function is coupled with the Transmit settings if Setting Control is set to "Coupled."

The STM-0/1/4 Receive Settings 1 screen contains the following options:

Option	Description

Settings Control	Select **Coupled** or **Independent**. When *Coupled* is selected, changes in the Receive settings will automatically be changed for the Transmit settings. When *Independent* is selected, changes made to the Receive settings will not affect Transmit settings.
*Interface	Selects the optical or electrical interface. The following options are available: • STM-0 • STM-0e • STM-1 • STM-1e • STM- 4
*Mapping	Maps the STM-4 interface to one of the following: E1, E3, DS1, DS3, C-11 Bulk, C-12 Bulk, C-2 Bulk, C-3 Bulk, C-4 Bulk, C4-4c Bulk, C-11 ATM, C-12 ATM, C-2 ATM, C-3 ATM, C-4 ATM, or C4-4c ATM. **Note:** Some options may not appear depending on your current configuration and hardware.
*AU Type	Selects an Administrative Unit type to include AU-3, AU-4, or AU-4-4c.
*Foreground AU Dropped	Select the foreground Administrative Unit to be dropped. Values are from 1 to 48. **Note:** The options that appear will depend on your current configuration.

*Orderwire Drop	Allows you to drop an orderwire circuit for a protocol processor. The following options are available: • None • E1 • E2
DataCom Channel Drop	Defines specific bytes in the Section and Line overhead that is used to send operation and maintenance information between the Section and Line equipment. The following options are available: • None • RS PRBS 2^7-1 • RS PRBS 2^7-1 (Inverted) • RS DCC Port • MS PRBS 2^7-1 • MS PRBS 2^7-1 (Inverted) • MS DCC Port
*Foreground TUG-3 Dropped	Select 1 through 3 as the foreground Tributary Unit-3 to be dropped. **Note:** *None* will display unless AU-4 is set as the AU type.
*Foreground Trib# Dropped	Select 1 through 28 for the number of foreground Tributary Units to be dropped. **Note:** *None* will display if mapping is set to C4-4c, C-4, C-3, or AU type is set to AU-3.

*Foreground Pattern Expected	Selects the expected Foreground Pattern. The following options are available: PRBS 9, PRBS 9 INV, PRBS 11, PRBS 11 INV, PRBS 15, PRBS 15 INV, PRBS 20, PRBS 20 INV, PRBS 23, PRBS 23 INV, Live, and User Defined. **Note:** If Container Contents is not set to *Bulk*, this option will not be available.

STM-0/1/4 Receive Settings 2

This function configures the STM Receive mapping, which maps an STM pattern into the STM interface.

Options marked with an asterisk (*) indicate that the function is coupled with the Transmit settings if Setting Control is set to "Coupled."

The following options appear on the STM-0/1/4 Receive Settings 2 screen.

Option	Description
PLM Alarm Reporting	Disable or enable Payload Label Mismatch reporting.
Expected HP Signal Label	Enter any eight bits for the Higher-Order Path Signal Label for byte C2 expected. Configure to receive a specific value for the C2 byte. The following options are available: • **Unequipped (00):** The expected C2 byte is 00000000. • **Equipped (01):** The expected C2 byte is 00000001. • **TUG Structured (02):** The expected C2 byte is 00000010. • **Lock TU Mode (03):** The expected C2 byte is 00000011. • **Asyn Mapping for 34368 KB (04):** The expected C2 byte is 00000100. • **Asyn Mapping for 139264 KB**

	(12): The expected C2 byte is 00010010. • **Mapping for ATM (13):** The expected C2 byte is 00010011. • **Mapping for DQDB (14):** The expected C2 byte is 00010100. • **Asyn Mapping for FDDI (15):** The expected C2 byte is 00010110. • **O.181 Test Signal Mapping (FE):** The expected C2 byte is 11111110. • **VC-AIS (FF):** The expected C2 byte is 11111111. • **User Defined:** Allows an 8-bit Path Signal Label, from 00h to FFh, to be entered for the C2 byte value.
Expected LP Signal Label	Select one of the following values for the expected Lower Order Path Signal: • Unequipped - (00000000) • Equipped - (00000001) • Asynchronous - 00000010 • Bit Synchronous - 00000011 • Byte Synchronous - 00000100 • O.181 Test Signal Mapping - 00000110 • VC-AIS - 00000111 • User Defined - An eight-bit pattern from 00h to FFh.
TIM Alarm Reporting	Disables or enables Trace Identifier Mismatch reporting. This function enables TIM alarm reporting. A Trace Identifier Mismatch (TIM) alarm occurs when the incoming J1 or J0 trace does not match the expected J1 or JO trace.
SS Bits Alarm Reporting	Disables or enables SS bits reporting. This function is used in conjunction with the Expected SS Bits function. If enabled, and an SS Bits mismatch is detected on the received signal, the duration in seconds will appear under

	the Results Scan function.
Expected SS Bits	Selects one of the following as the expected SS Bits value: • 00 (SONET) • 01 (Undefined) • 10 (SDH) • 11 (Undefined)
Expected J0 Trace	Allows you to enter the expected J0 Trace. Options include Default, All Ones, or User. User-defined allows you to enter any eight bits.
Expected J1 Trace	Allows you to enter the expected J1 Trace. Options include Default, All Ones, or User. User-defined allows you to enter any eight bits.
Expected J2 Trace	Allows you to enter the expected J2 Trace. Options include Default, All Ones, or User. User-defined allows you to enter any eight bits.

STM-0/1/4 Receive Section Overhead

This function displays the Section Overhead bytes for a specific SOH slot on the incoming STM signal. This is a read-only function.

The following options are available in the STM-0/1/4 Receive Section Overhead screen.

Options	**Description**
Showing	Displays the Section Overhead slot being monitored on the incoming side STM signal.
RS	Displays the Regenerator Section Overhead bytes (A1, A2, Z0, B1, E1, F1, D1, D2, and D3)
MS and AU Pointer	Displays the Multiplex Section Overhead bytes (B2, K1, K2, D4-D12, Z1, Z2, and E2) and AU pointer bytes (H1, H2, and H3)
J0Trace	Displays the Regenerator Section

	trace.

STM-0/1/4 Receive Path Overhead

This function displays the incoming Higher-Order Path and Lower-Order Overhead bytes. It also displays the J1 and J2 Trace messages. This is a read-only function.

The following options are available in the STM-0/1/4 Receive Path Overhead screen.

Options	Description
HP	Displays the Higher-Order Path bytes to include: F3, K3, N1, B3, C2, G1, F2, H4, Z3, Z4, Z5.
LP	Displays the Lower-Order Path bytes to include: • **For C-3 and AU-4 settings:** B3, C2, G1, F2, F3, H4, Z3, Z4, Z5 • **For C-11, C-12, and C2 settings:** V5, F3, N2, K4
J1 Trace	The J1 Trace byte is part of the Path OH and is known as the Higher-Order Path trace or J1 trace. The HP trace is a 64-byte pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The J1 trace can be configured to send the unit's default pattern or a customized pattern.
J2 Trace	Displays the Lower-Order Path Trace.

STM-0/1/4 Receive Signal Status

This function displays the following measurements of the incoming SDH signal:

- Frequency in MHz.
- Optical Power (dBm)
- Line Frequency offset received in Hz and PPM

By selecting the Update Signal Calibration button you can update the following calibrations:

Channel 1

- Zero power reading
- -10 dBm power reading
- -5 dBm power reading

Channel 2

- Zero power reading
- -30 dBm power reading
- -10 dBm power reading

To enable protocol processor calibration:

1. From the **System** tab, select **Misc**.
2. From **Local Settings**, select **Enable Calibration**.

> The user must have Admin or Calibrate privileges to enable the calibration mode.

3. See Calibrate STM-0/1/4 Power for specific calibration instructions before proceeding.

Results

STM-0/1/4 Results

All monitored activity that the system receives is eventually reported to the Results screen. This screen provides several layers of granularity for analyzing the incoming signal, pattern, errors, and alarms.

The main functions under Results are:

- Scan
- Err
- Alarm
- PTR
- Large LED
- Event Log
- Graph
- DCC Mon

STM-0/1/4 Results Scan

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected. This function displays a list of received errors and alarms. For **alarms**, the duration is reported as a count in seconds. For **errors**, an error count is reported.

When no activity is occurring, the screen displays, "No errors or alarms."

STM-0/1/4 Results Errors

The system can monitor and report errors on the incoming STM signal. The Errors function provides a detailed analysis of the incoming errors.

The errors reported are a result of:

- Incoming errors that are generated by the STM network, or
- Errors being intentionally generated by the system when it is used in a loopback environment

The following errors can be monitored:

- B1 (Regenerator Section BIP-8)
- MS-REI (Multiplex Section - Remote Error Indicator)
- B2 (Multiplex Section BIP-8)
- HP-REI (Higher-Order Path - Remote Error Indicator)
- AU-NDF (Administrative Unit - New Data Flag)
- B3 (Higher-Order Path BIP-8)
- LP-REI (Lower-Order Path - Remote Error Indication)
- LP-BIP (Lower-Order Path - Bit Interleaved Parity)
- TU-NDF (Tributary Unit - New Data Flag)
- BIT ERR (BIT errors reported in the payload)

The following parameters are measured for these incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format for current seconds only

STM-0/1/4 Results Alarms

This function monitors and reports alarms and their duration on the incoming STM signal. The Alarms function lists the duration of the alarm in seconds.

The following alarms can be monitored:

- LOS (Loss of Signal)
- LOF (Loss of Frame)
- OOF (Out of Frame)
- RS-TIM (Regenerator Section - Trace Identifier Mismatch for the J0 byte)
- MS-AIS (Multiplex Section - Alarm Indication Signal)
- MS-RDI (Multiplex Section - Remote Defect Indicator)
- APS (Automatic Protection Switching)
- AU-AIS (Administrative Unit - Alarm Indication Signal)
- AU-LOP (Administrative Unit - Loss of Pointer)
- HP-UNEQ (Higher-Order Path Unequipped Payload)
- HP-RDI (Higher-Order Path - Remote Defect Indicator)
- HP-TIM (Higher-Order Path - Trace Identifier Mismatch for the J1 byte)
- HP-PLM (Higher-Order Path - Payload Label Mismatch)
- TU-LOP (Tributary Unit Loss of Pointer)
- TU-LOM (Tributary Unit Loss of Multiframe alignment)
- TU-AIS (Tributary Unit - Alarm Indication Signal)
- LP-RDI (Lower-Order Path - Remote Defect Indicator)
- LP-RFI (Lower-Order Path - Remote Fault Indicator)
- LP-UNEQ (Lower-Order Path - Unequipped Payload)
- LP-TIM (Lower-Order Path - Trace Identifier Mismatch)
- LP-PLM (Lower-Order Path - Payload Label Mismatch)
- PAT Sync (Pattern Synchronization)
- CONCAT - (Concatenated)

Results Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	**Then this indicates ...**
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

For a list of available LEDs in the STM-4 protocol processor, see STM-4 LEDs.

STM-0/1/4 Results PTR

This function monitors and reports received STM AU and TU Pointer statistics. A count of the following Pointer statistics appear:

- Positive Justification: Indicates the Positive Pointer Justification count.
- Negative Justification: Indicates the Negative Pointer Justification count.
- Pointer Justification Seconds: Indicates the duration of a Pointer adjustment.
- NDF Count: Indicates the New Data Flag count.
- Receive Pointer Value in HEX and decimal (DEC) format: Valid Pointers range from 0 to 782.

STM-0/1/4 Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

STM-4 Results Graphs

Use the Graphs button to view error and alarm results for the STM-4 protocol processor. These graphs show the test history for either the current test or the previous test. You can configure the graph function to display any combination of STM-4 alarms and errors.

To use the Results Graph functions, see the Using Graphs section.

Results DCC Mon

The DCC Monitor lets you view the following Datacom channel TX/RX configuration data:

- DataCom Channel Drop from SDH TX/RX Setting or DCC Connector
- LEDs
- PAT Sync Seconds
- Bit Error
  - Count
  - Seconds
  - Current Rate
  - Average Rate

Test

STM-0/1/4 Test

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- SET 1
- Service Disruption
- RTD
- TU Scan

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Service Disruption

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The service disruption measurements show a granular accuracy of 1 frame duration. See the chart at the bottom of this page for time per frame durations for each protocol processor.

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

  For **E4**, **E3**, **E1**, **DS3** and **DS1** processors, the Protection Switch Criteria is limited to: Loss of Pattern Sync and Bit Errors.

  For **SONET** and **SDH** processors the Protection Switch Criteria include: B1, SEF / OOF, AIS-L / MS-AIS, AIS-P / AU-AIS, AIS-V / TU-AIS, and PRBS (Loss of Pattern Sync and Bit Errors).

  For **OTN** processors the Protection Switch Criteria include: OOF, OTU:AIS, OTU:BIP8, ODU:AIS, ODU:BIP8, and PRBS (Loss of Pattern Sync and Bit Errors).

- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **State** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the

previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

- **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.
- **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.
- **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)** - Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.
- **Protection Switch Time (Frames)** - Indicates the number of errored frames received during the service disruption event.
- **History Recent Milli Seconds** - Shows the time durations for the last ten measurements recorded.
- **History Recent Frames** - Shows the frame durations for the last ten measurements recorded.

A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing Service Disruption.

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
SONET / SDH	0.125 ms (125 µs)	16383 frames (2047.875 ms)
OTU 1	0.049 ms (49 µs)	16383 frames (802.302 ms)
OTU 2	0.012 ms (12 µs)	16383 frames (199.732 ms)
E4	0.021 ms (21 µs)	255 frames (5.361 ms)
E3	0.045 ms (45 µs)	255 frames (11.397 ms)

E1	0.125 ms (125 µs)	4095 frames (511.875 ms)
DS3	0.106 ms (106 µs)	255 frames (27.133 ms)
DS1	0.125 ms (125 µs)	4095 frames (511.875 ms)

Click this link for Ethernet Service Disruption specifics.

Test - RTD (Round-Trip Delay)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **State:** Starts and stops round-trip delay mode.

  Single Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in frame counts and milliseconds. Frame counts indicates the number of frames received before the AIS frame is received by the unit. Milliseconds indicates how long it took for the AIS frame to travel out and return to the unit.

  Continuous Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and continuously transmitted through your network. The current frame count and duration appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.

  Stop Round-Trip Delay - Stops round-trip delay activity. The State returns to Inactive.
- **Round Trip Delay Time (milliSec):** Indicates the duration in seconds that it took for the known frame to return to the unit.
- **Round Trip Delay Time (Frames):** Indicates the number of frames received during the measurement.
- **Consecutive Good Time Required:** This function allows you to enter the duration (in milliseconds) of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 0.125 to 2047.875 milliseconds and is entered using a keypad.

- **Consecutive Good Frames Required**: This function allows you to enter the number of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 1 to 16383 frames and is entered using a keypad.

For more information about round-trip delay, select *Round-Trip Delay* in the Common Tasks section of the online help.

Test - TU Scan

The TU Scan function inspects and then reports the contents of the 28 foreground TUG drops that are obtained within a multiplexed STM signal.

The information reported consists of items such as the framing and pattern activity detected on each TU channel drop.

The protocol processor must be receiving a valid signal, otherwise, the scan aborts. While a scan is in progress, you cannot access other functions.

Select **Start Scan** to view the Foreground TUG framing and pattern activity on each of the 28 TU drops. The Foreground TUG was configured from the Receive / Set 1 screen.

Select **Stop Scan** to halt the process.

Performance Monitoring

STM-0/1/4 Performance Monitoring

Performance Monitoring provides greater detail about incoming MS, RS, HP, LP, and bit errors.

The following functions are available on the STM-0/1/4 Performance Monitoring screen:

- RS
- MS
- HP
- LP
- Bit

Performance Monitoring RS

This provides a detailed breakdown for Regenerator Section errors detected and logged by the STM-0/1/4 protocol processor.

G.826 Near B1 Errors

- Errored Block (EB) count.
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or Failure.

Performance Monitoring MS

This provides a detailed breakdown for Multiplexor section errors detected and logged by the STM-0/1/4 protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the **G.826/G.829 toggle button** in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.829 results.

This section is broken down into the following areas:

IMPORTANT: Select the **G.826/G.829** button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.829 statistics. Toggling the Near B2 Errors output also toggles the Far MS REI Errors output.

G.826 and G.829 Near B2 Errors and Far MS REI Errors

- Errored Block (EB) count.
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.

- Status: Pass or Failure.
- G.826/G.829: Select the command button to toggle between G.826 and G.829 error statistics.

M.2101.1 Near B2 Errors and Far MS REI Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, Failure.

Performance Monitoring HP

This provides a detailed breakdown for Higher-Order Path errors detected and logged by the STM-0/1/4 protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the **G.826/G.828** toggle button in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.828 results.

This section is broken down into the following areas:

G.826 and G.828 Near B3 Errors and Far HP REI Errors

IMPORTANT: Select the **G.826/G.828** button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.828 statistics. Toggling the Near B3 Errors output also toggles the Far HP REI Errors output.

- Errored Block (EB) count.
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure.

- G.826/G.828: Select the command button to toggle between G.826 and G.828 error statistics.

M.2101.1 Near B3 Errors and Far HP REI Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure.

Performance Monitoring LP

This provides a detailed breakdown for Lower-Order Path errors detected and logged by the STM-0/1/4 protocol processor.

For the ITU Standards option, you can select the **G.826/G.828** toggle button in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.828 results.

This section is broken down into the following areas:

IMPORTANT: Select the **G.826/G.828** button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.828 statistics. Toggling the Near LP BIP Errors output also toggles the Far LP REI Errors output.

G.826 and G.828 Near LP BIP Errors and Far LP REI Errors

- Errored Block (EB) count.
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure.
- G.826/G.828: Select the command button to toggle between G.826 and G.828 error statistics.

M.2101.1 Near LP BIP Errors and Far LP REI Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure.

Performance Monitoring BIT

This provides a detailed breakdown for BIT errors detected and logged by the STM-0/1/4 protocol processor.

In addition to monitoring the errors, you can set allocation percentages and durations by selecting their respective buttons.

This section is broken down into the following areas:

G.821 BIT Errors

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.821 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or Failure

G.826 BIT Errors

- Errored Block (EB) count.
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or Failure.

M.2101.1 BIT Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.

- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or Failure

STM-0/1/4 LEDs

When the STM-0/1/4 protocol processor is selected, the following LEDs are displayed in the LEDs Quick Status Area of the touch screen.

LED	Description
Laser On/Off	Enables or disables the laser.
TX	Displays the transmit interface and laser frequency.
RX	Displays the receive interface and laser frequency.
E/A	Displays the error and/or alarm generated. "None" displays if no errors are alarms are generated.
Test Paused	Indicates if a timed test has been paused using the Action/Duration button.
RS	Regenerator Section Overhead OK. This is a status LED.
LOS	Loss of Signal. An alarm LED indicating a valid STM signal is not being received. If an all-zeros pattern exists for 100 milliseconds or longer on the incoming STM signal, then an LOS is reported.
LOF	Loss of Frame. An alarm LED indicating that a frame alignment problem with the incoming STM-4 signal has been detected. An LOF is reported if a severely errored framing (SEF) defect continues for three milliseconds or longer.
OOF	Out of Frame. An alarm LED indicating that four consecutive frames have been received with invalid or errored framing patterns.

B1	Section Bit Interleaved Parity 8 Code Violation. An error LED indicating parity errors occurred on one of the eight parity checks when evaluated by byte 1 of the STM signal.
MS	Multiplex Section Overhead OK. This is a status LED.
MS-AIS	Multiplex Section - Alarm Indication Signal. An alarm LED Indicating an all-ones characteristic or adapted information signal was detected on the MS. It is generated to replace the normal traffic signal when it contains a defect condition in order to prevent consequential downstream failures being declared or alarms being raised.
MS-RDI	Multiplex Section - Remote Defect Indicator. An alarm LED indicating a signal returned to the transmitting MS Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect.
MS-REI	Multiplex Section - Remote Error Indication. An error LED indication returned to a transmitting node that an errored block has been detected at the MS receiving node.
MS-APS	Multiplex Section - Automated Protection Switching. An alarm LED indicating the K1 and K2 bytes on the incoming STM signal have changed.
B2	Multiplex Section Bit Interleaved Parity Code byte. An error LED indicating parity errors occurred on any of the 24 parity checks when evaluated by the byte B2 of the STM-4.
HP	Higher-Order Path OK. This is a status LED.
AU-AIS	Administrative Unit - Alarm Indication Signal. An alarm LED indicating an all-ones characteristic or adapted information signal was detected on the AU. It is generated to replace the

	normal traffic signal when it contains a defect condition in order to prevent consequential downstream failures being declared or alarms being raised.
AU-LOP	Administrative Unit - Loss of Pointer. An alarm LED indicating a consecutive number of invalid pointers of NDFs were received on the AU.
AU-PTR	Administrative Unit - Pointer Adjustment. An event LED indicating there was pointer movement occurring on the AU. This LED flashes red during a Pointer Adjustment event.
HP-UNEQ	Higher-Order Path - Unequipped. An alarm LED indicating an all-zeros patterns was detected in the C2 byte. This byte is received from the HP terminating equipment.
HP-RDI	Higher-Order Path - Remote Defect Indicator. An alarm LED indicating a signal was returned to the transmitting HP Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect.
HP-REI	Higher-Order Path - Remote Error Indication. An error LED indicating to the transmitting node that an errored block has been detected at the HP receiving node.
B3	Path Bit Interleaved Parity Code (Path BIP-8) byte. An error LED indicating that a parity code (even) was used to determine if a transmission error has occurred over a path. Its value was calculated over all the bits of the previous virtual container before scrambling and placed in the B3 byte of the current frame.
LP	Lower-Order Path OK. This is a status LED.
TU-AIS	Tributary Unit - Alarm Indication Signal. An alarm LED indicating an all-ones characteristic or adapted information

	signal was detected on the TU. It is generated to replace the normal traffic signal when it contains a defect condition in order to prevent consequential downstream failures being declared or alarms being raised. **Note:** This LED is only displayed if C-11, C-12, C-2, or AU-4 with C-3 is selected.
TU-LOP	Tributary Unit - Loss of Pointer. An alarm LED indicating a consecutive number of invalid pointers or NDFs were received on the TU. **Note:** This LED is only displayed if C-11, C-12, C-2, or AU-4 with C-3 is selected.
TU-PTR	Tributary Unit - Pointer Adjustment. An event LED indicating pointer movement is occurring on the TU. This LED flashes red during a Pointer Adjustment event. **Note:** This LED is only displayed if C-11, C-12, C-2, or AU-4 with C-3 is selected.
TU-LOM	Tributary Unit - Loss of Multiframe. An alarm LED declared when two consecutive multiframe alignment signals have been received with an error on the TU.
LP-BIP	Lower-Order Path - Bit Interleaved Parity. Indicates that an error on the LP occurred during a parity check, which involves grouping all the bits in a block into units and then performing a parity check of each bit position in the group. This is an error LED. **Note:** This LED is only displayed if C-11, C-12, C-2, or AU-4 with C-3 is selected.
LP-RDI	Lower-Order Path - Remote Defect Indicator. Indicates a signal was returned to the transmitting LP Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect. This is an alarm LED. **Note:** This LED is only displayed if C-11, C-12, C-2, or AU-4 with C-3 is selected.

LP-RFI	Lower-Order Path - Remote Failure Indicator. Indicates a defect on the LP that persisted beyond the maximum time allocated to the transmission system protection mechanisms. When this occurs, the RFI is sent to the far end and initiates a path protection switch. This is an alarm LED. **Note:** This LED is only displayed if C-11, C-12, C-2, or AU-4 with C-3 is selected.
LP-REI	Lower-Order Path - Remote Error Indication. Indicates to the transmitting node that an errored block has been detected at the LP receiving node. This is an error LED. **Note:** This LED is only displayed if C-11, C-12, C-2, or AU-4 with C-3 is selected.
LP-UNEQ	Lower-Order Path - Unequipped. Indicates that an all-zeros patterns has been detected in the C2 byte. This byte is being received from LP terminating equipment. This is an alarm LED. **Note:** This LED is only displayed if C-11, C-12, C-2, or AU-4 with C-3 is selected.
PAT SYNC	Indicates a loss of pattern synchronization. This is an alarm LED. **Note:** This LED is enabled only if the container contents selected are Bulk Filled.
Bit Err	An error LED indicating a bit error was detected in the payload. **Note:** This LED is enabled only if the container contents selected are Bulk Filled.
SS MisMatch	Displays when the expected SS bit setting does not match what is received. SS Bits Alarm Reporting must be enabled for this alarm to generate. This is an alarm LED.

STM-16 Tab

STM-16 Overview

The STM-16 online help is divided into the following sections:

- STM-16 Specific Tasks
- STM-16 Screen and Function Descriptions

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

STM-16 Specific Tasks

STM-16 Specific Tasks

This section contains STM-16-specific tasks. General tasks are listed in Common Tasks located in the Getting Started section

- Calibrate STM-16 Optical Power
- Monitor STM-16 Section Overhead
- Monitor STM-16 Path Overhead
- Change STM-16 Section Overhead
- Change STM-16 Path Overhead
- Configuring APS Commands
- Change Overhead Bytes in Passthru Mode

Calibrate STM-16 Optical Power

The following procedures describe the unit's optical power calibration. While performing this task, you will measure, record, and enter the Zero optical power input and the optical power readings for -20 dBm and -10 dBm.

Before You Begin

Read these procedures before trying to calibrate the unit.

WARNING: Power the unit off before removing the optical connector dust caps to clean the unit's fiber optic ports.

Before performing optical power calibration, use a fiber-optics cleaning kit to clean the fiber-optic ports on the unit, the optical power meter, the optical attenuator, and the fiber cables. Dirty optical fibers will affect optical measurements.

The following equipment is required for unit optical calibration:

- Two three-foot singlemode, fiber-optic cables
- Variable optical attenuator
- Optical power meter
- Fiber-optics cleaning kit
- Pencil and paper to record optical power measurements

Restoring Raw Power Readings

The following restores the unit's raw (unconverted) power readings.

1. Make sure that the dust caps are on the unit's TX and RX optical ports.
2. Turn the unit on.
3. Make sure that the dust caps are on the unit's TX and RX optical ports.
4. Turn the unit on.
5. From the **System** tab, select **Misc**.
6. From **Local Setting**, select **Enable Calibration**.

> The user must have Admin. or Calibrate privileges to enable the calibration mode.

7. From the **STM-16** tab, select **Receive**.
8. Select **SIG** from the tabs along the left-side of the Receive screen and choose **Update Signal Calibration**.
9. Select **Zero power reading**, and enter **0** from touch screen keypad, then select **OK**.
10. Select **-20 power reading**, and enter **0** from touch screen keypad, then select **OK**.
11. Select **-10 power reading**, and enter **0** from touch screen keypad, then select **OK**.
12. Select **Save** to restore the raw (unconverted) power reading.

Obtaining Zero Optical Power Input

1. Make sure that the dust caps are still on the unit's RX optical ports so that no light is present on the RX optical port.
2. Record the Raw optical power reading, which is the **Zero power reading** value.

Obtaining -20 dBm Power Reading

1. With the unit turned on, connect a fiber-optic cable from the protocol processor's **TX optical port** to the optical attenuator's input connector.
2. Attach a fiber-optic cable from the attenuator's output port to the optical power meter.
3. Turn the unit's laser on.
4. Adjust the attenuator so that the optical power meter reads **-20 dBm**.
5. Disconnect the fiber-optic cable from the optical power meter, and attach it to the protocol processor's **RX optical port**.
6. Record the optical power reading, which is the **-20 dBm power reading** value.

Obtaining -10 dBm Power Reading

1. With the unit turned on, connect a fiber-optic cable from the protocol processor's **TX optical port** to the optical attenuator's input connector.
2. Attach a fiber-optic cable from the attenuator's output port to the optical power meter.
3. Turn the unit's laser on.
4. Adjust the attenuator so that the optical power meter reads **-10 dBm**.
5. Disconnect the fiber-optic cable from the optical power meter, and attach it to the protocol processor's **RX optical port**.
6. Record the optical power reading, which is the **-10 dBm power reading** value.

Entering Power Readings

1. Select **Zero power reading**. A touch screen keypad appears. Enter the value recorded earlier for the Zero Power Reading, and select **OK**.
2. Select **-20 dBm power reading**. A touch screen keypad appears. Enter the value recorded earlier for the -20 dBm Power Reading, and select **OK**.
3. Select **-10 dBm power reading**. A touch screen keypad appears. Enter the value recorded earlier for the -10 dBm Power Reading and, select **OK**.
4. Select the **Save** button to save the new calibration values.

Monitor STM-16 Section Overhead

The system can monitor and display the Section Overhead bytes (MS and RS OH) and AU pointer.

The Section Overhead consists of the Multiplex Section and Regenerator Section bytes. You can monitor the incoming signal and view individual bytes for any of the 16 slots in the STM signal.

To view incoming path overhead bytes:

1. Select **STM-16**.
2. Select **Receive**.
3. Select **SOH**. The Section Overhead bytes appear.
4. Select the **Showing** button to choose an STM slot from the Select Showing Slot Entry list.

   For example, if you select Slot 2 then second slot of SOH bytes are displayed.

   The number of Slots available and the specific set of STM OH bytes displayed for each slot is dependent on the selecting Interface Rate and Mapping.

5. The Receive / SOH screen shows the RS OH, MS OH and J0 Trace for the selected slot, while the Receive / POH screen shows the STS Path OH and J1 trace for the selected STS, and the VT OH and J2 trace if VT mapped.

Monitor STM-16 Path Overhead

The system can monitor and display the Path Overhead bytes (HP and LP OH) and the J1 and J2 Trace bytes.

The Path Overhead consists of the Higher-Order and Lower-Order Overhead bytes. You can monitor the incoming signal and view individual bytes for any of the 16 slots in the STM signal.

To view incoming path overhead bytes:

1. Select **STM-16**.
2. Select **Receive**.
3. Select **POH**. The Path Overhead bytes appear.

Change STM-16 Section Overhead

The Section Overhead (SOH) function allows you to stress an STM network by directly editing the Multiplex Section (MS) and Regenerator Section OH bytes to simulate errors, alarms, and other stress conditions.

A specific slot can be selected, and its RS and MS Overhead bytes can be changed for transmission out of the system. By altering the OH bytes, this allows other STM-16 equipment to detect, and if necessary, react to these changes.

To change Section Overhead bytes:

1. Select **STM-16**.
2. Select **Transmit**.
3. Select **SOH**. The Section Overhead bytes appear.
4. Select the **Showing** button to choose an STM slot from the Select Showing Slot Entry list.

   For example, if you select Slot 2 then second slot of SOH bytes are displayed.

   The number of Slots available and the specific set of STM OH bytes displayed for each slot is dependent on the selecting Interface Rate and Mapping.

5. Select an **RS** or **MS** OH byte button.

   A keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

   The byte can also appear in HEX or decimal notation. Select the **HEX** or **DEC** button on the keypad.

The bit value can also be erased from the keypad using the **Clear** button.

6. When editing is complete, select **OK** to save the new value. **Cancel** discards any changes made to the byte and restores the previous value.

Change STM-16 Path Overhead

The Path Overhead (POH) function allows you to stress an STM network by directly editing the Higher-Order and Lower-Order Path OH bytes to simulate errors, alarms, and other stress conditions.

A specific slot can be selected, and its Higher-Order and Lower-Order Overhead bytes can be changed for transmission out of the system. By altering the OH bytes, this allows other STM-16 equipment to detect, and if necessary, react to these changes.

To change Path Overhead bytes:

1. Select **STM-16**.
2. Select **Transmit**.

3. Select **POH**.
4. Select an **HP** or **LP** OH byte.

   A keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

   The byte can also appear in HEX or decimal notation. Select the **HEX** or **DEC** button on the keypad.

The bit value can also be erased from the keypad using the **Clear** button.

5. When editing is complete, select **OK** to save the new value. **Cancel** discards any changes made to the byte and restores the previous value.

Configuring APS (K1 and K2) Commands

Automatic Protection Switching (APS) is a function that allows an LTE to switch to a backup (or protection) channel in case errors or failures occur on the working channel. APS commands can be configured for either Linear- or Ring-based SONET and SDH networks and are transmitted using the K1 and K2 bytes of the Line Overhead.

You can test your network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response by configuring the K1 and K2 bytes.

You can create up to 16 different K1 and K2 byte configurations (known as byte sequences) to measure and stress your equipment's APS switching capabilities.

To configure K1 and K2 byte values:

1. Select **Transmit** button.
2. Select the **APS** button. The initial APS screen appears containing a table of the K1 and K2 byte sequences that can be transmitted. A total of 16 K1 and K2 byte sequences can appear in the table.
3. To make a new entry:
   - Select **New Item**

   To edit an item:

   - Select **Item <#>**, for example, Item 12.

The Apply Maintenance to Entry screen appears, which contains functions used to configure and set the measurement criteria of the K1 and K2 bytes.

4. From the Apply Maintenance to Entry dialog box, select **APS Mode**. The APS Mode dialog box appears.
5. Choose **Linear** protection switching mode or **Ring** signaling mode.
6. From the Apply Maintenance to Entry dialog box, select a K1 byte/bit option. A value dialog box associated with the K1 selection appears. The K1 byte is a request for switch action. There are three functions that allow you to edit the K1 byte:

    - Use the **K1 Full Byte** function to set all eight bits of the K1 byte at once.
    - Use the **K1 Bits 1-4** function to set the first four bits of the K1 byte.
    - Use the **K1 Bits 5-8** function to set the last four bits of the K1 byte.

7. From the Apply Maintenance to Entry dialog box, select a K2 byte/bit. A value dialog box associated with the K2 selection appears. The K2 byte provides additional information about SONET/SDH network architecture and alarm conditions. There are four functions that allow you to edit the K2 byte:

    - Use the **K2 Full Byte** function to set all eight bits of the K2 byte at once.
    - Use the **K2 Bits 1-4** function to set the first four bits of the K2 byte.
    - Use the **K2 Bit 5 (provisioned)** function to set the fifth bit of the K2 byte.
    - Use the **K2 Bits 6-8** function to set the last three bits of the K2 byte.

8. From the Apply Maintenance to Entry dialog box, select **Duration** in Frames to set up the number of frames that will be transmitted containing the newly configured K1 and K2 bytes.
9. Select **Update**. The initial APS screen appears on the touch screen.
10. To configure additional K1 and K2 bytes, repeat steps 3-9 as described above. Otherwise, proceed to the next section to transmit K1 and K2 bytes.

To transmit K1 and K2 bytes:

1. Make sure that K1 and K2 byte sequences are configured as described above.
2. Select **Start** to transmit the K1 and K2 bytes.

To stop transmitting K1 and K2 bytes:

1. Select the **APS** button and choose **Stop**.

Related Topic:

Monitor incoming APS activity

Change Overhead Bytes in Passthru Mode

Passthru mode allows an incoming STM-16 signals to pass through the unit without altering the data in the signal. However, the Regenerator Section and Multiplex Section Overhead bytes can be changed to simulate errors, alarms, and other stress conditions such as Pointer Adjustments. This lets you verify if equipment in the SDH network can detect changed Overhead bytes.

To configure the unit for Passthru mode:

1. From the **STM-16** tab, select **Transmit**.
2. Select **SET 1**.
3. Select the **Passthru Mode** function. The **Select Passthru Mode** window appears.
4. Select **On** to enable Passthru mode.

To change SOH bytes in Passthru mode:

1. Select **SOH**. When Passthru mode is enabled:
    - By default, the OH bytes are passed-through (looped) the unit without being altered. (These bytes are currently disabled on the touch screen.)
    - However, the **Intrusive Overhead buttons** appear to the right of the OH bytes. These buttons allow you to select a specific which OH bytes to intrude on, allowing their values to be changed.
2. Select an **Intrusive Overhead button**. For example, select F1 Pass.

   The selected Intrusive Overhead button changes to indicate that a specific byte has been selected. For example, F1 Pass now appears as F1 Intrude. In addition, the OH byte is now enabled and displays its value.

3. Select the same OH byte (from the left side of the screen) that you selected for Passthru mode (on the right side of the touch screen). For example, select the F1 byte.

   A keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to

change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

The byte can also appear in HEX or decimal notation by selecting the **HEX** or **DEC** button on the keypad.

4. When editing is complete, select **OK** to save the new value which will be transmitted out of the unit.

When you intrude on any Regenerator Section OH byte, you automatically intrude on the B1 OH byte. The B1 byte is calculated over all OH bytes. If any OH bytes are changed while in Passthru mode, the transmitted B1 byte will be different from the initial byte value received.

For Multiplex Section OH, both the B1 and B2 bytes are automatically intruded. When these bytes are unintruded, the transmitted B1 and B2 bytes will be different from the initial byte values received.

Screen Functions and Descriptions

STM-16 Screen Functions and Descriptions Overview

The following function screens are available through the STM-16 protocol processor tab.

- STM-16 Transmit
- STM-16 Receive
- STM-16 Results
- STM-16 Test
- STM-16 Performance Monitoring
- STM-16 LEDs

Transmit

STM-16 Transmit

The STM-16 Transmit screen contains the following functions:

- Transmit Settings 1 (SET 1)
- Transmit Settings 2 (SET 2)
- Transmit Section Overhead (SOH)

- Transmit Section Overhead (POH)
- Transmit Pointer Adjustments (PTR)
- Transmit Automatic Protection Switching (APS)
- Transmit Errors and Alarms (Error Alarm)

Transmit Settings 1

The STM-16 Transmit Settings 1 screen contains the following options.

Option	Description
Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.
Passthru Mode	Activates or deactivates pass-thru mode, allowing an incoming STM signal to pass through the unit without altering the data in the signal. The following options are available: **On** and **Off**.
Mapping	Sets mapping to C-4-16c. Note: C-4-4c Add/Drop mappings are available in systems that also contain an STM 0/1/4 circuit pack.
AU-4 Added	Select 1 to 4, All, or None as the foreground channel. **Note:** This function is not available in systems that do not contain an STM 0/1/4 circuit pack.
Background AU Pattern	Enter any 32 bit value as the background channel. **Note:** This function is not available in systems that do not contain an STM 0/1/4 circuit pack.
Payload Pattern	Select User-defined (32 bit value), PRBS 15, PRBS 15 INV, PRBS 23, PRBS 23 INV, PRBS 31,or PRBS 31 INV.
Clock Reference	Select Internal, Recovered, or Bits/Sets.
Laser Type	Select 1310 nm or 1550 nm laser

	type on the 2.5G circuit pack. Some NIC units might be equipped with a single laser type, based on the purchased configuration.
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. • **Off.** The unit's laser will be off when the unit is turned on. • **On.** The unit's laser will be on when the unit is turned on. • Restore Previous State. When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.

Transmit Settings 2

The STM-16 Transmit Settings 2 screen contains the following options.

Option	Description
Line Frequency Offset	Adjusts the offset of the signal frequency of the transmitted SDH signal. The frequency can be adjusted in parts per million (PPM). The following options are available: • **Off**=0: The frequency cannot be adjusted. • **Edit:** Adjusts the signal frequency in PPM. Use the + and - arrow keys to adjust the 00.0 decimal place. The frequency offset ranges from -100.0 to 100.0 in increments of 0.1. The default value is 00.0. After an offset value is entered, the Confirm button on the touch screen keypad must be selected for the new offset

	value to be accepted.
SS Bits in H1 Label	Set to SONET (00) or SDH (10).
HP Signal Level	Set the C2 byte to: • Unequipped (00) • Equipped (01) • TUG Structured (02) • Lock TU Mode (03) • Asyn Mapping for 34368 KB (04) • Asyn Mapping for 139264 KB (12) • Map for ATM (13) • Map for DQDB (14) • Map for FDDI (15) • O.181 Test Signal Mapping (FE) • VC-AIS (FF) • User Defined (any eight bit pattern 0 to FF. **Note:** This option is coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will change in the Overhead screen as well.
Synchronization Status (S1)	Sets the S1 byte to: • Quality Unknown: Sets byte value to 00000000. • Rec. G.811: Sets byte value to 00000010. • Rec. G.812 Transmit: Sets byte value to 00000100. • Rec. G.812 Local: Sets byte value to 00001000. • Sync Eqip Timing Src: Sets byte value to 00001011. • User Defined (any eight bit pattern 0 to FF.
Trigger In	Determines how the protocol processor responds when an external pulse is received using the Trigger In connector. Select one of the

	following: • **Restart:** The protocol processor restarts when an external pulse is received. • **Error Insert:** The protocol processor inserts an error (as defined by **Trigger Out**) when an external pulse is received. • **None:** The protocol processor does not respond to an external pulse.
TC Overhead Processing	Enables Tandem Connection Monitoring (TCM) transmit mode. • **Enable**: For SDH, the unit uses its TCM circuitry and the N1 byte to generate errors and alarms between TCM equipment. For SONET, the unit uses the Z5 byte. • **Disable**: TCM mode is disabled, and the N1 and Z5 bytes follow normal operation.

STM-16 Transmit SOH

The STM-16 Transmit SOH screen contains the following options:

Function	Description
Showing	Select an Overhead slot from one to 48. This function selects a specific SOH slot within the STM-16 signal. The overhead bytes that appear on the OH screen are associated with this slot. There are 48 SOH slots available in an STM-16 signal.
RS Overhead	Select the Regenerator Section Overhead to include: A1, A2, Z0, B1, E1, F1, D1, D2, and D3.
MS Overhead	Select the Multiplex Section

	Overhead to include:H1, H2, H3, B2, K1, K2, D4-12, Z1, Z2, and E2.
Intrusive Overhead	Select an intrusive overhead button. **Note**: This option is only enabled if Pass Thru is enabled.
J0	Selects a default or customized pattern to be used as the J0 trace. Select one of the following patterns: • **Default (64 byte)**: Selects the Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 62 characters, appended with a CR and LF. • **User Defined (64 byte)**: Selects a user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 62 characters, appended with a CR and LF. • **All Ones**: Selects an All Ones pattern as the J0 trace pattern. • **All Zeros**: Selects an All Zeros pattern as the J0 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to15 characters, appended with a CRC-7.

STM-16 Transmit POH

The STM-16 Transmit POH screen contains the following options:

Function	Description
AU-4-16 Added -1	Select 1 to 4, All, or None.
HP Overhead	Select the Higher-Order Path Overhead to include: B3, J1, C2, G1, F2, H4, Z3, Z4, and Z5. **Note**: This option will be disabled if Passthru mode is enabled, or if AU-4 is set to None.
J1 Trace	Selects a default or customized pattern to be used as the J1 trace. Select one of the following patterns: • **Default (64 byte)**: Selects the Digital Lightwave ASCII message as the J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)**: Selects a user-defined ASCII message as the J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones**: Selects an All Ones pattern as the J1 trace pattern. • **All Zeros**: Selects an All Zeros pattern as the J1 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the J1 trace pattern. The message consists of 16 characters. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the J1 trace

	pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 16 characters in length.
TC Trace	The TC Trace is a 16-byte pattern that can be created for repeated transmission between TCM equipment. The pattern is a string of ASCII characters and can be configured to send the unit's default pattern or a customized pattern. **Note**: Enable TCM mode (using TC Overhead Processing) before sending the TC Trace. Select one of the following patterns: • **Default**: Selects the 16-byte Digital Lightwave ASCII message as the TC trace pattern. • **User Defined**: Selects a 16-byte user-defined ASCII message as the TC trace pattern. The message is entered and saved using a touch screen keyboard.

Transmit Pointer

The STM-16 Transmit Pointer screen contains the following options.

Function	Description
NDF Flag	The NDF Flag allows you to specify whether the NDF bits are set when a new Pointer is present in the generated signal. The following options are available: **Yes** (On): Generates an NDF when a

	new Pointer is transmitted. **No** (Off): Disables NDF functionality.
Pointer Value	The Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the Virtual Container. The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from 0 to 782. After entering the new Pointer Value, the Pointer automatically moves to the new position.
Frequency Offset	Adjusts the rate at which AU Pointer adjustments are needed in the Administrative Unit (AU). Enter a frequency type ranging from -100.0 ppm to +100.0 ppm. This function is disabled by entering 0.
Pointer Action	Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. **Single options** - Inserts a single Pointer movement with each selection of the INC Pointer or DEC Pointer button. The Pointer value changes by one. **Increment/Decrement option** - Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. **Continuous options** - Inserts a continuous Pointer movement with the selection of the INC Pointer or DEC Pointer button. The movement continues until the Stop Sequence button is selected.
Burst Count	This function allows you to determine the number of Pointer location

	movements to occur when the INC Pointer or DEC Pointer buttons are pressed. The Pointer burst count ranges from 1 to 8.
Ms between Bursts	Allows the user to set the number of Milliseconds between bursts. Valid valued are 34 - 10000.
INC Pointer / DEC Pointer	Alternates the Pointer insertion from increment to decrement with a 200-msec delay in between.

Transmit - APS

Transmit APS

This is an Automatic Protection Switching (APS) function used to configure transmit APS activity. APS is a feature that allows the LTE to switch to a backup line in case of errors or failures on the main line. APS commands can be configured for either Linear- or Ring-based networks and are transmitted using bytes K1 and K2 of the Line overhead.

You can test the network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response.

The following options are available on the APS screen:

- **New Item** - Opens the Apply Maintenance to Entry window, from which you configure K1 and K2 bytes.
- **Start** - Begins transmission of the K1 and K2 byte configuration.
- **Clear** - Clears the table.

The following Apply Maintenance to Entry window APS Transmit functions are available:

APS Mode - Linear

This function configures the system to transmit APS functions for a Linear (span) network.

- K1 Full Byte (Linear Mode)
- K1 Bits 1-4 (Linear Mode)
- K1 Bits 5-8 (Linear Mode)
- K2 Full Byte (Linear Mode)
- K2 Bit 5 (Provisioned) (Linear Mode)
- K2 Bits 1-4 (Linear Mode)
- K2 Bits 6-8 (Linear Mode)

APS Mode - Ring

This function configures the system to transmit APS functions for a Ring network.

- K1 Full Byte (Ring Mode)
- K1 Bits 1-4 (Ring Mode)
- K1 Bits 5-8 (Ring Mode)
- K2 Full Byte (Ring Mode)
- K2 Bit 5 (Provisioned) (Ring Mode)
- K2 Bits 1-4 (Ring Mode)
- K2 Bits 6-8 (Ring Mode)

Duration in Frames

The Duration in Frames function determines the number of frames transmitted that contain specific K1 and K2 bytes. These bytes are configured using the functionality located on the transmit APS screen.

Frame count is entered using a keypad. Values ranging from 1 to 65535 frames can be entered.

K1 Bits 1-4 (Linear Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description
(0000) NR	No Request, Bit pattern 0000
(0001) Non Rev	Do not revert, Bit pattern 0001
(0010) RR	Reverse Request (Ring), Bit pattern 0010
(0011) Unused	Not Used, Bit pattern 0011
(0100) EXER	Exerciser (Ring), Bit pattern 0100
(0101) Unused	Not used, Bit pattern (0101)
(0110) WTR	Wait to restore, Bit pattern (0110)
(0111) Unused	Not used, Bit pattern (0111)
(1000) MS	Manual switch, Bit Pattern 1000
(1001) Unused	Not used, Bit pattern (1001)
(1010) SD-LP	Signal degrade low priority, Bit pattern (1010)
(1011) SD-HP	Signal degrade high priority, Bit pattern (1011)

(1100) SF-LP	Signal fail low priority, Bit pattern (1100)
(1101) SF-HP	Signal fail high priority, Bit pattern (1101)
(1110) FS	Forced switch, Bit pattern (1110)
(1111) LP	Lockout of protection, Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	**Description**
(0000) NR	No request, Bit pattern 0000
(0001) RR-R	Reverse request (Ring), Bit pattern 0001
(0010) RR-S	Reverse request (Span), Bit pattern 0010
(0011) EXER-R	Exerciser (Ring), Bit pattern 0011
(0100) EXER-S	Exerciser (Span), Bit pattern 0100
(0101) WTR	Wait to restore, Bit pattern (0101)
(0110) MS-R	Manual switch (Ring), Bit pattern (0110)
(0111) MS-S	Manual switch (Span), Bit pattern (0111)
(1000) SD-R	Signal degrade (Ring), Bit Pattern 1000
(1001) SD-S	Signal degrade (Span), Bit pattern (1001)
(1010) SD-P	Signal degrade (Path), Bit pattern (1010). This is the Transmit Default button setting.
(1011) SD-R	Signal degrade (Ring), Bit pattern (1011)
(1100) SF-S	Signal fail (Span), Bit pattern (1100)
(1101) FS-R	Forced switch (Ring), Bit pattern (1101)
(1110) FS-S	Forced switch (Span), Bit pattern (1110)
(1111) LP-S	Lockout of protection (Span), Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 5-8 (Linear Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Linear mode, these bits indicate the channel number. For example, Code 0 is the Null Channel, Codes 1-14 are the working channels, and Code 15 is an extra traffic channel.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit

	pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Bits 5-8 (Ring Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Ring mode, these bits contain the Destination Code Identification.

The following options are available:

Options	**Description**
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit

	pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Full Byte (Linear Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	**Description**
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K1 Full Byte (Ring Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Bit 5 (Provisioned) (Linear Mode)

This function edits the 5th bit of the K2 byte. In Linear mode. This bit controls the type of protection switching architecture used.

The following options are available:

Options	Description
1+1	Provisioned for 1+1 mode; Bit 5 = 0
1 : n	Provisioned for 1:n mode; Bit 5 = 1

K2 Bit 5 (Provisioned) (Ring Mode)

This function edits the 5th bit of the K2 byte. In Ring mode, this bit controls the type of path code used.

The following options are available:

Options	Description
SHT / OTO	Short Path Code; Bit 5 = 0
LNG / OTN	Long Path Code; Bit 5 = 1. When selected, both the Transmit Default and Transmit Illegal button settings are configured for LNG/OTN.

K2 Bits 1-4 (Linear Mode - SDH)

This function edits the first four bits of the K2 byte. In Linear mode, the first four bits indicate which working channel is bridged onto the protection channel during a traffic switching event.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101

#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K2 byte. In Ring mode, the first four bits are the Source Node Identification. (The Source Node ID is set to the Node's own ID.)

The following options are available:

Options	**Description**
#0	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.

#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Linear Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Unused	Not used, Bit pattern 000
(001) Unused	Not used, Bit pattern 001
(010) Unused	Not used, Bit pattern 010
(100) Unused	Not used, Bit pattern 100
(100) Uni-direct	Provisioned for Unidirectional switching, Bit pattern 10
(101) Bi-direct	Provisioned for Bidirectional switching, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Ring Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Idle	Idle, Bit pattern 000
(001) Br	Bridged, Bit pattern 001
(010) Br&Sw	Bridged and switched, Bit pattern 010. This is the Transmit Default button setting.
(100) Ex Tr	Extra traffic on protection channel, Bit pattern 100
(100) Unused	Not used, Bit pattern 10
(101) Unused	Not used, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS /	Multiplex Section Alarm Indication Signal,

AIS-L	Bit pattern 111. This is the Transmit Illegal button setting.

K2 Full Byte (Linear Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Full Byte (Ring Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.

Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

STM-16 Transmit Error Alarm

This function determines the type of error transmitted by the unit. The purpose of generating an error with unit is to stress the network element that is receiving the error by testing if it can detect the incoming error and then report error statistics such as error counts and rates. The following options are available:

Error to Insert

Select an error to insert. Choose one of the following options.

Option	Description
None	No errors are generated. Turns errors off.
B1 Error	Generates a BIP-8 (Bit Interleaved Parity, 8-bit) error over the Regenerator Section layer. Bits in the B1 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
B2 Error	Generates a BIP-8 error over the Multiplex Section layer. Bits in the B2 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.

B3 Error	Generates a BIP-8 error over the Higher-Order Path layer. Bits in the B3 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
MS-REI	Generates a Remote Error Indicator over the Multiplex Section layer. An MS-REI is a count of B2 errors received at the far end. When the unit transmits this error, it simulates a downstream NE sending an error count back to the source of its incoming SDH signal. The unit uses the M1 byte of the MSOH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and rates. (This type of error was formerly called a Line Far End Block Error - FEBE-L.)
HP-REI Error (Path FEBE)	Generates a Remote Error Indicator over the Higher-Order Path layer. An HP-REI is a count of B3 errors received at the far end. When the unit transmits this error, it simulates an NE sending an error count back to the source of its incoming SDH signal. The unit uses the G1 byte of the HPOH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and error rates.
BIT Error	Generates bit errors. This type of simulation allows an NE (in this case, the downstream equipment) to be

	tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and error rates.
TC-IEC	Generates a Tandem Connection Incoming Error Count over the Path layer. A TC-IEC is a count of B3 errors received by TCM equipment at the far end. Bits 1-4 of the N1 byte are the IEC bits.
TC-REI	Generates a Tandem Connection Remote Error Indicator over the Path layer between TCM equipment. Bit 5 of the N1 byte is used for this error.
TC-OEI	Generates a Tandem Connection Outgoing Error Indicator over the Path layer between TCM equipment. Bit 6 of the N1 byte is used for this error.

Error Insert Rates

The Error to Insert function determines the type of error transmitted. The Error Insert Rate function sets the error rate for the selected error. The unit starts transmitting errors after the insertion rate is selected.

The following options are available for 10G Interface Rates:

Option	**Descriptions**
Off	Turns error transmission off.
1e-X	X is a value from 3 to 10; for example, 1e-3 through 1e-10. X will vary based on the type of error selected.
Maximum	Generates errors at the maximum rate listed below.

If this error is inserted...	**Then this range of rates is available...**
B1	1e-5 to 1e-10; maximum rate is 2.57e-5
B2	1e-3 to 1e-10; maximum rate is 1.25e-3
B3	1e-5 to 1e-10; maximum rate is

	2.66e-5
MS-REI (MS-FEBE)	1e-4 to 1e-10; maximum rate is 8.29e-4
HP-REI (HP-FEBE)	1e-5 to 1e-10; maximum rate is 2.66e-5
Bit	1e-3 to 1e-10; maximum rate is 1e-3
TC-IEC error	1e-5 to 1e-10; maximum rate is 2.66e-5
TC-REI error	1e-6 to 1e-10; maximum rate is 3.33e-6
TC-OEI error	1e-6 to 1e-10; maximum rate is 3.33e-6

For information about inserting errors, select Insert Errors in the Common Tasks section of the online help.

Alarm Generated (SDH)

This function configures the unit to generate an alarm in the transmit SDH signal. Alarm generation by the unit is one way to test if downstream SDH equipment reacts properly to the alarm it receives in the incoming SDH signal.

The following alarms are available:

Option	Description
None	No alarms are generated. Turns alarms off.
LOS	Loss of Signal. An all-zeros pattern is transmitted to simulate a loss of signal or loss of optical power. This forces the downstream SDH equipment to (1) generate an AIS alarm to its downstream network elements (NE), and (2) generate an RDI alarm to its upstream NEs.
LOF	Loss of Frame. An all-zeros pattern is inserted into the A1 and A2 framing bytes of the Section OH. This simulates the absence of a valid framing pattern. This forces the downstream SONET equipment to generate an AIS alarm to its downstream network elements (NE),

	and generate an RDI alarm to its upstream NEs.
AU-LOP	Administrative Unit Loss of Pointer. This simulates a loss of a valid STS Pointer. When the downstream NE receives an AU-LOP, it generates a DSn AIS alarm to its downstream equipment and an HP-RDI alarm to its upstream equipment.
MS-AIS	Multiplex Section Alarm Indication Signal. The transmission of an MS-AIS to a downstream NE forces that NE to send an AU-AIS alarm to the next downstream NE. The NE will also send an MS-RDI alarm to its upstream equipment. An MS-AIS simulates an alarm generated by Line terminating equipment (LTE).
MS-RDI	Multiplex Section Remote Defect Indicator. This generates an MS-RDI condition using the K2 byte of the Line OH. This simulates a downstream NE (in this case the system unit) at the Line layer, reporting a failure to an upstream NE. The downstream NE (unit) has encountered a downstream failure and is alerting upstream SDH equipment. To do this, the unit changes the pattern of the K2 byte. The NE receiving the MS-RDI alarm should detect a change to the K2 byte on the incoming SDH signal. This forces the NE to generate a Remote Alarm Indicator (RAI) to its upstream NEs.
AU-AIS	Administrative Unit Alarm Indication Signal. The transmission of an AU-AIS to a downstream NE forces that NE to send an AIS alarm to the next downstream NE. The NE will also send an RDI alarm to its upstream equipment. An AU-AIS simulates an alarm generated by Path terminating equipment (PTE).

HP-RDI	Higher-Order Path Remote Defect Indicator. This generates an HP-RDI condition using the G1 byte of the Higher-Order Path OH. This simulates a downstream NE (in this case, the unit), at the Path layer, reporting a failure to an upstream NE. To do this, the unit changes the pattern of the G1 byte in the Path OH. The NE receiving the HP-RDI alarm should detect a change to the G1 byte on the incoming SDH signal.
HP-UNEQ	Higher-Order Path Unequipped Alarm. An all-zeros pattern is inserted into the C2 byte of the HPOH. The C2 byte is the HP Signal Label. (This type of error is used between Higher-Order Path terminating equipment-PTE). When a PTE receives this alarm, it will generate an AIS to downstream NEs.
TC-RDI	Tandem Connection-Remote Defect Indicator. Generates an alarm to upstream equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 8 in multiframe 73 of the N1 byte.
TC-ODI	Tandem Connection-Outgoing Defect Indicator. Generates an alarm to upstream TCM equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 7 in multiframe 74 of the N1 byte.
TC-AIS	Tandem Connection-Alarm Indication Signal. Generates an AIS alarm to downstream TCM equipment by setting Bits 1-4 of the N1 byte to 1110.
TC-UNEQ	Tandem Connection-Unequipped. Generates an all-zeros pattern is

	inserted into the N1 byte of the Path OH.
TC-LOF	Tandem Connection-Loss of Frame. Generates a loss of a valid multiframe pattern to downstream equipment.

After selecting an alarm, the alarm continues until one of the following occurs:

- The alarm is turned off using the **None** option.
- A mapping change occurs.

For more information about inserting alarms, select *Insert Alarms* in the Common Tasks section of the online help.

Receive

STM-16 Receive

The STM-16 Receive screen contains the following functions:

- Receive Settings 1 (SET 1)
- Receive Settings 2 (SET 2)
- Receive Section Overhead (SOH)
- Receive Path Overhead (POH)
- Receive Signal Status (SIG)

STM-16 Receive Settings 1

This function configures the STM-16 Receive mapping, which maps a pattern into the STM-16 interface.

Options marked with an asterisk (*) indicate that the function is coupled with the Transmit settings if Setting Control is set to "Coupled."

The STM-16 Receive Settings 1 screen contains the following options.

Option	Description
*Settings Control	If **Coupled** is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If **Independent** is selected, settings established on the Receive screen will only affect Receive mode.
*Mapping	Sets mapping to C-4-16c.

	Note: C-4-4c mappings and below are available in systems that contain circuit packs (cards) lower than 2.5G (STM-16/OC-48).
AU-4-4c Dropped	Selects a specific STM-4 signal as the foreground (or source) channel in the STM-16 signal. The source channel can be used to transmit alarms, errors, or patterns. The four STM-4 signals are multiplexed into a single STM-16 signal. The following options are available: • **1:** Selects STM-4 #1 to transmit as the source channel. • **2:** Selects STM-4 #2 to transmit as the source channel. • **3:** Selects STM-4 #3 to transmit as the source channel. • **4:** Selects STM-4 #4 to transmit as the source channel. **Note:** This function is not available in systems that do not contain circuit packs (cards) lower than 2.5G (STM-16/OC-48).
Payload Pattern	Selects the type of pattern that the unit expects to receive on the incoming SDH signal. **Note:** This function is automatically coupled to its equivalent Transmit function. The following options are available: Live (user data is received; no pattern is used), User Defined (range from 1 bit to 32 bits and is entered using a touch screen keypad), PRBS 2^15-1, PRBS 2^15-1 Inverted, PRBS 2^23-1, PRBS 2^23-1 Inverted, PRBS 2^31-1, and PRBS 2^31-1 Inverted.
Trigger Out	Allows the protocol processor to

	respond to an external "pulse" received. Select from one of the following events: None, LOF, OOF, B1, B2, B3, Frame, MS-REI, MS-RDI, HP-REI, HP-RDI, Bit, New Pointer with NDF, New Pointer without NDF, Pointer Increment /Decrement, and AU-LOP.

STM-16 Receive Settings 2

This function configures the unit's STM-16 receive parameters. The SET 2 screen contains the following options.

Options	Description
PLM Alarm Reporting	This function enables Higher-Order Path Payload Label Mismatch (HP-PLM) alarm reporting. An HP-PLM alarm occurs when the incoming Higher-Order Path Signal Label (C2 byte) does not match the expected Higher-Order Path Signal Label (C2 byte). The following options are available: • **Enabled:** HP-PLM alarms are recognized and reported. • **Disabled:** HP-PLM alarms are ignored.
Expected HP Signal Label	Configure to receive a specific value for the C2 byte. The following options are available: • **Unequipped (00):** The expected C2 byte is 00000000. • **Equipped (01):** The expected C2 byte is 00000001. • **TUG Structured (02):** The expected C2 byte is 00000010. • **Lock TU Mode (03):** The

	expected C2 byte is 00000011. • **Async for 34M (E3) or 45M (DS3) Mappings (04):** The expected C2 byte is 00000100. • **Async for 140M (E4) Mapping (12):** The expected C2 byte is 00010010. • **Mapping for ATM (13):** The expected C2 byte is 00010011. • **Mapping for DQDB (14):** The expected C2 byte is 00010100. • **Mapping for FDDI (15):** The expected C2 byte is 00010101. • **Mapping for 10G WAN IEEE802.3 (1A):** The expected C2 byte is 00011010. • **O.181 Test Signal Mapping (FE):** The expected C2 byte is 11111110. • **All Ones Signal - VC-AIS (FF):** The expected C2 byte is 11111111. • **User Defined:** Allows an 8-bit Path Signal Label, from 00h to FFh, to be entered for the C2 byte value.
TIM Alarm Reporting	An HP Path Trace Identifier Mismatch (HP-TIM) alarm occurs when the incoming J1 trace does not match the expected J1 trace. A Regenerator Section Trace Identifier Mismatch (RS-TIM) alarm occurs when the incoming J0 trace does not match the expected J0 trace. The following options are available: • **Enabled:** TIM alarms are recognized and reported. • **Disabled:** TIM alarms are

	ignored.
Expected J0	Defines the expected J0 trace received on the incoming SDH signal. A RS-TIM alarm occurs if the incoming J0 trace does not match the expected J0 trace. The J0 byte is part of the Regenerator Section OH and is known as the Section trace, or J0 trace. The J0 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. • **Default (64 byte):** Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte):** Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones:** Selects an All Ones pattern as the J0 trace pattern. • **All Zeros:** Selects an All Zeros pattern as the J0 trace pattern. • **Default (16 byte):** Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte):** Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The

	message can be up to 15 characters , appended with a CRC-7.
Expected J1	Defines the expected J1 trace received on the incoming SDH signal. A HP-TIM alarm occurs if the incoming J1 trace does not match the expected J1 trace. The J1 byte is part of the Higher-order Path OH and is known as the Path trace, or J1 trace. The J1 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The following options are available: • **Default (64 byte):** Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte):** Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones:** Selects an All Ones pattern as the J1 trace pattern. • **All Zeros:** Selects an All Zeros pattern as the J1 trace pattern. • **Default (16 byte):** Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte):** Selects a user-defined ASCII message as the expected J1

	trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters , appended with a CRC-7.
SS Bits Alarm Reporting	Disables or enables SS bits reporting. This function is used in conjunction with the Expected SS Bits function. If enabled, and an SS Bits mismatch is detected on the received signal, the duration in seconds will appear under the Results Scan function.
Expected SS Bits	Selects one of the following as the expected SS Bits value: • 00 (SONET) • 01 (Undefined) • 10 (SDH) • 11 (Undefined)
TC Error/Alarm Processing	Enables or disables Tandem Connection Monitoring (TCM) mode. This function is used in conjunction with the Expected TC Trace function. The **TC Summary LED** turns red if a TCM error or alarm is reported. Select the TC Summary text for more details. • **Enable:** Turns on TCM error and alarm reporting mode. • **Disable:** Turns off TCM error and alarm reporting mode. (**Note:** Disable this option if you are not performing TCM testing. This will prevent false error and alarm reporting.)
Expected TC Trace	Defines the expected TC trace received on the incoming signal. For SONET, this is in the Z5 byte. For SDH, this is in the N1 byte. The

	following options are available: • **Default:** Selects the 16-byte Digital Lightwave ASCII message at the expected TC trace pattern. • **User Defined:** Selects a 16-byte user-defined ASCII message as the expected TC trace pattern. The message is entered and saved using a screen keypad.

STM-16 Receive SOH

The STM-16 Receive SOH screen contains the following options:

Function	Description
Showing	Selects a specific SOH slot to monitor on the incoming STM-16 signal. For an STM-16 signal, slots 1-48 can be viewed. The following bytes appear for the selected SOH slot: Regenerator Section Overhead bytes (A1, A2, Z0, B1, E1, F1, D1, D2, and D3), Line Overhead bytes (B2, K1, K2, D4-D12, Z1, Z2, and E2), Pointer bytes (H1, H2, and H3), and J0 Trace byte.
RSOH	Displays the Overhead bytes for a specific Regenerator Section OH slot on the incoming SDH STM-16 signal. This is a read-only function.
MSOH	Displays the Overhead bytes for a specific Multiplex Section OH slot on the incoming SDH STM-16 signal. This is a read-only function.
J0	Displays the J0 trace received on the incoming SDH signal. This is a read-only function.

STM-16 Receive POH

The STM-16 Receive POH screen contains the following functions:

Function	Description
AU-4-4 Dropped	Selects a specific STM-4 signal to monitor in the STM-16 signal. The system receives an STM-16 signal that is demuxed into four STM-4 signals and then processed by the system. The following options are available: • **1**: Selects STM-4 #1 as the dropped and monitored channel. • **2**: Selects STM-4 #2 as the dropped and monitored channel. • **3**: Selects STM-4 #3 as the dropped and monitored channel. • **4**: Selects STM-4 #4 as the dropped and monitored channel.
HPOH	Displays the Overhead bytes for a specific Higher-Order Path OH slot on the incoming SDH STM-16 signal. This is a read-only function. The following Higher-Order Path Overhead bytes appear: B3, C2, G1, F2, H4, Z3, Z4, and Z5.
J1 Trace	Displays the J1 trace received on the incoming SDH signal. This is a read-only function.
TC Trace	Displays the TC trace received on the incoming SDH signal. This is a read-only function.

STM-16 Receive Signal Status

This function displays the following measurements of the incoming SDH signal:

- Frequency in MHz.
- Line Frequency offset received in Hz and ppm
- Optical Power in dBm
- Update Signal Calibration - Calibrating the system's optical power should be done carefully. To keep unauthorized users from changing calibration settings, the Update Signal Calibration button on the protocol processor's Receive SIG screen is unavailable by default. To change the setting, a user with Admin or Calibrate privileges must enable the calibration mode.

To enable protocol processor calibration:

1. From the **System** tab, select **Misc**.
2. From **Local Settings**, select **Enable Calibration**.

The user must have Admin or Calibrate privileges to enable the calibration mode.

3. See Calibrate Optical Power for specific calibration instructions before proceeding.

Results

Results

All monitored activity that the system receives is eventually reported to the Results screen. This screen provides several layers of granularity for analyzing the incoming signal, pattern, errors, and alarms.

The main functions under Results are:

- Scan
- Err
- Alarm
- PTR
- Event
- APS
- Large LEDs
- Graph

Results SCAN

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected. This function displays a list of received errors and alarms. For **alarms**,

the duration is reported as a count in seconds. For **errors**, an error count is reported.

When no activity is occurring, the screen displays, "No errors or alarms."

Results Errors

The unit can monitor and report errors on the incoming SDH signal. The Errors function provides a detailed analysis of the incoming error as described below.

The errors reported are a result of:

- Incoming errors that are generated by the SDH network, or
- Errors being intentionally generated by the system when it is used in a loopback environment

The following errors can be monitored:

- B1 (Regenerator Section BIP-8)
- B2 (Multiplex Section BIP-8)
- MS-REI (Multiplex Section Remote Error Indicator)
- B3 (Higher-Order Path BIP-8)
- BIT (BIT errors reported in the payload)
- HP- NDF (errors occurring as a result of the Receive Pointer being recorded without receiving a New Data Flag)
- HP-REI (Higher-Order Path Remote Error Indicator)
- TC-IEC (Tandem Connection-Incoming Error Count)
- TC-REI (Tandem Connection-Remote Error Indicator)
- TC-OEI (Tandem Connection-Outgoing Error Indicator)

The following parameters are measured for these incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format

Results Alarms

The unit can monitor and report alarms and their duration on the incoming SDH signal. The Alarms function lists the duration of the alarm in seconds.

The following alarms can be monitored:

- Clock Sync
- LOS (Loss of Signal)
- LOF (Loss of Frame)
- OOF (Out of Frame)

- RS-TIM (Regenerator Section Trace Identifier Mismatch for the J0 byte)
- MS-AIS (Multiplex Section Alarm Indication Signal)
- MS-RDI (Multiplex Section Remote Defect Indicator)
- APS (Automatic Protection Switching)
- AU-AIS (Administrative Unit Alarm Indication Signal)
- AU-LOP (Administrative Unit Loss of Pointer)
- HP-UNEQ (Higher-Order Path Unequipped Payload)
- HP-RDI (Higher-Order Path Remote Defect Indicator)
- HP-TIM (Higher-Order Path Trace Identifier Mismatch for the J1 byte)
- HP-PLM (Higher-Order Path Payload Label Mismatch)
- Pat Sync (Pattern Synchronization)
- CONCAT (Concatenated)
- TC-RDI (Tandem Connection-Remote Defect Indicator)
- TC-ODI (Tandem Connection-Outgoing Defect Indicator)
- TC-AIS (Tandem Connection-Alarm Indication Signal)
- TC-UNEQ (Tandem Connection-Unequipped)
- TC-TIM (Tandem Connection-Trace Identifier Mismatch)
- TC-LOF (Tandem Connection-Loss of Frame)

Results Pointer (PTR)

This function monitors and reports received Pointer statistics. A count of the following Pointer statistics appear:

- **Positive Justification:** Indicates the Positive Pointer Justification count.
- **Negative Justification:** Indicates the Negative Pointer Justification count.
- **Pointer Justification Seconds:** Indicates the duration of a Pointer adjustment.
- **NDF Count:** Indicates the New Data Flag count.
- **Rx Pointer Bytes (in HEX):** Valid Pointers range from 0x0 to 0x30e.
- **Rx Pointer Value (in decimal):** Valid Pointers range from 0 to 782.

Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

Results APS

The APS Results monitor incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 16 byte sequences can appear on the touch screen.

The following information appears in the APS report for the last 16 K1 and K2 byte sequences received:

- The HEX value of the K1 byte.
- The HEX value of the K2 byte.
- The number of frames received that contain the K1 and K2 bytes.
- The elapsed time of the frames that contain the K1 and K2 bytes.

Per GR-253-CORE, only the upper 12 bits of the K1/K2 bytes (K1 bits 1-8 and the K2 bits 1-4) are used for APS operation. K2 bit 5 sets the APS mode type (1+1, 1:1) and cannot be changed during operation. K2 bits 6-8 are for alarms. Any changes to the lower four bits of the K2 byte do not affect APS operation. The Results APS table only starts and displays a new entry item if the upper 12 K1/K2 bits stabilize on a new value for a minimum of three consecutive frames.

Results Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	**Then this indicates ...**
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.

White with **black** text	No activity from this specific function.

For a list of available LEDs in the STM-16 protocol processor, see STM-16 LEDs.

Results Graphs

Use the Graphs button to view error and alarm results for the STM-16 protocol processor. These graphs show the test history for either the current test or the previous test. You can configure the graph function to display any combination of STM-16 alarms and errors.

To use the Results Graph functions, see the Using Graphs section.

Test

STM-16 Test

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- SET 1
- Service Disruption
- RTD

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration:** This function configures how long a timed test runs for.
- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select *Start a Test* in the Common Tasks section of the online help.

Test - Service Disruption

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

The service disruption measurements show a granular accuracy of 1 frame duration. See the chart at the bottom of this page for time per frame durations for each protocol processor.

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

  For **E4**, **E3**, **E1**, **DS3** and **DS1** processors, the Protection Switch Criteria is limited to: Loss of Pattern Sync and Bit Errors.

  For **SONET** and **SDH** processors the Protection Switch Criteria include: B1, SEF / OOF, AIS-L / MS-AIS, AIS-P / AU-AIS, AIS-V / TU-AIS, and PRBS (Loss of Pattern Sync and Bit Errors).

  For **OTN** processors the Protection Switch Criteria include: OOF, OTU:AIS, OTU:BIP8, ODU:AIS, ODU:BIP8, and PRBS (Loss of Pattern Sync and Bit Errors).

- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The available range is listed in the chart below.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The available range is listed in the chart below.

- **State** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

  - **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

  - **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.

  - **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs)** - Indicates the duration in seconds that it took for the service disruption event (errored frames) to occur.
- **Protection Switch Time (Frames)** - Indicates the number of errored frames received during the service disruption event.
- **History Recent Milli Seconds** - Shows the time durations for the last ten measurements recorded.
- **History Recent Frames** - Shows the frame durations for the last ten measurements recorded.

A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing Service Disruption.

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
SONET / SDH	0.125 ms (125 µs)	16383 frames (2047.875 ms)
OTU 1	0.049 ms (49 µs)	16383 frames (802.302 ms)
OTU 2	0.012 ms (12 µs)	16383 frames (199.732 ms)

E4	0.021 ms (21 µs)	255 frames (5.361 ms)
E3	0.045 ms (45 µs)	255 frames (11.397 ms)
E1	0.125 ms (125 µs)	4095 frames (511.875 ms)
DS3	0.106 ms (106 µs)	255 frames (27.133 ms)
DS1	0.125 ms (125 µs)	4095 frames (511.875 ms)

Click this link for Ethernet Service Disruption specifics.

Test - RTD (Round-Trip Delay)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **State:** Starts and stops round-trip delay mode.

  Single Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in frame counts and milliseconds. Frame counts indicates the number of frames received before the AIS frame is received by the unit. Milliseconds indicates how long it took for the AIS frame to travel out and return to the unit.

  Continuous Round-Trip Delay - If selected, an AIS alarm is inserted into a frame and continuously transmitted through your network. The current frame count and duration appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.

  Stop Round-Trip Delay - Stops round-trip delay activity. The State returns to Inactive.
- **Round Trip Delay Time (milliSec):** Indicates the duration in seconds that it took for the known frame to return to the unit.
- **Round Trip Delay Time (Frames):** Indicates the number of frames received during the measurement.

- **Consecutive Good Time Required:** This function allows you to enter the duration (in milliseconds) of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 0.125 to 2047.875 milliseconds and is entered using a keypad.
- **Consecutive Good Frames Required**: This function allows you to enter the number of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement. The range is 1 to 16383 frames and is entered using a keypad.

For more information about round-trip delay, select *Round-Trip Delay* in the Common Tasks section of the online help.

Performance Monitoring

STM-16 Performance Monitoring

Performance Monitoring provides greater detail about incoming Regenerator Section, Multiplex Section, Higher-Order Path, and Bit errors.

The following options are available:

- RS
- MS
- HP
- BIT
- LP

Perf Monitoring RS

This provides a detailed breakdown for Regenerator Section errors detected and logged by the STM-16 protocol processor.

G.826 Near B1 Errors

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

Perf Monitoring MS

This provides a detailed breakdown for Multiplex Section errors detected and logged by the STM-16 protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the **G.826/G.829 toggle button** in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.829 results.

This section is broken down into the following areas:

IMPORTANT: Select the **G.826/G.829** button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.829 statistics. Toggling the Near B2 Errors output also toggles the Far MS REI Errors output.

G. 826 and G.829 Near B2 Errors and Far MS REI Errors

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure
- G.826/G.829: Select the command button to toggle between G.826 and G.829 error statistics.

M.2101.1 Near B2 Errors and Far MS REI Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.

- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

Perf Monitoring HP

This provides a detailed breakdown for Higher-Order Path errors detected and logged by the STM-16 protocol processor.

For the ITU Standards option, you can select the **G.826/G.828** toggle button in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.828 results.

This section is broken down into the following areas:

IMPORTANT: Select the **G.826/G.828** button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.828 statistics. Toggling the Near LP BIP Errors output also toggles the Far LP REI Errors output.

This section is broken down into the following areas:

G. 826 Near B3 Errors and Far HP REI Errors

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure.
- G.826/G.828: Select the command button to toggle between G.826 and G.828 error statistics.

M.2101.1 Near B3 Errors and 1 Far HP REI Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.

- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure.

Perf Monitoring LP

This provides a detailed breakdown for Lower-Order Path errors detected and logged by the STM-16 protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the **G.826/G.828 toggle button** in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.828 results.

This section is broken down into the following areas:

IMPORTANT: Select the **G.826/G.828** button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.828 statistics. Toggling the Near B2 Errors output also toggles the Far MS REI Errors output.

This section is broken down into the following areas:

G.826 and G.828 Near LP BIP Errors and Far LP REI Errors

- Errored Block (EB) count.
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure.
- G.826/G.828: Select the command button to toggle between G.826 and G.828 error statistics.

M.2101.1 Near LP BIP Errors and Far LP REI Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.

- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure.

Performance Monitoring BIT

This provides a detailed breakdown for BIT errors detected and logged by the STM-16 protocol processor.

In addition to monitoring the errors, you can set allocation percentages and durations by selecting their respective buttons.

This section is broken down into the following areas:

G.821 BIT Errors

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.821 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure

G.826 BIT Errors

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure

M.2101.1 BIT Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.

- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

STM-16 LEDs

This section defines the SDH LEDs that appear on the touch screen's LED area and when the Large LEDs tab is selected.

LED	Definition
APS	Automated Protection Switching. Indicates that the K1 and K2 bytes on the incoming STM signal have changed. This is an alarm LED.
AU-AIS	Administrative Unit - Alarm Indication Signal. Indicates an all-ones characteristic or adapted information signal was detected on the AU. It is generated to replace the normal traffic signal when it contains a defect condition in order to prevent consequential downstream failures being declared or alarms being raised. This is an alarm LED.
AU-LOP	Administrative Unit - Loss of Pointer. Indicates that a consecutive number of invalid pointers or NDFs were received on the AU. This is an alarm LED.
B1	Regenerator Section BIP-8 Code Violation. Indicates parity errors occurred on one of the eight parity checks when evaluated by byte 1 of the SDH frame. This is an error LED.
B2	Multiplex Section BIP-8 Code Violation. Indicates that parity errors occurred on any of the parity checks when evaluated by the B2 byte of the SDH frame. This is an error LED.
B3	Higher-Order Path BIP-8 Code Violation. This is a parity code (even) used to determine if a transmission error has occurred over a path. Its value is calculated over all the bits of the previous virtual container before scrambling and placed in the B3 byte of

	the current frame. This is an error LED.
BIT	BIT Error. Indicates a bit error was detected in the payload. This is an error LED.
CLK	Clock. Displays the type of transmit clock specified in the setting. Clock settings include: SETS, Bits, Internal, or RCVD. This is an alarm LED.
HP OK	Higher-Order Path OK. This is a status LED.
HP-RDI	Higher-Order Path - Remote Defect Indicator. Indicates a signal was returned to the transmitting HP Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect. This is an alarm LED.
HP-REI	Higher-Order Path - Remote Error Indication. Indicates to the transmitting node that an errored block has been detected at the HP receiving node. This is an error LED.
HP-UNEQ	Higher-Order Path - Unequipped. Indicates that an all-zeros patterns was detected in the C2 byte. This byte is received from the HP terminating equipment. This is an alarm LED.
LOF	Loss of Frame. Indicates that a frame alignment problem with the incoming signal has been detected. An LOF is reported if an Out of Frame (OOF) defect continues for three milliseconds or longer. This is an alarm LED.
LOS	Loss of Signal. Indicates that a valid STM-4 signal is not being received. If an all-zeros pattern exists for 100 milliseconds or longer on the incoming STM signal, then an LOS is reported. This is an alarm LED.
MS-AIS	Multiplex Section - Alarm Indication Signal. Indicates an all-ones characteristic or adapted information signal was detected on the MS. It is

	generated to replace the normal traffic signal when it contains a defect condition in order to prevent consequential downstream failures being declared or alarms being raised. This is an alarm LED.
MS OK	Multiplex Section Overhead OK. This is a status LED.
MS-RDI	Multiplex Section - Remote Defect Indicator. Indicates a signal returned to the transmitting MS Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect. This is an alarm LED.
MS-REI	Multiplex Section - Remote Error Indication. An indication returned to a transmitting node that an errored block has been detected at the MS receiving node. This is an error LED.
OOF	Out of Frame. Indicates that four consecutive frames have been received with invalid or errored framing patterns. This is an alarm LED.
PAT SYNC	Indicates a loss of pattern synchronization. This is an alarm LED.
PTR-ADJ	Administrative Unit - Pointer Adjustment. Indicates that there was pointer movement occurring on the AU. This LED flashes red during a Pointer Adjustment event. This is an event LED.
RS OK	Regenerator Section Overhead OK. This is a status LED.
RX	Displays the received optical power in dBm. This is a status LED.
SS MisMatch	Displays when the expected SS bit setting does not match what is received. SS Bits Alarm Reporting must be enabled for this alarm to generate. This is an alarm LED.
TC-AIS	Tandem Connection-Alarm Indication Signal. Indicates if IEC bits 1110 are

	being received from upstream TCM equipment. (Bits 1-4 of the N1 byte are the IEC bits.) This is an alarm LED.
TC-IEC	Tandem Connection-Incoming Error Count. Indicates a B3 error count is being received from downstream TCM equipment. Bits 1-4 of the N1 byte are used for this indicator. This is an error LED.
TC-LOF	Tandem Connection-Loss of Frame. Indicates the loss of a valid multiframe pattern from upstream TCM equipment. This is an alarm LED.
TC-ODI	Tandem Connection-Outgoing Defect Indicator. Indicates that the unit is sending an ODI alarm to upstream TCM equipment. Bit 7 in multiframe 74 of the N1 byte is used for this indicator. This is an alarm LED.
TC-OEI	Tandem Connection-Outgoing Error Indication. Indicates that the unit is sending an OEI error to upstream TCM equipment. Bit 6 of the N1 byte is used for this indicator. This is an error LED.
TC-RDI	Tandem Connection-Remote Defect Indication. Indicates that a defect has occurred at the downstream TCM equipment. The unit is receiving an alarm. Bit 8 in multiframe 73 of the N1 byte is used for this indicator. This is an alarm LED.
TC-REI	Tandem Connection-Remote Error Indication. Indicates that an error has occurred at the downstream TCM equipment. The unit is receiving an error. Bit 5 of the N1 byte is used for this indicator. This is an error LED.
TC SUMMARY	Tandem Connection Summary. Indicates if a TCM error or alarm has been detected. If this LED is red, click on the LED text (TC Summary) to display the TC LEDs.
TC-UNEQ	Tandem Connection-Unequipped.

	Indicates that a 00h pattern has been detected in the N1 byte of a Tandem Connection. This is an alarm LED.

STM-64 Tab

STM-64 Overview

This section of the online help system has topics that discuss:

- STM-64 Specific Tasks
- STM-64 Screen and Function Descriptions

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

STM64 Specific Tasks

STM-64 Specific Tasks

This section includes tasks that are specific to STM-64 protocol processor. For a list of general tasks, which apply to all protocol processor modes, see Common Tasks located in the Getting Started section.

- Calibrate STM-64 Optical Power
- Change STM-64 RS Overhead
- Change STM-64 MS Overhead
- Change STM-64 HP Overhead
- Configuring APS Commands
- Change Overhead Bytes in Passthru Mode

Calibrate Optical Power (STM-64)

The following procedures describe the optical power calibration. While performing this task, you will measure, record, and enter the Zero optical power input (no optical power, not to be confused with 0 dBm) and the optical power readings for -15 dBm and -5 dBm.

Before You Begin

- Read these procedures before trying to calibrate the system.

WARNING: Power the system off before removing the optical connector dust caps to clean the unit's fiber optic ports.

- Before performing optical power calibration, use a fiber-optics cleaning kit to clean the fiber-optic ports on the unit, the optical power meter, the optical attenuator, and the fiber cables. Dirty optical fibers will affect optical measurements.
- The following equipment is required for optical calibration:
  - Two three-foot singlemode, fiber-optic cables
  - Variable optical attenuator (set to the correct wavelength)
  - Optical power meter (set to the correct wavelength)
  - Fiber-optics cleaning kit
  - Pencil and paper to record optical power measurements

Restoring Raw Power Readings

The following restores the raw (unconverted) power readings.

1. Make sure that the dust caps are on the unit's TX and RX optical ports.
2. Turn the unit on.

1. From the **System** tab, select **Misc**.
2. From **Local Setting**, select **Enable Calibration**.

> The user must have Admin. or Calibrate privileges to enable the calibration mode.

5. From the **SDH** tab, select **Receive**.
6. Set the Interface rate to **STM-64** (9953.28 MHz)
7. Select **SIG** from the tabs along the left-side of the Receive screen and choose **Update Signal Calibration**.
8. Select **Zero power reading**. A touch screen keypad appears. Enter **0** and select **OK**.
9. Select **-15 dBm power reading**. A touch screen keypad appears. Enter **0** and select **OK**.
10. Select **-5 dBm power reading**. A touch screen keypad appears. Enter **0** and select **OK**.
11. Select the **Save** button to restore the raw (unconverted) power reading.

Obtaining Zero Optical Power Input

1. Make sure that the dust caps are still on the unit's RX optical ports so that no light is present on the RX optical port.
2. Record the Raw optical power reading, which is the **Zero power reading** value.

Obtaining -15 dBm Power Reading

1. Connect a fiber-optic cable from the **10 Gbps TX** optical port to the optical attenuator's input connector.
2. Attach a fiber-optic cable from the attenuator's output port to the reference optical power meter.
3. Turn the laser on.
4. Adjust the variable attenuator so that the optical power meter reads -15 dBm.
5. Disconnect the fiber-optic cable from the optical power meter, and attach it to the **10 Gbps RX** optical port.
6. Record the Raw optical power reading, which is the **-15 dBm power reading** value.

Obtaining -5 dBm Power Reading

1. Disconnect the fiber-optic cable from the unit's **10 Gbps RX** optical port and re-attach it to the optical power meter.
2. Adjust the variable attenuator so that the power meter reads -5 dBm.
3. Disconnect the fiber-optic cable from the optical power meter, and re-attach it to the **10 Gbps RX** optical port.
4. Record the Raw optical power reading, which is the **-5 dBm power reading** value.

Entering Optical Power Readings

1. Select **Zero power reading**. A touch screen keypad appears. Enter the value recorded earlier for the Zero Power Reading and select **OK**.
2. Select **-15 dBm power reading**. A touch screen keypad appears. Enter the value recorded earlier for the -15 dBm Power Reading and select **OK**.
3. Select **-5 dBm power reading**. A touch screen keypad appears. Enter the value recorded earlier for the -5 dBm Power Reading and select **OK**.
4. Select the **Save** button to save the new calibration values.
5. Adjust the variable attenuator to different degrees of attenuation, and compare the NIC's measured power levels to the reference optical power meter.
6. Tweak and save the above raw power values as needed to ensure that the accuracy of the NIC's measured power levels are within +/- 1.5 dBm of the reference optical power meter.
7. This completes the optical calibration procedure.

Regenerator Section Overhead

The Regenerator Section Overhead (RS Overhead) consists of the first nine bytes of the Transport OH.

The system allows direct access and editing of the RS Overhead bytes to simulate errors, alarms, and other stress conditions. This method of stressing the network is an alternative to using the system's error and alarm functions.

The following RS Overhead bytes can be edited:

RS Overhead Byte	Description
A1	Framing byte
A2	Framing byte
Z0	RS Growth byte
B1	RS BIP-8. This byte is also used to generate B1 errors.
E1	Orderwire byte
F1	RS User Channel
D1	RS Data Communication Channel (DCC)
D2	RS DCC
D3	RS DCC

To Edit RS Overhead Bytes:

1. Select the **STM-64** tab.
2. Select the **Transmit** button.
3. Select the **SOH** button. The RS Overhead and MS Overhead bytes appear.
4. Select a RS Overhead byte.

   A keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

   The byte can also appear in HEX or decimal notation. Select the **HEX** or **DEC** button on the keypad.

The bit value can also be erased from the keypad using the **Clear** button.

5. When editing is complete, select **OK** to save the new value. (**Cancel** discards any changes made to the byte and restores the previous value.)

Multiplex Section Overhead

The Multiplex Section Overhead (MS Overhead) bytes consists of 18 bytes that are responsible for:

- Defining the SDH Pointer
- Controlling linear and ring APS switching
- Setting Line Data Communication Channel (DCC) parameters

The following MSOH bytes can be edited:

MS Overhead Bytes	**Description**
H1	Pointer byte. Bits 1 through 4 represent the New Data Flag (NDF) value. Bits 5 and 6 are reserved. Bits 7 and 8 are combined with the H2 byte to identify the beginning of an SDH payload, the Synchronous Payload Envelope (SPE). This marker is called a Pointer.
H2	Pointer byte. This byte is combined with the H1 byte to create the Pointer.
H3	Pointer Action.
B2	MS BIP-8. This byte is also used to generate B2 errors.
K1	Automatic Protection Switching (APS). This byte is a request for switch action.
K2	Automatic Protection Switching (APS). This byte is also used to generate MS-RDI alarms.
D4 through D12	MS Data Communication Channel (DCC).
Z1	Growth
Z2	Growth
E2	Orderwire.

To Edit MS Overhead Bytes:

1. Do one of the following:
    - For STM-64, select the **STM-64** tab.
    - For STM-16, select the **STM-16** tab.
2. Select the **Transmit** button.
3. Select the **SOH** button.

    The RS Overhead and MS Overhead bytes appear.

4. Select an MS Overhead byte.
5. A keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

   The byte can also appear in HEX or decimal notation. Select the **HEX** or **DEC** button on the keypad.

The bit value can also be erased from the keypad using the **Clear** button.

6. When editing is complete, select **OK** to save the new value. (**Cancel** discards any changes made to the byte and restores the previous value.)

Higher-Order Path Overhead

The Higher-Order Path Overhead (HP Overhead) consists of eight bytes that are responsible for monitoring performance and transporting the payload in an SPE.

The unit allows direct access and editing of the HP Overhead to simulate errors, alarms, and other stress conditions. This method of stressing the network is an alternative to using the unit's error and alarm functions.

The following Higher-Order Path Overhead bytes can be edited:

Higher-Order Path Overhead Byte	Description
B3	BIP-8. This byte is also used to generate B3 errors.
C2	Path Signal Label.
G1	Path Status. This byte is also used to generate HP-REI errors.
F2	Path User Channel
H4	Indicator
Z3	Path Growth
Z4	Path Growth
Z5	Tandem Connection

To Edit Higher-Order Path Overhead Bytes:

1. Select the **STM-64** tab.
2. Select the **Transmit** button.
3. Select the **POH** button. The Higher-Order Path Overhead bytes appear.

4. Select an **OH byte**.

   A keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

   The byte can also appear in HEX or decimal notation. Select the **HEX** or **DEC** button on the keypad.

The bit value can also be erased from the keypad using the **Clear** button.

5. When editing is complete, select **OK** to save the new value. (**Cancel** discards any changes made to the byte and restores the previous value.)

Configuring APS (K1 and K2) Commands

Automatic Protection Switching (APS) is a function that allows an LTE to switch to a backup (or protection) channel in case errors or failures occur on the working channel. APS commands can be configured for either Linear- or Ring-based SONET and SDH networks and are transmitted using the K1 and K2 bytes of the Line Overhead.

You can test your network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response by configuring the K1 and K2 bytes.

You can create up to 16 different K1 and K2 byte configurations (known as byte sequences) to measure and stress your equipment's APS switching capabilities.

To configure K1 and K2 byte values:

1. Select **Transmit** button.
2. Select the **APS** button. The initial APS screen appears containing a table of the K1 and K2 byte sequences that can be transmitted. A total of 16 K1 and K2 byte sequences can appear in the table.
3. To make a new entry:
   - Select **New Item**

   To edit an item:

   - Select **Item <#>**, for example, Item 12.

   The Apply Maintenance to Entry screen appears, which contains functions used to configure and set the measurement criteria of the K1 and K2 bytes.

4. From the Apply Maintenance to Entry dialog box, select **APS Mode**. The APS Mode dialog box appears.
5. Choose **Linear** protection switching mode or **Ring** signaling mode.
6. From the Apply Maintenance to Entry dialog box, select a K1 byte/bit option. A value dialog box associated with the K1 selection appears. The K1 byte is a request for switch action. There are three functions that allow you to edit the K1 byte:

    - Use the **K1 Full Byte** function to set all eight bits of the K1 byte at once.
    - Use the **K1 Bits 1-4** function to set the first four bits of the K1 byte.
    - Use the **K1 Bits 5-8** function to set the last four bits of the K1 byte.

7. From the Apply Maintenance to Entry dialog box, select a K2 byte/bit. A value dialog box associated with the K2 selection appears. The K2 byte provides additional information about SONET/SDH network architecture and alarm conditions. There are four functions that allow you to edit the K2 byte:

    - Use the **K2 Full Byte** function to set all eight bits of the K2 byte at once.
    - Use the **K2 Bits 1-4** function to set the first four bits of the K2 byte.
    - Use the **K2 Bit 5 (provisioned)** function to set the fifth bit of the K2 byte.
    - Use the **K2 Bits 6-8** function to set the last three bits of the K2 byte.

8. From the Apply Maintenance to Entry dialog box, select **Duration** in Frames to set up the number of frames that will be transmitted containing the newly configured K1 and K2 bytes.
9. Select **Update**. The initial APS screen appears on the touch screen.
10. To configure additional K1 and K2 bytes, repeat steps 3-9 as described above. Otherwise, proceed to the next section to transmit K1 and K2 bytes.

To transmit K1 and K2 bytes:

1. Make sure that K1 and K2 byte sequences are configured as described above.
2. Select **Start** to transmit the K1 and K2 bytes.

To stop transmitting K1 and K2 bytes:

1. Select the **APS** button and choose **Stop**.

Related Topic:

Monitor incoming APS activity

Change Overhead Bytes in Passthru Mode

Passthru mode allows an incoming STM-64 signals to pass through the unit without altering the data in the signal. However, the Regenerator Section and Multiplex Section Overhead bytes can be changed to simulate errors, alarms, and other stress conditions such as Pointer Adjustments. This lets you verify if equipment in the SDH network can detect changed Overhead bytes.

To configure the unit for Passthru mode:

1. From the **STM-64** tab, select **Transmit**.
2. Select **SET 1**.
3. Select the **Passthru Mode** function. The **Select Passthru Mode** window appears.
4. Select **On** to enable Passthru mode.

To change SOH bytes in Passthru mode:

1. Select **SOH**. When Passthru mode is enabled:
    - By default, the OH bytes are passed-through (looped) the unit without being altered. (These bytes are currently disabled on the touch screen.)
    - However, the **Intrusive Overhead buttons** appear to the right of the OH bytes. These buttons allow you to select a specific which OH bytes to intrude on, allowing their values to be changed.
2. Select an **Intrusive Overhead button**. For example, select F1 Pass.

    The selected Intrusive Overhead button changes to indicate that a specific byte has been selected. For example, F1 Pass now appears as F1 Intrude. In addition, the OH byte is now enabled and displays its value.

3. Select the same OH byte (from the left side of the screen) that you selected for Passthru mode (on the right side of the touch screen). For example, select the F1 byte.

    A keypad appears allowing the byte's 8-bit pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

    The byte can also appear in HEX or decimal notation by selecting the **HEX** or **DEC** button on the keypad.

4. When editing is complete, select **OK** to save the new value which will be transmitted out of the unit.

When you intrude on any Regenerator Section OH byte, you automatically intrude on the B1 OH byte. The B1 byte is calculated over all OH bytes. If any OH bytes are changed while in Passthru mode, the transmitted B1 byte will be different from the initial byte value received.

For Multiplex Section OH, both the B1 and B2 bytes are automatically intruded. When these bytes are unintruded, the transmitted B1 and B2 bytes will be different from the initial byte values received.

Screen and Function Definitions

STM-64 Screen Functions and Descriptions Overview

The following function screens are available through the STM-64 protocol processor tab.

- STM-64 Transmit
- STM-64 Receive
- STM-64 Results
- STM-64 Test
- STM-64 Performance Monitoring
- STM-64 LEDs

Transmit

STM-64 Transmit Screen

The STM-64 (TX) Transmit function contains a variety of functions and options that allow you to control the transmit parameters for a SDH signal from the unit.

This functionality allows you to control and adjust specific overhead bytes and to verify if the SDH facility can detect problems and adjust accordingly. In addition, it allows you to inject errors and alarms to verify if the SDH facility is capable of detecting and responding to these conditions.

STM-64 TX functions consist of the following buttons:

- **SET 1:** Configures the unit's transmit parameters for your STM-64 test environment.
- **SET 2:** Configures the unit's transmit parameters for your STM-64 test environment.

- **SOH**: Allows editing of the Regenerator and Multiplex Section Overhead bytes to determine if the SDH facility can detect problems due to changes and errors in Overhead bytes. In addition, the J0 Trace byte can be edited and transmitted to stress a continuous connection between SDH Network Elements (NE).
- **POH**: Allows editing of the Higher-Order Path Overhead bytes to determine if the SDH facility can detect problems due to changes and errors in Overhead bytes. In addition, the J1 Trace and TCM Trace bytes can be edited and transmitted to stress a continuous connection between SDH Network Elements (NE).
- **PTR**: Allows editing, incrementing, and decrementing of the STM-64 Pointer.
- **APS**: Controls APS functions and allows manipulation of K1 and K2 bytes.

- **ERROR ALARM:** Configures the type of error or alarm transmitted.

STM-64 Transmit Settings 1

The STM-64 Transmit Settings 1 screen configures the unit's transmit parameters. It contains the following functions.

Functions	Description
Settings Control	If **Coupled** is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If **Independent** is selected, settings established on the Transmit screen will only affect Transmit mode.
Passthru Mode	Activates or deactivates pass-thru mode, allowing an incoming STM signal to pass through the unit without altering the data in the signal. The following options are available: **On** and **Off**.
Mapping	Defines the concatenated mapping setting. The following mappings can be applied using only the 10 Gbps circuit pack (STM-64 protocol processor): **C-4-64c Bulk**, **C-4-16c Bulk**, **C-4-4c Bulk**, **C-4 Bulk**, and **C-3 Bulk**. • **C-4-64c Bulk**. Maps a concatenated C-4-64c signal into an STM-64. • **C-4-16c Bulk**. Maps a

	concatenated C-4-16c signal into an STM-64. Four C-4-16s make up an STM-64. • **C-4-4c Bulk**. Maps a concatenated C-4-4c signal into an STM-64. Sixteen C-4-4s make up an STM-64. • **C-4 Bulk**. Maps a concatenated C-4 signal into an STM-64. Sixty-four C-4s make up an STM-64. • **C-3 Bulk**. Maps a concatenated AU-3/C-3 signal into an STM-64. 192 C-3s make up an STM-64.. If the unit is equipped with a 2.5 Gbps circuit pack (STM-16 protocol processor), the following mappings also appear and are described below: **C-4-16 A/D** and **C-4-16 A/D LI**. • **C-4-16 A/D**. Maps four C-4-16s into an STM-64. The C-4-16s are generated internally from the STM-16 protocol processor. • **C-4-16 A/D LI**. Maps four C-4-16s into an STM-64. The C-4-16s are derived externally and enter the unit using the STM-16 protocol processor's line interface connectors.
AU-4-16 Added **Note:** AU-4-16 Added is only available when Mapping is set to a C-4-16 option.	Selects a specific AU-4-16 signal as the foreground (or source) channel in the STM-64 signal. The source channel can be used to transmit alarms, errors, or patterns. The unit multiplexes four AU-4-16 signals into a single STM-64 signal. • **1 - 4.** Selects a specific AU-4-16 (AU-4-16 #1 through AU-4-16 #4) as the foreground channel.

	• **ALL.** Transmit the foreground channel across all four AU-4-16 channels. • **None.** No foreground channel is selected.
AU-4-4 Added **Note:** AU-4-4 Added only appears when Mapping is set to C-4-4c Bulk.	Selects a specific AU-4-4 signal as the foreground (or source) channel in the STM-64 signal. The source channel can be used to transmit alarms, errors, or patterns. The unit multiplexes four AU-4-4 signals into a single STM-64 signal. • **1 - 16.** Selects a specific AU-4-4 (AU-4-4 #1 through AU-4-4 #16) as the foreground channel. • **ALL.** Transmit the foreground channel across all 16AU-4-4 channels. • **None.** No foreground channel is selected.
AU-4 Added **Note:** AU-4 Added only appears when Mapping is set to C-4 Bulk.	Selects a specific AU-4-16 signal as the foreground (or source) channel in the STM-64 signal. The source channel can be used to transmit alarms, errors, or patterns. The unit multiplexes four AU-4-16 signals into a single STM-64 signal. • **1 - 64.** Selects a specific AU-4 (AU-4 #1 through AU-4 #64) as the foreground channel. • **ALL.** Transmit the foreground channel across all 64 AU-4 channels. • **None.** No foreground channel is selected.
AU-3 Added **Note:** AU-3 Added only appears when Mapping is set to C-3 Bulk.	Selects one of 192 AU-3 signals as the foreground channel in the STM-64 signal. • **1 - 192.** Selects a specific AU-

	3 (AU-3 #1 through AU-3 #192) as the foreground channel. • **ALL.** Transmits the foreground channel across all 192 AU-3 channels. • **None.** No foreground channel is selected.
Background AU-4-16 Pattern **Note:** Only appears when Mapping is set to C-4-16c Bulk.	Determines the type of pattern inserted into the three remaining AU-4-16 background channels of an STM-64 signal. The pattern can range from 1 bit to 32 bits and is entered using screen keypad. It can be entered in Hex, decimal, or binary format.
Background AU-4-4 Pattern **Note:** Only appears when Mapping is set to C-4-4c Bulk.	Determines the type of pattern inserted into the 15 remaining AU-4-4 background channels of an STM-64 signal. The pattern can range from 1 bit to 32 bits and is entered using screen keypad. It can be entered in Hex, decimal, or binary format.
Background AU-4 Pattern **Note:** Only appears when Mapping is set to AU-4.	Determines the type of pattern inserted into the 63 remaining AU-4 background channels of an STM-64 signal. The pattern can range from 1 bit to 32 bits and is entered using screen keypad. It can be entered in Hex, decimal, or binary format.
Background AU-3 Pattern **Note:** Only appears when Mapping is set to AU-3	Determines the type of pattern inserted into the 191 remaining AU-3 background channels of an STM-64 signal. The pattern can range from 1 bit to 32 bits and is entered using screen keypad. It can be entered in Hex, decimal, or binary format.
Payload Pattern	Select User-Defined (32 bit value), PRBS 15, PRBS 15 INV, PRBS 23, PRBS 23 INV, PRBS 31,or PRBS 31 INV.
Clock Reference	Select Internal, Recovered, or Bits/Sets.
Laser Type	This is a read only setting that

	displays installed 10G laser's wavelength. The 10G circuit pack only supports a single wavelength configuration.
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. • **Off**. The unit's laser will be off when the unit is turned on. • **On**. The unit's laser will be on when the unit is turned on. • **Restore Previous State**. When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.

STM-64 Transmit Settings 2

The STM-64 Transmit Settings 2 screen contains the following functions.

Functions	Description

Line Frequency Offset	Adjusts the offset of the signal frequency of the transmitted SDH signal. The frequency can be adjusted in parts per million (PPM). The following options are available: **Off = 0**: The frequency cannot be adjusted. **Edit:** Adjusts the signal frequency in PPM. Use the + and - arrow keys to adjust the 00.0 decimal place. The frequency offset ranges from -100.0 to 100.0 in increments of 0.1. The default value is 00.0. After an offset value is entered, the Confirm button on the touch screen keypad must be selected for the new offset value to be accepted.
SS Bits in H1 Label	This function allows bits 5 and 6, which are the SS bits, of the H1 Pointer byte to be set to support a SONET or SDH Transport OH. Changes to the Transport OH are another way to stress an SDH network by simulating errors, alarms, and other stress conditions. The following options are available: • **00 (SONET)**: Sets bits 5 and 6 of the H1 Pointer byte to 0 (****00**). • **01 (Undefined)**: Sets bit 5 to 0 and bit 6 to 1 (****01**). • **10 (SDH)**: Sets bit 5 to 1 and bit 6 to 0 (****10**). • **11 (Undefined)**: Sets bit 5 and 6 of the H1 Pointer byte to 1 (****11**).

HP Signal Label	Set the C2 byte to: • Unequipped (00) • Equipped (01) • TUG Structured (02) • Lock TU Mode (03) • Async Mapping for 34368 KB (04) • Async Mapping for 139264 KB (12) • Map for ATM (13) • Map for DQDB (14) • Map for FDDI (15) • O.181 Test Signal Mapping (FE) • VC-AIS (FF) • User Defined (any eight bit pattern 0 to FF. **Note:** This option is coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will change in the Overhead screen as well.

Synchronization Status (S1)	Sets the S1 byte to: • 00 Quality Unknown: Sets byte value to 00000000. • 02 Rec. G.811: Sets byte value to 00000010. • 04 Rec. G.812 Transmit: Sets byte value to 00000100. • 08 Rec. G.812 Local: Sets byte value to 00001000. • 0B Sync Eqip Timing Src: Sets byte value to 00001011. • 0F Do Not Use for Sync • User Defined (any eight bit pattern 0 to FF.

Trigger In	Determines how the protocol processor responds when an external pulse is received. Each protocol processor can be configured to respond to an external pulse received using the Trigger In connector. The following options are available: • **Restart**: The protocol processor will restart when an external pulse is received. • **Error Insert**: The protocol processor will insert an error (as defined by the Output Trigger function) when an external pulse is received. • **None**: The protocol processor will do nothing when an external pulse is received.
TC Overhead Processing	Enables Tandem Connection Monitoring (TCM) transmit mode. • **Enable:** For SDH, the unit uses its TCM circuitry and the N1 byte to generate errors and alarms between TCM equipment. For SONET, the unit uses the Z5 byte. • **Disable:** TCM mode is disabled, and the N1 and Z5 bytes follow normal operation.

STM-64 Transmit Regenerator and Multiplex Section Overhead

The STM-64 Transmit SOH screens contains the following functions.

Functions	Description
Showing	Selects a specific Overhead slot within the STM-64 signal. The overhead bytes that appear on the OH screen are associated with this slot. There are 192 SOH slots available in an STM-64 signal.
RS Overhead	Select and edit the following Overhead bytes: A1, A2, Z0, B1, E1, F1, D1, D2, and D3.
MS Overhead	Select and edit the following Overhead bytes: H1, H2, H3, B2, K1, K2, D4-D12, Z1, Z2, and E2.
J0 Trace	Selects a default or customized pattern to be used as the J0 trace. Select one of the following patterns: • **Default (64 byte)**: Selects the Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 62 characters, appended with a CR and LF. • **User Defined (64 byte)**: Selects a user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 62 characters, appended with a CR and LF. • **All Ones**: Selects an All Ones pattern as the J0 trace pattern. • **All Zeros**: Selects an All Zeros pattern as the J0 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to15 characters, appended with a CRC-7.

STM-64 Transmit Pointer Generation

The STM-64 Transmit Pointer screen contains the following functions.

Function	Description
NDF Flag	The NDF Flag allows you to specify whether the NDF bits are set when a new Pointer is present in the generated signal. The following options are available: **Yes** (On): Generates an NDF when a new Pointer is transmitted. **No** (Off): Disables NDF functionality.
Pointer Value	The Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the Virtual Container. The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from 0 to 782. After entering the new Pointer Value, the Pointer automatically moves to the new position.
Frequency Offset	Adjusts the rate at which AU Pointer adjustments are needed in the Administrative Unit (AU). Enter a frequency type ranging from -100.0 ppm to +100.0 ppm. This function is disabled by entering 0.
Pointer Action	Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. **Single options** - Inserts a single Pointer movement with each selection of the INC Pointer or DEC Pointer button. The Pointer value changes by one. **Increment/Decrement option** - Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected.

	Continuous options - Inserts a continuous Pointer movement with the selection of the INC Pointer or DEC Pointer button. The movement continues until the Stop Sequence button is selected.
Burst Count	This function allows you to determine the number of Pointer location movements to occur when the INC Pointer or DEC Pointer buttons are pressed. The Pointer burst count ranges from 1 to 8.
Ms between Bursts	Allows the user to set the number of Milliseconds between bursts. Valid valued are 34 - 10000.
INC Pointer / DEC Pointer	Alternates the Pointer insertion from increment to decrement with a 200-msec delay in between.

Related Topics:

For information about making Pointer adjustments, select *Make Pointer Adjustments* in the Common Tasks section of the online help.

Transmit - APS

Transmit APS

This is an Automatic Protection Switching (APS) function used to configure transmit APS activity. APS is a feature that allows the LTE to switch to a backup line in case of errors or failures on the main line. APS commands can be configured for either Linear- or Ring-based networks and are transmitted using bytes K1 and K2 of the Line overhead.

You can test the network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response.

The following options are available on the APS screen:

- **New Item** - Opens the Apply Maintenance to Entry window, from which you configure K1 and K2 bytes.
- **Start** - Begins transmission of the K1 and K2 byte configuration.
- **Clear** - Clears the table.

The following Apply Maintenance to Entry window APS Transmit functions are available:

APS Mode - Linear

This function configures the system to transmit APS functions for a Linear (span) network.

- K1 Full Byte (Linear Mode)
- K1 Bits 1-4 (Linear Mode)
- K1 Bits 5-8 (Linear Mode)
- K2 Full Byte (Linear Mode)
- K2 Bit 5 (Provisioned) (Linear Mode)
- K2 Bits 1-4 (Linear Mode)
- K2 Bits 6-8 (Linear Mode)

APS Mode - Ring

This function configures the system to transmit APS functions for a Ring network.

- K1 Full Byte (Ring Mode)
- K1 Bits 1-4 (Ring Mode)
- K1 Bits 5-8 (Ring Mode)
- K2 Full Byte (Ring Mode)
- K2 Bit 5 (Provisioned) (Ring Mode)
- K2 Bits 1-4 (Ring Mode)
- K2 Bits 6-8 (Ring Mode)

Duration in Frames

The Duration in Frames function determines the number of frames transmitted that contain specific K1 and K2 bytes. These bytes are configured using the functionality located on the transmit APS screen.

Frame count is entered using a keypad. Values ranging from 1 to 65535 frames can be entered.

K1 Bits 1-4 (Linear Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description
(0000) NR	No Request, Bit pattern 0000
(0001) Non	Do not revert, Bit pattern 0001

Rev	
(0010) RR	Reverse Request (Ring), Bit pattern 0010
(0011) Unused	Not Used, Bit pattern 0011
(0100) EXER	Exerciser (Ring), Bit pattern 0100
(0101) Unused	Not used, Bit pattern (0101)
(0110) WTR	Wait to restore, Bit pattern (0110)
(0111) Unused	Not used, Bit pattern (0111)
(1000) MS	Manual switch, Bit Pattern 1000
(1001) Unused	Not used, Bit pattern (1001)
(1010) SD-LP	Signal degrade low priority, Bit pattern (1010)
(1011) SD-HP	Signal degrade high priority, Bit pattern (1011)
(1100) SF-LP	Signal fail low priority, Bit pattern (1100)
(1101) SF-HP	Signal fail high priority, Bit pattern (1101)
(1110) FS	Forced switch, Bit pattern (1110)
(1111) LP	Lockout of protection, Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	**Description**
(0000) NR	No request, Bit pattern 0000
(0001) RR-R	Reverse request (Ring), Bit pattern 0001
(0010) RR-S	Reverse request (Span), Bit pattern 0010
(0011) EXER-R	Exerciser (Ring), Bit pattern 0011
(0100) EXER-S	Exerciser (Span), Bit pattern 0100
(0101) WTR	Wait to restore, Bit pattern (0101)

(0110) MS-R	Manual switch (Ring), Bit pattern (0110)
(0111) MS-S	Manual switch (Span), Bit pattern (0111)
(1000) SD-R	Signal degrade (Ring), Bit Pattern 1000
(1001) SD-S	Signal degrade (Span), Bit pattern (1001)
(1010) SD-P	Signal degrade (Path), Bit pattern (1010). This is the Transmit Default button setting.
(1011) SD-R	Signal degrade (Ring), Bit pattern (1011)
(1100) SF-S	Signal fail (Span), Bit pattern (1100)
(1101) FS-R	Forced switch (Ring), Bit pattern (1101)
(1110) FS-S	Forced switch (Span), Bit pattern (1110)
(1111) LP-S	Lockout of protection (Span), Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 5-8 (Linear Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Linear mode, these bits indicate the channel number. For example, Code 0 is the Null Channel, Codes 1-14 are the working channels, and Code 15 is an extra traffic channel.

The following options are available:

Options	**Description**
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit

	pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Bits 5-8 (Ring Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Ring mode, these bits contain the Destination Code Identification.

The following options are available:

Options	**Description**
Null (#0)	Protection channel requesting switch

	action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Full Byte (Linear Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K1 Full Byte (Ring Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Bit 5 (Provisioned) (Linear Mode)

This function edits the 5th bit of the K2 byte. In Linear mode. This bit controls the type of protection switching architecture used.

The following options are available:

Options	Description
1+1	Provisioned for 1+1 mode; Bit 5 = 0
1 : n	Provisioned for 1:n mode; Bit 5 = 1

K2 Bit 5 (Provisioned) (Ring Mode)

This function edits the 5th bit of the K2 byte. In Ring mode, this bit controls the type of path code used.

The following options are available:

Options	Description
SHT / OTO	Short Path Code; Bit 5 = 0
LNG / OTN	Long Path Code; Bit 5 = 1. When selected, both the Transmit Default and Transmit Illegal button settings are configured for LNG/OTN.

K2 Bits 1-4 (Linear Mode - SDH)

This function edits the first four bits of the K2 byte. In Linear mode, the first four bits indicate which working channel is bridged onto the protection channel during a traffic switching event.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K2 byte. In Ring mode, the first four bits are the Source Node Identification. (The Source Node ID is set to the Node's own ID.)

The following options are available:

Options	Description
#0	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100

#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Linear Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Unused	Not used, Bit pattern 000
(001) Unused	Not used, Bit pattern 001
(010) Unused	Not used, Bit pattern 010
(100) Unused	Not used, Bit pattern 100
(100) Uni-direct	Provisioned for Unidirectional switching, Bit pattern 10
(101) Bi-direct	Provisioned for Bidirectional switching, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Ring Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Idle	Idle, Bit pattern 000
(001) Br	Bridged, Bit pattern 001
(010) Br&Sw	Bridged and switched, Bit pattern 010. This is the Transmit Default button setting.
(100) Ex Tr	Extra traffic on protection channel, Bit pattern 100
(100) Unused	Not used, Bit pattern 10
(101) Unused	Not used, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Full Byte (Linear Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Full Byte (Ring Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

STM-64 Transmit Error Alarm

This function determines the type of error transmitted by the unit. The purpose of generating an error with unit is to stress the network element that is receiving the error by testing if it can detect the incoming error and then report error statistics such as error counts and rates. The following options are available:

Error to Insert

Select an error to insert. Choose one of the following options.

Option	Description
None	No errors are generated. Turns errors off.
B1 Error	Generates a BIP-8 (Bit Interleaved Parity, 8-bit) error over the Regenerator Section layer. Bits in the B1 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream

	equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
B2 Error	Generates a BIP-8 error over the Multiplex Section layer. Bits in the B2 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
B3 Error	Generates a BIP-8 error over the Higher-Order Path layer. Bits in the B3 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
MS-REI	Generates a Remote Error Indicator over the Multiplex Section layer. An MS-REI is a count of B2 errors received at the far end. When the unit transmits this error, it simulates a downstream NE sending an error count back to the source of its incoming SDH signal. The unit uses the M1 byte of the MSOH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and rates. (This type of error was formerly called a Line Far End Block Error - FEBE-L.)
HP-REI Error (Path FEBE)	Generates a Remote Error Indicator over the Higher-Order Path layer. An HP-REI is a count of B3 errors received at the far end. When the unit transmits this error, it simulates an NE sending an error count back to

	the source of its incoming SDH signal. The unit uses the G1 byte of the HPOH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and error rates.
BIT Error	Generates bit errors. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and error rates.
TC-IEC	Generates a Tandem Connection Incoming Error Count over the Path layer. A TC-IEC is a count of B3 errors received by TCM equipment at the far end. Bits 1-4 of the N1 byte are the IEC bits.
TC-REI	Generates a Tandem Connection Remote Error Indicator over the Path layer between TCM equipment. Bit 5 of the N1 byte is used for this error.
TC-OEI	Generates a Tandem Connection Outgoing Error Indicator over the Path layer between TCM equipment. Bit 6 of the N1 byte is used for this error.

Error Insert Rates

The Error to Insert function determines the type of error transmitted. The Error Insert Rate function sets the error rate for the selected error. The unit starts transmitting errors after the insertion rate is selected.

The following options are available for 10G Interface Rates:

Option	Descriptions
Off	Turns error transmission off.

1e-X	X is a value from 3 to 10; for example, 1e-3 through 1e-10. X will vary based on the type of error selected.
Maximum	Generates errors at the maximum rate listed below.

If this error is inserted...	**Then this range of rates is available...**
B1	1e-6 to 1e-10; maximum rate is 6.43e-6
B2	1e-3 to 1e-10; maximum rate is 1.25e-3
B3	1e-6 to 1e-10; maximum rate is 6.65e-6
MS-REI (MS-FEBE)	1e-4 to 1e-10; maximum rate is 2.07e-4
HP-REI (HP-FEBE)	1e-6 to 1e-10; maximum rate is 6.65e-6
Bit	1e-3 to 1e-10; maximum rate is 1e-3
TC-IEC error	1e-6 to 1e-10; maximum rate is 6.65e-6
TC-REI error	1e-7 to 1e-10; maximum rate is 8.31e-7
TC-OEI error	1e-7 to 1e-10; maximum rate is 8.31e-7

For information about inserting errors, select Insert Errors in the Common Tasks section of the online help.

Alarm Generated (SDH)

This function configures the unit to generate an alarm in the transmit SDH signal. Alarm generation by the unit is one way to test if downstream SDH equipment reacts properly to the alarm it receives in the incoming SDH signal.

The following alarms are available:

Option	**Description**
None	No alarms are generated. Turns alarms off.
LOS	Loss of Signal. An all-zeros pattern is

	transmitted to simulate a loss of signal or loss of optical power. This forces the downstream SDH equipment to (1) generate an AIS alarm to its downstream network elements (NE), and (2) generate an RDI alarm to its upstream NEs.
LOF	Loss of Frame. An all-zeros pattern is inserted into the A1 and A2 framing bytes of the Section OH. This simulates the absence of a valid framing pattern. This forces the downstream SONET equipment to generate an AIS alarm to its downstream network elements (NE), and generate an RDI alarm to its upstream NEs.
AU-LOP	Administrative Unit Loss of Pointer. This simulates a loss of a valid STS Pointer. When the downstream NE receives an AU-LOP, it generates a DSn AIS alarm to its downstream equipment and an HP-RDI alarm to its upstream equipment.
MS-AIS	Multiplex Section Alarm Indication Signal. The transmission of an MS-AIS to a downstream NE forces that NE to send an AU-AIS alarm to the next downstream NE. The NE will also send an MS-RDI alarm to its upstream equipment. An MS-AIS simulates an alarm generated by Line terminating equipment (LTE).
MS-RDI	Multiplex Section Remote Defect Indicator. This generates an MS-RDI condition using the K2 byte of the Line OH. This simulates a downstream NE (in this case the system unit) at the Line layer, reporting a failure to an upstream NE. The downstream NE (unit) has encountered a downstream failure and is alerting upstream SDH equipment. To do this, the unit changes the

	pattern of the K2 byte. The NE receiving the MS-RDI alarm should detect a change to the K2 byte on the incoming SDH signal. This forces the NE to generate a Remote Alarm Indicator (RAI) to its upstream NEs.
AU-AIS	Administrative Unit Alarm Indication Signal. The transmission of an AU-AIS to a downstream NE forces that NE to send an AIS alarm to the next downstream NE. The NE will also send an RDI alarm to its upstream equipment. An AU-AIS simulates an alarm generated by Path terminating equipment (PTE).
HP-RDI	Higher-Order Path Remote Defect Indicator. This generates an HP-RDI condition using the G1 byte of the Higher-Order Path OH. This simulates a downstream NE (in this case, the unit), at the Path layer, reporting a failure to an upstream NE. To do this, the unit changes the pattern of the G1 byte in the Path OH. The NE receiving the HP-RDI alarm should detect a change to the G1 byte on the incoming SDH signal.
HP-UNEQ	Higher-Order Path Unequipped Alarm. An all-zeros pattern is inserted into the C2 byte of the HPOH. The C2 byte is the HP Signal Label. (This type of error is used between Higher-Order Path terminating equipment-PTE). When a PTE receives this alarm, it will generate an AIS to downstream NEs.
TC-RDI	Tandem Connection-Remote Defect Indicator. Generates an alarm to upstream equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 8 in multiframe 73 of the N1 byte.

TC-ODI	Tandem Connection-Outgoing Defect Indicator. Generates an alarm to upstream TCM equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 7 in multiframe 74 of the N1 byte.
TC-AIS	Tandem Connection-Alarm Indication Signal. Generates an AIS alarm to downstream TCM equipment by setting Bits 1-4 of the N1 byte to 1110.
TC-UNEQ	Tandem Connection-Unequipped. Generates an all-zeros pattern is inserted into the N1 byte of the Path OH.
TC-LOF	Tandem Connection-Loss of Frame. Generates a loss of a valid multiframe pattern to downstream equipment.

After selecting an alarm, the alarm continues until one of the following occurs:

- The alarm is turned off using the **None** option.
- A mapping change occurs.

For more information about inserting alarms, select *Insert Alarms* in the Common Tasks section of the online help.

Receive

STM-64 Receive

The Receive (RX) function contains several functions and options that configure the receive signal parameters. If the incoming signal does not match the expected parameters, errors, and alarms can be logged by the system.

Receive functionality consists of the:

- STM-64 Receive Settings 1
- STM-64 Receive Settings 2
- STM-64 Receive Overhead (SOH / POH)
- STM-64 Receive Signal Status

STM-64 Receive Settings 1

This function configures the STM-64 receive mapping, which maps a pattern into the STM-64 interface.

Options marked with an asterisk (*) indicate that the function is coupled with the Transmit settings if Setting Control is set to "Coupled."

The following options appear on the STM-64 Receive SET 1 screen.

Options	Description
*Settings Control	If **Coupled** is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If **Independent** is selected, settings established on the Receive screen will only affect Receive mode.
*Mapping	Defines the concatenated mapping setting. The following mappings can be applied using only the 10 Gbps circuit pack (STM-64 protocol processor: C-4-64c Bulk, C-4-16c Bulk, C-4-4c Bulk, C-4 Bulk, C-3 Bulk, and C-4-64c POS. • C-4-64c Bulk. Maps a concatenated C-4-64c signal into an STM-64. • C-4-16c Bulk. Maps a concatenated C-4-16c signal into an STM-64. Four C-4-16s make up an STM-64. • C-4-4c Bulk. Maps a concatenated C-4-4c signal into an STM-64. Sixteen C-4-4s make up an STM-64. • C-4 Bulk. Maps a concatenated C-4 signal into an STM-64. Sixty-four C-4s make up an STM-64. • C-3 Bulk. Maps a concatenated AU-3/C-3 signal into an STM-64. 192 C-3s make up an STM-64.. • C-4-64c POS. Configures the

	unit for Packet Over SONET/SDH operation. • (Note: This option only appears if the unit is licensed for 10G POS mapping.) • If the unit is equipped with a 2.5 Gbps circuit pack (STM-16 protocol processor), the following mappings also appear and are described below: C-4-16 A/D and C-4-16 A/D LI. • C-4-16 A/D. Maps four C-4-16s into an STM-64. The C-4-16s are generated internally from the STM-16 protocol processor. • C-4-16 A/D LI. Maps four C-4-16s into an STM-64. The C-4-16s are derived externally and enter the unit using the STM-16 protocol processor's line interface connectors.
AU-4-16 Dropped **Note:** AU-4-16 Dropped only appears when Mapping is set to C-4-16c Bulk.	Selects a specific AU-4-16 signal to monitor in the STM-64 signal. The unit receives an STM-64 signal that is demuxed into four AU-4-16 signals and then processed. • **1 - 4.** Selects a specific AU-4-16 (AU-4-16 #1 through AU-4-16 #4) as the dropped and monitored channel. • **None.** No AU-4-16s are selected.
AU-4-4 Dropped **Note:** AU-4-4 Dropped only appears when Mapping is set to C-4-4c Bulk.	Selects a specific AU-4-4 signal to monitor in the STM-64 signal. The unit receives an STM-64 signal that is demuxed into 16 AU-4-4 signals and then processed. • **1 - 16.** Selects a specific AU-4-4 (AU-4-4 #1 through AU-4-4 #16) as the dropped and

	monitored channel. • **None.** No AU-4-4s are selected.
AU-4 Dropped **Note:** AU-4 Dropped only appears when Mapping is set to C-4 Bulk.	Selects a specific AU-4 signal to monitor in the STM-64 signal. The unit receives an STM-64 signal that is demuxed into 64 AU-4 signals and then processed. • **1 - 64.** Selects a specific AU-4 (AU-4 #1 through AU-4 #64) as the dropped and monitored channel. • **None.** No AU-4s are selected.
AU-3 Dropped **Note:** AU-3 Dropped only appears when Mapping is set to C-3 Bulk.	Selects a specific AU-3 signal to monitor in the STM-64 signal. The unit receives an STM-64 signal that is demuxed into 192 AU-3 signals and then processed. • **1 - 192.** Selects a specific AU-3 (AU-3 #1 through AU-3 #192) as the dropped and monitored channel. • **None.** No AU-3s are selected.
Payload Pattern	Selects the type of pattern that the unit expects to receive on the incoming SDH signal. The following options are available: Live (user data is received; no pattern is used), User Defined (range from 1 bit to 32 bits and is entered using a touch screen keypad), PRBS 2^15-1, PRBS 2^15-1 Inverted, PRBS 2^23-1, PRBS 2^23-1 Inverted, PRBS 2^31-1, and PRBS 2^31-1 Inverted.
Trigger Out	Allows the protocol processor to respond to an external "pulse" received. The following options can be selected: None, LOF, OOF, B1, B2, B3, BIT, Frame, MS-RDI, HP-RDI, MS-REI,

	HP-REI, or Ptr Increment, Ptr Decrement, New Ptr with NDF, or New Ptr without NDF.

STM-64 Receive Settings 2

This function configures the unit's receive STM-64 parameters.

Function	Description
PLM Alarm Reporting	This function enables Higher-Order Path Payload Label Mismatch (HP-PLM) alarm reporting. An HP-PLM alarm occurs when the incoming Higher-Order Path Signal Label (C2 byte) does not match the expected Higher-Order Path Signal Label (C2 byte). The following options are available: • **Enabled:** HP-PLM alarms are recognized and reported. • **Disabled:** HP-PLM alarms are ignored.

Expected HP Signal Label	Configure to receive a specific value for the C2 byte. The following options are available: • **Unequipped (00):** The expected C2 byte is 00000000. • **Equipped (01):** The expected C2 byte is 00000001. • **TUG Structured (02):** The expected C2 byte is 00000010. • **Lock TU Mode (03):** The expected C2 byte is 00000011. • **Async Mapping for 34368 KB (04):** The expected C2 byte is 00000100. • **Async Mapping for 139264 KB (12):** The expected C2 byte is 00010010. • **Mapping for ATM (13):** The expected C2 byte is 00010011. • **Mapping for DQDB (14):** The expected C2 byte is 00010100. • **Asyn Mapping for FDDI (15):** The expected C2 byte is 00010101. • **O.181 Test Signal Mapping (FE):** The expected C2 byte is 11111110. • **VC-AIS (FF):** The expected C2 byte is 11111111. • **User Defined:** Allows an 8-bit Path Signal Label, from 00h to FFh, to be entered for the C2 byte value.

TIM Alarm Reporting	An HP Path Trace Identifier Mismatch (HP-TIM) alarm occurs when the incoming J1 trace does not match the expected J1 trace. A Regenerator Section Trace Identifier Mismatch (RS-TIM) alarm occurs when the incoming J0 trace does not match the expected J0 trace. A Tandem Connection Trace Identifier Mismatch (TC-TIM) alarm occurs when the incoming TC trace does not match the expected TC trace. The following options are available: • **Enabled:** TIM alarms are recognized and reported. • **Disabled:** TIM alarms are ignored.

Expected J0	Defines the expected J0 trace received on the incoming SDH signal. Select one of the following patterns: • **Default (64 byte)**: Selects the Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 62 characters, appended with a CR and LF. • **User Defined (64 byte)**: Selects a user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 62 characters, appended with a CR and LF. • **All Ones**: Selects an All Ones pattern as the J0 trace pattern. • **All Zeros**: Selects an All Zeros pattern as the J0 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to15 characters, appended with a CRC-7.

Expected J1	Defines the expected J1 trace received on the incoming SDH signal. Select one of the following patterns: • **Default (64 byte)**: Selects the Digital Lightwave ASCII message as the J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • **User Defined (64 byte)**: Selects a user-defined ASCII message as the J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • **All Ones**: Selects an All Ones pattern as the J1 trace pattern. • **All Zeros**: Selects an All Zeros pattern as the J1 trace pattern. • **Default (16 byte)**: Selects the Digital Lightwave ASCII message as the J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. • **User Defined (16 byte)**: Selects a user-defined ASCII message as the J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.
SS Bits Alarm Reporting	Disables or enables SS bits reporting. This function is used in conjunction with the Expected SS Bits function. If enabled, and an SS Bits mismatch is detected on the received signal, the duration in seconds will appear under the Results Scan function.

Expected SS Bits	Selects one of the following as the expected SS Bits value (bits 5 and 6 of the received H1 Pointer byte): • **00 (SONET)** • **01 (Undefined)** • **10 (SDH)** • **11 (Undefined)**
TC Error/Alarm Processing	Enables or disables Tandem Connection Monitoring (TCM) mode. This function is used in conjunction with the **Expected TC Trace** and **TIM Alarm Reporting** functions. The TC Summary LED turns red if a TCM error or alarm is reported. Select the TC Summary text for more details. • **Enable:** Turns on TCM error and alarm reporting mode. • **Disable:** Turns off TCM error and alarm reporting mode. (**Note:** Disable this option if you are not performing TCM testing. This will prevent false error and alarm reporting.)

Expected TC Trace	Defines the expected TC trace received on the inco9ming signal. For SONET, this is in the Z5 byte. For SDH, this is in the N1 byte. The following options are available: • **Default:** Selects a 16-byte Digital Lightwave ASCII message at the expected TC trace pattern. • **All Ones (16 byte):** Selects a 16-byte All Ones pattern as the TC trace pattern. • **All Zeros (16 byte):** Selects a 16-byte All Zeros pattern as the TC trace pattern. • **User Defined:** Selects a 16-byte user-defined ASCII message as the expected TC trace pattern. The message is entered and saved using a screen keypad.

STM-64 Receive Overhead Screens for SOH and POH

The STM-64 Receive Overhead screens contain the following functions.

Function	Options
Showing (SOH)	Selects a specific SOH slot within the STM-64 signal. The overhead bytes that appear on the OH screen are associated with this slot. There are 192 SOH slots available in an STM-64 signal.
AU-4-16c Dropped (POH)	Selects 1 to 4 as the specific STM-16 channel to monitor in the STM-64 signal.
RS Overhead (SOH)	Displays the Regenerator Section Overhead bytes for the selected SOH slot on the incoming STM-64 signal. This is a read-only function.
MS Overhead (SOH)	Displays the Multiplex Section Overhead bytes for the selected SOH

	slot on the incoming STM-64 signal. This is a read-only function.
HP Overhead (POH)	Displays the Higher-order Path Overhead for the selected SOH slot on the incoming STM-64 signal. This is a read-only function.
J0 Trace (SOH)	Displays the J0 trace received on the incoming STM-64 signal.
J1 (POH)	Displays the J1 trace received on the incoming STM-64 signal.
TC Trace (POH)	Displays the TC trace received on the incoming STM-64 signal.

STM-64 Receive Signal Status

Displays the following measurements of the incoming SDH signal:

- Received optical power in dBm
- Line Frequency in MHz for STM-64
- Frequency offset received in KHz and ppm
- Update Signal Calibration - Calibrating the system's optical power should be done carefully. To keep unauthorized users from changing calibration settings, the Update Signal Calibration button on the protocol processor's Receive SIG screen is unavailable by default. To change the setting, a user with Admin or Calibrate privileges must enable the calibration mode.

  To enable protocol processor calibration:

  1. From the **System** tab, select **Misc**.
  2. From **Local Settings**, select **Enable Calibration**.

  The user must have Admin or Calibrate privileges to enable the calibration mode.

  3. See Calibrate Optical Power for specific calibration instructions before proceeding.
  4. After setting the **Zero power reading**, -**20 dBm power reading**, and **-10 dBm power reading**, select the **Save** button to update the signal calibration.

Related Topics:

Line Frequency Offset

Results

STM-64 Results - Overview

All monitored activity that the system receives is eventually reported to the Results screen. This screen provides several layers of granularity for analyzing the incoming signal, pattern, errors, and alarms.

The STM-64 Results screen contains the following functions:

- Scan
- Err
- Alarm
- PTR
- Event
- APS
- Large LEDs
- Graphs

Results - Scan

This function displays a list of received errors and alarms. For **alarms**, the duration is reported as a count in seconds. For **errors**, an error count is reported.

The message **No Errors or Alarms** appears if no events are received by the system.

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

Results - Errors

The system can monitor and report errors on the incoming SDH signal. The **Errors** function provides a detailed analysis of the incoming error as described below.

The errors reported are a result of:

- Incoming errors that are generated by the SDH network, or
- Errors being intentionally generated by the system when it is used in a loopback environment

The following errors can be monitored:

- B1 (Regenerator Section BIP-8)
- B2 (Multiplex Section BIP-8)
- B3 (Higher-Order Path BIP-8)

- MS-REI (Multiplex Section Remote Error Indicator)
- HP-REI (Higher-Order Path Remote Error Indicator)
- BIT (BIT errors reported in the payload)
- NDF-P (Path New Data Flag counts)
- TC-IEC (Tandem Connection-Incoming Error Count)
- TC-REI (Tandem Connection-Remote Error Indicator)
- TC-OEI (Tandem Connection-Outgoing Error Indicator)

The following parameters are measured for these incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format
- Error-free seconds using an 8-digit format
- Errored seconds
- Severely Errored seconds
- Unavailable errored seconds

Results - Alarms

The system can monitor and report alarms and their duration on the incoming SDH signal. The **Alarms** function lists the duration of the alarm in seconds.

The following alarms can be monitored:

- Clock Sync
- LOS (Loss of Signal)
- LOF (Loss of Frame)
- OOF (Out of Frame)
- RS-TIM (Regenerator Section Trace Identifier Mismatch for the J0 byte)
- MS-AIS (Multiplex Section Alarm Indication Signal)
- MS-RDI (Multiplex Section Remote Defect Indicator)
- APS-L (Automatic Protection Switching)
- AU-AIS (Administrative Unit Alarm Indication Signal)
- AU-LOP (Administrative Unit Loss of Pointer)
- CONCAT (Concatenated)
- HP-UNEQ (Higher-Order Path Unequipped Payload)
- HP-RDI (Higher-Order Path Remote Defect Indicator)
- HP-TIM (Higher-Order Path Trace Identifier Mismatch for the J1 byte)
- HP-PLM (Higher-Order Path Payload Label Mismatch)
- Pattern Sync
- TC-RDI (Tandem Connection-Remote Defect Indicator)
- TC-ODI (Tandem Connection-Outgoing Defect Indicator)
- TC-AIS (Tandem Connection-Alarm Indication Signal)
- TC-UNEQ (Tandem Connection-Unequipped)
- TC-TIM (Tandem Connection-Trace Identifier Mismatch)

- TC-LOF (Tandem Connection-Loss of Frame)

Results - Pointer (PTR)

This function monitors and reports received Pointer statistics. A count of the following Pointer statistics appear:

- **Positive Justification:** Indicates the Positive Pointer Justification count.
- **Negative Justification:** Indicates the Negative Pointer Justification count.
- **Pointer Justification Seconds:** Indicates the duration of a Pointer adjustment.
- **NDF Count:** Indicates the New Data Flag count.
- **Rx Pointer Bytes (in HEX):** Valid Pointers range from 0x0 to 0x30e.
- **Rx Pointer Value (in decimal):** Valid Pointers range from 0 to 782.

Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending**/**Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the Use the Event Log section.

Results APS

The APS Results monitor incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 16 byte sequences can appear on the touch screen.

The following information appears in the APS report for the last 16 K1 and K2 byte sequences received:

- The HEX value of the K1 byte.
- The HEX value of the K2 byte.
- The number of frames received that contain the K1 and K2 bytes.
- The elapsed time of the frames that contain the K1 and K2 bytes.

Per GR-253-CORE, only the upper 12 bits of the K1/K2 bytes (K1 bits 1-8 and the K2 bits 1-4) are used for APS operation. K2 bit 5 sets the APS mode type (1+1, 1:1) and cannot be changed during operation. K2 bits 6-8 are for alarms. Any changes to the lower four bits of the K2 byte do not affect APS operation. The Results APS table only starts and displays a new entry item if the upper 12 K1/K2 bits stabilize on a new value for a minimum of three consecutive frames.

Results - Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with **black** text	The specific function is active and OK.
Red with **black** text	An error or alarm event is in progress.
White with **red** text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with **black** text	No activity from this specific function.

For a list of available LEDs in the STM-64 protocol processor, see STM-64 LEDs.

Results - Graph

This function allows incoming errors and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

For more information about graphs, select *Use Graphs* in the Common Tasks section of the online help.

Perf Monitor
STM-64 Performance Monitoring

Performance Monitoring provides greater detail about incoming Regenerator Section, Multiplex Section, and Higher-Order Path errors.

- RS
- MS
- HP
- BIT

Performance Monitoring RS

This provides a detailed breakdown for Regenerator Section errors detected and logged by the STM-64 protocol processor.

G.826 Near B1 Errors

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

Performance Monitoring MS

This provides a detailed breakdown for Multiplexor section errors detected and logged by the STM-64 protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the **G.826/G.829 toggle button** in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.829 results.

This section is broken down into the following areas:

IMPORTANT: Select the **G.826/G.829** button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.829 statistics. Toggling

the Near B2 Errors output also toggles the Far MS REI Errors output.

G.826 and G.829 Near B2 Errors and Far MS REI Errors

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure
- G.826/G.829: Select the command button to toggle between G.826 and G.829 error statistics.

M.2101.1 Near B2 Errors and Far MS REI Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

Performance Monitoring HP

The HP screen provides a detailed breakdown for Higher-Order Path errors detected and logged by the STM-64 protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the **G.826/G.828** toggle button in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.828 results.

This section is broken down into the following areas:

G.826 and G.828 Near B3 Errors and Far HP REI Errors

IMPORTANT: Select the **G.826/G.828** button in the lower-right corner of the

ITU Standards window to toggle between G.826 and G.828 statistics. Toggling the Near B3 Errors output also toggles the Far HP REI Errors output.

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure
- G.826/G.828: Select the command button to toggle between G.826 and G.828 error statistics.

M.2101.1 Near B3 Errors and Far HP REI Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

Performance Monitoring BIT

This provides a detailed breakdown for BIT errors detected and logged by the STM-64 protocol processor.

In addition to monitoring the errors, you can set allocation percentages and durations by selecting their respective buttons.

This section is broken down into the following areas:

G.821 BIT Errors

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.

- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.821 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

G.826 BIT Errors

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

M.2101.1 BIT Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

STM-64 LED Definitions

This section defines the SDH LEDs that appear on the touch screen's **LED area** and when the **Large LEDs** tab is selected.

LED	Definition
APS	Automated Protection Switching. Indicates that the K1 and K2 bytes on the incoming STM signal have changed. This is an alarm LED.
AU-AIS	Administrative Unit - Alarm Indication Signal. Indicates an all-ones characteristic or adapted information signal was detected on the AU. It is generated to replace the normal traffic signal when it contains a defect

	condition in order to prevent consequential downstream failures being declared or alarms being raised. This is an alarm LED.
AU-LOP	Administrative Unit - Loss of Pointer. Indicates that a consecutive number of invalid pointers or NDFs were received on the AU. This is an alarm LED.
B1	Regenerator Section BIP-8 Code Violation. Indicates parity errors occurred on one of the eight parity checks when evaluated by byte 1 of the SDH frame. This is an error LED.
B2	Multiplex Section BIP-8 Code Violation. Indicates that parity errors occurred on any of the parity checks when evaluated by the B2 byte of the SDH frame. This is an error LED.
B3	Higher-Order Path BIP-8 Code Violation. This is a parity code (even) used to determine if a transmission error has occurred over a path. Its value is calculated over all the bits of the previous virtual container before scrambling and placed in the B3 byte of the current frame. This is an error LED.
BIT ERR	BIT Error. Indicates a bit error was detected in the payload. This is an error LED.
CLK	Clock. Displays the type of transmit clock specified in the setting. Clock settings include: SETS, Bits, Internal, or RCVD. This is an alarm LED.
HP	Higher-Order Path OK. This is a status LED.
HP-RDI	Higher-Order Path - Remote Defect Indicator. Indicates a signal was returned to the transmitting HP Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect. This is an alarm LED.
HP-REI	Higher-Order Path - Remote Error

	Indication. Indicates to the transmitting node that an errored block has been detected at the HP receiving node. This is an error LED.
HP-UNEQ	Higher-Order Path - Unequipped. Indicates that an all-zeros patterns was detected in the C2 byte. This byte is received from the HP terminating equipment. This is an alarm LED.
LOF	Loss of Frame. Indicates that a frame alignment problem with the incoming signal has been detected. An LOF is reported if an Out of Frame (OOF) defect continues for three milliseconds or longer. This is an alarm LED.
LOS	Loss of Signal. Indicates that a valid STM-4 signal is not being received. If an all-zeros pattern exists for 100 milliseconds or longer on the incoming STM signal, then an LOS is reported. This is an alarm LED.
MS-AIS	Multiplex Section - Alarm Indication Signal. Indicates an all-ones characteristic or adapted information signal was detected on the MS. It is generated to replace the normal traffic signal when it contains a defect condition in order to prevent consequential downstream failures being declared or alarms being raised. This is an alarm LED.
MS	Multiplex Section Overhead OK. This is a status LED.
MS-RDI	Multiplex Section - Remote Defect Indicator. Indicates a signal returned to the transmitting MS Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect. This is an alarm LED.
MS-REI	Multiplex Section - Remote Error Indication. An indication returned to a transmitting node that an errored block has been detected at the MS receiving

	node. This is an error LED.
OOF	Out of Frame. Indicates that four consecutive frames have been received with invalid or errored framing patterns. This is an alarm LED.
PAT SYNC	Indicates a loss of pattern synchronization. This is an alarm LED.
PTR	Administrative Unit - Pointer Adjustment. Indicates that there was pointer movement occurring on the AU. This LED flashes red during a Pointer Adjustment event. It is an event LED.
RS	Regenerator Section Overhead OK. This is a status LED.
RX	Displays the received optical power in dBm. For STM-64, the optimum input range is from -2 dBm to -14 dBm. A value of -25 dBm or below indicates no signal. This is a status LED.
TC SUMMARY	Tandem Connection Summary. Indicates if a TCM error or alarm has been detected. If this LED is red, select the LED text (**TC Summary**) to display the TC LEDs.
TC-AIS Select the text, "**TC Summary**" to display the TC LEDs	Tandem Connection-Alarm Indication Signal. Indicates if IEC bits 1110 are being received from upstream TCM equipment. (Bits 1-4 of the N1 byte are the IEC bits.) This is an alarm LED.
TC-IEC Select the text, "**TC Summary**" to display the TC LEDs	Tandem Connection-Incoming Error Count. Indicates a B3 error count is being received from downstream TCM equipment. Bits 1-4 of the N1 byte are used for this indicator. This is an error LED.
TC-LOF Select the text, "**TC Summary**" to display the TC LEDs	Tandem Connection-Loss of Frame. Indicates the loss of a valid multiframe frame alignment signal (FAS) pattern from upstream TCM equipment. This is an alarm LED.
TC-ODI	Tandem Connection-Outgoing Defect Indicator. Indicates that the unit is

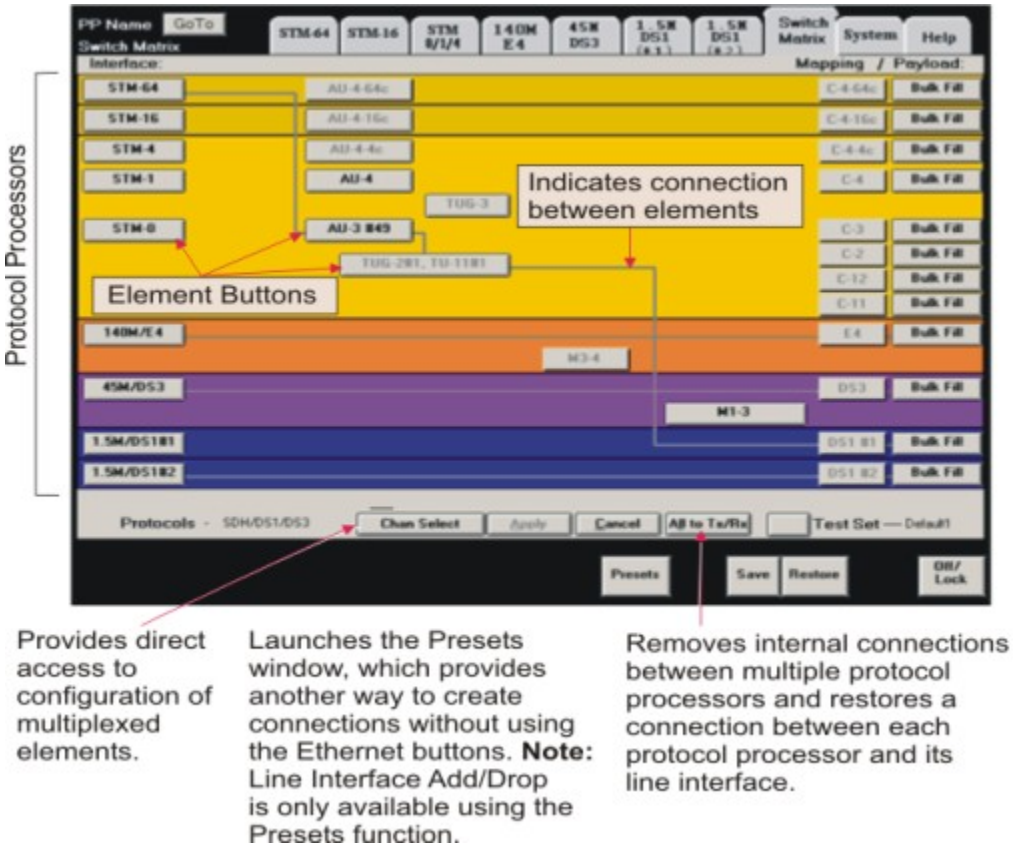
Select the text, "**TC Summary**" to display the TC LEDs	sending an ODI alarm to upstream TCM equipment. Bit 7 in multiframe 74 of the N1 byte is used for this indicator. This is an alarm LED.
TC-OEI Select the text, "**TC Summary**" to display the TC LEDs	Tandem Connection-Outgoing Error Indication. Indicates that the unit is sending an OEI error to upstream TCM equipment. Bit 6 of the N1 byte is used for this indicator. This is an error LED.
TC-RDI Select the text, "**TC Summary**" to display the TC LEDs	Tandem Connection-Remote Defect Indication. Indicates that a defect has occurred at the downstream TCM equipment. The unit is receiving an alarm. Bit 8 in multiframe 73 of the N1 byte is used for this indicator. This is an alarm LED.
TC-REI Select the text, "**TC Summary**" to display the TC LEDs	Tandem Connection-Remote Error Indication. Indicates that an error has occurred at the downstream TCM equipment. The unit is receiving an error. Bit 5 of the N1 byte is used for this indicator. This is an error LED.
TC-UNEQ Select the text, "**TC Summary**" to display the TC LEDs	Tandem Connection-Unequipped. Indicates that a 00h pattern has been detected in the N1 byte of a Tandem Connection. This is an alarm LED.

Switch Matrix Tab

Switch Matrix

The Switch Matrix allows you to display and define a protocol processor's multiplexing structure from a single screen. This fast and convenient configuration method lets you select a protocol processor interface, route the signal through available mappings, drop the signal to other protocol processors, and select a payload to use within the signal. (See Switch Matrix Guidelines below.)

The following is an example of the Switch Matrix in SDH mode.



Switch Matrix Guidelines

When using the Switch Matrix:

- ALWAYS start from left to right by first selecting an **Interface** button.
- NEXT, after selecting an interface, its available Container, Mapping, and Payload buttons are enabled to help you create a valid signal configuration.

- LAST, after making the connections between elements, select the **Apply** button for the new configuration and connections to take affect.

Using the Switch Matrix

The **Switch Matrix** is a graphical display of the unit's current interface and mapping connections. It allows you to configure the unit from a single screen using the following methods:

- Switch Matrix components
- Presets button

To configure the unit using the Switch Matrix components:

1. Select the **Switch Matrix** tab.
2. Starting from the left, select an **Interface** button. After selecting an interface, the appropriate Mapping, Container, and Payload buttons are enabled on the Switch Matrix. This will help you create a valid configuration.
3. From the **Mapping** and **Payload** columns, select the desired, and available, Mapping and Payload buttons.
4. Select **Apply**. The unit applies the new configuration. Signal lines appear to illustrate the new data flow.

To disengage the configured protocol connections:

- Select **All to Tx/Rx**. This globally disconnects any internal connections between multiple protocol processors. A protocol processor will now expect to receive a signal using its line interface.

To configure the unit using the Presets button:

1. Select the **Switch Matrix** tab.
2. Select the **Presets** button located below the Switch Matrix. The Presets window appears.
3. Select the **Interface** button and choose an interface as a starting point.
4. Select the **Configuration** button and choose a protocol to connect to the selected interface. If necessary, select the Configuration button again to create additional connections.
5. Select the **Apply** button. The unit takes a few moments to apply the new protocol connections. When complete, the mappings and configurations associated with the selected Preset are automatically made. Signal lines appear to illustrate the new data flow.

   For more information, see Presets.