User Manual

Tektronix

# OTS
# Optical Test System
# 10 Gb/s SONET/SDH test module

071-0855-05

Tektronix, Inc.
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USA

# Warranty

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

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# General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any equipment connected to it.

To avoid potential hazards, use this product only as specified.

*Only qualified personnel should perform service procedures.*

While using this product, you may need to access other parts of the system. Read the *General Safety Summary* in other system manuals for warnings and cautions related to operating the system.

## How to Avoid Fire or Personal Injury

**Use Proper Power Cord.** To avoid fire hazard, use only the power cord specified for this product.

**Use Proper Power Source.** Do not operate this product from a power source that applies more than the voltage specified.

**Connect and Disconnect Properly.** Do not connect or disconnect test leads while they are connected to a voltage source.

**Avoid Electric Overload.** To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.

**Ground the Product.** This product 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 product, ensure that the product is properly grounded.

**Observe All Terminal Ratings.** To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

The common terminal is at ground potential. Do not connect the common terminal to elevated voltages.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

**Use Proper AC Adapter.** Use only the AC adapter specified for this product.

**Do Not Look into the End of a Fibreglass Cable.** Never look into the end of a fibreglass cable or a single fibre which could be connected to a laser source. Laser radiation can damage your eyes because it is invisible and your pupils do not contract instinctively as with normal bright light. If you think your eyes have been exposed to laser radiation, you should have your eyes checked immediately by an eye doctor. The optical output's radiation power corresponds to the laser class in accordance with IEC 825-1, 11.93.

**Use Proper Fuse.** To avoid fire hazard, use only the fuse type and rating specified for this product.

**Avoid Exposed Circuitry.** Do not touch exposed connections and components when power is present.

**Do Not Operate With Suspected Failures.** If you suspect there is damage to this product, have it inspected by qualified service personnel.

**Do not operate in Wet/Damp Conditions.** To avoid electric shock, do not operate this product in wet or damp conditions.

**Do Not Operate in Explosive Atmosphere.** To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

**Wear Eye Protection.** To avoid eye injury, wear eye protections if there is a possibility of exposure to high-intensity rays.

**Keep Product Surfaces Clean and Dry.**

**Provide Proper Ventilation.** Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

# Safety Terms and Symbols

## Terms in this Manual

These terms may appear in this manual:

| Icon | Label | Meaning |
|---|---|---|
| ⚠ | **WARNING!** | Warning statements identify conditions or practices that could result in injury or loss of life. |
| ⚠ | **CAUTION!** | Caution statements identify conditions or practices that could result in damage to this product or other property. |

## Terms on the Product

These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

## Symbols on the Product

The following symbols may appear on the product:


CAUTION
Laser Radiation

Protective Ground
(Earth) Terminal

ATTENTION
Refer to Manual

Electrostatically
hazardous

# Preface

This manual describes how to use the Tektronix OTS9100 module. This manual is your primary source of information about how the OTS9100 module functions.

The user interface also provides Windows Help files for further information on specific topics.

## How This Manual is Organized

This manual is divided into four sections: *Getting Started*, *Operating Basics*, *Reference*, and *Appendices*.

- *Getting Started* provides an overview of the OTS9100 module and describes first-time operation.
- *Operating Basics* explains the basic principles of operating the OTS9100. The Operating Basics section also includes sample applications.
- *Reference* provides a brief overview of the syntax and format used for remote commands and provides explanations and listings of all the remote commands that may be used with the OTS9100 system.
- The *Appendices* provide a listing of specifications, default factory settings, an incoming inspection test, list of acronyms, and other useful information.

## Conventions

This manual uses the following conventions:

- The names of front-panel connectors and LEDs appear in the manual in the same format as found on the front panel label, for example, OPTICAL IN and Rx DATA OUT.
- When the user interface is discussed, all menus, names tags, and button appear in the manual in the same format as found in the user interface, for example, Enable COM2 and Output Pulse Trigger.
- In reference to terminology, the user interface may be set to either SDH or SONET references. The user manual provides SDH terminology with SONET terminology in parenthesis immediately following the SDH version. If no second terminology is present, the terminology is the same for both SDH and SONET.
- In reference to the instrument, the following conventions apply:
  - When referring to the four card 10Gb/s system (Optics, Transmit, Receive, and Clock), the name OTS9100 is used.
  - When referring to each individual card, the card name is used, for example, Optics and Transmit.

***NOTE:*** *Some of the content found in this manual does not pertain to some instruments. Depending on the software revision and the options installed, some of the features described in these pages may not be available.*

# Getting Started

This chapter describes the preparation and initial setup of the **OTS9100 module.** Also provided is a list of standard and optional accessories for each of the individual cards.

## Product Description

The Optical Test System OTS9100 Module set consists of a 10 Gb/s SONET/SDH transmitter and receiver. The transmitter consists of a high-speed OC-192c/STM-64c SONET/SDH digital signal generator feeding a 10 Gb/s fiber-coupled laser and modulator. It is capable of generating fixed and pseudo-random test patterns mapped into a set of sub-rate payloads or one full payload rate. The transmitter may also retransmit received 10 Gb/s signals with or without alarm and error insertion via intrusive through mode capabilities. Both transmitter and receiver support Unframed Mode. The transmitter supports flexible generation of alarms and errors at SONET and SDH levels (SONET Section, Line and Path; SDH Regenerator Section, Multiplex Section and Path).

The receiver consists of a high-speed 10 Gb/s (9.9532 Gb/s) optical receiver feeding an OC-192c/STM-64c digital signal analyzer. The receiver supports both SONET and SDH (SONET Section, Line and Path; SDH Regenerator Section, Multiplex Section and Path) alarm and error detection and accumulation for subsequent software analysis with the ability to print out reports.

The standard OTS9100 module consists of one each of an OTS91L4, OTS91R2, OTS91T3 and OTS91C3 card. A mixed suite of optical cards provides the OTS9100 module with flexibility to test for different optical requirements.

The OTS91L4 Transceiver card is the standard optical card for this module. The OTS9100 module will accept any of the OTS optical cards as a replacement for the OTS91L4, expanding the range of the system to support different types of test analysis. The only requirement is that the optics card be placed in the first slot position within the OTS9100 module.

Optical card offerings consist of the following:

OTS91L4 Transceiver with 1550 nm or 1310 nm laser option

OTS91L5 Transmitter with 1550 nm or 1310 nm laser option

OTS91L6 Receiver Only

OTS91L7 Transceiver with External Laser Interface (does not include an internal laser)

OTS91L8 Transmit Only with External Laser Interface (does not include an internal laser)

# OTS9100 Features and Capabilities:

- OC-192 SONET Section, Line, and Path Testing
  B1, B2, B3, REI-L, REI-P and random bit Error Generation
  B1, B2, B3, REI-L, REI-P Error Measurement
  Section, Line, and Path Alarm Generation
  J0, J1 byte and sequence Capture; J0, J1 Edit
  Section, Line, and Path Alarm Detection
  Section, Line, and Path Alarm and Error Generation
  STS1, STS3c, STS12c, STS48c, STS192c structured payloads filled with user-selected test pattern

- STM-64 SDH Regenerator Section and Multiplex Section Testing
  B1, B2, B3, MS-REI, HP-REI, and random bit Error Generation
  B1, B2, B3, MS-REI, HP-REI Error Measurement
  RS, MS, and Path Alarm Generation
  J0, J1 byte and sequence Capture; J0, J1 Edit
  RS, MS, and Path Alarm Detection
  RS, MS, and Path Layer Alarm Error Generation
  VC-3, VC-4-4c, VC-4-16c, VC-4-64c structured payloads filled with user-selected test pattern

- Multi-channel capability in a single mainframe
- Available in Transceiver, Receive Only, and Transmit Only configurations
- Electrical Offset of Receiver Decision Threshold
- Windows 2000 compatible user interface
- Easily switched between SONET and SDH modes
- Through Mode with Overhead Editing, Error, and Alarm Injection
- Direct user download of software updates
- GR-253-CORE and CCITT/ITU G.708, G.709 framing
- Complete Remote Control via RS-232, GPIB, and Ethernet LAN (10BaseT) ports and scripting available with the implementation of the OTS Toolkit
- Interface to STE, LTE and other test equipment
- High Output Power 1310 nm or 1550 nm Laser Allows Support for Multiple Receivers via an Optical Splitter
- G.828/G.829 B1, B2 and B3 Error Analysis
- SONET (OC-192c) and SDH (STM-64c) Format Signals Supported in a Single Module
- Interchangeable Between the Rackmount, Benchtop and Portable Chassis
- Report Printout Capabilities

The OTS9100 meets the needs of development, manufacturing, and service engineers by providing the capabilities for:

- System interrogation and conformance testing
- System Qualification
- Manufacturing Production Testing
- Manufacturing Test of SONET/SDH and DWDM Network equipment
- Network Integrity testing
- Network Performance monitoring
- Network Troubleshooting
- Design Verification
- DWDM Parallel Channel System Test
- Module Test
- Equipment Performance Monitoring
- In-service Monitoring

# Accessories

Accessories included with the **OTS9100 module** are provided in the following list. If you wish to purchase optional accessories contact your local Tektronix Representative.

## Standard with each shipment

| | |
|---|---|
| | Certificate of Traceable Calibration |
| 119-6364-11 | OTS9000 Software CD |
| 063-3560-03 | OTS9100 User Manual CD |
| 071-1060-03 | OTS9100 Installation Guide |

***NOTE:*** *DC Blocks are provided for use in two instances only. The first being, one DC Block must always be connected to the OTS91R2 Receive Card at the Rx interface port in all OTS9100 modules (see Figure 1-3 for cabling illustration).*

*The second is in regard to use with the Transmit interconnection when using earlier versions of the optics cards; the OTS91L1, OTS91L2 and the OTS91L3, the earlier optics cards will require that a DC Block be connected to the Tx DATA OUT interface port.*

*DO NOT ATTACH A DC BLOCK TO THE OTS91T3 WHEN USING OTS91L4, OTS91L5, OTS91L6, OTS91L7 OR OTS91L8, DEGRADATION WILL OCCUR.*

Each of the optical cards requires a specific set of accessories. Additional items are listed by each card type below.

## OTS91L4 Standard

| | |
|---|---|
| 174-4702-00 | 6” coax cable (one included with shipment) |
| 174-4277-01 | 8” coax cable (one included with shipment) |

## OTS91L5 Standard

| | |
|---|---|
| 174-4702-00 | 6” coax cable (one included with shipment) |

## OTS91L6 Standard

| | |
|---|---|
| 174-4702-00 | 6” coax cable (one included with shipment) |
| 174-4277-01 | 8” coax cable (one included with shipment) |

## OTS91L7 Standard

| | |
|---|---|
| 174-4702-00 | 6” coax cable (two included with shipment) |
| 174-4277-01 | 8” coax cable (one included with shipment) |

## OTS91L8 Standard

| | |
|---|---|
| 174-4702-00 | 6” coax cable (one included with shipment) |

***Note:*** *Optical connectors require customer supplied cabling.*

## OTS91R2 Standard

| | |
|---|---|
| 174-4275-01 | 4” coax cable (one included with shipment) |
| 119-6156-00 | DC Block |

## OTS91T3 Standard

| | |
|---|---|
| 174-4275-01 | 4” coax cable (one included with shipment) |
| 174-4275-01 | 6” coax cable (one included with shipment) |
| 119-6156-00 | DC Block |

## OTS91C3 Standard

| | |
|---|---|
| 174-4275-01 | 4” coax cable (one included with shipment) |

## Optional

Interface Cables, RS-232-C, GPIB:

| | |
|---|---|
| **RS-232-C** | |
| 012-1379-00 | 9-pin female to 9-pin male |
| 012-1298-00 | 9-pin female to 25-pin male |
| **GPIB** | |
| 012-0991-00 | 2m, double-shielded |
| 012-0991-01 | 1m, double-shielded |

***NOTE:*** *The GPIB cable is standard equipment with an OTS9010 mainframe.*

Adapters, SMA:

| | |
|---|---|
| 015-0572-00 | SMA male to BNC male |
| 015-0554-00 | SMA male to BNC female |
| 015-0549-00 | Male to female connector (Used permanently installed to prolong life of instrument connector) |
| 020-1693-00 | SMA Kit |

Miscellaneous:

| | |
|---|---|
| 119-5610-00 | Fixed 15 dB optical attenuator; FC/PC connector |
| 119-5970-00 | Fixed 15dB optical attenuator, SC/PC connector |
| 119-5972-00 | Fixed 15dB optical attenuator, ST/PC connector |

## International Power Plug Options (Chassis Only)

| **Option #** | **Description** |
|---|---|
| A1 | 220V, Euro Plug |
| A2 | 240V, UK Plug |
| A3 | 240V, Aust Plug |
| A4 | 240V, North American Plug |
| A5 | 220V, Swiss Plug |
| A99 | No power cord |

# First Operation

## OTS9100 Installation

Before using the system, verify that it is properly set up and powered on, as follows:

1. Remove the unit from its shipping carton and place it on an anti-static surface.
2. Verify that the operating environment is within the limits detailed under the Environmental Requirement section in this manual.
3. Allow approximately 2 inches (5 cm) clearance for cooling at the front and rear of the unit. The fans draw air into the system from the front and exhaust the air through the rear of the OTS9000 chassis system or through the sides of the OTS9010 and OTS9040 chassis systems.
4. If the module cards are not already installed, perform the following steps:

***CAUTION!*** *When installing and removing cards from the chassis, power must not be present. Ensure that all power switches are in the OFF position and power cords are not installed before removing or installing cards.* ***The chassis does NOT support hot-swap installations.***

A. Remove the cards from the packaging, if necessary.

***CAUTION!*** *All OTS cards are static sensitive. When handling cards, ensure that personnel are properly grounded and OTS cards are always placed on anti-static surfaces. If proper precautions are not taken, damage will occur.*

B. For those locations in which cards are being installed, remove the blanking panels and air diverters.

C. Verify the required configuration of cards before proceeding. Carefully install each card into a slot in the chassis. Make sure that the card is lined up and fits cleanly with the connectors into the backplane of the chassis.

***CAUTION!*** *Beware of bending the pins of the connectors when installing and removing cards from the chassis. Backplane connectors with bent pins will cause damage to both the card and the chassis.*

To install the card, slowly slide the card into the desired slot. Make sure the card is lined up with the connectors and push down on the top release and up on the bottom release until the card snaps into place.

When the card is in place, tighten the two screws to secure it.

***CAUTION!*** *Do not torque the screws with more than 2 in-lbs of force or damage will occur.*

5. Verify that the power switch of the OTS chassis is in the OFF position.
6. Plug the unit into the appropriate AC Power source as follows:

**Table 1-4: Power Requirements**

| AC Voltage | Voltage Range | Frequency Range |
|---|---|---|
| 110 VAC | 90 VAC - 132 VAC | 48 - 62 Hz |
| 220 VAC | 180 VAC - 250 VAC | 48 - 62 Hz |

## Removing Cards

To remove the OTS cards, perform the following steps:

1. Turn off the power.
2. Fully loosen the two screws found on the top and bottom of the card.
3. Push up on the top release and down on the bottom release until the card is released from the connectors.
4. Carefully slide the card out of the slot.

***NOTE:*** *If a card is removed, a blanking panel and air diverter must be installed to ensure proper airflow through the system. Failure to replace the air diverter and blanking panel could cause the system to overheat.*

## Slot Positioning of OTS Cards

The slot in which each card is installed is very important to the proper operation of the instrument. Because of the user interface configurations, certain cards must be in specific slot positions in order to take advantage of features to operate correctly.

The OTS9100 module consists of a grouping of four cards. For every OTS9100 module group, the Optics card *must be* in the leftmost card or slot 1 (Does not apply to a multi-channel system). The Optics card must be followed by the Receive card in the second position, the Transmit card must be in the third position and the Clock Trigger card must always be in the right-most position or fourth position within the four card module grouping.

### Multiple Modules

A module group may span the CPU in a multi-module system if necessary. The sequence of cards should continue from one side of the CPU slot(s) onto the other side. The CPU card(s) may interrupt the sequence physically but does not end the module group. Slot positioning with the CPU interrupting a sequence of cards will not affect the functionality of the OTS cards on either side of the CPU slot position(s). Empty slots, or slots containing non-Tektronix cards; effectively 'end' the module group.

When an OTS9100 10 Gb/s module and an OTS9200 Jitter module are loaded within the same chassis the slot positioning must start with the OTS9100 optical card positioned in the first position with the rest of the OTS9100 module loading sequentially as described above, the OTS9200 module must be adjacent to the OTS9100.

Through Mode operation is only supported when the module has been loaded into slots 1-4 of the chassis and only when the modules are installed in the following order:

- Optics card is in slot 1
- Receive card is in slot 2
- Transmit card is in slot 3
- Clock Trigger card is in slot 4

If cards are not installed in this order, "through mode" is not allowed as a Tx Signal Source.

***NOTE:*** *If the slot positioning rules are not followed, the module functions will be invalid. The transmitter and receiver functionality depends upon the absolute slot position and relative order of the cards.*

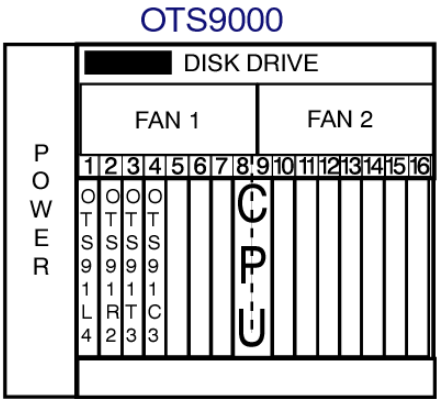



Figure 1-1: OTS9000 with card slot assignment

The slot assignments shown in Figure 1-1 show an OTS9100 module loaded into an OTS9000 chassis to support through mode.

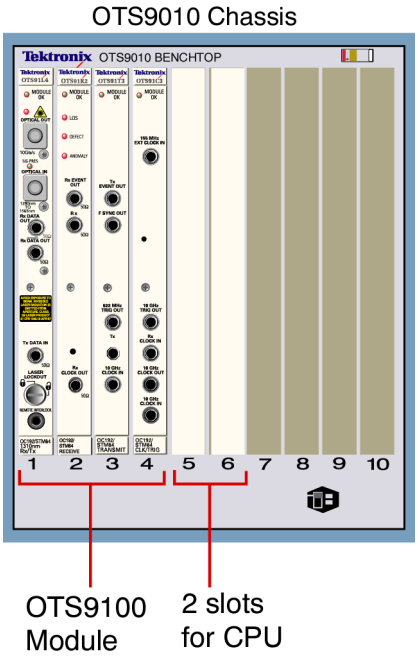



Figure 1-2: OTS9040 with OTS9100 installation

The slot assignments shown in Figure 1-2 show an OTS9100 module loaded into an OTS9040 chassis.

## Module Card Interconnection

Before powering on the system, install the cables and DC blocks provided for signal interconnection of the module cards. Use Figure 1-3 as a reference guide. (See Appendix G for cabling an OTS9100 module with a tunable laser).

***NOTE:*** *Depending upon the configuration of the OTS cards within the OTS-9000, some of these connections may not need to be made. If multiple cards are present within the system, the 8" cables provided may be required in place of the 4" cables.*

1. Attach a 4 or 6" coax cable from the Rx DATA OUT port of the Optical card. Connect the other end of the cable to the Rx DATA IN port DC block located on the Receive card. The Optical card is now connected to the Receive card.
2. Attach a 4 or 6" coax cable to the Tx DATA IN port of the Optics card. Connect the other end of the 4 or 6" coax cable from the Tx DATA IN port to the Tx DATA OUT (Tx) port of the Transmit card. The Optical card is now connected to the Transmit card.
3. For through mode only: Attach a 4 or 6" coax cable to the Rx CLOCK OUT port of the Receive card. Connect the other end of the cable to the Rx CLOCK IN port of the Clock Trigger card. The Receive card is now connected to the Clock Trigger card.
4. Attach a 4" coax cable to the 10GHz Clock In port of the Transmit card to the 10GHz Clock Out port of the Clock Trig card. The Transmit card is now connected to the Clock Trig card.

***NOTE:*** *To install peripherals (mouse, monitor, keyboard), refer to the chassis manual.*

***CAUTION!*** *Before moving previously installed cables, loosen the connections on both ends of the cable. If one end of a cable is moved and the other end is not loosened, damage to the cable will occur.*

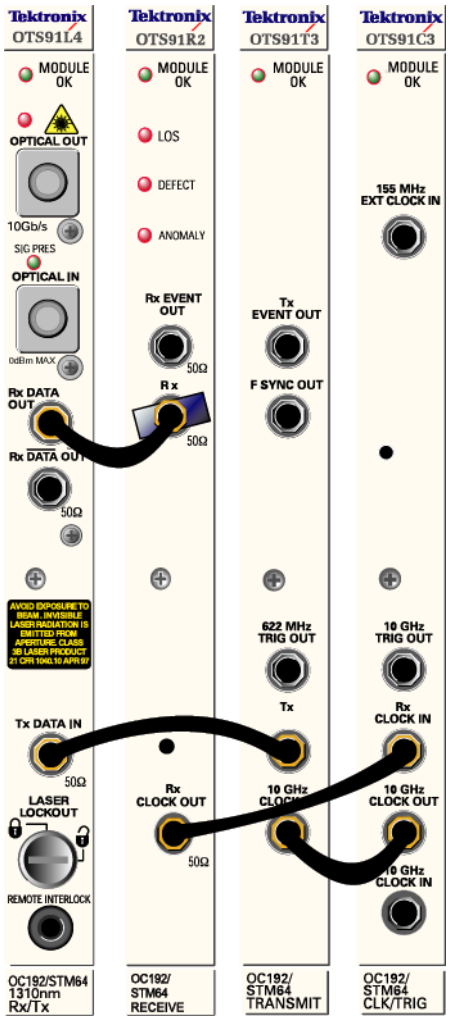



Figure 1-3: Proper location Interconnection cables

## Power On and Software Initialization

1. Set the Power Switch, on the back of the chassis, to the ON position. Turn on the display monitor. Wait for Windows to boot and present the login prompt.
2. The first time the system is turned on, a Microsoft Licensing Wizard will run, follow the prompts and enter the Windows 2000 License Key number, operator name, password and network identifier. The License Key number is located on a label affixed to the OTS chassis. This utility will run only for this initial one time system launch.
3. To logon, press CNTL-ALT+DEL.
4. The logon information dialog box is now displayed. Verify that the user name is 'Administrator' and there is no password then click OK.
5. To launch the system application, click the OTS9000 icon on the desktop.

***NOTE:*** *The OTS9000 application may also be reached through the START menu. Click START, select Tektronix, then select OTS9000.*

## Module Quick Check

***NOTE:*** *Before installing the optical cables, clean the optical fiber connectors on both the cable ends and the front panel connectors.*

1. With proper in-line 15dB attenuator, connect a single mode optical cable between the Optical OUT and Optical IN connectors on the Optics card.

***CAUTION!*** *Signal levels greater than 0 dBm may damage the Optical Input devices. Always pad the input level to less than 0 dBm.*

*Always use 15dBm of attenuation when connecting the OTS9100 module transmit output to its receive input. Failure to do so will damage the optical detector.*

2. If the instrument is not already powered on, start the system as described in the *Power On and Software Initialization* procedure of the previous section.
3. From the Menu Bar, click the System button; this opens a drop down menu. In the drop down menu select Signal Standard then select Set to SONET.
4. **Transmitter Setup**
   From the Menu Bar, click on View and select System View. The System View should display an image with each card in position. Check this view to ensure that all the cards loaded are visible. Blue lines spanning across the cards represent the correct cabling for the configuration of cards loaded in the system. The System View window is meant to be used as a reference for verifying cards and cabling a system. It does not provide a means to determine live or dead cards.
5. Click the Setup Category bar in the Navigation window and select the OTS91T3 10Gb/s Tx+ #1 icon. The Setup Property Page associated with the selected icon should display.
6. In the Property Page window, select the Signal tab and make the following selections from the pull-down menus:
   - Signal Source: Internal
   - Timing Source: Internal
   - Trigger Output: Anomaly
   - Active Channel, Signal Structure: STS-1
   - Active Channel, Test Pattern: PRBS 2^23-1 (ITU)
   - Active Channel, 1
7. Select the Error Insertion tab and make the following selections:
   - Anomaly Insertion Setup Type: None
   - Defect Insertion Setup Type: None
8. **Receiver Setup**
   In the Navigation window, keeping the Setup Category as the active category (always check the Title Bar of the Setup Menu to ensure that it is associated with the correct device), select the OTS91R2 10Gb/s Rx+ #1 icon and set the Receiver Threshold Offset level to 0 mV.
9. In the Navigation window, click on the Test Control Category bar and select the OTS91R2 10Gb/s Rx+ #1 icon.
10. Click the Edit Test Control Settings.

11. Click the radio button for Continuous test mode and then click OK to close the dialog box.
12. Use the key provided to disable the laser lockout at the front of the Optical card.
13. On the Laser Control bar, select the OTS91T3 10Gb/s Tx+ #1 laser and click On. On the Optics module card front panel, verify the following:
    - the Optical Out LED lights green
    - the Sig Pres LED under Optical IN lights green
14. On the Test Control bar, click the start button to begin a test.
15. On the front panel of the Receive module card, verify that the LOS, DEFECT, and ANOMALY LEDs are all off.
16. Verify that the Status window has no lit error indicators except the green Signal Present indicator.
17. In the Navigation window, click the Setup bar and select the OTS91T3 10Gb/s Tx+ #1 icon.
18. Select the Error Insertion tab.
19. Under Anomaly Insertion Setup, click the pull-down menu for Type and select B1 BIP.
20. Click Apply Anomaly Setup Changes.
21. Click Insert Single three times to insert three single errors. Verify that the Anomaly LED on the Receive front panel flashes for each B1 injected. In the Status window, the red B1 indicator should flash for each B1 injected and the yellow B1 indicator should remain lit.
22. In the Navigation window, click Measurements and select the OTS91T3 10Gb/s Rx+ #1 icon.
23. Click on the Cumulative tab.
24. Verify that the B1 line has data entered.
25. On the Test Control bar, click the Stop Test button.
26. On the Laser Control bar, select the OTS91T3 10Gb/s Tx+ #1 laser and click Off.
27. Use the key provided to enable the laser lockout.

## Emergency Startup Disk

Instructions for creating an emergency startup disk can be found in Appendix D. It is recommended that you take the time to do this simple procedure every time you change your system configuration.

## Shutdown and Power Off

If necessary, it is considered safe to shut off power without prior shutdown steps. However, it is strongly suggested that a more orderly shutdown be followed. To perform an orderly shutdown, use the following steps:

1. Close the OTS9000 application by selecting Exit under the System menu.
2. From the Start button on the Windows 2000 Taskbar, choose Shut Down.
3. On the Shutdown dialog box, choose Shut down the computer and click Yes.
4. When the Windows 2000 message 'It is now safe to turn off your computer' appears, turn off power.

# Module Operating Basics

This section describes the **OTS9100 module** front panel indicators and connectors.

## Front Panel Indicators and Connectors

Figure 2-1 shows a complete view of the front panel.

***WARNING:*** *Always avoid exposure to the laser beam. Before power is applied to the OTS9100 module be sure that all laser outputs are either covered with the screw cap provided or connected to the appropriate circuit.*

The front panel is made up of four different cards:

- Optics
- Transmit
- Receive
- Clock Trigger

The following sections describe each of these cards in more detail.

***NOTE:*** *There are several versions of the optical card available. Each OTS91Lx series card has been designed with targeted analysis capabilities directed at specific analysis needs. For additional information on each OTS91Lx series card see Appendix A.*

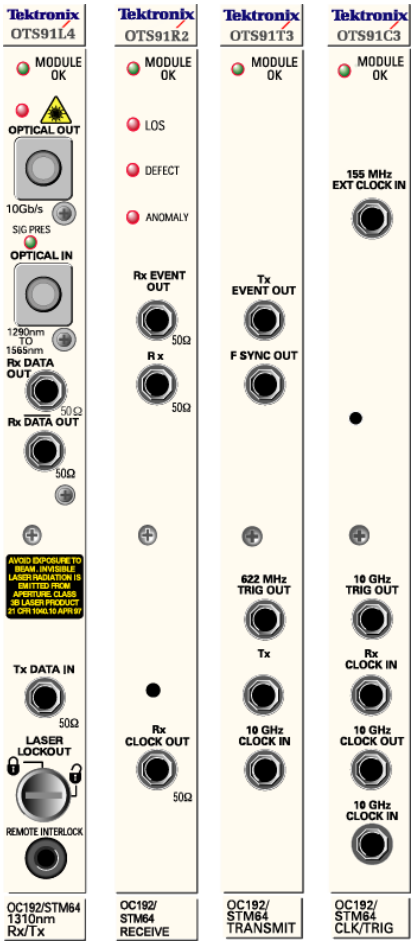



**Figure 2-1: OTS9100 Front Panel**

# 10Gb/s Transceiver Optics

The 10Gb/s Transceiver is available with two laser options, 1310 nm and 1550 nm. The 1310 nm Optical Transceiver consists of a 1310 nm Transmitter combined with a broad band Receiver. The 1550 nm Optical Transceiver consists of a 1550 nm Transmitter combined with a broad band Receiver

Figure 2-2 shows the Transceive card with 1310 nm laser front panel.

The front panel of the Transceiver card has optical inputs and outputs, a laser lockout feature, and LED monitoring lights. Each of these items is described in more detail below.

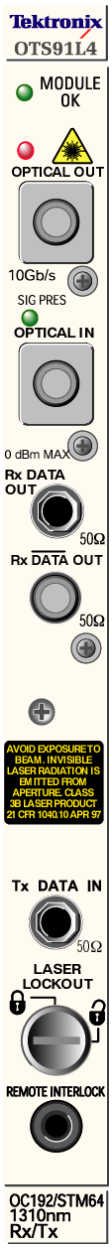



**Figure 2-2: 1310 nm Transceiver Front Panel**

## Module OK

The Module OK LED should be green while the instrument is running. On power up, the LED first lights red, then will switch to green when the system has finished initializing.

***NOTE:*** *If the LED remains red after the system has finished initializing, call Tektronix for service.*

The **Optics Transceiver card** of the OTS9100 module provides all of the optical interfaces of the 10Gb/s SDH/SONET module.

Figure 2-2 shows the Optic Transceiver card front panel.

***WARNING:*** *Always avoid exposure to the laser beam. Before power is applied to the OTS9100 module be sure that all laser outputs are either covered with the screw cap provided or connected to the appropriate circuit. Keeping a laser output covered prevents dirt from contaminating the connector.*

## Optical OUT

The Optical Output transmits an optical data signal at a wavelength of 1310 nm or 1550 nm, with the proper installed option. The optical connector can be configured with field interchangeable shells: FC (standard), ST, or SC type. The field interchangeable shells are easily removed to allow cleaning of the optical connector interface.

The LED found under Optical OUT will light to green when the laser is active.

***NOTE:*** *If the LED lights red or fails to light at all, call Tektronix for service.*

## Optical IN

The Optical IN connection accepts the incoming optical signal to the receiver. This input signal must have a wavelength between 1290 nm and 1565 nm and must not exceed –0 dBm of power.

The green LED labeled SIG PRES under the Optical IN heading will light when the Optics card detects an incoming signal. Red flashing indicates an optical loss condition. An amber flashing LED indicates an optical overload condition.

***WARNING:*** *The incoming signal must be attenuated to within specified power levels. If the signal exceeds –0 dBm, damage may occur.*

## Rx DATA OUT

Rx DATA OUT provides signal interconnection between the module cards. This output must be connected to the Rx DATA IN connection found on the Receive card of the OTS9100 module using the coax cable and DC block provided.

## $\overline{\text{Rx DATA OUT}}$

$\overline{\text{Rx DATA OUT}}$ is a 10 Gb/s DATA Signal provided for jitter measurements. This signal must be connected to the 10 Gb/s DATA IN connector of the OTS92H1 Clock Receive card.

## Tx Data IN

Tx Data Input provides signal interconnection between the module cards. This input must be connected to the Tx Data Out connection found on the Transmit card of the OTS9100 module using the coax cable provided.

***WARNING:*** *Always avoid exposure to the laser beam. Before power is applied to the OTS9100 module be sure that all laser outputs are either covered with the screw cap provided or connected to the appropriate circuit.*

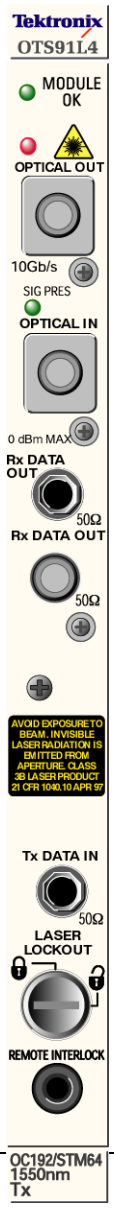



**Figure 2-3: 1550 nm Transceiver Front Panel**

## Laser Lockout, Remote Interlock

REMOTE INTERLOCK is a bantam plug normally closed connection internally wired in series with the laser lockout key switch. It can be used with additional hardware to remotely disable the laser output.

***NOTE:*** *If this connection is used, the ferrite bead provided with the module must be attached to the remote interlock cable for lower emissions and CE mark conformance. Install the bead close to the end of the cable connected to the Optics card.*

Laser LOCKOUT is a safety device. The key switch disables the laser output when it is turned to the "closed lock" position. The laser output can only be turned on when the key is in the "open lock" position.

***NOTE:*** *The laser output cannot be enabled unless:*

- *The Laser Lockout key switch is set to the "open lock" or on position.*
- *The Remote Interlock is either not used or externally enabled.*
- *The Laser output is software enabled.*

***NOTE:*** *Optical cables use and care*

1. *When using the optical cables ensure that the cable is firmly seated in the front panel connector. The optical connectors on the front panel are keyed. If the cable is not inserted into the connector key properly, the connection between cable and front panel will not be complete and so will cause errors in transmission and receiver functions.*
2. *Always be sure to clean both cable connectors and front panel connectors before installing optical cables. A dirty optical connection can cause errors in transmission and receiver functions.*

# Receive Analysis

The **Receive card** contains the receiver SDH/SONET signal analysis functionality for the OTS9100 10Gb/s SDH/SONET module.

Figure 2-4 shows the Receive card front panel.

## Module OK

The Module OK LED should be green while the instrument is running. On power up, the LED first lights red, then will switch to yellow, and finally to green when the system has finished initializing.

***NOTE:*** *If the LED remains red after the system has finished initializing, call Tektronix for service.*

## LOS

The LOS (Loss of Signal) LED indicator can be off, red, or yellow. This indicator will turn red when the receiver detects a Loss-of-signal condition. Once the receiver regains the signal, the LOS indicator will turn to yellow and remain yellow until a new test is started, the module is powered off, or the receiver detects another Loss-of-signal condition.

A yellow history indicator signifies that LOS has occurred since the most recent test started, but is not currently detected.

The LOS indicator will turn off when a new test is started.

## DEFECT

The Defect indicator can be off, red, or yellow. This indicator will turn red when a defect (no signal present, LOS, LOF, OOF (SEF), MS-AIS (AIS-L), MS-RDI (RDI-L), LOP, AIS-P, or RDI-P) is detected. It will flash red if defects are detected intermittently.

A yellow history indicator signifies that a Defect has been detected since the most recent test started, but is not currently detected.

The Defect indicator will turn off when a new test is started.


**Figure 2-4: Receive Front Panel**

## ANOMALY

The Anomaly indicator can be off, red, or yellow. This indicator will turn red if an anomaly (B1, B2, REI-L, B3, FAS, REI-P, or payload error) is detected. It will flash red if an anomaly is detected intermittently.

A yellow history indicator signifies that an Anomaly has been detected since the most recent test started, but is not currently detected.

The Anomaly indicator will turn off when a new test is started.

## Rx Event OUT

The Rx Event Output is user activated and provides an active HIGH for each alarm or error condition generated. The output will provide a single pulse for each frame containing errors. It can be used as a means of triggering an oscilloscope or other test equipment. The output has an SMA connector and requires 50 termination for signal integrity.

## Rx Data IN

The Rx Data Input provides signal interconnection between the module cards. This input must be connected to the Rx DATA OUT connection found on the Optics card of the OTS9100 module using the coax cable and DC block provided.

## Rx Clock OUT

The Rx Clock Output provides signal interconnection between the module cards. This output must be connected to the Rx Clock Input found on the Clock Trigger card of the OTS9100 module using the coax cable provided.

# Transmit Generation

The **Transmit card** of the OTS9100 module contains all of the transmitter functionality for the 10Gb/s SDH/SONET module.

Figure 2-5 shows the Transmit card front panel.

## Module OK

The Module OK LED should be green while the instrument is running. On power up, the LED first lights red, then will switch to green when the system has finished initializing.

The LED will flash YELLOW if one or more internal clock circuits can not lock to the 10GHz clock input. This condition occurs when the input clock is not within specified frequency range.

***Note:*** *If the LED flashes Yellow, the 10 GHz input clock is missing or out of range. If the LED remains red after the system has finished initializing, call Tektronix for service.*

## Tx EVENT OUT

The Tx Event Output is user activated and provides an active HIGH for each alarm or error condition generated. The output will provide a single pulse for each frame containing errors. It can be used as a means of triggering an oscilloscope or other test equipment. The output has an SMA connector and requires 50 Ohms termination for signal integrity.

## F-SYNC OUT

The Frame Synchronization Output provides a signal that is asserted to indicate the start of a frame. It may be used as a means of triggering an oscilloscope to capture the 10Gb/s Optical Output signal. The output has an SMA connector and requires 50 Ohms termination for signal integrity.


**Figure 2-5:**
**Transmit Front Panel**

## 622 MHz TRIG OUT

The 622 MHz TRIG OUT provide a bit-rate/16 signal that may be used for triggering an oscilloscope to capture the 10 Gb/s Output signal. The output has an SMA connector and requires 50 Ohms termination for signal integrity.

## Tx DATA OUT

Tx Data Output provides a DC-coupled CML output signal for interconnection between the module cards. This output must be connected to the Tx DATA IN connection found on the Optics card of the OTS9100 module using the coax cable provided.

*Note: When connecting to an OTS91L1 card, a DC block must also be installed.*

## 10 GHz CLOCK IN

The 10 GHz Clock IN is the bit-rate clock for the Tx Data Out interface. This input must be connected to the 10 GHz Clock Out port of the Clock Trigger card using the coax cable provided.

# Clock Trigger

The **Clock Trigger card** provides the reference clock sources for the transmitter and receiver functions of the 10 Gb/s SDH/SONET module.

Figure 2-6 shows the Clock Trigger card front panel.

## Module OK

The Module OK LED should be green while the instrument is running. On power up, the LED first lights red, then will switch to green when the system has finished initializing.

The LED will flash YELLOW if the clock's multiplier can not lock to the selected reference input. This condition occurs when the input clock is not within specified frequency range.

***Note:*** *If the LED flashes Yellow, the 10 GHz input clock is missing or out of range. If the LED remains red after the system has finished initializing, call Tektronix for service.*

## 155 MHz EXTERNAL CLOCK IN

The External Clock Input accepts a 155 MHz clock signal which can be used to offset the transmit signal. The input has an SMA connector and 50 Ohms termination.

## 10 GHz TRIG OUT

The 10 GHz Trigger Output provides a bit-rate signal that may be used for triggering an oscilloscope to capture the 10 Gb/s Output signal. The output has an SMA connector and requires 50 Ohms termination for signal integrity.

## Rx CLOCK IN

The Rx Clock Input provides signal interconnection between the module cards. This input must be connected to the Rx Clock Output found on the Receive card of the OTS9100 module using the coax cable provided.


**Figure 2-6: Clock Trigger Front Panel**

## 10 GHz Clock Out

This output is connected to the OTS91T3 card using the coax cable provided.

## 10 GHz CLOCK IN

The 10 GHz Clock IN provides a bit-rate clock input that typically is connected to the OTS92H1 10 GHz JITTER Clock Out port. This input is selected when Transmit Timing is set to “Jitter”.

# Software Interface Operating Basics

This section describes the OTS9000 software interface. It also reviews the basic functionality of the Microsoft Windows® application software with menu descriptions.

# User Interface

The user interface software for the OTS Family Optical Test System controls all configuration, testing, and measuring commands of the OTS cards. The user interface provides easily navigated menus using Windows® 'point and click' operation on a Windows 2000 workstation.

Refer to the section, *Getting Started*, for information on how to load and launch the user interface software.

When the OTS Optical Test System is first powered on the software scans the card slots to determine what modules are loaded. The user interface then provides icons in the navigation window for each card loaded into the system. These icons always reflect the cards loaded and will change depending on the system being used. Because of this 'on the fly' software feature, some of the menus and abilities described in this manual may not be available in all systems since many features require a particular card installation. In addition, some of the menu screens may appear different from those displayed in this manual.

The user interface screen has a number of windows and bars that comprise the main screens of the software, some of which may be disabled. The next section, *Elements of the User Interface*, identifies each element on the main screen. The sections following it provide supporting descriptions for each of these elements.

***NOTE:*** *The user interface is a Microsoft Windows 2000® application. Information regarding standard Windows 2000 functions is beyond the scope of this document. For further information on basic commands and functions of Windows 2000, refer to the Windows 2000 manual.*

# Elements of the User Interface

The user interface has a number of windows and bars that comprise the main screens of the software. Figure 2-6 identifies each of these elements. The Navigation Window, Test, Laser Control bars, and Status Windows may be disabled for more viewing space, if desired.

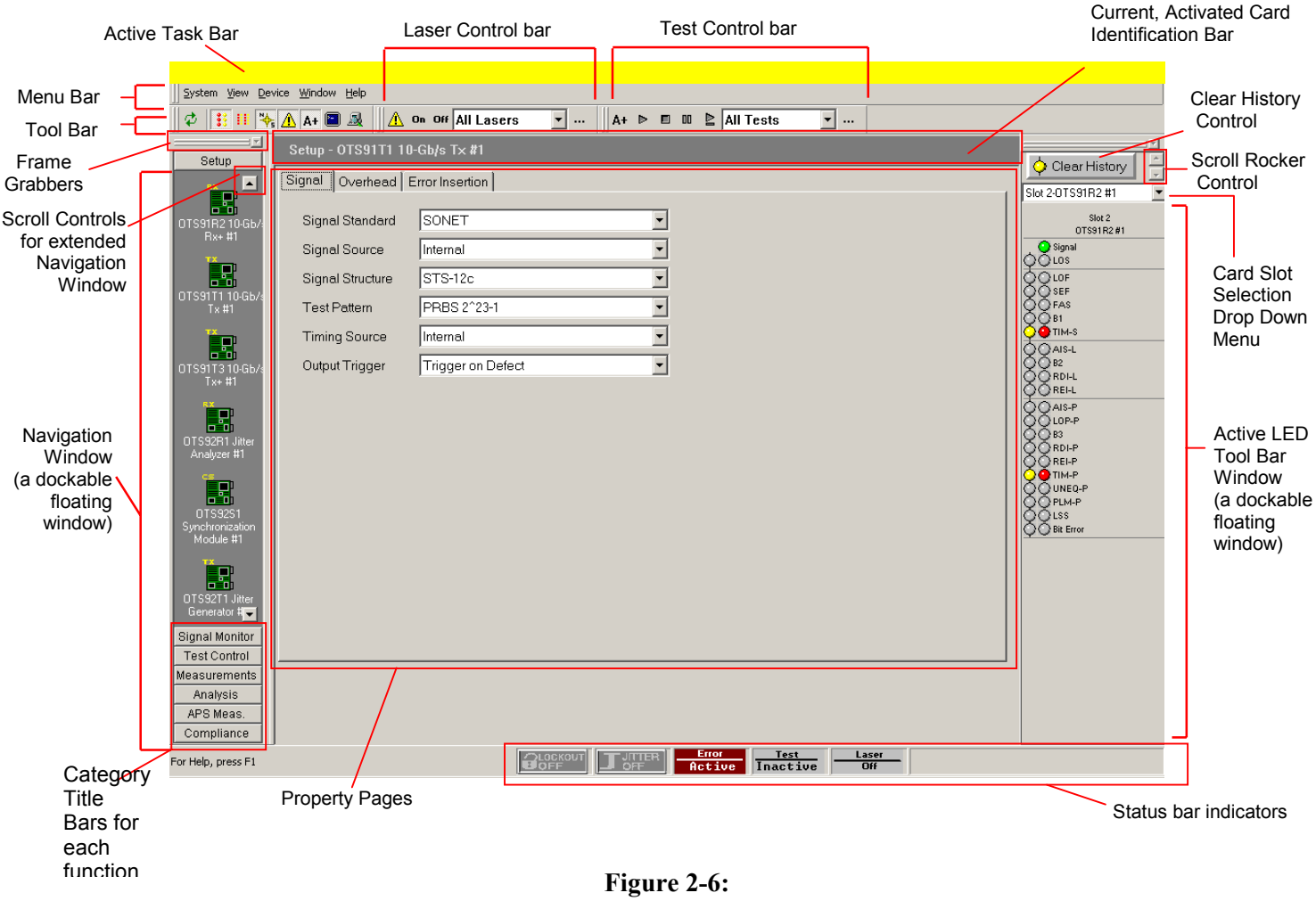
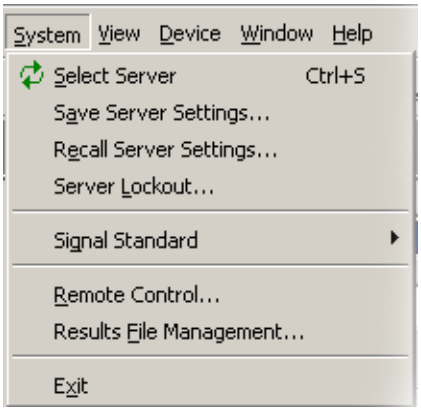



**Figure 2-6:**
**Location of Status and Navigation Windows displayed in a Single Mode View**

# Task Bar


The Task bar reflects the active device and function. When a device is selected from the Navigation window the identification of that device will appear in the Task bar. The window controls for the Tektronix interface can be accessed by using these selections they include, restore, minimize, maximize and close.

# Menu Bar




The Menu provides the access to System controls and functions, Views, Device controls and functions, Window and Help functions. The Menu bar contains the control menus for System, View, Device, Window and Help. The Menu Bar controls can also be accessed by clicking on the buttons found in the Tool Bar that correspond. The corresponding button is shown beside each menu selection.

## System

The System menu provides the user with access to system level functions. The functions accessed through the System selection are Select Server, Save Server Settings, Recall Server Settings, Server Lockout, Signal Standard (choose SONET or SDH), Remote Control, Results File Management and Exit.

## View

The View menu allows the user to control which toolbars will be activated in the working window framework. The functions accessed through the View selection are Navigation Window, Tool Bar, LED window, LED Panel, Laser Control Bar, Test Control Bar, SCPI, System View, Test Results Files, Toolbars and Options.

## Device

The Device menu access the controls used for the selected device. The controls used for the device are Setup, Signal Monitor, Test Control, Measurements, Analysis, APS Measurements and Compliance.

## Window

The Window menu provides the ability to setup how the menus are displayed within the OTS workspace. It is possible to set the display to a single window or multiple menu windows through this menu. Display functions include Single Mode (displaying one window at a time) and Multiple Mode (displaying many windows simultaneously).

### Single Mode

Single Mode displays one active window, full size, with no visible representation for other properties. Exit the Single Mode display by deselecting the check box for Single Mode from the Menu bar. Deselecting Single Mode enables other Window options.

### Multiple Mode

To get a multiple window display, more than one window at a time, select Cascade, Tile Horizontally, Tile Vertically. To enable this feature Multiple functions must be active. Setup displays the active device setup menu.

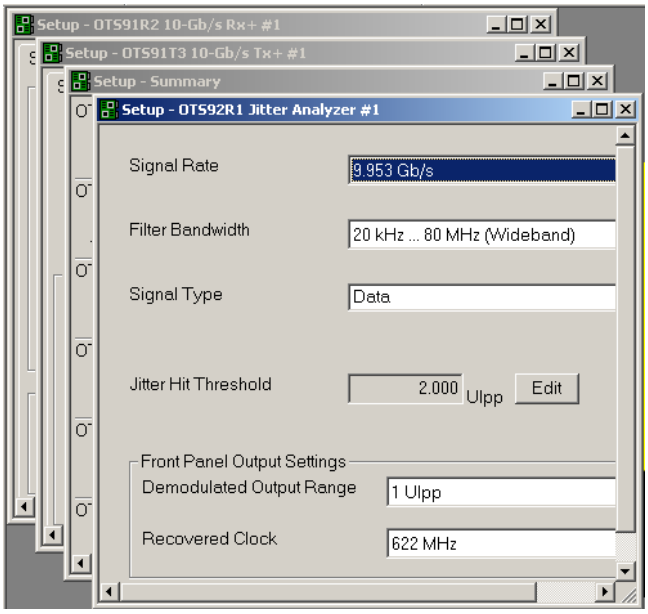


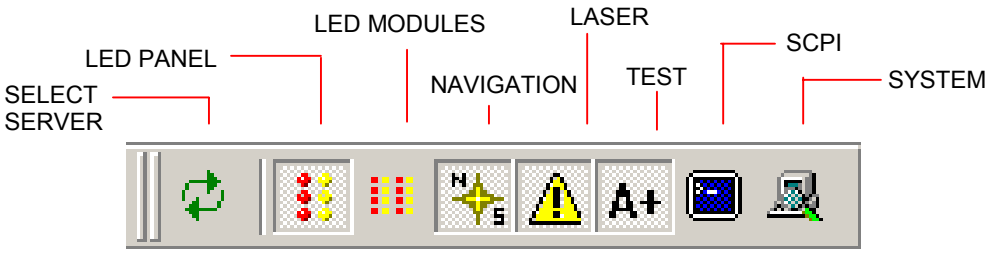

**Figure 2-6:**
**Multiple Window Mode View**

## Help

The Help menu provides a means of accessing more information on the product, on the system and on the company. The menu consists of Help Topics (OTS Product Family Help System), System Info (clipboard indicating which modules are installed), Remote Commands (key word search field) and About Tektronix (license and version).

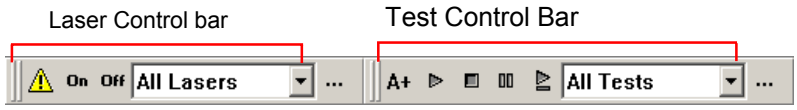
# Tool Bar

The toolbar provides easy access to different views and selections of the user interface. The buttons on the toolbar provide a toggle between select server, the LED window, the module LED panel, the system view, the Navigation window, the laser and test control bars, and the SCPI output. Each of these controls is discussed in further detail in later sections. The Test Control bar may be activated via the View menu or from the toggle key on the toolbar.




***NOTE**: Changing parameters while a test is in progress may cause invalid errors.*

# Laser Control Bar




The Laser Control bar provides the user with software control over the laser. Use the pull down menu to select which laser to activate or deactivate. Click the On button to turn on the selected laser. Click the Off button to turn off the selected laser.

Click the  button to close the bar or use the View menu to activate the bar. When the "…" button is clicked, the Setup Summary is displayed.

# Test Control Bar

The Test Control bar provides the controls to start, stop, pause, and continue the test. If multiple cards are present, the test control bar also allows the user to choose the specific card under test by use of the pull down menu. The Test Control bar may be activated via the View menu or from the A+ toggle button on the toolbar.

**NOTE:** Changing parameters while a test is in progress may cause invalid errors.

# Main Status Bar


The main status bar, provides a summary status all active modules, these could include laser, test, error insertion, optical and jitter transmit states of all modules. Whether a status button displays on the status bar or not is dependent upon the configuration of the loaded OTS cards. Each button has to states, an On or Active state and an OFF or Inactive state.

## Client Lockout

The user interface has the ability to lockout other users from setting parameters. To set the lockout control, double click the box to the left of the main status bar (if this feature is in an inactive state the box will be an empty gray square). The Lockout Control dialog box will be displayed. Click the desired button and then click OK to return to the main screen. When the lockout is in effect, a lock symbol will appear in the box by the main status bar. To unlock the server, use the same procedure.

When one client has locked out others, the lockout indicator ON will be displayed. If an operator tries to change a configuration parameter while locked out, a warning dialog will be displayed.

The lockout control dialog box may also be accessed by selecting Server Lockout from the System menu.

## Jitter

If jitter is generated the Jitter Inactive status box will change color and change from Jitter Inactive to active. If no jitter is being generated the Jitter Inactive message is displayed on a background of gray.

## Error

If an error insertion rate is active, the status bar will change color and change from Error Inactive to Error Active. If no errors are being created the Error Inactive message is displayed on a background of gray.

### Test

If a test is active in any module in the system, the status bar will change color and the Test Inactive message will change to Test Active. If no test is being conducted the Test Inactive message is displayed on a background of gray.

### Laser Off

If any laser is active in the system, the status bar will change from Laser Off to a Laser On warning. If the laser is not in use the Laser Off message is displayed on a background of gray.

### Frame Grabbers

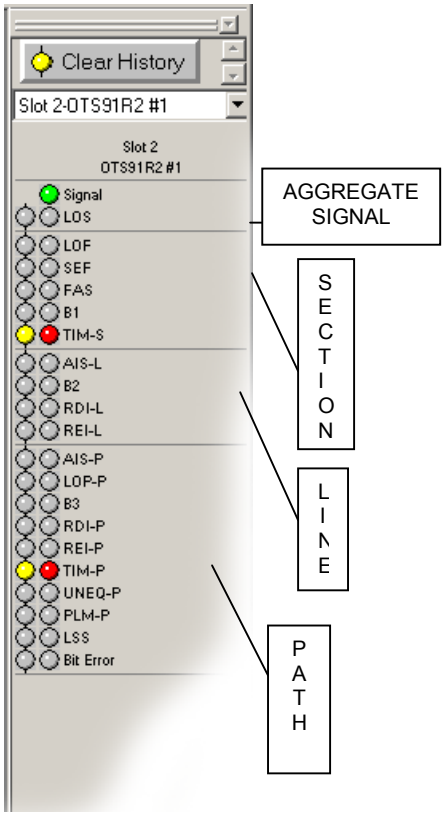
Frame Grabbers indicate that a window within the interface is dockable or will float. They can be vertical or horizontal, each bar representing a window. Double click on the button containing the bars and the window will detach from its location. To reattach the window, drag it back to that location.

# LED Window

Activating the LED Status window provides the user with a virtual LED status panel for the OTS9100 receiver(s), as shown in Figure 2-7. The virtual indicators found on this window provide error conditions, both current and historical, for all traditional receiver error LEDs. The LED Status window may be activated through the View menu or from the toggle key on the toolbar.

Each condition has two separate indicators, the one on the right is the Current condition and the indicator on the left is the History. The Current indicators will turn red and the History indicators will turn yellow if an error condition currently exists. Once the condition has been removed, the red Current indicator will turn off. The yellow History indicator will remain on until a new test has been started or until the Clear History button is clicked.

See Table 2-1 for a description of each indicator.

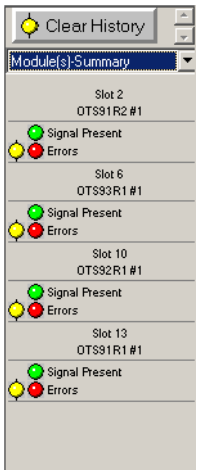



***Note:*** *Extended Panel information can be viewed with scrolling LED bars, this feature is only enabled when a panel is extended beyond the framework.*

Three LED panel views can be enabled from within the OTS9000 application, the Module Summary Panel, the Slot Signal Panel and the User Customizable Signal Panel.

***Note:*** *The LED panels display Receiver information only. When only one receiver has been selected from the navigation bar no user selectable signals will be available.*

Click on the drop down menu for the LED panel to access the possible choices for the LED panel. Each selection provides specific controls for the active LED. The choices are Module Signal, Slot Signal and User Selected Signal. Each state is described below.




### Module Signal Summary LED Panel

The summary of signal states for an individual panel. The Module Signal Summary LED Panel provides a summary status of error signals for the active panel.

### Slot Signal LED Panel

Selecting the Slot Signal will display the LEDs for the chosen card slot.

### User Selected Signal LED Window

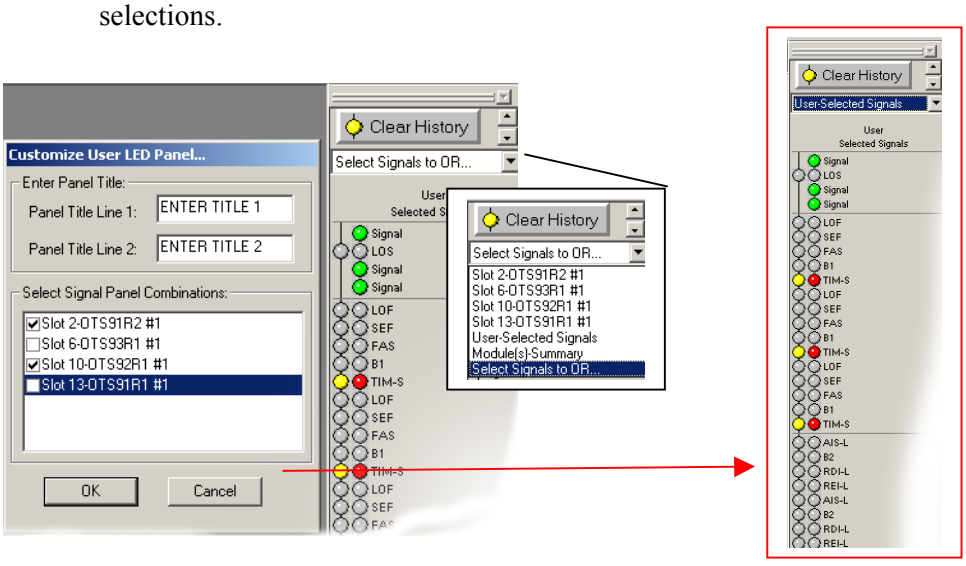
The User Selected panel displays the results of a "User defined" state. The user can select specific cards and display the LED states for all cards selected. Multiple LED panel readings are aggregated into one uniform panel display. For example, an LOS LED will be lit or "ON" if even one out of a grouping of three cards has a loss of signal. If all three cards have no LOS then the LOS LED would be "OFF" or not lit.

A fourth panel titled Select Signals to OR…provides access to the User Selected panel. Choosing Select Signals to OR from the drop down menu launches a Customizable User LED Panel menu. Three Entry Fields are contained within the menu, Panel Title Line 1, Panel Title Line 2 and a list of active cards with check boxes.

Panel Title Line 1: Enter the name or title to be assigned to a user defined test group.

Panel Title Line 2: Enter the name or title to be assigned to a user defined test group.

Select Signal Panel Combinations provides a listing of all available Receiver cards. Choose a combination of cards by clicking in the boxes adjacent to the card titles to select (check) or deselect (uncheck) each available card. The User Defined Panel displays the results of these selections.




## Clear History

The Clear History button is used to clear the current history. History will begin resampling data starting from the point in time that it was cleared.

# Module LED Panel

The module LED panel operates like the LED Window. This panel is accessed via the View menu. It may also be toggled from the tool bar. To make the panel always remain on top of the Windows screen, check the box marked 'Always on top'.

There are two differences between the LED Window and the module LED panel. The module LED panel does not provide the LED display options; all LEDs are always displayed. In addition, in the module LED panel mode, all receiver LED panels are shown. In the example in Figure 2-8, there are four receiver cards loaded, an OTS91R2, OTS93R1, OTS92R1, OTS91R1 and one synchronization card the OTS92S1. Observe that the LEDs shown are different for each card.

***NOTE:*** *For each card, the user interface only displays the options available for that card. If the options are not displayed, then the option is not available for that particular card. This view does not display the Module Summary or the User Definable panels.*

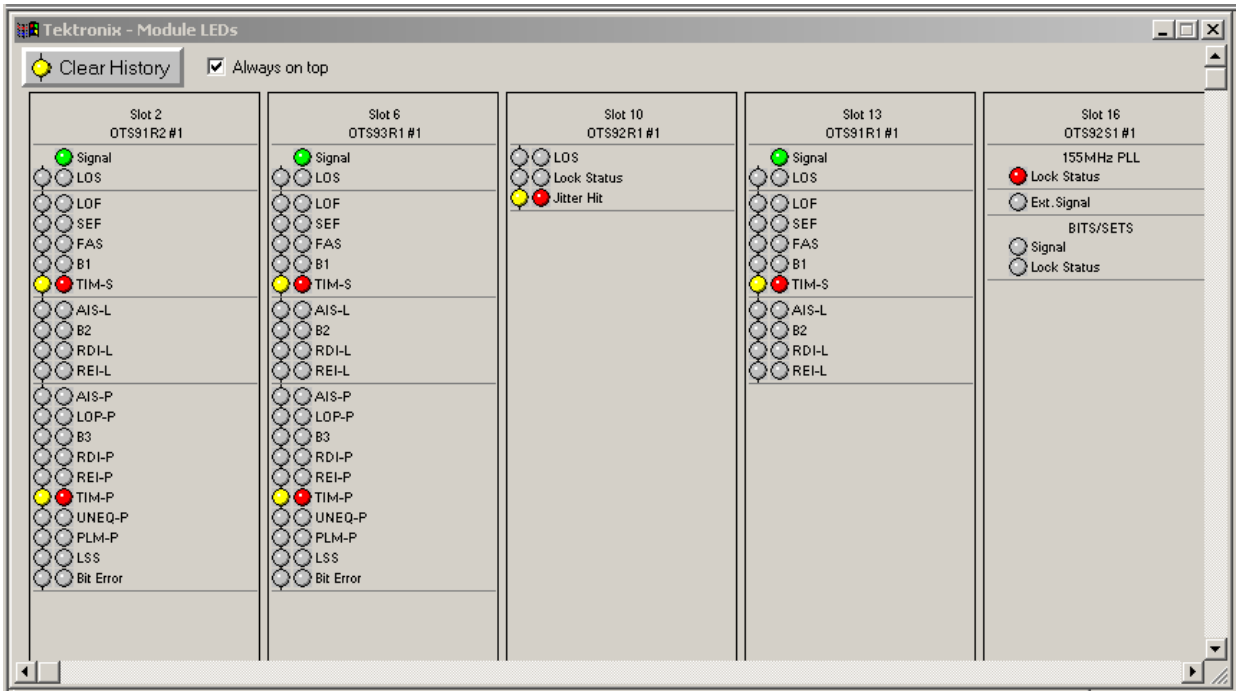



**Figure 2.7. The LED Module Display**

**Table 2-1: Description of Status Window Virtual LED Indicators**

| LED name | Description |
|---|---|
| Signal Present | The Signal indicator will light green when the receiver senses an incoming signal. |
| LOS | The Loss of Signal indicator is activated when a LOS condition has been detected. |
| LOF | The Loss of Frame indicator is activated when a *Loss of frame* condition has occurred. |
| SEF (OOF) | The Severely Errored Frame (Out of Frame) indicator is activated when an *Out of frame* condition has occurred. |
| FAS | The Frame Alignment Sequence indicator activates when errors have been detected in the A1/A2 framing bytes. |
| B1 | The B1 indicator will activate when SDH Regenerator (SONET Section) parity errors have occurred. |
| TIM-S (RS TIM) | The TIM indicator activates when a J0 trace is received that does not match the expected trace. |
| AIS-L (MS AIS) | The AIS indicator activates when the overhead and SPE are set to all ones for a user-selected time. |
| B2 | The B2 indicator activates when SDH Multiplex Section (SONET Line) parity errors have been detected. |
| RDI-L (MS RDI) | The RDI indicator activates when bits 6, 7, and 8, of the K2 byte have been a binary 110, respectively, for five or more consecutive frames. |
| MS REI (REI-L) | The REI indicator activates when a non-zero value in the M1 byte is detected. |
| AIS-P (AU-AIS) | The Path AIS indicator activates when the pointer is set to hex 3FF for five consecutive frames. |
| LOP-P (AU-LOP) | The LOP (Loss of Pointer) indicator is activated when a *Loss of Pointer* condition has occurred. A LOP condition exists when ten consecutive pointer errors are received. |
| B3 | The B3 indicator activates when Path parity errors have been detected. |
| | |
| RDI-P (HP-RDI) | The RDI indicator activates when bits 5, 6, and 7 of the K3 byte have been a binary 1xx, respectively. |
| REI-P (HP-REI) | The Path REI indicator activates when bits 1-4 of G1 are decimal values between one and eight. |
| TIM-P (HP-TIM) | The TIM indicator activates when a J1 trace is received that does not match the expected trace. The trace setup is explained later in this section. |
| UNEQ-P (HP-UNEQ) | The unequipped path indicator activates when C2 equals zero. |
| PLM-P (HP-PLM) | The Path Label Mismatch occurs when the received C2 does not match the expected C2. |
| LSS | The Loss of Sequence indicator activates if BER is greater than or equal to 0.20 during an interval of one second or if the test sequence and reference sequence are out of phase. |
| Bit Error (TSE) | The Test Sequence Error indicator activates when a bit error occurs in the payload. |

# LED Display Selection

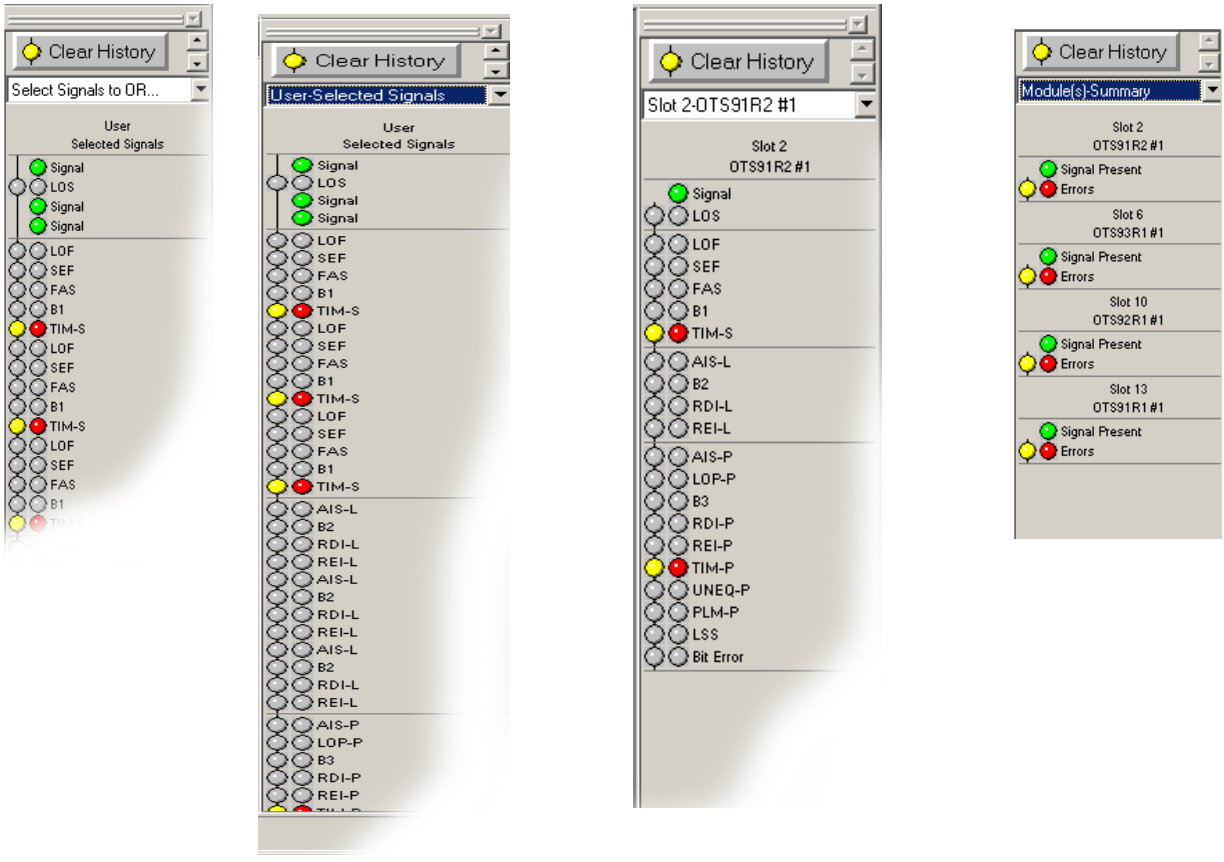
The LED indicators displayed in the LED window reflect the status of each OTS receiver loaded in the system. Choices may be made by using the pull down menu to select each individual slot, a Module Summary, or User Selected Signals. Figure 2-9 reflects the LED Window for each of the LED Display selections.

If Select Signals to OR is selected a menu with a check box list displays. Choices made in this menu determine what the User Selected Signals will display. Two user defined fields are provided as a means to label different test names.

The User Selected Signals display reflects all the user defined selections made in the Select Signals to OR… check box.

Module Summary displays a generalized summarization of all LED states of each individual slot.

Selecting an individual slot from the drop down menu causes all the LEDs associated with the selected card slot to display. Only the status of the selected slot will be displayed.




**Select Signal** **User Selected Signal** **Slot Signal** **Module Summary (default view)**

**Figure 2-9: LED Display selection options**

# Navigation Window

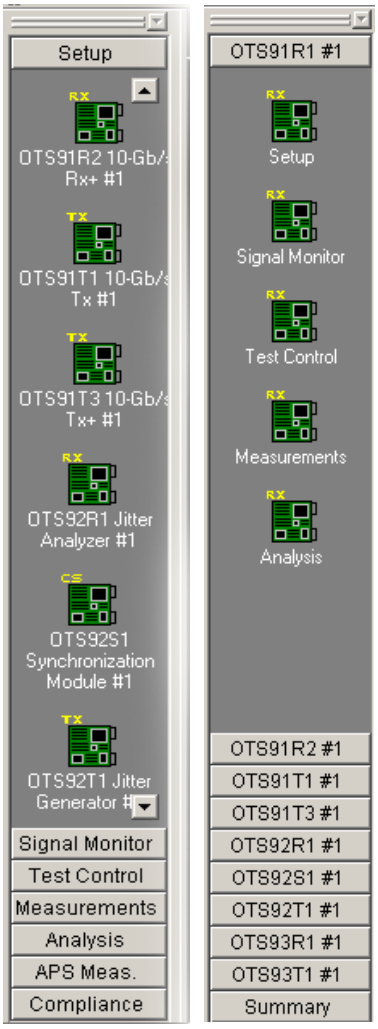
The Navigation window provides the ability to set up, monitor and test the module, and to view the test results. The Navigation window can be displayed via two methods, by category or by device. Set the display window by selecting View>Options from the File Menu bar. A choice of, by Category or By Device, is provided under the Navigation Mode column in this window.

The Navigation window contains categories representing Setup, Signal, Monitor, Test control, Measurements, Analysis, APS measurement and Compliance. It displays each of the OTS cards loaded in the system with an associated device icon. Each category provides additional configuration and control options for the selected OTS card.

When selected each Category bar moves to the top of the Navigation window, reflecting the current selection. If a new icon is not selected from the new navigation view, the menu will still reflect the previous Navigation window selection. For example, the Navigation window may show the Signal Monitor icons, when the currently selected menu is actually Setup-OTS91T2 10Gb/s Tx #1.

The Navigation bar is adaptive. Entries are added depending on the system configuration. When the server connection is established, the user interface automatically scans for loaded hardware and displays the appropriate folders and icons for the hardware on that server.

For example, the sample screen, reflects three transmitters (OTS91T1, OTS91T3 and OTS92T1), two receivers (OTS91R2 and OTS92R1) and one synchronization card (OTS92S1). Each card is represented with a separate icon. Multiple icons of the same type provide the same screens, but contain custom controls for each specific card.




Category View Device View

***Note:*** *Pay attention to the relationship between the icon selected in the Navigation window to the Active Title Bar.*

When changing screen controls by clicking on a category title in the Navigation window, ensure that the correct device is still currently activated. A new device icon in the Navigation window must be clicked to change the associated screen menu.

**Scroll Buttons**

The scroll buttons are part of the Navigation window. They provide scroll support for accessing any card icons that are beyond the immediate viewable area of the Navigation window frame.

***Note:*** *The Navigation window is a dockable window. Double click on the horizontal grabbers at the top of the window frame to undock the window and float it within the OTS interface. To redock or return the floating Navigation window, click and drag it back to the original location, where it will be repositioned in its original frame.*

**Summary Icons**

Every device has an associated summary represented by a summary icon within the Navigation Window. Double click on each summary icon for each device activated to view the

# Setup Property Menus

When SETUP is selected from the Navigation window by clicking on the SETUP Title bar, icons for all loaded Transmitter and Receiver cards, in addition to a summary menu, are displayed. The Setup Property menus provide separate configuration control over each transmitter or receiver function.

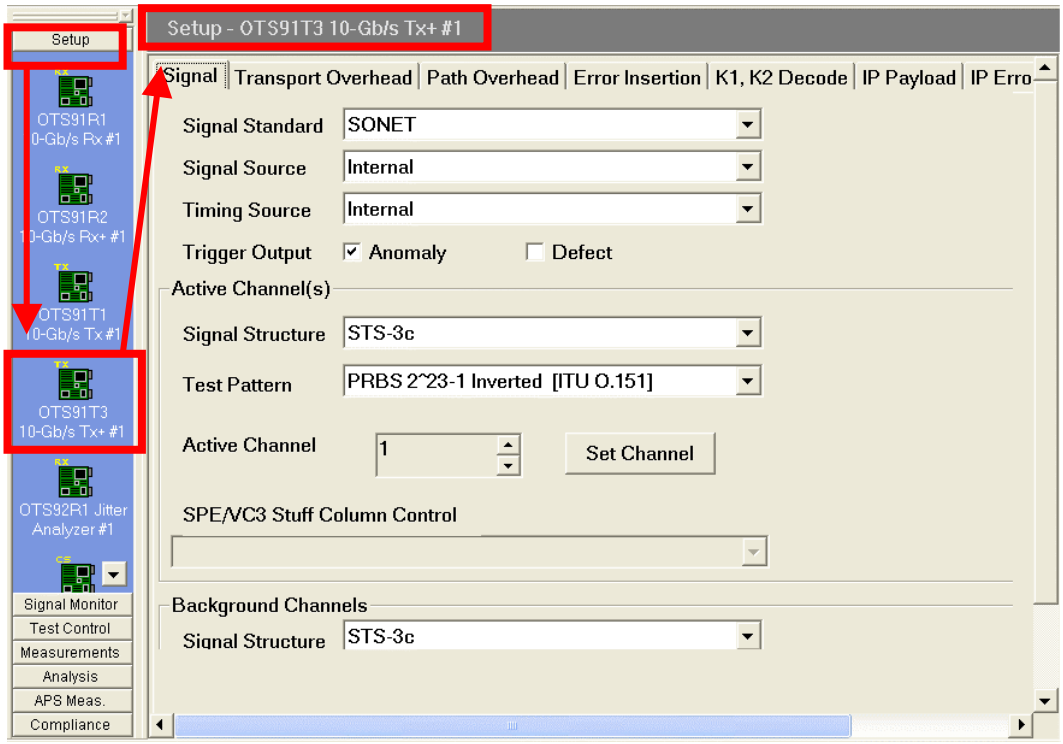
Each Receiver and Transmitter card has a setup menu that pertains to it. If an Receiver (Rx) icon is clicked, the Receiver setup menu is displayed for the Rx card it relates to. If a Tx icon is clicked, the Transmitter setup menu is displayed for the selected transmitter icon.

The transmit and receive setup menus may contain multiple menu screens; each selected by a tab. Each tab represents a category of functionality specific to the transmitter or receiver setup. Every card has a setup menu that pertains to it.

**1. Click on Setup**

**2. Click on the icon**

**3. Note the Active Card Title Bar**




***Note:*** *Scroll bars at the bottom and to the right-hand side of the Setup Window allow the user to scroll when menu information extends beyond the window frame.*

# Transmitter – Signal

The Signal Property menu of the Transmitter setup, as shown in Figure 2-10, provides the controls for selecting the Signal setup, Transport overhead, Path overhead, Error insertion, K1, K2 Decode, IP payload and IP error. In addition, the signal structure and test pattern for both the active channels and the background channels are configured on this setup menu. Each of the selections available is described in more detail in the following sections.

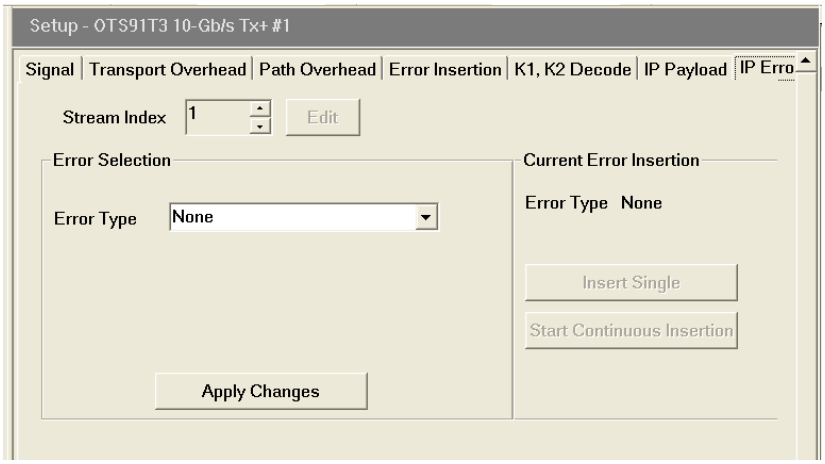



**Figure 2-10: Transmitter Setup – Signal menu**

## Signal Standard

Signal Standard selects the operating mode of the transmitter. To select either SONET or SDH mode, click on the pull-down menu and select the desired operating mode. The operating mode may also be selected via the menu bar. Click on System – Signal Standard and select either Set to SONET or Set to SDH.

***NOTE:*** *If the signal standard is selected via the menu bar (View>Options), the signal standard is set for all devices in the system.*

## BERT Mode

For some modules a third option is available from the Signal Standard menu, the BERT mode. With this mode, the OTS9100 becomes a BERT generator. The Test Pattern selection for the active channel is the only valid selection on the transmitter signal setup page when BERT mode is selected. When the signal standard is returned to either SONET or SDH mode, the settings will return to the last settings used.

Most LED indicators are invalidated by the BERT mode. The only valid active LEDs are Signal Present, TSE, and LSS.

## Signal Source

Signal Source selects the data source used as the output signal. The modes available are Internal mode and Through mode.

- **Internal Mode:** Internal mode provides an internally-generated 9.95238 Gb/s signal with the data in a PN7 scrambled NRZ format.
- **Through Mode:** If using through mode, the user has the choice of passing a 9.95238 GHz signal through the module in two ways, non-intrusive and intrusive. Non-intrusive will output an unmodified external signal. Intrusive allows the user to modify some aspects of the external signal as it passes through the module. To set the Overhead bytes available for overwriting, refer to the Transport Overhead or Path Overhead screens.

***NOTE:*** *As described in* Getting Started*, if the modules are not installed into the proper slots, Through Mode is not available as a signal source option.*

## Timing Source

The timing source pull-down menu selects either internal or external timing. Internal timing uses the internal clock. External timing uses the External 155 Clock In connection on the Clock Trig module.

## Trigger Output

The Trigger Output allows the user to select what condition activates the output trigger. Check the appropriate box for Anomaly Trigger or Defect trigger, or activate both. The triggering on defects provides an active HIGH for each frame in which a defect is inserted. The triggering on anomalies provides an active HIGH for each frame in which an anomaly is inserted.

## Active Channel(s)

The Active Channel(s) section controls the settings for signal structure and test pattern of the selected active channel(s). To set the active channel, use the up/down cursors or click the Set Channel button. When the Set Channel button is clicked, the bar for Active channel changes into an interactive menu. Type in the text box to select the channel or click Set Channel 1 to choose channel 1. If the Set All button is clicked, the Background Channels section is grayed out. Set channel from 1 to 192 or set all.

### Signal Structure

Signal structure allows the user to choose the mapping structure of the transmitted signal. The mapping structures provided are listed in the table below. As shown, the structures all provide concatenated structures.

| SONET | SDH |
|---|---|
| 1 x STS-192c | 1 x VC4-64c |
| 4 x STS-48c | 4 x VC4-16c |
| 16 x STS-12c | 16 x VC4-4c |
| 64 x STS-3c | 64 x VC4 |
| 192 x STS-1 | 192 x VC3 |

### Test Pattern

Test Pattern allows the user the select a pattern to fill the chosen active channel of the internally generated 9.95238 Gb/s signal. The patterns available are:

- PN15 (PRBS 2^15-1), Inverted PN15 (ITU O.151)
- PN23 (PRBS 2^23-1), Inverted PN23 (ITU O.151)
- PN31 (PRBS 2^31-1), Inverted PN31 (ITU O.150)
- All Zeros
- All Ones
- Fixed Data (8-bit)
- POS (Only valid when Signal Structure is STS-192c/VC-4-64C)

When Fixed Data is selected a button marked Edit Fixed Data is displayed. To change the Fixed Data to a different value, click the Edit Fixed Data button and type the new value into the text box beside the button. In the Test Pattern selection box, observe that the value after Fixed Data changes to match the newly entered value.

**Packet Over SONET (POS)**

In order to use the POS testing capabilities, POS must be selected as the Active Channel Test Pattern. Select POS from the drop down menu under Active Channel Test Pattern in the Receiver Setup menu. The following setup conditions must exist before POS can be selected:

- Signal Source is set to Internal.
- Timing Source is set to Internal.
- Signal Structure is set to STS-192c.

***NOTE:*** *To transmit a POS test pattern, the Signal Structure must be set to STS-192c and the signal source cannot be through mode.*

**SPE/VC3 Stuff Column Control**

The stuff column control allows column 30 and column 59 of the SPE (VC3) to be stuffed with either all zeros or with the payload pattern. This option is only available if the Signal Structure is STS-1 or VC3. Set channel from 1 to 192 or set all.

## Background Channels

The Background Channels section controls the settings for signal structure and test pattern of the non-active channels.

### Signal Structure

Signal structure allows the user to choose the mapping structure for the background channels of the transmitted signal. The mapping structures provided for background channels are listed in the table below.

| SONET | SDH |
|---|---|
| 1 x STS-192c | 1 x VC4-64c |
| 4 x STS-48c | 4 x VC4-16c |
| 16 x STS-12c | 12 x VC4-4c |
| 64 x STS-3c | 64 x VC4 |
| 192 x STS-1 | 192 x VC3 |

### Test Pattern

Test Pattern allows the user to select one of four available patterns to fill the background of the internally generated 9.95238 Gb/s signal. The default pattern fill is inverted PN23. The patterns available are:

- Inverted PN23 (ITU O.151)
- All Zeros
- All Ones
- Fixed Data (8-bit)

When Fixed Data is selected a button marked Edit Fixed Data is displayed. To change the Fixed Data to a different value, click the Edit Fixed Data button and type the new value into the text box beside the button. In the Test Pattern selection box, observe that the value after Fixed Data changes to match the newly entered value.

#### SPE/VC3 Stuff Column Control

The stuff column control allows column 30 and column 59 of the SPE (VC3) to be stuffed with either all zeros or with the selected payload pattern. This option is only available if the pattern Background Signal Structure is STS-1 or VC3.

## Transmitter – Transport Overhead

The Transport overhead property menu, as shown in Figure 2-11, can be used to pass or change the 9.95238 Gb/s signal overhead bytes in the first STS-1 or STM-1 of the OC-192 or STM-64 frame, respectively. In addition, the J0 Trace and S1 byte may be edited. The editing procedure for each is described in more detail in the following sections.

***NOTE:*** *Overhead data displays are in hexadecimal format. All edits to overhead display must be in hexadecimal format.*

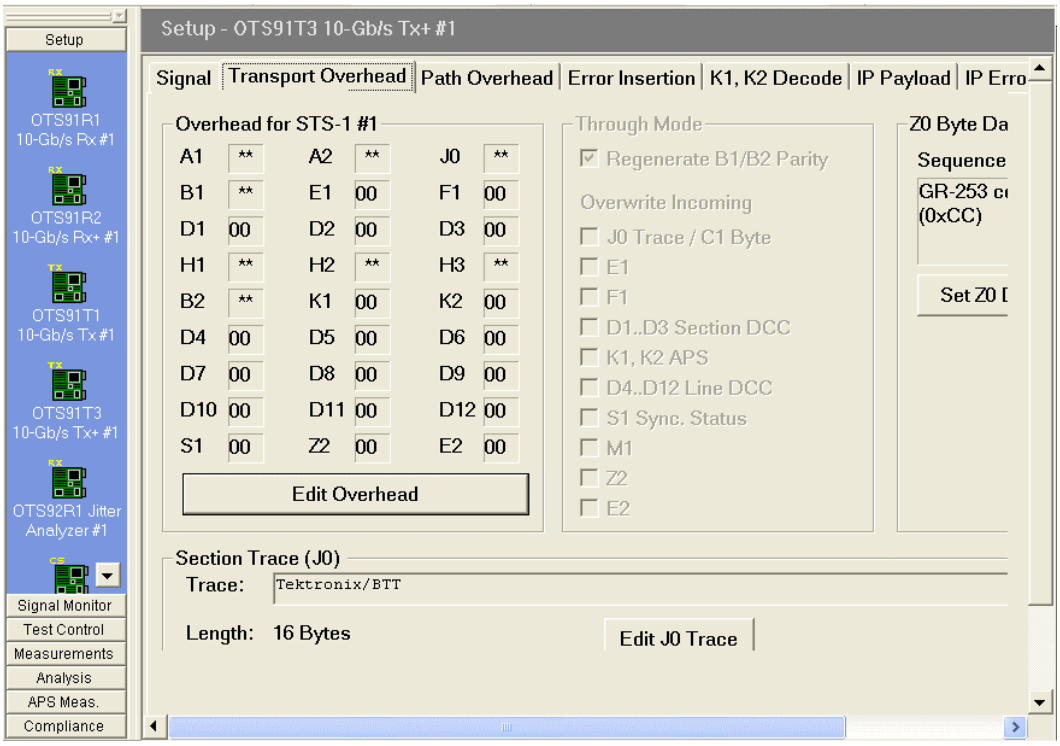



**Figure 2-11: Transmitter – Transport Overhead menu**

## Edit Overhead

To edit the overhead, click the Edit Overhead button. This brings up a dialog box, shown in Figure 2-12. The dialog box displays accessible overhead bytes in white while the non-applicable boxes for the function are grayed out (they do not apply to the selection). The grayed out bytes are not available for editing. To edit all other bytes, highlight the appropriate box and type in the desired entry. To set the overhead back to its default state, click the Restore Defaults button. When editing is complete, click OK to return to the main screen.

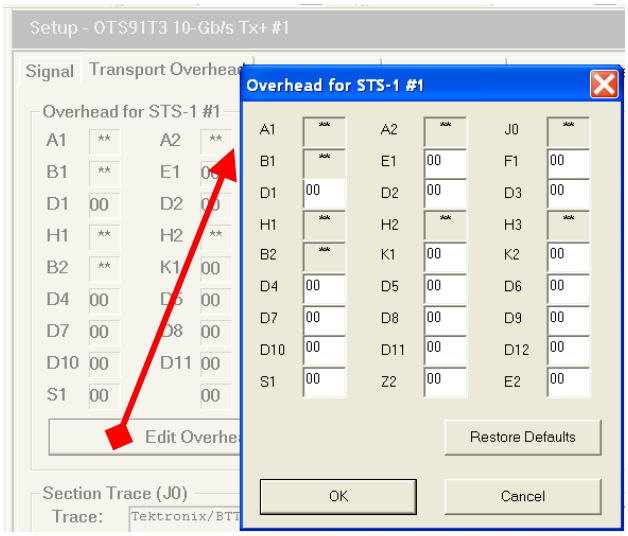



**Figure 2-12: Edit Overhead dialog box**

## Through Mode

When using through mode, a number of the overhead bytes may be overwritten as the external signal passes through the card. This is done through the use of the Through Mode selections available in the Overhead menu, as shown in Figure 2-13. If the box is checked for Regenerate B1/B2 Parity, the receiver will recalculate the B1/B2 parity and insert the new information into the overhead as the signal is passed through the card. To disable B1/B2 parity regeneration, ensure that the Regenerate B1/B2 Parity box is not selected.

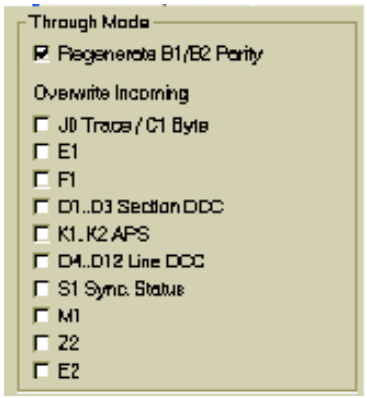



**Figure 2-13: Through Mode Overwrite menu**

To overwrite an incoming byte, click in the box beside the selection under the Overwrite Incoming heading. If you wish to keep a byte from being overwritten, make sure the box beside the selection is not selected. The bytes available to be overwritten are J0 Trace/C1 Byte, E1, F1, D1..D3 Section DCC, K1..K2 APS, D2..D12 Line DCC, S1 Sync Status, M1, Z2, and E2. Parity regeneration is always enabled if the user chooses to overwrite any incoming Overhead bytes.

***NOTE:*** *There is no explicit byte edit for M1. Checking the M1 overwrite setting provides the ability to insert REI-L.*

## J0 Multi-Byte Trace

J0 Trace provides a capability to uniquely identify each of the multiple channels being carried in a Dense Wave Division Multiplexer (DWDM) system, providing an end-to-end continuity check. Since only the SONET framing byte plus J0 are in the unscrambled overhead of the SONET signal, it is possible to extract for display the J0 trace to confirm channel ID.

The OTS9100 has the ability to generate unique J0 traces. This allows test signals to be easily identified, or to simulate network-element generated traffic without the Trace Identifier Mismatch (TIM) alarm being generated. The OTS9100 capability to display the received J0 trace allows users to verify continuity and correct routing of individual channels within the multi-channel DWDM system.

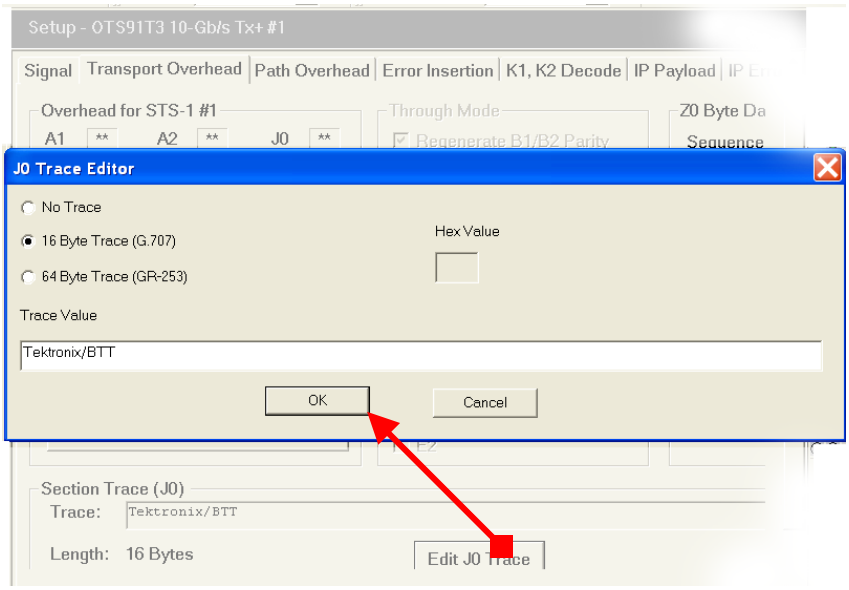



**Figure 2-14: Transmitter J0 Trace dialog box**

To edit, click on the Edit J0 Trace button. A dialog box is displayed, as shown in Figure 2-14, reflecting the current settings of the J0 Trace. Click the appropriate radio button to choose between No Trace, 16 Byte Trace, and 64 Byte Trace. To input a Trace Value, click in the Trace Value box and start typing. When edits are complete, click OK to return to the main menu. In 16-byte, the last byte is filled with CRC. In 64-byte, the last two bytes are filled with CR LF.

## Transmitter – Path Overhead

The Path overhead property menu, as shown in Figure 2-16, of the Transmitter setup can be used to pass or change the 9.95238 Gb/s signal path overhead bytes in the first STS-1 or STM-1 of the OC-192 or STM-64 frame, respectively. In addition, the J1 Trace and C2 path label may be edited. The editing procedure for each is described in more detail in the following sections.

***NOTE:*** *Overhead data displays are in hexadecimal format. All edits to overhead display must be in hexadecimal format.*

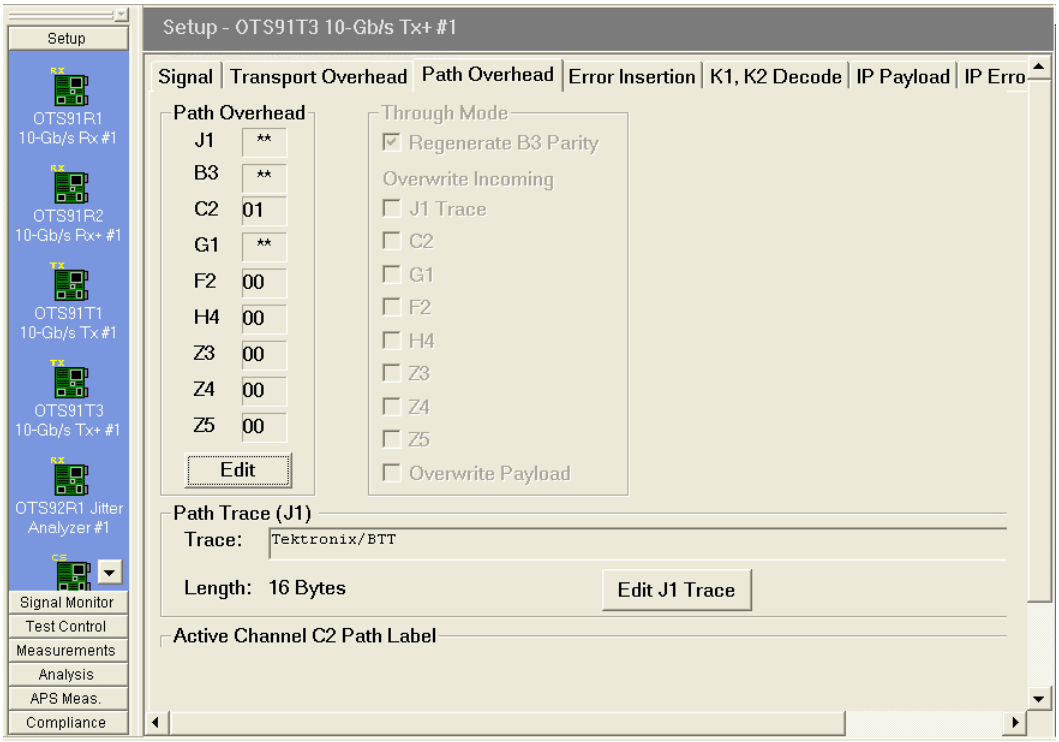



**Figure 2-16: Transmitter – Path Overhead Property Menu**

## Edit Path Overhead

To edit the path overhead, click the Edit button. This brings up a Path Overhead dialog box, shown in Figure 2-17. The dialog box displays the overhead bytes in white text boxes. To edit, highlight the appropriate box and type in the desired entry. To set the overhead back to its default state, click the Restore Defaults button. When editing is complete, click OK to return to the main screen.

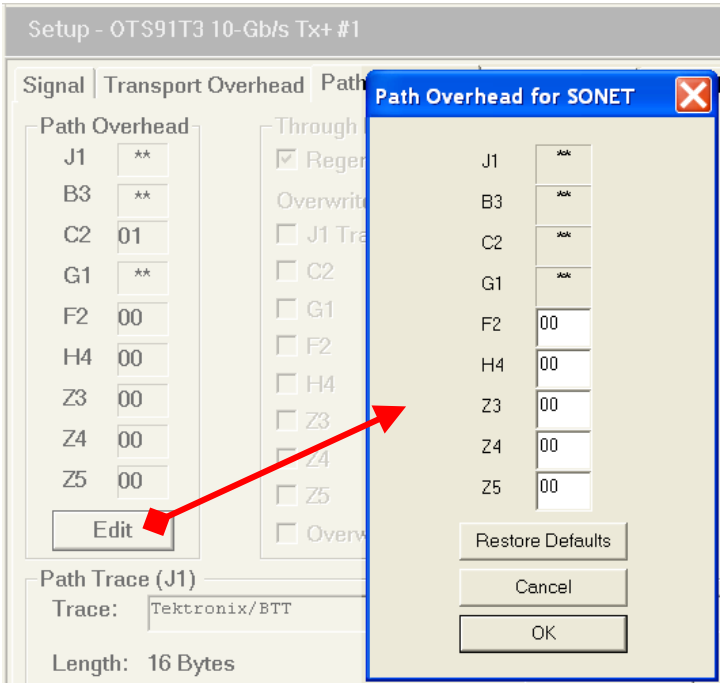



**Figure 2-17: Path Overhead dialog box**

## Path Through Mode

When using through mode, a number of the Path overhead bytes may be overwritten as the external signal passes through the module. This is done through the use of the Through Mode selections available in the Path Overhead menu, as shown in Figure 2-18. If the box is checked for Regenerate B3 Parity, the receiver will recalculate the B3 parity and insert the new information into the overhead as the signal is passed through the module. To disable B3 parity regeneration, ensure that the Regenerate B3 Parity box is not selected.

To overwrite an incoming byte, click in the box beside the selection under the Overwrite Incoming heading. If you wish to keep a byte from being overwritten, make sure the box beside the selection is not checked. The bytes available to be overwritten are J1 Trace, C2, G1, F2, H4, Z3, Z4, and Z5. B3 parity regeneration is always enabled if any of the byte or payload overwrite selections are checked.

If Overwrite Payload is checked, the payload data is replaced with the Test Pattern selected on the Signal page.

***NOTE:*** *There is no explicit byte edit for G1. Checking the G1 overwrite setting provides the ability to insert REI-P.*

***NOTE:*** *The Tx Signal Structure in the Tx Setup menu must match the Signal Structure of the mating Rx in order for intrinsic Path Through mode to operate correctly. If the Signal Structure of the Tx does not match the Signal Structure of the Rx, the overwritten bytes will not be accurate. This is also true for B3 regeneration.*

## J1 Multi-Byte Trace

J1 Trace provides a capability to uniquely identify each of the multiple channels being carried in a Dense Wave Division Multiplexer (DWDM) system, providing an end-to-end continuity check. It is possible to extract for display the J1 trace to confirm channel ID.

The OTS9100 has the ability to generate unique J1 traces. This allows test signals to be easily identified, or to simulate network-element generated traffic without the Trace Identifier Mismatch (TIM) alarm being generated. The OTS9100 capability to display the received J1 trace allows users to verify continuity and correct routing of individual channels within the multi-channel DWDM system.

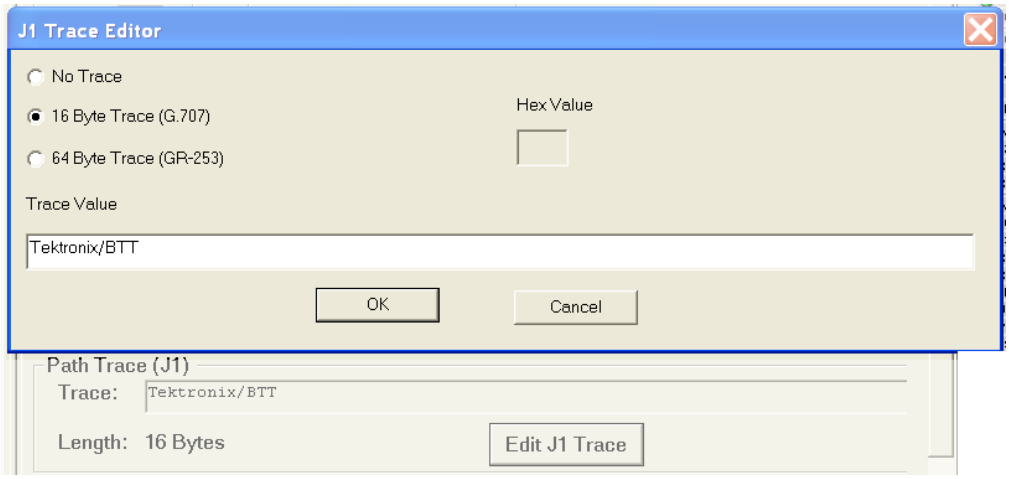



**Figure 2-19: Transmitter J1 Trace dialog box**

To edit, click on the Edit J1 Trace button. A dialog box is displayed, as shown in Figure 2-19, reflecting the current settings of the J1 Trace. Click the appropriate radio button to choose between No Trace, 16 Byte Trace, and 64 Byte Trace. To input a Trace Value, click in the Trace Value box and start typing. When edits are complete, click OK to return to the main menu. In 16-byte, the last byte is filled with CRC. In 64-byte, the last two bytes are filled with CR LF.

## Transmitter – Error Insertion

The error insertion menu, as shown in Figure 2-21, of the Transmitter setup allows the user to inject anomalies and defects.

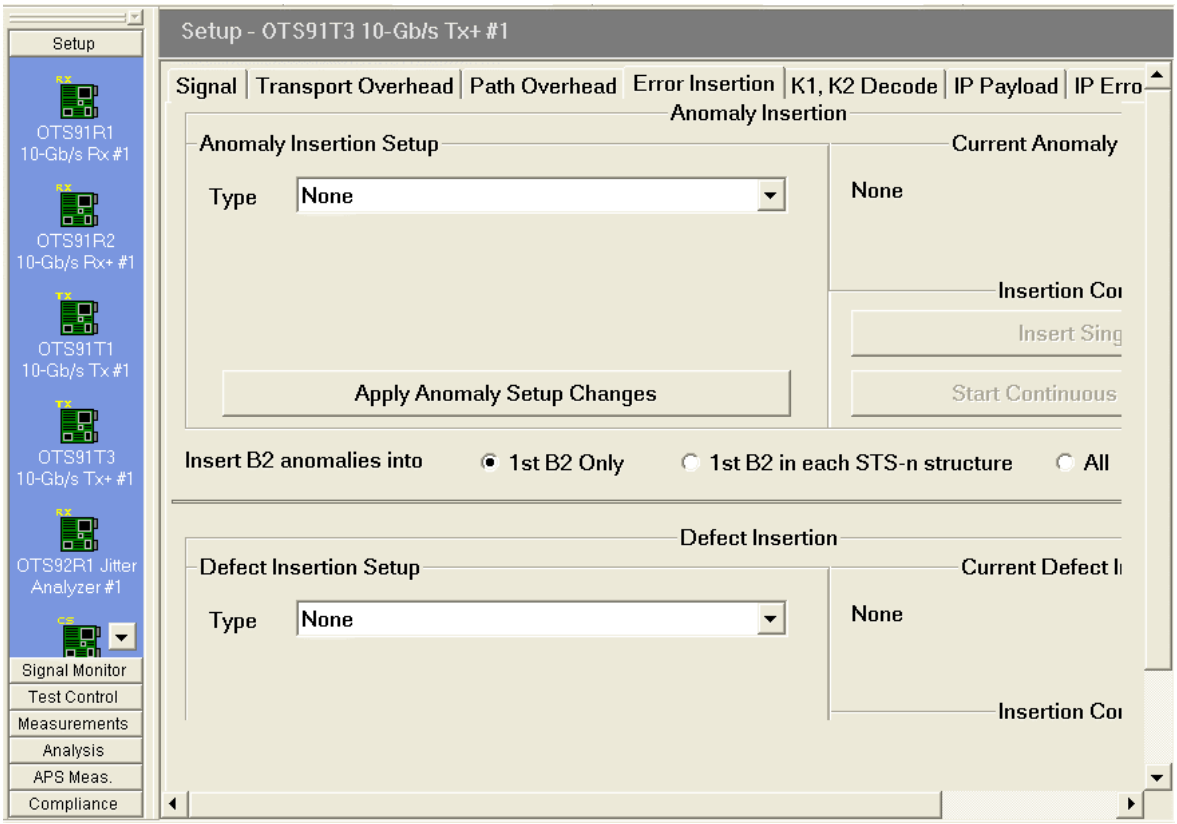



**Figure 2-21: Transmitter Error Insertion menu**

The menu is broken into two separate sections:

- Anomaly Insertion – provides the ability to inject a single anomaly or continuously inject at a selected rate.
- Defect Insertion - provides the ability to inject a defect as a single burst or in continuous insertion

## Anomaly Insertion

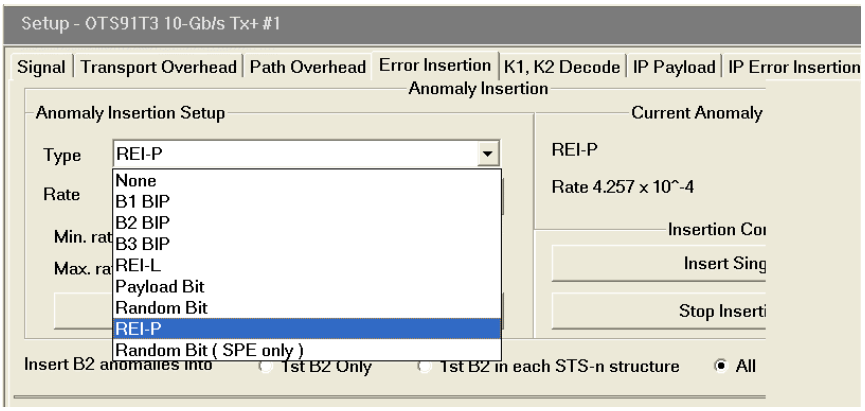



**Figure 2-22: Anomaly Insertion of the Error Insertion menu**

The anomaly insertion section of the error insertion menu, as shown in Figure 2-22, provides all controls for inserting anomalies. The Anomaly Insertion Setup, shown to the left of the example (Figure 2-22), provide menus for anomaly insertion setup. The Current Anomaly Insertion and Insertion Control, shown to the right, supply information on the current insertion state and provide the insertion controls.

To select the type of anomaly injected, use the pull-down menu labeled Type under Anomaly Insertion Setup. The anomaly types available are B1 BIP, B2 BIP, B3 BIP, MS REI (REI-L), Payload Bit, Random Bit, REI-P, and Random Bit (SPE only). To choose an anomaly rate, click on the arrows or highlight and type in the boxes labeled Rate. Or click on the Max Rate button to inject the maximum rate.

***NOTE:*** *For these changes to take place, the Apply Anomaly Setup Changes button must be clicked. The Current Anomaly Insertion settings will then reflect the new changes.*

The ability to insert single B2 anomalies in either the first B2 only or the first B2 in each STM-n/OC-n structure can also be selected by clicking the appropriate radio button.

To start the anomaly injection, click one of the buttons under Insertion Control.

- Insert Single – Clicking on this button will inject a single anomaly of the type reflected under Current Anomaly Insertion.
- Start Continuous Insertion – Clicking on this button will inject a continuous insertion of the anomaly type reflected under Current Anomaly Insertion at the indicated rate.

### Anomaly Insertion and Through Mode

When inserting an anomaly in through mode, the user must check the appropriate overwrite box for the anomaly type. For example, to insert a B1 or B2 error, the Regenerate B1/B2 Parity box must be selected or the error will have no effect. The list of available anomaly types is dependent upon the overwrite controls enabled. Thus, if no overwrite controls are selected, the anomaly list will be quite short.

## Defect Insertion

The Defect Insertion section of the Error Insertion menu, as shown in Figure 2-23, provides all controls for inserting defects. The Defect Insertion Setup, on the left side, provides menus for defect insertion setup. The Current Defect Insertion and Insertion Control, on the right side, supply information on the current insertion state and provide the insertion controls.

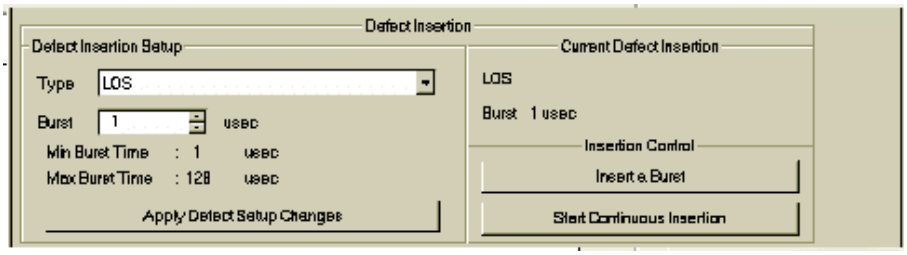



**Figure 2-23: Defect Insertion of the Error Insertion menu**

To select the type of defect injected, use the pull-down menu labeled Type under Defect Insertion Setup. The defect types available are LOS, LOF, MS AIS (AIS-L), MS RDI (RDI-L), AIS-P, RDI-P, ERDI-P Payload, ERDI-P Server, ERDI-P Connectivity, and LOP-P. To choose a defect burst time, click on the arrows or highlight and type in the boxes labeled Burst.

***NOTE:*** *For these changes to take place, the Apply Defect Setup Changes button must be clicked. The Current Defect Insertion settings will then reflect the new changes.*

To start the defect insertion, click one of the buttons under Insertion Control.

- Insert a Burst – Clicking on this button will inject a single burst of the defect type reflected under Current Defect Insertion.
- Start Continuous Insertion – Clicking on this button will continuously inject the defect type reflected under Current Defect Insertion.

## Transmitter – K1, K2 Decode

The K1, K2 Decode menu, as shown in Figure 2-24, of the Transmitter setup allows the user to edit the K1 and K2 bytes for Automatic Protection Switching (APS) measurements.

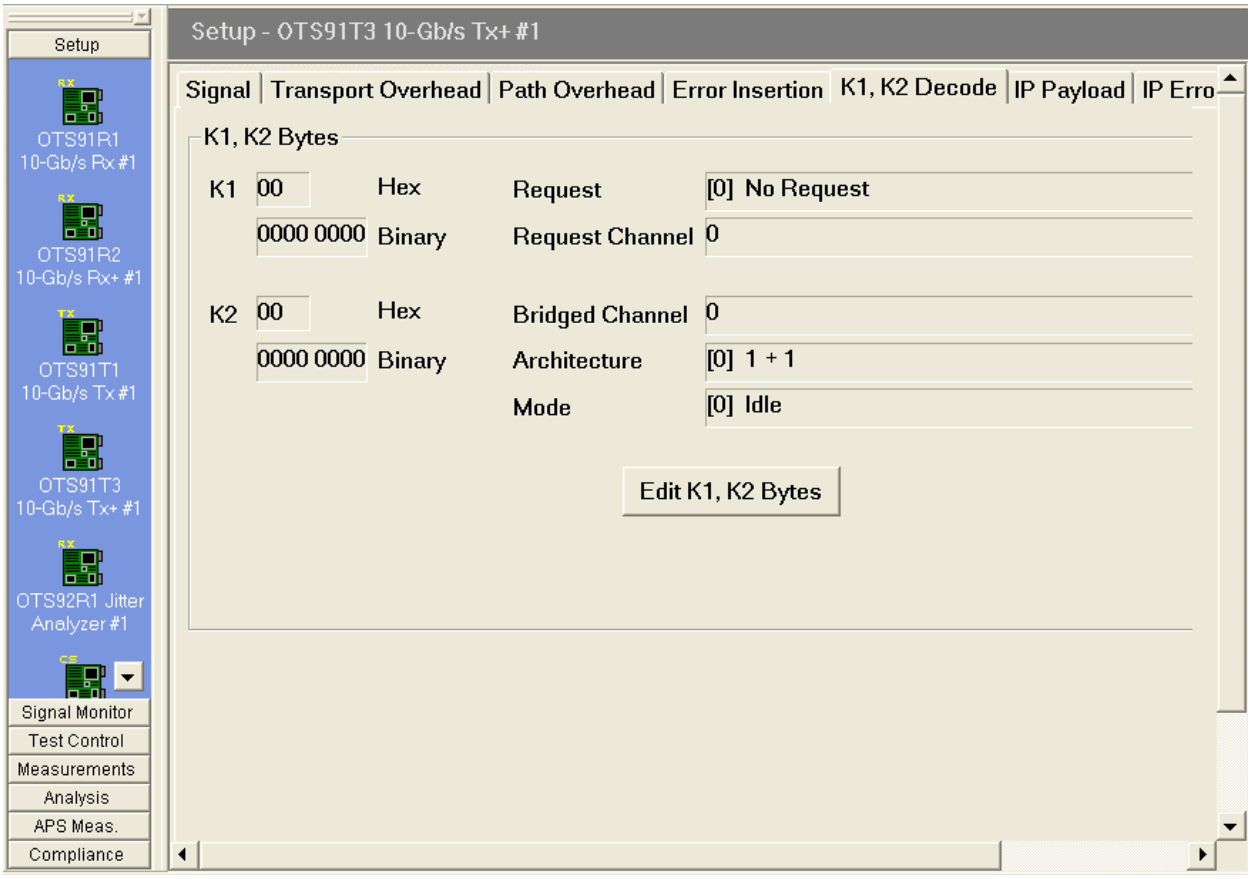



**Figure 2-24: Transmitter – K1, K2 Decode menu**

To edit, click the Edit K1,K2 Bytes button. This brings up a dialog box, shown in Figure 2-25. The dialog box displays the current K1,K2 settings and allows the option to edit the byte via hexadecimal or symbolic form (a subset of 0x00...0xFF).

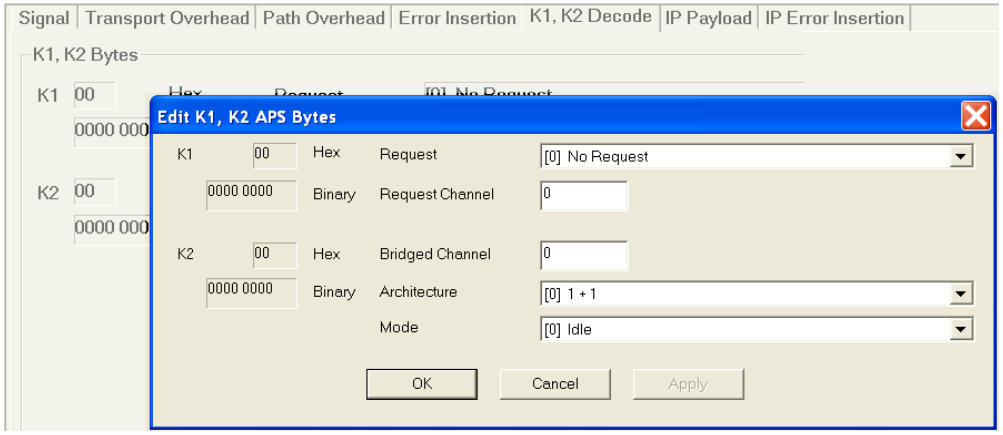



**Figure 2-25: Edit K1, K2 Bytes dialog box**

For K1, type in the channel being set and click on the Request pull-down menu to select the new value. The values available from the pull-down menu are:

- (0) No Request
- (1) Do Not Revert
- (2) Reverse Request
- (3) Unused
- (4) Exercise
- (5) Unused
- (6) Wait to Restore
- (7) Unused
- (8) Manual Switch
- (9) Unused
- (10) Signal Degrade, Low Priority
- (11) Signal Degrade, High Priority
- (12) Signal Fail, Low Priority
- (13) Signal Fail, High Priority
- (14) Forced Switch
- (15) Lockout of Position

For K2, type in the bridged channel being set then use the pull-down menus to select the architecture and mode. The values available from the architecture pull-down menu are:

- (0) 1 + 1
- (1) 1 + N

The values available from the mode pull-down menu are:

- (0) Idle
- (1) Bridged
- (2) Bridged and Switched
- (3) Not Used (Span)/Ext TR (Ring)
- (4) Unidirectional
- (5) Bidirectional
- (6) RDI-L
- (7) AIS-L

## Transmitter - IP Payload

The new Packet Over SONET (POS) feature characterizes physical layer performance of SONET and SDH equipment by generating and measuring IP traffic.

Specifically, the POS feature provides the ability to determine physical layer operating limits based on IP QoS. For instance, the sensitivity of IP routers to received laser power, optical jitter tolerace, degraded Signal to noise, and frequency offset can be determined using IP measurements.

The principle benefit of this additional feature is confidence that IP QoS is not preturbed by conforming physical layer degradations. The POS feature is not intended to be a comprehensive IP QoS tester but to enhance physical layer testing.

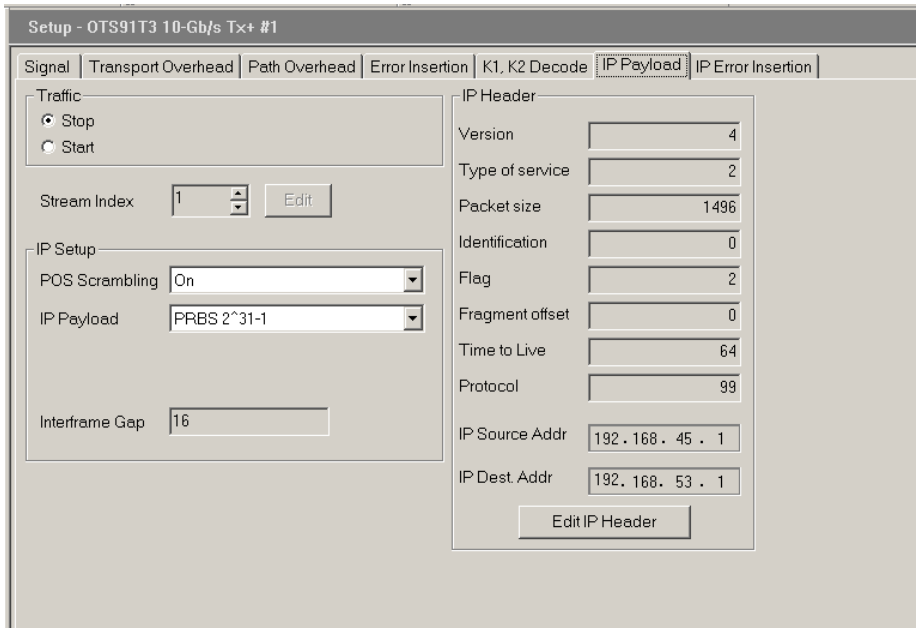



**Figure 2-26: IP Header Menu**

The IP Payload menu consists of property controls for Traffic, IP Header Setup, POS Scrambling, IP Payload and Interframe Gap. To edit the IP Header click on the Edit IP Header button. Drop down menus included in this menu allow the user to set specific properties.

**IP Setup**

The IP Payload data-gram starts with the IP header. The user can set the source and destination IP addresses. The access to these fields is through the Edit IP Header button, as described in the next section. The identification field of each data-gram contains a 16-bit number that is incremented by one for each. The sequence does not restart but continues from one packet to the next. The IP Setup area identifies the sequence and packet information.

POS Scrambling can be set to ON or OFF via the pull down menu.

The IP Payload is selectable by the pull down menu. The selections available are:

- PRBS 31
- 16-bit Word, user-selectable

If the 16-bit Word is selected, an EDIT button and selection box is displayed.

The Interframe Gap is fixed at 16. Traffic can be stopped or started by clicking the button in the Traffic section.

**IP Header**

To edit the IP Header click the button to display the Edit IP Header dialog box, as shown in Figure 2-27.

The grayed out areas of the dialog box are fixed data not selectable by the user. The user can modify the information in the white boxes.

To modify the information, click in the box and type in the new selection.

The IP Source Address contains a four-byte (32-bit) with IPv4 Internet address. This address identifies the original source of the packets.

The IP Destination Address contains a four-byte (32-bit) with IPv4 Internet address. This address identifies the final destination of the packets.

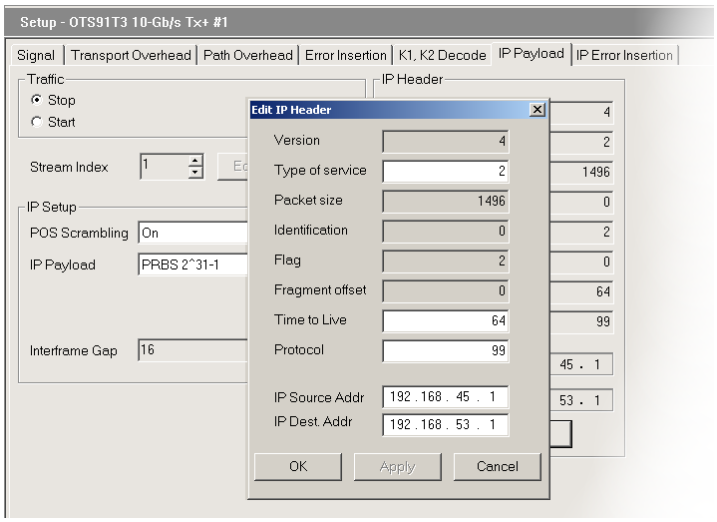



**Figure 2-27: Edit Menu for IP Header**

## Transmitter - IP Error Insertion

The IP Error Insertion Property menu consists of property controls for Stream Index, Error Selection, Error Type, Error Rate, Minimum. Rate, Maximum. Rate, and Current Error Insertion display drop down menus supply other options for each category.

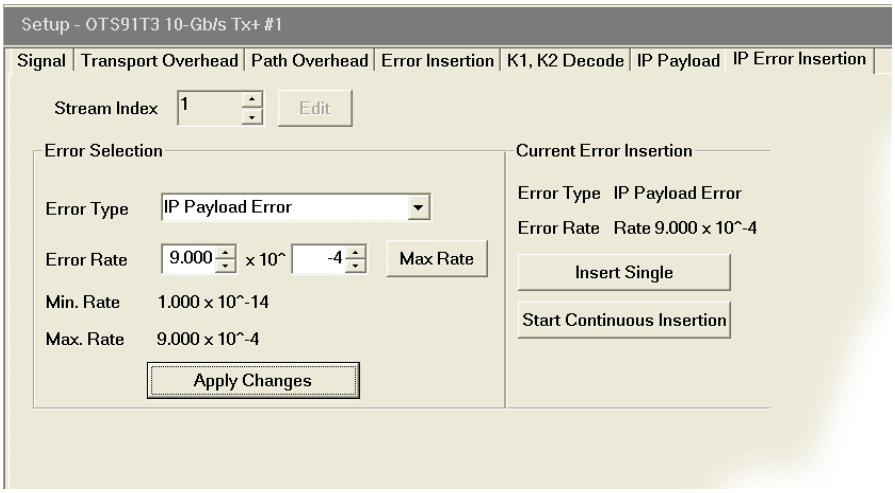



**Figure 2-28: IP Error Insertion Menu**

The Stream Index is fixed at a value of 1.

The Current Error Insertion section is only available if there is an Error Type selected under the Error Selection area.

**Error Selection**
The Error Type is selected by using the pull down menu. The Error Types available include:

- None
- HDLC FCS Error
- IP Payload Error
- IP Header Checksum Error

Once the error type is selected, the Error Rate must be selected. Use the up/down cursors or just type in the rate. For the maximum rate, click the Max Rate button.

The default setting for error type is None so before the Current Error Insertion menu is available, an error type must be selected and applied.

***NOTE:*** *The Apply Changes button must be clicked before the changes become active.*

**Current Error Insertion**

The Current Error Insertion menu is only available when the error type applied is an actual error type and not the default no error setting. The Current Error Insertion menu identifies the current error type and error rate selected.

If the Insert Single button is clicked, a single error is inserted into the IP Payload. If the Start Continuous Insertion button is clicked, errors are continuously inserted into the IP Payload. The button changes to say Stop Insertion and ACTIVE is displayed in the Current Error Insertion menu area.

To stop the error insertion, click the Stop Insertion button. The active notice is no longer displayed and the button name returns to Start Continuous Insertion.

## Receiver – Signal

The signal menu of the Receiver setup, as shown in Figure 2-26, allows the user to set the signal standard and structure, the active channel, the test pattern, and the output pulse trigger. This menu also indicates the current value of the receiver threshold offset. Drop down menus provide other choices for test analysis. Each of the selections available is described in more detail in the following sections.

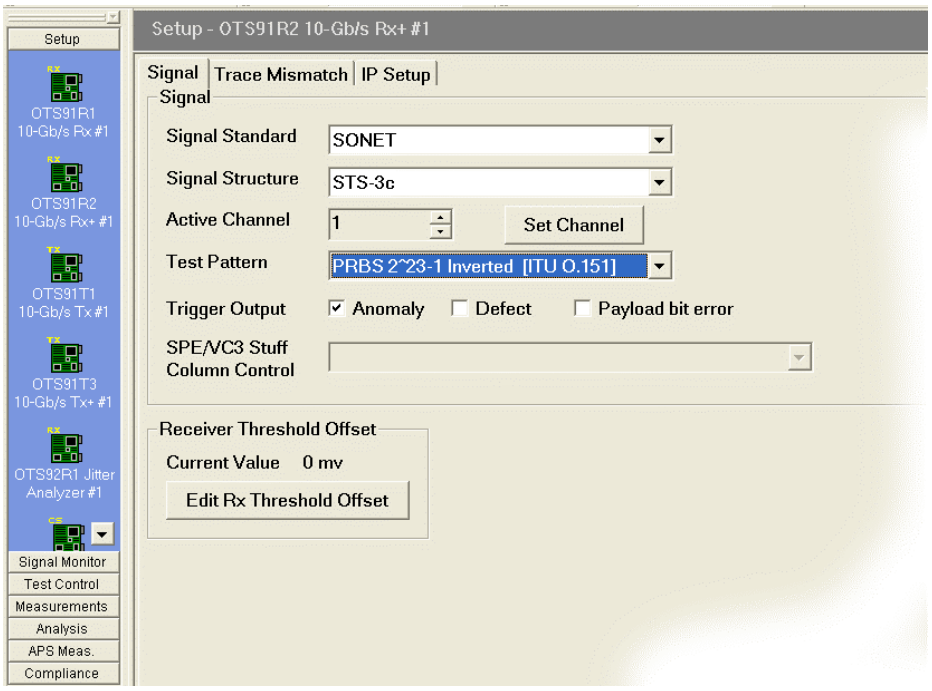



**Figure 2-26: Receiver Setup - Signal menu**

### Signal Standard

Signal Standard selects the operating mode of the receiver. To select either SONET or SDH mode, click on the pull-down menu and select the desired operating mode. The operating mode may also be selected via the menu bar. Click on System – Signal Standard and select either Set to SONET or Set to SDH.

***NOTE:*** *If the signal standard is selected via the menu bar (View>Options), the signal standard is set for all devices in the system.*

## BERT Mode

For some modules there is a third option available from the Signal Standard menu, the BERT mode. With this mode, the OTS9100 becomes a BERT generator. The Test Pattern selection for the active channel is the only valid selection on the transmitter signal setup page when BERT mode is selected. When the signal standard is returned to either SONET or SDH mode, the settings will return to the current selections in the setup menus.

Most LED indicators are also invalidated by the BERT mode. The only valid LEDs are Signal Present, TSE, and LSS.

## Signal Structure

Signal structure allows the user to choose the mapping structure of the received signal. The mapping structures provided are listed in the table below. As shown, the structures all provide concatenated structures.

| SONET | SDH |
|---|---|
| 1 x STS-192c | 1 x VC4-64c |
| 4 x STS-48c | 2 x VC4-16c |
| 16 x STS-12c | 16 x VC4-4c |
| 64 x STS-3c | 64 x VC4 |
| 192 x STS-1 | 192 x VC3 |

## Active Channel(s)

The Active Channel(s) section controls the settings for signal structure and test pattern of the selected active channel(s). To set the active channel, use the up/down cursors or click the Set Channel button. When the Set Channel button is clicked, the bar for Active channel changes into an interactive menu. Type in the text box to select the channel or click Set Channel 1 to choose channel 1.

**Test Pattern**

Test Pattern allows the user the select a pattern to fill the chosen active channel of the internally generated 9.95238 Gb/s signal. The patterns available are:

- PN15 (PRBS 2^15-1), Inverted PN15 (ITU O.151)
- PN23 (PRBS 2^23-1), Inverted PN23 (ITU O.151)
- PN31 (PRBS 2^31-1), Inverted PN31 (ITU O.150)
- All Zeros
- All Ones
- Fixed Data (8-bit)

In order to use the POS testing capabilities, POS must be selected as the Active Channel Test Pattern. In addition, POS must be selected as the Active Channel Test Pattern in the Receiver Setup menu.

***NOTE:*** *To receive a POS test pattern, the Signal Structure must be set to STS-192c.*

When Fixed Data is selected a button marked Edit Fixed Data is displayed. To change the Fixed Data to a different value, click the Edit Fixed Data button and type the new value into the text box beside the button. In the Test Pattern selection box, observe that the value after Fixed Data changes to match the newly entered value.

**SPE/VC3 Stuff Column Control**
The stuff column control allows column 30 and column 59 of the SPE (VC3) to be stuffed with either all zeros or with the payload pattern. This option is only available if the pattern is STS-1 or VC3.

## Trigger Output

The Trigger Output allows the user to select what condition activates the output trigger. Check the appropriate box for Anomaly, Defect, or Payload trigger, or activate all three. Triggering on defects provides an active HIGH for each frame in which a defect is inserted. Triggering on anomalies provides an active HIGH for each frame in which an anomaly is inserted. Triggering on anomalies provides an active HIGH for every occurring TSE error.

## Receiver Threshold Offset

The Receiver Threshold Offset provides a means to change the decision point of the signal eye. The decision point is the point at which the signal is declared a one or a zero. The receiver threshold offset allows the user to shift this decision point changing the offset. This ability is useful during Q-factor analysis and accelerated BER testing.

To edit, click the Edit Rx Threshold Offset button, which then displays the Receiver threshold offset dialog box as shown in Figure 2-27.

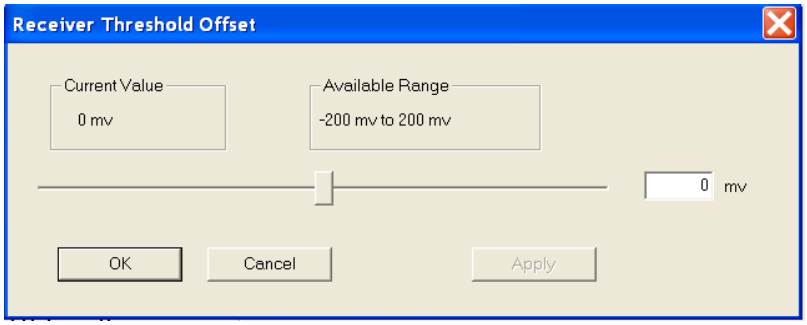



**Figure 2-27: Receiver Threshold Offset dialog box**

The current value of the receiver threshold offset is displayed in the upper left-hand corner under the Current Value heading. The available range is shown in the right-hand corner. To change the threshold offset, click and drag the slide bar then click Apply. The Current Value should change to match the new value.

***NOTE:*** *The new value will not take affect until Apply is clicked. If the slide bar is changed but Apply is not clicked, the Current Value will not change.*

## Receiver – Trace Mismatch

The trace mismatch menu of the Receiver setup, as shown in Figure 2-28, provides the setup information for the J0/J1 Trace, C2 Status, and HP Detection. Each of the selections available is described in more detail in the following sections.

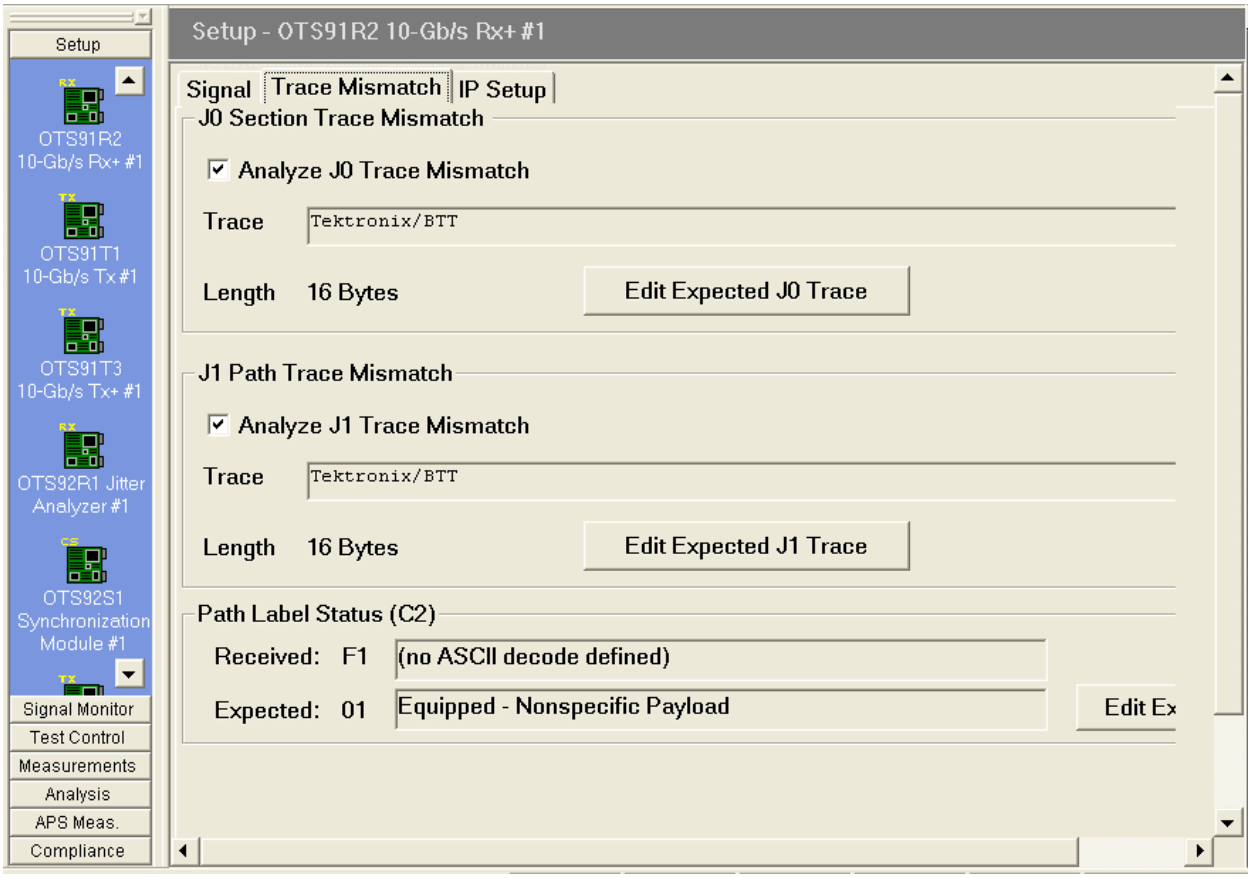



**Figure 2-28: Receiver Setup – Trace Mismatch menu**

### J0 Multi-Byte Trace

J0 Trace provides a capability to uniquely identify each of the multiple channels being carried in a Dense Wave Division Multiplexer (DWDM) system, providing an end-to-end continuity check. The OTS9100 has the ability to generate unique J0 traces. This allows test signals to be easily identified, or to simulate network-element generated traffic without the Trace Identifier Mismatch (TIM) alarm being generated. The OTS9100 capability to display the received J0 trace allows users to verify continuity and correct routing of individual channels within the multi-channel DWDM system.

To analyze, ensure the box beside the Analyze J0 Trace Mismatch is checked.

To edit, click on the Edit Expected J0 Trace button. A dialog box is displayed, as shown in Figure 2-29, reflecting the current settings of the J0 Trace. Click the appropriate radio button to choose between No Trace, 16 Byte Trace, and 64 Byte Trace. To input a Trace Value, click in

the Trace Value box and start typing. When the desired edits are complete, click OK to return to the main menu. In 16-byte, the last byte is filled with CRC. In 64-byte, the last two bytes are filled with CR LF.

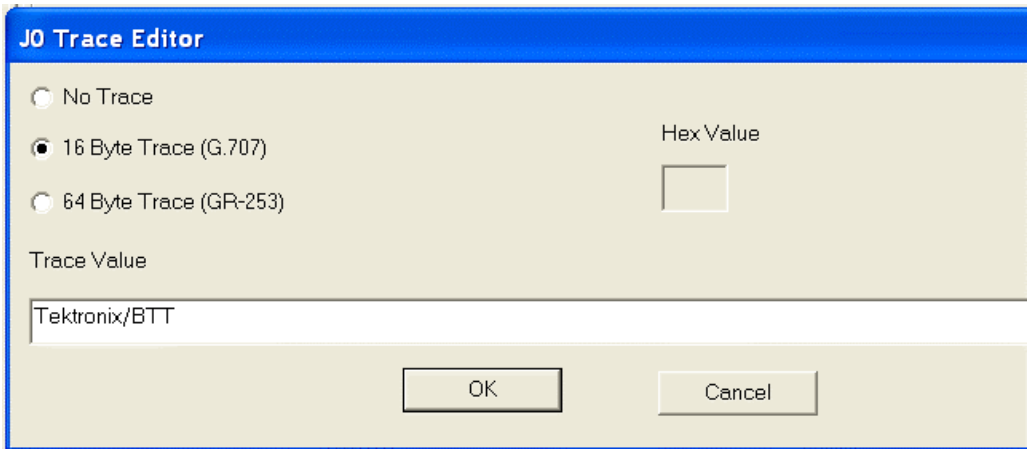



**Figure 2-29: J0 Trace Editor dialog box**

## J1 Multi-Byte Trace

J1 Trace provides a capability to uniquely identify each of the multiple channels being carried in a Dense Wave Division Multiplexer (DWDM) system, providing an end-to-end continuity check.

To analyze, ensure the box beside the Analyze J1 Trace Mismatch is checked.

To edit, click on the Edit Expected J1 Trace button. A dialog box is displayed, as shown in

Figure 2-30, reflecting the current settings of the J1 Trace. Click the appropriate radio button to choose between No Trace, 16 Byte Trace, and 64 Byte Trace. To input a Trace Value, click in the Trace Value box and start typing. In 16-byte, the last byte is filled with CRC. In 64-byte, the last two bytes are filled with CR LF.

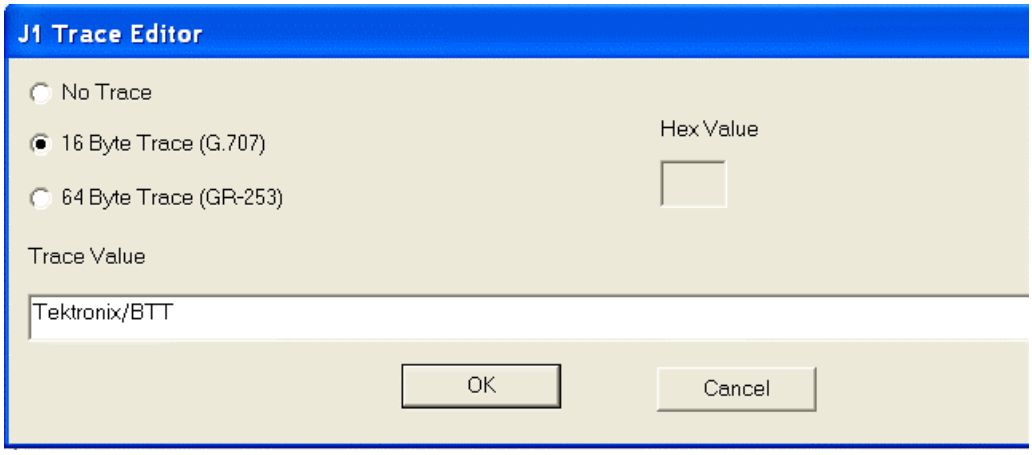



**Figure 2-30: J1 Trace Editor dialog box**

## Edit C2 Byte

The C2 byte is the Path Signal label. The C2 byte can be any value from 0x00 to 0xFF and may be set in hexadecimal or symbolic form.

To edit, click the Edit Expected C2 button. This brings up a dialog box, shown in Figure 2-31. The dialog box displays the current C2 setting and allows the option to edit the byte via hexadecimal or symbolic form (a subset of 0x00...0xFF).

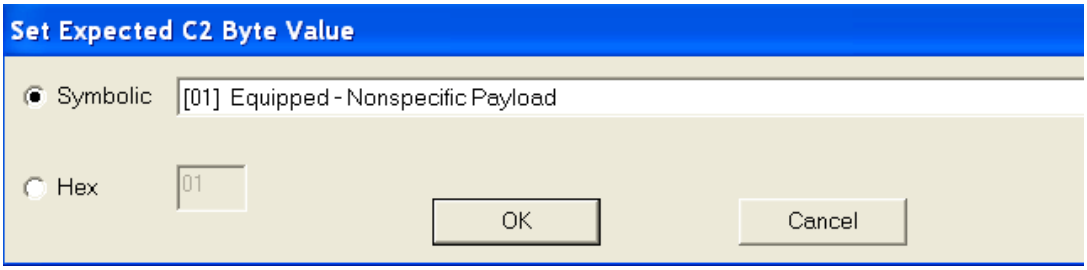



**Figure 2-31: Edit C2 dialog box**

To change the setting, click the radio button for Symbolic or Hex (hexadecimal). Type in the text box by the Hex heading to input a new value or click on the Symbolic button and click on the pull-down menu. The values available from the pull-down menu are:

- (00) Unequipped
- (01) Equipped – Nonspecific
- (02) VT-Structured STS-1 SPE
- (03) Locked VT Mode
- (04) Asynchronous Mapping for DS3
- (12) Asynchronous Mapping for DS4NA
- (13) Mapping for ATM
- (14) Mapping for DQDB
- (15) Asynchronous Mapping for FDDI
- (16) HDLC-Over-SONET Mapping
- (FE) O.181 Test Signal (TSS1 to TSS3) Mapping
- (FF) Reserved

## HPPLM and HP Unequipped Detection

If Anaylysis Path Label Mismatch box is checked the Detect any Mismatch and Detect Signal Label Mismatch per GR253 Table 6-2 boxes are enabled and Path Label Mismatch is analyzed, otherwise the boxes are disabled and Label Mismatch will not be analyzed.

For the HP Unequipped Detection section, if the box is checked, the Unequipped High Path is analyzed.

# Receiver – IP Setup

The IP Setup menu of the Receiver setup, as shown in Figure 2-6, provides the IP setup information. Each of the selections available is described in more detail in the following sections.

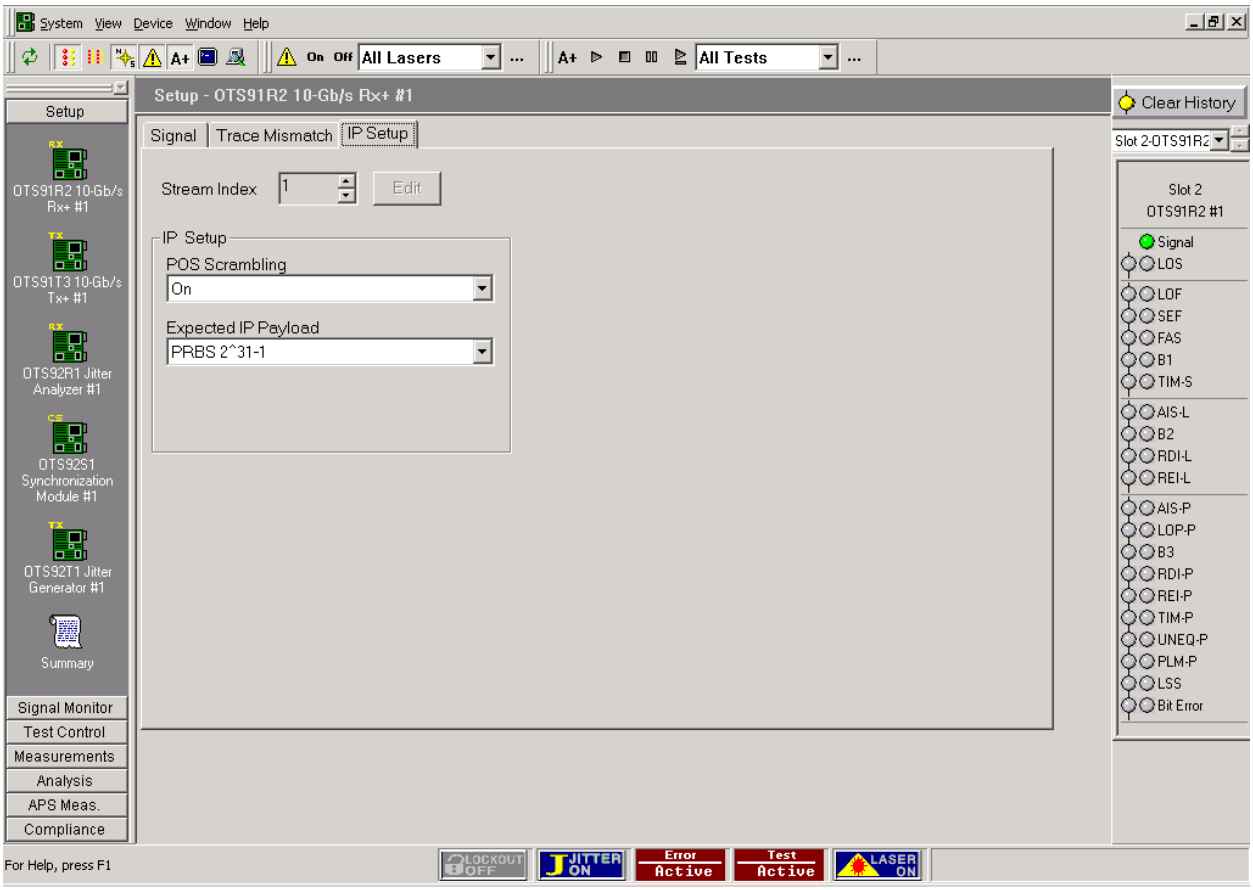



**Figure 2-6: Receiver Setup – IP Setup menu**

The Stream Index is fixed at a value of 1.

**IP Setup**
The IP Payload data-gram starts with the IP header.

POS Scrambling can be set to ON or OFF via the pull down menu.

The IP Payload is selectable by the pull down menu. The selections available are:

- PRBS 31
- 16-bit Word, user-selectable

If the 16-bit Word is selected, an EDIT button and selection box is displayed.

## Setup - Summary

The Setup Summary menu, as shown in Figure 2-32, provides a summary of the setup conditions for each Transmitter and Receiver individually. Clicking on the Turn Laser OFF buttons will turn the laser off. Clicking on the Receiver Setup will display the Receiver Setup menu for the specific Receiver number chosen. Clicking on the Transmitter Setup will display the last edited menu tab of the Transmitter Setup menu for the specific Transmitter number chosen.

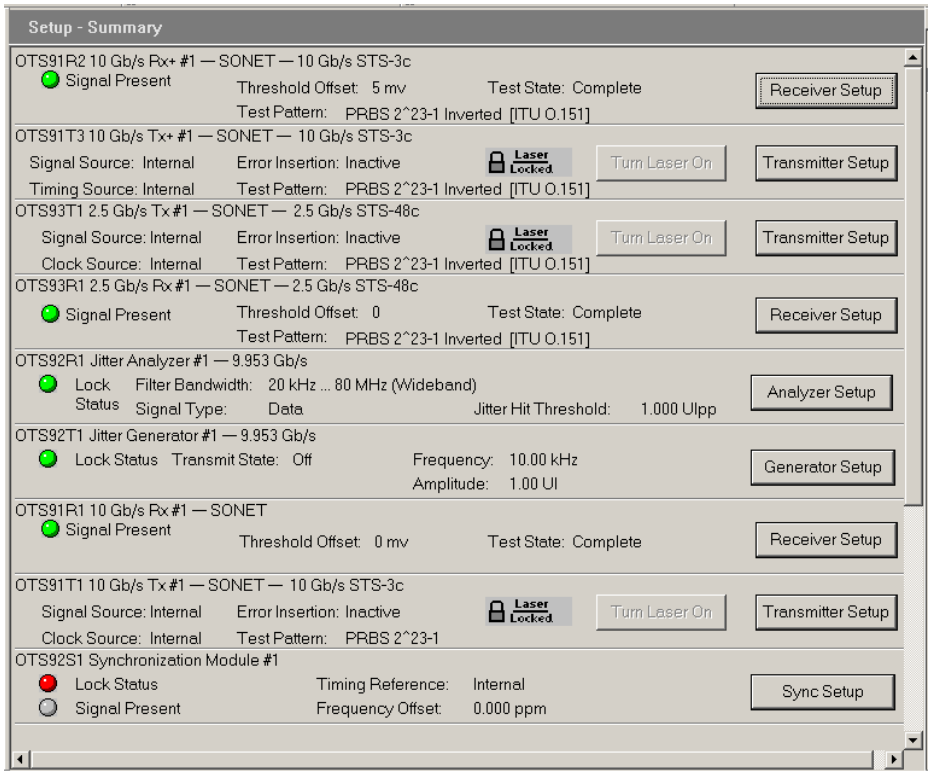



**Figure 2-32: Setup Summary menu**

# Signal Monitor Menus

When Signal Monitor is selected from the Navigation window, icons for all loaded Receiver modules are displayed. The Signal Monitor menu provides separate configuration control over each receiver by these individual icons.

If an Rx icon is clicked, the Receiver signal monitor menu is displayed. This menu contains four separate menu screens; each selected by a tab. These tabs, Transport Overhead, Path Overhead, K1,K2 Decode, and Payload, each display an aspect of the Signal Monitor function.

## Receiver – Transport Overhead

The transport overhead menu, as shown in Figure 2-33, displays the current activity of the transport overhead as monitored by the selected receiver. The Section Trace (J0) and the S1 Synchronization Status provide additional information received.

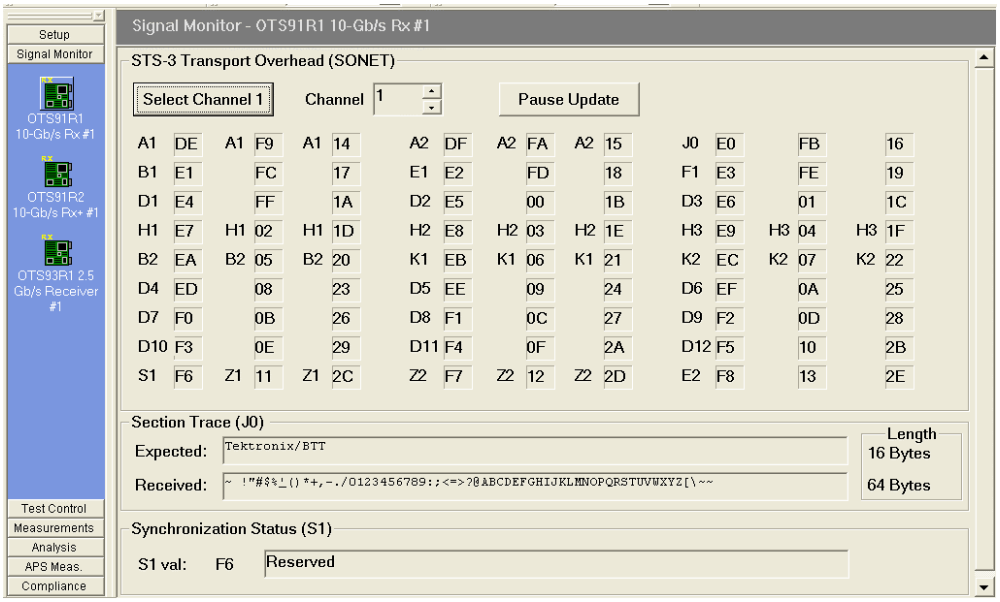



**Figure 2-33: Signal Monitor – Transport Overhead**

The Transport Overhead section displays the overhead for the selected STM-1/STS-3. The information presented on the screen is constantly updated. To suspend the update, click the Pause Update button. The button will change to a Resume Update button and will say "PAUSED" beside it, as shown in Figure 2-34. The display will not be updated again until the Resume Update button is clicked.

***NOTE:*** *Pausing the update only suspends the local display updates, the OTS9100 is still capturing data.*
***NOTE:*** *The title at the top of the menu reflects the overhead in the mode of the selected receiver, not the notation selected through the options menu.*

# RS Trace (Section Trace) (J0)

The Section Trace (J0) provides the current values of the J0 multi-byte trace. The 16-byte J0 Trace receives 15 bytes ending with a CRC. The 64-byte J0 Trace receives 62 bytes with CR LF. The Expected and Received values are both displayed, providing an easy visual comparison of the J0 Trace. The length of the Trace is also provided as both expected and received values.

# S1 Synchronization Status

S1 Synchronization Status displays the S1 byte values. The S1 byte values are decoded and displayed in ASCII format. To edit the S1 byte, go to the Overhead section of the Transmitter setup and enter the desired hexadecimal value.

The S1 byte display is only active when the overhead channel is set to 1.

## Receiver – Path Overhead

The path overhead menu, as shown in Figure 2-35, displays the current activity of the path overhead as monitored by the selected receiver. The Path Trace (J1) and the C2 Status provide additional information received.

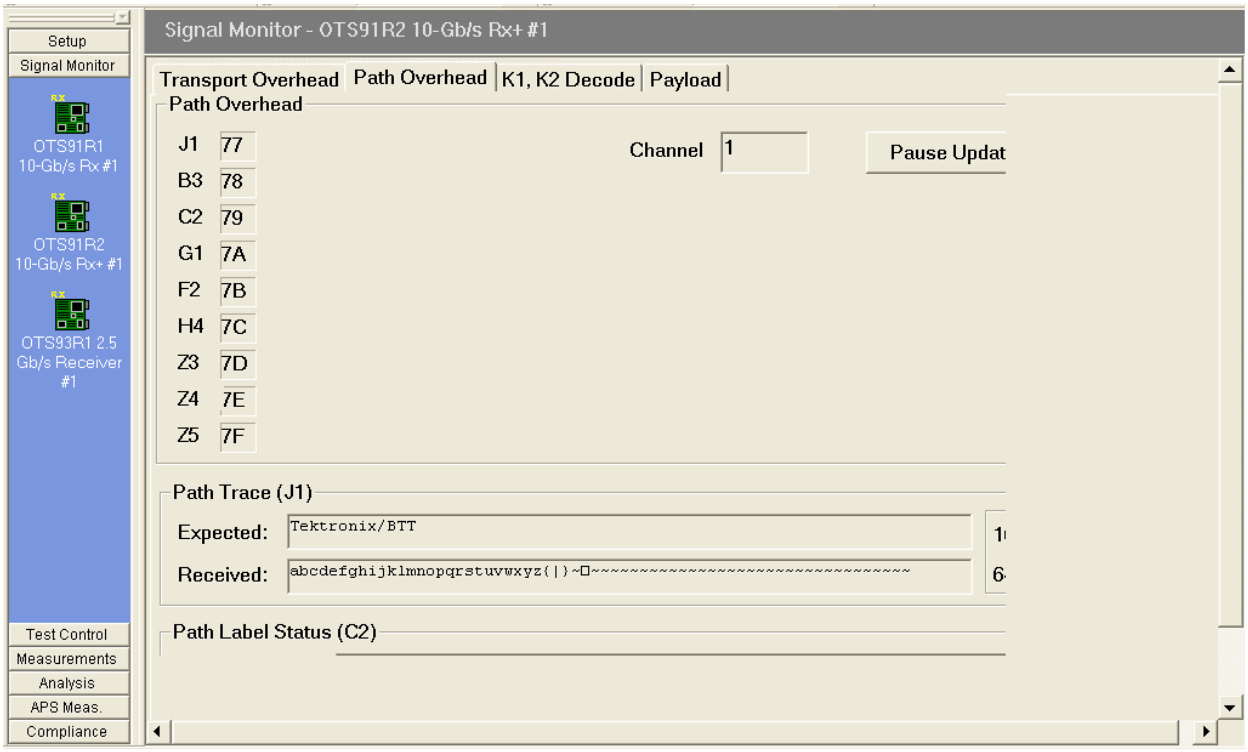



**Figure 2-35: Signal Monitor – Path Overhead**

The Path Overhead section displays the overhead for the selected STM-1/STS-3. The information presented on the screen is constantly updated. To suspend the update, click the Pause Update button. The button will change to a Resume Update button and will say "PAUSED" beside it. The display will not be updated again until the Resume Update button is clicked.

***NOTE:*** *Pausing the update only suspends the local display updates, the OTS9100 is still capturing data.*

The listed channel refers to the active channel of the receiver. Only the active channel payload can be monitored. To change this display, change the active channel in the receiver signal menu setup.

## Path Trace (J1)

The Path Trace (J1) provides the current values of the J1 multi-byte trace. The 16-byte J1 Trace receives 15 bytes ending with a CRC. The 64-byte J1 Trace receives 62 bytes with CR LF. The Expected and Received values are both displayed, providing an easy visual comparison of the J1 Trace. The length of the Trace is also provided as both expected and received values.

## C2 Status

C2 Status displays the received and expected C2 byte values. The C2 byte value is decoded and displayed in ASCII format. To edit the C2 byte, go to the Path Overhead section of the Transmitter setup and enter the desired hexadecimal value.

## Receiver – K1,K2 Decode

The K1,K2 Decode signal monitor screen, as shown in Figure 2-36, displays the received results of the K1, K2 bytes.

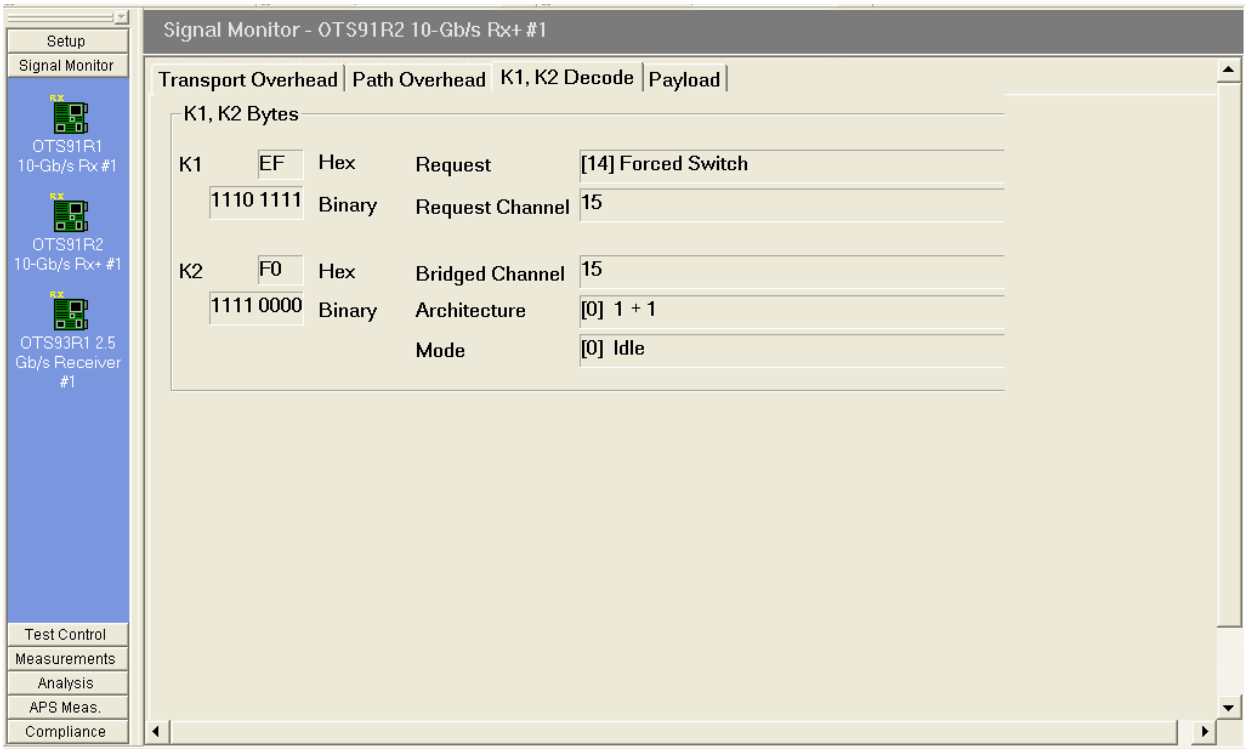



**Figure 2-36: Signal Monitor – K1,K2 Decode**

## Receiver – Payload

The Payload signal monitor screen, as shown in Figure 2-37, provides a graphical representation of the signal structure of the system. The system analyzes the incoming signal and displays the configuration. Any of the structures can be clicked and the identifying information for that channel is displayed.

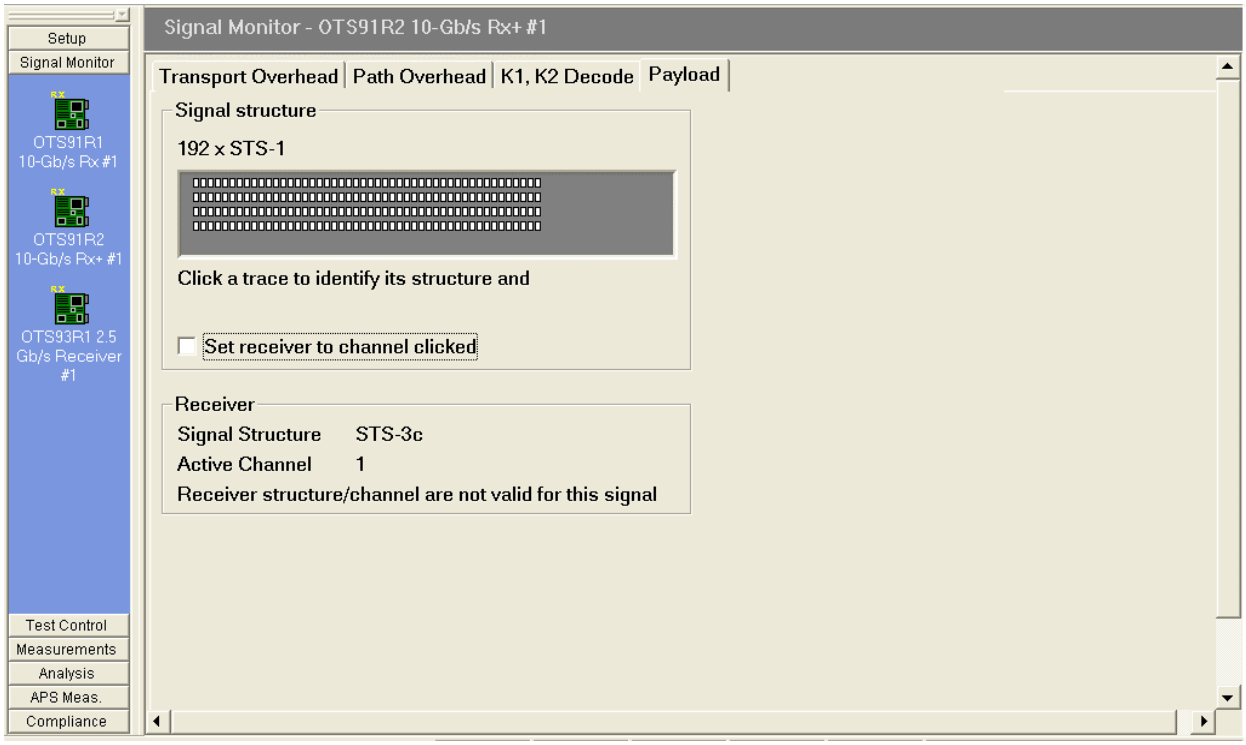



**Figure 2-37: Signal Monitor – Payload**

# Test Control Menu

When Test Control is selected from the Navigation window, the Test Control menu is displayed, as shown in Figure 2-38. The Test Control menu allows the user to choose the type of test to run and the time the test will run.

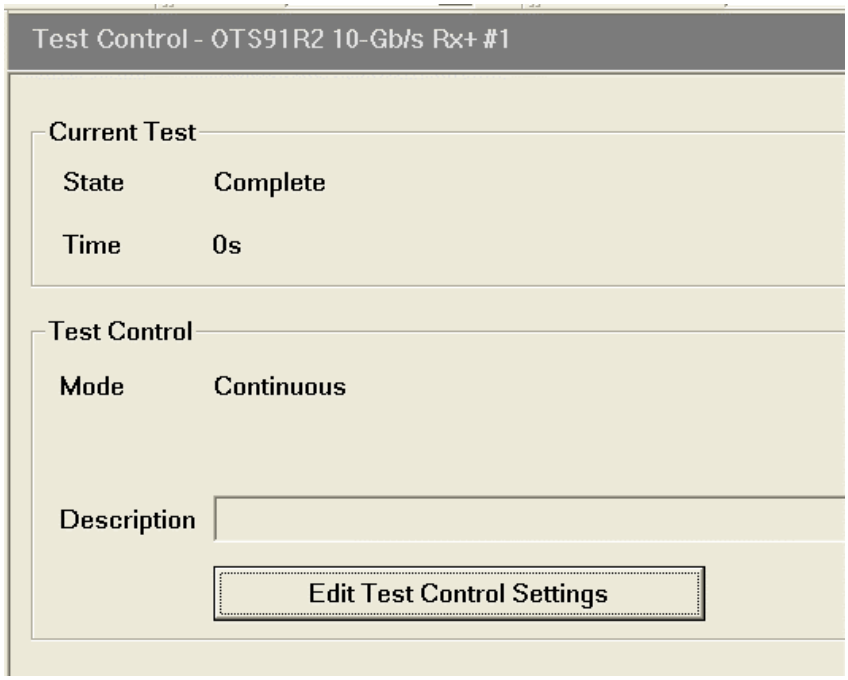



**Figure 2-38: Test Control Menu**

The Current Test section describes the state of the current test and the time of the current test. The Test Control section provides the current test mode and provides an edit box for the user to include a description of the current test. To edit the test control settings, click on the Edit Test Control Settings button. The Test Parameters dialog box, shown in Figure 2-39, is now displayed.

The Test Mode section enables the user to set continuous, timed, or timed-repetitive tests. The Continuous setting configures the test cycle so that it will run continuously from the time that the Start button is clicked until the Stop button is clicked. The Timed setting configures the test cycle to run the test for the duration of the test time. The Timed-Repetitive setting configures the test cycle to run the test for the duration of the test time and then to repeat the same test again. To choose the Test Mode click the appropriate radio button.

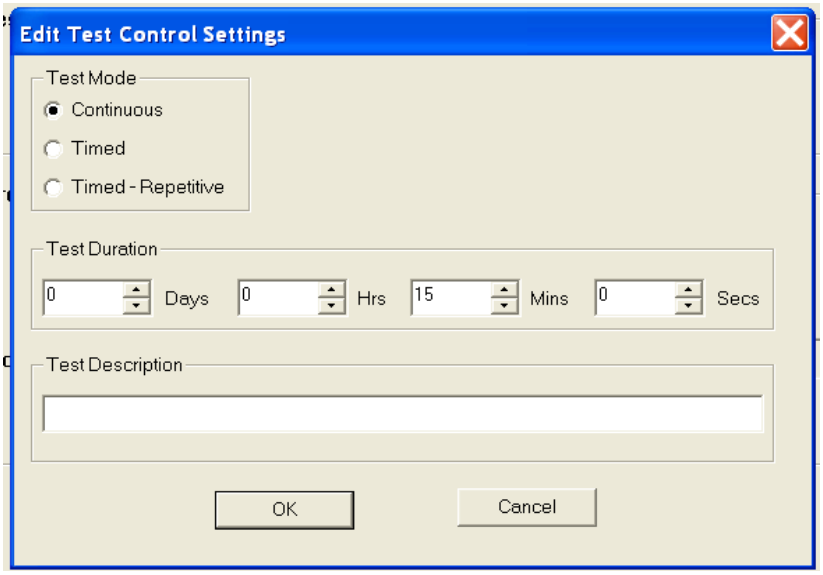



**Figure 2-39: Test Control Parameters dialog box**

The Test Duration section provides the means to set the length of the test if the Timed or Timed-Repetitive tests were chosen. To set the test duration select the desired test length time by clicking up/down arrows in the Days, Hours, Minutes, and Seconds boxes.

By clicking in the box labeled Test Description, a description of the test may be entered. When editing is finished, click OK to return to the Test Control menu.

# Test Control Summary

The Test Control Summary menu, as shown in Figure 2-40, provides a summary of the test control conditions for each Receiver individually. Clicking the Edit button will display the Test Control menu for the specific receiver number chosen. Clicking the Start button will begin a test on the specific receiver number chosen. Once the Start button is clicked, it changes to a Stop button. The Pause button is grayed out until a test is started, then it may be clicked to pause a test.

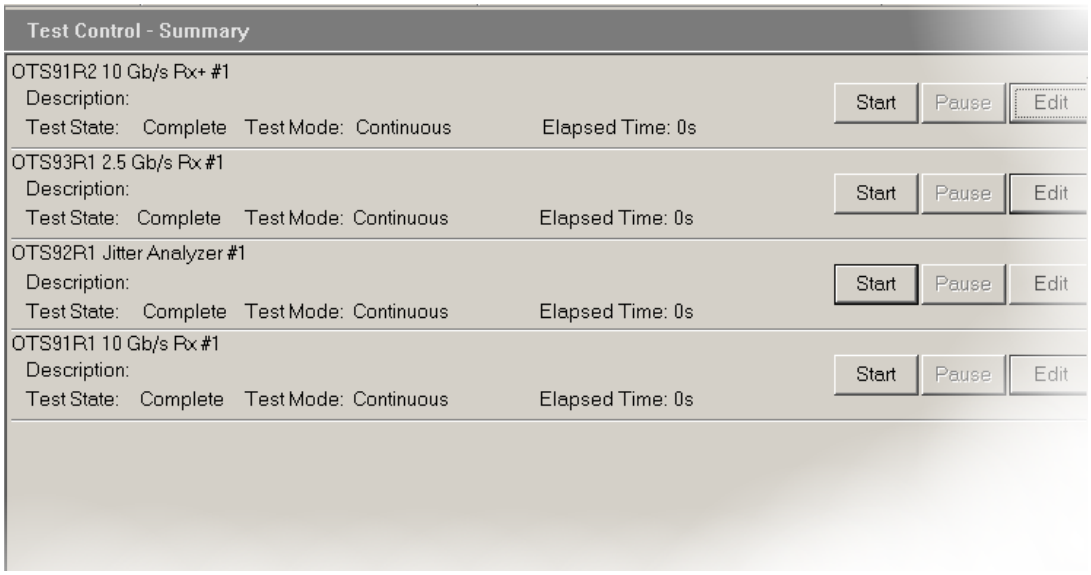



**Figure 2-40: Test Control Summary menu**

# Measurements Menu

When Measurements is selected from the Navigation window, the Measurements menu is displayed. The Measurements menu provides separate configuration control over each receiver through associated icons.

If an Rx icon is clicked, the Receiver signal monitor menu is displayed. This menu contains separate menu screens; each selected by a tab. These tabs, each display an aspect of the Receiver Measurement function.

## Receiver - Real-Time

The Real-Time menu has four tab selections provided as property page display choices: Real-Time, Cumulative, History and IP Measurements. The real-time display menu provides the ability to view the errored seconds, error counts, and error ratios for each error condition monitored during the last n seconds (up to sixty). There is a Section and Line View, a Path View and a Selected View. If Selected is chosen, a window is displayed, which allow the user to select four error measurements.

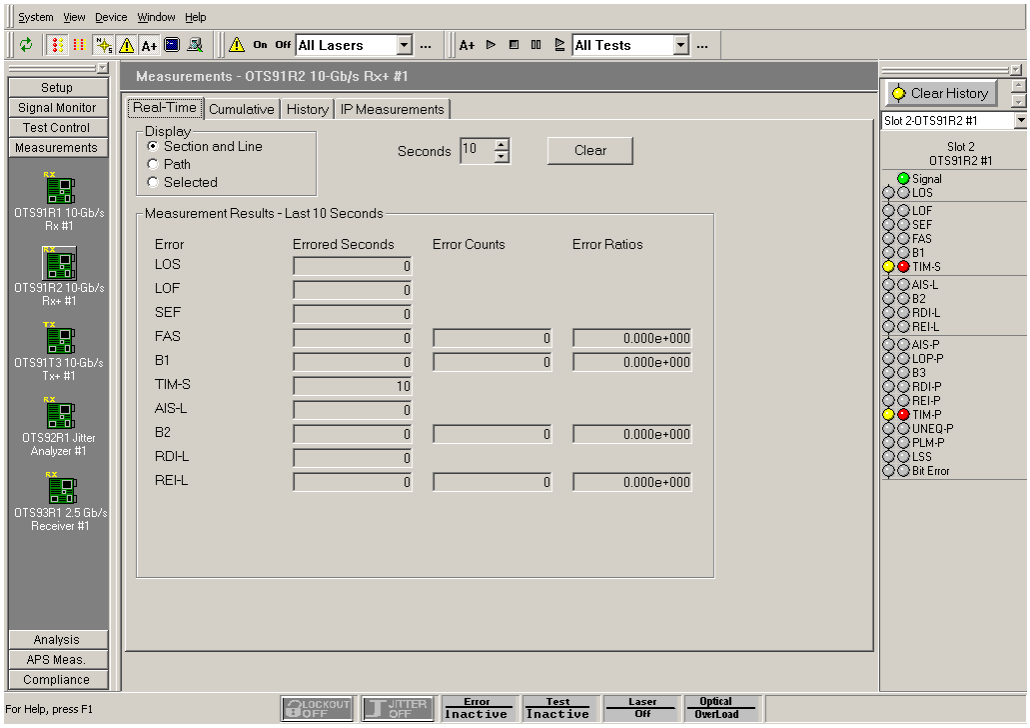



**Figure 2-41: Real-Time menu – Section and Line display**

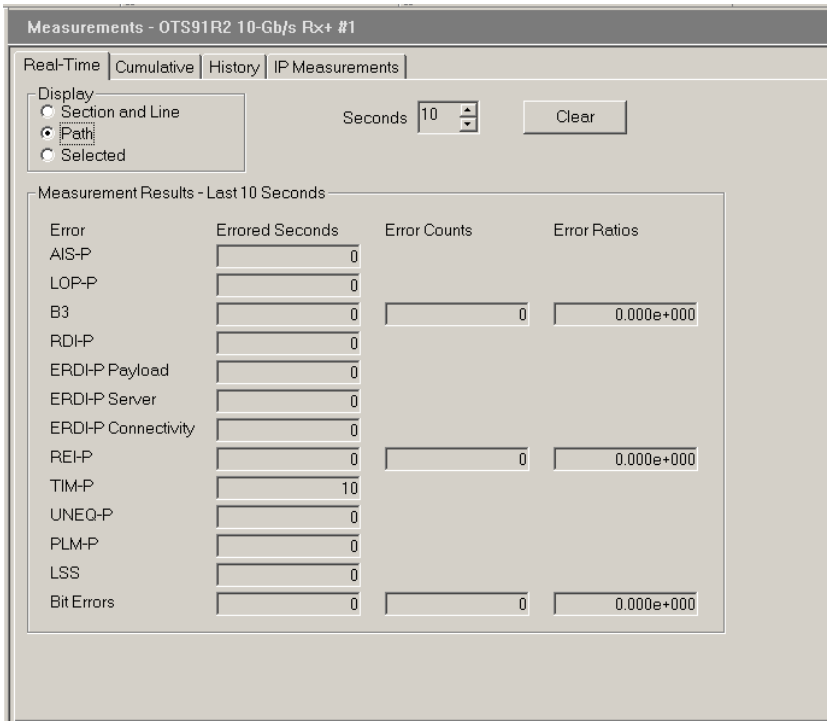



**Figure 2-42: Real-Time menu – Path display**

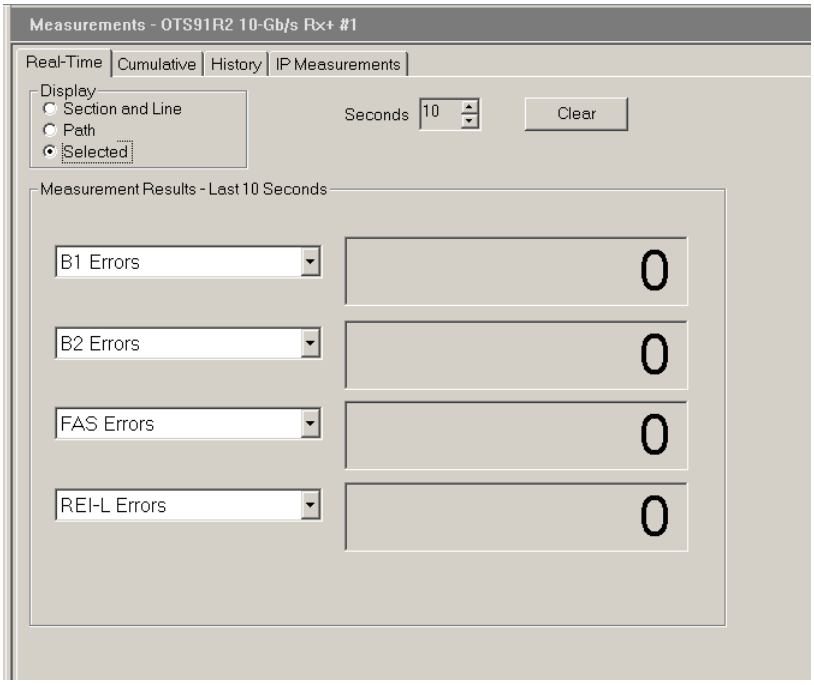



**Figure 2-42: Real-Time menu – Selected display**

## Receiver - Cumulative

The cumulative menu has two selections on the top for Display choices, Section and Line, and Path. The cumulative display menu provides a summary of the errored seconds, error counts, and error ratios for each error condition monitored during the test. The results are accumulated while the test is in progress and are cleared when a new test begins. The measurements shown reflect the display choice, as shown in Figures 2-44 and 2-45.

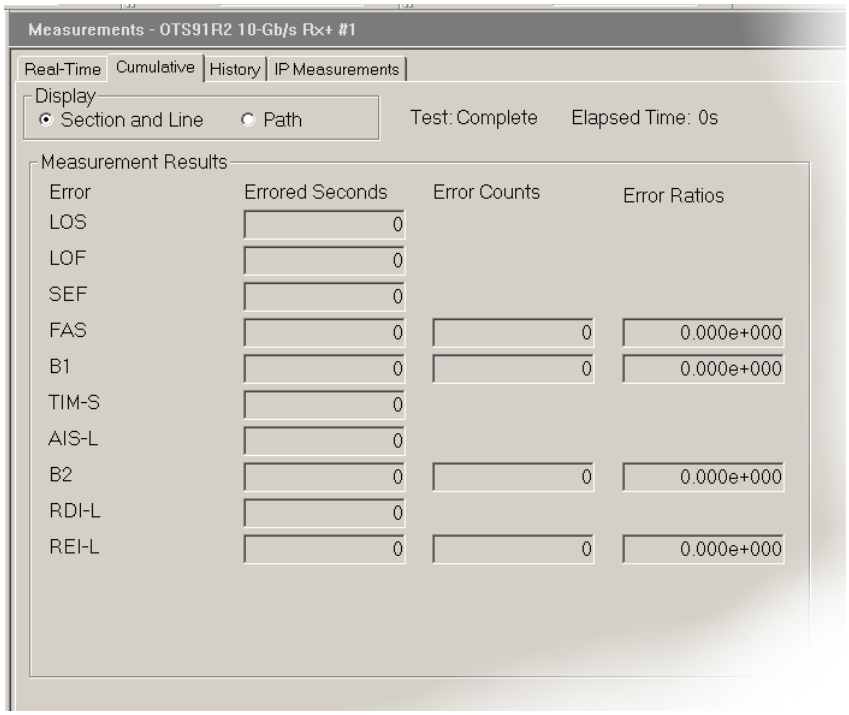



**Figure 2-44: Cumulative Measurements Display – Section and Line**

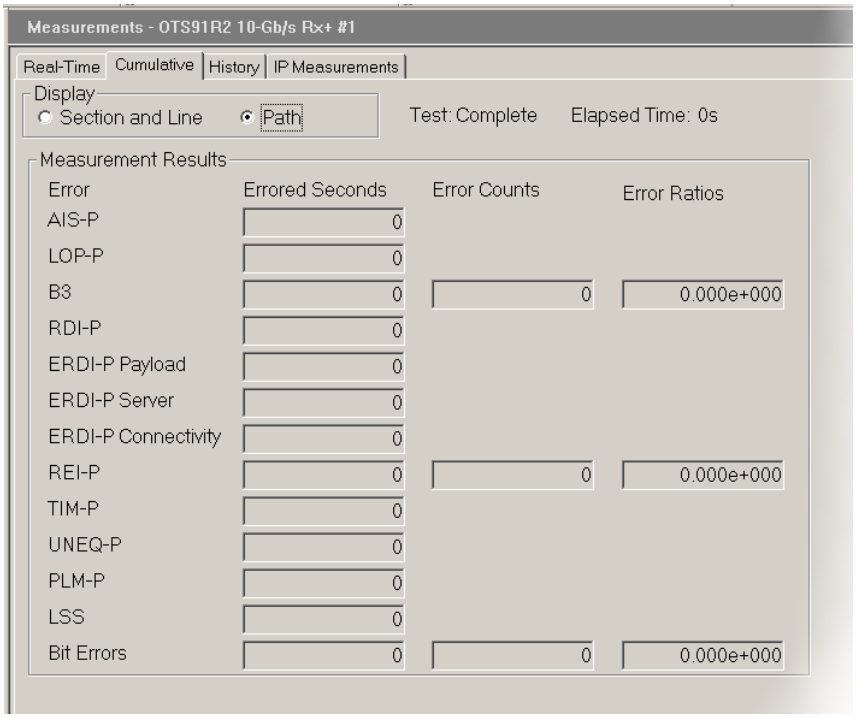



**Figure 2-45: Cumulative Measurements Display - Path**

## Receiver – History

The history display shows the results history data collected by the associated receiver during the current or most recent test, as shown in Figures 2-46 and 2-47. The selections for display choices are Section/Line and Path.

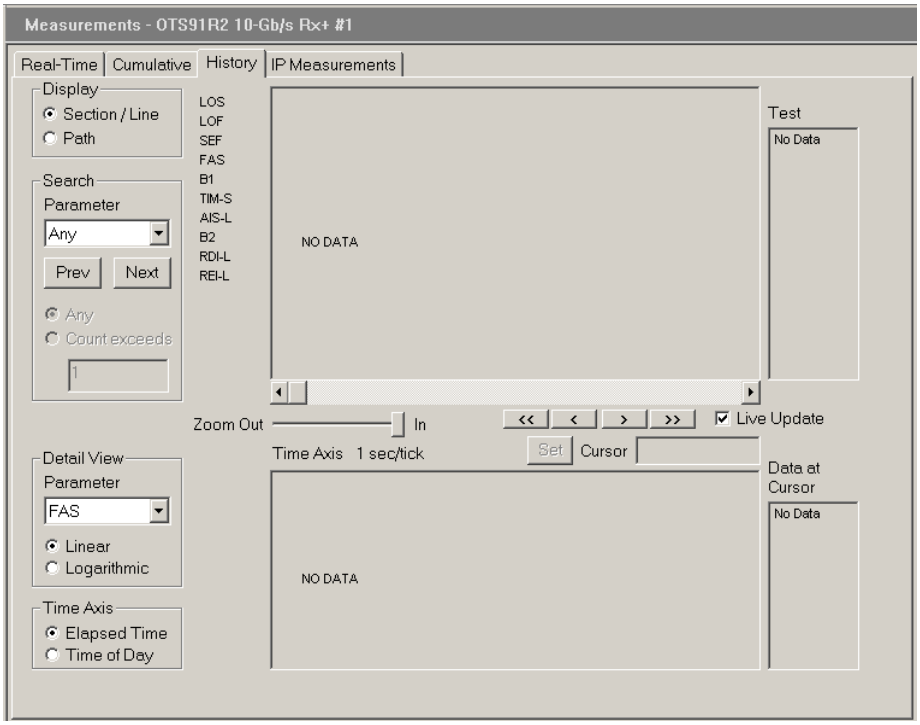



**Figure 2-46: Example of Results History Data – Section/Line**

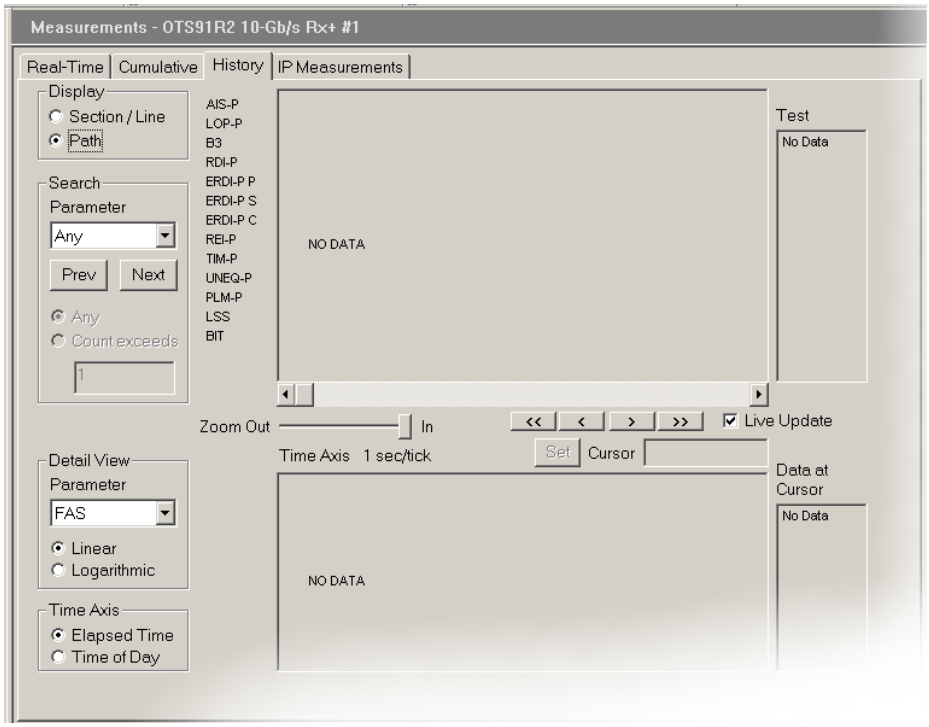



**Figure 2-47: Example of Results History Data –Path**

The **upper window** shows a trace for each measurement parameter. A dark rectangle is shown for a measurement interval during which an errored second occurred (LOS, LOF, LOP, SEF/OOF, TIM, AIS, RDI, PLM, UNEQ, LSS) or one or more errors were counted (B1, B2, B3, FAS, REI, BIT/TSE).

The **lower window** shows a bar-graph display (B1, B2, FAS, REI) of the anomaly selected by the **Detail View** selector. The display may be linear or logarithmic, and is automatically scaled based on the maximum value for that parameter.

The **Zoom Out/In** slider sets the display's time axis. The limits are 1 second/tick to 1 hour/tick. The display and the detail view scale are set accordingly.

The **Scroll bar** scrolls the display horizontally.

The display **Time Axis** may be set to show elapsed test time or time of day. Elapsed test time does not accrue when a test is paused; time of day continues.

The **Cursor**, shown as a colored line on the display, identifies a particular measurement sample. It may be positioned in several ways:

- Incrementally, by moving it with the four **Cursor buttons**
- Directly, by clicking the mouse in one of the data windows.
- Directly, by entering a time value in the **Cursor** field and clicking the **Set** button.

When the Time Axis display is set to Elapsed Time, the cursor position may be entered:

- In seconds, e.g., 135
- In hours:minutes:seconds, e.g., **2:15** or **0:2:15**
- In days, hours, minutes, seconds, e.g., **3d 4h 2m 15s**

If the first character of the time specification is a plus (**+**) or minus (**–**) sign, the time is taken relative to the current cursor position.

When the Time Axis display is set to Time of Day, times are taken as time-of-day; day specifications are relative to 0, the first day of the test. Thus, 1:00 PM on the day following the start of the test would be entered as **1d 13:00:00**.

The **Live Update** check box causes the data display to track new data as a test is running. When it is set, the cursor is automatically positioned on the most recently acquired sample and the windows scroll accordingly. Moving the cursor automatically turns off this feature.

When the **Zoom Out/In** slider is set to a resolution other than the finest, the display may be **automatically zoomed** by clicking the mouse at one edge of the area of interest, holding down the left button, and dragging it to the other edge. The zoom setting and scroll position will adjust to show the selected area at the highest resolution possible.

The **Test** window shows the test start time and date, elapsed time, and test state.

The **Data at Cursor** window shows the cursor position (elapsed time or time-of-day, as selected), the count of the selected parameter at the cursor, and the maximum value for that parameter at the current display resolution.

The **Search** controls allow searching, forward or backward, for an occurrence of the specified parameter. The search starts from the cursor location; it will not wrap beyond the end (forward) or beginning (backward) of the data. For the B1, B2, FAS, MS-REI (REI-L), B3, REI-P, and TSE parameters, one may specify a search threshold: the search will find only intervals containing at least that many errors.

## Receiver – IP Measurements

When Measurements is selected from the Navigation window, the Measurements menu is displayed. If a Receiver icon is clicked, the Receiver Measurements menu is displayed. This menu contains four separate menu screens; each selected by a tab. These tabs, Real-Time, Cumulative, History, and IP Measurements, each display an aspect of the Receiver Measurement function.

The IP Measurements screen, as shown in Figure 2-7, provides the measurement results of the HDLC Frames and the IP Packets/Bytes.

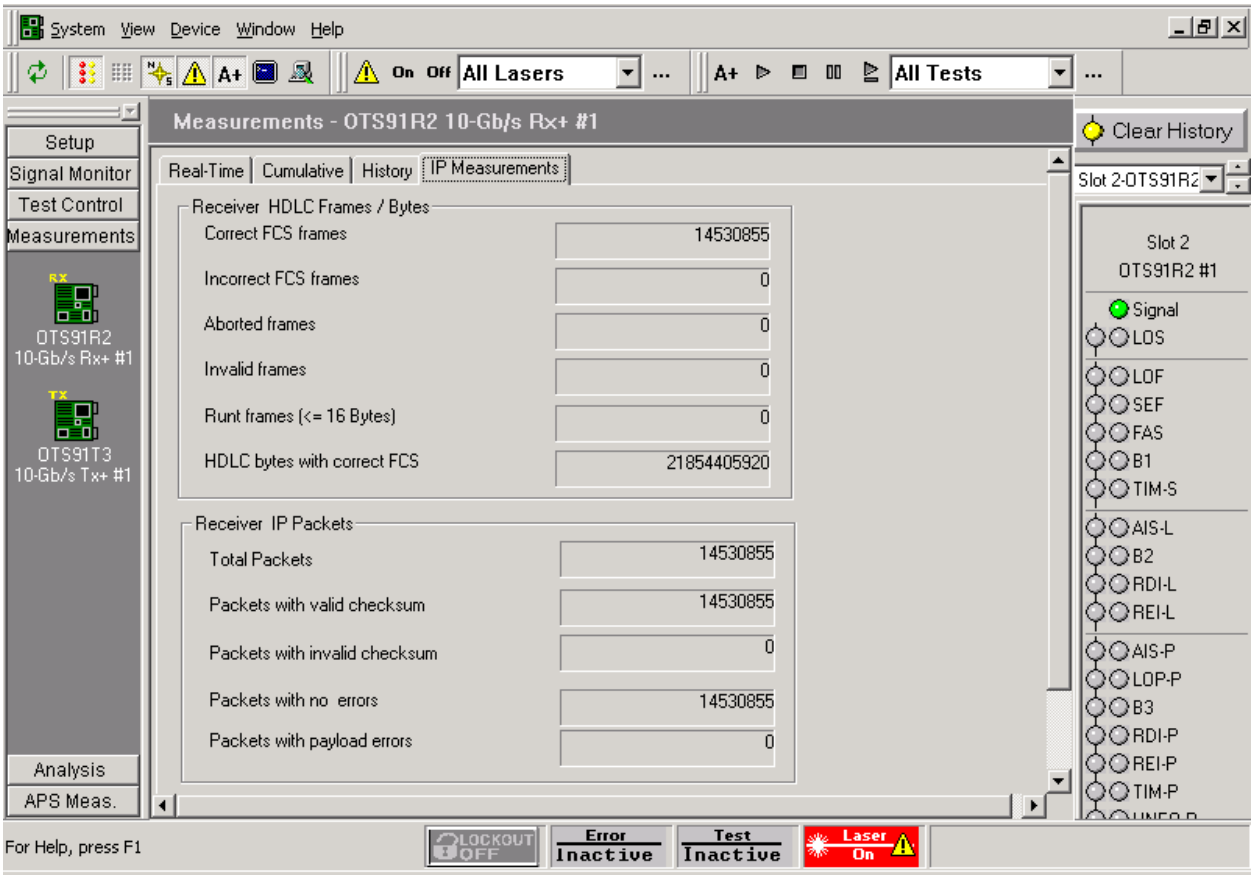



**Figure 2-7: Receiver IP Measurements display**

The IP Packets section results are only updated for HDLC frames with correct FCS. Within the IP Packets, the payload is only verified for packets with a valid header checksum. Packets with No Errors are packets with correct FCS, valid header checksum, and no IP payload errors.

# Transmitter - IP Measurements

When Measurements is selected from the Navigation window, the Measurements menu is displayed. If a transmitter icon is clicked, the Transmitter Measurements menu is displayed. This menu, as shown in Figure 2-8, provides summary results of the transmitted HDLC Frames and the IP Packets transmitted and transmitted with errors.

***NOTE:*** *Traffic has to be started to get statistics.*

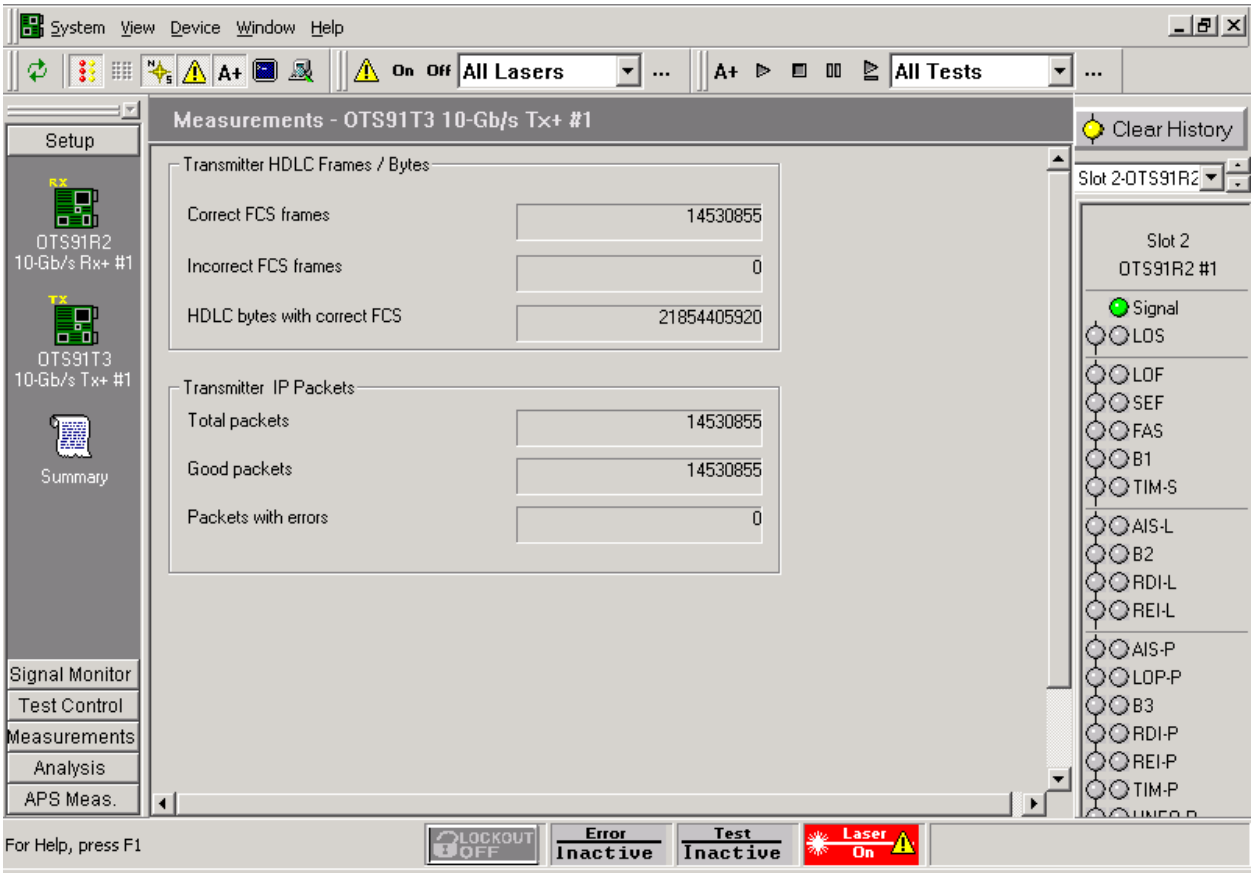



**Figure 2-8: Transmitter IP Measurements display**

In the Transmitter IP Packets section, Packets with errors is the total of the errors for the IP header checksum and payload. Only one error type may be inserted at a time.

The Good IP Packets count is performed prior to FCS computation. Introducing FCS errors results in a mismatch between the transmitter and receiver IP Good packets results. This is due to the fact that the receiver does not process IP datagrams with incorrect FCS.

# Analysis Menu

When the Analysis Category bar is selected from the Navigation window, and an icon chosen, the Analysis properties menu associated with that device icon is displayed. The results are accumulated while the test runs and are cleared when a new test begins.

The Analysis property menu contains two separate menu screens; each selected by a tab. These tabs, SONET/T1M1 and SDH/G.826, each display an aspect of the Receiver Analysis function.

## Analysis – SONET/T1M1

The SONET/T1M1 menu has two selections provided for Analysis Results; Section/Line and Path. Click either one to display the SONET analysis results for that selection. The display reflects the available Near End and Far End error count analysis data, as shown in Figures 2-48 and 2-49. The analysis data is explained in greater detail below.

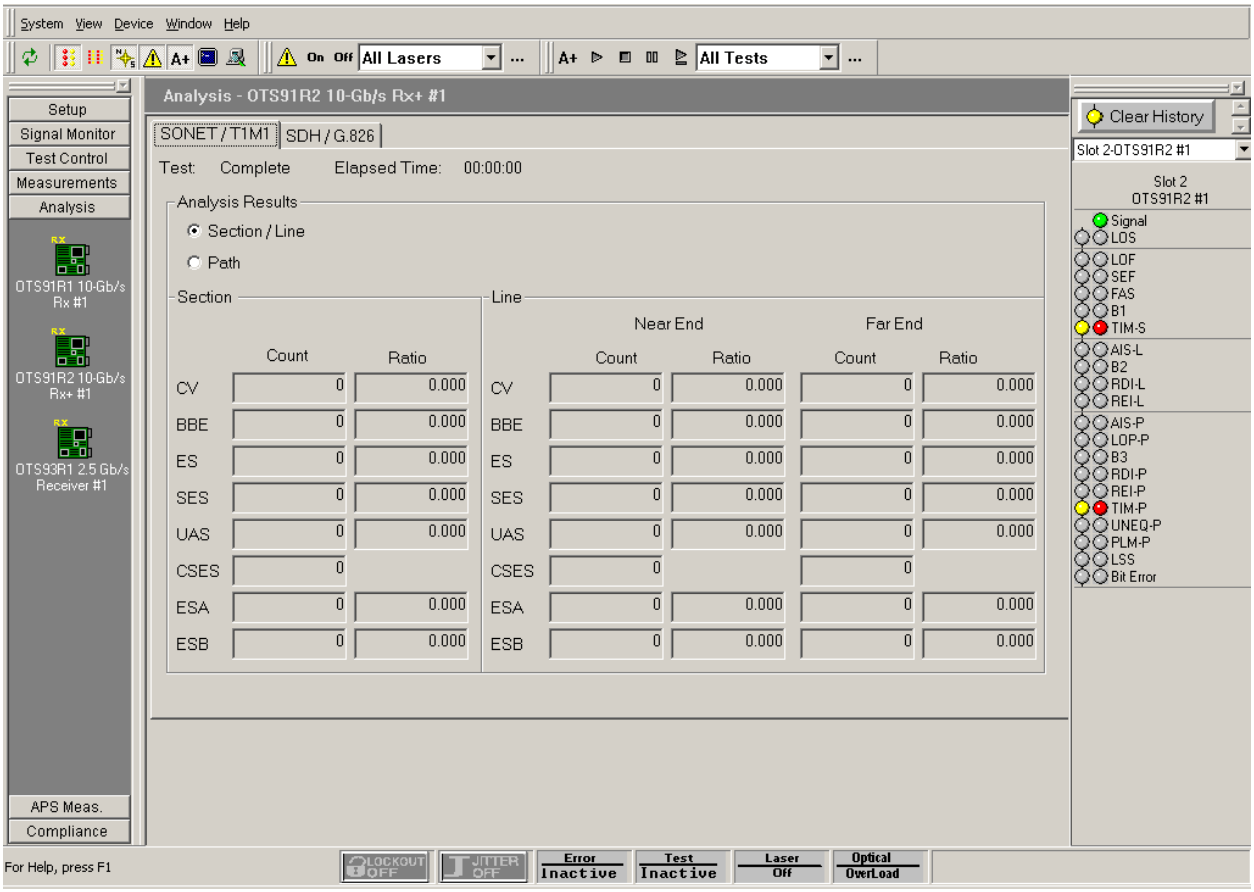



**Figure 2-48: Analysis menu – SONET/T1M1 Section/Line**

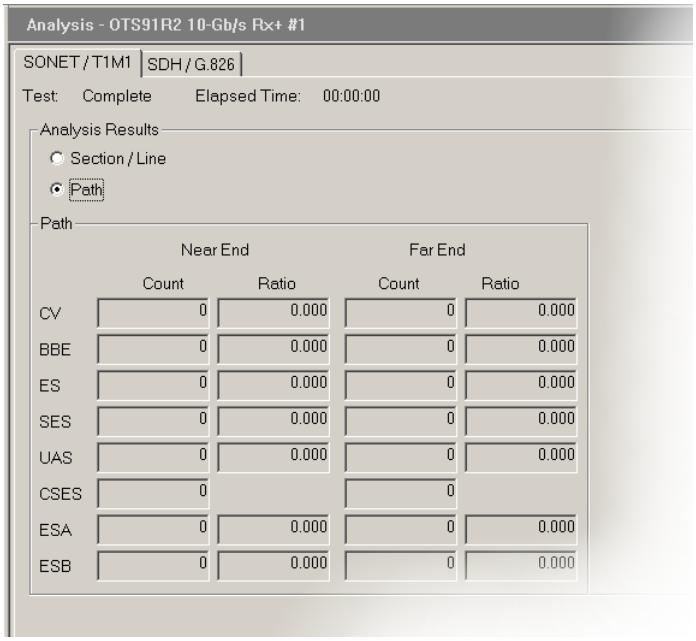



**Figure 2-49: Analysis menu – SONET/T1M1 Path**

The error count and the error ratio are both displayed when applicable. The results are broken down separately into Section, Line, and Path results. Each item of the analysis results is briefly described as follows.

**CV – Code Violations** are counted per ITU-T G.826 and GR-253-CORE specifications.

**BBE – Background block errors** are the count of errored blocks during non-severely errored seconds.

**ES – Errored Seconds** are the number of seconds since testing was started (or restarted) in which one or more errors were detected. Errored seconds are only counted during available time.

**SES – Severely Errored Seconds** are counted per ITU-T G.826 and GR-253-CORE specifications. Severely errored seconds are only counted during available time.

**UAS – Unavailable Seconds** are the number of seconds during which error performance was such that the received signal was deemed to be unavailable. Transition into and out of the unavailable state is evaluated according to ITU-T G.826 and GR-253-CORE standards.

**CSES – Consecutive Severely Errored Seconds** are the count of consecutive severely errored second periods. A CSES period is defined as a period of more than 2, but less than 10, consecutive SES.

**ESA – Errored Second Type A** is a second in which a single anomaly was detected.

**ESB – Errored Second Type B** is a second in which there was more than one anomaly, but fewer than the threshold for declaration of a Severely Errored Second.

## Analysis – SDH/G.826

The SDH/G.826 menu has two selections on the top for Analysis Results; RS/MS and Path. Click either choice to display the SDH analysis results for the selection. The display reflects the available Near End and Far End error count analysis data, as shown in Figures 2-50 and 2-51. The analysis data is explained in greater detail below.

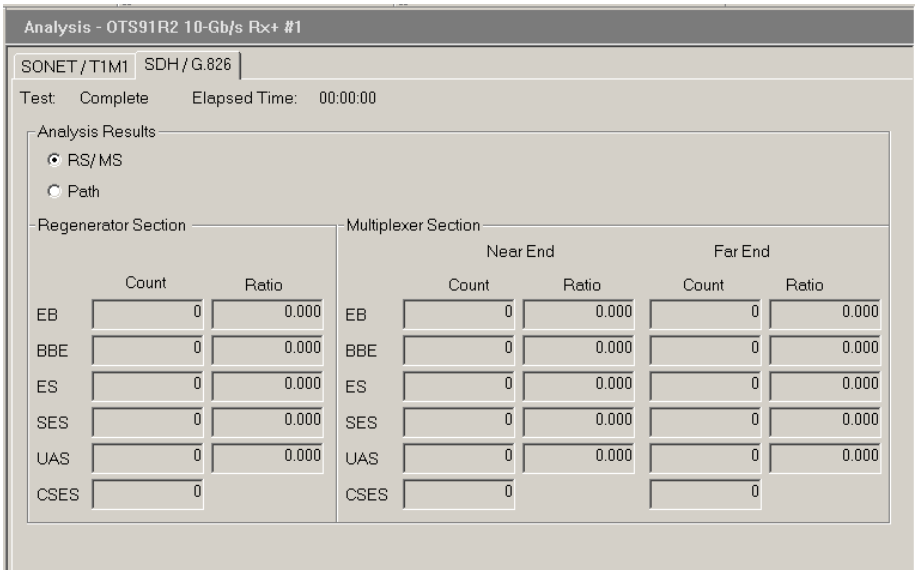



**Figure 2-50: Analysis menu – SDH/G.826 RS/MS**

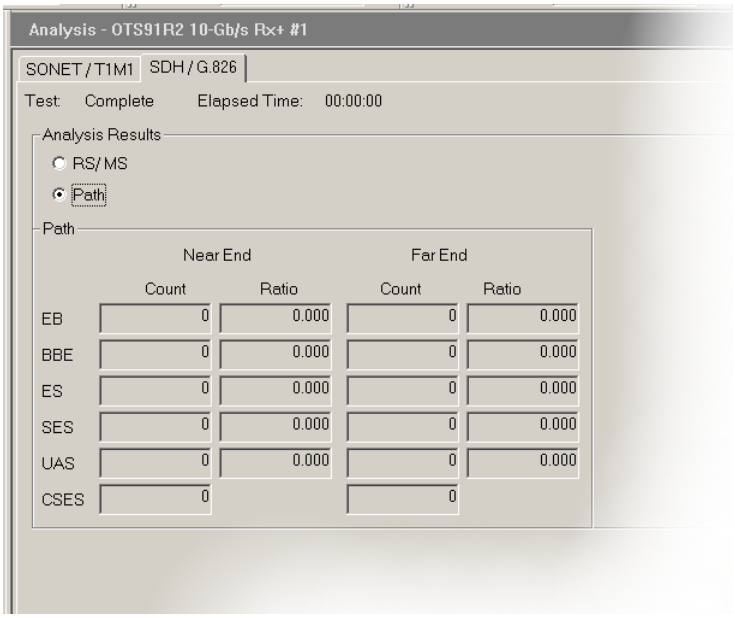



**Figure 2-51: Analysis menu – SDH/G.826 Path**

The error count and the error ratio are both displayed when applicable. The results are broken down separately into Section, Line, and Path results. Each item of the analysis results is briefly described as follows.

**EB – Errored Blocks** are counted per ITU-T G.826 and GR-253-CORE specifications.

**BBE – Background block errors** are the count of errored blocks during non-severely errored seconds.

**ES – Errored Seconds** are the number of seconds since testing was started (or restarted) in which one or more errors were detected. Errored seconds are only counted during available time.

**SES – Severely Errored Seconds** are counted per ITU-T G.826 and GR-253-CORE specifications. Severely errored seconds are only counted during available time.

**UAS – Unavailable Seconds** are the number of seconds during which error performance was such that the received signal was deemed to be unavailable. Transition into and out of the unavailable state is evaluated according to ITU-T G.826 and GR-253-CORE standards.

**CSES – Consecutive Severely Errored Seconds** are the count of consecutive severely errored second periods. A CSES period is defined as a period of more than 2, but less than 10, consecutive SES.

# APS Measurements Menu

When APS Category bar is selected from the Navigation window, and an icon chosen, the APS Measurements property menu is displayed, as shown in Figure 2-52. This menu controls setup, implementation, and results viewing of the APS Duration Counter test.

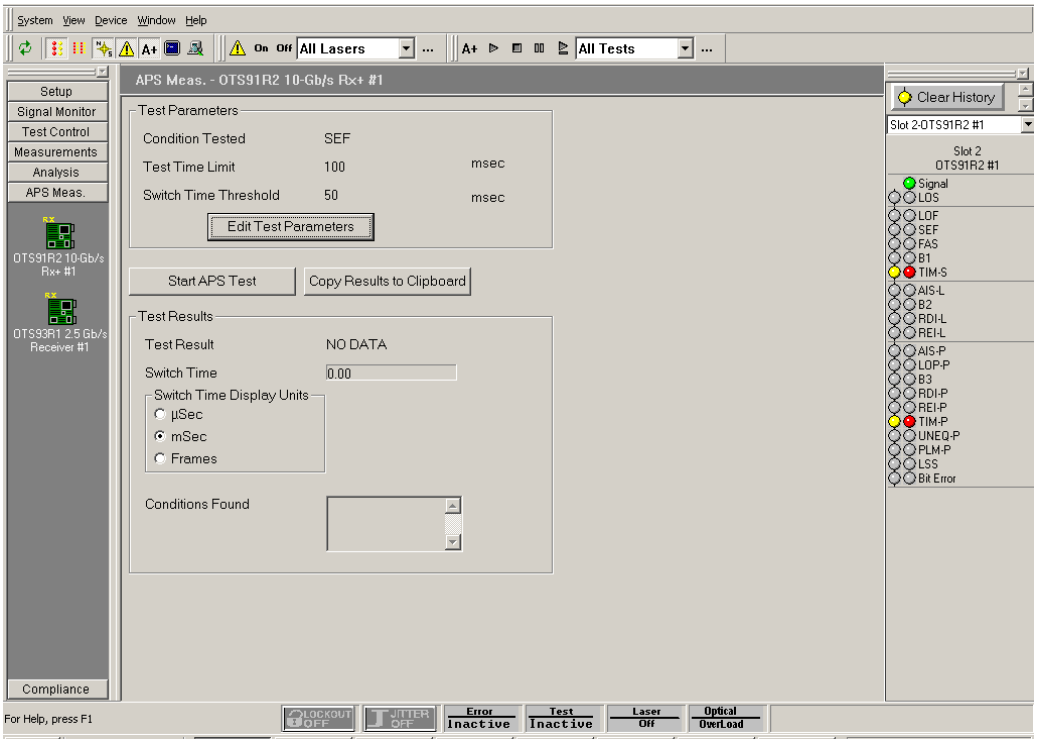



**Figure 2-52: APS Measurements menu**

The Automatic Protection Switching (APS) duration counter test verifies that the system performs APS switching in an expected manner. There are three parameters that require setup before the test is activated. To set, click the Edit Test Parameters button to display the Set APS Test Parameters dialog box, as shown in Figure 2-53.

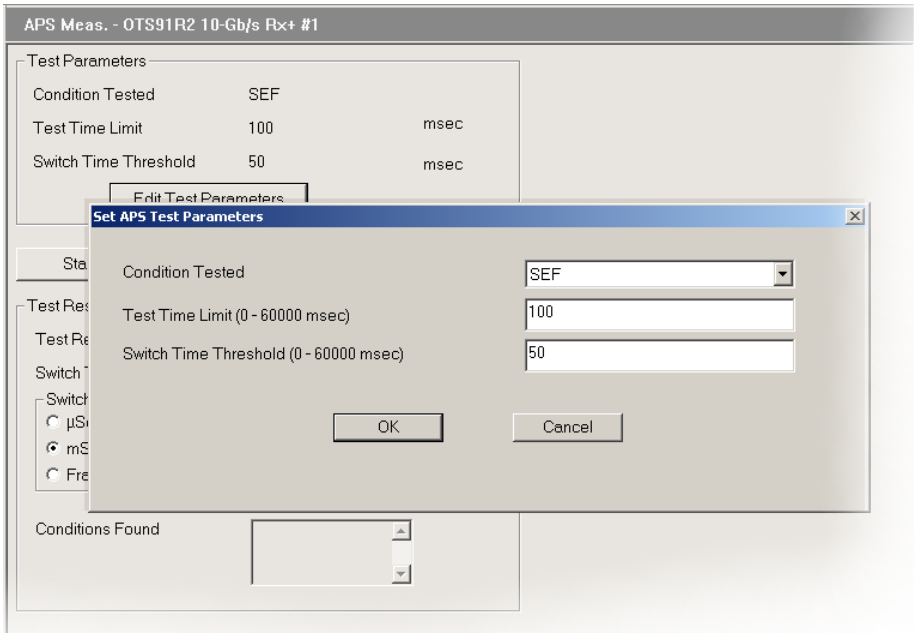



**Figure 2-53: Set APS Test Parameters dialog box**

The Condition Tested selects the condition that triggers an APS switch. The test will not begin until this condition occurs and it will end when the last condition occurs. The conditions available are SEF/OOF, LOS, B1, B2, B3, TSE, AIS-L, AIS-P, RDI-L, and RDI-P and Optical LOS (only available if using an OTS91L4, OTS91L6 or OTS91L7 Optical card).

The Test Time Limit defines the time the test will run AFTER the first condition occurs. Once the first condition occurs, the Test Time Limit starts and ends the test once the limit is reached. To set the limit, click in the text box and enter the new limit, up to one minute.

The Switch Time Threshold is the test limit. The APS switch time (entered as usec) is the time elapsed between the first condition occurrence and the last condition occurrence. If the time between these two events exceeds the Switch Time Threshold, the test fails. If the time is within the Switch Time Threshold, the test passes. To set this threshold, click in the text box and enter the new threshold.

The Conditions Found area of the menu lists any non-Condition Tested errors that occurred during the Switch Time Threshold.

To start the test, click the Start APS Test button.

***NOTE:*** *When the test is begun the Test Active status button will light. The test does not actually start until the first Condition occurs. For example, if the AIS-L is the selected Condition Tested, the Test Time Limit will not trigger until the first AIS-L error occurs. At that point, whether it be five minutes or five hours after the start test button was clicked, the Test Time Limit will trigger and the test will begin.*

To copy the test results, click the Copy Results to Clipboard button. A dialog box is displayed, as shown in Figure 2-54, which allows annotations to be added to the results file and provides the file for viewing. Once OK is clicked, the results are copied to the clipboard and can be pasted into another application or document from there by typing CTRL+V.

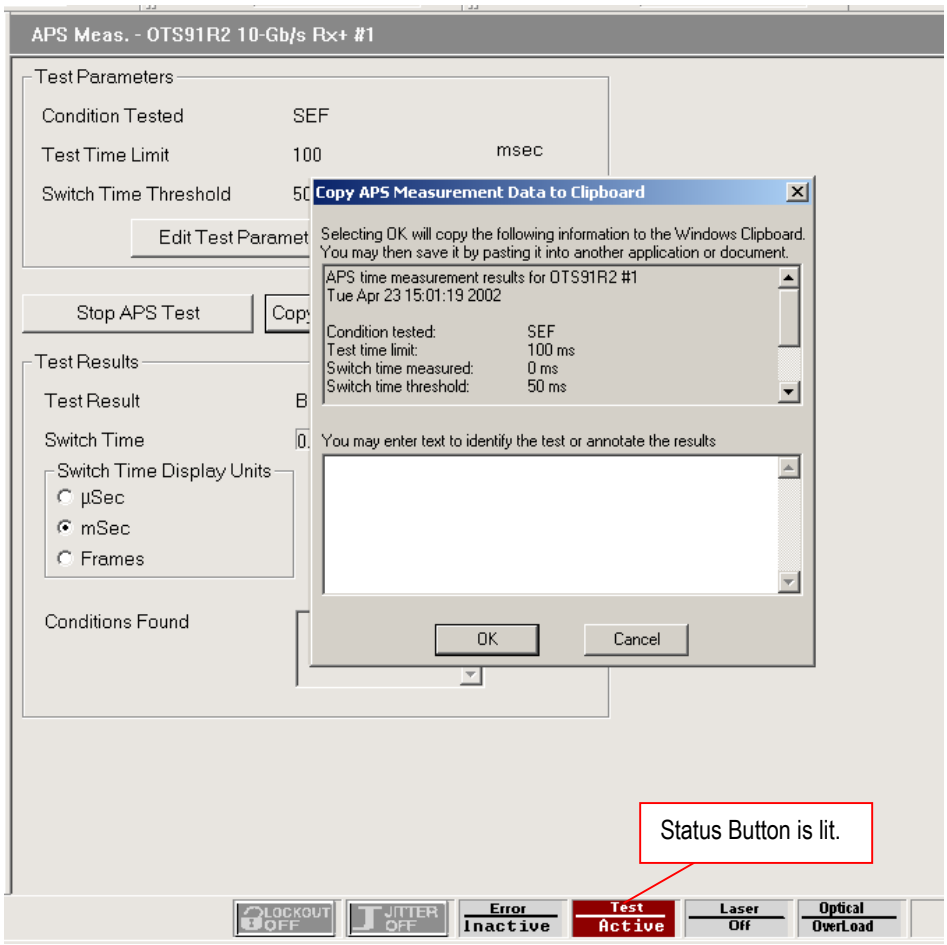



**Figure 2-54: Copy APS Measurement Data dialog box**

# Remote Access Setups

The remote control settings for selecting GPIB, RS-232, and Ethernet LAN controls are located under the menu bar in the System menu. Click on the System menu and select Remote Control. The Remote Control Settings dialog box is displayed. Across the top are tabs for GPIB, COM1, COM2, and Telnet, as shown in Figures 2-63, 2-64, and 2-65.

To set up the proper configurations for the type of remote access desired, select the appropriate setup information via the pull-down menus and boxes provided.

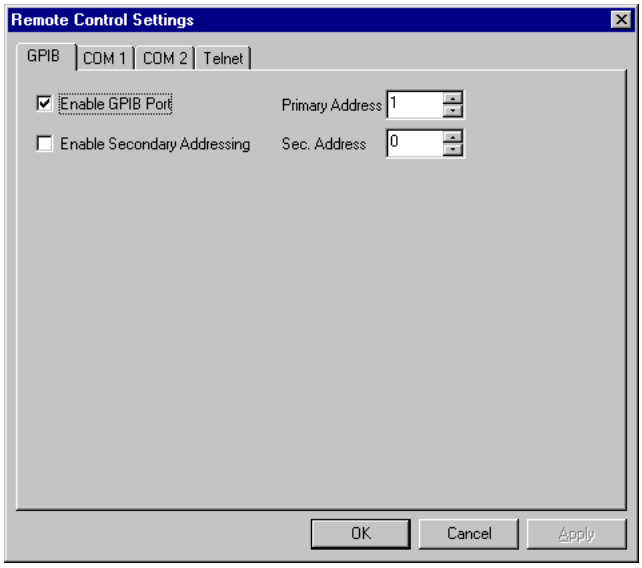



**Figure 2-63: GPIB Remote Control Settings**

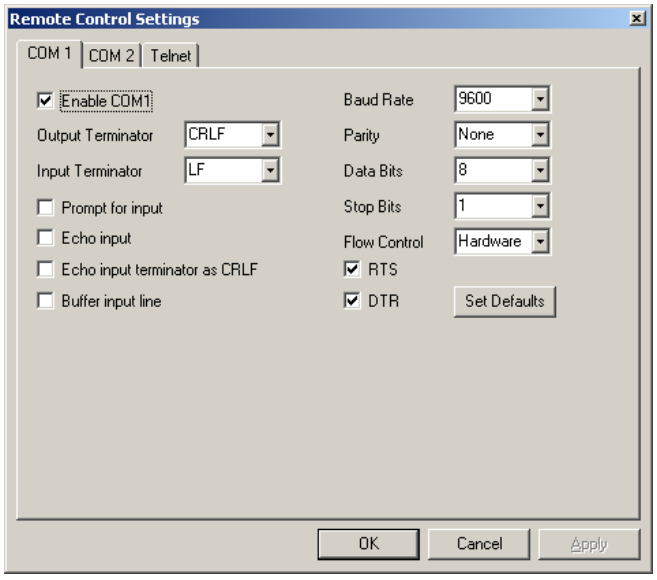



**Figure 2-56: COM 1/COM 2 Remote Control Settings**

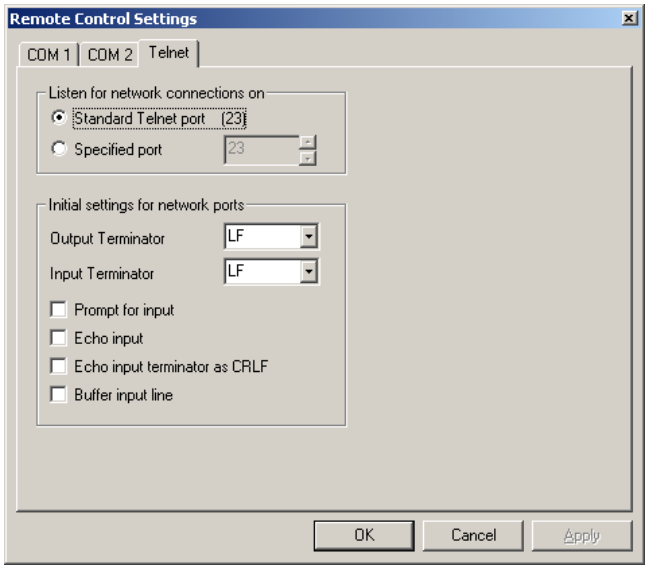



**Figure 2-57: Telnet (network) Remote Control Settings**

# Select Server

The select server dialog box, as shown in Figure 2-58, allows the user to select the server when the OTS system is networked. If there are no networks available, the only selection is LocalServer.

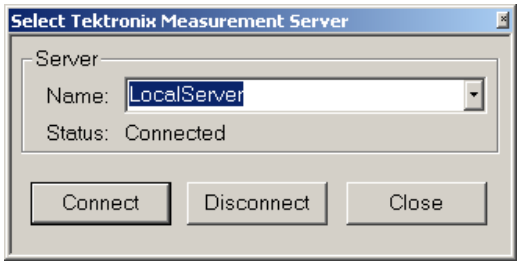



**Figure 2-58: Select Server dialog box**

# View Options

To open the options menu, as shown in Figure 2-59, click View and select Options. The options menu allows the user to customize the user interface to their preferences.

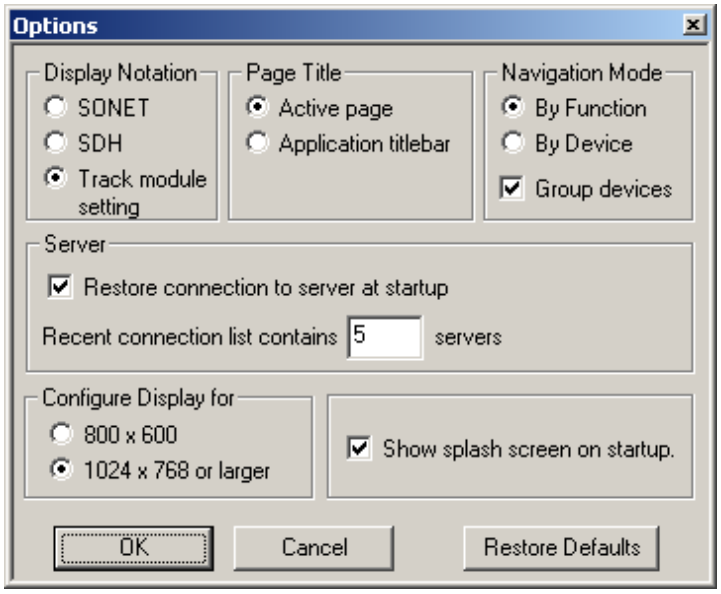



**Figure 2-59: View Options dialog box**

## Display Notation

Since SONET and SDH provide different notation in regards to some measurements, the display notation option allows the user to set the notation to their choice. If SONET is selected, then where applicable, all notation will be in SONET. If SDH is selected, then where applicable, all notation will be in SDH.

***NOTE:*** *This switch does not affect the actual functionality of the module. It affects only the notation on the user interface for viewing convenience.*

If the 'Track Module Setting' option is selected, then the display notation follows that of the module setting. For example, if the module is set to SONET mode, then SONET notation is displayed.

## Server (System)

The server selections allow the user to restore connection to the server at startup and to change the quantity displayed in the recent connection list. These server connections refer to the specific OTS system.

## Display Configuration

Display configuration provides two different display sizes, 800x600 and 1024x768.

***NOTE:*** *For viewing on the OTS9010, the 800x600 display is recommended. Otherwise, the whole screen will only be viewable with the use of scrollbars.*

# System View

A system view is available by clicking View and selecting System View. This view, as shown in Figure 2-62, represents all modules currently installed in the OTS system. The System View reflects the name of each card and its slot position. This feature is provided as a reference for proper module installation and connections for multiple modules. The screen may also be reached by pressing CTRL-Y on the keyboard.

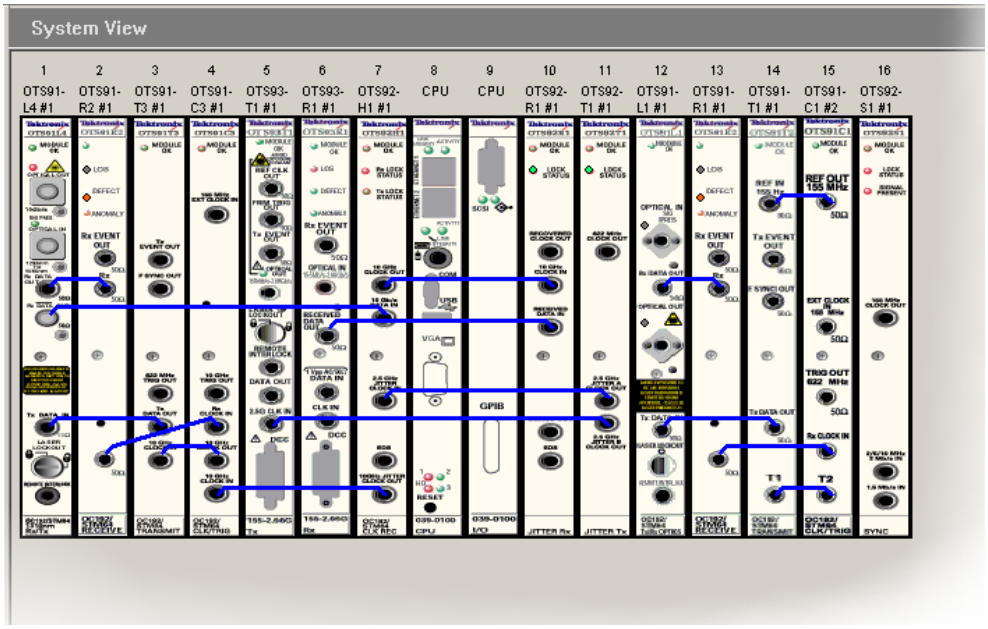



**Figure 2-62: System View**

# SCPI Output

The SCPI Output option is provided for use in programming remote commands. To activate, click on the View menu and select SCPI Output. A dialog box, as shown in Figure 2-63, is displayed which provides an echo for all commands performed via the user interface. The commands are shown in SCPI format and may be copied from the dialog box into a text document.

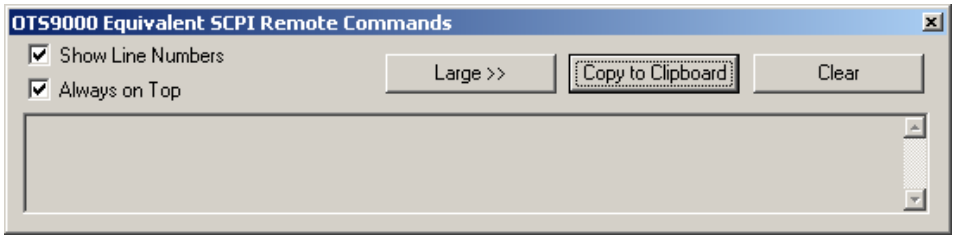



**Figure 2-63: View SCPI Output dialog box**

***NOTE:*** *If the OTS system contains different module types (for example, OTS91T2 and OTS93T1 cards) all shared remote commands must include a slot designation. If the slot number is not included, the system will return an error message stating that a slot number is required.*

# Results Files

Every time a test is started, data files are generated. These files are stored on the C-drive in a folder marked 'Tektronix Measurement Data'. To view these files from the user interface, click on View and select 'Test Results Files'. The Results Viewer dialog box is displayed. Refer to the Results Viewer description in this section for further information.

# Results File Management

As tests are run measurement data files accumulate in the 'Tektronix Measurement Data' folder. Once this folder becomes large from the quantity and size of the files, overall system performance will suffer. The OTS system provides a results file cleanup tool to assist in automatically managing these files.

***NOTE:*** *By default the system will keep only the most recent 100 results files. If there is a need to preserve all results files the user must explicitly disable results file cleanup before any tests are run.*

To access the Results File Management tool, click on the Systems menu and select Results File Management. The Results File Deletion Parameters dialog box is displayed, as shown in Figure 2-64.

All cleanup parameters may be independently enabled or disabled by modifying the check box to the left of the relevant parameter. Disabled parameters will retain their prior settings while disabled. The value fields for disabled will be grayed out indicating that the relevant limit is not being checked. All changes to parameters do not take effect until the 'OK' button is pressed.

The overall cleanup process is controlled by the pair of radio buttons at the top of the dialog. If the 'Disabled' button is selected then all results file cleanup will be turned off.

Results file cleanup is accomplished in two steps. The first step selects files to be moved or deleted. Results file sets (a history file and a summary file) are processed from oldest to newest based on the setting of the 'Delete files by oldest' control. This allows files to be selected based on their creation time, last modification time or last accessed time. Files are added to the delete/move list until all enabled criteria have been met.

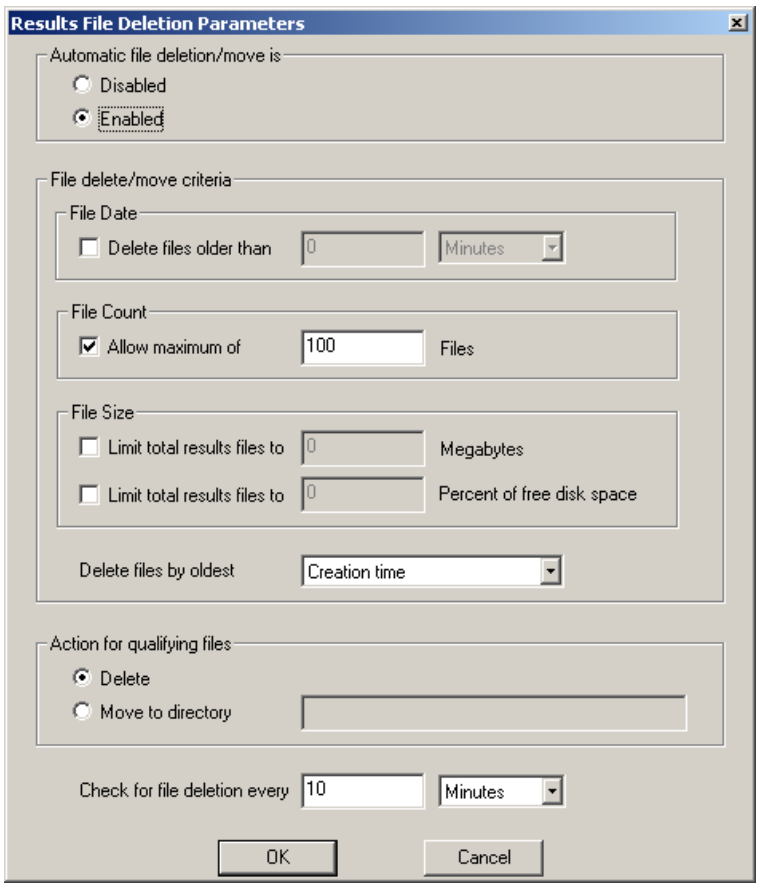



**Figure 2-64: Results File Management dialog box**

The cleanup facility allows files to be moved or removed based on their absolute age, the total number of files present or the total size of the files (either in absolute megabytes or as a percentage of the total capacity of the disk). The age of a file is determined based on the 'Delete files by oldest' setting. The number of files present counts 'sets' of results data (a summary file and its associated history file count as one 'results file set').

When enough files have been added to the list to meet all enabled limits the indicated files are either deleted or moved to the indicated directory. If processing of a given file fails (possibly due to file permissions or the destination directory being unavailable) processing of files will proceed through the remainder of the list. For a move to complete successfully, the target directory must exist and be accessible to the OTS system. If a move fails, the system will simply retry the operation next time the cleanup process runs.

The final control in the dialog allows the user to control how frequently the cleanup process runs. It is guaranteed that cleanup passes will occur no more frequently than specified here. It is possible for the system to defer cleanup for a longer interval as necessary.

# ResultsViewer

The OTS Results Viewer is a stand-alone Windows program that reads the Test Results files from the OTS Test System. It provides the following functionality:

- Access to test results files, either on the OTS system or on the file system of the computer that is running ResultsViewer
- Display of results data – Cumulative Results, Analysis, and History – with the same presentation as the OTS User Interface, TekUI
- Printing of Cumulative Results and Analysis data, and export of the same text to an ASCII text file or the Windows clipboard
- Export of Cumulative Results, Analysis, and History data in delimited ASCII-text form, to a file or to the Windows clipboard
- Printing of History data to a graphical form
- Copying results files to a directory on the local file system

***NOTE:*** *The results of a test are stored in two files, with the same file name but different extensions. One has extension* ***.sum*** *(summary information) and one has the extension* ***.his*** *(history data). Although ResultsViewer file selection operations involve only the .sum file, both files are used and must be present and in the same directory. Therefore,*

- *If you copy a test's results files to another computer or directory, you must copy both the ".sum" and the ".his" files*
- *If you rename a test's results files, you must rename both the ".sum" and ".his" file to have the same name*
- *If you use the File menu Save As function to copy the currently active test results to a directory on the local computer, the operation creates both the ".sum" and the ".his" files under the specified name*

## Operation

To start ResultsViewer, double-click on its icon. It can also be started from TekUI, by clicking on the View menu and selecting Test Results.

## Opening files on the local computer

**On the Local computer:**

To open a file locally, click on File and select Open Local File. A dialog box displays from which the user may select one or more test results files. Files with an extension of .sum are test results files.

**On the OTS System:**

To open a file on the OTS system, the ResultsViewer must be connected to an operating OTS system. Once the ResultsViewer is connected, click on File and select Open File on Server. A dialog box appears with a listing of all available files, their creation times, and any Test Description text with which the user annotated the test.

## Connecting to an OTS System

ResultsViewer uses the same mechanism as the OTS User Interface program, TekUI. The OTS user manual discusses this procedure in more detail. In quick overview, click on File and Select Server in ResultsViewer. A dialog box displays from which the user can connect to an OTS system or disconnect an existing connection.

***NOTE:*** *When ResultsViewer is started from TekUI, it starts, by default, connected to the same OTS system as TekUI.*

## Viewing results files

When a test results file is opened, a measurement screen is displayed, as shown in Figure 2-65. The screen has three tabs for Cumulative Results, Analysis Results, and History Data. The window title bar displays the file name, the start time for the test displayed, and the device whose data is displayed.

These screens provide the same information and controls as the Measurement Results screens in the TekUI. Refer to Measurement Results section of the module user manual for detailed information of the data presented.

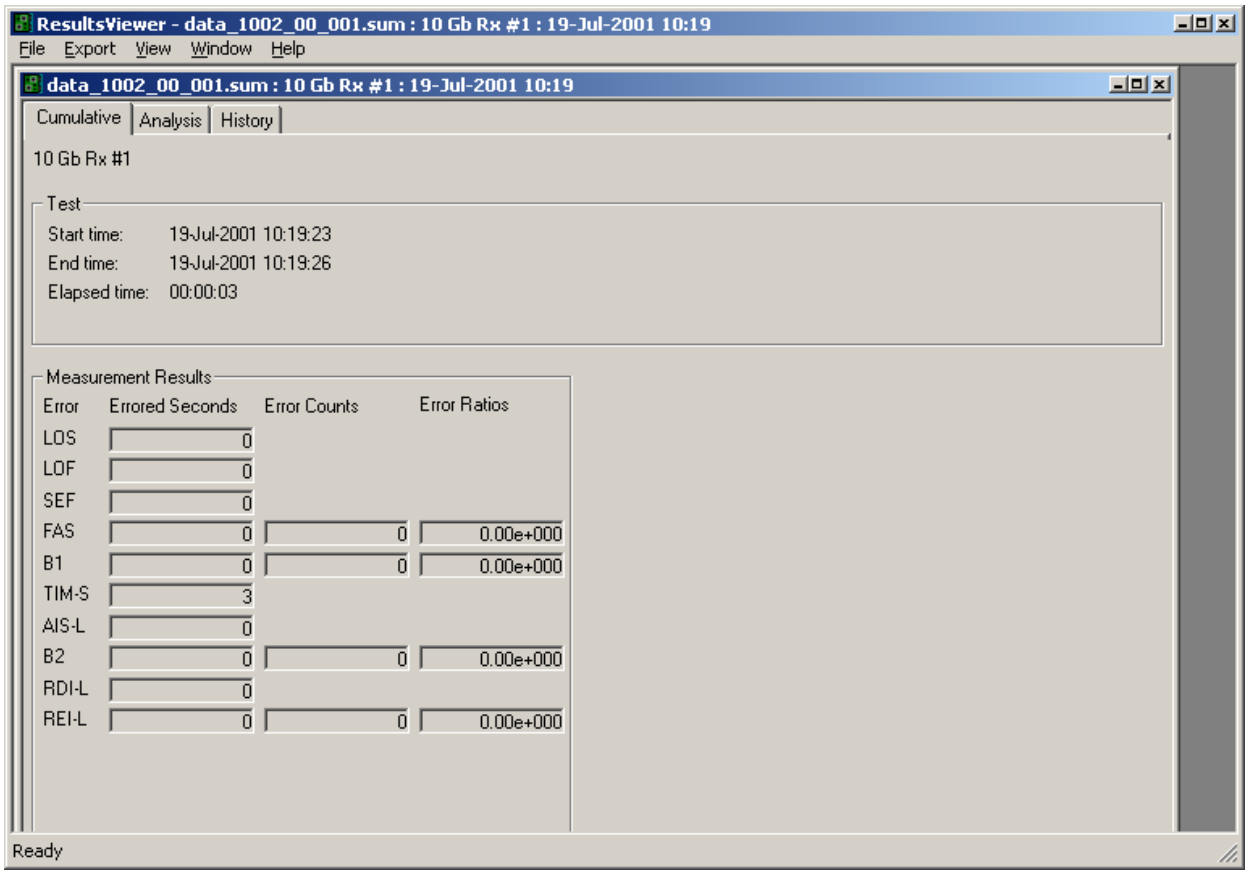



Figure 2-65: Cumulative Results screen of the ResultsViewer

## Selecting and arranging windows

The Window menu in the ResultsViewer contains the usual commands to close, cascade, tile, and otherwise arrange windows. It also contains a list of windows for all open files, and this list provides direct access to any window.

## Printing results data

All Print controls are located under the File menu. The Print Setup option allows selecting a printer, even when no files are open.

Print Results prints a report displaying all the parameters of the Cumulative Data and Analysis pages.

Print History Graphics prints a page showing the same information as is displayed on the active window's history tab.

## Configuring ResultsViewer

To configure the ResultsViewer, click View and select Options. An Options dialog box will appear in which the user may change the following options:

- SONET or SDH conventions for parameter names
- Option to have ResultsViewer automatically connect to an OTS system on start-up
- Option to have ResultsViewer display the Tektronix splash screen on start-up

## Exporting test data to other programs

ResultsViewer can export results data as either ASCII text, primarily intended for documentation, or delimited, formatted ASCII text readable by spreadsheet programs.

**Exporting text**

To export the test results file as text, click on Export and select Summary (text) to File. This option writes an ASCII file containing exactly the same information as the printed output of the Print Results command. Summary (text) to Clipboard writes the same ASCII text to the Windows clipboard. Summary Text Preview displays the same text in a pop-up window.

**Exporting numeric data**

Under the Export menu, the Data to File selection writes a file of delimited ASCII data containing information selected by the user; Data to Clipboard writes the same information to the Windows clipboard. Data Preview displays the same text in a pop-up window. The following paragraphs describe the data available, the formats, and the process of configuring a file to contain the desired information.

**The data**

Table 2-2 shows a sample output, which reflects all possible fields of data.

**Table 2-2: Sample output of data from a test results file**

| | | | | | |
|---|---|---|---|---|---|
| T1 | "Test File Info" | | | | |
| S01 | "File" | "data_1022_00_004.sum" | | | |
| S02 | "Start Time" | 9/13/00 5:00:2 PM | | | |
| S03 | "End Time" | 9/13/00 5:00:6 PM | | | |
| S04 | "Test Time" | 0d 00:00:04 | | | |
| S05 | "Description" | "" | | | |
| T1 | "Cumulative Measurements" | | | | |
| T2 | "Param" | "ES" | | | |
| C01 | "LOS" | 0 | | | |
| C02 | "LOF" | 0 | | | |
| C03 | "OOF" | 0 | | | |
| C04 | "TIM" | 0 | | | |
| C05 | "AIS" | 0 | | | |
| C06 | "RDI" | 0 | | | |
| T2 | "Param" | "ES" | "COUNT" | "RATIO" | |
| C07 | "B1" | 0 | 0 | 0.00 | |
| C08 | "FAS" | 0 | 0 | 0.00 | |
| C09 | "B2" | 0 | 0 | 0.00 | |
| C10 | "REI" | 0 | 0 | 0.00 | |
| T2 | "Param" | "ES" | | | |
| C11 | "TIM-P" | 0 | | | |
| C12 | "AIS-P" | 0 | | | |
| C13 | "RDI-P" | 0 | | | |
| C14 | "LSS" | 0 | | | |
| C15 | "PLM" | 0 | | | |
| T2 | "Param" | "ES" | "COUNT" | "RATIO" | |
| C18 | "B3" | 0 | 0 | 0.00 | |
| C19 | "REI-P" | 0 | 0 | 0.00 | |
| C20 | "TSE" | 0 | 0 | 0.00 | |
| T1 | "Sonet GR-253 Analysis(Section)" | | | | |
| T2 | "Param" | "Count" | "Ratio" | | |
| A101 | "EB" | 0 | 0.00 | | |
| A102 | "BBE" | 0 | 0.00 | | |
| A103 | "ES" | 0 | 0.00 | | |
| A104 | "SES" | 0 | 0.00 | | |
| A105 | "ESA" | 0 | 0.00 | | |
| A106 | "ESB" | 0 | 0.00 | | |
| T2 | "Param" | "Count" | | | |
| A107 | "CSES" | 0 | | | |
| T2 | "Param" | "Count" | "Ratio" | | |
| A108 | "UAS" | 0 | 0.00 | | |
| T1 | "Sonet GR-253 Analysis(Line Near end/Far end)" | | | | |
| T2 | "Param" | "Count" | "Ratio" | "Count" | "Ratio" |
| A201 | "EB" | 0 | 0.00 | 0 | 0.00 |

| | | | | | |
|---|---|---|---|---|---|
| A202 | "BBE" | 0 | 0.00 | 0 | 0.00 |
| A203 | "ES" | 0 | 0.00 | 0 | 0.00 |
| A204 | "SES" | 0 | 0.00 | 0 | 0.00 |
| A205 | "ESA" | 0 | 0.00 | 0 | 0.00 |
| A206 | "ESB" | 0 | 0.00 | 0 | 0.00 |
| T2 | "Param" | "Count" | "Count" | | |
| A207 | "CSES" | 0 | 0 | | |
| T2 | "Param" | "Count" | "Ratio" | "Count" | "Ratio" |
| A208 | "UAS" | 0 | 0.00 | 0 | 0.00 |
| T1 | "Sonet GR-253 Analysis(Path Near end/Far end)" | | | | |
| T2 | "Param" | "Count" | "Ratio" | "Count" | "Ratio" |
| A501 | "EB" | 0 | 0.00 | 0 | 0.00 |
| A502 | "BBE" | 0 | 0.00 | 0 | 0.00 |
| A503 | "ES" | 0 | 0.00 | 0 | 0.00 |
| A504 | "SES" | 0 | 0.00 | 0 | 0.00 |
| A505 | "ESA" | 0 | 0.00 | 0 | 0.00 |
| A506 | "ESB" | 0 | 0.00 | 0 | 0.00 |
| T2 | "Param" | "Count" | "Count" | | |
| A507 | "CSES" | 0 | 0 | | |
| T2 | "Param" | "Count" | "Ratio" | "Count" | "Ratio" |
| A508 | "UAS" | 0 | 0.00 | 0 | 0.00 |
| T1 | "SDH G.826 Analysis (Regenerator Section)" | | | | |
| T2 | "Param" | "Count" | "Ratio" | | |
| A301 | "EB" | 0 | 0.00 | | |
| A302 | "BBE" | 0 | 0.00 | | |
| A303 | "ES" | 4 | 1.00 | | |
| A304 | "SES" | 4 | 1.00 | | |
| T2 | "Param" | "Count" | | | |
| A305 | "CSES" | 1 | | | |
| T2 | "Param" | "Count" | "Ratio" | | |
| A306 | "UAS" | 0 | 0.00 | | |
| T1 | "SDH G.826 Analysis (Multiplex Section Near end/Far end)" | | | | |
| T2 | "Param" | "Count" | "Ratio" | "Count" | "Ratio" |
| A401 | "EB" | 0 | 0.00 | 0 | 0.00 |
| A402 | "BBE" | 0 | 0.00 | 0 | 0.00 |
| A403 | "ES" | 0 | 0.00 | 0 | 0.00 |
| A404 | "SES" | 0 | 0.00 | 0 | 0.00 |
| T2 | "Param" | "Count" | "Count" | | |
| A405 | "CSES" | 0 | 0 | | |
| T2 | "Param" | "Count" | "Ratio" | "Count" | "Ratio" |
| A406 | "UAS" | 0 | 0.00 | 0 | 0.00 |
| T1 | "SDH G.826 Analysis (Path Near end/Far end)" | | | | |
| T2 | "Param" | "Count" | "Ratio" | "Count" | "Ratio" |
| A601 | "EB" | 0 | 0.00 | 0 | 0.00 |
| A602 | "BBE" | 0 | 0.00 | 0 | 0.00 |
| A603 | "ES" | 0 | 0.00 | 0 | 0.00 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A604 | "SES" | 0 | 0.00 | 0 | 0.00 | | | | | | | | |
| T2 | "Param" | "Count" | "Count" | | | | | | | | | | |
| A605 | "CSES" | 0 | 0 | | | | | | | | | | |
| T2 | "Param" | "Count" | "Ratio" | "Count" | "Ratio" | | | | | | | | |
| A606 | "UAS" | 0 | 0.00 | 0 | 0.00 | | | | | | | | |
| T1 | "History Data" | | | | | | | | | | | | |
| T2 | "Resolution" | "SampleCount" | | | | | | | | | | | |
| H1 | 1 | 4 | | | | | | | | | | | |
| T2 | "Time" | "Day" | "Clock" | "LOS" | "LOF" | "OOF" | "TIM" | "AIS" | "RDI" | "B1" | "B2" | "FAS" | "REI" | "TIM-P" |
| H2 | 0 | 0 | 17:00:02 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| H2 | 1 | 0 | 17:00:03 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| H2 | 2 | 0 | 17:00:04 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| H2 | 3 | 0 | 17:00:05 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| H3 | "Pause" | 00:00:07 | | | | | | | | | | | | |
| H2 | 4 | 0 | 17:00:13 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

## Record type codes

Each record appears as one line of text. If the report options include Record Type Codes, the first entry in each record is a code indicating the type of that record.

Record types are:

- General

| | |
|---|---|
| T1 | Text – Section heading |
| T2 | Text – Column headings |

- Summary report (Test file) info

| | |
|---|---|
| S01 | File name |
| S02 | Test start time |
| S03 | Test end time |
| S04 | Test elapsed time, not including pauses |
| S05 | Test description text |

- Cumulative results

| | | |
|---|---|---|
| C01 | LOS | ES |
| C02 | LOF | ES |
| C03 | OOF | ES |
| C04 | TIM-S (RS-TIM) | ES |
| C05 | AIS-L (MS-AIS) | ES |
| C06 | RDI-L (MS-RDI) | ES |
| C07 | B1 | ES, Count, Ratio |
| C08 | FAS | ES, Count, Ratio |
| C09 | B2 | ES, Count, Ratio |
| C10 | REI-L (MS-REI) | ES, Count, Ratio |
| C11 | TIM-P (HP-TIM) | ES |
| C12 | AIS-P (HP-AIS) | ES |
| C13 | RDI-P (HP-RDI) | ES |
| C14 | LSS | ES |
| C15 | PLM (HPPLM) | ES |
| C18 | B3 | ES, Count, Ratio |
| C19 | REI-P (HP-REI) | ES, Count, Ratio |
| C20 | TSE | ES, Count, Ratio |

***NOTE:*** *C11 through C20 are applicable only for OTS91T2 and OTS91R2 module cards.*

- Sonet GR-253 (Section) Analysis

| | | |
|---|---|---|
| A101 | EB | Count, Ratio |
| A102 | BBE | Count, Ratio |
| A103 | ES | Count, Ratio |
| A104 | SES | Count, Ratio |
| A105 | ESA | Count, Ratio |
| A106 | ESB | Count, Ratio |
| A107 | CSES | Count (only) |
| A108 | UAS | Count, Ratio |

- Sonet GR-253 (Line) Analysis

| | | |
|---|---|---|
| A201 | EB | Count, Ratio (Near End); Count, Ratio (Far End) |
| A202 | BBE | Count, Ratio (Near End); Count, Ratio (Far End) |
| A203 | ES | Count, Ratio (Near End); Count, Ratio (Far End) |
| A204 | SES | Count, Ratio (Near End); Count, Ratio (Far End) |
| A205 | ESA | Count, Ratio (Near End); Count, Ratio (Far End) |
| A206 | ESB | Count, Ratio (Near End); Count, Ratio (Far End) |
| A207 | CSES | Count (Near End); Count (Far End) (only) |
| A208 | UAS | Count, Ratio (Near End); Count, Ratio (Far End) |

- Sonet GR-253 (Path) Analysis

| | | |
|---|---|---|
| A501 | EB | Count, Ratio (Near End); Count, Ratio (Far End) |
| A502 | BBE | Count, Ratio (Near End); Count, Ratio (Far End) |
| A503 | ES | Count, Ratio (Near End); Count, Ratio (Far End) |
| A504 | SES | Count, Ratio (Near End); Count, Ratio (Far End) |
| A505 | ESA | Count, Ratio (Near End); Count, Ratio (Far End) |
| A506 | ESB | Count, Ratio (Near End); Count, Ratio (Far End) |
| A507 | CSES | Count (Near End); Count (Far End) (only) |
| A508 | UAS | Count, Ratio (Near End); Count, Ratio (Far End) |

***NOTE:*** *A501 through A508 are applicable only for OTS91R2 module cards.*

- SDH G.826 (Regenerator Section) Analysis

| | | |
|---|---|---|
| A301 | EB | Count, Ratio |
| A302 | BBE | Count, Ratio |
| A303 | ES | Count, Ratio |
| A304 | SES | Count, Ratio |
| A305 | CSES | Count (only) |
| A306 | UAS | Count, Ratio |

- SDH G.826 (Multiplex Section) Analysis

| | | |
|---|---|---|
| A401 | EB | Count, Ratio (Near End); Count, Ratio (Far End) |
| A402 | BBE | Count, Ratio (Near End); Count, Ratio (Far End) |
| A403 | ES | Count, Ratio (Near End); Count, Ratio (Far End) |
| A404 | SES | Count, Ratio (Near End); Count, Ratio (Far End) |
| A405 | CSES | Count (Near End); Count (Far End) (only) |
| A406 | UAS | Count, Ratio (Near End); Count, Ratio (Far End) |

- SDH G.826 (Path) Analysis

| | | |
|---|---|---|
| A601 | EB | Count, Ratio (Near End); Count, Ratio (Far End) |
| A602 | BBE | Count, Ratio (Near End); Count, Ratio (Far End) |
| A603 | ES | Count, Ratio (Near End); Count, Ratio (Far End) |
| A604 | SES | Count, Ratio (Near End); Count, Ratio (Far End) |
| A605 | CSES | Count (Near End); Count (Far End) (only) |
| A606 | UAS | Count, Ratio (Near End); Count, Ratio (Far End) |

***NOTE:*** *A601 through A606 are applicable only for OTS91T2 and OTS91R2 module cards.*

History data

H1 Time resolution (seconds/sample), Number of samples in report period

H2 History data: selected fields from

- Sample time (seconds since start of test)
- Calendar day relative to the day on which the test started
- Time-of-day
- LOS
- LOF
- OOF
- TIM-S (RS-TIM)
- AIS-L (MS-AIS)
- RDI-L (MS-RDI)
- B1
- B2
- FAS
- REI-L (MS-REI)

- TIM-P (HP-TIM)
- AIS-P (HP-AIS)
- RDI-P (HP-RDI)
- B3
- REI-P (HP-REI)
- TSE
- LSS
- PLM (HP-PLM)

***NOTE:*** *TIM-P (HP-TIM) through PLM (HP-PLM) are applicable only for OTS91R2 module cards.*

H3 Test Pause/Power-Out indicator, Time in hr:min:sec of pause

***NOTE:*** *The number of samples in the H1 record includes samples with all counts zero, even if the report is set to exclude these.*

## Configuring the exported data

To configure the exported data, click on Export and select Data Setup. The Configure Data Report dialog box, as shown in Figure 2-66, is now displayed. To enable a selection, click the box or radio button beside it. The report written to the file or clipboard is configured accordingly.

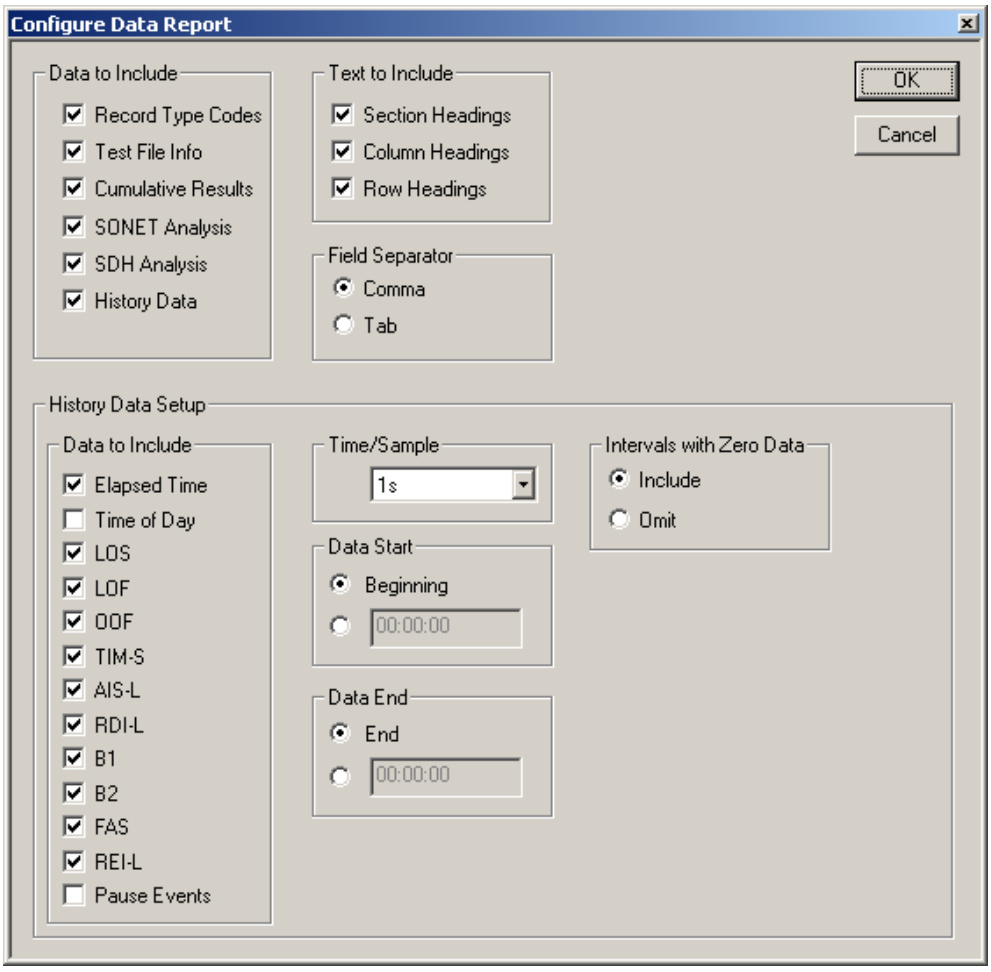



**Figure 2-66: Configure Data Report dialog box**

# OTS System Event Printer Application

This is an auxiliary application that runs on the OTS system to log receiver events (defects and anomalies). Events may be printed as they are logged, if a printer is attached to the system, or the list of logged events may be captured to a file or to the Windows clipboard.

## Starting the Event Printer program

The Event Printer is a separate application from the user interface. To start Event Printer, double-click its desktop icon. When started, the Event Printer main screen is displayed, as shown in Figure 2-67.

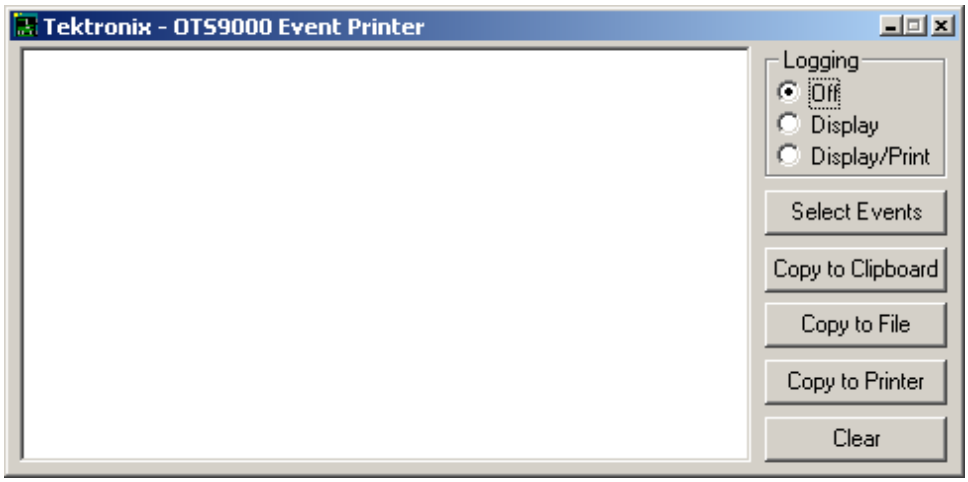



**Figure 2-67: Event Printer main screen**

## Logging

Logging controls how events are logged. The selections available are:

- Off. Event logging is disabled
- Display. Events are logged to the application's text window only
- Display/Print. Events are logged to the application's window and to the default Windows printer

## Select Events

Clicking this button brings up a window, shown and discussed below, with which the user selects the events to be monitored.

## Copy to Clipboard

Clicking this button copies the list of logged events to the Windows Clipboard, from which it may be pasted into another application such as a word processor.

## Copy to File

Clicking this button brings up a file selection dialog, with which the user specifies the location and name of a text file to receive the list of logged events.

## Copy to Printer

Clicking this button copies the list of logged events to the default Windows printer. Note that this button is disabled if the currently selected logging mode is Display/Print.

## Clear

Clicking this button clears the list of logged events. Any events that haven't already been copied or printed are thus lost.

## Selecting events to log

Clicking the *Select Events* button brings up the Select Events to Monitor display, as shown in Figure 2-68, which has one panel for each OTS receiver module.

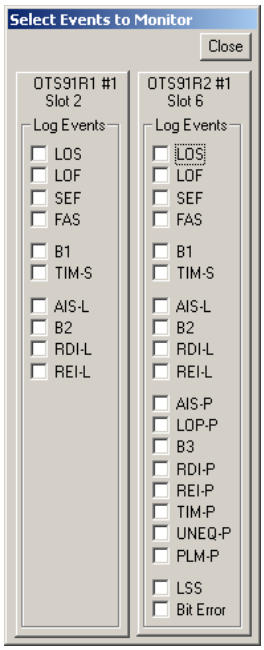



**Figure 2-68: Select Events to Monitor dialog box**

Checking a check box on a receiver's panel enables logging for the corresponding event on that receiver.

The events selected are saved in persistent storage on the OTS system and are restored when the Event Printer application is next started.

## Muting: Event Printer behavior with continuous events

When Event Printer logs events in five consecutive seconds, it follows the last event with the words MUTE ON and suppresses further logging. When a one-second interval occurs in which no loggable events occur, Event Printer logs the event as MUTE OFF and resumes normal event logging.

## Minimizing the Event Printer window

The Event Printer application may be minimized, so that its window is not displayed but its button is visible in the Windows Taskbar. It continues to log events while minimized.

**Exiting the Event Printer application stops the logging of events.**

## Configuring a printer in Windows

Printing events as they occur is only possible with a printer capable of printing a single line at a time, e.g., a dot-matrix printer. Printers such as laser printers, which print an entire page at a time, cannot do this.

To use a suitably capable printer for line-at-a-time operation, configure it as follows:

1. In the Windows Start Menu, select Settings->Printers
2. Right-click the printer selected as the default Windows printer, and select Properties.
3. Select the Scheduling tab
4. Select "Print directly to the printer" and click OK

# Reference

This chapter describes the remote commands that may be used to control the OTS9100 system and the OTS9100 module from an external controller. The remote commands conform to IEEE 488.2 and SCPI conventions. The OTS9100 system accepts remote commands over GPIB, RS-232 serial links, or a network using Telnet protocol.

The **Commands Overview** section organizes the remote commands by function in a simple command tree format.

The **Syntax** section provides an overview of IEEE 488.2 command formats, the SCPI conventions, and the data formats used by the OTS9100 system. Readers familiar with these topics may find that it duplicates material they already know.

The **Command Descriptions** section provides detailed descriptions of the format and parameters of each OTS9100 system remote commands. These commands are listed in alphabetical order and listed by page number in the Table of Contents.

## Commands Overview

This section organizes the OTS9100 remote commands by function in a simple command tree format. Each main topic provides a brief description of the command set uses and then lists each command in that section. For more detail on specific commands, refer to the following section, *Command Descriptions*, which lists all commands in alphabetical order.

### IEEE 488.2 System Commands

These commands control basic generic functionality and interface control functions.

| | |
|---|---|
| Clear interface error status | *CLS |
| Enable error status conditions | *ESE |
| Query error status | *ESR? |
| Query identification string | *IDN? |
| Query all instrument settings | *LRN? |
| Query operation complete | *OPC? |
| Recall system settings | *RCL |
| Restore default settings | *RST |
| Restore saved settings | *SAV |

### Remote Control Setup and Format Commands

These commands provide commands to initialize the error reporting system, get the error status from the previous commands, query response command headers and keywords in short or long form, and set binary block data format.

| | |
|---|---|
| Initialize error reporting system | :status:preset |
| Get error status from previous commands | :system:error |
| Query response command headers | :system:headers |
| Query response keywords – short/long form | :system:verbose |
| Binary or hex block data format | :system:format:block |

## Remote Control Port Settings

These commands provide the GPIB, Serial, and network port setups as well as the serial and network port protocols.

| | |
|---|---|
| GPIB port setup | :system:communicate:gpib:primary<br>:system:communicate:gpib:secondary |
| COM1 serial port setup | |
| enable | :system:communicate:serial:com1a:enable |
| baud rate | :system:communicate:serial:com1a:rate |
| number of data bits | :system:communicate:serial:com1a:ndata |
| number of stop bits | :system:communicate:serial:com1a:nstop |
| flow control mode | :system:communicate:serial:com1a:flow |
| parity | :system:communicate:serial:com1a:parity |
| RS-232 DTR line | :system:communicate:serial:com1a:dtr |
| RS-232 RTS line | :system:communicate:serial:com1a:rts |
| COM2 serial port setup | :system:communicate:serial:com2a: ... as above |
| Network port connect address | :system:communicate:network:ipport |
| COM1 serial port protocol | |
| echo control | :system:communicate:serial:com1a:echo |
| prompt | :system:communicate:serial:com1a:prompt |
| input terminator | :system:communicate:serial:com1a:rxterm |
| output terminator | :system:communicate:serial:com1a:txterm |
| COM2 serial port protocol | :system:communicate:serial:com2a: ... as above |
| Network session protocol, initial values | :system:communicate:network: ... as above |
| Current serial or network port session protocol | :system:communicate:port: ... as above |

## Remote Control Lockout

These commands enable remote control lockout.

:system:lock:request
:system:lock:release

## System Configuration Queries

These commands provide the ability to query the modules installed in the OTS9100 system to determine what configurations are installed.

:system:config:module:slots
:system:config:module:type
:system:config:module:version
:system:config:module:variant
:system:config:module:serial

## Save and Restore System Settings

These commands provide the save and restore functionality for system level settings.

*SAV
*RCL
:system:description:setup

## System File Management

These commands define the necessary settings to allow the system to delete old files thus preventing performance degradation due to lack of memory.

:system:files:mgmt:results

## System Signal Standard (OTS9100 module)

This command sets all system modules to the SONET or SDH signal standard.

:system:signal:standard

## Receiver Commands (OTS9100 module)

These commands provide configuration and control of the receiver settings.

| | |
|---|---|
| Signal standard | :sense:signal:standard |
| Receiver input threshold | :sense:input:threshold |
| Line rate | :sense:data:rate |
| Signal structure | :sense:data:structure |
| Active payload channel | :sense:data:channel |
| Payload data | :sense:data:payload:pattern |
| Generate trigger on anomaly or defect received | :sense:trigger:mode |
| Received signal status | :sense:status:leds |
| J0 section trace received | :sense:data:section:trace |
| J0 section trace comparison value | :sense:analysis:section:trace |
| J1 path trace received | :sense:data:path:trace |
| J1 path trace comparison value | :sense:analysis:path:trace |
| Path label mismatch | :sense:data:poh:hpplm |
| | :sense:data:poh:c2a:byte |
| Overhead monitor channel selection | :sense:overhead:monitor:channel |
| Transport overhead data received | :sense:data:toh |
| Receiver Optics | :sense:optical |

## Receiver Signal Measurement Commands (OTS9100 module)

These commands provide control of the signal measurement functions.

| | |
|---|---|
| Line parameters | :sense:measure:line:cumulative |
| | :sense:measure:line:window |
| Section parameters | :sense:measure:section:cumulative |
| | :sense:measure:section:window |
| Path parameters | :sense:measure:path:cumulative |
| | :sense:measure:path:window |
| Windowed measurement setup | :sense:measure:window |
| APS measurements | :sense:measure:apstime |

## Receiver Signal Analysis Commands (OTS9100 module)

These commands provide control of the signal analysis functions.

| | |
|---|---|
| GR-253 analysis – Line parameters | :sense:analysis:gr253a:line |
| GR-253 analysis – Path parameters | :sense:analysis:gr253a:path |
| GR-253 analysis – Section parameters | :sense:analysis:gr253a:section |
| G.826 analysis – MS parameters | :sense:analysis:g826a:ms |
| G.826 analysis – Path parameters | :sense:analysis:g826a:path |
| G.826 analysis – RS parameters | :sense:analysis:g826a:rs |

## Receiver Test Control (OTS9100 module)

These commands provide control of test setup parameters.

| | |
|---|---|
| Test execution: continuous, timed, repetitive | :sense:test:mode |
| Timed test duration | :sense:test:time |
| Test annotation text | :sense:test:description |
| Test start/stop and run-state query | :sense:test:state |
| Test elapsed time query | :sense:test:time:elapsed |

## Transmitter Commands (OTS9100 module)

These commands provide configuration and control of the transmitter settings.

| | |
|---|---|
| Signal standard | :source:signal:standard |
| Laser off/on | :source:output:laser |
| Laser information | :source:output:laser:info |
| Line rate | :source:data:rate |
| Data source (internal or through) | :source:data:source |
| Clock source | :source:clock:source |
| Signal structure | :source:data:structure |
| Active payload channel | :source:data:channel |
| Payload data | :source:data:payload:pattern |
| Background pattern | :source:data:payload:background:pattern |
| Background structure | :source:data:background:structure |
| Anomaly insertion | :source:insert:anomaly |
| Defect insertion | :source:insert:defect |
| Generate trigger on anomaly or defect | :source:trigger:mode |
| J0 section trace | :source:data:section:trace |
| J1 Path trace | :source:data:path:trace |
| Transport overhead data | :source:data:toh |
| Path overhead data | :source:data:poh |
| Path overhead C2 byte | :source:data:poh:c2a |
| Through mode overhead insertion | :source:data:overhead:passthrough |
| Through mode parity calculation | :source:data:parity:loop |
| Optical output laser | :sense:optical |

# Syntax

This section contains information on the Standard commands for Programmable Instruments (SCPI) and IEEE 488.2 Common Commands that may be used to program the OTS9100 10Gb/s SDH/SONET module.

## IEEE 488.2 Common Commands

### Description

ANSI/IEEE Standard 488.2 defines the codes, formats, protocols, and usage of common commands and queries used on the GPIB interface between the controller and the instruments. The OTS9100 complies with this standard.

### Command and Query Structure

The syntax of an IEEE 488.2 common command is an asterisk (*) followed by a command and, optionally, a space and parameter value. The syntax for an IEEE 488.2 common query is an asterisk (*) followed by a query and a question mark. The following are examples of common commands:

- *ESE 16
- *CLS

The following are examples of common queries:

- *ESR?
- *IDN?

## Block Format

IEEE-488 block format is a means of encoding arbitrary binary data, including characters that aren't valid in text strings, for transmission over a GPIB link. The format is most easily explained with an example.

This is a block containing 16 bytes of data:

#216abcdeFGHIJklmnop

where:

'#' denotes the start of a block

'2' is the number of digits that follow, to represent the byte count in the block

'16' is the number (represented by two decimal digits) of data bytes

'abcdeFGHIJklmnop' is the 16 data bytes in this example

The OTS9100 uses blocks in commands and queries for overhead data and section trace sequences; the descriptions of these commands include the number of bytes expected or sent.

## Hex Block Format

The GPIB can transmit eight-bit binary data without problems. But the OTS9100 can also be controlled over RS-232 serial links and Telnet protocol over network links. These may not be able to send eight-bit data or ASCII control characters. For this reason, the OTS9100 remote command system implements an alternative block format called *hex block format* in which each byte of binary data is sent as two hex digits using the characters 0 to 9 and A to F.

Blocks in hex format thus consist of twice many characters as the corresponding blocks in binary format.

The block in the example above would be, in hex format,

#23261626364654647484 94A6B6C6D6E6F70

where

'#232' is the prefix for a 32-character block

'61' is the hexadecimal representation of "a," the first character in the block

'62' is the hexadecimal representation of "b," and so on.

Note that the block's count of data bytes is doubled, representing twice as much data as in the binary-format block.

The OTS9100 system must be explicitly set to transmit or receive blocks in *binary* or *hex* block format. See the description of the command.

## SCPI Commands and Queries

SCPI is a standard that provides guidelines for remote programming of instruments. These guidelines provide a consistent programming environment for instrument control and data usage. This environment uses defined programming messages, instrument responses, and data format across all SCPI instruments, regardless of manufacturer. The OTS9100 modules uses a command language derived from this SCPI standard.

The SCPI language is based on a hierarchical tree structure, as shown in Figure 3-1, that represents a subsystem. The top level of the tree is the root node; it is followed by one or more lower-level nodes.

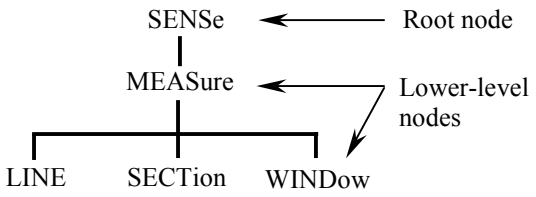



**Figure 3-1: Example of SCPI subsystem hierarchy tree**

You can create commands and queries from these subsystem hierarchy trees.

## Command Format

A *command* sets the value of an instrument parameter or initiates an instrument event. A command consists of one or more alphanumeric keywords separated by colons; this part is called the *header*. If the command includes parameter values, these appear after the header and separated from the header by a space. Multiple parameter values are separated by commas.

**Example**

The command to set the OTS-9100 Receiver input threshold voltage to 100 mV is

:SENSE:INPUT:THRESHOLD 100

where :SENSE:INPUT:THRESHOLD is the header, and 100 is the parameter value.

## Query format

A *query* fetches the current value of an instrument parameter, measurement, or status condition. A query consists of a *header*, like that of a command, followed by a question mark. If a query includes parameter values, these appear after the question mark and a separating space.

**Example**

The query to fetch from the OTS-9100 Receiver the current setting of the input threshold voltage is

:SENSE:INPUT:THRESHOLD?

The response to this query might be the value, 100 - it might also be formatted as a complete command, for example:

:SENSE:INPUT:THRESHOLD 100

as controlled by the :SYSTEM:HEADERS and :SYSTEM:VERBOSE commands (q.v.).

## Parameter types and formats

Parameter values may be of several different types, e.g., integer numbers, floating-point numbers, selections from a list of particular values, strings, etc. The following are the parameter types that appear in OTS9100 remote control commands.

<NR1> An integer number.

<NR2> A decimal number with integer and/or fractional parts, e.g., 12.43

<NR3> A decimal number in scientific notation, e.g., 1.243E1

***NOTE:*** *A command parameter value specified as <NR2> or <NR3> may be entered in either standard or scientific-notation formats. A query will return its value in the format indicated.*

<Enum> A selection from an enumerated list of values that appear as alphanumeric keywords, usually with a mnemonic value.

For example, the command that specifies the payload inserted into the generated signal appears as:

:SOURCE:DATA:PAYLOAD:PATTERN <Enum>

followed by a list of possible values,

| | |
|---|---|
| PRBS23A | Standard PRBS $2^{23}$-1 pattern |
| PRBS23I | Inverted PRBS $2^{23}$-1 pattern |
| ZEROS | Constant zero data |
| ONES | Constant one data |

The command must include one of these values; the corresponding query returns one of these values corresponding to the instrument's current setting.

<Boolean> A binary value that typically indicates whether a function is on or off, enabled, or disabled. Querying a Boolean parameter always returns 0 or 1, never OFF or ON.

Boolean values may be specified as follows:

| | |
|---|---|
| 0 or OFF | off, disabled |
| 1 or ON | on, enabled |

<String> A string of characters, delimited by either apostrophes ' or quote marks ". Strings must, in general, be composed of ASCII printing characters and may not contain the apostrophe or quote mark used as the delimiter.

<Block> An array of arbitrary binary data (bytes), including characters not in the ASCII printing character set. A block is transmitted as a block header followed by data bytes, as in the following example:

#216ABCDEFGHIJKLMNOP

in which:

- ⇒ The # character indicates that what follows is a block of data
- ⇒ The first digit, 2 in this example, is the number of digits in the block length field
- ⇒ The next digits, of which there are two in this example, indicate the number of bytes of data that follow. In this example, there are 16 bytes, so the block length field is 16. There are two digits in "16," so the character "2" following the "#" is the digit count.
- ⇒ The bytes that follow, ABCDEFGHIJKLMNOP, are the actual data. The number of bytes of data must match the number indicated by the block header.

## Optional and alternative parameters

Some parameters are optional; these appear in brackets ([ ]):

:SENSE:STATUS:LEDS [<NR1>]

The command description includes the meaning of the parameter and the effect of leaving it out. Some parameters may accept data of more than one type; the alternatives are shown separated by a vertical bar. For example,

:SYSTEM:COMMUNICATE:GPIB:PRIMARY <Enum>|<NR1>

means that the command can accept either a keyword from the given enum list or an integer numeric value.

## Abbreviating Commands, Queries, and Parameters

You can abbreviate most SCPI commands, queries, and parameters to an accepted short form. This manual shows these short forms as a combination of upper and lower case letters. The upper case letters tell you what the accepted short form should consist of, as shown in Figure 3-2, you can create a short form by using only the upper case letters. The accepted short form and long form are equivalent and request the same action of the instrument.

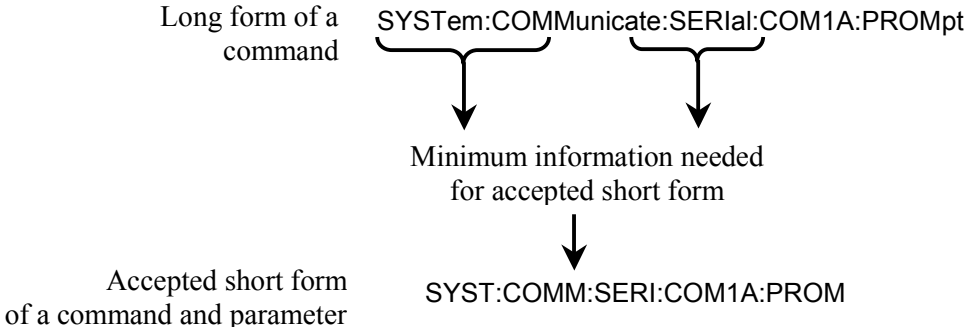



**Figure 3-2: Example of abbreviating a command**

***NOTE:*** *The numeric part of a command or query must always be included in the accepted short form. In Figure 3-2, the "1" of "COM1A" is always included in the command or query.*

## Controlling Responses to Queries

You can control the form of responses returned by queries by changing the parameter values of SYSTem:HEADers and SYSTem:VERBose. These two commands control whether the query nodes are returned with the response, and, if the query nodes are returned, whether they are in the long or short form. SYSTem:HEADers controls the presence of the query nodes, and SYSTem:VERBose controls the length of these nodes. The table below shows the possible combinations of these commands and an example of a query response.

| SYSTem:HEADers set to: | SYSTem:VERBose set to: | Example of a response |
|---|---|---|
| 1 or ON | 1 or ON | OUTPUT1:TELECOM:TYPE OPTICAL |
| 1 or ON | 0 or OFF | OUTPUT1:TEL:TYPE OPT |
| 0 or OFF | 0 or OFF | OPT |
| 0 or OFF | 1 or ON | OPTICAL |

## Chaining Commands and Queries

You can chain several commands or queries together into a single message. To create a chained message, first create a command or query, add a semicolon (;), and then add more commands or queries and semicolons until you are done. Figure 3-3 illustrates a chained message consisting of several commands and queries. The single chained message should end in a command or query, not a semicolon. Responses to any queries in your message are separated by semicolons.

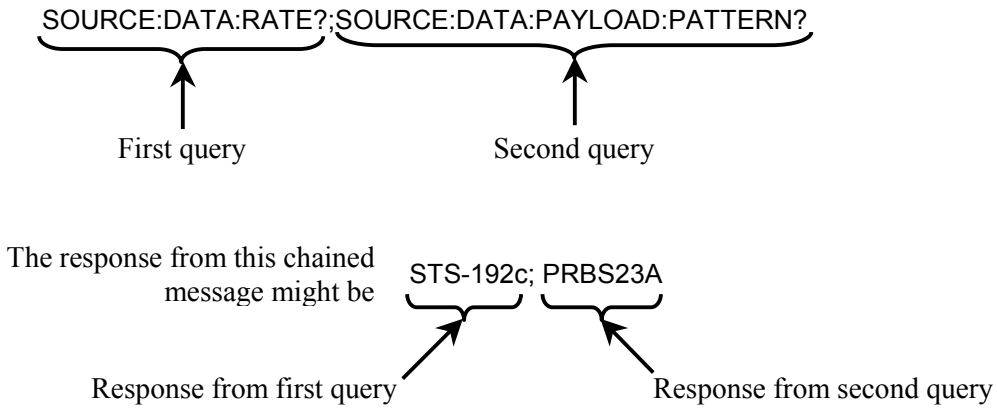



**Figure 3-3: Example of chaining commands and queries**

If a command or query has the same root and lower-level nodes as the previous command or query, you can omit these nodes. In Figure 3-4, the second command has the same root and lower-level nodes (SOURCe:INSErt:ANOMaly) as the first command, so these nodes can be omitted.

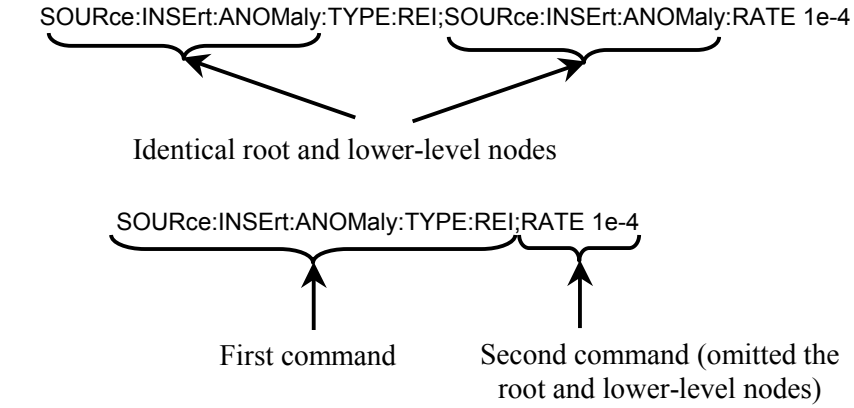



**Figure 3-4: Example of omitting root and lower-level nodes in chained message**

## General Rules

Here are some general rules for using SCPI commands, queries, and parameters:

- You can use single (‘ ’) or double (“ ”) quotation marks for quoted strings, but you cannot use both types of quotation marks for the same string.

  correct: “This string uses quotation marks correctly.”

  correct: ‘This string also uses quotation marks correctly.’

  incorrect: “This string does not use quotation marks correctly.’

- You can use upper case, lower case, or a mixture of both cases for all command, queries, and parameters.

  SOURCE:DATA:STRUCTURE

  is the same as

  source:data:structure

  and

  SOURCE:data:Structure

- No embedded spaces are allowed between or within nodes.

  correct: SOURce:DATA:STRUcture

  incorrect: SOURce: DATA: STRUcture

  incorrect: SO URce:DATA: STRU cture

## Slot Specifiers

The OTS9100 system can contain multiple modules of the same type, e.g., more than one receiver, more than one transmitter. Any module-specific command or query may include, as a numeric suffix on the header’s first keyword, the slot number of the target module to indicate the particular instance of that module for which the command or query is intended.

For example, the command

:SOURCE5:INSERT:ANOMALY:MODE CONTINUOUS

is intended for the transmitter module in slot 5.

Slot specifiers are indicated by **<Slot>** in the command listings. Slot specifiers are optional; if a slot specifier is omitted, the command or query is directed to the lowest-numbered slot that contains a module for which the command or query is valid.

# Command Description

This section provides detailed descriptions of the format and parameters of each OTS9100 command. These commands are listed in alphabetical order.

***NOTE:*** *Not all commands and command parameters are available for all modules. Commands with option limitations are so noted.*

## *CLS

This command clears the IEEE-488.2 error status register and event queue.

**Syntax** *CLS

## *ESE

This command sets the value of the IEEE-488.2 Event Status Enable register. The query form returns the current value.

**Syntax** *ESE?
*ESE <NR1>

## *ESR

This query returns the value of the IEEE-488.2 Event Status Register.

**Syntax** *ESR?

## *IDN

This query returns the identification string for the Tektronix OTS9100 instrument.
**Syntax** *IDN?

## *LRN

This query returns the current state of the instrument as a string of commands that will restore the instrument to that state.

**Syntax** *LRN?

## *OPC

This query returns '1' to indicate that any pending operation is complete.

**Syntax** *OPC?

## *RCL

This command recalls system parameter settings from the specified buffer. The buffer specification is a number in the range 1 to 99.

**Syntax** *RCL <NR1>

## *RST

This command restores all system parameters to their default values.

**Syntax** *RST

## *SAV

This command saves system parameter settings to the specified buffer. The buffer specification is a number in the range 1 to 99.

**Syntax** *SAV <NR1>

## :SENSe:ANALysis:G826A:MS:FAR

This query returns the value of the specified Far-End Multiplexor Section parameter from G.826 analysis of received data.

**Syntax** :SENSe<slot>:ANALysis:G826A:MS:FAR? <Enum>

| Parameter | Description |
|---|---|
| ETIME | Elapsed time |
| EB_C | Errored blocks |
| EB_R | Errored block ratio |
| BBE_C | Background block errors |
| BBE_R | Background block error ratio |
| EFS_C | Error-free seconds |
| EFS_R | Error-free seconds ratio |
| ES_C | Errored seconds |
| ES_R | Errored second ratio |
| SES_C | Severely errored seconds |
| SES_R | Severely errored second ratio |
| CSES_C | Consecutive SES periods |
| UAS_C | Unavailable seconds |
| UAS_R | Unavailable seconds error ratio |

## :SENSe:ANALysis:G826A:MS:FAR:ALL

This query returns the values of all of the Far-End Multiplexor Section parameters from G.826 analysis of received data. The parameters are returned in the order in which they are listed under :SENSe:ANALysis:G826A:MS:FAR.

**Syntax** :SENSe<slot>:ANALysis:G826A:MS:FAR:ALL?

## :SENSe:ANALysis:G826A:MS:NEAR

This query returns the value of the specified Near-End Multiplexer Section parameter from G.826 analysis of received data.

**Syntax** :SENSe<slot>:ANALysis:G826A:MS:NEAR? <Enum>

| Parameters | Description |
|---|---|
| ETIME | Elapsed time |
| EB_C | Errored blocks |
| EB_R | Errored block ratio |
| BBE_C | Background block errors |
| BBE_R | Background block error ratio |
| EFS_C | Error-free seconds |
| EFS_R | Error-free seconds ratio |
| ES_C | Errored seconds |
| ES_R | Errored second ratio |
| SES_C | Severely errored seconds |
| SES_R | Severely errored second ratio |
| CSES_C | Consecutive SES periods |
| UAS_C | Unavailable seconds |
| UAS_R | Unavailable seconds error ratio |

## :SENSe:ANALysis:G826A:MS:NEAR:ALL

This query returns the values of all of the Near-End Multiplexer Section parameters from G.826 analysis of received data. The parameters are returned in the order in which they are listed under :SENSe:ANALysis:G826A:MS:NEAR.

**Syntax** :SENSe<slot>:ANALysis:G826A:MS:NEAR:ALL?

## :SENSe:ANALysis:G826A:PATH:FAR

This query returns the value of the specified Far-End Path parameter from G.826 analysis of received data. Ratios are returned as NR3 values, other parameters as NR1 values.

**Syntax:** :SENSe<slot>:ANALysis:G826A:PATH:FAR? <Enum>

| Parameters | Description |
|---|---|
| ETIME | Elapsed time |
| EB_C | Errored blocks |
| EB_R | Errored block ratio |
| BBE_C | Background block errors |
| BBE_R | Background block error ratio |
| EFS_C | Error-free seconds |
| EFS_R | Error-free seconds ratio |
| ES_C | Errored seconds |
| ES_R | Errored second ratio |
| SES_C | Severely errored seconds |
| SES_R | Severely errored second ratio |
| CSES_C | Consecutive SES periods |
| UAS_C | Unavailable seconds |
| UAS_R | Unavailable seconds error ratio |

## :SENSe:ANALysis:G826A:PATH:FAR:ALL

This query returns the values of all of the Far-End Path parameters from G.826 analysis of received data. The parameters are returned in the order in which they are listed under the heading :SENSe:ANALysis:G826A:PATH:FAR. Ratios are returned as NR3 values, other parameters as NR1 values.

**Syntax:** :SENSe<slot>:ANALysis:G826A:PATH:FAR:ALL?

## :SENSe:ANALysis:G826A:PATH:NEAR

This query returns the value of the specified Near-End Path parameter from G.826 analysis of received data. Ratios are returned as NR3 values, other parameters as NR1 values.

**Syntax:** :SENSe<slot>:ANALysis:G826A:PATH:NEAR? <Enum>

| **Parameters** | **Description** |
|---|---|
| ETIME | Elapsed time |
| EB_C | Errored blocks |
| EB_R | Errored block ratio |
| BBE_C | Background block errors |
| BBE_R | Background block error ratio |
| EFS_C | Error-free seconds |
| EFS_R | Error-free seconds ratio |
| ES_C | Errored seconds |
| ES_R | Errored second ratio |
| SES_C | Severely errored seconds |
| SES_R | Severely errored second ratio |
| CSES_C | Consecutive SES periods |
| UAS_C | Unavailable seconds |
| UAS_R | Unavailable seconds error ratio |

## :SENSe:ANALysis:G826A:PATH:NEAR:ALL

This query returns the values of all of the Near-End Path parameters from G.826 analysis of received data. The parameters are returned in the order in which they are listed under the heading :SENSe:ANALysis:G826A:PATH:NEAR. Ratios are returned as NR3 values, other parameters as NR1 values.

**Syntax:** :SENSe<slot>:ANALysis:G826A:PATH:NEAR:ALL?

## :SENSe:ANALysis:G826A:RS

This query returns the value of the specified Regenerator Section parameter from G.826 analysis of received data.

**Syntax** :SENSe<slot>:ANALysis:G826A:RS? <Enum>

| Parameter | Description |
|---|---|
| ETIME | Elapsed time |
| EB_C | Errored blocks |
| EB_R | Errored block ratio |
| BBE_C | Background block errors |
| BBE_R | Background block error ratio |
| ES_C | Errored seconds |
| ES_R | Errored second ratio |
| SES_C | Severely errored seconds |
| SES_R | Severely errored second ratio |
| CSES_C | Consecutive SES periods |
| UAS_C | Unavailable seconds |
| UAS_R | Unavailable seconds error ratio |

## :SENSe:ANALysis:G826A:RS:ALL

This query returns the values of all of the Regenerator Section parameters from G.826 analysis of received data. The parameters are returned in the order in which they are listed under :SENSe:ANALysis:G826A:RS.

**Syntax** :SENSe<slot>:ANALysis:G826A:RS:ALL?

## :SENSe:ANALysis:GR253A:LINE:FAR

This query returns the value of the specified Far-End Line parameter from GR-253 analysis of received data.

**Syntax** :SENSe<slot>:ANALysis:GR253A:LINE:FAR? <Enum>

| Parameters | Description |
|---|---|
| CV_C | CV Count |
| CV_R | CV Count Ratio |
| BBE_C | Background block errors |
| BBE_R | Background block error ratio |
| ES_C | Errored seconds |
| ES_R | Errored second ratio |
| SES_C | Severely errored seconds |
| SES_R | Severely errored second ratio |
| ESA_C | Errored seconds type A |
| ESA_R | Errored second type A ratio |
| ESB_C | Errored seconds type B |
| ESB_R | Errored second type B ratio |
| CSES_C | Consecutive SES periods |
| UAS_C | Unavailable seconds |
| UAS_R | Unavailable seconds error ratio |

## :SENSe:ANALysis:GR253A:LINE:FAR:ALL

This query returns the values of all of the Far-End Line parameters from GR-253 analysis of received data. The parameters are returned in the order in which they are listed under :SENSe:ANALysis:GR253A:LINE:FAR.

**Syntax** :SENSe<slot>:ANALysis:GR253A:LINE:FAR:ALL?

## :SENSe:ANALysis:GR253A:LINE:NEAR

This query returns the value of the specified Near-End Line parameter from GR-253 analysis of received data.

**Syntax** :SENSe<slot>:ANALysis:GR253A:LINE:NEAR? <Enum>

| **Parameters** | **Description** |
|---|---|
| CV_C | CV Count |
| CV_R | CV Count ratio |
| BBE_C | Background block errors |
| BBE_R | Background block error ratio |
| ES_C | Errored seconds |
| ES_R | Errored second ratio |
| SES_C | Severely errored seconds |
| SES_R | Severely errored second ratio |
| ESA_C | Errored seconds type A |
| ESA_R | Errored second type A ratio |
| ESB_C | Errored seconds type B |
| ESB_R | Errored second type B ratio |
| CSES_C | Consecutive SES periods |
| UAS_C | Unavailable seconds |
| UAS_R | Unavailable seconds error ratio |

## :SENSe:ANALysis:GR253A:LINE:NEAR:ALL

This query returns the values of all of the Near-End Line parameters from GR-253 analysis of received data. The parameters are returned in the order in which they are listed under :SENSe:ANALysis:GR253A:LINE:NEAR.

**Syntax** : SENSe<slot>:ANALysis:GR253A:LINE:NEAR:ALL?

## :SENSe:ANALysis:GR253A:PATH:FAR

This query returns the value of the specified Far-End Path parameter from GR-253 analysis of received data. Ratios are returned as NR3 values, other parameters as NR1 values.

**Syntax:** :SENSe<slot>:ANALysis:GR253A:PATH:FAR? <Enum>

| Parameters | Description |
|---|---|
| CV_C | CV Count |
| CV_R | CV Count ratio |
| BBE_C | Background block errors |
| BBE_R | Background block error ratio |
| ES_C | Errored seconds |
| ES_R | Errored second ratio |
| SES_C | Severely errored seconds |
| SES_R | Severely errored second ratio |
| ESA_C | Errored seconds type A |
| ESA_R | Errored second type A ratio |
| ESB_C | Errored seconds type B |
| ESB_R | Errored second type B ratio |
| CSES_C | Consecutive SES periods |
| UAS_C | Unavailable seconds |
| UAS_R | Unavailable seconds error ratio |

## :SENSe:ANALysis:GR253A:PATH:FAR:ALL

This query returns the values of all of the Far-End Path parameters from GR-253 analysis of received data. The parameters are returned in the order in which they are listed under the heading :SENSe:ANALysis:GR253A:PATH:FAR. Ratios are returned as NR3 values, other parameters as NR1 values.

**Syntax:** :SENSe<slot>:ANALysis:GR253A:PATH:FAR:ALL?

## :SENSe:ANALysis:GR253A:PATH:NEAR

This query returns the value of the specified Near-End Path parameter from GR-253 analysis of received data. Ratios are returned as NR3 values, other parameters as NR1 values.

**Syntax:** :SENSe<slot>:ANALysis:GR253A:PATH:NEAR? <Enum>

| Parameters | Description |
|---|---|
| CV_C | CV Count |
| CV_R | CV Count ratio |
| BBE_C | Background block errors |
| BBE_R | Background block error ratio |
| ES_C | Errored seconds |
| ES_R | Errored second ratio |
| SES_C | Severely errored seconds |
| SES_R | Severely errored second ratio |
| ESA_C | Errored seconds type A |
| ESA_R | Errored second type A ratio |
| ESB_C | Errored seconds type B |
| ESB_R | Errored second type B ratio |
| CSES_C | Consecutive SES periods |
| UAS_C | Unavailable seconds |
| UAS_R | Unavailable seconds error ratio |

## :SENSe:ANALysis:GR253A:PATH:NEAR:ALL

This query returns the values of all of the Near-End Path parameters from GR-253 analysis of received data. Ratios are returned as NR3 values, other parameters as NR1 values. The parameters are returned in the order in which they are listed under :SENSe:ANALysis:GR253A:PATH:NEAR.

**Syntax:** :SENSe<slot>:ANALysis:GR253A:PATH:NEAR:ALL?

## :SENSe:ANALysis:GR253A:SECTion

This query returns the value of the specified Section parameter from GR-253 analysis of received data.

**Syntax** :SENSe<slot>:ANALysis:GR253A:SECTion? <Enum>

| **Parameters** | **Description** |
|---|---|
| CV_C | CV Count |
| CV_R | CV Count ratio |
| BBE_C | Background block errors |
| BBE_R | Background block error ratio |
| ES_C | Errored seconds |
| ES_R | Errored second ratio |
| SES_C | Severely errored seconds |
| SES_R | Severely errored second ratio |
| ESA_C | Errored seconds type A |
| ESA_R | Errored second type A ratio |
| ESB_C | Errored seconds type B |
| ESB_R | Errored second type B ratio |
| CSES_C | Consecutive SES periods |
| UAS_C | Unavailable seconds |
| UAS_R | Unavailable seconds error ratio |
| SEFS_C | Severely errored framing seconds |
| SEFS_R | Severely errored framing second ratio |

## :SENSe:ANALysis:GR253A:SECTion:ALL

This query returns the values of all of the Section parameters from GR-253 analysis of received data. The parameters are returned in the order in which they are listed under :SENSe:ANALysis:GR253A:SECTion.

**Syntax** :SENSe<slot>:ANALysis:GR253A:SECTion:ALL?

## :SENSe:ANALysis:PATH:HPPLM

This command enables or disables the inclusion of Path Label Mismatch errors in the analysis of received signals. The query form returns the current setting.

Syntax: :SENSe<slot>:ANALysis:PATH:HPPLM?
:SENSe<slot>:ANALysis:PATH:HPPLM <Boolean>

## :SENSe:ANALysis:PATH:HPPLM:GENEric

This command enables or disables generic equipment evaluation in the detection of Path Label Mismatch errors. If enabled, the detection of Generic Unequipped (code 01) does not cause a Path Label Mismatch error. The query form returns the current setting.

Syntax: :SENSe<slot>:ANALysis:PATH:HPPLM:GENEric?
:SENSe<slot>:ANALysis:PATH:HPPLM:GENEric <Boolean>

## :SENSe:ANALysis:PATH:HPUNEQ

This command enables or disables the inclusion of Path Label Unequipped errors in the analysis of received signals. The query form returns the current setting.

Syntax: :SENSe<slot>:ANALysis:PATH:HPUNEQ?
:SENSe<slot>:ANALysis:PATH:HPUNEQ <Boolean>

## :SENSe:ANALysis:PATH:LABEl:EXPEcted

This command sets the comparison value for Path Label Mismatch analysis. The query form returns the current setting.

Syntax: :SENSe<slot>:ANALysis:PATH:LABEl:EXPEcted?
:SENSe<slot>:ANALysis:PATH:LABEl:EXPEcted <NR1>

## :SENSe:ANALysis:PATH:TRACe:EXPEcted

This command sets the data sequence length and data byte values against which the receiver compares the received signal for path Trace Identifier Mismatch measurements. The data bytes are formatted as a standard IEEE-488 data block. The query form returns the current settings of these parameters.

**Syntax:** :SENSe<slot>:ANALysis:PATH:TRACe:EXPEcted?
:SENSe<slot>:ANALysis:PATH:TRACe:EXPEcted <Enum> ,<Block>

| **Parameters** | **Description** |
|---|---|
| L1B | Constant 8-bit data |
| L16B | A repeating sequence of 16 bytes, 0-filled with CRC |
| L16FREE | A repeating sequence of 16 bytes, arbitrary format |
| L64B | A repeating sequence of 64 bytes, space-filled with CR/LF |
| L64FREE | A repeating sequence of 64 bytes, arbitrary format |

## :SENSe:ANALysis:PATH:TRACe:EXPEcted:TYPE

This command sets the data sequence length used by the receiver for path Trace Identifier Mismatch measurements. This parameter may also be set by the :SENSe:ANALysis:PATH:TRACe:EXPEcted command. The query form returns the current setting of this parameter.

**Syntax:** :SENSe<slot>:ANALysis:PATH:TRACe:EXPEcted:TYPE?
:SENSe<slot>:ANALysis:PATH:TRACe:EXPEcted:TYPE <Enum>

| **Parameters** | **Description** |
|---|---|
| L1B | Constant 8-bit data |
| L16B | A repeating sequence of 16 bytes, 0-filled with CRC |
| L16FREE | A repeating sequence of 16 bytes, arbitrary format |
| L64B | A repeating sequence of 64 bytes, space-filled with CR/LF |
| L64FREE | A repeating sequence of 64 bytes, arbitrary format |

## :SENSe:ANALysis:PATH:TRACe:EXPEcted:VALUe

This command sets the data byte values used by the receiver for path Trace Identifier Mismatch measurements. The data bytes are formatted as a standard IEEE-488 data block. These values may also be set by the :SENSe:ANALysis:PATH:TRACe:EXPEcted command. The query form returns the current values.

**Syntax:** :SENSe<slot>:ANALysis:PATH:TRACe:EXPEcted:VALUe?
:SENSe<slot>:ANALysis:PATH:TRACe:EXPEcted:VALUe <Block>

## :SENSe:ANALysis:PATH:TRACe:EXPEcted:VALUe:STRIng

This command sets the data byte values used by the receiver for path Trace Identifier Mismatch measurements. The byte values are formatted as an ASCII string. These values may also be set by the :SENSe:ANALysis:PATH:TRACe:EXPEcted command. The query form returns the current values.

**Syntax:** :SENSe<slot>:ANALysis:PATH:TRACe:EXPEcted:VALUe:STRIng?
:SENSe<slot>:ANALysis:PATH:TRACe:EXPEcted:VALUe:STRIng <String>

## :SENSe:ANALysis:PATH:TRACe:TIM

This command enables or disables the inclusion of path Trace Identifier Mismatch errors in the analysis of received signals. The query form returns the current setting.

**Syntax:** :SENSe<slot>:ANALysis:PATH:TRACe:TIM?
:SENSe<slot>:ANALysis:PATH:TRACe:TIM <Boolean>

## :SENSe:ANALysis:SECTion:TRACe:EXPEcted

This command sets the data sequence length and data byte values against which the receiver compares the received signal for Trace Identifier Mismatch measurements. The data bytes are formatted as a standard IEEE-488 data block. The query form returns the current settings of these parameters.

**Syntax** :SENSe<slot>:ANALysis:SECTion:TRACe:EXPEcted?
:SENSe<slot>:ANALysis:SECTion:TRACe:EXPEcted <Enum> ,<Block>

| **Parameters** | **Description** |
|---|---|
| L1B | Constant 8-bit data |
| L16B | A repeating sequence of 16 bytes, 0-filled with CRC |
| L16FREE | A repeating sequence of 16 bytes, arbitrary format |
| L64B | A repeating sequence of 64 bytes, space-filled with CR/LF |
| L64FREE | A repeating sequence of 64 bytes, arbitrary format |

## :SENSe:ANALysis:SECTion:TRACe:EXPEcted:TYPE

This command sets the data sequence length used by the receiver for Trace Identifier Mismatch measurements. This parameter may also be set by the :SENSe:ANALysis:SECTion:TRACe:EXPEcted command. The query form returns the current setting of this parameter.

**Syntax** :SENSe<slot>:ANALysis:SECTion:TRACe:EXPEcted:TYPE?
:SENSe<slot>:ANALysis:SECTion:TRACe:EXPEcted:TYPE <Enum>

| **Parameters** | **Description** |
|---|---|
| L1B | Constant 8-bit data |
| L16B | A repeating sequence of 16 bytes, 0-filled with CRC |
| L16FREE | A repeating sequence of 16 bytes, arbitrary format |
| L64B | A repeating sequence of 64 bytes, space-filled with CR/LF |
| L64FREE | A repeating sequence of 64 bytes, arbitrary format |

## :SENSe:ANALysis:SECTion:TRACe:EXPEcted:VALUe

This command sets the data byte values used by the receiver for Trace Identifier Mismatch measurements. The data bytes are formatted as a standard IEEE-488 data block. These values may also be set by the :SENSe:ANALysis:SECTion:TRACe:EXPEcted command. The query form returns the current values.

**Syntax** :SENSe<slot>:ANALysis:SECTion:TRACe:EXPEcted:VALUe?
:SENSe<slot>:ANALysis:SECTion:TRACe:EXPEcted:VALUe <Block>

## :SENSe:ANALysis:SECTion:TRACe:EXPEcted:VALUe:STRIng

This command sets the data byte values used by the receiver for Trace Identifier Mismatch measurements. The byte values are formatted as an ASCII string. These values may also be set by the :SENSe:ANALysis:SECTion:TRACe:EXPEcted command. The query form returns the current values.

**Syntax** :SENSe<slot>:ANALysis:SECTion:TRACe:EXPEcted:VALUe:STRIng?
:SENSe<slot>:ANALysis:SECTion:TRACe:EXPEcted:VALUe:STRIng <String>

## :SENSe:ANALysis:SECTion:TRACe:TIM

This command enables or disables the inclusion of Trace Identifier Mismatch errors in the analysis of received signals. The query form returns the current setting.

**Syntax** :SENSe<slot>:ANALysis:SECTion:TRACe:TIM?
:SENSe<slot>:ANALysis:SECTion:TRACe:TIM <Boolean>

## :SENSe:DATA:AUTOscan:STRUcture

This query returns the signal structure found in the received signal.

**Syntax** :SENSe<slot>:DATA:AUTOscan:STRUcture?

| **Parameters** | **Description** |
|---|---|
| 192 | Bulk data at 10Gb/s |
| 48 | Bulk data at 2.5Gb/s |
| 12 | Bulk data at 622Mb/s |
| 3 | Bulk data at 155Mb/s |
| 1 | Bulk data at 51Mb/s |
| 0 | Mixed signal structure |

## :SENSe:DATA:CHANnel

This command selects the active channel for the received signal. The query form returns the current setting.

**Syntax:** :SENSe<slot>:DATA:CHANnel?
:SENSe<slot>:DATA:CHANnel <NR1>

## :SENSe:DATA:IP:PAYLoad:PATTern

This command selects the test pattern inserted as IP payload into the received signal. The query form returns the current setting.

**Syntax** :SENSe<slot>:DATA:IP:PAYLoad:PATTern?
:SENSe<slot>:DATA:IP:PAYLoad:PATTern <Parameter>

| **Parameters** | **Description** |
|---|---|
| PRBS31A | ITU standard PRBS 2^31-1 pattern |
| PRBS31I | Inverted PRBS 2^31-1 pattern |
| USER | Constant 16-bit user-specified data |

## :SENSe:DATA:IP:PAYLoad:PATTern:UDATA

This command specifies the data value inserted into the received signal when constant data is selected for the IP test pattern. The query form returns the current setting.

**Syntax** :SENSe<slot>:DATA:IP:PAYLoad:PATTern:UDATA?
:SENSe<slot>:DATA:IP:PAYLoad:PATTern:UDATA <NR1>

## :SENSe:DATA:IP:STReam:INDEX

This query form returns the current setting.

**Syntax** :SENSe<slot>:DATA:IP:STReam:INDEX?

## :SENSe:DATA:PATH:TRACe

This query returns the most recently received J1 path trace type (length) and data. See the command :SOURce:DATA:PATH:TRACe for the formats of the enum and block values returned. The data bytes are returned in standard IEEE-488 block data format.

**Syntax:** :SENSe<slot>:DATA:PATH:TRACe?

## :SENSe:DATA:PATH:TRACe:TYPE

This query returns the most recently received J1 path trace type (length). See the command :SOURce:DATA:PATH:TRACe:TYPE for the format of the enum value returned.

**Syntax:** :SENSe<slot>:DATA:PATH:TRACe:TYPE?

## :SENSe:DATA:PATH:TRACe:VALUe

This query returns the most recently received J1 path trace data. The data bytes are returned in IEEE-488 block data format.

**Syntax:** :SENSe<slot>:DATA:PATH:TRACe:VALUe?

## :SENSe:DATA:PATH:TRACe:VALUe:STRIng

This query returns the most recently received J1 path trace data. The data is returned as an ASCII string.

**Syntax:** :SENSe<slot>:DATA:PATH:TRACe:VALUe:STRIng?

## :SENSe:DATA:PAYLoad:PATTern

This command selects the test pattern for the received signal. The query form returns the current setting.

**Syntax:** :SENSe<slot>:DATA:PAYLoad:PATTern?
:SENSe<slot>:DATA:PAYLoad:PATTern <Enum>

| **Parameters** | **Description** |
|---|---|
| PRBS15A | ITU standard PRBS 2^15-1 pattern |
| PRBS15I | Inverted PRBS 2^15-1 pattern |
| PRBS23A | ITU standard PRBS 2^23-1 pattern |
| PRBS23I | Inverted PRBS 2^23-1 pattern |
| PRBS31A | ITU standard PRBS 2^31-1 pattern |
| PRBS31I | Inverted PRBS 2^31-1 pattern |
| ZEROs | Constant zero data |
| ONEs | Constant one data |
| USER | Constant 8-bit user-specified |
| LIVE | Live data |

## :SENSe:DATA:PAYLoad:PATTern:UDATA

This command selects the fixed test pattern for the received signal. The query form returns the current setting.

**Syntax:** :SENSe<slot>:DATA:PAYLoad:PATTern:UDATA?
:SENSe<slot>:DATA:PAYLoad:PATTern:UDATA <NR1>

## :SENSe:DATA:POH:ALL

This query returns a block of data representing the Path Overhead data from an STS-1 in the received signal. There are 9 bytes in the block returned. For SONET, these bytes are J1 B3 C2 G1 F2 H4 Z3 Z4 Z5; for SDH, these bytes are J1 B3 C2 G1 F2 H4 F3 K3 N1.

**Syntax:** :SENSe<slot>:DATA:POH:ALL? [<NR1>]

## :SENSe:DATA:POH:BYTE

This query returns a single byte of data from the Path Overhead data for the selected active channel in the received signal. The numeric parameter, with range 1 to 9, specifies the byte in the order listed under :SENSe:DATA:POH:ALL.

**Syntax:** :SENSe<slot>:DATA:POH:BYTE? <NR1>

## :SENSe:DATA:POH:BYTE:C2A

This query returns the Path Label (C2) byte from the selected active channel in the received signal.

**Syntax:** :SENSe<slot>:DATA:POH:BYTE:C2A?

## :SENSe:DATA:POS:SCRambling

This command enables or disables the packet over sonnet scrambling. The query form returns the current setting. <Slot> is an optional number that specifies the module slot containing the device that is the target of the command; if omitted, it defaults to the lowest-numbered slot containing an applicable device.

**Syntax** :SENSe<slot>:DATA:POS:SCRambling?
:SENSe<slot>:DATA:POS:SCRambling <Boolean>

## :SENSe:DATA:RATE

This query returns the input signal rate expected by the OTS-9000 receiver.

**Syntax** :SENSe<slot>:DATA:RATE?

| **Parameters** | **Description** |
|---|---|
| G10A | 10 Gb/s (OC-192 or STM-64) |

## :SENSe:DATA:SECTion:TRACe

This query returns the most recently received J0 section trace type (length) and data. The data bytes are returned in standard IEEE-488 block data format.

**Syntax** :SENSe<slot>:DATA:SECTion:TRACe?

## :SENSe:DATA:SECTion:TRACe:TYPE

This query returns the most recently received J0 section trace type (length).

**Syntax** :SENSe<slot>:DATA:SECTion:TRACe:TYPE?

## :SENSe:DATA:SECTion:TRACe:VALUe

This query returns the most recently received J0 section trace data. The data bytes are returned in IEEE-488 block data format.

**Syntax** :SENSe<slot>:DATA:SECTion:TRACe:VALUe?

## :SENSe:DATA:SECTion:TRACe:VALUe:STRIng

This query returns the most recently received J0 section trace data. The data is returned as an ASCII string.

**Syntax** :SENSe<slot>:DATA:SECTion:TRACe:VALUe:STRIng?

## :SENSe:DATA:SPE:STUFfing

This command controls the receiver's treatment of columns 30 and 59, which can be used for SPE fixed byte stuffing. When enabled, these columns are treated as stuffing columns and are not considered part of the payload. When disabled, columns 30 and 59 are treated as part of the payload. This command is applicable only to STS-1 structure. The query form returns the current setting.

**Syntax:** :SENSe<slot>:DATA:SPE:STUFfing?
:SENSe<slot>:DATA:SPE:STUFfing? <Boolean>

## :SENSe:DATA:STRUcture

This command sets the receiver structure. The query form returns the current setting.

**Syntax:** :SENSe<slot>:DATA:STRUcture?
:SENSe<slot>:DATA:STRUcture <Enum>

| **Parameters** | **Description** |
|---|---|
| G10C | Bulk data at 10 Gb/s |
| G2P5C | Bulk data at 2.5 Gb/s |
| M622C | Bulk data at 622 Mb/s |
| M155C | Bulk data at 155 Mb/s |
| M51A | Bulk data at 51 Mb/s (SONET only) |

## :SENSe:DATA:TOH:STM1A:ALL

This query returns a block of data representing the Transport Overhead data from an STM-1 in the received signal.

There are 81 bytes - three groups of 27 - in the block returned, representing the STS-1 overhead data for each STS-1 in the STM-1.

**Syntax** :SENSe<slot>:DATA:TOH:STM1A:ALL?

## :SENSe:DATA:TOH:STS1A:ALL

This query returns a block of data representing the Transport Overhead data from an STS-1 in the received signal.

There are 27 bytes in the block returned. These correspond to the overhead bytes A1, A2, J0, B1, E1, F1, D1..D3, H1..H3, B2, K1, K2, D4..D12, S1, Z2, E2.

**Syntax** :SENSe<slot>:DATA:TOH:STS1A:ALL? [<NR1>]

## :SENSe:INPUt:THREshold

This command sets the receiver input offset threshold value in millivolts for the OTS receiver. The query form returns the current setting.

**Syntax** :SENSe<slot>:INPUt:THREshold?
:SENSe<slot>:INPUt:THREshold <NR1>

## :SENSe:INPut:THReshold:LOS

This command sets the LOS threshold value. The query form returns the currently active setting for the LOS threshold.

**Syntax** :SENSe<slot>:INPut:THReshold:LOS?
:SENSe<slot>:INPut:THReshold:LOS <NR1>

## :SENSe:MEASure:APSTime:CONDition

This command sets the condition tested for APS switch time measurement. The query form returns the current setting

**Syntax:** :SENSe<slot>:MEASure:APSTime:CONDition?
:SENSe<slot>:MEASure:APSTime:CONDition <Enum>

| **Parameters** | **Description** |
|---|---|
| LOS | Loss of Signal |
| OOF | Severely Errored Frame / Out of Frame |
| B1BIP | B1 errors |
| B2BIP | B2 errors |
| B3BIP | B3 errors |
| BIT | Bit (payload) errors |
| AIS_L | Line AIS / MS-AIS |
| AIS_P | Path AIS |
| RDI_L | Line RDI / MS-RDI |
| RDI_P | Path RDI |

## :SENSe:MEASure:APSTime:DETEcted

This query returns one or more values to indicate the receiver events detected during the most recently performed APS measurement.

**Syntax:** :SENSe<slot>:MEASure:APSTime:DETEcted?

| Parameters | Description |
|---|---|
| NONE | No conditions were detected |
| LOS | Loss of Signal |
| OOF | Severely Errored Frame / Out of Frame |
| B1BIP | B1 errors |
| B2BIP | B2 errors |
| B3BIP | B3 errors |
| BIT | Bit (payload) errors |
| AIS_L | Line AIS / MS-AIS |
| AIS_P | Path AIS |
| RDI_L | Line RDI / MS-RDI |
| RDI_P | Path RDI |

## :SENSe:MEASure:APSTime:MAXTime

This command sets the maximum time for APS switch time measurement. The query form returns the current setting

**Syntax:** :SENSe<slot>:MEASure:APSTime:MAXTime?
:SENSe<slot>:MEASure:APSTime:MAXTime <NR1>

## :SENSe:MEASure:APSTime:RUN

This command starts (1) an APS switch time measurement, or stops (0) any measurement in progress.

**Syntax:** :SENSe<slot>:MEASure:APSTime:RUN <Boolean>

## :SENSe:MEASure:APSTime:STATus

This query returns the status of the most recently performed APS switch time measurement.

**Syntax:** :SENSe<slot>:MEASure:APSTime:STATus?

| Parameters | Description |
|---|---|
| INVALID | No valid result is available |
| BUSY | An APS time measurement is in process |
| PASS | The current APS time test passed |
| FAIL | The current APS time test failed |

## :SENSe:MEASure:APSTime:THREshold

This command sets the threshold time for APS switch time measurement. If the measured switch time exceeds the threshold time, the test fails. The query form returns the current setting.

**Syntax:** :SENSe<slot>:MEASure:APSTime:THREshold?
:SENSe<slot>:MEASure:APSTime:THREshold <NR1>

## :SENSe:MEASure:APSTime:VALUe

This query returns, as a NR1 value, the APS switch time value measured by the most recently performed APS measurement. The units for the value can be specified as milliseconds, microseconds, or frames. If the unit specification is omitted, the unit defaults to milliseconds.

**Syntax:** :SENSe:MEASure:APSTime:VALUe? <Enum>

| Parameters | Description |
|---|---|
| FRAMES | The current APS time value in frames |
| USEC | The current APS time value in microseconds |
| MSEC | The current APS time in milliseconds |

***NOTE:*** *This command is only targeted for a receiver card. Unlike other cards, you cannot target the optical card directly by using the slot number of the optical card.*

## :SENSe:MEASure:HDLC:FRAMes

This query returns the value of the specified result parameter in NR1 format.

**Syntax** :SENSe<slot>:MEASure:HDLC:FRAMes? <Parameter>

| Parameters | Description |
|---|---|
| GFCS | Count of HDLC frames received with good FCS |
| BFCS | Count of HDLC frames received with bad FCS |
| ABORted | Count of aborted HDLC frames |
| INValid | Count of invalid HDLC frames |
| MINSize | Count of HDLC frames received with minimum size violation |

## :SENSe:MEASure:HDLC:FRAMes:ALL

This query returns the values of all of the parameters of the SENSe :MEASure:HDLC:FRAMes? query. The parameters are returned in the order in which they are listed under :SENSe:MEASure:HDLC:FRAMes values are returned in NR1 format.

**Syntax** :SENSe<slot>:MEASure:HDLC:FRAMes:ALL?

## :SENSe:MEASure:HDLC:BYTes

This query returns the number of HDLC bytes received with good FCS.

**Syntax** :SENSe<slot>:MEASure:HDLC:BYTes?

## :SENSe:MEASure:IP:PACKets

This query returns the value of the specified result parameter in NR1 format.

**Syntax** :SENSe<slot>:MEASure:IP:PACKets? <Parameter>

| Parameters | Description |
|---|---|
| TOTal | Total count of IP bytes received |
| GOOD | Count IP bytes received with good checksum |
| BAD | Count of IP bytes received with bad checksum |
| FREE | Count of IP Packet received with no payload errors |
| PAYLoad | Count of IP Packet received with payload errors |

## :SENSe:MEASure:IP:PACKets:ALL

This query returns the values of all of the parameters of the SENSe :MEASure:IP:PACKets? query. The parameters are returned in the order in which they are listed under :SENSe:MEASure:IP:PACKets values are returned in NR1 format.

**Syntax** :SENSe<slot>:MEASure:IP:PACKets:ALL?

## :SENSe:MEASure:LINE:CUMUlative

This query returns the value of the specified result parameter for the most recent test.

**Syntax** :SENSe<slot>:MEASure:LINE:CUMUlative? <Enum>

| Parameters | Description |
|---|---|
| B2_C | B2 errors |
| B2_ES | B2 errored seconds |
| B2_ER | B2 error ratio |
| REI_C | REI errors |
| REI_ES | REI errored seconds |
| REI_ER | REI error ratio |
| AIS_ES | AIS errored seconds |
| RDI_ES | RDI errored seconds |

## :SENSe:MEASure:LINE:CUMUlative:ALL

This query returns the values of all of the parameters of the :SENSE:MEASURE:LINE:CUMULATIVE? query. The parameters are returned in the order in which they are listed under :SENSE:MEASURE:LINE:CUMULATIVE.

**Syntax** :SENSe<slot>:MEASure:LINE:CUMUlative:ALL?

## :SENSe:MEASure:LINE:WINDow

This query returns the value of the specified result parameter as measured during the most recent 'N' seconds. The duration 'N' of the measurement window is set by the :SENSE:MEASURE:WINDOW:SIZE command.

**Syntax** :SENSe<slot>:MEASure:LINE:WINDow? <Enum>

| Parameters | Description |
|---|---|
| B2_C | B2 errors |
| B2_ES | B2 errored seconds |
| B2_ER | B2 error ratio |
| REI_C | REI errors |
| REI_ES | REI errored seconds |
| REI_ER | REI error ratio |
| AIS_ES | Loss-of-signal errored seconds |
| RDI_ES | Loss-of-frame errored seconds |

## :SENSeMEASure:LINE:WINDow:ALL

This query returns the values of all of the parameters of the :SENSE:MEASURE:LINE:WINDOW? query, as measured during the most recent N-second period. The parameters are returned in the order in which they are listed under :SENSE:MEASURE:LINE:WINDOW.

**Syntax** :SENSe<slot>:MEASure:LINE:WINDow:ALL?

## :SENSe:MEASure:PATH:CUMUlative

This query returns the value of the specified result parameter for the most recent test. Ratios are returned in NR3 format; other values are returned in NR1 format.

**Syntax:** :SENSe<slot>:MEASure:PATH:CUMUlative? <Enum>

| Parameters | Description |
|---|---|
| B3_C | B3 errors |
| B3_ES | B3 errored seconds |
| B3_ER | B3 error ratio |
| REI_C | Path REI errors |
| REI_ES | Path REI errored seconds |
| REI_ER | Path REI error ratio |
| AIS_ES | Path AIS errored seconds |
| RDI_ES | Path RDI errored seconds |
| PLM_ES | Path Label Mismatch errored seconds |
| UNEQ_ES | Path Label Unequipped errored seconds |
| LSS_ES | Loss of Synch errored seconds |
| LOP_ES | Loss of Pointer errored seconds |
| J1TIM_ES | Path trace mismatch errored seconds |
| PAYL_C | Payload errors |
| PAYL_ES | Payload errored seconds |
| PAYL_ER | Payload error ratio |
| RDIPAY_ES | Path RDI (Payload) errored seconds |
| RDICON_ES | Path RDI (Connectivity) errored seconds |
| RDISRV_ES | Path RDI (Server) errored seconds |

## :SENSe:MEASure:PATH:CUMUlative:ALL

This query returns the values of all of the parameters of the :SENSe:MEASure:PATH:CUMUlative? query. The parameters are returned in the order in which they are listed under the heading :SENSe:MEASure:PATH:CUMUlative. Ratios are returned in NR3 format; other values are returned in NR1 format

**Syntax:** :SENSe<slot>:MEASure:PATH:CUMUlative:ALL?

## :SENSe:MEASure:PATH:WINDow

This query returns the value of the specified result parameter as measured during the most recent 'N' seconds. The duration 'N' of the measurement window is set by the :SENSe:MEASure:WINDow:SIZE command.

**Syntax:** :SENSe<slot>:MEASure:PATH:WINDow? <Enum>

| **Parameters** | **Description** |
|---|---|
| B3_C | B3 errors |
| B3_ES | B3 errored seconds |
| B3_ER | B3 error ratio |
| REI_C | Path REI errors |
| REI_ES | Path REI errored seconds |
| REI_ER | Path REI error ratio |
| AIS_ES | Path AIS errored seconds |
| RDI_ES | Path RDI errored seconds |
| PLM_ES | Path Label Mismatch errored seconds |
| UNEQ_ES | Path Label Unequipped errored seconds |
| LSS_ES | Loss of Synch errored seconds |
| LOP_ES | Loss of Pointer errored seconds |
| J1TIM_ES | Path trace mismatch errored seconds |
| PAYL_C | Payload errors |
| PAYL_ES | Payload errored seconds |
| PAYL_ER | Payload error ratio |
| RDIPAY_ES | Path RDI (Payload) errored seconds |
| RDICON_ES | Path RDI (Connectivity) errored seconds |
| RDISRV_ES | Path RDI (Server) errored seconds |

## :SENSe:MEASure:PATH:WINDow:ALL

This query returns the values of all of the parameters of the :SENSe:MEASure:PATH:WINDow? query, as measured during the most recent N-second period. The parameters are returned in the order in which they are listed under :SENSe:MEASure:PATH:WINDow. Ratios are returned in NR3 format; other values are returned in NR1 format.

**Syntax:** :SENSe<slot>:MEASure:PATH:WINDow:ALL?

## :SENSe:MEASure:SECTion:CUMUlative

This query returns the value of the specified result parameter for the most recent test.

**Syntax** :SENSe<slot>:MEASure:SECTion:CUMUlative? <Enum>

| Parameters | Description |
|---|---|
| B1_C | B1 errors |
| B1_ES | B1 errored seconds |
| B1_ER | B1 error ratio |
| FAS_C | Framing errors |
| FAS_ES | Framing errored seconds |
| FAS_ER | Framing error ratio |
| LOS_ES | Loss-of-signal errored seconds |
| LOF_ES | Loss-of-frame errored seconds |
| OOF_ES | Out-of-frame errored seconds |
| RSTIM_ES | RS trace mismatch errored seconds |

## :SENSe:MEASure:SECTion:CUMUlative:ALL

This query returns the values of all of the parameters of the :SENSE:MEASURE:SECTION:CUMULATIVE? query. The parameters are returned in the order in which they are listed under :SENSE:MEASURE:SECTION:CUMULATIVE.

**Syntax** :SENSe<slot>:MEASure:SECTion:CUMUlative:ALL?

## :SENSe:MEASure:SECTion:WINDow

This query returns the value of the specified result parameter as measured during the most recent 'N' seconds. The duration 'N' of the measurement window is set by the :SENSE:MEASURE:WINDOW:SIZE command.

**Syntax** :SENSe<slot>:MEASure:SECTion:WINDow? <Enum>

| Parameters | Description |
|---|---|
| B1_C | B1 errors |
| B1_ES | B1 errored seconds |
| B1_ER | B1 error ratio |
| FAS_C | Framing errors |
| FAS_ES | Framing errored seconds |
| FAS_ER | Framing error ratio |
| LOS_ES | Loss-of-signal errored seconds |
| LOF_ES | Loss-of-frame errored seconds |
| OOF_ES | Out-of-frame errored seconds |
| RSTIM_ES | RS trace mismatch errored seconds |

## :SENSe:MEASure:SECTion:WINDow:ALL

This query returns the values of all of the parameters of the :SENSE:MEASURE:SECTION:WINDOW? query, as measured during the most recent N-second period. The parameters are returned in the order in which they are listed under :SENSE:MEASURE:SECTION:CUMULATIVE.

**Syntax** :SENSe<slot>:MEASure:SECTion:WINDow:ALL?

## :SENSe:MEASure:WINDow:CLEAR

This command clears the data in the sliding measurement window.

**Syntax** :SENSe<slot>:MEASure:WINDow:CLEAR

## :SENSe:MEASure:WINDow:LEVEL

This query returns the number of seconds of measurement data included in the current windowed-measurement calculations. Normally this value will be the same as the window size; clearing the window data or changing the window size causes the sliding window to refill as new measurements are made.

**Syntax** :SENSe<slot>:MEASure:WINDow:LEVEL?

## :SENSe:MEASure:WINDow:SIZE

This command sets the duration in seconds of the interval over which windowed results measurements are calculated. The query form returns the current setting.

**Syntax** :SENSe<slot>:MEASure:WINDow:SIZE?
:SENSe<slot>:MEASure:WINDow:SIZE <NR1>

## :SENSe:OPTical:INPut:OVERload

This query returns a Boolean value indicating whether or not the optical power has exceeded its maximum threshold. A return value of 1 indicates that optical power is overloaded, while a return value of 0 indicates that optical power is at an acceptable level. This command and query may be directed either to the OTS Optics card or to the associated Receiver card.

**Syntax** :SENSe<slot>:OPTical:INPut:OVERload?

## :SENSe:OPTical:THReshold:AUTO

This command sets the auto-correct option for the receiver set point control to either on (1) or off (0). When set with to the on (1) value, the system sets the receiver point with its default value, and disallows any further manual setting. When set to the off (0) value, the user can manually adjust the receiver set point. The query version of this action returns the current setting for the auto-correct value.

**Syntax** :SENSe<slot>:OPTical:THReshold:AUTO?
:SENSe<slot>:OPTical:THReshold:AUTO <Boolean>

## :SENSe:OVERhead:MONItor:CHANnel

This command selects the particular channel of the received signal from which overhead data is monitored. The query form returns the current setting.

**Syntax** :SENSe<slot>:OVERhead:MONItor:CHANnel?
:SENSe<slot>:OVERhead:MONItor:CHANnel <NR1>

## :SENSe:SIGNal:STANdard

This command sets individual OTS9100 modules to the SONET or SDH signal mode. The query form returns the current setting.

**Syntax** :SENSe <Slot>:SIGNal:STANdard?
:SENSe <Slot>:SIGNal:STANdard SONET | SDH

| **Parameters** | **Description** |
|---|---|
| SONET | Set module to SONET signal mode |
| SDH | Set module to SDH signal mode |
| BERT | Set module to BERT |

## :SENSe:STATus:LEDS

This query reports the occurrence of various error and status conditions typically shown by front-panel status indicator lights. The response is an integer number representing the time of the most recent status change, followed by strings identifying the active conditions. The strings are listed in the table below. An optional numeric parameter specifies a time value, such that only events that occurred after that time are reported. If the time parameter is not present, it defaults to zero, corresponding to the start of the most recent test.

**Syntax** :SENSe<slot>:STATus:LEDS? [<NR1>]

| Condition | String | Word and bit value |
|---|---|---|
| Signal Not Present | optical-los | Parameter 1, bit value 1 (hex 1) |
| LOS | los | Parameter 2, bit value 1 (hex 1) |
| LOF | lof | Parameter 2, bit value 2 (hex 2) |
| OOF | oof | Parameter 2, bit value 4 (hex 4) |
| B1 | B1 | Parameter 2, bit value 8 (hex 8) |
| FAS | fas | Parameter 2, bit value 16 (hex 10) |
| RS-TIM / J0 Mismatch | j0-tim | Parameter 2, bit value 32 (hex 20) |
| MS AIS / AIS-L | ais-l | Parameter 3, bit value 1 (hex 1) |
| B2 | b2 | Parameter 3, bit value 2 (hex 2) |
| MS RDI / RDI-L | rdi-l | Parameter 4, bit value 1 (hex 1) |
| MS REI / REI-L | rei-l | Parameter 4, bit value 2 (hex 2) |
| No conditions set | (none) | All parameters 0 (hex 0) |

## :SENSe:STATus:LEDS:HEXadecimal

This query is an alternative form of :SENSe:STATus:LEDS. It returns a time value and four integer values that represent the status conditions listed in the table above. The parameters are returned as hexadecimal (base 16) numbers. Each condition appears as a bit value in one of the four parameter values returned; the particular parameter and bit value appears in the table above. Note that the high-order eight bits of each parameter identify the parameter in question and do not represent LED status conditions. The optional time parameter specifies the earliest time of interest.

**Syntax** :SENSe<slot>:STATus:LEDS:HEXadecimal? [<NR1>]

## :SENSe:STATus:LEDS:NUMEric

This query is an alternative form of :SENSe:STATus:LEDS. It returns a time value and four integer values that represent the status conditions listed in the table above. The parameters are returned as decimal numbers. Each condition appears as a bit value in one of the four parameter values returned; the particular parameter and bit value appears in the table above. Note that the high-order eight bits of each parameter identify the parameter in question and do not represent LED status conditions. The optional time parameter specifies the earliest time of interest.

**Syntax** :SENSe<slot>:STATus:LEDS:NUMEric? [<NR1>]

## :SENSe:STATus:PATH:LEDS

This query reports the occurence of various path-layer error and status conditions typically shown by front-panel status indicator lights. The response is an integer number representing the time of the most recent status change, followed by strings identifying the active conditions. The strings are listed in the table below. An optional numeric parameter specifies a time value, such that only events that occurred after that time are reported. If the time parameter is not present, it defaults to zero, corresponding to the start of the most recent test.

**Syntax** :SENSe<slot>:STATus:PATH:LEDS? [<NR1>]

| Condition | String | Word and bit value |
|---|---|---|
| AIS-P / AU-AIS | ais-p | Parameter 1, bit value 1 (hex 1) |
| LOP-P / AU-LOP | lop-p | Parameter 1, bit value 4 (hex 4) |
| B3 | b3 | Parameter 1, bit value 2 (hex 2) |
| RDI-P (all) / HP-RDI (all) | rdi-p | Parameter 2, bit value 1 (RDI-P), 2 (ERDI-P Payload), 4 (ERDI-P Server), 8 (ERDI-P Connectivity) |
| REI-P / HP-REI | rei-p | Parameter 2, bit value 16 (hex 10) |
| TIM-P / HP-TIM | tim-p | Parameter 1, bit value 128 (hex 80) |
| UNEQ-P / HP-UNEQ | uneq-p | Parameter 1, bit value 64 (hex 40) |
| PLM-P / HP-PLM | plm-p | Parameter 1, bit value 256 (hex 100) |
| LSS | lss | Parameter 3, bit value 2 (hex 2) |
| Bit Error / TSE | bit | Parameter 3, bit value 1 (hex 1) |
| No conditions set | (none) | All parameters 0 (Hex 0) |

## :SENSe:STATus:PATH:LEDS:HEXadecimal

This query is an alternative form of :SENSe:STATus:PATH:LEDS. It returns a time value and three integer values that represent the status conditions listed in the table above. The parameters are returned as hexadecimal (base 16) numbers. Each condition appears as a bit value in one of the four parameter values returned; the particular parameter and bit value appears in the table above. Note that the high-order eight bits of each parameter identify the parameter in question and do not represent LED status conditions. The optional time parameter specifies the earliest time of interest.

**Syntax** :SENSe<slot>:STATus:PATH:LEDS:HEXadecimal? [<NR1>]

## :SENSe:STATus:PATH:LEDS:NUMEric

This query is an alternative form of :SENSe:STATus:PATH:LEDS. It returns a time value and three integer values that represent the status conditions listed in the table above. The parameters are returned as decimal numbers. Each condition appears as a bit value in one of the four parameter values returned; the particular parameter and bit value appears in the table above. Note that the high-order eight bits of each parameter identify the parameter in question and do not represent LED status conditions. The optional time parameter specifies the earliest time of interest.

**Syntax** :SENSe<slot>:STATus:PATH:LEDS:NUMEric? [<NR1>]

## :SENSe:TEST:DESCription

This command sets the description text that is written to the results file at the start of a text. The text may be up to 127 characters long. The query form returns the current setting.

**Syntax** :SENSe<slot>:TEST:DESCription?
:SENSe<slot>:TEST:DESCription <String>

## :SENSe:TEST:MODE

This command sets the way the OTSsystem runs a test. The query form returns the current setting.

**Syntax** :SENSe<slot>:TEST:MODE?
:SENSe<slot>:TEST:MODE <Enum>

| **Parameters** | **Description** |
|---|---|
| CONTinuous | The test runs continuously |
| TIMEd | The test runs for a preset amount of time |
| REPEtitive | The test runs for a preset time and then restarts |

## :SENSe:TEST:STATe

This command controls the OTSsystem's execution of a test. The query form returns the state of a currently-executing test.

**Syntax** :SENSe<slot>:TEST:STATe?
:SENSe<slot>:TEST:STATe <Enum>

| **Parameters** | **Description** |
|---|---|
| RUN | Start a test |
| PAUSe | Pause the test in progress |
| RESUme | Resume the test in progress |
| END | Stop the test |
| RESTart | Stop the test and start a new test |
| STARTING | A test is starting (status query only) |
| STOPPING | A test is stopping (status query only) |

## :SENSe:TEST:TIME

This command sets the time duration for a test. The query form returns the currently programmed time.

**Syntax** :SENSe<slot>:TEST:TIME?
:SENSe<slot>:TEST:TIME <NR1>

## :SENSe:TEST:TIME:ELAPsed

This query returns the time since the start of the current test.

**Syntax** :SENSe<slot>:TEST:TIME:ELAPsed?

## :SENSe:TRIGger:MODE

This command sets the condition that will produce a trigger output from the OTS-9000 receiver. The query form returns the current setting.

**Syntax** :SENSe<slot>:TRIGger:MODE?
:SENSe<slot>:TRIGger:MODE <Enum>

| Parameters | Description |
|---|---|
| OFF | The trigger output is disabled |
| ANOMaly | A trigger occurs when an anomaly is received |
| DEFEct | A trigger occurs when a defect is received |
| PAYload | A trigger occurs when a payload data error is received |
| AD | A trigger occurs when an anomaly or defect is received |
| AP | A trigger occurs when an anomaly or payload data error is received |
| DP | A trigger occurs when a defect or payload data error is received |
| ADP | A trigger occurs when an anomaly, defect, or payload data error is received |

## :SOURce:CLOCk:SOURce

This command selects the timing source for the signal generated by the OTS-9000 transmitter. The query form returns the current setting.

**Syntax** :SOURce<slot>:CLOCk:SOURce?
:SOURce<slot>:CLOCk:SOURce <Enum>

| Parameters | Description |
|---|---|
| INTErnal | Transmitter timing is based on the OTS-9000's internal reference |
| EXTErnal | Transmitter timing is derived from an external signal applied to the clock/trigger card |

## :SOURce:DATA:BACKground:STRUcture

This command sets the background structure of the signal generated by the OTS-9000 transmitter. The query form returns the current setting.

**Syntax:** :SOURce<slot>:DATA:BACKground:STRUcture?
:SOURce<slot>:DATA:BACKground:STRUcture <Enum>

| Parameters | Description |
|---|---|
| G10C | Bulk data at 10 Gb/s |
| G2P5C | Bulk data at 2.5 Gb/s |
| M622C | Bulk data at 622 Mb/s |
| M155C | Bulk data at 155 Mb/s |
| M51A | Bulk data at 51 Mb/s (SONET only) |

## :SOURce:DATA:CHANnel

This command sets the active channel of the signal generated by the OTS-9000 transmitter. The query form returns the current setting.

**Syntax:** :SOURce<slot>:DATA:CHANnel?
:SOURce<slot>:DATA:CHANnel <NR1>

## :SOURce:DATA:CHANnel:REPLicate

This command enables insertion of the active-channel payload into all channels of the generated signal. When enabled, all channels contain identical payload data and the background-channel settings have no effect. The query form returns the current setting.

**Syntax:** :SOURce<slot>:DATA:CHANnel:REPLicate?
:SOURce<slot>:DATA:CHANnel:REPLicate <Boolean>

## :SOURce:DATA:HDLC:IFRame:GAP

This query returns the HDLC inter frame gap.

**Syntax** :SOURce<slot>:DATA:HDLC:IFRame:GAP?

## :SOURce:DATA:IP:HEADer:ADDRess:DEST

This command sets the transmitter IP header destination address. The query form returns the current settings. The first parameter specifies the first most significant byte. The last parameter specifies the least significant byte.

**Syntax** :SOURce<slot>:DATA:IP:HEADer:ADDRess:DEST?
:SOURce<slot>:DATA:IP:HEADer:ADDRess:DEST <NR1>,<NR1>,<NR1>,<NR1>

## :SOURce:DATA:IP:HEADer:ADDRess:SOURce

This command sets the transmitter IP header source address. The query form returns the current settings. The first parameter specifies the first most significant byte. The last parameter specifies the least significant byte.

**Syntax** :SOURce<slot>:DATA:IP:HEADer:ADDRess:SOURce?
:SOURce<slot>:DATA:IP:HEADer:ADDRess:SOURce <NR1>,<NR1>,<NR1>,<NR1>

## :SOURce:DATA:IP:HEADer:FLAG

This query returns the transmitter IP header flag. The value returned is formatted as NR1 parameter.

**Syntax** :SOURce<slot>:DATA:IP:HEADer:FLAG?

## :SOURce:DATA:IP:HEADer:FRAG:OFFSet

This query returns the transmitter IP header fragment offset. The value returned is formatted as NR1 parameter.

**Syntax** :SOURce<slot>:DATA:IP:HEADer:FRAG:OFFSet?

## :SOURce:DATA:IP:HEADer:ID

This query returns the transmitter IP header identification. The value returned is formatted as NR1 parameter.

**Syntax** :SOURce<slot>:DATA:IP:HEADer:ID?

## :SOURce:DATA:IP:HEADer:PROTocol

This command sets the transmitter IP header protocol. The query form returns the transmitter IP header protocol.

**Syntax** :SOURce<slot>:DATA:IP:HEADer:PROTocol?
:SOURce<slot>:DATA:IP:HEADer:PROTocol <NR1>

## :SOURce:DATA:IP:HEADer:PSIZe

This command sets the transmitter IP header packet size. The query form returns the transmitter IP header packet size.

**Syntax** :SOURce<slot>:DATA:IP:HEADer:PSIZe?

## :SOURce:DATA:IP:HEADer:TSERVice

This command sets the IP header type of service. The query form returns the IP header type of service.

**Syntax** :SOURce<slot>:DATA:IP:HEADer:TSERVice?
:SOURce<slot>:DATA:IP:HEADer:TSERVice <NR1>

## :SOURce:DATA:IP:HEADer:TTLive

This command sets the transmitter IP header time to live .The query form returns the transmitter IP header time to live.

**Syntax** :SOURce<slot>:DATA:IP:HEADer:TTLive?
:SOURce<slot>:DATA:IP:HEADer:TTLive <NR1>

## :SOURce:DATA:IP:HEADer:VERSion

This query returns the IP header version. The value returned is formatted as NR1 parameter.

**Syntax** :SOURce<slot>:DATA:IP:HEADer:VERSion?

## :SOURce:DATA:IP:PAYLoad:PATTern

This command selects the test pattern inserted as IP payload into the transmitted signal. The query form returns the current setting.

**Syntax** :SOURce<slot>:DATA:IP:PAYLoad:PATTern?
:SOURce<slot>:DATA:IP:PAYLoad:PATTern <Parameter>

| **Parameters** | **Description** |
|---|---|
| PRBS31A | ITU standard PRBS 2^31-1 pattern |
| USER | Constant 16-bit user-specified data |

## :SOURce:DATA:IP:PAYLoad:PATTern:UDATa

This command specifies the data value inserted into the transmitted signal when constant data is selected for the IP test pattern. The query form returns the current setting.

**Syntax** :SOURce<slot>:DATA:IP:PAYLoad:PATTern:UDATa?
:SOURce<slot>:DATA:IP:PAYLoad:PATTern:UDATa <NR1>

## :SOURce:DATA:IP:STReam:INDEX

This query form returns the transmitter sub stream index.

**Syntax** :SOURce<slot>:DATA:IP:STReam:INDEX?

## :SOURce:DATA:IP:TRAFfic

This command sets the transmitter IP traffic state. The query form returns the IP traffic state.

**Syntax** :SOURce<slot>:DATA:IP:TRAFfic?
:SOURce<slot>:DATA:IP:TRAFfic <Boolean>

## :SOURce:DATA:POS:SCRambling

This command enables or disables the packet over SONET scrambling. The query form returns the current setting.

**Syntax** :SOURce<slot>:DATA:POS:SCRambling?
:SOURce<slot>:DATA:POS:SCRambling <Boolean>

## :SOURce:DATA:OVERhead:PASSthru

This command controls the source of transmitted overhead data in Through Mode. The first parameter specifies an overhead data field; the second selects whether that field's data comes from the received signal (ON) or is generated by the OTS transmitter (OFF). The query form returns the current setting for the specified field.

**Syntax** :SOURce<slot>:DATA:OVERhead:PASSthru? <Enum>
:SOURce<slot>:DATA:OVERhead:PASSthru <Enum> ,<Boolean>

| **Parameters** | **Description** |
|---|---|
| APS | K1 and K2 (APS) bytes (bit value 16 in ...:ALL command) |
| DCC_S | D1 through D3 (Section DCC) bytes (bit value 8) |
| DCC_L | D4 through D12 (Line DCC) bytes (bit value 32) |
| E1A | E1 byte (bit value 2) |
| E2A | E2 byte (bit value 512) |
| F1A | F1 byte (bit value 4) |
| J0A | J0 (Section trace) byte (bit value 1) |
| M1A | M1 byte (bit value 128) |
| S1A | S1 byte (bit value 64) |
| Z2A | Z2 byte (bit value 256) |

## :SOURce:DATA:OVERhead:PASSthru:ALL

This command controls the source of transmitted overhead data in Through Mode. The parameter is a numeric value in which each bit enables retransmission of received data for one specific overhead field. The bit values are shown under :SOURCE:DATA:OVERHEAD:PASSTHROUGH. The query form returns the current setting.

**Syntax** :SOURce<slot>:DATA:OVERhead:PASSthru:ALL?
:SOURce<slot>:DATA:OVERhead:PASSthru:ALL <NR1>

## :SOURce:DATA:PARIty:LOOP

This command enables the local calculation of B1 and B2 parity bits when the transmitter is in Through Mode. When this function is enabled, the B1 and B2 bits are calculated from the payload value; when it is disabled, the B1 and B2 bits have the values of the received B1 and B2 bits. This setting has no effect when the payload is internally generated. The query form returns the current setting.

**Syntax** :SOURce<slot>:DATA:PARIty:LOOP?
:SOURce<slot>:DATA:PARIty:LOOP <Boolean>

| **Parameters** | **Description** |
|---|---|
| THRU | B1 and B2 bit values are taken from the received signal |
| REGEN | B1 and B2 bit values are regenerated from the transmitted data |
| FORCE_THRU | B1 and B2 bit values are taken from the received signal, independent of the setting of this parameter |
| FORCE_REGEN | B1 and B2 bit values are regenerated from the transmitted data, independent of the setting of this parameter |

## :SOURce:DATA:PATH:OVERhead:PASSthru

This command controls the source of transmitted path overhead data in Through Mode. The first parameter specifies a path overhead data field; the second selects whether that field's data comes from the received signal (ON) or is generated by the OTS transmitter (OFF). The query form returns the current setting for the specified field.

**Syntax** :SOURce<slot>:DATA:PATH:OVERhead:PASSthru? <Enum>
:SOURce<slot>:DATA:PATH:OVERhead:PASSthru <Enum> ,<Boolean>

| **Parameters** | **Description** |
|---|---|
| C2A | C2 (path label) POH byte (bit value 131,072 in…:ALL command) |
| F2A | F2 POH byte (bit value 524,288) |
| F3A | F3 (Z3) POH byte (bit value 2,097,152) |
| G1A | G1 POH byte (bit value 262,144) |
| H4A | H4 POH byte (bit value 1,048,576) |
| J1A | J1 (path trace) POH byte (bit value 65,536) |
| K3A | K3 (Z4) POH byte (bit value 4,194,304) |
| N1A | N1 POH byte (bit value 8,388,608) |
| PAYload | Payload data (bit value 16,777,216) |

## :SOURce:DATA:PATH:OVERhead:PASSthru:ALL

This command controls the source of transmitted path overhead data in Through Mode. The parameter is a numeric value in which each bit enables retransmission of received data for one specific path overhead field. The bit values are shown under :SOURce:DATA:PATH:OVERhead:PASSthru. The query form returns the current setting.

**Syntax** :SOURce<slot>:DATA:PATH:OVERhead:PASSthru:ALL?
:SOURce<slot>:DATA:PATH:OVERhead:PASSthru:ALL <NR1>

## :SOURce:DATA:PATH:TRACe

This command sets the data sequence length and data byte values transmitted in the Path Trace (J1) byte of the Path Overhead. The data bytes are formatted as a standard IEEE-488 data block. The query form returns the current settings.

**Syntax:** :SOURce<slot>:DATA:PATH:TRACe?
:SOURce<slot>:DATA:PATH:TRACe <Enum> ,<Block>

| **Parameters** | **Description** |
|---|---|
| L1B | Constant 8-bit data |
| L16B | A repeating sequence of 16 bytes, 0-filled with CRC |
| L16FREE | A repeating sequence of 16 bytes, arbitrary format |
| L64B | A repeating sequence of 64 bytes, space-filled with CR/LF |
| L64FREE | A repeating sequence of 64 bytes, arbitrary format |

## :SOURce:DATA:PATH:TRACe:TYPE

This command sets the data sequence length transmitted in the Path (J1) byte of the Path Overhead. The query form returns the current setting.

**Syntax:** :SOURce<slot>:DATA:PATH:TRACe:TYPE?
:SOURce<slot>:DATA:PATH:TRACe:TYPE <Enum>

| **Parameters** | **Description** |
|---|---|
| L1B | Constant 8-bit data |
| L16B | A repeating sequence of 16 bytes, 0-filled with CRC |
| L16FREE | A repeating sequence of 16 bytes, arbitrary format |
| L64B | A repeating sequence of 64 bytes, space-filled with CR/LF |
| L64FREE | A repeating sequence of 64 bytes, arbitrary format |

## :SOURce:DATA:PATH:TRACe:VALUe

This command sets the data byte values transmitted in the Path Trace (J1) byte of the Path Overhead. The data bytes are formatted as a standard IEEE-488 data block. The query form returns the current values.

**Syntax:** :SOURce<slot>:DATA:PATH:TRACe:VALUe?
:SOURce<slot>:DATA:PATH:TRACe:VALUe <Block>

## :SOURce:DATA:PATH:TRACe:VALUe:STRIng

This command sets the data byte values transmitted in the Path Trace (J1) byte of the Path Overhead. The data byte values are specified as an ASCII string. The query form returns the current values.

**Syntax:** :SOURce<slot>:DATA:PATH:TRACe:VALUe:STRIng?
:SOURce<slot>:DATA:PATH:TRACe:VALUe:STRIng <String>

## :SOURce:DATA:PAYLoad:BACKground:PATTern

This setting selects the background test pattern inserted as payload into the transmitted signal. The query form returns the current setting.

**Syntax:** :SOURce<slot>:DATA:PAYLoad:BACKground:PATTern?
:SOURce<slot>:DATA:PAYLoad:BACKground:PATTern <Enum>

| **Parameters** | **Description** |
|---|---|
| PRBS15A | ITU standard PRBS 2^15-1 pattern |
| PRBS15I | Inverted PRBS 2^15-1 pattern |
| PRBS23A | ITU standard PRBS 2^23-1 pattern |
| PRBS23I | Inverted PRBS 2^23-1 pattern |
| PRBS31A | ITU standard PRBS 2^31-1 pattern |
| PRBS31I | Inverted PRBS 2^31-1 pattern |
| ZEROs | Constant zero data |
| ONEs | Constant one data |
| USER | Constant 8-bit user-specified data |
| LIVE | Live data |

## :SOURce:DATA:PAYLoad:BACKground:PATTern:UDATA

This command selects the background fixed test pattern for the Transmitter signal The query form returns the current setting.

**Syntax:** :SOURce<slot>:DATA:PAYLoad:BACKground:PATTern:UDATA?
:SOURce<slot>:DATA:PAYLoad:BACKground:PATTern:UDATA <NR1>

## :SOURce:DATA:PAYLoad:PATTern

This setting selects the test pattern inserted as payload into the transmitted signal. The query form returns the current setting.

**Syntax** :SOURce<slot>:DATA:PAYLoad:PATTern?
:SOURce<slot>:DATA:PAYLoad:PATTern <Enum>

| **Parameters** | **Description** |
|---|---|
| PRBS15A | ITU standard PRBS 2^15-1 pattern |
| PRBS15I | Inverted PRBS 2^15-1 pattern |
| PRBS23A | ITU standard PRBS 2^23-1 pattern |
| PRBS23I | Inverted PRBS 2^23-1 pattern |
| PRBS31A | ITU standard PRBS 2^31-1 pattern |
| PRBS31I | Inverted PRBS 2^31-1 pattern |
| ZEROs | Constant zero data |
| ONEs | Constant one data |
| USER | Constant 8-bit user-specified data |
| LIVE | Live data |

## :SOURce:DATA:PAYLoad:PATTern:UDATA

This command selects the fixed test pattern for the Transmitter signal The query form returns the current setting.

**Syntax:** :SOURce<slot>:DATA:PAYLoad:PATTern:UDATA?
:SOURce<slot>:DATA:PAYLoad:PATTern:UDATA <NR1>

## :SOURce:DATA:POH:ALL

This command sets the values of all bytes in the generated STS-1 #1 Path Overhead data. The query form returns the current setting. There are 9 bytes in the data block. For SONET, these bytes are J1 B3 C2 G1 F2 H4 Z3 Z4 N1; for SDH, these bytes are J1 B3 C2 G1 F2 H4 F3 K3 N1.

**Syntax:** :SOURce<slot>:DATA:POH:ALL? [<NR1>]
:SOURce<slot>:DATA:POH:ALL <NR1> ,<Block>

## :SOURce:DATA:POH:BACKground:BYTE:C2A

This command sets the values of the C2 byte in the generated Path Overhead data in all background (inactive) channels. The query form returns the current setting.

**Syntax:** :SOURce<slot>:DATA:POH:BACKground:BYTE:C2A?
:SOURce<slot>:DATA:POH:BACKground:BYTE:C2A <NR1>

## :SOURce:DATA:POH:BYTE

This command sets the value of a specific byte in the generated STS-1 #1 Path Overhead data. The byte selection is specified by three numeric parameters: the first specifies the STS-1 number, the second specifies the row number, and the third specifies the data. Because only STS-1 #1 may be selected, the first parameter must be set to 1. The query form returns the current byte value.

**Syntax:** :SOURce<slot>:DATA:POH:BYTE? <NR1>
:SOURce<slot>:DATA:POH:BYTE <NR1> ,<NR1>

## :SOURce:DATA:POH:BYTE:C2A

This command sets the value of the C2 byte in the generated STS-1 #1 Path Overhead data. The query form returns the current setting.

**Syntax** :SOURce<slot>:DATA:POH:BYTE:C2A?
:SOURce<slot>:DATA:POH:BYTE:C2A <NR1>

## :SOURce:DATA:POH:DEFAult

This command sets all bytes in the generated STS-1 #1 Path Overhead data to their default values.

**Syntax** :SOURce<slot>:DATA:POH:DEFAult

## :SOURce:DATA:RATE

This query returns the output signal rate generated by the OTS transmitter.

**Syntax** :SOURce<slot>:DATA:RATE?

| **Parameters** | **Description** |
|---|---|
| G10A | 10 Gb/s (OC-192 or STM-64) |

## :SOURce:DATA:SECTion:TRACe

This command sets the data sequence length and data byte values transmitted in the Section Trace (J0) byte of the Transport Overhead. The data bytes are formatted as a standard IEEE-488 data block. The query form returns the current settings.

**Syntax** :SOURce<slot>:DATA:SECTion:TRACe?
:SOURce<slot>:DATA:SECTion:TRACe <Enum> ,<Block>

| **Parameters** | **Description** |
|---|---|
| L1B | Constant 8-bit data |
| L16B | A repeating sequence of 16 bytes, 0-filled with CRC |
| L16FREE | A repeating sequence of 16 bytes, arbitrary format |
| L64B | A repeating sequence of 64 bytes, space-filled with CR/LF |
| L64FREE | A repeating sequence of 64 bytes, arbitrary format |

## :SOURce:DATA:SECTion:TRACe:TYPE

This command sets the data sequence length transmitted in the Section Trace (J0) byte of the Transport Overhead. The query form returns the current setting.

**Syntax** :SOURce<slot>:DATA:SECTion:TRACe:TYPE?
:SOURce<slot>:DATA:SECTion:TRACe:TYPE <Enum>

| **Parameters** | **Description** |
|---|---|
| L1B | Constant 8-bit data |
| L16B | A repeating sequence of 16 bytes, 0-filled with CRC |
| L16FREE | A repeating sequence of 16 bytes, arbitrary format |
| L64B | A repeating sequence of 64 bytes, space-filled with CR/LF |
| L64FREE | A repeating sequence of 64 bytes, arbitrary format |

## :SOURce:DATA:SECTion:TRACe:VALUe

This command sets the data byte values transmitted in the Section Trace (J0) byte of the Transport Overhead. The data bytes are formatted as a standard IEEE-488 data block. The query form returns the current values.

**Syntax** :SOURce<slot>:DATA:SECTion:TRACe:VALUe?
:SOURce<slot>:DATA:SECTion:TRACe:VALUe <Block>

## :SOURce:DATA:SECTion:TRACe:VALUe:STRIng

This command sets the data byte values transmitted in the Section Trace (J0) byte of the Transport Overhead. The data byte values are specified as an ASCII string. The query form returns the current values.

**Syntax** :SOURce<slot>:DATA:SECTion:TRACe:VALUe:STRIng?
:SOURce<slot>:DATA:SECTion:TRACe:VALUe:STRIng <String>

## :SOURce:DATA:SOURce

This command sets the source of the data at the output of the OTS-9000 transmitter. The query form returns the current setting.

**Syntax** :SOURce<slot>:DATA:SOURce?
:SOURce<slot>:DATA:SOURce <Enum>

| **Parameters** | **Description** |
|---|---|
| INTErnal | The payload data comes from the internal test pattern generator |
| THRU | Through mode: the transmitted data comes from the receiver |

## :SOURce:DATA:SPE:BACKground:STUFfing

This command controls the SPE fixed byte stuffing in non-active STS-1 channels. When enabled, columns 30 and 59 of the background channels contain the fixed byte value zero and are not used for payload. This command is applicable when the background channel structure is set to STS-1. When disabled, columns 30 and 59 are part of the background payload. The query form returns the current setting. <Slot> is an optional number that specifies the module slot containing the device that is the target of the command; if omitted, it defaults to the lowest-numbered slot containing an applicable device.

**Syntax** :SOURce<slot>:DATA:SPE:BACKground:STUFfing?
:SOURce<slot>:DATA:SPE:BACKground:STUFfing <Boolean>

## :SOURce:DATA:SPE:STUFfing

This command controls the SPE fixed byte stuffing. When enabled, columns 30 and 59 of the active STS-1 channel contain the fixed byte value zero and are not used for payload. When disabled, columns 30 and 59 are part of the payload. This command is applicable when the active channel structure is set to STS-1. The query form returns the current setting.

**Syntax** :SOURce<slot>:DATA:SPE:STUFfing?
:SOURce<slot>:DATA:SPE:STUFfing <Boolean>

## :SOURce:DATA:STRUcture

This command sets the structure of the signal generated by the OTS-9000 transmitter. The query form returns the current setting.

**Syntax** :SOURce<slot>:DATA:STRUcture?
:SOURce<slot>:DATA:STRUcture <Enum>

| Parameter | Description |
|---|---|
| G10C | Bulk data at 10Gb/s |
| G2P5C | Bulk data at 2.5 Gb/s |
| M622C | Bulk data at 622 Mb/s |
| M155C | Bulk data at 155 Mb/s |
| M51A | Bulk data at 51 Mb/s (SONET only) |

## :SOURce:DATA:TOH:STS1A:ALL

This command sets the values of all bytes in the generated STS-1 #1 Transport Overhead data. The query form returns the current setting. There are 27 bytes in the data block. These correspond to the overhead bytes A1, A2, J0, B1, E1*, F1*, D1*, D2*, D3*, H1..H3, B2, K1*, K2*, D4*..D12*, S1*, Z2*, E2*. Only those bytes marked with * are settable; the values of the other bytes are automatically set by the transmitter.

**Syntax** :SOURce<slot>:DATA:TOH:STS1A:ALL? [<NR1>]
:SOURce<slot>:DATA:TOH:STS1A:ALL <NR1> ,<Block>

## :SOURce:DATA:TOH:STS1A:BYTE

This command sets the value of a specific byte in the generated STS-1 #1 Transport Overhead data. The byte selection is specified by three numeric parameters, for STS-1 number, row, and column; because only STS-1 #1 may be selected, the first parameter must be set to 1. The query form returns the current byte value.

**Syntax** :SOURce<slot>:DATA:TOH:STS1A:BYTE? <NR1> ,<NR1> ,<NR1>
:SOURce<slot>:DATA:TOH:STS1A:BYTE <NR1> ,<NR1> ,<NR1> ,<NR1>

## :SOURce:DATA:TOH:STS1A:DEFAult

This command sets all bytes in the generated STS-1 #1 Transport Overhead data to their default values.

**Syntax** :SOURce<slot>:DATA:TOH:STS1A:DEFAult

## :SOURce:INSErt:ANOMaly:MODE

This command specifies how anomalies are inserted. The query form returns the current setting.

**Syntax** :SOURce<slot>:INSErt:ANOMaly:MODE?
:SOURce<slot>:INSErt:ANOMaly:MODE <Enum>

| Parameter | Description |
|---|---|
| NONE | Anomaly insertion is disabled |
| SINGle | A single anomaly is inserted |
| BURSt | A burst of anomalies is inserted |

## :SOURce:INSErt:ANOMaly:RATE

This command sets the rate at which continuously-generated anomalies are inserted. The query form returns the current value.

**Syntax** :SOURce<slot>:INSErt:ANOMaly:RATE?
:SOURce<slot>:INSErt:ANOMaly:RATE <NR3>

## :SOURce:INSErt:ANOMaly:RATE:RANGe

This query returns the minimum and maximum rate values for the specified anomaly type.

**Syntax** :SOURce<slot>:INSErt:ANOMaly:RATE:RANGe? <Enum>

| Parameters | Description |
|---|---|
| NONE | No anomaly is selected |
| B1BIP | B1 parity errors |
| B2BIP | B2 parity errors |
| B3BIP | B3 parity errors |
| REI | Line REI errors |
| REI_P | Path REI errors |
| PATTern | Pattern bit errors |
| RANDom | Errors in randomly-selected framing, overhead, and payload bits |
| BIT_SPE | Errors in randomly-selected SPE bits (SONET mode only) |
| BIT_VC | Errors in randomly-selected VC bits (SDH mode only) |

## :SOURce:INSErt:ANOMaly:REPLicate:B2A

This command specifies whether a generated B2 error is replicated into all the B2 bytes of the frame (ON) or appears only in the first byte (OFF). The query form returns the current setting.

**Syntax** :SOURce<slot>:INSErt:ANOMaly:REPLicate:B2A?
:SOURce<slot>:INSErt:ANOMaly:REPLicate:B2A <Boolean>

## :SOURce:INSErt:ANOMaly:STATe

This query returns the current state of anomaly insertion.

**Syntax** :SOURce<slot>:INSErt:ANOMaly:STATe?

| Parameters | Description |
|---|---|
| INACT | Defect/anomaly insertion is inactive |
| SING_INACT | One-time defect/anomaly insertion is inactive |
| SING_DWELL | One-time defect/anomaly insertion is active |
| BRST_INACT | Burst defect/anomaly insertion is inactive |
| BRST_ACT | Burst defect/anomaly insertion is active, between bursts |
| BRST_DWELL | Burst defect/anomaly insertion is active |
| CONT_INACT | Continuous defect/anomaly insertion is inactive |
| CONT_ACT | Continuous defect/anomaly insertion is inactive |
| CONT_DWELL | Continuous defect/anomaly insertion is active |

## :SOURce:INSErt:ANOMaly:TYPE

This command selects the type of anomaly inserted. The query form returns the current selection.

**Syntax** :SOURce<slot>:INSErt:ANOMaly:TYPE?
:SOURce<slot>:INSErt:ANOMaly:TYPE <Enum>

| Parameters | Description |
|---|---|
| NONE | No anomaly is selected |
| B1BIP | B1 parity errors |
| B2BIP | B2 parity errors |
| B3BIP | B3 parity errors |
| REI | Line REI errors |
| REI_P | Path REI errors |
| PATTern | Pattern bit errors |
| RANDom | Errors in randomly-selected framing, overhead, and payload bits |
| BIT_SPE | Errors in randomly-selected SPE bits (SONET mode only) |
| BIT_VC | Errors in randomly-selected VC bit (SDH mode only) |

## :SOURce:INSErt:DEFEct:MODE

This command specifies how defects are inserted. The query form returns the current setting.

**Syntax** :SOURce<slot>:INSErt:DEFEct:MODE?
:SOURce<slot>:INSErt:DEFEct:MODE <Enum>

| Parameters | Description |
|---|---|
| NONE | Defect insertion is disabled |
| BURSt | A defect condition is asserted for a programmed time |
| CONTinuous | A defect condition is asserted continously |

## :SOURce:INSErt:DEFEct:STATe

This query returns the current state of defect insertion.

**Syntax** :SOURce<slot>:INSErt:DEFEct:STATe?

| Parameters | Description |
|---|---|
| INACT | Defect/anomaly insertion is inactive |
| SING_INACT | One-time defect/anomaly insertion is inactive |
| SING_DWELL | One-time defect/anomaly insertion is active |
| BRST_INACT | Burst defect/anomaly insertion is inactive |
| BRST_ACT | Burst defect/anomaly insertion is active, between bursts |
| BRST_DWELL | Burst defect/anomaly insertion is active |
| CONT_INACT | Continuous defect/anomaly insertion is inactive |
| CONT_ACT | Continuous defect/anomaly insertion is inactive |
| CONT_DWELL | Continuous defect/anomaly insertion is active |

## :SOURce:INSErt:DEFEct:TIME

This command sets the duration of timed defect insertion in the units appropriate to the selected defect. The query form returns the current value.

**Syntax** :SOURce<slot>:INSErt:DEFEct:TIME?
:SOURce<slot>:INSErt:DEFEct:TIME <NR1>

## :SOURce:INSErt:DEFEct:TIME:RANGe

This query returns a units keyword and two integer numbers representing the minimum and maximum duration values for timed defects. The units keyword is one of FRAME, US, MS, S, SEC10 (0.1S), and SEC100 (0.01S).

**Syntax** :SOURce<slot>:INSErt:DEFEct:TIME:RANGe? <Enum>

| Parameter | Description |
|---|---|
| NONE | No defect is selected |
| LOS | Loss of signal |
| LOF | Loss of frame |
| AIS_L | Line AIS |
| RDI_L | Line RDI |
| AIS_P | Path AIS |
| RDI_P | Path RDI |
| RDIPAY_P | Path RDI (Payload) |
| RDISRV_P | Path RDI (Server) |
| RDICON_P | Path RDI (Connectivity) |
| LOP_P | Path loss of pointer |

## :SOURce:INSErt:DEFEct:TYPE

This command selects the type of defect inserted. The query form returns the current selection.

**Syntax** :SOURce<slot>:INSErt:DEFEct:TYPE?
:SOURce<slot>:INSErt:DEFEct:TYPE <Enum>

| Parameters | Description |
|---|---|
| NONE | No defect is selected |
| LOS | Loss of signal |
| LOF | Loss of frame |
| AIS_L | Line AIS |
| RDI_L | Line RDI |
| AIS_P | Path AIS |
| RDI_P | Pat RDI |
| RDIPAY_P | Path RDI (Payload) |
| RDISRV_P | Path RDI (Server) |
| RDICON_P | Path RDI (Connectivity) |
| LOP_P | Path loss of pointer |

## :SOURce:INSert:IP:ANOMaly:MODE

This command specifies how IP anomalies are inserted. The query form returns the current setting.

**Syntax** :SOURce<slot>:INSert:IP:ANOMaly:MODE?
:SOURce<slot>:INSert:IP:ANOMaly:MODE <Parameter>

| Parameters | Description |
|---|---|
| NONE | IP anomaly insertion is disabled |
| SINGle | A single IP anomaly is inserted |
| CONTinuous | IP anomalies are inserted continuously, at the programmed rate |

## :SOURce:INSert:IP:ANOMaly:RATE

This command sets the rate at which continuously generated IP anomalies are inserted. The query form returns the current value.

**Syntax** :SOURce<slot>:INSert:IP:ANOMaly:RATE?
:SOURce<slot>:INSert:IP:ANOMaly:RATE <NR3>

## :SOURce:INSert:IP:ANOMaly:RATE:RANGe

This query returns the minimum and maximum rate values for the specified IP anomaly type. The values returned are formatted as NR3 parameters.

**Syntax** :SOURce<slot>:INSert:IP:ANOMaly:RATE:RANGe? <Parameter>

| **Parameters** | **Description** |
|---|---|
| NONE | No anomaly is selected |
| FCS | HDLC frame check sequence errors |
| PAYLoad | IP payload errors |
| CRC | IP header check sum errors |

## :SOURce:INSert:IP:ANOMaly:TYPE

This command selects the type of IP anomaly inserted. The query form returns the current selection.

**Syntax** :SOURce<slot>:INSert:IP:ANOMaly:TYPE?
:SOURce<slot>:INSert:IP:ANOMaly:TYPE <Parameter>

| **Parameters** | **Description** |
|---|---|
| NONE | No anomaly is selected |
| FCS | HDLC frame check sequence errors |
| PAYLoad | IP payload errors |
| CRC | IP header check sum errors |

## :SOURce:MEASure:HDLC:BYTes

This query returns the number of HDLC bytes transmitted with good FCS.

**Syntax** :SOURce<slot>:MEASure:HDLC:BYTes?

## :SOURce:MEASure:HDLC:FRAMes

This query returns the value of the specified result parameter.

**Syntax** :SOURce<slot>:MEASure:HDLC:FRAMes? <Parameter>

| Parameters | Description |
|---|---|
| GPCS | Count of HDLC frames transmitted with good FCS |
| BFCS | Count of HDLC frames transmitted with bad FCS |

## :SOURce:MEASure:HDLC:FRAMes:ALL

This query returns the values of all of the parameters of the :SOURce:MEASure:HDLC:FRAMes?

**Syntax** :SOURce<slot>:MEASure:HDLC:FRAMes:ALL?

## :SOURce:MEASure:IP:PACKets

This query returns the value of the specified result parameter.

**Syntax** :SOURce<slot>:MEASure:IP:PACKets? <Parameter>

| Parameters | Description |
|---|---|
| TOTal | Total count of transmitted IP packets |
| GOOD | Count of good transmitted IP packets |
| BAD | Count of IP packets transmitted without errors |

## :SOURce:MEASure:IP:PACKets:ALL

This query returns the values of all of the parameters of the :SOURce:MEASure:IP:PACKets?

**Syntax** :SOURce<slot>:MEASure:IP:PACKets:ALL?

## :SOURce:OUTPut:LASER

This command enables or disables the Transmitter's output laser. The query returns the current setting. The laser, when turned on, takes some time to reach operating conditions; during this time, the query returns INITIALIZING.

**Syntax** :SOURce<slot>:OUTPut:LASER?
:SOURce<slot>:OUTPut:LASER <Enum>

| Parameters | Description |
|---|---|
| OFF | Set laser off |
| ON | Set laser on |
| INITializing | The laser is initializing (query response only) |

## :SOURce:OUTPut:LASer:INFO:OPTion

This command queries the value of the device option code.

**Syntax** :SOURce<slot>:OUTPut:LASer:INFO:OPTion?

## :SOURce:OUTPut:LASer:INFO:SERial

This command queries the value of the laser serial number.

**Syntax** :SOURce<slot>:OUTPut:LASer:INFO:SERial?

## :SOURce:OUTPut:LASer:INFO:WAVelength

This command queries the value of the Laser Wavelength setting.

**Syntax** :SOURce<slot>:OUTPut:LASer:INFO:WAVelength?

## :SOURce:OUTPut:LASER:INTERlock

This query returns the state of the interlock key switch on the OTS interface module connected to the selected transmitter. The key must be on for the laser to operate.

**Syntax** :SOURce<slot>:OUTPut:LASER:INTERlock?

## :SOURce:SIGNal:STANdard

This command sets individual OTS9100 modules to the SONET or SDH signal mode. The query form returns the current setting.

**Syntax** :SOURce <Slot>:SIGNal:STANdard?
:SOURce <Slot>:SIGNal:STANdard SONET | SDH

| **Parameters** | **Description** |
|---|---|
| SONET | Set module to SONET signal mode |
| SDH | Set module to SDH signal mode |
| BERT | Set module to BERT |

## :SOURce:TRIGger:MODE

This command sets the condition that will produce a trigger output from the OTS-9000 transmitter. The query form returns the current setting.

**Syntax** :SOURce<slot>:TRIGger:MODE?
:SOURce<slot>:TRIGger:MODE <Enum>

| Parameters | Description |
|---|---|
| OFF | The trigger output is disabled |
| ANOMaly | A trigger occurs when an anomaly is generated |
| DEFEct | A trigger occurs when a defect is generated |
| AD | A trigger occurs when an anomaly or defect is generated |

## :STATus:PRESet

This command initializes the Interface Status subsystem to a defined initial state.

**Syntax** :SYSTem:COMMunicate:GPIB:PRIMary?
:SYSTem:COMMunicate:GPIB:PRIMary <Enum> |<NR1>

| Parameters | Description |
|---|---|
| NONE | The GPIB port is disabled |

## :SYSTem:COMMunicate:GPIB:PRIMary

This command sets the primary address for the GPIB remote control port. A value of NONE disables the GPIB port. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:GPIB:PRIMary?
:SYSTem:COMMunicate:GPIB:PRIMary <Enum> |<NR1>

| Parameters | Description |
|---|---|
| NONE | The GPIB port is disabled |

## :SYSTem:COMMunicate:GPIB:SECOndary

This command sets the secondary address for the GPIB port. A value of NONE disables secondary addressing. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:GPIB:SECOndary?
:SYSTem:COMMunicate:GPIB:SECOndary <Enum> |<NR1>

| Parameters | Description |
|---|---|
| NONE | Secondary GPIB addressing is disabled |

## :SYSTem:COMMunicate:NETWork:ECHO

This command sets the initial value of the echo control variable for new network connections. This setting has no effect on connections already established (see :SYSTEM:COMMUNICATE:PORT:ECHO). The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:NETWork:ECHO?
:SYSTem:COMMunicate:NETWork:ECHO <NR1>

| Bit value | Function |
|---|---|
| 0 | Disables echo |
| 1 | Enables echo |
| 2 | Causes the input terminator character to be echoed as CR-LF |
| 4 | Enables input line buffering: received characters are not processed until the terminating CR or LF |

## :SYSTem:COMMunicate:NETWork:IPPORT

This command sets the IP port address on which the system listens for new connections. Changing the setting has no effect on connections already established. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:NETWork:IPPORT?
:SYSTem:COMMunicate:NETWork:IPPORT <NR1>

## :SYSTem:COMMunicate:NETWork:PROMpt

This command sets the initial state of the user prompt on new network connections. This setting has no effect on connections already established (see :SYSTEM:COMMUNICATE:PORT:PROMPT). The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:NETWork:PROMpt?
:SYSTem:COMMunicate:NETWork:PROMpt <Boolean>

## :SYSTem:COMMunicate:NETWork:RXTERM

This command sets the initial selection, for new network connections, of the character recognized as End-of-Input. This setting has no effect on connections already established (see :SYSTEM:COMMUNICATE:PORT:RXTERM). The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:NETWork:RXTERM?
:SYSTem:COMMunicate:NETWork:RXTERM <Enum>

| Parameters | Description |
|---|---|
| LF | Line feed (LF) character, 0x0A; an optional preceding CR is ignored |
| CR | Carriage return (CR) character, 0x0D; an optional preceding LF is ignored |

## :SYSTem:COMMunicate:NETWork:TXTERM

This command sets the initial selection, for new network connections, of the characters sent at the end of a query response. This setting has no effect on connections already established (see :SYSTEM:COMMUNICATE:PORT:TXTERM). The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:NETWork:TXTERM?
:SYSTem:COMMunicate:NETWork:TXTERM <Enum>

| **Parameters** | **Description** |
|---|---|
| LF | Line feed (LF) character, 0x0A |
| CR | Carriage return (CR) character, 0x0D |
| CRLF | CR followed by LF |
| LFCR | LF followed by CR |

## :SYSTem:COMMunicate:PORT:ECHO

The PORT commands affect the character-based remote control port (serial port or network connection) that receives the command; they are not valid for the GPIB. This command controls, for the current remote-control port, how the system echoes the characters it receives. The parameter is a numeric value containing three individual control bits. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:PORT:ECHO?
:SYSTem:COMMunicate:PORT:ECHO <NR1>

| **Bit value** | **Function** |
|---|---|
| 0 | Disables echo |
| 1 | Enables echo |
| 2 | Causes the input terminator character to be echoed as CR-LF |
| 4 | Enables input line buffering: received characters are not processed until the terminating CR or LF |

## :SYSTem:COMMunicate:PORT:PROMpt

This command enables or disables the user prompt on the current remote-control port. When the prompt is enabled, the system prompts when it is ready for a command. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:PORT:PROMpt?
:SYSTem:COMMunicate:PORT:PROMpt <Boolean>

## :SYSTem:COMMunicate:PORT:RXTERM

This command selects, for the current remote-control port, the character the OTS system recognizes as End-of-Input. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:PORT:RXTERM?
:SYSTem:COMMunicate:PORT:RXTERM <Enum>

| **Parameters** | **Description** |
|---|---|
| LF | Line feed (LF) character, 0x0A; an optional preceding CR is ignored |
| CR | Carriage return (CR) character, 0x0D; an optional preceding LF is ignored |

## :SYSTem:COMMunicate:PORT:TXTERM

This command controls, for the current remote-control port, the characters the OTS system sends at the end of a query response. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:PORT:TXTERM?
:SYSTem:COMMunicate:PORT:TXTERM <Enum>

| **Parameters** | **Description** |
|---|---|
| LF | Line feed (LF) character, 0x0A |
| CR | Carriage return (CR) character, 0x0D |
| CRLF | CR followed by LF |
| LFCR | LF followed by CR |

## :SYSTem:COMMunicate:SERIal:COM1A:DTR

This command controls the state of the DTR (Data Terminal Ready) control signal on the COM1 port. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM1A:DTR?
:SYSTem:COMMunicate:SERIal:COM1A:DTR <Boolean>

## :SYSTem:COMMunicate:SERIal:COM1A:ECHO

This command controls, for the COM1 serial port, how the system echoes the characters it receives. The parameter is a numeric value containing three individual control bits. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM1A:ECHO?
:SYSTem:COMMunicate:SERIal:COM1A:ECHO <NR1>

| Bit value | Function |
|---|---|
| 0 | Disables echo |
| 1 | Enables echo |
| 2 | Causes the input terminator character to be echoed as CR-LF |
| 4 | Enables input line buffering: received characters are not processed until the terminating CR or LF |

## :SYSTem:COMMunicate:SERIal:COM1A:ENABle

This command enables or disables the operation of serial port COM1 as a remote control port. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM1A:ENABle?
:SYSTem:COMMunicate:SERIal:COM1A:ENABle <Boolean>

## :SYSTem:COMMunicate:SERIal:COM1A:FLOW

This command sets the type of flow control used for serial communications on the COM1 serial port. When flow control is enabled, the receiver signals the sender when its buffer is full, so as not to lose characters. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM1A:FLOW?
:SYSTem:COMMunicate:SERIal:COM1A:FLOW <Enum>

| Parameters | Description |
|---|---|
| NONE | No flow control is enabled |
| HARDware | Flow control uses RS-232 control signals |
| SOFTware | Flow control uses XON and XOFF characters in the data stream |

## :SYSTem:COMMunicate:SERIal:COM1A:NDATA

This command sets the number of data bits per character on the COM1 serial port. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM1A:NDATA?
:SYSTem:COMMunicate:SERIal:COM1A:NDATA <Enum>

| Parameters | Description |
|---|---|
| N7A | Seven-bit data |
| N8A | Eight-bit data |

## :SYSTem:COMMunicate:SERIal:COM1A:NSTOP

This command sets the number of stop bits per character on the COM1 serial port. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM1A:NSTOP?
:SYSTem:COMMunicate:SERIal:COM1A:NSTOP <Enum>

| Parameters | Description |
|---|---|
| N1A | One stop bit |
| N1P5A | One and one-half stop bits |
| N2 | Two stop bits |

## :SYSTem:COMMunicate:SERIal:COM1A:PARIty

This command sets, for the COM1 serial port, the function of the high-order (eighth) bit in each serial. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM1A:PARIty?
:SYSTem:COMMunicate:SERIal:COM1A:PARIty <Enum>

| Parameters | Description |
|---|---|
| NONE | No parity |
| ODD | Odd parity |
| EVEN | Even parity |
| MARK | The parity bit is always set |
| SPACE | The parity bit is always clear |

## :SYSTem:COMMunicate:SERIal:COM1A:PROMpt

This command enables or disables the user prompt on the COM1 serial port. When the prompt is enabled, the system prompts when it is ready for a command. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM1A:PROMpt?
:SYSTem:COMMunicate:SERIal:COM1A:PROMpt <Boolean>

## :SYSTem:COMMunicate:SERIal:COM1A:RATE

This command sets the baud rate for the COM1 serial port. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM1A:RATE?
:SYSTem:COMMunicate:SERIal:COM1A:RATE <Enum>

| **Parameters** | **Description** |
|---|---|
| R1200B | 1200 baud |
| R2400B | 2400 baud |
| R4800B | 4800 baud |
| R9600B | 9600 baud |
| R19KB | 19.2K baud |
| R38KB | 38.4K baud |
| R57KB | 57.6K baud |
| R115KB | 115.2K baud |

## :SYSTem:COMMunicate:SERIal:COM1A:RTS

This command controls the state of the RTS (Request to Send) control signal on the COM1 port. It has no effect when hardware flow control is enabled. The query form returns the current setting.

Syntax :SYSTem:COMMunicate:SERIal:COM1A:RTS?
:SYSTem:COMMunicate:SERIal:COM1A:RTS <Boolean>

## :SYSTem:COMMunicate:SERIal:COM1A:RXTERM

This command selects, for the COM1 serial port, the character the OTS-9000 system recognizes as End-of-Input. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM1A:RXTERM?
:SYSTem:COMMunicate:SERIal:COM1A:RXTERM <Enum>

| **Parameters** | **Description** |
|---|---|
| LF | Line feed (LF) character, 0x0A; an optional preceding CR is ignored |
| CR | Carriage return (CR) character, 0x0D; an optional preceding LF is ignored |

## :SYSTem:COMMunicate:SERIal:COM1A:TXTERM

This command controls, for the COM1 serial port, the characters the OTS system sends at the end of a query response. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM1A:TXTERM?
:SYSTem:COMMunicate:SERIal:COM1A:TXTERM <Enum>

| Parameters | Description |
|---|---|
| LF | Line feed (LF) character, 0x0A |
| CR | Carriage return (CR) character, 0x0D |
| CRLF | CR followed by LF |
| LFCR | LF followed by CR |

## :SYSTem:COMMunicate:SERIal:COM2A:DTR

This command controls the state of the DTR (Data Terminal Ready) control signal on the COM2 port. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM2A:DTR?
:SYSTem:COMMunicate:SERIal:COM2A:DTR <Boolean>

## :SYSTem:COMMunicate:SERIal:COM2A:ECHO

This command controls, for the COM2 serial port, how the system echoes the characters it receives. The parameter is a numeric value containing three individual control bits. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM2A:ECHO?
:SYSTem:COMMunicate:SERIal:COM2A:ECHO <NR1>

| Bit value | Function |
|---|---|
| 0 | Disables (0) echo |
| 1 | Enables (1) echo |
| 2 | Causes the input terminator character to be echoed as CR-LF |
| 4 | Enables input line buffering: received characters are not processed until the terminating CR or LF |

## :SYSTem:COMMunicate:SERIal:COM2A:ENABle

This command enables or disables the operation of serial port COM2 as a remote control port. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM2A:ENABle?
:SYSTem:COMMunicate:SERIal:COM2A:ENABle <Boolean>

## :SYSTem:COMMunicate:SERIal:COM2A:FLOW

This command sets the type of flow control used for serial communications on the COM2 serial port. When flow control is enabled, the receiver signals the sender when its buffer is full, so as not to lose characters. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM2A:FLOW?
:SYSTem:COMMunicate:SERIal:COM2A:FLOW <Enum>

| Parameter | Description |
|---|---|
| NONE | No flow control is enabled |
| HARDware | Flow control uses RS-232 control signals |
| SOFTware | Flow control uses XON and XOFF characters in the data stream |

## :SYSTem:COMMunicate:SERIal:COM2A:NDATA

This command sets the number of data bits per character on the COM2 serial port. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM2A:NDATA?
:SYSTem:COMMunicate:SERIal:COM2A:NDATA <Enum>

| Parameters | Description |
|---|---|
| N7A | Seven-bit data |
| N8A | Eight-bit data |

## :SYSTem:COMMunicate:SERIal:COM2A:NSTOP

This command sets the number of stop bits per character on the COM2 serial port. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM2A:NSTOP?
:SYSTem:COMMunicate:SERIal:COM2A:NSTOP <Enum>

| Parameters | Description |
|---|---|
| N1A | One stop bit |
| N1P5A | One and one-half stop bits |
| N2 | Two stop bits |

## :SYSTem:COMMunicate:SERIal:COM2A:PARIty

This command sets, for the COM2 serial port, the function of the high-order (eighth) bit in each serial. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM2A:PARIty?
:SYSTem:COMMunicate:SERIal:COM2A:PARIty <Enum>

| Parameter | Description |
|---|---|
| NONE | No parity |
| ODD | Odd parity |
| EVEN | Even parity |
| MARK | The parity bit is always set |
| SPACE | The parity bit is always clear |

## :SYSTem:COMMunicate:SERIal:COM2A:PROMpt

This command enables or disables the user prompt on the COM2 serial port. When the prompt is enabled, the system prompts when it is ready for a command. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM2A:PROMpt?
:SYSTem:COMMunicate:SERIal:COM2A:PROMpt <Boolean>

## :SYSTem:COMMunicate:SERIal:COM2A:RATE

This command sets the baud rate for the COM2 serial port. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM2A:RATE?
:SYSTem:COMMunicate:SERIal:COM2A:RATE <Enum>

| Parameters | Description |
|---|---|
| R1200B | 1200 baud |
| R2400B | 2400 baud |
| R4800B | 4800 baud |
| R9600B | 9600 baud |
| R19KB | 19.2K baud |
| R38KB | 38.4K baud |
| R57KB | 57.6K baud |
| R115KB | 115.2K baud |

## :SYSTem:COMMunicate:SERIal:COM2A:RTS

This command controls the state of the RTS (Request to Send) control signal on the COM2 port. It has no effect when hardware flow control is enabled. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM2A:RTS?
:SYSTem:COMMunicate:SERIal:COM2A:RTS <Boolean>

## :SYSTem:COMMunicate:SERIal:COM2A:RXTERM

This command selects, for the COM2 serial port, the character the OTS-9000 system recognizes as End-of-Input. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM2A:RXTERM?
:SYSTem:COMMunicate:SERIal:COM2A:RXTERM <Enum>

| Parameters | Description |
|---|---|
| LF | Line feed (LF) character, 0x0A; an optional preceding CR is ignored |
| CR | Carriage return (CR) character, 0x0D; an optional preceding LF is ignored |

## :SYSTem:COMMunicate:SERIal:COM2A:TXTERM

This command controls, for the COM2 serial port, the characters the OTS-9000 system sends at the end of a query response. The query form returns the current setting.

**Syntax** :SYSTem:COMMunicate:SERIal:COM2A:TXTERM?
:SYSTem:COMMunicate:SERIal:COM2A:TXTERM <Enum>

| Parameters | Description |
|---|---|
| LF | Line feed (LF) character, 0x0A |
| CR | Carriage return (CR) character, 0x0D |
| CRLF | CR followed by LF |
| LFCR | LF followed by CR |

## :SYSTem:CONFig:MODule:SERIAL

This query accepts a module slot number, between 1 and 16, and returns a string identifying the Tektronix module card serial number as a quoted string.

**Syntax** :SYSTem:CONFig:MODule:SERIAL? <NR1>

## :SYSTem:CONFig:MODule:TYPE

This query accepts a module slot number, between 1 and 16, and returns a string identifying the Tektronix module in the specified slot. If the slot specified does not contain an OTS system, this query returns the string 'Non-Tek device or empty slot'.

**Syntax** :SYSTem:CONFig:MODule:TYPE? <NR1>

## :SYSTem:CONFig:MODule:VARIANT

This query accepts a module slot number, between 1 and 16, and returns the module variant as a decimal number, or 0 if there is no variant information. "Variant" is the module sub-type, for example, the Optics card may be a Transceiver, Transmit only, or Receive only version

**Syntax** :SYSTem:CONFig:MODule:VARIANT? <NR1>

## :SYSTem:CONFig:MODule:VERSion

This query accepts a module slot number, between 1 and 16, and returns the version information associated with the Tektronix module in the specified slot. The string returned has the format Mnn.nn,Unn.nn,Dnn.nn,Xnn.nn,Fnn.nn and contains major and minor version numbers for the module itself and its utility, driver, FPGA file, and firmware. Fields that are not applicable to the particular module are returned as 0. If the specified slot does not contain an OTS system, this query returns an error.

**Syntax** :SYSTem:CONFig:MODule:VERSion? <NR1>

## :SYSTem:CONFig:SLOTs

This query returns the number of module slots in the system.

**Syntax** :SYSTem:CONFig:SLOTs?

## :SYSTem:DESCription:SETUp

This command sets a text string that is stored with the current system settings and which may be used to annotate or identify the instrument setup. The query form returns the current setting.

**Syntax** :SYSTem:DESCription:SETUp?
:SYSTem:DESCription:SETUp <String>

## :SYSTem:ERRor

This query returns the next event in the Error and Event Queue. The *ESR? query must be given before events occuring since the last *ESR? query can be read.

**Syntax** :SYSTem:ERRor?

## :SYSTem:FILEs:MGMT:RESUlts:AGE

This command sets the maximum age of a file, a delta of file creation time and current system time. Files at this age or older are deleted on the next revisit, as set by INTErval. This command takes three comma separated parameters: Days,Hrs,Mins. The query form returns the current setting in the same form.

**Syntax:** :SYSTem:FILEs:MGMT:RESUlts:AGE?
:SYSTem:FILEs:MGMT:RESUlts:AGE <NR1> ,<NR1> ,<NR1>

## :SYSTem:FILEs:MGMT:RESUlts:COUNt

This command sets the maximum number of result files allowed before deletion begins. The order in which files are deleted is based on the sort criteria, see the SORT command below. The query form returns the current setting.

**Syntax:** :SYSTem:FILEs:MGMT:RESUlts:COUNt?
:SYSTem:FILEs:MGMT:RESUlts:COUNt <NR1>

## :SYSTem:FILEs:MGMT:RESUlts:DESTination

This command defines the path to the files to be deleted. This command requires the full path including drive letter. The query form returns the current directory path marked for deletion.

**Syntax:** :SYSTem:FILEs:MGMT:RESUlts:DESTination?
:SYSTem:FILEs:MGMT:RESUlts:DESTination <String>

## :SYSTem:FILEs:MGMT:RESUlts:ENABle

This command enables or disables each individual deletion trigger. During the current revisit interval the enable flags are polled, if an enabled criteria is met file deletion will begin and continue until all enabled criteria have been satisfied. Disabling the revisit interval flag will keep the system from deleting any files, while maintaining user-selected criteria. NOTE: The system requires a single numeric (base 10) parameter, flags are described as a bit field, the user must convert from the bit field (or hex) to a numeric integer. Flags are cumulative. Sending the value of zero disables all criteria.

**Syntax:** :SYSTem:FILEs:MGMT:RESUlts:ENABle?
:SYSTem:FILEs:MGMT:RESUlts:ENABle <NR1>

| Bit Value | Criteria affected |
|---|---|
| 0x1 | Enables (1) or disables (0) deletion based on number of files. Set by the COUNt command. |
| 0x2 | Enables (1) or disables (0) deletion based on total consumed space of files. Set by the TOTAlsize command. |
| 0x4 | Enables (1) or disables (0) deletion based on percentage of volume consumed. Set by the PERcent command. |
| 0x8 | Enables (1) or disables (0) deletion based on age of files (delta). Set by the AGE command. |
| 0x10 | Enables (1) or disables (0) the revisit interval. Set by the INTErval command. |

## :SYSTem:FILEs:MGMT:RESUlts:INTErval

This command sets the minimum amount of time the system waits between polling file deletion criteria. If any deletion criteria have been met, such as number of files, deletion will begin. If no criteria are met no deletion will take place until the next interval. The query form returns the current setting. NOTE: Units for INTErval are usec. Settings of less than 30000usec (30sec) should be avoided since constant revisits consume system resources. It is important to understand that this is a requested minimum interval, actual intervals are based on free CPU cycles.

**Syntax:** :SYSTem:FILEs:MGMT:RESUlts:INTErval?
:SYSTem:FILEs:MGMT:RESUlts:INTErval <NR1>

## :SYSTem:FILEs:MGMT:RESUlts:PERcent

This command sets the maximum percentage of disk volume that files are allowed to consume before deletion begins. The order in which files are deleted is based on the sort criteria, see the SORT command below. The query form returns the current setting.

**Syntax:** :SYSTem:FILEs:MGMT:RESUlts:PERcent?
:SYSTem:FILEs:MGMT:RESUlts:PERcent <NR1>

## :SYSTem:FILEs:MGMT:RESUlts:SORT

This command defines the sorting method by which files are prioritized for deletion. The system default is by a file's creation time. The query form returns the current sorting method.

**Syntax:** :SYSTem:FILEs:MGMT:RESUlts:SORT?
:SYSTem:FILEs:MGMT:RESUlts:SORT <Enum>

| Parameters | Description |
|---|---|
| CREAted | Sort by creation time |
| MODified | Sort by last modified time |
| ACCEssed | Sort by last accessed time |

## :SYSTem:FILEs:MGMT:RESUlts:TOTAlsize

This command sets the maximum amount of space combined files are allowed to span before deletion is initiated. The order in which files are deleted is based on the sort criteria, see the SORT command below. The query form returns the current setting. NOTE: Units for TOTAlsize are in megabytes.

**Syntax:** :SYSTem:FILEs:MGMT:RESUlts:TOTAlsize?
:SYSTem:FILEs:MGMT:RESUlts:TOTAlsize <NR1>

## :SYSTem:FORMat:BLOCk

This command selects whether binary block data command parameters are transmitted as raw 8-bit binary characters or pairs of hex digits. Some communication links may not be able to send raw binary data. The query form returns the current setting.

**Syntax** :SYSTem:FORMat:BLOCk?
:SYSTem:FORMat:BLOCk <Enum>

| Parameters | Description |
|---|---|
| BINary | Block data uses raw 8-bit binary bytes |
| HEX | Block data uses two hex digits per byte |

## :SYSTem:HEADers

This command enables or disables command headers in query responses. When headers are enabled, the response to a query is in the form of a complete command sufficient to set the present value. When headers are disabled, the query returns only the present value. The query form returns the current setting.

**Syntax** :SYSTem:HEADers?
:SYSTem:HEADers <Boolean>

## :SYSTem:LOCK:RELease

This command releases the lock set by a :SYSTEM:LOCK:REQUEST operation. The lock must have been set by the same user; an attempt to release a lock set by another user will not succeed. If no lock is set this command is ignored.

**Syntax** :SYSTem:LOCK:RELease

## :SYSTem:LOCK:RELease:FORCE

This command releases any lock set by a :SYSTEM:LOCK:REQUEST operation or any corresponding user-interface operation.

**Syntax** :SYSTem:LOCK:RELease:FORCE

## :SYSTem:LOCK:REQuest

This query attempts to lock' the system interface, ie, to take exclusive control of the system for commands that change system settings ('set' commands). It returns 1 if the lock succeeds, 0 if it fails.

**Syntax** :SYSTem:LOCK:REQuest?

## :SYSTem:SIGNal:STANdard

This command sets the OTS9100 system to the SONET or SDH signal mode. The query form returns the current setting.

**Syntax** :SYSTem:STANdard?
:SYSTem:STANdard SONET | SDH

| **Parameters** | **Description** |
|---|---|
| SONET | Set system to SONET signal mode |
| SDH | Set system to SDH signal mode |

## :SYSTem:VERBose

This command selects short- or long-form command headers in query responses. The query form returns the current setting. Long-form responses are composed of the full header keywords; short-form responses use the abbreviated keywords.

**Syntax** :SYSTem:VERBose?
:SYSTem:VERBose <Boolean>

## *TST

This query returns a Boolean value representing self-test results.

**Syntax** *TST?

# Specifications

This section begins with a brief description of the OTS9100 module. Following the description, the section contains a complete listing of the instrument specification.

The organization of this section is as follows:

- System Specifications
- Transmitter (Tx) Specifications
- Receiver (Rx) Specifications
- Certifications and Compliance

## Environmental Specifications

### Temperature Ranges

Operating Temperature: -0° to +35°Celsius
Non-Operating Temperature: -20° to +60°Celsius

### Humidity Ranges

Operating Humidity: 0 to +30°Celsius with relative humidity ≤ 80% non-condensing and up to +35 °C with a relative humidity ≤ 60% non-condensing.

Non-Operating Humidity: 0 to +30°Celsius with relative humidity ≤ 90% non-condensing and up to +60 °C with a relative humidity ≤ 25% non-condensing.

### Dimensions

The dimensions of all module cards are 6u (233.35 mm x 160 mm, 9.19 inches x 6.3 inches) form factor with 4hp (20.32 mm, 0.8 inches) front panel.

### Weight

| | |
|---|---|
| Clock Trig module card: | 0.75 lb |
| Transmit module card: | 1.0 lb |
| Receiver module card: | 1.0 lb |
| Optics module card: | 1.75 lbs |

# Transmitter Specifications

## Clock Source

| | |
|---|---|
| Internally generated clock: | 9953.28 MHz +/- 4.6ppm |
| Thru mode clock: | Derived from clock recovered from received signal |
| External Clock: | 155.52MHz +/- 100ppm |

## Signal Generation

### Internal Mode

This mode requires no external test equipment to generate a valid 9.95238 Gb/s output.

- Data: 9.95238 Gb/s output with PN7 scrambled NRZ format; in BERT mode, unframed and unscrambled PRBS data

**Table A-1: SONET Default Overhead**

| | |
|---|---|
| **Section** | A1 and A2 are set to (hexadecimal) F6H and 28H, respectively.<br>The J0 byte is set to the 16-byte string "Tektronix/BTT". The first byte of this string is the CRC.<br>B1 contains computed BIP-8.<br>191 Z0 bytes are set to 0xCC.<br>All other Section OverHead (SOH) set to 00H. |
| **Line** | For each channel, the first H1 is set to 62H and the first H2 is set to 0AH.<br>For concatenated structures, subsequent H1's are set to 93H and H2's are set to FFH filling the remaining pointer values for the structure before repeating first H1, H2.<br>H3's are all set to 00H.<br>B2 contains (192) computed BIP-8.<br>All other Line OverHead (LOH) set to 00H. |
| **Path** | B3 contains computed BIP-8<br>The J1 byte is set to the 16-byte string "Tektronix/BTT". The first byte of this string is the CRC.<br>All other Path OverHead (POH) set to 00H. |

**Table A-2: SDH Default Overhead**

| | |
|---|---|
| **Regenerator Section** | A1 and A2 are set to (hexadecimal) F6H and 28H, respectively.<br>The J0 byte is set to the 16-byte string "Tektronix/BTT". The first byte of this string is the CRC.<br>B1 contains computed BIP-8.<br>All other Section OverHead (SOH) set to 00H. |
| **Multiplexer Section** | For each channel, the first H1 is set to 6AH and the first H2 is set to 0AH.<br>For concatenated structures, subsequent H1's are set to 93H and H2's are set to FFH filling the remaining pointer values for the structure before repeating first H1, H2.<br>H3's are all set to 00H.<br>B2 contains (192) computed BIP-8. B2 contains computed BIP-Nx24.<br>All other Line OverHead (LOH) set to 00H. |
| **Path** | B3 contains computed BIP-8.<br>The J1 byte is set to the 16-byte string "Tektronix/BTT". The first byte of this string is the CRC.<br>All other Path OverHead (POH) set to 00H. |

## Through Mode

- BERT mode: Generates an unframed and unscrambled PRBS data pattern. Fixed data patterns of all ones, all zeros, or user byte are not allowed in this mode. Random Bit Errors can be inserted. No other settings or controls, for example structure, overhead, and anomalies, apply in this mode.
- Non-intrusive mode: External 10 Gb/s data signal is passed through the module without modification.
- Intrusive mode (Active Through Mode): Allows overhead bytes to be overwritten while regenerating the received 10 Gb/s signal. Alarms and errors can also be added to the received signal prior to retransmission. Several Overhead bytes in the first STS-3c (or first 3 STS-1's) (SONET) or AU-4 (SDH) may be independently set as hexadecimal values in the range of 00 to FF. The A1, A2, B1, B2, and H1-H3 bytes may not be overwritten. The settable bytes include J0, E1, F1, D1-D3, K1, K2, D4-D12, S1, and E2. Clear-text coding and dedicated menus for S1 (Synchronization Status Byte) and K1/K2 (MSP-Multiplex Section Protection/ APS – Automatic Protection Switching) bytes may also be overwritten. The B1/B2/B3 bytes may be recalculated.

***NOTE:*** *M1 may not be explicitly edited but the overwrite control must be set to allow REI-L anomalies to be inserted in through mode.*

The path overhead may also be overwritten. B3 may be recalculated. J1, C2, F2, H4, Z3/F3, Z4/K3, and Z5/N1 are the path overhead bytes available for overwriting. The payload can be replaced with an internally generated payload by selecting the "Overwrite Payload" control.

***NOTE:*** *In intrusive through mode, any defect applied has immediate effect. Certain anomalies have no effect unless overwrite is turned on for the anomaly byte. This applies to B1 BIP (B1), B2 BIP (B2), REI-L (M1), B3 BIP (B3), and REI-P (G1). Random Bit, Random SPE Bit, and payload bit may always be applied.*

***NOTE:*** *G1 may not be explicitly edited but the overwrite control must be set to allow REI-P anomalies to be inserted in through mode.*

## Internal Payload Structures

In SONET mode, the signal can be multiplexed as (192) STS-1, (64) STS-3c, (16) STS-12c, (4) STS-48c, or (1) STS-192c.

In SDH mode, the signal can be multiplexed as (192) VC-3, (64) VC-4, (16) VC-4-4c, (4) VC-4-16c, or (1) VC-4-64c.

For STS-1 and VC-3, the stuff columns may be set to 0 or filled with payload. In SPE/VC3 Bulk mode, columns 30 and 59 will be filled with payload. In SPE/VC3 Stuff mode, columns 30 and 59 will be filled with zero byte.

### Active Channel

The active channel affects which payload is affected by the active controls, including the POH edit. The active channel range is dependent upon the structure and is so limited. The user may control the structure, the SPE/VC3 Stuff column control, and the test pattern for each active channel.

### Background Channel

The user may control structure, SPE/VC3 Stuff column control, and test pattern.

***NOTE:*** *The background structure can never be ST-192c or VC-4-64c as that would take up the entire signal.*

## Test Patterns

The test patterns available include PN15, PN15 Inverted, PN23, PN23 Inverted (ITU-T 0.181), PN31, PN31 Inverted, All zeros, All ones, Fixed 8-bit Data (user-editable).

## Overhead Manipulation Specifications

Subsequent to the default values, the following overhead modifications are possible:

The following bytes can be individually selected and edited:

J0, J1, E1, F1, F2, D1-D3, G1, H4, K1, K2, D4-D12, S1, M1, E2, Z0, Z3, Z4, Z5
C2 of the active POH (all other C2 bytes can be set to a user-selectable 8-bit value)

Z0 bytes 2 through 192 may be edited to a fixed byte value, set to the column number (ITU G. 783), set to 0xCC (GR-253), or set to a series of Consecutive Identical Digits (CID).

J0 editing: Single byte, 16-byte sequence (ITU-T), 64-byte sequence (SONET)

J1 editing: Single byte, 16-byte sequence (ITU-T), 64-byte sequence (SONET)

Some bytes can be altered through alarm and error generation as follows:

1. Generating errored frames will invert all 192 A1 and A2 bits.
2. Generating RDI-L (MS-RDI) will force least significant 3 bits of K2 to 110.
3. Generating AIS-L (MS-AIS) will force least significant 3 bits of K2 to 111. AIS-L is a signal with valid section overhead and a scrambled all ones pattern for the line overhead and payload.
4. B1 error injection inverts one or more bits in one or more B1 bytes.
5. B2 error injection inverts one or more bits in one or more B2 bytes.
6. B3 error injection inverts one or more bits in one or more B3 bytes.
7. REI-L (MS-REI) error injection sets M1 byte to indicate one or more errors.
8. REI-P (HP-REI) error injection sets the four most significant bits of the G1 byte to indicate one or more errors.
9. LOP error injection sets the H1/H2 pointer bytes to 63/0F for SONET and 6B/0F for SDH. This equates to a pointer value of 783, which is over the maximum allowable pointer value of 782.
10. AIS-P (HP-AIS) forces all ones into the H1/H2/H3 bytes and the entire SPE.
11. RDI-P (HP-RDI) has four different defect types. The RDI-P defect forces the G1 byte bits 4-1 to the following values:
    - "one bit" RDI-P: '100'
    - Enhanced RDI-P Payload: '010'
    - Enhanced RDI-P Server: '101'
    - Enhanced RDI-P Connectivity: '110'

The rest of the POH in the active channel can be set to the user-selected values.

## Error Injection

Error Rates: All error rates can be selected in the form X.Y e-Z. See Table A-3 for maximum and minimum error rates.

Random Errors: Errors are distributed across the entire 10Gb/s signal; includes overhead and payload.

Random SPE Errors: Errors are distributed across the SPE only (Path and payload).

B1, B2, or B3 single error or error rate is generated by inverting a random bit in the byte.

MS REI/ REI-L: The OC-192 M1 byte is overwritten to convey the error count.

**Table A-3: Error Rate Max/Min**

| Error Type | Maximum Rate | Minimum Rate |
|---|---|---|
| B1 | $6.430 \times 10^{-6}$ | $1 \times 10^{-14}$ |
| B2 | $6.502 \times 10^{-6}$ | $1 \times 10^{-14}$ |
| B3 | $2.66 \times 10^{-5}$ | $1 \times 10^{-14}$ |
| REI-L (MS-REI) | $2.072 \times 10^{-4}$ | $1 \times 10^{-14}$ |
| Payload Bit | $3.906 \times 10^{-3}$ | $1 \times 10^{-14}$ |
| Random Bit | $3.906 \times 10^{-3}$ | $1 \times 10^{-14}$ |
| REI-P (HP-REI) | $2.66 \times 10^{-5}$ | $1 \times 10^{-14}$ |
| Random Bit (SPE only) (Random VC Bit) | $3.906 \times 10^{-3}$ | $1 \times 10^{-14}$ |

## Defect/ Alarm Generation

LOS: 9.95238 Gb/s output is forced to all zeros for a user selected time, from 1 to 15 microseconds with a resolution of 1 microsecond or continuously.

LOF, SEF: All of the A1 and A2 bytes of the 9.95238 Gb/s output are inverted for a user-selected time.

AIS-L (MS-AIS): The Line OH (Multiplex Section OH) and the entire SPE are set to all ones for a user-selected time.

RDI-L (MS-RDI): The '110' code is set in the three least significant bits of the K2 byte for a user-selected time.

LOP (HP-LOP) sets the H1/H2 pointer bytes to 63/0F for SONET and 6B/0F for SDH. This equates to a pointer value of 783, which is over the maximum allowable pointer value of 782.

AIS-P (HP-AIS) forces all ones into the H1/H2/H3 bytes and the entire SPE.

RDI-P (HP-RDI) has four different defect types. The RDI-P defect forces the G1 byte bits 4-1 to the following values:

- “one bit” RDI-P: ‘100’
- Enhanced RDI-P Payload: ‘010’
- Enhanced RDI-P Server: ‘101’
- Enhanced RDI-P Connectivity: ‘110’

For all Defects except LOS, the time is selected in frames, up to 240000, or continuous.

# Receiver (Analyzer) Specifications

## Measurements

B1 Errors: The 9.95238 Gb/s input is monitored for Section level (Regenerator Section) errors by comparing the received B1 byte to the recomputed BIP-8 parity. The errors are detected and counted.

B2 Errors: The 9.95238 Gb/s input is monitored for Line (Multiplex Section) errors by comparing the 192 received B2 bytes to the recomputed BIP-8 x 192 (BIP-24 x 64) parity. The errors are detected and counted.

B3 Errors: The 9.95238 Gb/s input is monitored for Path level errors of the active channel by comparing the received B3 byte to the recomputed BIP-8 parity. The errors are detected and counted.

REI-L/MS-REI: The 9.95238 Gb/s input is monitored for REI-L/MS-REI in the M1 byte. The errors are detected and counted.

REI-P: The 9.95238 Gb/s input is monitored for REI-P. The errors are detected and counted.

Frame Alignment Sequence Errors (FAS): The last two A1 bytes and the first two A2 bytes (A1, A1, A2, A2) of the 9.95238 Gb/s input are monitored for errors.

For SDH, B1, B2, B3, MS-REI per G.821 and G.826, unavailability per G.827.

For SONET, B1, B2, B3, REI-L per GR-253-CORE.

Error counts for the following are available through the receiver: Errored Blocks, Errored Seconds, Severely Errored Seconds, Unavailable Ratio, Unavailable Seconds, Errored Seconds Ratio, Severely Errored Seconds Ratio, Consecutive Severely Errored Seconds Periods, Background Block Errors, Background Block Error Ratio, Total Count, Available Errored Blocks, Available Errored Seconds, Available Background Block Errors, Available Severely Errored Seconds, and BER.

## Alarms Detection

LOS: 9.95238 Gb/s input is monitored for the all zeros condition. When the 10 Gb/s signal has been off for more than 2 microseconds the LOS condition is declared. The LOS alarm will assert no later than 127 microseconds after receiving the low signal (all zeros) condition.

LOF, SEF: If 4 or more consecutive frames have FAS errors, then SEF is declared and reframing is attempted. If SEF persists for more than 3 milliseconds, LOF is declared.

AIS-L: The K2 byte is monitored for occurrence of all ones in three least significant bits.

- SONET: If it occurs in five consecutive frames AIS-L is declared.
- SDH: If it occurs in three consecutive frames MS-AIS is declared.

RDI-L: The K2 byte is monitored for occurrence of the '110' code in three least significant bits.

- SONET: If it occurs in five consecutive frames RDI-L is declared.
- SDH: If it occurs in three consecutive frames MS-RDI is declared.

AIS-P: If the pointer equals 3FF for three to five frames, then AIS-P is declared.

RDI_P: If the G1 bits 5, 6, and 7 do not equal 000 or 001, a RDI-P condition is declared.

REI-P: If the G1 bits 1 through 4 contain the numbers one through eight (binary, 0001 through 1000), a REI-P condition is declared.

## Overhead Display

Approximately every 100 milliseconds each byte of the first three STS-1 Transport Overheads (AU-4) are extracted and displayed. J0 and J1 are extracted and displayed in ASCII string. Trace-Identifier-Mismatch (TIM) can be declared by comparing against a user-defined trace.

# Transmitter Input and Output Specifications

## OTS91L4-15, OTS91L5-15 Signal Name: 9.95238 Gb/s Optical Output Data

Signal Rate: 9.95238 Gb/s ± 100ppm

Pulse Mask Compliance: GR-253 (SONET), G.957 (SDH)

Data Format: PN7 scrambled NRZ formatted data; in BERT mode, unframed and unscrambled PRBS data

Wavelength: 1550 nm ± 6 nm

Average Power: ≥+3 dBm (minimum), +5 dBm (typical)

Extinction Ratio: ≥10 dB (minimum), 12 dB (typical)

Wavelength Aging Drift: +\- 0.01nm/yr

Sidemode Suppression: >30 dB

Chirp: $\alpha = 0$ (nominal)

Optical Return Loss: > 30dB (minimum)

Eye Crossing: 50% (typical)

Connector: FC/PC (standard), SC or ST available

Optical Rise and Fall Time: ≤30 ps at 20%-80%

Optical Extinction for Continuos LOS insertion: > 30 dB

This output can be "locked out" for safety (as UL safety requirements specify) using the front panel key switch or remote interlock.

Fiber Type: Single Mode

Modulator Type: Mach Zender/Lithium Niobate

Description: Primary output to device under test

## OTS91L7, OTS91L8 Signal Name: 9.95238 Gb/s Optical Input

Wavelength: 1528 nm - 1565 nm

Average Power: 0dBm - +16dBm

Insertion Loss: < 7.5dB, 6.0dB typical

***NOTE:*** *There is a 3dB reduction in measured power with a 50% duty cycle modulated signal.*

Optical Source Polarization Extinction: >14dB

Connector: FC/PC (standard), SC or ST available

Fiber Type: Input – Polarization-maintaining (PM) Panda type

Description: Optical input for external optical source

### OTS91L7, OTS91L8 Signal Name: 9.95238 Gb/s Optical Output Data

Signal Rate: 9.95238 Gb/s ± 100ppm

Pulse Mask Compliance: GR-253 (SONET), G.957 (SDH)

Data Format: PN7 scrambled NRZ formatted data; in BERT mode, unframed and unscrambled PRBS data

Wavelength: 1528 nm - 1565 nm (Determined by user-supplied external optical source)

Average Power: NA (Determined by user supplied external optical source)

Extinction Ratio: ≥10 dB (minimum), 12 dB (typical)

Wavelength Aging Drift: NA (Determined by user-supplied external optical source)

Sidemode Suppression: NA (Determined by user-supplied external optical source)

Chirp: $\alpha = 0$(nominal)

Optical Return Loss: > 30dB (minimum)

Eye Crossing: 50% (typical)

Connector: FC/PC (standard), SC or ST available

Optical Rise and Fall Time: ≤30 ps at 20%-80%

Optical Extinction for Continuos LOS insertion: > 30 dB

Remote interlock and key switch: NA (Should be located on user supplied external optical source)

Fiber Type: Output-Single Mode

Modulator Type: Mach Zender/Lithium Niobate

Description: Primary output to device under test

### OTS91L4-13, OTS91L5-13 Signal Name: 9.95238 Gb/s Optical Output Data

Signal Rate: 9.95238 Gb/s ± 100ppm

Pulse Mask Compliance: GR-253 (SONET), G.957 (SDH)

Data Format: PN7 scrambled NRZ formatted data; in BERT mode, unframed and unscrambled PRBS data

Wavelength: 1310 nm ± 20 nm

Average Power: -4 dBm (minimum) to +0 dBm , -1 dBm (typical)

Extinction Ratio: >8.2 dB , >9.0 dB (typical)

Sidemode Suppression: > 30dB

Optical Isolation: ≥ 25 dB

Eye Crossing: 50% (typical)

Connector: FC/PC (standard), SC or ST available

Optical Rise and Fall Time: ≤35 ps at 20%-80%

Optical Extinction for Continuos LOS insertion: > 30 dB

This output can be “locked out” for safety (as UL safety requirements specify) using the front panel key switch or remote interlock.

Fiber Type: Single Mode

Modulator Type: Electro-Absorption

Description: Primary output to device under test

### Frame Sync Output

Connector: SMA

External Termination: 50Ω, DC coupled

Voltage Output LOW: : 0.5V ≥ Vol ≥ 0.1V

Voltage Output HIGH: 1.3V ≥ Voh ≥ 0.9V

Symmetry: 55/45% (nominal)

Description: DC coupled, 8 KHz output used for monitoring 10 Gb/s data output.

### Event Trigger Output

Connector: SMA

External Termination: 50Ω, DC coupled

Voltage Output LOW: 0.8V ≥ Vol ≥ 0.0V

Voltage Output HIGH: 3.8V ≥ Voh ≥ 1.7V

Pulse Width: 25.7 ns (nominal)

Description: User specified to be asserted (active HIGH) for each generated Alarm or Error.

### 622 MHz Trigger Output

Connector: SMA

External Termination: 50Ω, AC coupled

Voltage Level: 500 mVpp

Frequency: 622.08 MHz

Description: Signal provided as a scope trigger for viewing data eye diagrams. This sub-rate clock is derived from the Line Clock.

### External 155.52 MHz Clock Input

Connector: SMA

Internal Termination: 50Ω, AC coupled

Voltage Level: 800 mVpp ± 200 mVpp

Frequency: 155.52 MHz ± 150ppm

Description: Provides a means to synchronize the transmit system to a user supplied reference.

### Transmitter Data Output (Electrical)

Connector: SMA

External Termination: 50Ω, DC coupled

Voltage Output LOW: 0.00V ≥ Vol ≥ -0.10V

Voltage Output HIGH: -0.45V ≥ Voh ≥ -0.60V

Description: Provides the 10 Gb/s data signal. Typically connected to TX DATA IN on the Optics card.

### 10 GHz Clock Input

Connector: SMA

Internal Termination: 50Ω, AC coupled

Voltage Level: 800 mVpp (nominal)

Frequency: 9.95328 GHz ± 150ppm

Description: Provides the Bit rate clock for the transmitter data output. This input is connected to the 10 Ghz Clock OUT of the Clock Trigger card (OTS91C3).

### 10 GHz Trigger Output

Connector: SMA

External Termination: 50Ω, DC coupled

Voltage Level: 0.0 Vdc, 800 mVpp (nominal)

Frequency: 9.95238 GHz

Description: Provides a copy of the 10 GHz Clock OUT which may be used for a scope trigger.

### RX Clock Input

Connector: SMA

Internal Termination: 50Ω, AC coupled

Voltage Level: 800 mVpp (nominal)

Frequency: 155.52 MHz +/- 150 ppm

Description: Signal is used by the PLL to lock the transmitter data output to recovered clock. Used for through mode or recovered timing when selected.

### 10 GHz Clock Output

Connector: SMA

External Termination: 50Ω, AC coupled

Voltage Output: 2.19 +/- 0.41 Vpp, 0.0 Vdc (10.6dbm +/- 1.6db)

Frequency: 9.95328 GHz +/- 150 ppm

Description: Bit rate clock for transmitter data output. This output is connected to the 10GHz Clock IN of the Transmit card.

# Receiver Input and Output Specifications

### OTS91L4, OTS91L6, OTS91L7 Signal Name: 9.95238 Gb/s Optical Input Data

Signal Rate: 9.95238 Gb/s ± 100ppm

Connector: FC/PC (standard), ST or SC available

Wavelength: 1290nm to 1565nm

Maximum Input Power:0 dBm

Input Power Range: -17 dBm to -2dBm at 1525 nm - 1565 nm, BER $<10^{-12}$

-16 dBm to -2 dBm at 1290 nm - 1330 nm, BER$< 10^{-12}$

Input Reflectance: < -27 dB

Jitter Tolerance: meets limits for OC-192c and SMT-64c network interface specifications per (GR-1377-CORE, Issue 5, 12/98) and G.825 (2/99).

Description: Primary optical input from device under test

### Event Trigger Output

Connector: SMA

External Termination: 50Ω, DC coupled

Voltage Output LOW: 0.8V ≥ Vol ≥ 0.0V

Voltage Output HIGH: 3.8V ≥ Voh ≥ 1.7V

Pulse Width: 25.7 ns (nominal)

Description: User specified to be asserted (active HIGH) for each generated Alarm or Error.

### RX Clock Output

Connector: SMA

External Termination: 50Ω, DC Coupled

Voltage Output LOW: 0.80 V +/- 0.20 V

Description: Used for Transceiver supporting through-mode.

### RX Data Input

Connector: SMA

Internal Termination: 50Ω, DC coupled

Voltage Level: 1 Vpp (typical)

Frequency: 9.95238 GB/s Data

Description: Electrical Data signal from the Optics card.

## Module Interconnect Specifications

### Signal Name: Tx Data Out / Tx Data In

Connector: SMA

Voltage Level: 0.5 Vpp (typical)

Description: Electrical data signal. Connect Tx DATA OUT (Transmit card) to Tx DATA IN (Optics card) with Tektronix supplied cable accessories

### Signal Name: Rx Data Out / Rx Data In

Connector: SMA

Voltage Level: 0.70 Vpp (typical)

Description: Electrical data signal. Connect Rx DATA OUT (Optics card) to Rx DATA IN (Receive card) with Tektronix supplied cable accessories (SMA-SMA coax and DC-Block).

### Signal Name: Rx $\overline{\text{Data}}$ Out / 10GHz/s Data In

Connector: SMA

Voltage Level: 0.70 Vpp (typical)

Description: Electrical data signal. Connect Rx $\overline{\text{DATA}}$ OUT (Optics card) to 10GHz/s DATA IN (Jitter Clock Receive Card) with Tektronix supplied cable accessories (SMA-SMA coax). Otherwise, terminate Rx DATA OUT with 50Ω.

### Signal Name: Rx Clock Out / Rx Clock In

Connector: SMA

Voltage Level: 0.8Vpp (typical)

Description: Clock signal. Connect Rx CLK OUT (Receive card) to Rx CLK IN (Sync card) with Tektronix supplied cable accessory (SMA-SMA coax).

# Certifications and Compliance

## Laser Safety

The lasers in the OTS9100 module comply with the following:

- U.S. Class IIIb per 21 CFR 1040
- European Class 3A per IEC 60825-1

## CE Mark Compliance

## EMC Compliance Directive

**OTS9100 Series 10 Gb/s SONET/SDH Test Module using the OTS9000 Optical Test System** meets the essential requirements per Article 10 of Directive 89/336/EEC for Electromagnetic Compatibility using the Technical Construction File (TCF) Route.

Competent Body issuing Certificate of Conformity: TÜV Product Service

Listing of Harmonized Standards applied:

| | |
|---|---|
| EN 55022 Class A | Radiated and Conducted Emissions |
| EN 61000-3-2 | Quasi-stationary Current Harmonics |
| | |
| EN 61326: 1997 | Immunity |
| IEC 1000-4-2 | ESD Immunity Performance Criterion B[1] |
| IEC 1000-4-3 | Radiated Immunity Performance Criterion A[1] |
| IEC 1000-4-4 | EFT Burst Immunity Performance Criterion B[1] |
| IEC 1000-4-5 | Fast Surge Immunity Performance Criterion B[1] |
| IEC 1000-4-6 | Conducted Immunity Performance Criterion A[1] |
| IEC 1000-4-11 | Voltage Interruptions Performance Criterion B[1] |

[1] Specified by EN 61326

*Conditions:*

- *Requires the following option - OTS9000 Option E1*
- *Equipment must be installed within a proximity of no less than 70m to any radio service to minimize possible interference. If interference is unavoidable, further actions may be required. Contact Tektronix for consultation.*

**OTS9100 Series 10Gb/s SONET/SDH Test Module using the OTS9010 or OTS9040 Optical Test System** meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility for all modules with serial number B000300 or higher.

# Appendix B
## Optical Card Front Panel Descriptions

## 10 Gb/s TRANSCEIVER OPTICS CARD (L4-15, L4-13)

The 10Gb/s Optical Transceiver card performs both E/O and O/E conversions for the OTS system. It is available with two laser options, 1310nm or 1550nm. The 1310nm Optical Transceiver consists of a 1310nm laser combined with a broadband Receiver. The 1550nm Optical Transceiver consists of a 1550nm laser combined with a broadband Receiver. The Optics transceiver card works in conjunction with the Transmit card which contains all of the transmit functionality for the OTS system. The Optics transceiver card also works in conjunction with the Receive card, which contains all of the receiver functionality and analysis capability for the OTS system.

Figure B-1 shows the Transceiver Optics card front panels.

### Module OK

The Module OK LED should be green while the instrument is running. On power up, the LED first lights red, then changes to green when the system has finished initializing.

***NOTE:*** *If the LED remains red after the system has finished initializing or fails to light at all, call Tek service.*

### Optical OUT

The Optical Output emits an optical data signal at a wavelength of 1310nm or 1550nm. The optical connector can be configured with field interchangeable shells; FC (standard), ST, or SC type. The field interchangeable shells are easily removed to allow easy cleaning of the connector interface.

The LED found above the Optical OUT heading flashes amber for five seconds and turns green when the laser is actived.

***NOTE:*** *If the LED flashes red, continues to flash amber, or fails to light at all, call Tektronix for service.*

***WARNING:*** *Always avoid exposure to the laser beam. Before power is applied to the OTS9100 system, be sure that all laser outputs are either covered with the screw cap provided or connected to the appropriate circuit.*

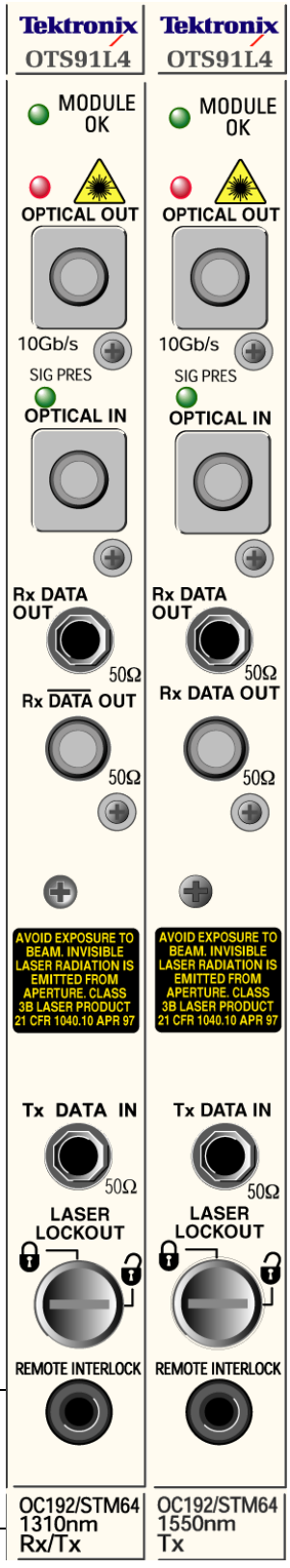



**Figure B-1: Transceiver Front Panels**

## Tx Data IN

Tx Data Input allows electrical data signals to be applied to the optical transmitter. This input must be connected to the Tx Data Out port found on the OTS91Tn Transmitter card of the OTS9100 system using the coax cable provided.

## Laser Lockout, Remote Interlock

REMOTE INTERLOCK is a bantam plug normally closed connection internally wired in series with the laser lockout key switch. It can be used with additional hardware to disable the laser output.

***NOTE:*** *If this connection is used, the ferrite bead provided with the module must be attached to the remote interlock cable for lower emissions and CE mark conformance. Install the bead close to the end of the cable connected to the Optics card.*

Laser LOCKOUT is a safety device. The key switch disables the laser output when it is turned to the "open lock" position. The laser output can only be turned on when the key is in the "closed lock" position.

***NOTE:*** *The laser output cannot be enabled unless:*

1. *The Laser Lockout key switch is set to the "open lock" or on position.*
2. *The Remote Interlock is either not used or externally enabled.*
3. *The Laser output is software enabled.*

***NOTE:*** *Optical cables use and care.*

1. *When using the optical cables ensure that the cable is firmly seated in the front panel connector. The optical connectors on the front panel are keyed. If the cable is not inserted into the connector key properly, the connection between cable and front panel will not be complete and so will cause errors in transmission and receiver functions.*
2. *Always be sure to clean both cable connectors and front panel connectors before installing optical cables. A dirty optical connection can cause errors in transmission and receiver functions.*

## Optical IN

The Optical IN port accepts the incoming optical signal to the receiver. This input signal must have a wavelength between 1290 nm and 1565 nm and must not exceed 0dBm of power.

The LED labeled SIG PRES above the OPTICAL IN heading will turn green when the Optics card detects an incoming signal. Flashing Red indicates an optical loss of signal (LOS) condition, and flashing amber indicates an optical overload condition.

***WARNING:*** *The incoming signal must be attenuated to within specified power levels. If the signal exceeds 0 dBm, damage may occur.*

## Rx DATA OUT

Rx DATA OUT provides signal interconnection between the system cards.
This output must be connected to the Rx DATA IN port found on the Receive card of the OTS9100 system using the coax cable and DC block provided.

## $\overline{\text{Rx DATA}}$ OUT

Rx $\overline{\text{DATA}}$ OUT is a 10Gb/s DATA Signal provided for jitter measurement.
This output must be connected to the 10 Gb/s DATA IN port found on the OTS92H1 Clock Receiver Card using the coax cable provided (no DC block is necessary). Otherwise, this output is normally terminated with 50Ω.

# 10 Gb/s TRANSMIT-ONLY OPTICS CARD (L5-15, L5-13)

The 10Gb/s Optical Transmit-only card is available with two laser options:
1310 nm or 1550 nm. This Optics card performs E/O conversion and works in conjunction with the **Transmit card**, which contains transmitter functionality for the OTS9100 system.

Figure B-2 shows the Transmitter Optics card front panels.

## Module OK

The Module OK LED should be green while the instrument is running. On power up, the LED first lights red, then changes to green when the system has finished initializing.

***NOTE:*** *If the LED remains red after the system has finished initializing or fails to light at all, call Tek service.*

## Optical OUT

The Optical Output emits an optical data signal at a wavelength of 1310 nm or 1550 nm, with the proper option. The optical connector can be configured with field interchangeable shells: FC(standard), ST, or SC type. The field interchangeable shells are easily removed to allow easy cleaning of the connector interface.

The LED located above the Optical OUT heading will flash amber for five seconds and then turn green when the laser is activated.

***NOTE:*** *If the LED flashes red, continues to flash amber, or fails to light at all, call Tektronix for service.*

***WARNING:*** *Always avoid exposure to the laser beam. Before power is applied to the OTS9100 system, be sure that all laser outputs are either covered with the screw cap provided or connected to the appropriate circuit.*

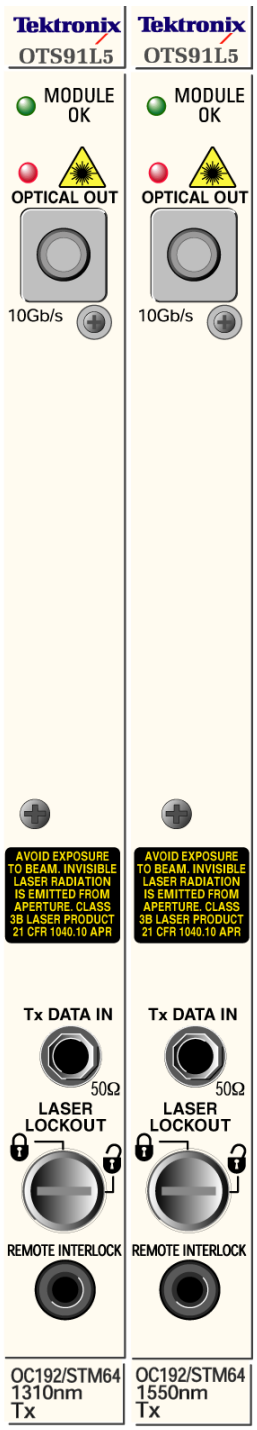



**Figure B-2:**
**Transmitter Front Panels**

## Tx Data IN

Tx Data Input allows electrical data signals to be applied to the optical transmitter. This input must be connected to the Tx Data Out port found on the OTS91Tn Transmitter card of the OTS9100 system using the coax cable provided.

## Laser Lockout, Remote Interlock

REMOTE INTERLOCK is a bantam plug normally closed connection internally wired in series with the laser lockout key switch. It can be used with additional hardware to disable the laser output.

***NOTE:*** *If this connection is used, the ferrite bead provided with the module must be attached to the remote interlock cable for lower emissions and CE mark conformance. Install the bead close to the end of the cable connected to the Optics card.*

Laser LOCKOUT is a safety device. The key switch disables the laser output when it is turned to the "open lock" position. The laser output can only be turned on when the key is in the "closed lock" position.

***NOTE:*** *The laser output cannot be enabled unless:*
*The Laser Lockout key switch is set to the "open lock" or on position.*
*The Remote Interlock is either not used or externally enabled.*
*The Laser output is software enabled.*

1. ***NOTE:*** *Optical cables use and care. When using the optical cables ensure that the cable is firmly seated in the front panel connector. The optical connectors on the front panel are keyed. If the cable is not inserted into the connector key properly, the connection between cable and front panel will not be complete and so will cause errors in transmission and receiver functions.*
2. *Always be sure to clean both cable connectors and front panel connectors before installing optical cables. A dirty optical connection can cause errors in transmission and receiver functions.*

## 10Gb/s OPTICAL RECEIVE-ONLY (L6)

The 10Gb/s **Optical Receive-only card** performs the O/E conversion for the OTS system. This Optics card works in conjunction with the **Receive card** which contains all of the receiver functionality and analysis capability for the OTS system.

Figure B-3 shows the Receiver Optics card front panel.

## Module OK

The Module OK LED should be green while the instrument is running. On power up, the LED first lights red and then changes to green when the system has finished initializing.

***NOTE:*** *If the LED remains red after the system has finished initializing, call Tektronix for service.*

## Optical IN

The Optical IN port accepts the receiver's incoming optical signal. This input signal must have a wavelength between 1290 nm and 1565 nm and must not exceed 0 dBm of power.

The LED labeled SIG PRES above the OPTICAL IN heading will turn green when the Optics card detects an incoming signal. Flashing Red indicates an optical loss of signal (LOS) condition, and flashing amber indicates an optical overload condition.

***WARNING:*** *The incoming signal must be attenuated to within specified power levels. If the signal exceeds 0 dBm, damage may occur.*

## Rx DATA OUT

Rx DATA OUT provides signal interconnection between the system cards.
This output must be connected to the Rx DATA IN port found on the Receive card of the OTS9100 system using the coax cable and DC block provided.

## Rx $\overline{\text{DATA}}$ OUT

Rx $\overline{\text{DATA}}$ OUT is a 10Gb/s DATA Signal provided for jitter measurement. This output must be connected to the 10 Gb/s DATA IN port found on the OTS92H1 Clock Receiver Card using the coax cable provided (no DC block is necessary). Otherwise, this output is normally terminated with 50Ω.


Figure B-3
Receive Only Front Panel

## 10Gb/s OPTICAL TRANSCEIVER INTERFACE / EXTERNAL LASER (L7)

The10Gb/s External Laser Transceiver card performs both E/O and O/E conversions for the OTS system. This card contains both an external laser interface for the OTS9100 system and a broadband optical receiver. The L7 Optics card works in conjunction with the **Transmit card,** which contains all of the transmitter functionality for the OTS system. The L7 Optics transceiver also works in conjunction with the **Receive card,** which contains all of the receiver functionality and analysis capability for the OTS system.

Figure B-4 shows the External Laser Transceiver card front panel.

## Module OK

The Module OK LED should be green while the instrument is running. On power up, the LED first lights red, then changes to green when the system has finished initializing.

***NOTE:*** *If the LED remains red after the system has finished initializing or fails to light at all, call Tek service.*

## Optical OUT

The Optical Output is a modulated version of the External Laser Optical Input. The optical connector can be configured with field interchangeable shells: FC (standard), ST, or SC type. The field interchangeable shells are easily removed to allow cleaning of the optical connector.

The LED found above the Optical OUT heading will flash amber for five seconds and then change to green when both the optical output is activated and the external laser is active. The LED may also be green if the external laser is active, even if the optical output has not been enabled.

***NOTE:*** *If the LED flashes red, continues to flash amber, or fails to light at all, call Tektronix for service.*

***WARNING:*** *Always avoid exposure to the laser beam. Before power is applied to the OTS9100 system, be sure that all laser outputs are either covered with the screw cap provided or connected to the appropriate circuit.*

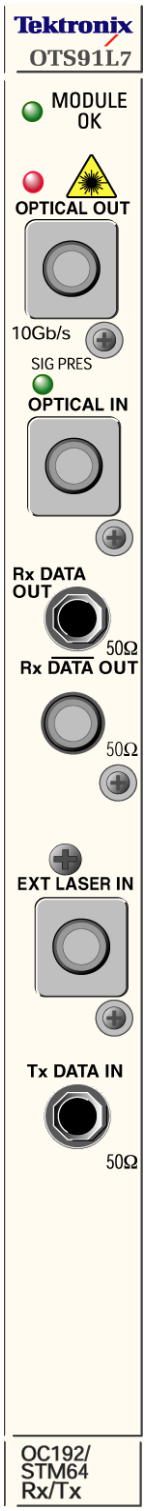



**Figure B-4. Transceiver Interface with External Laser Front Panel**

## External Laser IN

The External Laser In provides interconnection for external fixed or tunable wavelength laser sources. The input will accept OTS Tunable lasers or customer supplied lasers that meet specifications. A polarization-maintaining (PM) jumper and an optical source with good polarization extinction are required.

As with the Optical Output, the Tx optical input connector can be configured with field interchangeable shells.

## Tx Data IN

Tx Data Input provides signal interconnection between the system cards. This input must be connected to the Tx Data Out port found on the Transmit card of the OTS9100 system using the coax cable provided.

## Optical IN

The Optical IN port accepts the incoming optical signal to the receiver. This input signal must have a wavelength between 1290 nm and 1565 nm and must not exceed 0dBm of power.

The LED labeled SIG PRES above the OPTICAL IN heading will turn green when the Optics card detects an incoming signal. Flashing Red indicates an optical loss of signal (LOS) condition, and flashing amber indicates an optical overload condition.

***WARNING:*** *The incoming signal must be attenuated to within specified power levels. If the signal exceeds 0 dBm, damage may occur.*

## Rx DATA OUT

Rx DATA OUT provides signal interconnection between the system cards.
This output must be connected to the Rx DATA IN port found on the Receive card of the OTS9100 system using the coax cable and DC block provided.

## Rx $\overline{\text{DATA}}$ OUT

Rx $\overline{\text{DATA}}$ OUT is a 10Gb/s DATA Signal provided for jitter measurement. This output must be connected to the 10 Gb/s DATA IN port found on the OTS92H1 Clock Receiver Card using the coax cable provided (no DC block is necessary). Otherwise, this output is normally terminated with 50Ω.

# 10Gb/s OPTICALTRANSMIT ONLY/ EXTERNAL LASER (L8)

The 10Gb/s Transmit-only card Optics card with external laser provides an external laser interface for the OTS9100 system. This L8 Optics card provides E/O conversion and works in conjunction with the **Transmit card,** which contains transmitter functionality for the OTS9100 system.

Figure B-5 shows the Optical Transmitter card front panel.

## Module OK

The Module OK LED should be green while the instrument is running. On power up, the LED first lights red, then changes to green when the system has finished initializing.

***NOTE:*** *If the LED remains red after the system has finished initializing or fails to light at all, call Tek service.*

## Optical OUT

The Optical Output is a modulated version of the External Laser Optical Input. The optical connector can be configured with field interchangeable shells: FC (standard), ST, or SC type. The field interchangeable shells are easily removed to allow cleaning of the optical connector.

The LED found above the Optical OUT heading will flash amber for five seconds and then change to green when both the optical output is activated and the external laser is active. The LED may also be green if the external laser is active, even if the optical output has not been enabled.

***NOTE:*** *If the LED flashes red, continues to flash amber, or fails to light at all, call Tektronix for service.*

***WARNING:*** *Always avoid exposure to the laser beam. Before power is applied to the OTS9100 system, be sure that all laser outputs are either covered with the screw cap provided or connected to the appropriate circuit.*


**Figure B-5. Transmit Only External Laser Front Panel**

## External Laser IN

The External Laser In port provides interconnection for external fixed or tunable wavelength laser sources. The connection will accept OTS Tunable lasers or customer supplied lasers that meet specifications. A polarization-maintaining (PM) jumper and an optical source with good polarization extinction are required. As with the Optical Output, the Tx optical input connector can be configured with field interchangeable shells.

## Tx Data IN

Tx Data Input provides signal interconnection between the system cards. This input must be connected to the Tx Data Out port found on the Transmit card of the OTS9100 system using the coax cable provided.

# Emergency Startup Disk

These instructions explain how to make an emergency startup disk for your OTS system.

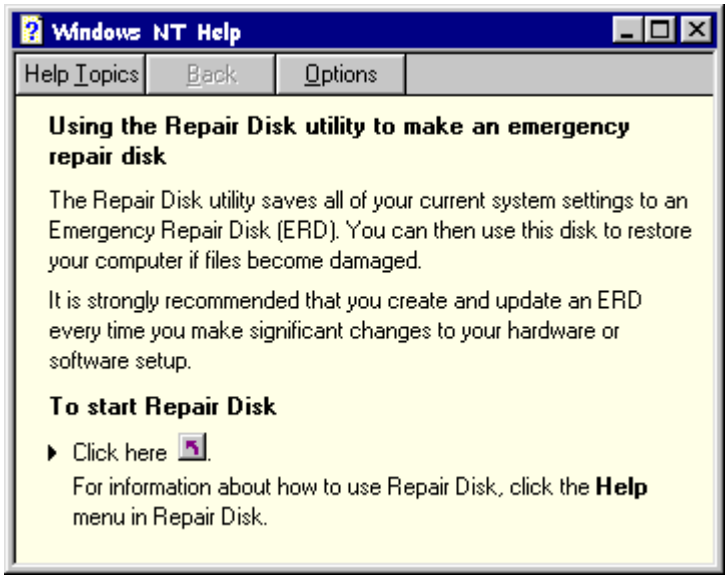
It is recommended that you take the time to do this procedure every time you change your system configuration (such as modifying the network settings). The process takes less than five minutes.

## Accessing Help Files

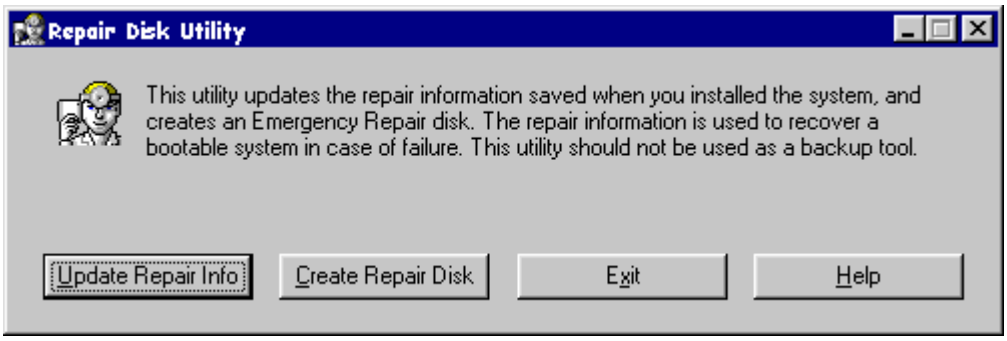
The procedure for making an emergency startup disk is located in the Windows Help files. Follow the steps below to access these files and create the emergency disk. You will need a blank floppy disk for the procedure.

***NOTE:*** *Make sure you are on the correct OTS system before making the emergency disk. Because of licensing information, an emergency startup disk must be made for each system.*

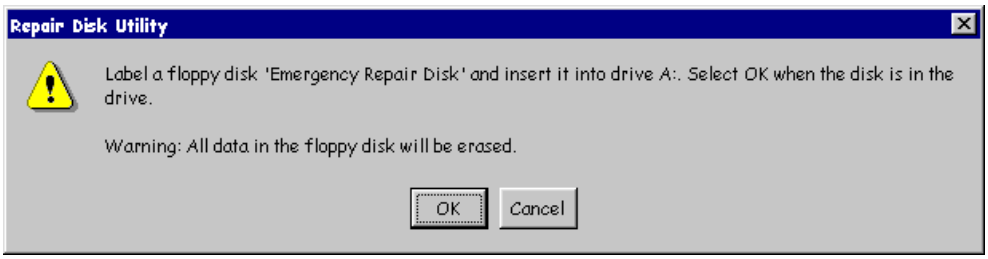
1. Click on the **Start** menu and select **Help**.
2. In the Help dialog box, select the **Index** tab and type in "Emergency".
3. The following dialog box is displayed. Click on the button as prompted to begin making the emergency disk.



4. The Repair Disk Utility box is now displayed. In this box you may update the repair information, create the repair disk, exit, or request additional help. Click Create Repair Disk.




5. The computer then prompts you to label the floppy disk and insert it into your floppy disk drive. Click on OK to continue.




6. The computer now creates your emergency disk. The computer erases the disk and then copies the pertinent files onto it.
7. When the computer finishes, it will prompt you with a final message. Exit the repair disk utility and remove your floppy disk. Be sure to store it in a safe location.

# List of Acronyms

| | |
|---|---|
| AIS-L | Line Alarm Indication Signal |
| AMI | Alternate Mark Inversion |
| ANSI | American National Standards Institute |
| ASCII | American Standard Code for Information Interchange |
| BBE | Background Block Error |
| BER | Bit Error Ratio |
| BIP | Bit Interleaved Parity |
| BIP-8 | Bit Interleaved Parity-8 |
| CFR | Code of Federal Regulations |
| CSES | Consecutive Severely Errored Second |
| CV | Coding Violation |
| EB | Errored Block |
| ES | Errored Second |
| ESA | Errored Second Type A |
| ESB | Errored Second Type B |
| FAS | Frame Alignment Signal |
| IEC | International Electrotechnical Commission |
| ITU | International Telecommunications Union |
| J0 TIM | J0 Trace Identifier Marker |
| LOF | Loss of Frame |
| LOS | Loss of Signal |
| MS | Multiplex Section |
| MS AIS | Multiplex Section Alarm Indication Signal |
| MS RDI | Multiplex Section Remote Defect Indication |
| MS REI | Multiplex Section Remote Error Indication |
| NE | Network Element |
| OC | Optical Carrier |
| OC-N | Optical Carrier level N |
| OOF | Out of Frame |
| OS | Operating System |
| RAI | Remote Alarm Indication |

| | |
|---|---|
| RAI-L | Line Remote Alarm Indication |
| RDI | Remote Defect Indication |
| RDI-L | Line Remote Defect Indication |
| REI | Remote Error Indication |
| REI-L | Line Remote Error Indication |
| RS | Regenerator Section |
| Rx | Receiver |
| SCPI | Standard Commands for Programmable Instruments |
| SDH | Synchronous Digital Hierarchy |
| SES | Severely Errored Second |
| SONET | Synchronous Optical Network |
| SPE | Synchronous Payload Envelope |
| STS | Synchronous Transport Signal |
| STS-N | Synchronous Transport Signal level N |
| TIM | Trace Identifier Mismatch |
| TOH | Transport Overhead |
| TU | Tributary Unit |
| TUG | Tributary Unit Group |
| Tx | Transmitter |
| UAS | Unavailable Second |
| VC | Virtual Container |
| VT | Virtual Tributary |

# Module Card Replacement

Replacement parts are available from or through your local Tektronix, Inc. service center or representative. For further information or module replacement, inquiries may be directed to the Service Call Center at (800) 833-9200.

The OTS9100 is serviced by module replacement. If a faulty module card is detected, use the following table to determine the necessary replacement card part number. Please have this number available when inquiring with your Tektronix representative.

| Tektronix Part Number | Description |
|---|---|
| 672-1609-00 | OTS91C1 Clock Trig card |
| 672-1688-00 | OTS91C3 Clock Trig card |
| 672-1606-00 | OTS91L1 Tx/Rx Optics card |
| 672-1608-00 | OTS91L2 Tx Optics card |
| 672-1607-00 | OTS91L3 Rx Optics card |
| 672-1705-00 | OTS91L413 Tx/Rx Optics card - 1310 nm |
| 672-1706-00 | OTS91L415 Tx/Rx Optics card - 1550 nm |
| 672-1707-00 | OTS91L513 Tx Optics card - 1310 nm |
| 672-1708-00 | OTS91L515 Tx Optics card - 1550 nm |
| 672-1709-00 | OTS91L6 Rx Optics card |
| 672-1710-00 | OTS91L7 External Tx/Rx Optics card |
| 672-1711-00 | OTS91L8 External Tx Optics card |
| 672-1604-00 | OTS91R1 Receive card |
| 672-1647-00 | OTS91R2 Receive card |
| 672-1605-00 | OTS91T1 Transmit card |
| 672-1646-00 | OTS91T2 Transmit card |
| 672-1689-00 | OTS91T3 Transmit card |

# Installing the Software

These instructions explain how to load the software. The OTS90x0 system is shipped with the software pre-loaded. This procedure should only be required if the software is accidentally wiped off the hard drive or if you receive a system software upgrade.

***NOTE:*** *The installation software will first remove any previous versions of the OTS90x0 system software prior to loading the new version. Since this involved a restarting the computer, it is recommended that all programs be closed prior to performing the installation.*

1. Remove the OTS90x0 CDrom from its case and place the CDrom into the OTS90x0 CDrom drive.
2. The CDrom setup program should start automatically. If it does not, click Start, Run, and type in "<CDrom drive letter>:\setup.exe".
3. Follow the prompts to install the new version of the software.
4. When the software is finished loading, remove the CDrom and place it in its case.

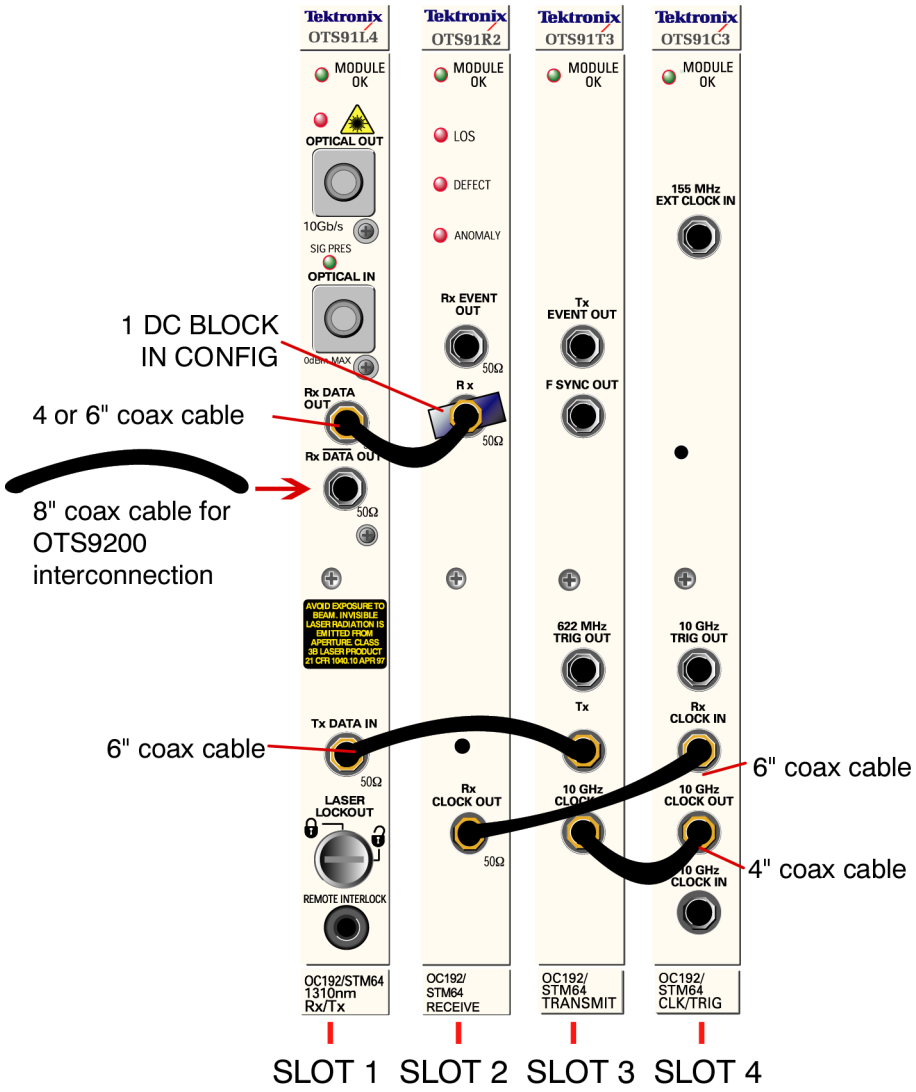
# Appendix

## Illustrations of cabled OTS9100 module

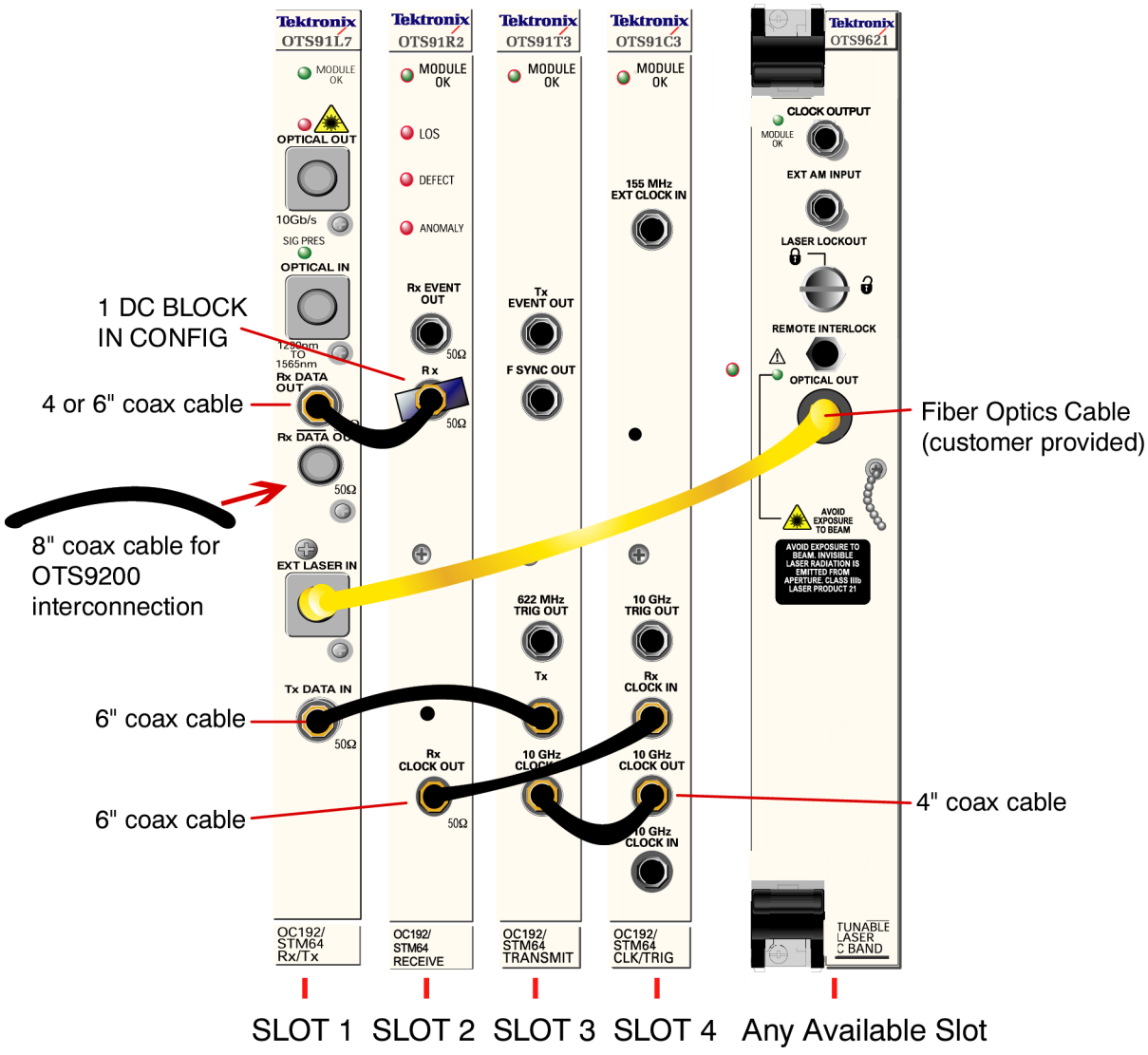
This appendix provides examples of cabling the **OTS9100 module.**

The examples provide a reference for location and recommended cable lengths used to configure the OTS9100 module.

**Cabling OTS9100 Module with OTS91L4 Optical Card**



**Cabling OTS9100 Module to OTS9261 Tunable Laser**



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## *R*



## *S*



## *T*

## *U*



## *V*



## *W*