User Manual

Tektronix

VX4610
SDH/SONET Generator/Receiver

070-8855-03

This document supports firmware version 1.30 and above.

Warning
The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to the Safety Summary prior to performing service.

Printed in the U.S.A.

Tektronix, Inc., P.O. Box 1000, Wilsonville, OR 97070–1000

WARRANTY

Tektronix warrants that the products that it manufactures and sells will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If a 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 the 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.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

THIS WARRANTY IS GIVEN BY TEKTRONIX IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. TEKTRONIX AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TEKTRONIX' RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. TEKTRONIX AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER TEKTRONIX OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

Table of Contents

Getting Started

Operating Basics

Syntax and Commands

Status and Events

Examples

Appendices

Glossary and Index

List of Figures

List of Tables

General Safety Summary

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

To Avoid Fire or Personal Injury

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 indirectly grounded through the grounding conductor of the mainframe 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.

Do Not Operate Without Covers

To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Use Proper Fuse

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

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.

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.

Wear Eye Protection

To avoid eye injury, wear eye protection if there is a possibility of exposure to high-intensity rays.

Product Damage Precautions

Provide Proper Ventilation

To prevent product overheating, provide proper ventilation.

Do Not Operate With Suspected Failures

If you suspect there is damage to this product, have it inspected by qualified service personnel.

Safety Terms and Symbols

Terms in This Manual

These terms may appear in this manual:

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
Refer to Manual

Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

Do Not Service Alone

Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

Disconnect Power

To avoid electric shock, disconnect the main power by means of the power cord or, if provided, the power switch.

Use Care When Servicing With Power On

Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

Preface

This manual describes the capabilities of the VX4610 SDH/SONET Generator/Receiver and how to use the instrument in a programming environment. All standard options are included. The VX4610 is controlled through the use of SCPI-derived commands (Standard Commands for Programmable Instruments) and IEEE 488.2 Common Commands. This manual describes how to use these commands to access information generated by or stored in the instrument.

About This Manual

The following table shows you where to find useful information on many topics related to your VX4610.

Where To find information in this manual

If you want to know:	Look in this part of the manual:
What are the features and capabilities of the VX4610	*VX4610 Features and Capabilities* starting on page 2–9
What are the detailed specifications for the VX4610	*Appendix A: Specifications* starting on page A–1
How to set up for remote communication	*Getting Started* starting on page 1–5
How to remove and reinstall a tributary add/drop module	*User Service* starting on page H–1
How to run a quick functional check	*Getting Started* starting on page 1–17
What are the VXIbus compliances	*VXIbus Interface* starting on page 2–25
How the programming model for this instrument is structured	*Programming Model* starting on page 2–27
How to perform simple tasks such as generating a normal or modified signal	*Examples of Command Usage* starting on page 2–33
How the command language syntax is structured	*Syntax* starting on page 3–1
What are the functional command groups	*Functional Command Groups* starting on page 3–7
What are the commands and queries	*Transmit Commands* section on page 3–11 through the *Common Commands* section

Where To find information in this manual (cont.)

If you want to know:	Look in this part of the manual:
What are the error and event messages	*Status and Events* section contains the error and event messages starting on page 4–8 The commands and queries in *Syntax and Commands* starting on page 3–11 list the error and event messages
How to structure a program containing commands and queries	*Examples* starting on page 5–1
What are the default values for the instrument	*Appendix E*

Related Manuals

The following documents are also available for the VX4610 SDH/SONET Generator/Receiver.

- The *VX4610 SDH/SONET Generator/Receiver Command List Reference* (Tektronix part number 070-8974-XX) provides a quick overview of the instrument programming commands.
- The *UI4610 Graphical User Interface Software User Manual* (Tektronix part number 070-8856-XX) provides detailed information about using the UI4610 Graphical User Interface Software to operate the VX4610.

Contacting Tektronix

Product Support	For application-oriented questions about a Tektronix measurement product, call toll free in North America: 1-800-TEK-WIDE (1-800-835-9433 ext. 2400) 6:00 a.m. – 5:00 p.m. Pacific time Or contact us by e-mail: tm_app_supp@tek.com For product support outside of North America, contact your local Tektronix distributor or sales office.
Service Support	Contact your local Tektronix distributor or sales office. Or visit our web site for a listing of worldwide service locations. http://www.tek.com

For other information	In North America: 1-800-TEK-WIDE (1-800-835-9433) An operator will direct your call.
To write us	Tektronix, Inc. P.O. Box 1000 Wilsonville, OR 97070-1000

Getting Started

Getting Started

This section begins with a brief description of the VX4610, and then explains how to configure and install the instrument in a VXIbus mainframe. Then you can perform the quick functional check, also included in this section, to gain confidence that the instrument operates properly.

Product Description

The Tektronix VX4610 SDH/SONET Generator/Receiver meets the test requirements of engineers and technicians who develop, manufacture, or verify synchronous network equipment. The instrument supports both the SDH (ITU) and SONET (Bellcore, ANSI) communication standards. A selection of plug-in interface modules allows you to analyze a wide range of electrical and optical communication signals. The following list highlights the capabilities of the VX4610:

- Transmit and receive SDH electrical signals at STM-1E rate (standard) and SDH optical signals at STM-1 and STM-4 rates (optional)
- Transmit and receive PDH electrical signals at 2 Mb/s, 34 Mb/s, and 140 Mb/s (optional)
- Add and drop PDH electrical signals at 2 Mb/s, 34 Mb/s, and 140 Mb/s (optional)
- Transmit and receive SONET electrical signals at STS-1 and STS-3 rates (standard) and SONET optical signals at OC-1, OC-3, and OC-12 rates (optional)
- Transmit and receive tributary electrical signals at DS1 and DS3 rates (optional)
- Add and drop tributary electrical signals at DS1 and DS3 rates (optional)
- Transmit and receive differential and single-ended ECL/PECL-level signals at SDH/SONET rates (optional)
- Output high–power (0dBm) laser at 1550nm (Option 05) or 1310nm (Option 10)
- Supports SONET concatenated payloads at STS-3 rate
- Generate valid or errored test signals and analyze incoming signals at SDH, SONET, DS1/DS3 and 2 Mb/s, 34 Mb/s, and 140 Mb/s rates (optional)
- Generate user-defined overhead bytes

- Generate user-defined payload patterns and custom sequence
- Triggered or manual capture of Transport/Section overhead
- Triggered or manual capture of custom payload sequence
- Trigger internally on received events (errors, alarms, failures, pointer adjustments, and APS changes)
- Trigger externally from front-panel or backplane inputs
- Send Trigger Output to other instruments (such as a counter/timer) to make extended measurements
- Show the current status of the received signal with front-panel lights
- Perform Pass/Fail testing based on performance measurement criteria
- Perform jitter tolerance testing using External Clock Input
- Add NRZ CLK/DATA Interface (optional)
- Combined Sonet/SDH Tributaries (optional)

The VX4610 is a two-wide VXI module designed to operate in any C-size VXIbus mainframe. With the addition of the Option 22 or 36 Add/Drop/Test module, the VX4610 becomes a three-wide module. With the Option 58 module, it becomes a four-wide module. The VX4610 is a VXIbus message-based servant that supports Normal Data Transfer mode. You can find additional information about the VXIbus operation of the VX4610 in the *Instrument I/O* section on page 2–25.

The ASCII command set is used for instrument control and communications in a programming environment. The commands use IEEE Std. 488.2 and SCPI-derived syntax. The communication between the VX4610 and the system controller or Slot 0 uses word serial protocol.

UI4610 Graphical User Interface Software

The VX4610 comes standard with the UI4610 Graphical User Interface Software. This software provides a virtual front panel for the VX4610 on the display screen of a personal computer. The virtual front panel allows you to get acquainted with the VX4610 and experiment with its features. You can also use it for interactive applications like debugging, or as a tool to generate programming commands for your system application.

The UI4610 Graphical User Interface Software package is a Microsoft Windows application that runs on any IBM-PC or compatible with the following minimum system requirements:

- 486 processor
- 16 MB RAM

- Microsoft Windows operating system, version 3.1
- VGA color display monitor
- National Instruments GPIB card and software
- 3.5 inch floppy disk drive
- Keyboard
- Mouse

Refer to the *UI4610 Graphical User Interface Software User Manual* for detailed information about the software. There you can find information on how to install the software, how to operate the VX4610 using the software, and how to use the software to generate programming commands.

Accessories

This section lists the standard and optional accessories for the VX4610 SDH/SONET Generator/Receiver. For information on optional modules, refer to page 2–1.

Standard Accessories

Table 1–1 lists the standard accessories that come with the VX4610.

Table 1–1: VX4610 SDH/SONET Generator/Receiver standard accessories

Accessory	Part number
VX4610 SDH/SONET Generator/Receiver User Manual	070-8855-XX
Universal Fiber Optic Connector Adapter Kit (two kits included)	020-1885-XX
UI4610 Graphical User Interface Software and *UI4610 Graphical User Interface Software User Manual*	070-8856-XX
VX4610 Reference Manual	070-8974-XX
75 Ω Coaxial Cable, BNC Male to BNC Male	012-1338-00

Optional Accessories

Table 1–2 lists the optional accessories for use with the VX4610. For information on optional modules, refer to page 2–1.

Table 1–2: VX4610 SDH/SONET Generator/Receiver optional accessories

Accessory	Part Number
Fiber Optic Cable, FC/PC to Diamond 3.5, 2 M	174-1385-00
Fiber Optic Cable, FC/PC to ST, 2 M	174-1386-00
Fiber Optic Cable, FC/PC to FC/PC, 2 M	174-1387-00
Fiber Optic Cable, FC/PC to Biconic, 2 M	174-1388-00
Fiber Optic Cable, FC/PC to Diamond 2.5, 2 M	174-1497-00
SMA Male to BNC Female Adapter	015-1018-00
50 Ω SMA Coaxial Cable	174-1364-00
120 Ω Balanced Cable, DIN41628L Male to DIN41628L Male	012-1469-00
75 Ω Coaxial Cable, BNC Male to WECo 440	012-1470-00
75 Ω Coaxial Cable, BNC Male to WECo 358	012-1471-00
110 Ω Shielded Cable, Bantam to Bantam	012-1314-00
100 Ω Adapter, DS1 Bantam to WECo 310	103-0365-00
75 Ω Adapter, BNC Female to WECo 440	103-0366-00
75 Ω Adapter, BNC Female to WECo 358	103-0367-00

SMB Cables. The Option 58 Add/Drop/Test module has SMB type connectors on the NRZ inputs and outputs. These are coaxial connections where the cable connectors are simply pressed on by hand. The SMB connectors are a smaller type normally used for 50 ohm connections.

Use a double-shielded cable with an EF-Johnson mini 75 ohm SMB connector. It should have a double-braided ferule and RG-179 coaxial cable. The double-shielded cable ensures minimal EMI radiation. Once source of this type of cable is the company

Custom Cable Assemblies
123 Osigian Blvd
Warner Robins, GA 31088
(912) 953-2358

Configuration

This section describes how to set the logical address for the VX4610 SDH/SONET Generator/Receiver prior to installing it into your VXIbus mainframe.

CAUTION. *Components in the VX4610 are susceptible to static-discharge damage. Observe standard handling precautions for static-sensitive devices. Wear a grounded wrist strap, or equivalent, while handling the VX4610 module.*

Setting the Logical Address

Every module in a VXIbus system must have a unique logical address. You must set the address for the VX4610 with two rear-panel switches before installing the module into a mainframe. See Figure 1–1 on page 1–6 for the location of the address switches. You can set the VX4610 to a specific address, or if the system resource manager supports dynamic configuration, you can set the switches to hexadecimal FF (decimal 255). If you choose dynamic configuration, the logical address is assigned by the controller at power on. Consult the VXI-MXI documentation included with your interface kit for instructions on the use and functions of your resource manager utility.

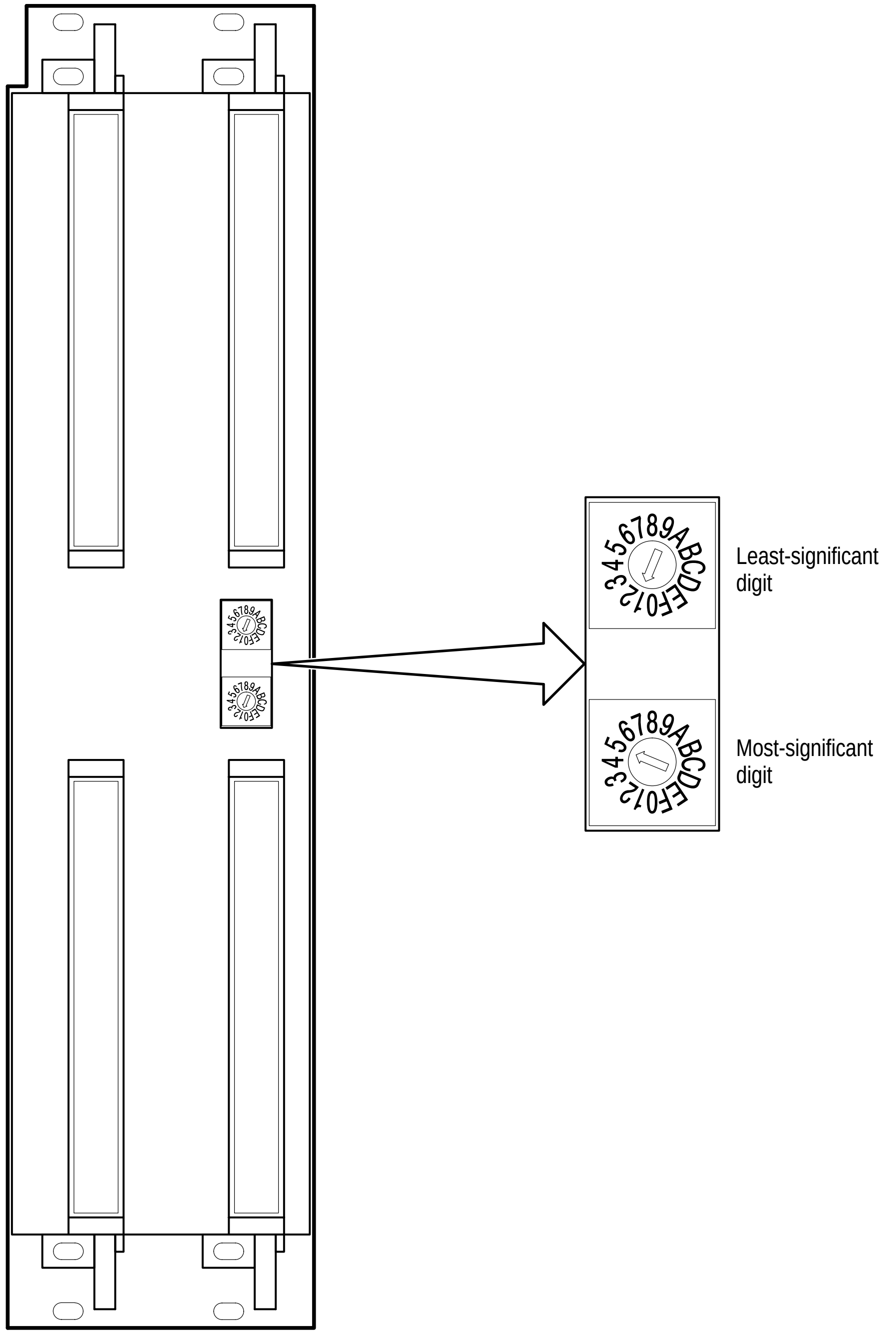


Figure 1–1: Location of the logical address switches on the VX4610 rear panel

Add/Drop/Test Modules Addresses. Add/Drop/Test modules do not require their own logical address. They communicate with the VX4610 over a ribbon cable and do not use the VXIbus for communication.

Installation

This section tells you how to install the VX4610 SDH/SONET Generator/Receiver into a Tektronix VXIbus mainframe. If you install your VX4610 into a VXIbus mainframe from another manufacturer, check the mainframe manual for any pertinent installation and capacity information.

Preparing the VXIbus Mainframe

You can install the VX4610 into any appropriate C- or D-size VXIbus mainframe using slots one through twelve. However, before installation it is important to check that the mainframe can provide adequate power and cooling for the VX4610.

Voltage and Current Requirements. Table 1–3 on page 1–7 lists the current that the VX4610 requires from each of the mainframe supplies with an Add/Drop/Test module installed. Be sure the mainframe can supply adequate current to the VX4610 and all other modules you plan to install into the same mainframe.

Table 1–3: VX4610 current requirements

Mainframe power supply voltage	Average current
+24 V	0.0 A
–24 V	0.0 A
+12 V	0.8 A
–12 V	0.3 A
+5 V	10.1 A
–5.2 V	6.3 A
–2 V	0.5 A

The maximum power dissipated by the VX4610 is 100 W with an Add/Drop/Test module installed.

Cooling Requirement. To limit the internal temperature rise to 10° C, the VX4610 requires an airflow of 3.0 l/s at a pressure drop of 0.05 mm H_2O. All Tektronix VXIbus mainframes meet the cooling requirement of the VX4610 if unused mainframe slots are covered with blank front panels. Be sure your VXIbus mainframe meets this requirement and that if you need blank front panels, you have them available.

WARNING. *Shock hazards exist due to high currents within the mainframe compartment. Do not change configuration of the Bus Grant and Interrupt Acknowledge jumpers unless you are technically qualified to do so.*

Jumper Settings. It does not matter how the Bus Grant (BG0–BG3) jumpers are set for the two slots occupied by the VX4610 because the module does not use the Bus Grant signals. Once installed, the VX4610 passes Bus Grant signals on to the higher-numbered VXIbus mainframe slots whether or not the jumpers are in place.

Correct placement of the Interrupt Acknowledge (IACK) jumpers is important only if the application program you use to control the VX4610 uses service requests (SRQ). The UI4610 Graphical User Interface Software, supplied with the VX4610, does not rely on SRQs in its communication with the module. Refer to the manual for your VXIbus mainframe for instructions to set these jumpers, if necessary.

Using Adjacent VXIbus Mainframe Slots. You must give special consideration to the VXIbus slots adjacent to the VX4610. The VX4610 is an expander module that drives the VXI Local Buses A and C on either side with class 2 (ECL) signals. The VX4610 has mechanical lock-out keys that limit adjacent modules to ones that are compatible with class 2 Local Bus signals.

Generally, the VX4610 can occupy slots one and two because most Slot 0 controllers do not drive their Local Bus C. The Option 02 ECL Interface Module accesses the Local Bus and must be installed immediately adjacent to the VX4610 or an Option 22, 36, or 58 module in the next higher numbered slot.

Any anchor module (a module that does not drive Local Bus A) can be installed in the next higher numbered slot relative to the location of the VX4610 system. You can avoid any incompatibilities by installing blank front panel covers on both sides of the VX4610 system.

Installing the VX4610 into a VXIbus Mainframe

To install the module in the mainframe, perform the following steps:

CAUTION. *To avoid damaging the Receive optical inputs, use a 10 dB attenuator with high-power optical sources, such as the Option 05 and 10 modules. Without adequate attenuation, these 0 dB optical sources will overdrive and damage the receiver inputs.*

---

1. Check that the mainframe rear-panel power switch is in the OFF position and that the front-panel ON/STANDBY switch is in the STANDBY position.
2. Inspect any VXIbus modules installed in the slots adjacent to the two slots where you intend to install the VX4610. Verify that those modules are compatible with the mechanical lock-out key on the VX4610. Refer to *Using Adjacent VXIbus Mainframe Slots* on page 1–8 for more information on this topic.
3. Insert the VX4610 into the mainframe top and bottom guides of the slots where you plan to install it. Push the module into the mainframe as far as it will go without forcing it.
4. Be sure that the module is fully seated into its VXIbus connectors by verifying that the front panel of the module is flush with the front of the mainframe chassis. If so, use a flat-blade screwdriver to tighten the module retainer screws at the top and bottom of the front panel to lock the module into the mainframe.
5. Please record information specific to this installation in Table 1–4 for future reference.

Table 1–4: VX4610 SDH/SONET Generator/Receiver installation record

Item	Write your entries here
VX4610 serial number	
VX4610 Option 02 serial number	
VX4610 Option 22 serial number	
VX4610 Option 36 serial number	
VX4610 Option 58 serial number	
VX4610 firmware version number[1]	
VX4610 logical address switch settings	
Installed in VXIbus mainframe slot numbers	
Installation performed by	
Date of installation	

Table 1–4: VX4610 SDH/SONET Generator/Receiver installation record (cont.)

Item	Additional installation information
Supported VXIbus Specification level	Revision 1.3
VXIbus device type	Message-based
VXI Local Bus class	Expander module, class 2 (ECL)
Manufacturer's identification number	4093

[1] **Refer to *Check VXIbus Communication* on page 1–17 for a method to determine the Firmware Version Number.**

Removing the VX4610

To remove the module from the mainframe, perform the following steps:

1. Check that the front panel ON/STANDBY switch is in the STANDBY position.

2. Use a flat-blade screwdriver to loosen the module retainer screws on the VX4610 and the Add/Drop/Test module (if installed).

3. Grasp both handles of the VX4610. At the same time, move the top handle upward and the bottom handle downward to eject the module. Then pull the module straight out of the mainframe with the two handles, as shown in Figure 1–2. If an optional Add/Drop/Test module is attached to the VX4610, you can use the handle on the Add/Drop/Test module to pull the modules out of the mainframe.

CAUTION. *To avoid personal injury or damaging the VX4610, do not use the handle on the front of the Add/Drop/Test module to pick up the VXIbus mainframe. Use the handle only for removing the VX4610 from the mainframe after the module retainer screws have been loosened.*

4. Once the module has been removed, store it in a static-free environment.

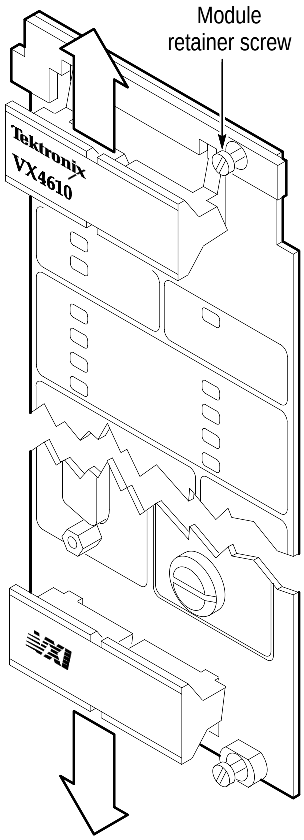


Figure 1–2: Removing the VX4610 from the mainframe

Configuring the GPIB Hardware

The UI4610 Software may communicate with the VX4610 through a standard GPIB interface connected to the VXIbus GPIB adapter. Install the GPIB board in your computer according to the manufacturer instructions and safety precautions.

Turn off your computer and the VX4610 system. Install the GPIB cable between the GPIB connector on your computer and the GPIB connector at the front of the VXIbus GPIB adapter shown in Figure 1–3. For proper operation, the system requires the following conventions when you use the GPIB interface:

- Check the specification for the number of devices for your specific GPIB interface. If you have other GPIB-configured devices connected to your system, do not exceed the recommended maximum number of devices on the bus.
- Assign a unique address to each GPIB device. Refer to page 1–6 to set the VX4610 logical address.

- Connect one device for each 2 m (6 ft) of cable.
- Do not exceed 20 m (65 ft) total cable length.
- Turn on at least two-thirds of the connected devices when operating the network.
- Connect the network devices in a star or linear configuration rather than in a loop or parallel configuration.

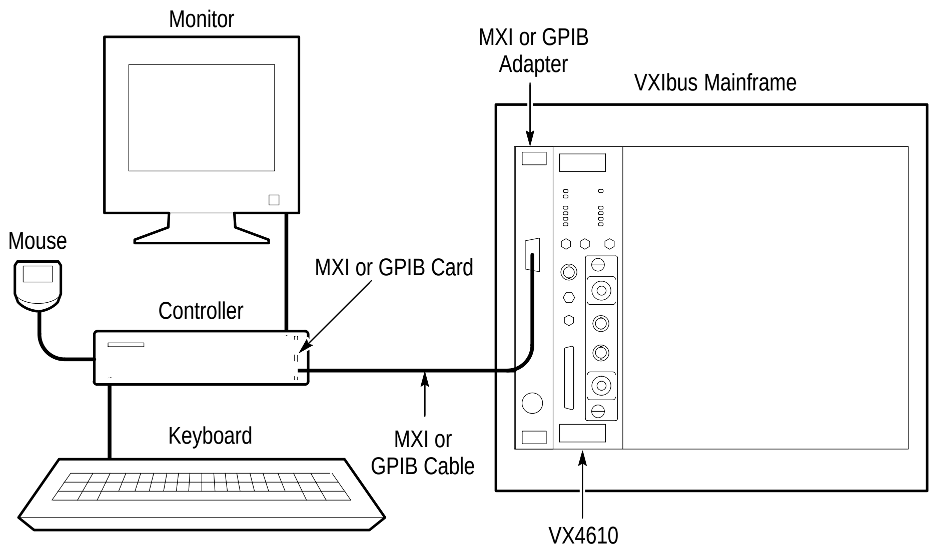


Figure 1–3: Typical GPIB or MXI/VXI system configuration

Configuring the MXI Hardware

The UI4610 Software may communicate with the VX4610 through a standard AT–MXI interface connected to the VXI/MXI bus Slot 0 controller. Install the MXI board in your computer according to the manufacturer's instructions and safety precautions.

Turn off your computer and the VX4610 system, then install the MXIbus cable between the MXI connector on your computer and the VXI/MXI connector at the front of the MXI adapter as shown in Figure 1–3. For proper operation, the system requires the following conventions when you use the MXI interface:

- MXI systems can have up to eight devices connected by daisy-chain cable. If you have other MXI-configured devices connected to the system, do not exceed *eight* devices on one MXI bus.
- Assign a unique address to each device. Refer to page 1–6 to set the VX4610 logical address.

- Connect one device for each 2 m (6 ft) of cable.
- Do not exceed 20 m (65 ft) total cable length.
- Connect the network devices in a star or linear configuration rather than in a loop or parallel configuration.

Establishing Communication with the VX4610

This discussion assumes you have installed the UI4610 Software and have started the software. Refer to the *UI4610 Graphical User Interface Software User Manual* for installation and operating information.

Each time the UI4610 Software starts, it automatically tries to communicate with the VX4610. At start-up, the UI4610 Software temporarily displays a dialog box that states whether communication with the VX4610 was successful or not.

Any time the UI4610 Software is running you can verify communication with the VX4610 using the Communications menu. To display the **Setup Communications** window, click on the **Communications** menu and select the **Setup Bus** command. The Setup Communications window provides selections to support GPIB or VISA/MXI communications, as shown in Figures 1–4 and 1–5.

When the UI4610 Software can communicate with the VX4610, the Instrument Connected check box contains an X. If you click on the ID command button in the GPIB dialog box, the VX4610 responds with its GPIB identification in the text box of the dialog.

Using VISA Software

VISA is the Virtual Instrument Software Architecture, which provides a vendor independent communications interface. VISA is not required to establish GPIB communications, but it can simplify communications. When you have the VISA software installed in your system, you can select the VISA mode and your communications link, such as MXI or GPIB, and get immediate communication. VISA simplifies communication between controllers and VXI modules from many vendors. The VX4610 and UI4610 products support the VISA system.

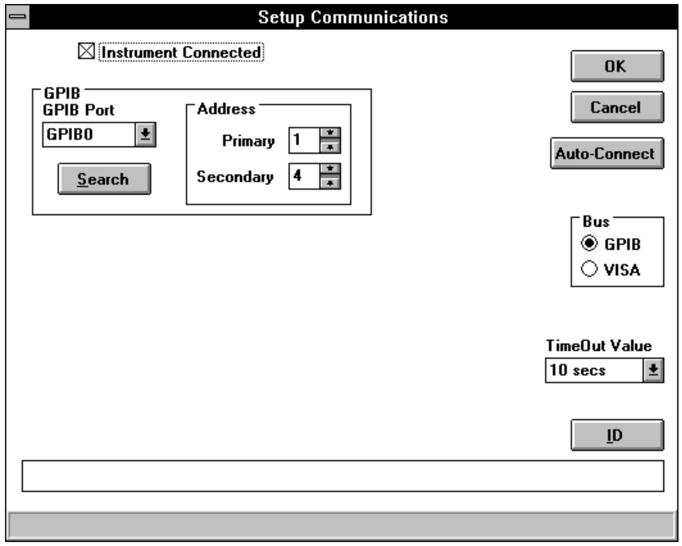


Figure 1–4: The Setup Communications dialog box for GPIB setup

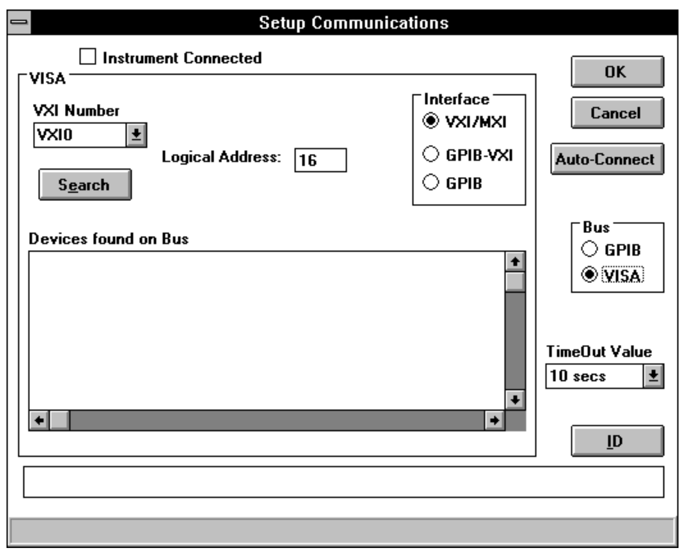


Figure 1–5: The Setup Communications dialog box for VISA setup

Setting the GPIB Address

To establish communications using the GPIB bus, follow these steps:

1. In the Setup Communications dialog box, click on the **Search** button to display the Search Bus dialog box (see Figure 1–6).

2. Click on the **Secondary Addressing** check box to include a search of secondary addresses.

3. Click on **Check** to begin a search for all devices connected to the bus.

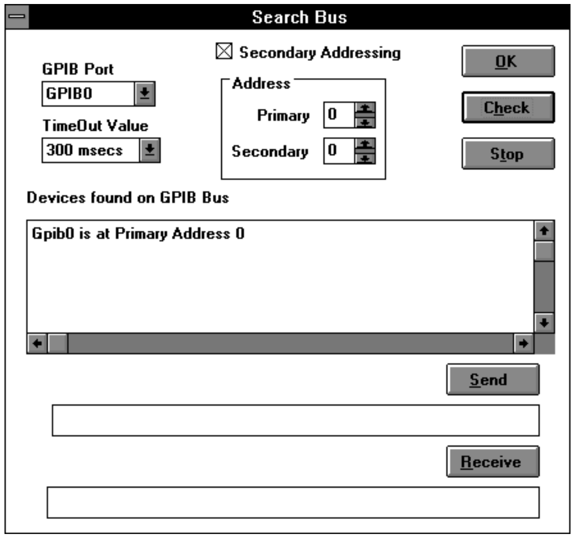


Figure 1–6: Search Bus dialog box

4. Once you recognize that your device is listed in **Devices found on GPIB Bus**, select **Stop** to halt further searching. Note the address.
5. Click on **OK** to close the Search Bus dialog and return to the GPIB dialog.
6. Click on the up or down arrows in the **Primary** address box and, optionally, the **Secondary** address box to set the correct address for your target device.
7. Click on the **ID** button to confirm communication with your instrument.
8. Click on **OK** to close the Communications dialog and proceed with other operations.

Setting the VISA Address

To establish communications using the VXI/MXI bus, follow these steps:

1. In the Setup Communications dialog box, click on the **VISA** button and the **VXI/MXI** interface button.
2. Find your instrument in the list of **Devices found on the Bus** and note its logical address.
3. Enter the device logical address in the logical address box and click on the **ID** button to confirm communication with your instrument.
4. Click on **OK** to close the Communications dialog and proceed with other operations.

Talk and Listen in the Search Bus Dialog Box

You may have noticed that the Search Bus dialog box (see Figure 1–6) conveniently includes Send and Receive command buttons. They allow you to talk and listen to a particular device while in the Search Bus dialog box. To talk and listen from the Search Bus dialog box, follow these steps:

1. Choose the **Setup BUS** command from the Communications menu and click on **Search** in the dialog box to display the Search Bus dialog.
2. Click on the up or down arrows in the **Primary** address box and optionally the **Secondary** address box to set the correct address for your target device.
3. Enter a valid command in the Send text box and click on the **Send** button.
4. Click on the **Receive** button to read the response, if your command requires a response.
5. Click on **OK** to close the Search Bus dialog and return to the GPIB dialog.
6. Click on **OK** to close the GPIB dialog and return to the main window.

Functional Check

This section describes several simple steps you can perform to check that the VX4610 is operating in its VXIbus mainframe. To confirm that the VX4610 meets all of its warranted specifications, you must perform the *Functional Tests* and *Physical Layer Tests* found in *Appendix I* of this manual.

Power-On Diagnostics

Connect AC power to the VXIbus mainframe and press the ON/STANDBY switch to the ON position. On the front panel of the VX4610, verify that the READY light turns on approximately five seconds after you power on the mainframe. The READY light verifies that the VX4610 is ready to accept commands. See Figure 1–7 for the location of the READY light.

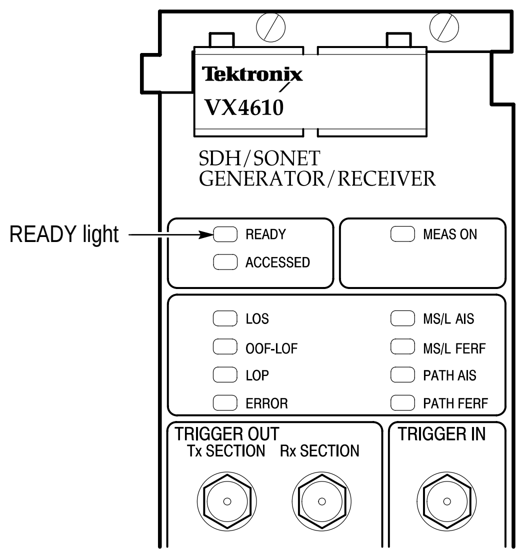


Figure 1–7: Location of the VX4610 READY light

Check VXIbus Communication

After powering on the VX4610, verify that the VX4610 communicates with a controller or commander by sending the *IDN? query to the VX4610 and reading the response. You can use the UI4610 Graphical User Interface Software to send the *IDN? query. Refer to the *UI4610 Graphical User Interface Software User Manual* for instructions to install this software and send this query.

If the VX4610 responds properly to the *IDN? query, you have verified successful communication with the module over the VXIbus. The VX4610 should respond to an *IDN? query as follows:

```
"TEKTRONIX,VX4610,<serial number>,<firmware version>"
```

VX4610 Basic Operation

After verifying communication, use the following simple test to verify that the generator and receiver sections of the VX4610 are functioning:

CAUTION. *To avoid damaging the Receive optical inputs, use a 10 dB attenuator with high-power optical sources, such as the Option 05 and 10 modules. Without adequate attenuation, these 0 dB optical sources will overdrive and damage the receiver inputs.*

1. Locate the group of eight signal status lights on the VX4610 front panel as shown in Figure 1–8. The LOS light should be on.
2. Connect a 75 Ω coaxial cable from the TRANSMIT output to the RECEIVE input on the front panel of the VX4610.
3. Set the VX4610 to begin transmitting data using the UI4610 Software.
4. Verify that all eight lights in the group are off.

If all eight signal status lights are off, you have verified that a signal transmitted by the VX4610 is being received by the VX4610 with no errors or alarms.

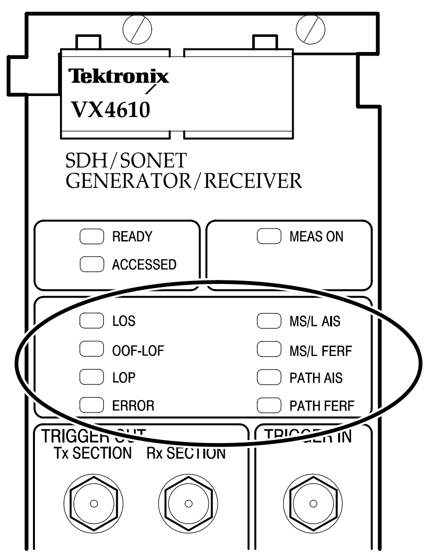


Figure 1–8: Location of the eight signal status lights

Option 02 ECL Interface Module Basic Operation

After checking the VX4610, use the following functional check to verify that the Option 02 ECL Interface Module (if installed) is functioning:

1. Locate the signal status lights and termination configuration switches on the ECL Interface Module front panel as shown in Figure 1–9. The status lights turn on to indicate the current settings of the termination configuration switches.

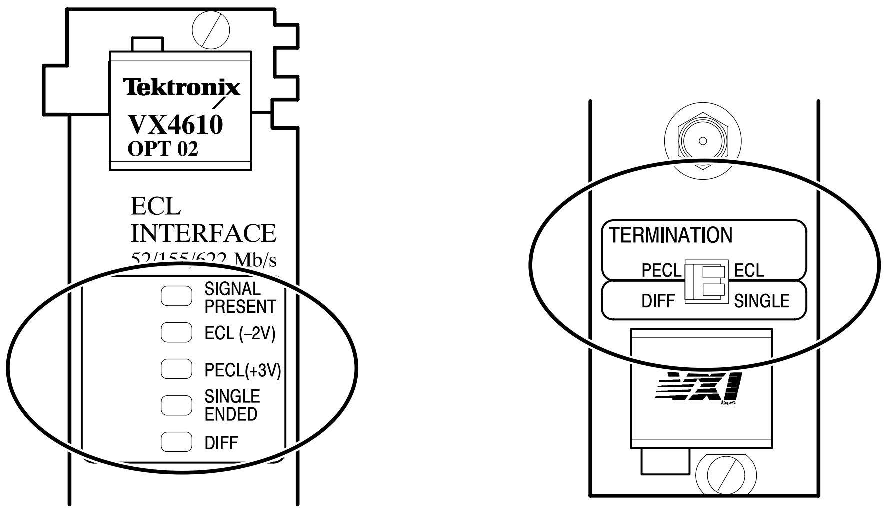


Figure 1–9: ECL Interface status lights and termination configuration switches

2. Set the termination configuration switches to the single and ECL positions.

3. Attach loop-back connections on the ECL Interface module using two 50 Ω SMA cables of equal length. See Figure 1–10.

   a. Connect **DATA** output to **DATA** input.

   b. Connect **CLOCK** output to **CLOCK** input.

The **SIGNAL PRESENT** light will turn on to confirm complete cable connection.

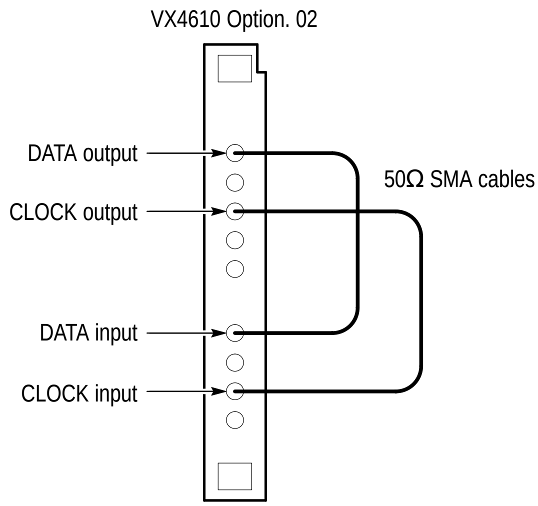


Figure 1–10: Single-ended loopback test setup

Operating Basics

Functional Overview

The *Functional Overview* describes the VX4610 SDH/SONET Generator/Receiver and its capabilities. The section covers three topics:

- Front-panel connectors and lights
- Simplified block diagram
- VX4610 features and capabilities

For detailed information about controlling the VX4610 through the command interface, refer to the *Syntax and Commands* section of this manual.

Front-Panel Connectors and Lights

Figure 2–1 shows the VX4610 SDH/SONET Generator/Receiver front panel with the Option 04 Module installed. To the right is the Option 02 ECL Interface Module. Table 2–1 describes the standard and optional Plug-in Interface Modules. Table 2–2 describes the optional Add/Drop/Test modules.

Table 2–1: VX4610 Plug-in Interface Modules

Plug-in Interface Module	Capability
Standard	52/155 Mb/s electrical transmit and receive
Option 03	52/155 Mb/s electrical and optical, transmit and receive
Option 04	52/155/622 Mb/s electrical and optical, transmit and receive, 1310 nm, –10 dBm
Option 05	52/155/622 Mb/s electrical and optical transmit and receive, 1550 nm, 0 dBm
Option 10	52/155/622 Mb/s electrical and optical transmit and receive, 1310 nm, 0 dBm

NOTE. *The optical TRANSMIT output is produced by a Class 1 laser device. The output from a Class 1 laser is safe to view without special eye protection. However, because other optical signals in your environment may exceed the Class 1 limits, we recommend eye protection as a precaution.*

CAUTION. *To avoid damaging the Receive optical inputs, use a 10 dB attenuator with high-power optical sources, such as the Option 05 and 10 modules. Without adequate attenuation, these 0 dB optical sources will overdrive and damage the receiver inputs.*

Table 2–2: VX4610 Option Modules

Option	Description
Option 02	ECL Interface
Option 22	DS1/DS3 Add/Drop/Test
Option 36	2 Mb/s, 34 Mb/s, 140 Mb/s Add/Drop/Test
Option 58	Both DS1/DS3 and 2 Mb/s, 34 Mb/s, 140 Mb/s Add/Drop/Test

Figure 2–1 identifies the locations of front-panel connectors and lights of the VX4610 and the Option 02 ECL Interface Module. Figure 2–2 identifies the standard and optional Plug-In Interface Modules. Figure 2–3 identifies the locations of front-panel connectors and lights of the Options 22, 36, and 58 Add/Drop/Test modules. See Tables 2–4 through 2–7 starting on page 2–10 for an explanation of the signal status lights on the VX4610 and the optional modules.

NOTE*. Occasionally, a VX4610, with the Option 02 ECL Interface Module, will indicate an LOS condition even though a valid signal is present. This situation can occur when all of the following conditions are met: the ECL Interface Module has active data and clock signals present at its inputs, the VX4610 is set to receive 155 or 622 Mb/s electrical or optical signals, and then a cable carrying an electrical or optical signal is connected to a VX4610 plug-in interface RECEIVE connector.*

To clear this LOS condition, reselect the receive rate after making the connection to the VX4610 RECEIVE connector. To prevent this LOS condition, remove the data or clock signals from the ECL Interface Module before making the connection to the VX4610 RECEIVE connector.

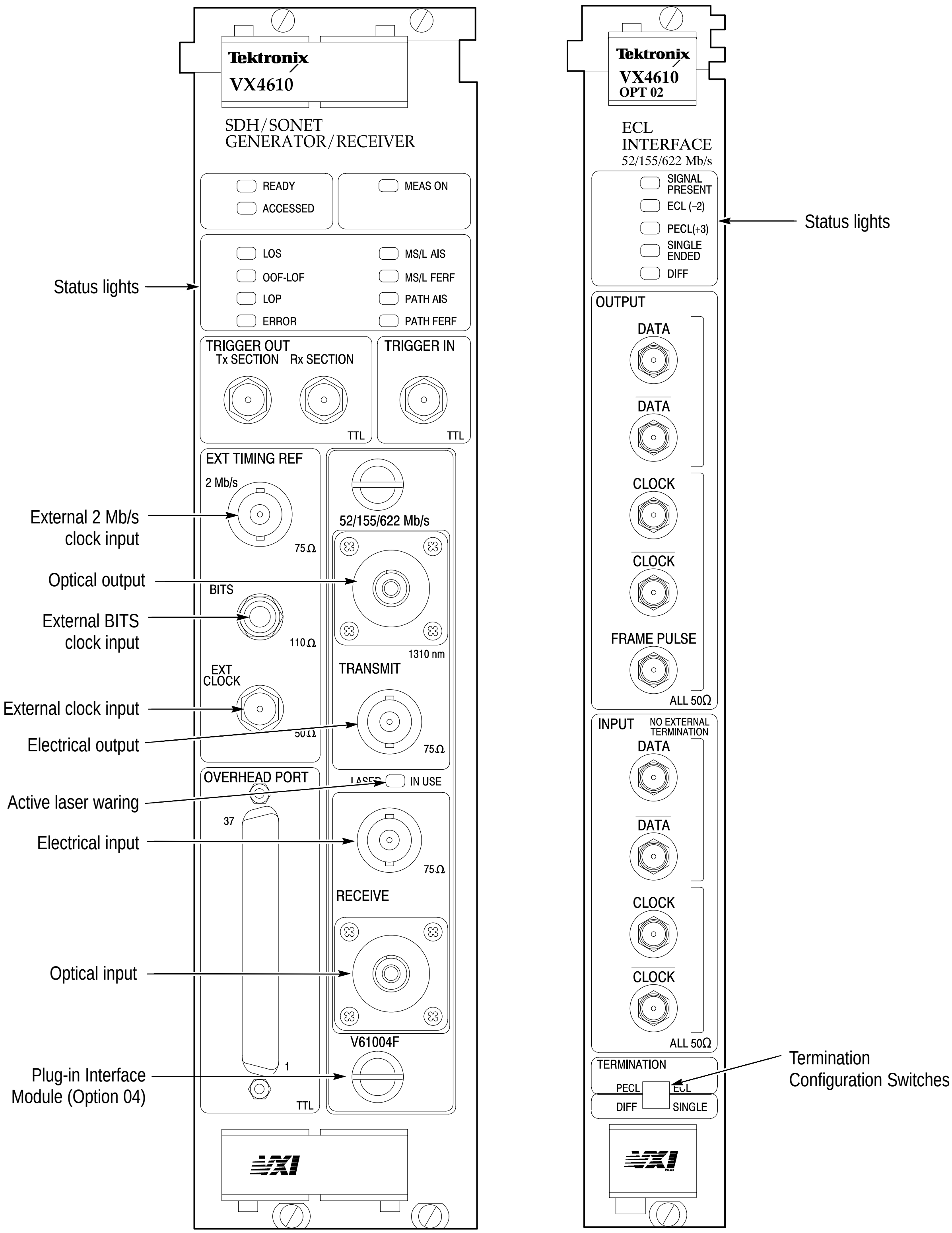


Figure 2–1: VX4610 with Standard and Option 02 ECL interface module

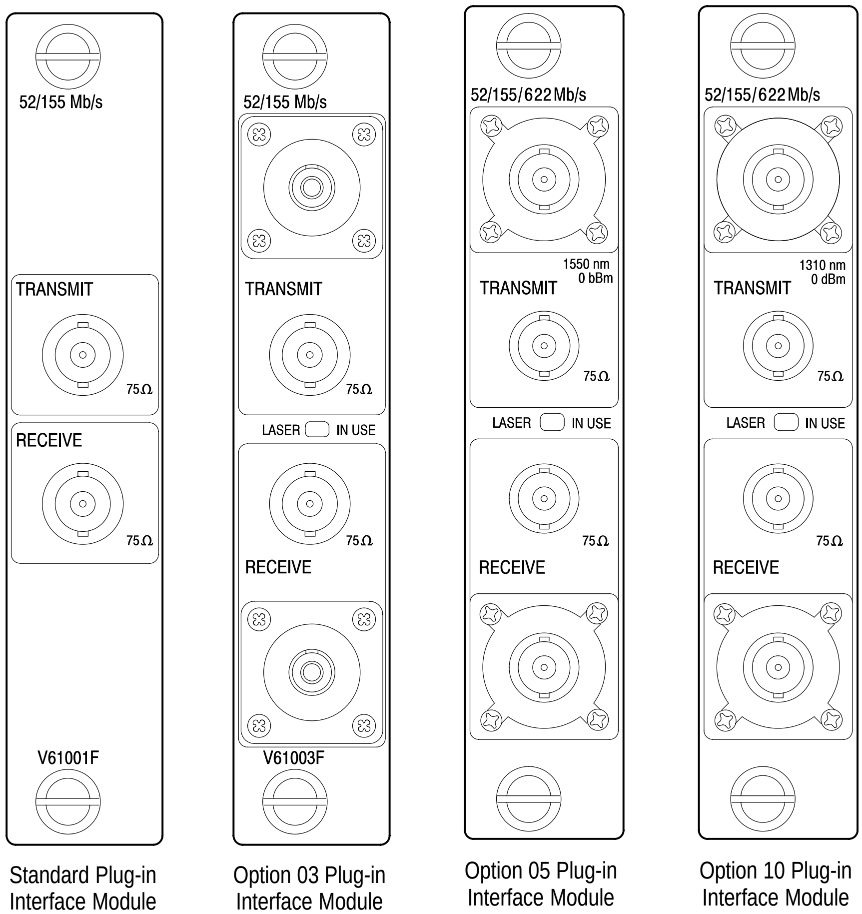


Figure 2–2: Optional plug-in interface modules

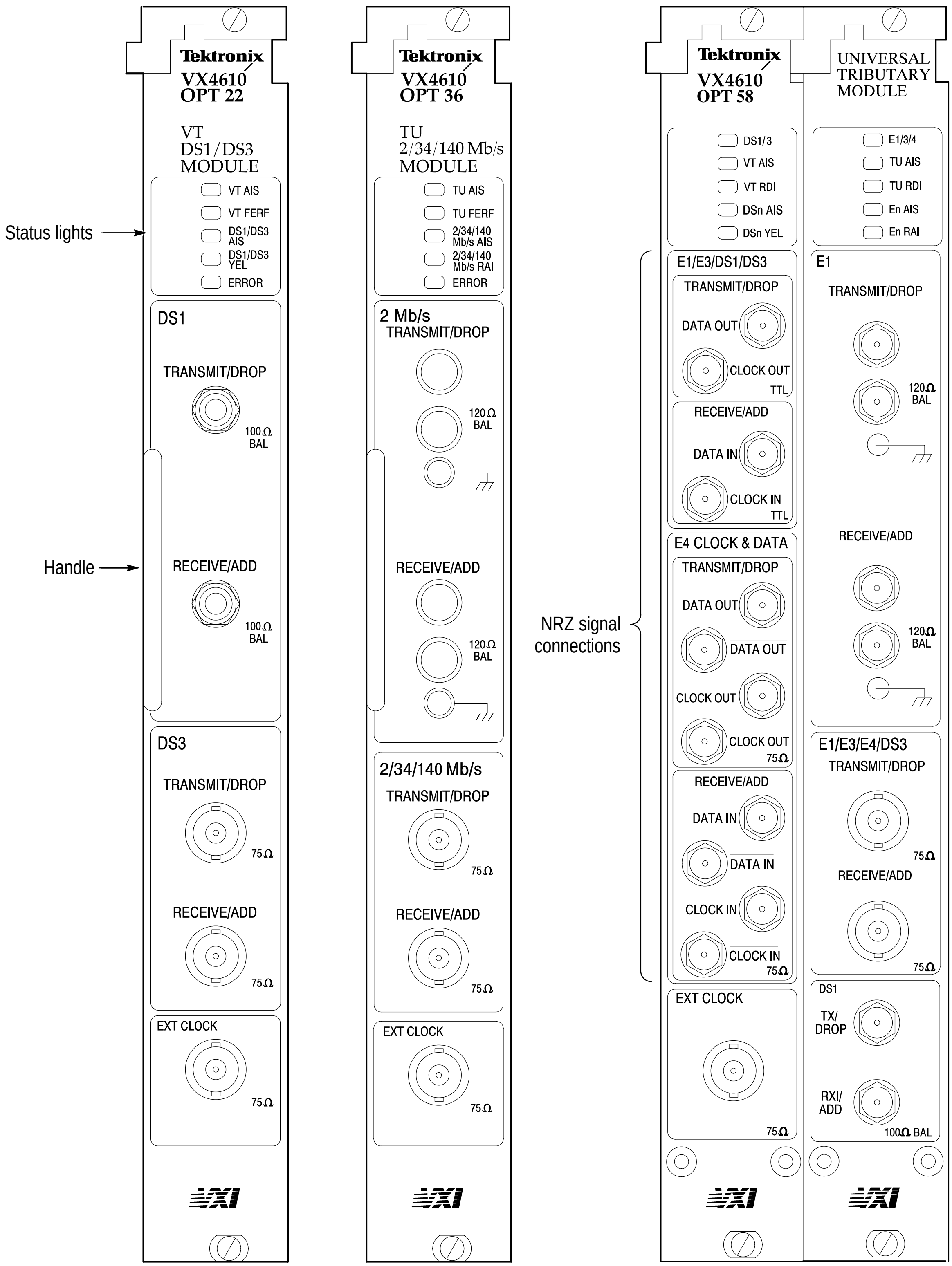


Figure 2–3: Option 22, 36, and 58 Add/Drop/Test Modules

Simplified Block Diagram

Figure 2–4 is a simplified block diagram of the VX4610 SDH/SONET Generator/Receiver with a Plug-in Interface Module and an Add/Drop/Test Option installed. The major functional blocks are described briefly following the block diagram.

Plug-in Interface Module

You can easily install any of the Plug-in Interface Modules to configure your VX4610 to best suite for your application. Later, you can upgrade the instrument if your needs change. The Plug-in Interface Modules contain the transmit and receive circuitry for the electrical interface. Transmit lasers and optical detectors are contained in the modules having optical capability.

Transmitter

As part of the Plug-in Interface Module, the Transmitter sends out the SONET or SDH signal. Depending on the module type, the Transmitter can have both electrical and optical outputs and can operate at one or more of the standard SONET/SDH transmit rates.

Receiver

Also part of the Plug-in Interface Module, the Receiver detects the incoming SONET or SDH signal. Depending on the module type, the Receiver can have both electrical and optical inputs and can operate at one or more of the standard SONET/SDH rates. The Receiver has an output to support clock recovery.

Generator and Receiver Protocol

The Generator and Receiver Protocol block performs all high-speed signal processing in the VX4610. The Generator Protocol section provides the data flow for a SONET or SDH signal by combining the payload and overhead components. The signal is generated with or without intentional errors and alarms included.

The Receiver Protocol section decodes the incoming SONET or SDH signal while testing for failures, alarms, and errors. The Receiver Protocol section assists the CPU with the extensive measurement system in the VX4610.

Add/Drop/Test Module

The Add/Drop/Test Option comes in three versions: one for SONET, one for SDH, and one for both. Option 22 (SONET) and Option 58 when operating in SONET mode handle DS1 (1.544 Mb/s) and DS3 (44.736 Mb/s) tributary signals. Option 36 (SDH) and Option 58 when operating in SDH mode handle 2 Mb/s, 34 Mb/s, and 140 Mb/s PDH signals. The Add/Drop/Test Option can map and demap the supported tributary signals, connecting to an external test or a test set included in the option. The Add/Drop/Test Option can function as a stand-alone tributary test set. Only one Add/Drop/Test module can be installed on a VX4610 at one time.

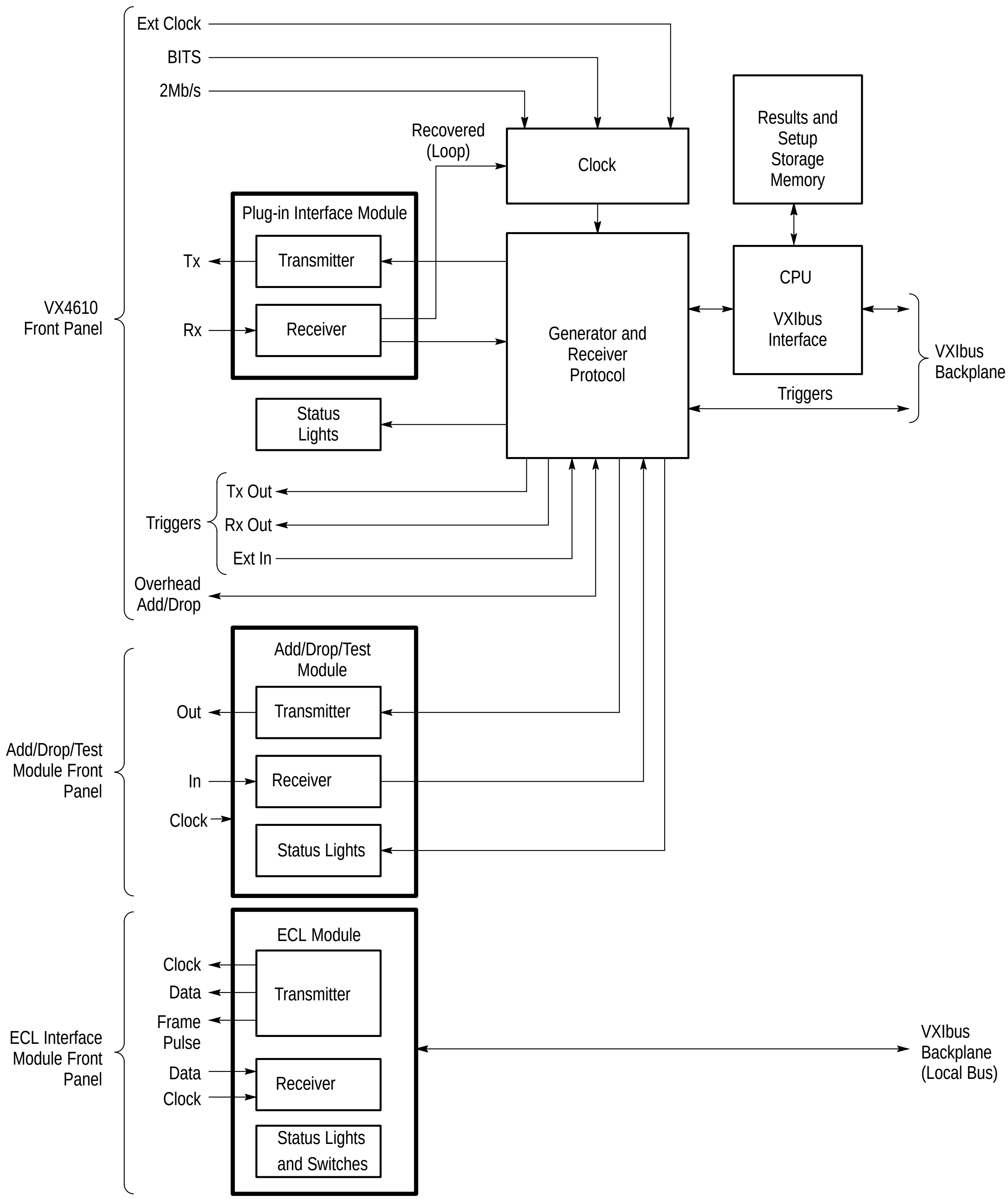


Figure 2–4: Simplified block diagram of the VX4610

ECL Interface Module

The Option 02 ECL Interface Module enables the VX4610 to transmit and receive ECL/PECL signals at SDH/SONET rates. The module uses the mainframe Local Bus to communicate with the VX4610. The ECL Interface module can be installed with a stand-alone VX4610, or it can be installed with a VX4610 and an Add/Drop/Test Option.

The clock input to the ECL Interface module uses an AC coupled differential amplifier. The termination voltage V_t (–2 or +3 V) is selected by the front panel termination configuration switch (PECL/ECL). See Figure 2–5.

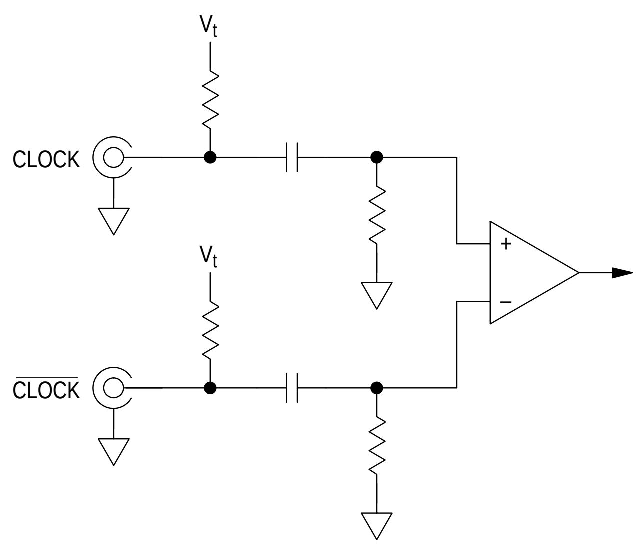


Figure 2–5: Simplified ECL Interface Module clock input circuit schematic

The clock input circuit can accept a single-ended clock input or a differential clock input. This is useful for circuits that use negative-edge triggers, or when timing skews require a $\overline{\text{CLOCK}}$ input instead of the CLOCK input.

Clock

The Clock provides the timing for Generator and Transmitter. The clock can be driven from a stable internal source, or the clock may be driven by or referenced from one of several external sources, one of which is the recovered clock from the Receiver. The Clock circuitry also has the ability to offset its output frequency from the standard SONET/SDH rates in order to stress test a network element.

CPU

The CPU controls all the functional blocks in the VX4610 and it provides the command interface to the VXIbus (interprets the IEEE 488.2 and SCPI-derived commands and queries). The CPU processes measurements made by the Receiver Protocol section and manages the Storage Memory.

Storage Memory

The Storage Memory is used to store instrument setups and log measurement results data. All storage memory is volatile.

VX4610 Features and Capabilities

This section summarizes the features and capabilities of the VX4610 SDH/SONET Generator/Receiver. The descriptions in this section can help provide a conceptual understanding of the VX4610. For more detailed information, refer to the *Syntax and Commands* section of this manual. That section contains the specific commands and queries that control the instrument, explains the interactions and dependencies between the commands, and describes any setup-dependent limits the instrument may have. (Many items described in this overview are associated with several programming commands.)

Operating Modes

The VX4610 operates in one of two primary modes: Normal or Through mode. Table 2–3 describes the differences between these modes.

Table 2–3: VX4610 operating modes

Operating mode	Description
Normal mode	Functioning like a network element, the receiver terminates an incoming SDH/SONET signal for analysis. The generator originates an SDH/SONET signal for transmission. The receiver and generator in the VX4610 can be coupled or can be operated independently.
Through mode	The rate and content of the transmitted signal is matched exactly to the received signal. Use Through mode to monitor an electrical or optical signal when a monitor point is not available.

Signal Status Lights

The VX4610 continuously monitors the received signal for alarms, errors, and failures. Eight front-panel lights show you the signal status at a glance. All status lights show the current signal status; the lights turn off as soon as the VX4610 no longer detects signal anomalies. Table 2–4 defines the abbreviations used to label the lights on the VX4610 front panel. When an optional add/drop/test module is installed, there are additional status lights that show the signal status of tributary signals. Table 2–6 defines the abbreviations used to label the lights on the DS1/DS3 Add/Drop/Test module front panel. Table 2–7 defines the abbreviations used to label the lights on the 2/34/140 Mb/s Add/Drop/Test module front panel. Table 2–5 defines the abbreviations used to label the lights on the Option 02 ECL Interface Module front panel.

Table 2–4: VX4610 signal status lights

Front-panel status light abbreviation	SDH meaning when lighted	SONET meaning when lighted
LOS	Loss of signal failure detected	Loss of signal failure detected
OOF-LOF	Out of frame failure or loss of frame failure detected	Out of frame failure or loss of frame failure detected
LOP	Loss of pointer failure detected	Loss of pointer failure detected
ERROR	Any error detected	Any error detected
MS/L AIS	Multiplexer section alarm indication signal detected	Line alarm indication signal detected
MS/L FERF	Multiplexer section far end receive failure detected	Line far end receive failure detected
PATH AIS	Path alarm indication signal detected	Path alarm indication signal detected
PATH FERF	Path far end receive failure detected	Path far end receive failure detected

Table 2–5: ECL interface module status lights

Front-panel status light abbreviation	Meaning when lighted
SIGNAL PRESENT	Both data and clock signals matching the interface configuration are present
ECL (–2V)	Interface is configured for ECL operation
PECL (+3V)	Interface is configured for PECL operation
SINGLE ENDED	Interface is configured for single-ended signals
DIFF	Interface is configured for differential signals

Table 2–6: DS1/DS3 Add/Drop/Test Module signal status lights

Front-panel status light abbreviation	Meaning when lighted
VT AIS	Virtual Tributary alarm indication signal detected
VT FERF	DS1/DS3 Far end receive failure detected
DS1/DS3 AIS	DS1/DS3 Alarm indication signal detected
DS1/DS3 YEL	DS1/DS3 Yellow signal detected
ERROR	Any error detected

Table 2–7: 2/34/140 Mb/s Add/Drop/Test Module signal status lights

Front-panel status light abbreviation	Meaning when lighted
TU AIS	Tributary unit alarm indication signal detected
TU FERF	Tributary unit far end receive failure detected
2/34/140 Mb/s AIS	Alarm indication signal detected on 2 Mb/s, 34 Mb/s, or 140 Mb/s signal
2/34/140 Mb/s RAI	Remote alarm indication detected on 2 Mb/s, 34 Mb/s, or 140 Mb/s signal
ERROR	Any error detected

Generator Features

The function of the Generator is to produce a SONET or SDH signal. If an optional Add/Drop/Test module is installed, the Generator can also produce DS1/DS3 or 2/34/140 Mb/s signals, depending on the module installed. Table 2–8 lists the primary controls that define the generator setup with a brief description of each control.

Table 2–8: Controls that define the generator setup

Generator controls	Description
Coupling	Select independent control of Generator parameters or couple them to the Receiver
Transmit Rate	Select an SDH/SONET standard rate, DS1/DS3, or 2/34/140 Mb/s rate (with optional add/drop/test module)
Transmit Level	Select electrical output level and line build out
Clock Sources	Select internal clock, external clock, external BITS reference, external DSn, external 2 Mb/s reference, external PDH, or recovered clock from Receive section (with optional add/drop/test module)
Line Clock Offset	Add positive or negative offset to line clock rate (with optional add/drop/test module)
Transmit Rate Frequency Offset	Add positive or negative offset to transmit clock rate
Pointer Movements	Select single, burst, or continuous pointer movements for SONET/SDH and VT/TU pointers (with optional add/drop/test module)
Mapping	Map an internally generated or externally supplied 2/34/140 Mb/s or DS1/DS3 signal into an SDH/SONET standard rate (with optional add/drop/test module)
Multiplexing	Multiplex a lower-rate signal into a channel of a higher-rate signal
Scrambler Control	Turn data scrambling on or off

Table 2–8: Controls that define the generator setup (cont.)

Generator controls	Description
Abnormal Condition Insertion	Generate alarms or failures for SDH/SONET signals and DS1/DS3 or 2/34/140 Mb/s signals (with optional add/drop/test module) Generate errors at various insertion rates for SDH/SONET signals and DS1/DS3 or 2/34/140 Mb/s signals (with optional add/drop/test module) Set error mask for single BIP error insertions Set FEBE count
Payload Equipped or Unequipped	Select equipped or unequipped code for active channel (inactive channels are unequipped)
Payload Patterns	Select internally generated PRBS or repeating-byte test patterns in active channel
Inactive-Channel Payloads	Set inactive-channel payload data to any fixed byte (default value is the channel number)
Multi-frame Payload Data Sequences	Set up and generate multi-frame sequence of custom payload data
Transport/Section Overhead	Generate custom byte values
Path Overhead	Generate custom byte values
Path Trace Byte String	Generate user path trace byte string
Add DCC and User Channels	Add serial data to Transport/Section or Path Overhead
Trigger Output	Provide trigger output concurrent with generated event and direct it to front panel, or backplane

The Generator output produces a signal at all times while the VX4610 is powered on except for the conditions defined in Table 2–9.

Table 2–9: Generator output status summary

Condition	Generator output status
When power is first applied	Generator output is not valid until the transmitter is started
During setup changes to a new transmit rate	Generator output is off for up to three seconds
During all other setup changes	Generator output is valid (no unintentional alarms generated)
During execution of Self Test or Diagnostics	Generator output is invalid

Receiver Features

The function of the Receiver is to monitor an incoming SONET or SDH signal. Table 2–10 lists the primary controls that define the Receiver setup with a brief description of each control.

Table 2–10: Controls that define the receiver setup

Receiver controls	Description
Coupling	Select independent control of Receiver parameters or couple them to the Generator
Receive Rate	Select an SDH/SONET standard rate, DS1/DS3, or 2/34/140 Mb/s rate (with optional add/drop/test module)
Receive Level	Select electrical sensitivity and equalization
Mapping	Demap a 2/34/140 Mb/s or DS1/DS3 signal from an SDH/SONET standard rate (with optional add/drop/test module)
Demultiplexing	Demultiplex a lower-rate signal from a channel of a higher-rate signal
Tributary Drop	Drop a tributary signal from an SDH/SONET signal (with optional add/drop/test module)
Scrambler Control	Turn data descrambling on or off
Payload Patterns	Select internally generated PRBS or repeating-byte test pattern to compare with incoming payload from active channel
Multi-frame Capture	Select triggered or manual capture of payload sequence or overhead Select trigger source and trigger position
Path Trace Byte String	Monitor or capture user path trace byte string
Drop DCC and User Channels	Drop serial data from Transport/Section or Path Overhead
Trigger Output	Provide trigger output concurrent with received event and direct it to front panel, backplane, or use for payload/overhead capture
Measure Electrical Voltage	Measure the peak voltage of the received electrical signal
Measure Optical Power	Measure the optical power level of the received signal in dBm
Autoscan	Automatically set up the Receiver parameters based on the incoming signal

Overhead Generation

To generate a user-defined overhead, you can individually set most Transport/Section and Path Overhead bytes using commands. You can set the Path Trace byte in the form of a 64-byte string. You can change the National Use bytes, defined only for the SDH Section Overhead, from their default values. The only bytes you cannot directly set are the ones controlled exclusively by the hardware: B1, B2, B3, G1, H1, H2, H3, and H4.

The VX4610 provides overhead add capability for both Data Communication Channels (DCC) and the User bytes (F1 and F2).

Payload Sequence Generation

The VX4610 can generate a continuous sequence of custom payload data. Depending on the signal structure, you can set the sequence to any length from one to 54 or 64 payloads. When the end of the payload data sequence is reached, it repeats.

You can directly set the individual bytes in each payload of the sequence to any value. This includes the path overhead bytes, which are part of each payload, except for J1, B3, and G1. You can also set all the payload bytes to an incrementing sequence or to a repeating, user-defined word.

***NOTE**. When generating a custom payload sequence, you can set the J1 byte in the form of a 64-byte string. You can affect the G1 byte if you set a FEBE count or a Path Yellow alarm.*

When generating a custom payload sequence, you can insert errors and move pointers. However, the Receiver Protocol section of the VX4610 cannot detect or measure errors in custom payload data unless the data is set to a fixed byte.

Overhead and Payload Capture

You can set up the VX4610 to capture overhead and payload data into memory. An overhead/payload capture is qualified by a trigger event or signal that you specify. When a capture occurs, one Transport/Section Overhead and a continuous sequence of payloads are acquired into memory. When setting up the capture, you can choose whether the trigger is located in the second, middle, or second-to-last frame of the sequence. Both overhead and payload capture are qualified by the same trigger event or signal.

Overhead drop capability is provided for both Data Communication Channels (DCC) and the User bytes (F1 and F2).

Overhead Capture. The VX4610 acquires the Transport/Section Overhead from the frame that contains the trigger event. The VX4610 acquires the Path Overhead that begins just prior to the trigger event. A trigger event is required before you can read any overhead data.

Payload Sequence Capture. When a triggered capture occurs, the VX4610 acquires a continuous sequence of payloads into memory. The payload sequence length is either 54 or 64 payloads, depending on the received signal structure. When setting up the capture, you can choose whether the trigger is located at the beginning, middle, or end of the sequence. Table 2–11 describes the timing of the payload capture sequence for the three trigger location choices.

Table 2–11: Payload sequence capture timing

Trigger position setting	Captured payload sequence with trigger event in listed payload		
	SDH	SONET with STS-1 structure	SONET with STS-3c structure
Beginning	2nd payload	2nd payload	2nd payload
Middle	27th payload	32nd payload	27th payload
End	53rd payload	63rd payload	53rd payload

Trigger Features

The VX4610 has two trigger features that can be linked together:

- Trigger outputs are derived from events occurring in the generator section and receiver section of the VX4610.
- Trigger input, from one of several sources, is used to trigger the capture of payload and overhead data.

Trigger Output. The generator section (Tx section) and receiver section (Rx section) produce triggers based on generated or detected events. The trigger outputs are directed to front-panel connectors and, if enabled, to a selected TTLTRG* line in the VXIbus backplane. In addition, the receiver section triggers can be internally coupled to the payload and overhead capture trigger input. Table 2–12 summarizes the events generated by the generator section and detected by the receiver section that you can select to produce a trigger output. Events marked *Pulse* produce a momentary trigger signal. Events marked *Level* produce an extended trigger signal that lasts for the duration of the event. Events marked *None* do not produce a trigger when the event occurs.

Table 2–12: Internally derived trigger events

Event that produces a trigger output	Generated in the generator section	Detected in the receiver section
Frame Pulse	Pulse	Pulse
Section/RS BIP Error	Pulse	Pulse
Line/MS BIP Error	Pulse	Pulse
Path BIP Error	Pulse	Pulse
Payload bit Error	Pulse	None
FEBE	Pulse	Pulse[1]
Line/MS FERF	Level	Level
Line/MS AIS	Level	Level
Path AIS	Level	Level
Path FERF	Level	Level
LOP	None	Level[2]
OOF	None	Level
LOF	None	Level
K1/K2 Byte Change	Pulse	Pulse
Any Pointer Adjustment	Pulse	None
Positive Byte Stuffing	None	Pulse
Negative Byte Stuffing	None	Pulse
Illegal Pointer	None	Pulse
NDF	None	Pulse
Invalid NDF	None	Pulse

[1] **This trigger event has an uncertainty of one frame when used to capture overhead or payload.**

[2] **The VX4610 does not use the status of S-bits to detect the LOP trigger event.**

Trigger Input. Trigger input is used in the payload and overhead capture process. The capture process has two steps. First, the capture is armed when an INITiate command is sent. Second, the capture is completed when the VX4610 receives a trigger input. The trigger input can originate from one of several sources:

- From a TTL-level signal connected to the front-panel TRIGGER IN connector, with rising- or falling-edge sensitivity
- From a TTL-level signal provided through one of the eight TTLTRG lines in the VXIbus backplane, with your choice of TTLTRG line number and polarity.
- From any of the events detected by the receiver section in Table 2–12
- From a TRIGger:IMMediate command sent by the controller

Measurement and Test Control

The VX4610 measures the received signal while a test is running and displays final results after the test has stopped. When you start a new test, the results data from the previous test is stored in a buffer. While a test is running, the front-panel MEAS ON light turns on. When the test is complete, you can look at the current results data or recall the previous results data for comparison.

If you set up a Pass/Fail test, the VX4610 evaluates measurement or analysis results against predefined criteria after a test is complete. Based on this evaluation, the instrument then returns a pass or fail result. See the next section, *Measurement and Analysis Results Overview*, for more information on the measurement results criteria used in Pass/Fail testing.

Measurement and Analysis Results Overview

As a test is running, the VX4610 performs complete SONET and SDH error measurement and analysis according to the standards defined in ANSI T1M1.3 and ITU-T G.826 and G.821, and ITU-T M.2100, respectively. In addition, the VX4610 accumulates measurements on other types of events, such as alarms and failures. With an optional Add/Drop/Test module installed, the VX4610 also performs error measurement and analysis on DS1/DS3 or 2/34/140 Mb/s signals (depending on the option installed). The VX4610 allows you to query intermediate measurement and analysis results while a test is running or you can query the final results after the test has completed.

Some measurements are also available in history form. To create a measurement history, the VX4610 stores the measured value every minute during the test. You can query this series of measurements while the test is running or after it has completed.

T1M1.3 and G.826, G.821 and M.2100 Error Analysis. The VX4610 simultaneously performs real-time error measurement and analysis on all the layers of the SONET/SDH signal shown in Table 2–13 and Table 2–14. Some results are available only with an add/drop/test option installed.

G.826 analysis is based on pattern bit errors occurring within the payload of an SDH or PDH rate signal. G.821 is an out-of-service measurement since the normal traffic payload is occupied by a pattern. M.2100 out-of-service is identical to G.821 pattern bit analysis. M.2100 in-service frame analysis is based on frame bit error in “live traffic” PDH and mapped PDH signals. It is intended to replace G.821 as an overall quality-of-service measurement for PDH.

Table 2–13: SDH/SONET errors measured by the VX4610

SDH	SONET
Regenerator Section (B1)	Section (B1)
Multiplexer Section (B2)	Line (B2)
Far-End Multiplexer Section (MS FEBE)	Far-End Line (Line FEBE)
Path (B3)	Path (B3)
Far-End Path (Path FEBE)	Far-End Path (Path FEBE)
Payload PRBS and fixed-byte patterns	Payload PRBS and fixed-byte patterns
Tributary Parity (TU Path BIP)	Tributary Parity (VT BIP)
Tributary Far-End (TU Path FEBE)	Tributary Far-End (VT FEBE)
CRC	DS1 CRC
Frame Bit	Frame Bit

Table 2–14: DS1/DS3/PDH errors measured by the VX4610 (add/drop/test options only)

2/34/140 Mb/s	DS1/DS3
Pattern Bit Errors	Pattern bit errors
Frame Alignment Errors	Frame Bit Errors
CRC Errors (2 Mb/s only)	CRC Errors–DS1 ESF
Not applicable	Parity Errors–DS3 (M13:P bits, C-bit: P and CP bits)

The VX4610 calculates most of the analysis results listed in Table 2–15 and Table 2–16 below for each of the error types listed in Table 2–13 and Table 2–14 above. (Some results are not calculated for some error types; see the material beginning on page 3–234 for detailed information on these restrictions.)

Table 2–15: Types of SONET/SDH error analysis performed

Error analysis result	Description
Coding Violations (CV)	A count of the errors detected by a bit-interleaved parity (BIP) check (history data is available)
Bit Error Ratio (BER)	Ratio of number of CVs to total number of bits
Errored Seconds (ES)	The number of seconds with at least one error
Type A Errored Seconds (ESA), SONET only	The number of seconds with exactly one error
Type B Errored Seconds (ESB), SONET only	The number of seconds with the number of errors between the limits: 1 < number of errors ≤ type B error threshold
Degraded Minutes (DM), SDH only	The number of minutes that the BER is between 10^{-3} and 10^{-6}
Severely Errored Seconds (SES)	The number of seconds where the number or errors is greater than the type B error threshold (SONET) or BER greater than 10^{-3} (SDH)
Severely Errored Framing Seconds (SEFS)	The number of seconds where the incoming signal cannot be framed
Error-Free Seconds (EFS)	The number of seconds with no errors
Percent Error-Free Seconds (%EFS)	The number of seconds with no errors as a percent of the total number of seconds
Unavailable Seconds (UAS)	The number of seconds that the signal had too many errors to be available for use; unavailability begins after ten contiguous severely-errored seconds
Total Errored Seconds (ES + UAS)	The number of seconds with at least one error including the seconds that the signal had too many errors to be available for use (history data is available)

Table 2–16: Types of tributary/PDH error analysis performed

Error analysis result	Description
Error count	Number of bit errors not occurring during periods of unavailability
Bit Error Ratio (BER)	Ratio of number of CVs to total number of bits
Errored Seconds (ES)	The number of seconds that had any error counts such as a Severely Errored Frame (SEF)
Alarms	The number of one-second intervals that contained a specific alarm (AIS) such as Loss of Signal (LOS) and Loss of Frame (LOF)

Alarm, Failure, and Pointer Measurement. The VX4610 measures the number of seconds during which each of the events listed in Table 2–17 is detected. History data, showing the accumulation of the event over time, is also available for each of these measurements.

Table 2–17: Additional events measured by the VX4610

SDH	SONET
RS TF Seconds	Not applicable
RS LOS Seconds	Section LOS Seconds
RS LOF Sections	Section LOF Seconds
MS SD Seconds	Not applicable
MS AIS Seconds	Line AIS Seconds
MS FERF Seconds	Line FERF Seconds
Path LOP Seconds	Path LOP Seconds
Path AIS Seconds	Path AIS Seconds
TU Path AIS Seconds	VT AIS Seconds
Path FERF Seconds	Path Yellow Seconds
TU Path FERF Seconds	VT FERF Seconds
NDF Seconds	NDF Seconds
Illegal Pointer seconds	Illegal Pointer Seconds
Positive Pointer Justifications	Positive Pointer Justifications
Negative Pointer Justifications	Negative Pointer Justifications
Loss-of-power Seconds[1]	Loss-of-power Seconds[1]

[1] **The number of seconds power to the VX4610 is interrupted.**

Pass/Fail Testing

With a Pass/Fail test, the VX4610 evaluates measurement or analysis results against predefined criteria after a test is complete. Based on this evaluation, the instrument then returns a pass or fail result. Table 2–18 summarizes the controlled elements of a Pass/Fail test.

Table 2–18: Elements of a pass/fail test

Element	Description
Test Name	A test name, up to eight characters long, used to identify the test setup when stored to disk
Test Description	An optional ASCII string, up to 72 characters, you can use to describe the test
Test Duration	The time duration of the test
Criteria and Thresholds	For any four measurements or analysis results, you can set thresholds, which if not met or if exceeded, cause the test to fail

Table 2–18: Elements of a pass/fail test (cont.)

Element	Description
Enable	Enables the evaluation of Pass/Fail test results
Results Query	Reads test results: passed, failed, or still running

Instrument I/O

The first section provides information on the signals available through the front-panel Overhead Add/Drop port. In the next section you can find information about the VXIbus interface of the VX4610.

Overhead Add/Drop Port

You use the Overhead Add/Drop port to add or drop the Section/RS and Line/MS data communication channels (DCC) and the Section/RS and Path user channels. The DCC and user channel add/drop functions are independent; for example, you can add a DCC while dropping a user channel. You can only add or drop one DCC or user channel at a time.

The Overhead Add/Drop port uses a gapped clock. Figure 2–6 shows typical gapped clock waveforms for the Line/MS DCC and the other channels.

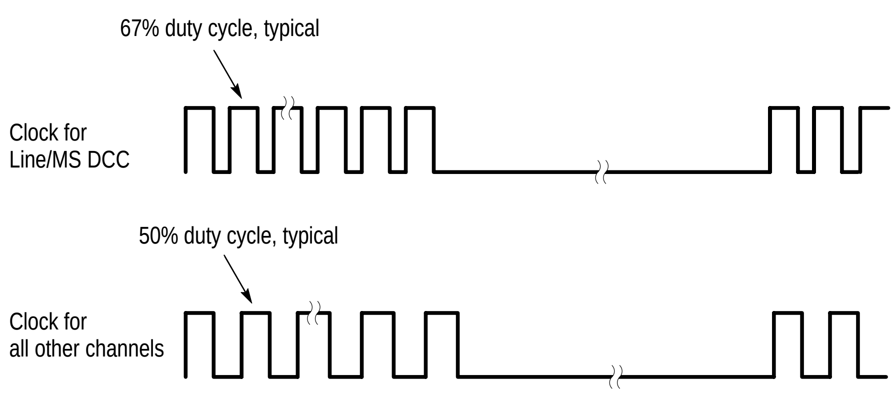


Figure 2–6: Typical gapped clock waveforms

Figure 2–7 shows how the pins are numbered on the Overhead Add/Drop port. Table 2–19 summarizes the different communication channels.

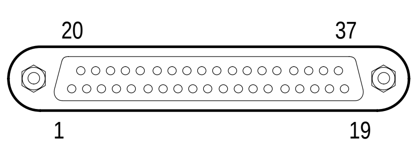


Figure 2–7: The overhead add/drop port

Table 2–19: Overhead channels added/dropped

Added channel	Bytes added	Data rate	Clock rate
Section/RS DCC	D1, D2, D3	192 kbps	216 kHz
Line/MS DCC	D4, D5, D6, D7, D8, D9, D10, D11, D12	576 kbps	2.16 MHz[1]
Section/RS User Channel	F1	64 kbps	72 kHz
Path User Channel	F2	64 kbps	72 kHz

1 **The Line/MS DCC signal has a 67% duty cycle.**

Table 2–20 summarizes the data signal pin assignments on the Overhead Add/Drop port.

Table 2–20: Overhead add/drop port data signal pin assignments

Differential Signal	Non-Inverted Pin	Inverted Pin
Added Tx Data (input)	4	22
Added Tx Clock (output)	5	23
Tx Common (ground)	37	37
Dropped Rx Data (output)	6	24
Dropped Rx Clock (output)	8	26
Rx Common (ground)	20	20

Table 2–21 summarizes the additional pin assignments on the Overhead Add/Drop port.

Table 2–21: Overhead add/drop port additional pin assignments

Signal	Pin
Shield (ground)	1
Signal Ground (ground)	19
Reserved	33
Tx Frame Pulse (output)[1]	15
Rx Frame Pulse (output)[1]	36

1 **The Frame Pulse signals are nominal 8 kHz, TTL, single-ended signals.**

VXIbus Interface

This section provides information about the VXIbus interface of the VX4610. The instrument complies with the VXIbus System Specification in the following ways:

- The VX4610 supports VXIbus System Specification revision 1.4.
- The VX4610 is a Message-Based Servant, which supports VXIbus configuration and communication registers.
- The VX4610 supports Word Serial Protocol and responds to the SCPI-derived and IEEE 488.2 Common Commands listed in the *Syntax and Commands* section of this manual.
- The VX4610 is a programmable interrupter, capable of asserting interrupts and performing interrupt acknowledge sequences.

VXI Local Bus

The VX4610 is an expander module that drives LBUSA and LBUSC lines of the VXI Local Bus with class 2 (ECL) signals. The instrument has mechanical lock-out keys that limit adjacent modules to ones that are compatible with class 2 Local Bus signals. The signals on the local bus will provide direct communication with modules developed to extend the VX4610 capability in the future.

TTL Trigger Bus

The VX4610 uses the TTLTRG* bus to export and import signals to and from other modules in the system. The VX4610 supports the SYNC trigger protocol; exported signals are broadcast on a TTLTRG* line and do not require acknowledgement from an acceptor module.

When exporting trigger signals, the VX4610 drives an adjacent, even-odd pair of TTLTRG* lines; Table 2–22 shows the four available choices. Trigger output signals are active low. Momentary trigger events produce active-low pulses. Extended trigger events produce a low level for the duration of the event.

Table 2–22: Trigger output line assignments

Even-numbered line driven by generator section	Odd-numbered line driven by receiver section
TTLTRG0*	TTLTRG1*
TTLTRG2*	TTLTRG3*
TTLTRG4*	TTLTRG5*
TTLTRG6*	TTLTRG7*

When importing triggers, the VX4610 can enable any one of the eight TTLTRG* lines to be the trigger input. You can select rising- or falling-edge polarity.

Programming Model

This section explains the two functional blocks of the VX4610 SDH/SONET Generator/Receiver, the subsystems of each functional block, and the two modes in which the instrument operates.

Functional Blocks

The VX4610 is made up of two independent functional blocks: a Generator and a Receiver. The Generator generates a SONET/SDH signal of known characteristics for testing. The Receiver accepts a telecommunications signal, breaks it apart to see what has gone wrong or been modified, and displays measurements for that signal.

Generator

The Generator consists of two major subsystems: OUTPUT1 and SOURCE. The OUTPUT1 subsystem commands determine *how* the signal is transmitted and set characteristics such as the signal type and transmission rate. The SOURCE subsystem commands determine *what* signal is transmitted. Use the SOURCE subsystem commands to set errors, alarms, failures, pointers, overhead, and the payload.

Receiver

The Receiver is made up of two major subsystems: INPUT1 and SENSE. The INPUT1 subsystem commands determine *how* a signal is received and set characteristics such as the signal type and rate. The SENSE subsystem commands determine *what* signal is received. Use the SENSE subsystem commands to set up tests, capture overhead, and access measurements.

Modes of Operation

The VX4610 operates in normal or through mode. Figure 2–8 illustrates how the modes of operation work within the two functional blocks.

Normal Mode

Use normal mode to generate a signal of known characteristics and to measure a received signal. You can generate a normal or modified signal in this mode. The SOURce:DATA:TELecom:SOURce OUTPUT1 command instructs the VX4610 to operate in normal mode.

Through Mode

Use through mode to transmit a received signal without modifying it. The rate and content of the transmitted signal are matched to that of the received signal. The SOURce:DATA:TELecom:SOURce INPUT1 command instructs the

VX4610 to operate in through mode; the instrument continues to measure the received signal.

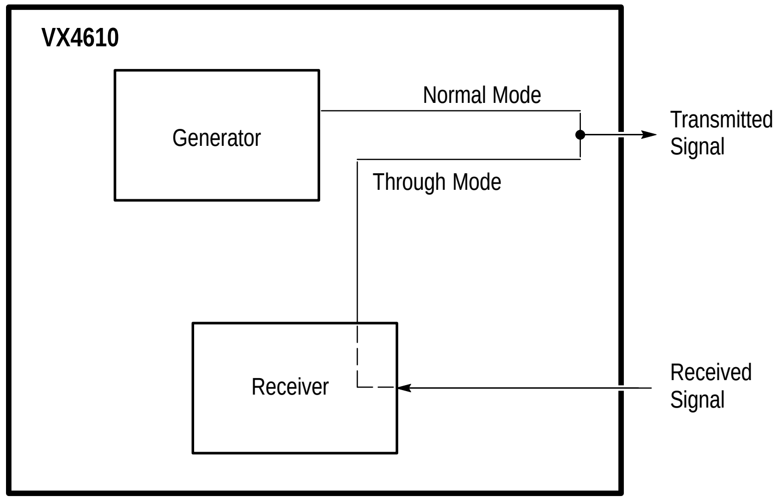


Figure 2–8: Modes of operation

Using Triggers

The VX4610 can be programmed to export and generate triggers, and then use these triggers to capture frame data (see *Custom Payload Capture and Generation* on page 2–30). Figure 2–9 illustrates the interaction between the functional areas of the VX4610 and the commands you can use to program the instrument. The circled numbers in the illustration refer to the numbers in parentheses in the following descriptions.

You can program the instrument to export a trigger from the Generator (1). This trigger can be sent to the front panel and to a selected line on the VXI Backplane. A trigger in the Receiver (2) can be sent to the front panel and to a selected line on the VXI Backplane. In addition, the trigger in the Receiver can be used to capture frame data (3). Triggers from the front panel (4), manual triggers (5), and TTL-level signals from the VXI Backplane (6) can also be used to capture frame data.

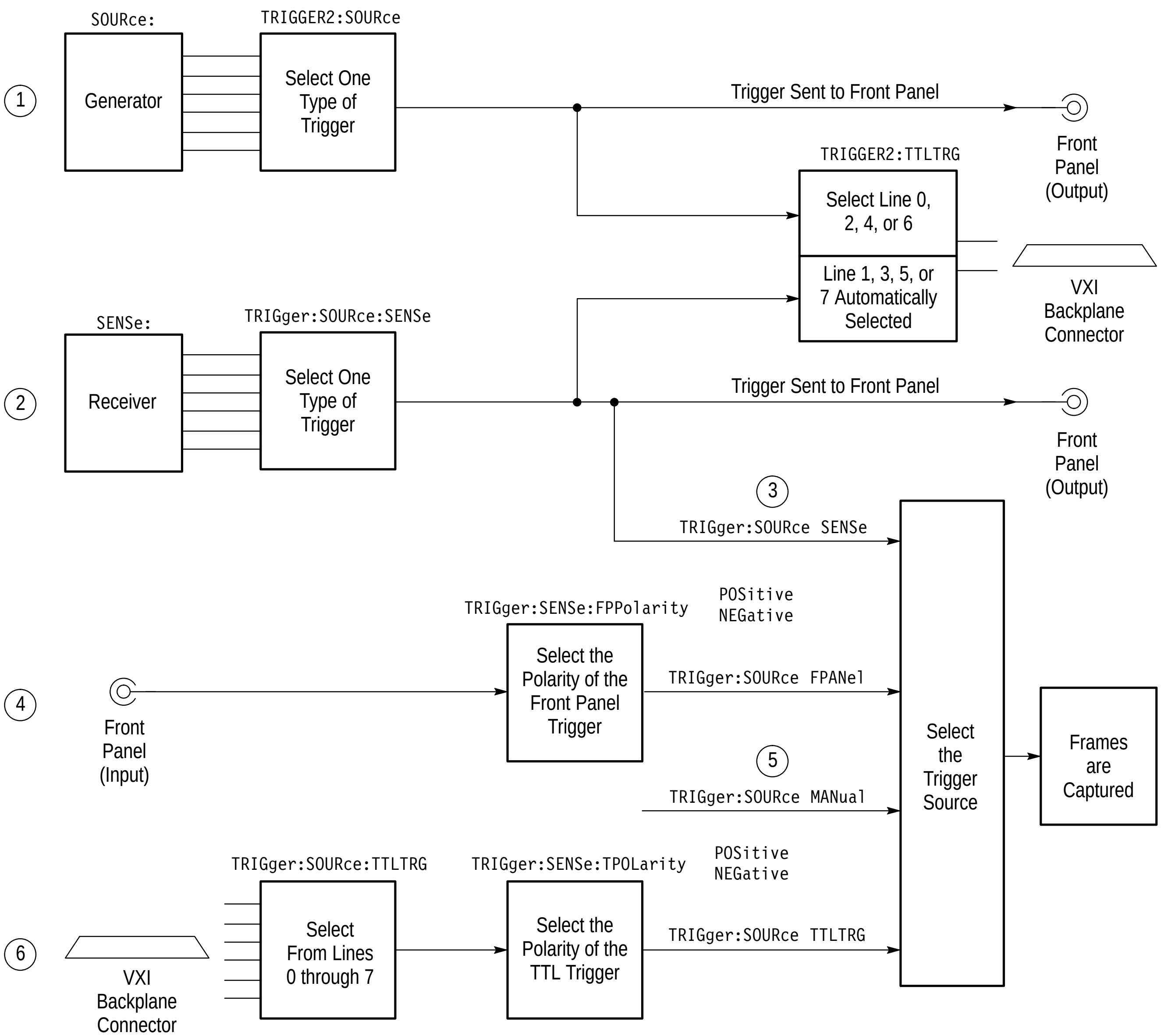


Figure 2–9: Trigger system in the VX4610

Custom Payload Generation and Capture

The VX4610 can generate a sequence of custom payloads and use the triggering subsystem to capture a sequence of custom payloads.

Custom Payload Generation

The VX4610 can generate a maximum of 64 or 54 custom payloads and insert them into the signal. As shown in Figure 2–10, use the SOURce:DATA:TELecom:PAYLoad:CUSTom:FRAME command to select which frame to edit. Then set individual bytes in the payload or set the entire payload by using the SOURce:DATA:TELecom:PAYLoad:CUSTom:DATA or :BDATA commands. Use the SOURce:DATA:TELecom:PAYLoad:CUSTOM:LENGth command to set the total number of payloads to generate.

Custom Payload Capture

The custom payload capture mechanism is initiated by a trigger event that you specify (see *Using Triggers* on page 2–28). When the capture completes, the following information is placed into memory for retrieval (see Figure 2–11):

- The Transport/Section Overhead from the frame containing the trigger event
- The Path Overhead for each payload
- A fixed number of payloads, 64 for an STS-1 structure, 54 for an STS-3c or AU-4 structure

Depending on the trigger position, the captured payloads will consist of pretrigger and posttrigger information. For example, if TRIGger:POSition is set to BEGIN, one frame of pretrigger information and 52 or 62 frames of posttrigger information will be available for query. Use the SENSe:DATA:TELecom:PAYLoad:CUSTom:FRAME command to set the frame number to query, and then use the SENSe:DATA:TELecom:PAYLoad:CUSTom:DATA? or :BDATA? queries to retrieve the payload data.

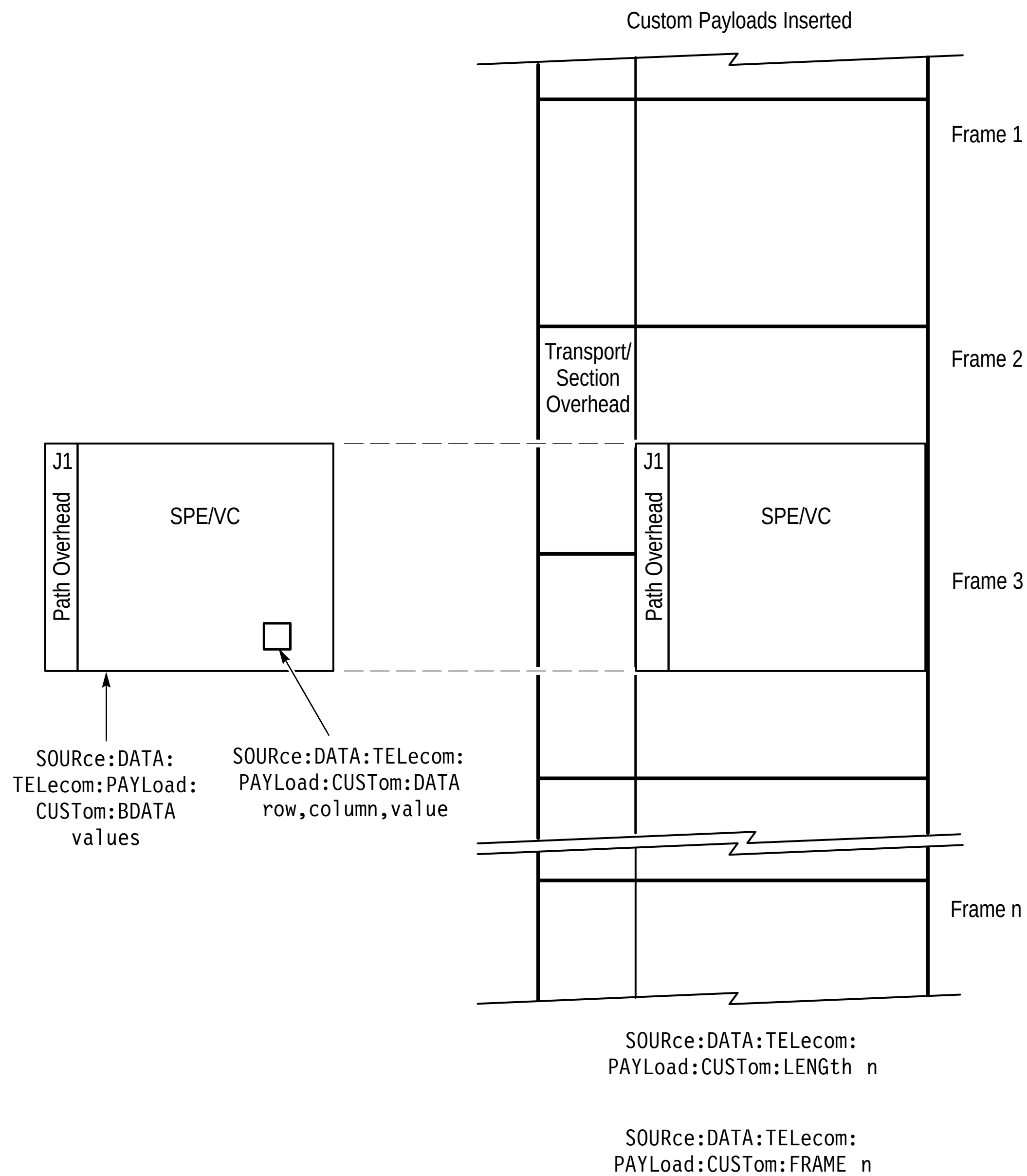


Figure 2–10: Custom payload generation

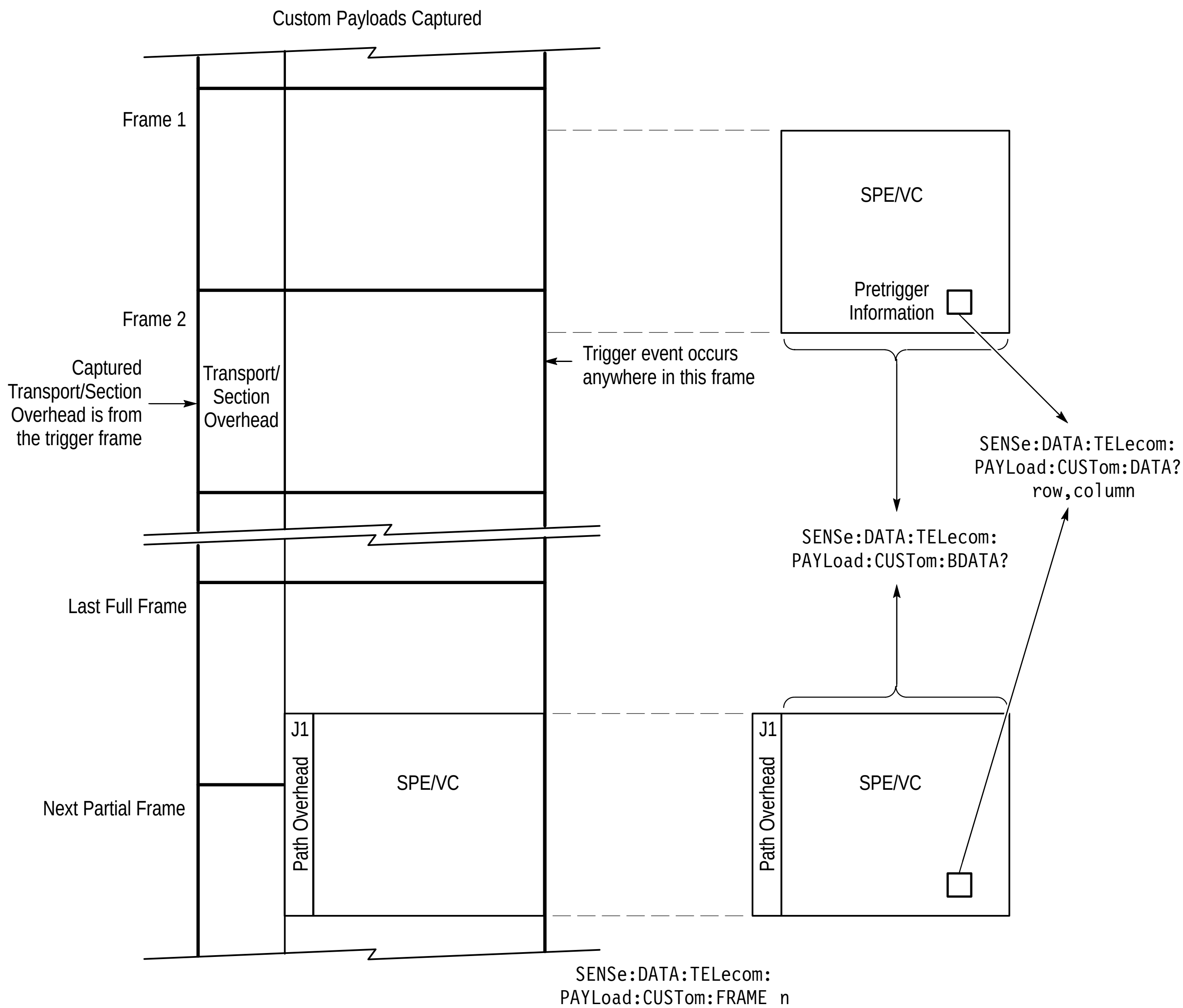


Figure 2–11: Custom payload capture

Examples of Command Usage

This section shows you how to use the commands and queries together to do such things as setting up normal or modified signals, generating errors, and accessing measurements. Use this section to learn about the command language before you start writing programs. Be sure to refer to the *Syntax and Commands* section for more details on how to construct commands and queries correctly.

***NOTE**. The commands and queries in this section are shown as a combination of uppercase and lowercase letters. The uppercase letters signify the accepted abbreviation of the command or query.*

Generating Signals

This section shows you how to generate normal and modified signals. Install and use the UI4610 Software or the CVI driver with these examples. Refer to the *UI4610 Graphical User Interface Software User Manual* for installation instructions for the UI4610 Software.

Generating Signals in Normal Mode

The following example shows you how to set up a normal electrical signal at an STS-1 rate, using channel one, and which contains a PRBS 2^{23}–1 test pattern:

1. Reset the VX4610 to a known state by sending the *RST command. *Appendix E* lists the default parameter values.
2. Set the System Mode to SONET.
3. Set up the signal physical characteristics by sending the following commands:
   OUTPUT1:TELecom:RATE STS1
   OUTPUT1:TELecom:TYPE ELECtrical
   OUTPUT1:TELecom:LEVel XCON
4. Set the instrument to normal mode by sending the SOURce:DATA:TELecom:SOURce OUTPUT1 command.
5. Set up to test on channel one by sending the SOURce:DATA:TELecom:CHANnel 1 command.
6. Select mapping by sending the SOURce:DATA:TELecom:PAYLoad:MAPPing EQUIpped command; this command sets the C2 byte to 01.

7. Select a payload test pattern of PRBS 2^{23}–1 by sending the SOURce:DATA:TELecom:PAYLoad:PATTern PRBS23 command.

At this point the instrument is generating a normal signal. You can now modify the signal or insert errors or alarms; the *Generating Modified Signals* section shows you how.

Generating Signals in Through Mode

When the instrument is operating in through mode, the received signal is transmitted without modification.

Set the instrument to through mode by sending the SOURce:DATA:TELecom: SOURce INPUT1 command.

Generating Modified Signals

This section shows you a few of the many ways to create modified signals.

Changing the Overhead. Use the following methods to insert information into the overhead to create a modified signal:

- Insert overhead data into the Section DCC (bytes D1, D2, and D3) from an external protocol analyzer by sending the SOURce:DATA:TELecom: OVERhead:INSert SDCC command. You can also insert data into the line DCC (bytes D4 through D12) or the F1 byte by using LDCC or F1 as the parameter value.
- Change the A1 byte on channel one by sending the SOURce:DATA: TELecom:OVERhead:DATA 1,A1,0,246 command. This command sets the A1 byte to a value of 246 (binary 11110110). The table included with the command description on page 3–56 lists the bytes available for selection.
- You can change the APS bytes in two ways:
  - Send the SOURce:DATA:TELecom:OVERhead:DATA 1,K1,0,#H0 command to set the K1 byte to zero. Use this command in the same way to set the K2 byte.
  - Send the SOURce:DATA:TELecom:OVERhead:APS command to set the K1 and K2 bytes together. For example, sending the SOURce:DATA: TELecom:OVERhead:APS #HFFFF command sets both K1 and K2 to decimal 255 (all ones in binary).

Changing Pointers. Use one of the following methods to adjust pointers.

To create a manual pointer adjustment, follow these steps:

1. Send the SOURce:DATA:TELecom:POINter:MODE MANual command
2. Send the SOURce:DATA:TELecom:POINter:VALue 590 command to create a pointer with a value 590. (If you use a value greater than 782, an illegal pointer is created.)
3. To generate a new data flag every time a pointer changes, send the SOURce:DATA:TELecom:POINter:NDFLag ON command.

To create pointer adjustments that alternately increment and decrement, follow these steps:

1. Send the SOURce:DATA:TELecom:POINter:MODE SINGle command.
2. Send the SOURce:DATA:TELecom:POINter:ACTion command to initiate the pointer adjustment.

To create a burst of pointer adjustments, follow these steps:

1. Send the SOURce:DATA:TELecom:POINter:MODE BURSt command.
2. To create three pointer adjustments with each burst of pointers, send the SOURce:DATA:TELecom:POINter:NBURst 3 command (if you do not specify the number of pointer adjustments, the instrument assumes you want two pointer adjustments for each burst).
3. Send the SOURce:DATA:TELecom:POINter:ACTion command to initiate a burst of pointer adjustments.

To create continuous pointer adjustments that alternate between up and down, follow these steps:

1. Send the SOURce:DATA:TELecom:POINter:DIRection ALTernate command (you can also specify UP or DOWN as the parameter value).
2. Send the SOURce:DATA:TELecom:POINter:MODE CONTinuous command to initiate the continuous pointer adjustments.

Generating a Failure. Generate a loss of frame failure by sending the SOURce:DATA:TELecom:FAILure:TYPE LOFrame command. You can also specify LOSignal or LOPointer as the parameter value to generate a loss of signal or loss of pointer.

Generating an Alarm. Generate a path alarm indication by sending the SOURce:DATA:TELecom:ALARm PAIS command. You can also specify a variety of other alarms.

***NOTE**. You must send the SOURce:DATA:TELecom:FAILure:TYPE NONE command before you generate any alarm. Failures and alarms cannot be generated simultaneously.*

Inserting Errors. Follow these steps to insert errors:

1. Enable error insertion by sending the SOURce:DATA:TELecom:ERRor: ENABle ON command.
2. Insert a B1 section code violation by sending the SOURce:DATA:TELecom: ERRor:TYPE SCV command. You can also specify LCV, PCV, PFEBE, or DATA as the parameter value to insert a B2 line code violation, B3 active path code violation, path far end block error, or payload data bit error, respectively.
3. You can insert errors at a continuous rate or immediately, upon command:
   - Insert continuous errors at a rate of 1E–5 by sending the SOURce: DATA:TELecom:ERRor:RATE 1E–5 command. You can select a variety of error rates depending on the signal rate and error type.
   - Force an immediate error insertion by sending the SOURce:DATA: TELecom:ERRor:IMMediate command.

Creating a Line Frequency Offset. Follow these steps to create a line frequency offset:

1. Select frequency offset pointer adjustments by sending the SOURce:DATA: TELecom:POINter:MODE FOFFset command.
2. Set the clock source to the internal clock by sending the SOURce:CLOCk: SOURce INTernal command.
3. Select line offset with no pointer adjustments by sending the SOURce:CLOCk:OFFSet:MODE LOFFset command.
4. Set the line offset value to –55.1 ppm by sending the SOURce:CLOCk: OFFSet:LVALue –55.1 command. The payload clock offset value will automatically be set to –55.1.

Receiving Signals

This section shows you how to set up the VX4610 to receive a signal, how to check the status of the signal, and how to drop and view overhead data. Install and use the UI4610 Software or the CVI driver with these examples.

Receiving a Signal Using a Manual Setup

The following example shows you how to manually set up your instrument to receive a normal electrical signal at an STS-1 rate on channel one:

1. Reset the instrument to a known state by sending the *RST command. *Appendix E* lists the default parameter values.

2. Set up the signal physical characteristics by sending the following commands:
INPUT1:TELecom:RATE STS1
INPUT1:TELecom:TYPE ELECtrical
INPUT1:TELecom:LEVel LOW

3. Set the source of the signal by sending the SENSe:DATA:TELecom: SOURce INPUT1 command.

4. Receive the signal through channel one by sending the SENSe:DATA: TELecom:CHANnel 1 command.

Receiving a Signal Using Autoscan

If you do not know what kind of signal you are going to receive, send the SENSe:DATA:TELecom:AUTOscan command. The instrument scans the incoming signal and sets up the receiver to the proper signal rate and payload mapping. The OPC bit is set when autoscan completes execution. To check if the autoscan was able to set up the receiver properly, first send the*ESR? query, and then send the SYSTem:ERRor? query. You will see an error number and description. If the autoscan failed, check to see if a signal is connected.

Checking the Physical Status of a Signal

The following steps show you how to check the physical status of a signal:

1. To check if you are receiving the signal, send the INPUT1:TELecom: STATus? query. If you get a response of LOSIGNAL, try another setup to receive the signal (refer to the *Receiving a Signal Using a Manual Setup* or *Receiving a Signal Using Autoscan* descriptions in this section). If you get a response of MONITOR, you are receiving a monitor signal of low amplitude.

2. Check the optical signal level of the incoming signal by sending the INPUT1:TELecom:OPWR? query. Values for a valid signal are –32 dBm to –5 dBm.

3. If you still are unable to find the proper settings for the incoming signal, check to see if the level is set properly by sending the INPUT1:TELecom: LEVel? query.

Checking Signal Status

To check the status of the received signal, send the SENSe:DATA:TELecom:STATus? query. A response of 8192 indicates a pattern lock on the received signal with no alarms or failures detected. Refer to the description for this query on page 3–208 for list of possible responses. Figure 3–6 on page 3–10 describes how to interpret this type of response.

Dropping the Overhead

Use one of the following ways to drop the overhead to an external protocol analyzer:

- Drop the Section DCC overhead (bytes D1, D2, and D3) to an external protocol analyzer by sending the SENSe:DATA:TELecom:OVERhead:DROP SDCC command. You can also drop Line DCC (bytes D4 through D12) or the F1 byte by using LDCC or F1 as the parameter value.
- Drop the F2 byte to an external protocol analyzer by sending the SENSe:DATA:TELecom:POVerhead:DROP F2 command.

Viewing the Overhead

Follow these steps to freeze the overhead and to query specific overhead bytes:

1. Start acquiring the overhead by sending the INITiate command.
2. To cause a trigger and stop acquiring overhead, send the TRIGger:IMMediate command.
3. Determine the value of the A1 overhead byte on channel one by sending the SENSe:DATA:TELecom:OVERhead DATA? 1,A1,0 query. The table included with the query description on page 3–225 lists the bytes available for selection.
4. To start acquiring overhead again, send the INITiate command.

SONET/SDH Signal Testing

This section shows you how to set up several types of tests, how to run these tests, and then how to view the results.

Taking BER Measurements

This example shows you how to run a five-minute BER test and view the test results:

1. Connect a cable from the TRANSMIT output to the RECEIVE input.
2. Reset the instrument to a known state by sending the *RST command. *Appendix E* lists the default parameter values.
3. Set the test duration to five minutes by sending the SENSe:DATA:TELecom: TEST:DURation 0,0,5,0 command.
4. Start the test by sending the SENSe:DATA:TELecom:TEST:STARt command.
5. Check whether the test is done by sending the SENSe:DATA:TELecom: TEST:STATus? query. If the first number in the response is 0, the test is done. If the first number is 1, look at the other numbers in the response string to see how long the test has been running. For example, a response of 1,0,0,4,50 indicates that the test has been running for 4 minutes and 50 seconds and is still running. If you had previously set a test duration of 5 minutes, you know that the test will be done in 10 seconds.
6. After the test has completed, send the following queries to view the error measurements:
   - The SENSe:DATA:TELecom:TEST:MEASure:ERRor:ECOUnt:SCV? query returns the number of B1 errors.
   - The SENSe:DATA:TELecom:TEST:MEASure:ERRor:ECOUnt:LCV? query returns the number of B2 errors.
   - The SENSe:DATA:TELecom:TEST:MEASure:ERRor:ECOUnt:PCV? query returns the number of B3 errors.

Measuring Continuous Pointer Adjustments

The following example shows you how to run a test that initiates continuous pointer adjustments, and then view the measurements:

1. Connect a cable from the TRANSMIT output to the RECEIVE input.
2. Reset the instrument to a known state by sending the *RST command. *Appendix E* lists the default parameter values.
3. Set the test duration by sending the SENSe:DATA:TELecom: TEST:DURation 0,0,0,0 command. This test will run continuously.

4. Set up continuous pointer adjustments that alternate between up and down by sending the SENSe:DATA:TELecom:POINter:MODE CONTinuous and SENSe:DATA:TELecom:POINter:DIRection ALTernate commands.

5. Set the pointer adjustment rate to 10 ms by sending the SENSe:DATA: TELecom:POINter:RATE 10 command.

6. Start the test by sending the SENSe:DATA:TELecom:TEST:STARt command.

7. To access the pointer adjustment measurements, send the commands listed below. Keep in mind that while the test is running, these measurements do not represent the final pointer adjustment measurements. Send the SENSe:DATA:TELecom:TEST:STOP command to stop the test, and then the SENSe:DATA:TELecom:MEASure:POINter: queries to access the final pointer adjustment measurements.

   - The SENSe:DATA:TELecom:MEASure:POINter:PPTR? query returns the number of positive (up) pointer adjustments.
   - The SENSe:DATA:TELecom:MEASure:POINter:NPTR? query returns the number of negative (down) pointer adjustments.
   - The SENSe:DATA:TELecom:MEASure:POINter:ICOUNt? query returns the total number of invalid pointers.

Trigger and Capture

This section shows you how to export and generate triggers, and how to use generated triggers to capture frame data.

Exporting a Trigger from the Generator

The following example shows you how to set up the VX4610 Generator to export a pointer action trigger to the VXI Backplane and front panel:

1. Reset the instrument to a known state by sending the *RST command. *Appendix E* lists the default parameter values.

2. Set up to export a pointer action trigger by sending the TRIGger2:SOURce PACTion command. For other valid triggers types, refer to the parameter tables included with this command description on page 3–365.

3. Export the trigger to line 0 on the VXI Backplane by sending the TRIGger2: TTLTRG 0 command. If you have the receiver set up to generate any triggers, these triggers are automatically exported to the VXI Backplane on line 1. (Generator triggers use VXI Backplane lines 0, 2, 4, or 6; Receiver triggers use lines 1, 3, 5, or 7.)

The transmitted and received triggers are automatically sent to the front panel.

Generating a Trigger from the Receiver

The following example shows you how to set up the VX4610 Receiver to generate an illegal pointer trigger and export this trigger to the VXI Backplane and front panel:

1. Reset the instrument to a known state by sending the *RST command. *Appendix E* lists the default parameter values.
2. Send the TRIGger:SOURce:SENSe IPTR command to set up an illegal pointer trigger in the Receiver. For other valid trigger types, refer to the parameter tables included with this command description on page 3–356.
3. If you want to export the trigger to line 5 on the VXI Backplane, send the TRIGger2:TTLTRG 4 command. If you have set up the Generator to export triggers, these triggers are automatically exported to the VXI Backplane on line 4.

   The transmitted and received triggers are automatically sent to the front panel.

Using Triggers in Stimulus Response Testing

The following example shows you how to use generated and exported triggers to test the stimulus response of your instrument:

1. Connect a cable from the TRANSMIT output to the RECEIVE input.
2. Connect the TRIGGER OUT Tx SECTION and Rx SECTION to a Counter/Timer.
3. Reset the instrument to a known state by sending the *RST command. *Appendix E* lists the default parameter values.
4. Set up the Generator to export a trigger on an APS change by sending the TRIGger2:SOURce APS command.
5. Set up the receiver to generate a trigger on an APS change by sending the TRIGger:SOURce:SENSe APS command.
6. Cause an APS change by sending the SOURce:DATA:TELecom:OVERhead:APS #HFFFF command.
7. To find out how much time it took the instrument to generate the exported APS change trigger, read the Counter/Timer.

Custom Payload Generation and Capture

This section shows you how map custom payload data into an active channel and use triggers to capture payload data.

Mapping Custom Payload into the Active Channel

The following steps show you how to map custom payload data into the active channel for SDH rates:

1. Reset the instrument to a known state by sending the *RST command. *Appendix E* lists the default parameter values.
2. Set the instrument to map a custom payload into channel one by sending the SOURce:DATA:TELecom:CHANnel 1 command.
3. Send the SOURce:DATA:TELecom:PAYLoad:MAPPing UNEQuipped command to disable custom payload generation while you access the payload data. (You can also use EQUIpped as the parameter.)
4. Set up the instrument to repeatedly send two frames by sending the SOURce:DATA:TELecom:PAYLoad:CUSTom:LENGth 2 command.
5. Edit the first payload frame in the sequence by sending the SOURce:DATA:TELecom:PAYLoad:CUSTom:FRAME 1 command.
6. Use one of the following methods to set the data values of the custom payload for the selected frame:
   - To set the data byte in row one, column two (the first data byte after the path overhead) to hexadecimal AA, send the SOURce:DATA:TELecom:PAYLoad:CUSTom:DATA 1,2,#HAA. Refer to the *SOURce:DATA:TELecom:PAYLoad:CUSTom Subsystem* section starting on page 3–116 for more information on setting individual bytes.
   - To set the entire block of custom payload frame data, use the SOURce:DATA:TELecom:PAYLoad:CUSTom:BDATA #42349 ... command (you must include 2349 bytes of binary data).
   - To set the entire custom payload frame to an incrementing data pattern, send the SOURce:DATA:TELecom:PAYLoad:CUSTom:PRESet INC command. All path overhead bytes are set to zero except for the J1, B3, G1, and H4 bytes which are set by the hardware.
7. Edit the second payload frame in the sequence by first sending the SOURce:DATA:TELecom:PAYLoad:CUSTom:FRAME 2 command, and then repeating step 6.
8. Start custom payload generation by sending the SOURce:DATA:TELecom:PAYLoad:MAPPing CUSTom command.

Capturing Custom Payload Data

The following steps show you how to use a FEBE trigger from the Receiver to capture SONET payload data and then query the data:

1. Reset the instrument to a known state by sending the *RST command. *Appendix E* lists the default parameter values.

2. Set up the triggering information as follows:

   a. Select the Receiver as the trigger source for capturing frame data by sending the TRIGger:SOURce SENSe command.

   b. To trigger on a FEBE error, send the TRIGger:SOURce:SENSe PFEBe command.

   c. To set the trigger position to the middle (half of the capture data is pretrigger data, half is posttrigger data), send the TRIGger:POSition MIDdle command.

3. Get the trigger system ready to recognize a trigger and capture frame data by sending the INITiate command.

4. Force a trigger to occur by sending the TRIGger:IMMediate command.

5. To make sure the capture of frame data has completed before querying the data, send the TRIGger:STATus? query until you receive a STOP response. Or, to manually stop the capture of frame data, send the ABORt command.

6. Once the frame capture has stopped, you can query the data that has been captured as described in steps a through c below. Sixty-four frames of data are returned if the receive structure is STS-1; fifty-four frames are returned for STS-3c and SDH structures. (For more details on the commands and queries used in the following steps, refer to the *SENSe:DATA:TELecom: PAYLoad:CUSTom Subsystem* section starting on page 3–116.)

   a. Set the frame number to query by sending the SENSe:DATA:TELecom: PAYLoad:CUSTom:FRAME 32 command. This will set the frame number to the trigger point for an STS-1 structure. You are now able to look at the data in the frame where the trigger occurred.

   b. To query a specific byte, such as the first data byte after the path overhead, send the SENSe:DATA:TELecom:PAYLoad:CUSTom:DATA? 1,2 query. The response is the decimal value of that byte.

   c. To query the entire frame capture data block, send the SENSe:DATA: TELecom:PAYLoad:CUSTom:BDATA? query. The binary response consists of 783 data bytes for the STS-1 structure (or 2349 data bytes for the STS-3c or AU-4 structures).

Tributary Signal Testing

Add/Drop/Test Option Only

This section discusses five ways to use the Add/Drop/Test Option of your VX4610 to test the viability of a network element (NE) and portions of the network.

VX4610 as a Stand-Alone Tributary Test Set

You can use the VX4610 as a stand-alone tributary test set without using any SONET or SDH features. You can verify DS1/DS3/PDH path connection, test path quality, and verify responses to faults. The VX4610 can both generate and receive DS1/DS3/PDH signals.

The following example generates a DS3 tributary signal and then inserts an alarm (Option 22 or Option 58 must be installed):

1. Configure your VX4610 as shown in Figure 2–12.

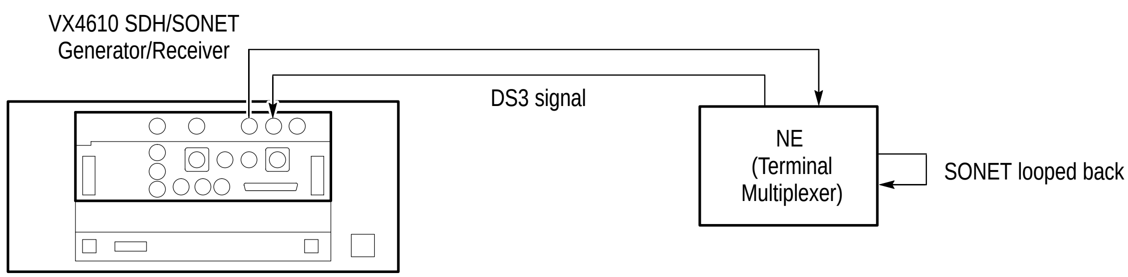


Figure 2–12: Setup for the VX4610 as a stand-alone tributary test set

2. Send the following commands to set up to generate a DS3 tributary signal with a defined framing and pattern:
   SYSTem:MODE SONET
   SOURce:DATA:TELecom:SOURce OUTPUT3
   SOURce:DATA:TELecom:TRIButary:FRAMing CBIT
   SOURce:DATA:TELecom:TRIButary:PATTern PRBS20

3. Send the following commands to set up to receive the tributary signal:
   SENSe:DATA:TELecom:SOURce INPUT3
   SENSe:DATA:TELecom:TRIButary:FRAMing CBIT
   SENSe:DATA:TELecom:TRIButary:PATTern PRBS20

4. Verify that the VX4610 is receiving the tributary signal correctly by sending the SENSe:DATA:TELecom:TRIButary:STATus? query. You should receive a response of 8192 indicating a pattern lock on the tributary signal.

5. Now verify the response to faults by inserting an alarm as follows:

   a. Send the SOURce:DATA:TELecom:TRIButary:ALARm AIS command to insert an AIS alarm.

   b. Then send the SENSe:DATA:TELecom:TRIButary:STATus? query. You should receive a response of 64 indicating a DS3 AIS alarm.

Testing the SONET/SDH Tributary Payload Mapping

You can use the VX4610 to create and monitor SONET/SDH tributary payloads. This test can verify error events and alarms in the demapped tributary signal, and can measure multiple layer signal quality.

The VX4610 maps a pattern into the tributary payload of a SONET/SDH signal. This signal is then generated by the VX4610 and transmitted to an NE. The VX4610 receives the SONET/SDH signal and measures both the SONET/SDH and mapped tributary signals.

The following example generates an SDH signal with a 2 Mb/s tributary mapped into it (Option 36 or Option 58 must be installed). Then, after the signal has been transmitted through an NE, the VX4610 receives the signal and measures the demapped 2 Mb/s tributary signal.

1. Configure your VX4610 as shown in Figure 2–13.

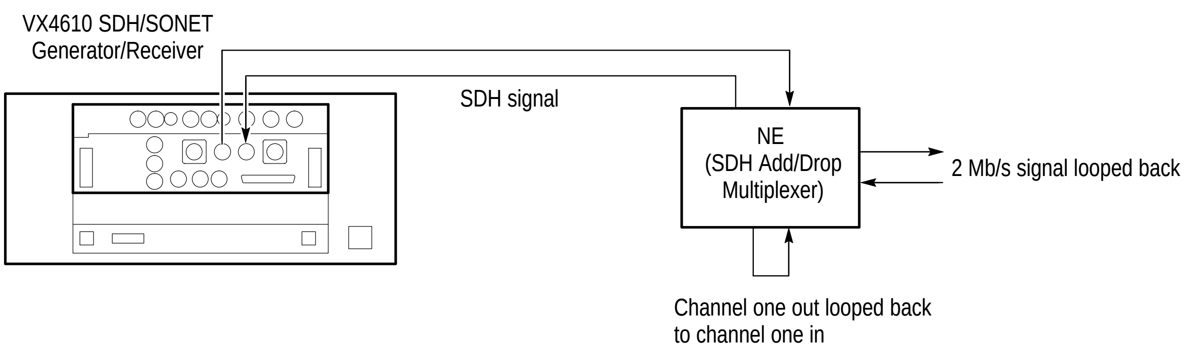


Figure 2–13: Setup for testing the SDH tributary payload mapping

2. Send the following commands to set up to generate an SDH signal with a defined tributary payload in channel 1:
   SYSTem:MODE SDH
   SOURce:DATA:TELecom:SOURce OUTPUT1
   OUTPUT1:TELecom:RATE STM1
   SOURce:DATA:TELecom:PAYLoad:MAPPing TRIButary
   SOURce:DATA:TELecom:TRIButary:CHANnel 1
   SOURce:DATA:TELecom:TRIButary:MAPPing TUASync
   SOURce:DATA:TELecom:TRIButary:FRAMing PCM31
   SOURce:DATA:TELecom:TRIButary:PATTern PRBS20
   SOURce:DATA:TELecom:TRIButary:BACKground:PATTern PRBS

3. Send the following commands to set up to receive and demap the tributary signal:
   SENSe:DATA:TELecom:SOURce INPUT1
   INPUT1:TELecom:RATE STM1
   SENSe:DATA:TELecom:PAYLoad:MAPPing TRIButary
   SENSe:DATA:TELecom:TRIButary:CHANnel 1
   SENSe:DATA:TELecom:TRIButary:FRAMing PCM31
   SENSe:DATA:TELecom:TRIButary:MAPPing TUASync
   SENSe:DATA:TELecom:TRIButary:PATTern PRBS20

4. Verify that the VX4610 is receiving the tributary signal correctly by sending the SENSe:DATA:TELecom:TRIButary:STATus? query. You should receive a response of 8192 indicating a pattern lock on the demapped tributary signal.

Testing the Mapping Capability of a Network Element

You can use the VX4610 to test the mapping capability of an NE. This test can introduce timing variations in the tributary signal and check for error-free mapping, verify mapping for correct channel assignments, and verify responses to errors, alarms, and failures.

The VX4610 generates a tributary signal which is sent to an NE. The NE maps this tributary signal into the SONET/SDH signal. This signal is received by the VX4610 which then demaps the tributary signal and measures it.

The following example generates a DS1 tributary signal and then inserts an error (Option 22 or Option 58 must be installed):

1. Configure your VX4610 as shown in Figure 2–14.

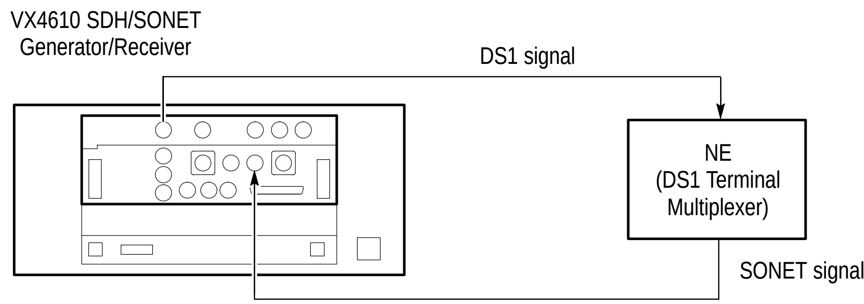


Figure 2–14: Setup for testing the mapping capability of an NE

2. Send the following commands to set up the VX4610 to generate a DS1 tributary signal with a defined framing:
   SYSTem:MODE SONET
   SOURce:DATA:TELecom:SOURce OUTPUT2
   SOURce:DATA:TELecom:TRIButary:FRAMing SF
   SOURce:DATA:TELecom:TRIButary:PATTern PRBS20

3. Send the following commands to set up to receive the SONET signal with a tributary signal mapped into it:
   SENSe:DATA:TELecom:SOURce INPUT1
   SENSe:DATA:TELecom:PAYLoad:MAPPing TRIButary
   SENSe:DATA:TELecom:TRIButary:MAPPing VTASYNC
   SENSe:DATA:TELecom:TRIButary:FRAMing SF
   SENSe:DATA:TELecom:TRIButary:PATTern PRBS20

4. Send the following commands to verify the NE response to faults; these commands insert a payload bit error into the tributary signal:
   SOURce:DATA:TELecom:ERRor:TYPE TRIButary
   SOURce:DATA:TELecom:TRIButary:ERRor DATA
   SOURce:DATA:TELecom:ERRor:IMMediate

5. Verify that the VX4610 is receiving and demapping the tributary signal correctly by sending the SENSe:DATA:TELecom:TRIButary:STATus? query. You should receive a response of 8704 indicating a DS1 bit error and pattern lock in the demapped tributary signal.

Testing the Demapping Capability of a Network Element

You can use the VX4610 to test the demapping capability of an NE. This test can introduce pointer adjustments, test signal quality, verify correct channel assignments, and verify responses to errors, alarms, and failures.

The VX4610 generates a tributary signal with a known pattern and maps this signal into the SONET/SDH signal. The signal is then sent to an NE, which demaps the tributary signal from the SONET/SDH signal. The VX4610 receiver monitors and measures the demapped tributary signal.

The following example maps a 140 Mb/s tributary signal into an SDH signal, receives the demapped 140 Mb/s signal from the NE, and then initiates pointer adjustments (Option 36 or Option 58 must be installed):

1. Configure your VX4610 as shown in Figure 2–15.

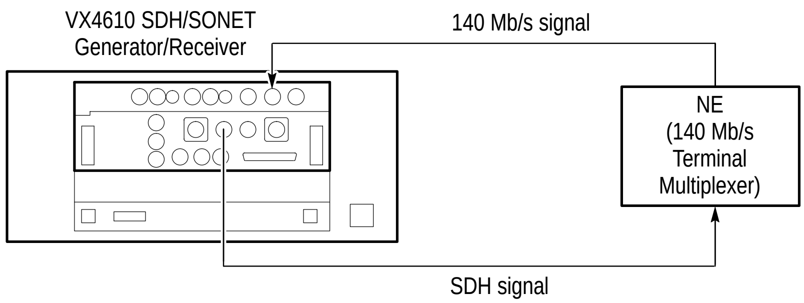


Figure 2–15: Setup for testing demapping capability of an NE

2. Send the following commands to set up to map a 140 Mb/s tributary signal into an SDH signal:
SYSTem:MODE SDH
SOURce:DATA:TELecom:SOURce OUTPUT1
SOURce:DATA:TELecom:PAYLoad:MAPPing TRIButary
SOURce:DATA:TELecom:TRIButary:MAPPing M140
SOURce:DATA:TELecom:TRIButary:FRAMing FRAMed
SOURce:DATA:TELecom:TRIButary:PATTern PRBS23

3. Send the following commands to set up to receive the demapped tributary signal:
INPUT3:TELecom:RATE M140
SENSe:DATA:TELecom:SOURce INPUT3
SENSe:DATA:TELecom:TRIButary:FRAMing FRAMed
SENSe:DATA:TELecom:TRIButary:PATTern PRBS23

4. Send the following commands to set up continuous pointer adjustments at a 50 ms rate:
SOURce:DATA:TELecom:POINter:MODE TRIButary
SOURce:DATA:TELecom:TRIButary:POINter:MODE CONTinuous
SOURce:DATA:TELecom:TRIButary:POINter:DIRection ALTernate
SOURce:DATA:TELecom:TRIButary:POINter:RATE 50

5. Verify that the VX4610 is receiving the demapped tributary signal correctly by sending the SENSe:DATA:TELecom:TRIButary:STATus? query. You should receive a response of 8192 indicating a pattern lock and no errors.

Testing the External Connection of an Add/Drop/Test Set

You can use the VX4610 to add an external tributary signal into the SONET/SDH signal. The testing is controlled by the external tributary test set that generates the tributary signal.

The external tributary test set generates a nonstandard tributary signal. The VX4610 receives this tributary signal and maps it directly into the SONET/SDH signal. The NE receives the SONET/SDH signal and demaps the tributary signal. The external tributary test set verifies that the NE demapped the tributary signal correctly.

The following example receives and maps an external DS3 tributary signal into a SONET signal (Option 22 or Option 58 must be installed):

1. Configure your VX4610 as shown in Figure 2–16.

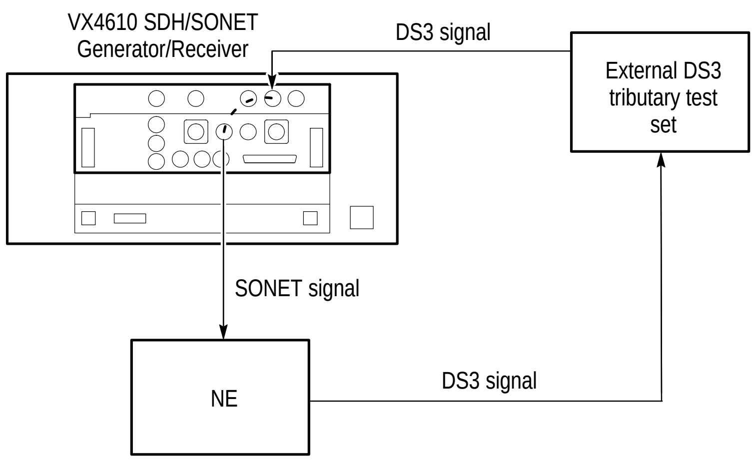


Figure 2–16: Setup for testing the external connection of an add/drop/test set

2. Send the following commands to set up the VX4610 to map the tributary signal directly into a SONET signal, and then generate the SONET signal (the tributary signal is not measured):
SYSTem:MODE SONET
SOURce:DATA:TELecom:SOURce OUTPUT1
SOURce:DATA:TELecom:PAYLoad:MAPPing TRIButary
SOURce:DATA:TELecom:TRIButary:ADD ON
SOURce:DATA:TELecom:TRIButary:MAPPing DS3

3. The external tributary test set should verify that the NE demapped the tributary signal correctly.

Syntax and Commands

Syntax

This section contains information on the Standard Commands for Programmable Instruments (SCPI) and IEEE 488.2 Common Commands you can use to program your VX4610.

SCPI Commands and Queries

SCPI is a standard created by a consortium 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 VX4610 uses a command language derived from this SCPI standard.

The SCPI language is based on a hierarchical tree structure (see 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.

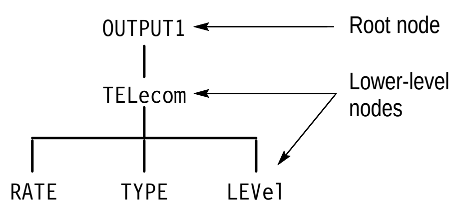


Figure 3–1: Example of SCPI subsystem hierarchy tree

You can create commands and queries from these subsystem hierarchy trees. Commands specify actions for the instrument to perform. Queries return information about the state of the instrument.

Creating Commands

SCPI commands are created by stringing together the nodes of a subsystem hierarchy tree and separating each node by a colon.

In Figure 3–1, OUTPUT1 is the root node and TELecom, RATE, TYPE, and LEVel are the lower-level nodes. To create a SCPI command, start with the root node OUTPUT1 and move down the tree structure adding nodes until you reach the end of a branch. Most commands and some queries have parameters; you must include a value for these parameters. If you specify a parameter value that is out of range, the parameter will be set to the default. The commands sections starting on page 3–11 list the valid values for all parameters.

OUTPUT1:TELecom:LEVel HIGH is an example of a valid SCPI command using the hierarchy tree in Figure 3–1.

Creating Queries

To create a query, start at the root node of a tree structure, move down to the end of a branch, and then add a question mark. OUTPUT1:TELecom:LEVel? is an example of a valid SCPI query using the hierarchy tree in Figure 3–1.

Parameter Types

Parameter types are given for every parameter in the command and query descriptions. The parameters are enclosed in brackets, for example, <pattern>. The parameter type is listed after the parameter and is enclosed in parentheses, for example, (discrete). Some parameter types are defined specifically for the VX4610 command set and some are defined by ANSI/IEEE 488.2-1987 (see Table 3–1).

Table 3–1: Parameter types used in syntax descriptions

Parameter type	Description	Example
binary	Binary numbers	#B0110
binary block[1]	A specified length of binary data	#512234xxxxx . . . where 5 indicates that the following 5 digits (12234) specify the length of the data in bits; xxxxx ... indicates the binary data
boolean	Boolean numbers or values	ON or 1 OFF or 0
discrete	A list of specific values	HIGH, LOW, MID, PRBS23
hexadecimal[2]	Hexadecimal numbers (0–9, A, B, C, D, E, F)	#HAA, #H1
NR1-numeric[2,3]	Integers	0, 1, 15, –1
NR2-numeric[2]	Decimal numbers	1.2, 3.141516, –6.5
NR3-numeric[2]	Floating point numbers	3.1415E–9, –16.1E5
string[4]	Alphanumeric characters (must be within quotation marks)	“Testing 1, 2, 3”

1 **Defined in ANSI/IEEE 488.2 as “Definite Length Arbitrary Block Response Data.”**

2 **An ANSI/IEEE 488.2–1987-defined parameter type.**

3 **Some commands and queries will accept a hexadecimal value even though the parameter type is defined as NR1-numeric.**

4 **Defined in ANSI/IEEE 488.2 as “String Response Data.”**

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.

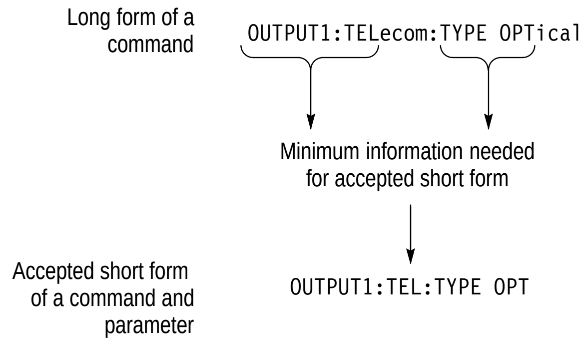


Figure 3–2: Example of abbreviating a command

***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 "OUTPUT1" 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. Table 3–2 shows the possible combinations of these commands and an example of a query response.

Table 3–2: Using commands to control the response to a query

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.

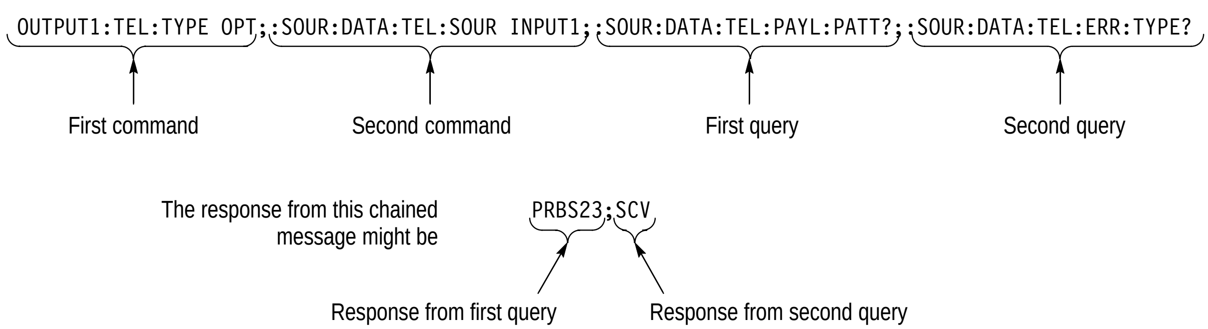


Figure 3–3: Example of chaining commands and queries

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:DATA:TELecom) as the first command, so these nodes can be omitted.

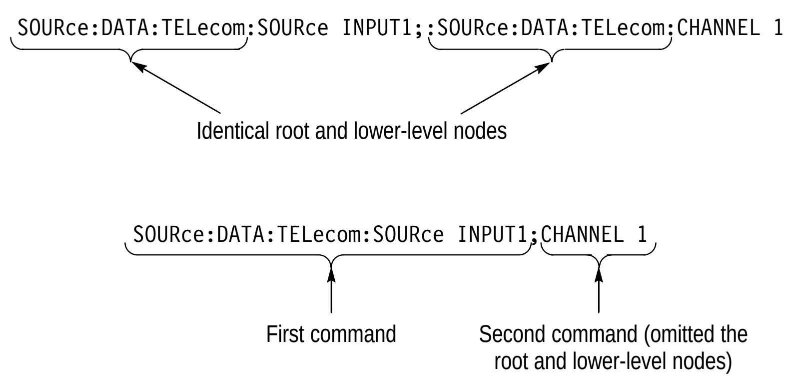


Figure 3–4: Example of omitting root and lower-level nodes in chained message

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 commands, queries, and parameters.

  ```
  INPUT1:TELECOM:TYPE ELECTRICAL
  ```

  is the same as

  ```
  input1:telecom:type electrical
  ```

  and

  ```
  INPUT1:telecom:Type ELECTRICAL
  ```

- No embedded spaces are allowed between or within nodes.

  correct: `OUTPUT1:TELecom:TYPE OPTical`

  incorrect: `OUTPUT1: TELecom: TYPE OPTical`

  incorrect: `OU TPUT1:TELe com:TYPE OPTical`

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 VX4610 complies with this standard.

Command and Query Structure

The syntax for 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. All of the common commands and queries are listed in the last part of the *Syntax and Commands* section. The following are examples of common commands:

- `*ESE 16`
- `*CLS`

The following are examples of common queries:

- `*ESR?`
- `*IDN?`

Functional Command Groups

All of the commands and queries in *Syntax and Commands* are organized into functional groups. Each section covers one functional group. For example, *Transmit Commands* contains all commands and queries that allow you to set up and transmit a signal. The commands and queries within each functional group are further organized into subsystems. For example, within *Transmit Commands* are subsystems that allow you to set the physical characteristics of a signal (the OUTPUT1 subsystem) and pointer adjustments (the SOURce:DATA:TELecom:POINter subsystem).

The functional groups and their subsystems are shown in Table 3–3.

Table 3–3: Functional groups and their subsystems

Functional group	Subsystem	Description	Starts on page
Transmit Commands	OUTPUT1	Controls physical setup of transmitted SONET/SDH signal	3–12
	OUTPUT2	Sets the characteristics of the transmitted or dropped DS1 or 2 Mb/s tributary signal (Add/Drop/Test Option Only)	3–20
	OUTPUT3	Sets the characteristics of the transmitted or dropped DS3, 34 Mb/s or 140 Mb/s tributary signal (Add/Drop/Test Option Only)	3–24
	SOURce:CLOCk	Controls transmitter clock	3–28
	SOURce:DATA:TELecom	Controls transmitter setup	3–38
	SOURce:DATA:TELecom:OVERhead and POVerhead	Controls transmitter overheads	3–53
	SOURce:DATA:TELecom:ERRor, ALARm, and FAILure	Controls transmitter abnormalities	3–72
	SOURce:DATA:TELecom:POINter	Controls transmitter pointers	3–88
	SOURce:DATA:TELecom:PAYLoad:CUSTom	Generates sequence of payloads that can be mapped into the active channel	3–116
	SOURce:DATA:TELecom:TRIButary	Controls transmitted or dropped tributary signal (Add/Drop/Test Option Only)	3–129
	SOURce:DATA:TELecom:TRIButary:ERRor, ALARm, and FAILure	Controls abnormal conditions in the transmitted or dropped tributary signal (Add/Drop/Test Option Only)	3–148
	SOURce:DATA:TELecom:TRIButary:POINter	Controls pointers in the transmitted or dropped tributary signal (Add/Drop/Test Option Only)	3–155

Table 3–3: Functional groups and their subsystems (cont.)

Functional group	Subsystem	Description	Starts on page
Receive Commands	INPUT1	Sets up physical connection of received SONET/SDH signal	3–182
	INPUT2	Sets the characteristics of the received or added DS1 or 2 Mb/s tributary signal (Add/Drop/Test Option Only)	3–193
	INPUT3	Sets the characteristics of the received or added DS3 , 34 Mb/s or 140 Mb/s tributary signal (Add/Drop/Test Option Only)	3–198
	SENSe:DATA:TELecom	Sets up receiver	3–203
	SENSe:DATA:TELecom:TEST	Starts and stops measurements	3–218
	SENSe:DATA:TELecom:OVERhead and POVerhead	Allows access to receiver overheads	3–225
	SENSe:DATA:TELecom:MEASure	Allows access to measurements	3–234
	SENSe:DATA:TELecom:MEASure: HISTory	Allows access to measurement histories	3–256
	SENSe:DATA:TELecom:MEASure: STESts	Controls pass/fail tests	3–266
	SENSe:DATA:TELecom:PAYLoad: CUSTom	Allows capture of custom payloads for viewing and editing	3–283
	SENSe:DATA:TELecom:AUTOscan	Automatically sets up receiver	3–289
	SENSe:DATA:TELecom:TRIButary	Controls viewing of tributary signal (Add/Drop/Test Option Only)	3–291
	SENSe:DATA:TELecom:MEASure: TRIButary	Allows access to measurements of tributary signals (Add/Drop/Test Option Only)	3–312
Transmitter and Receiver Setup Commands	INSTrument	Controls transmitter and receiver settings	3–327
Trigger and Capture Commands	ABORt, INITiate, and TRIGger	Allows use of triggering to capture custom payloads	3–349
	TRIGger2	Allows exporting of triggers from the Generator	3–365
Instrument Control Commands	SYSTem	Controls general instrument functions	3–371
Diagnostic Commands	DIAGnostic	Controls self tests	3–389
IEEE 488.2 Common Commands	(no subsystems; every command and query begins with *)	Allows access to generic commands	3–411

Each functional group section begins with a description of the functional group and is followed by a list of the subsystems included in the functional group. Then, for each of the subsystems, a description and hierarchy tree are given.

Each command and query within each subsystem are listed in the functional group sections in the format illustrated in Figure 3–5. For the sake of clarity, two tables are always given even though the parameters may be identical.

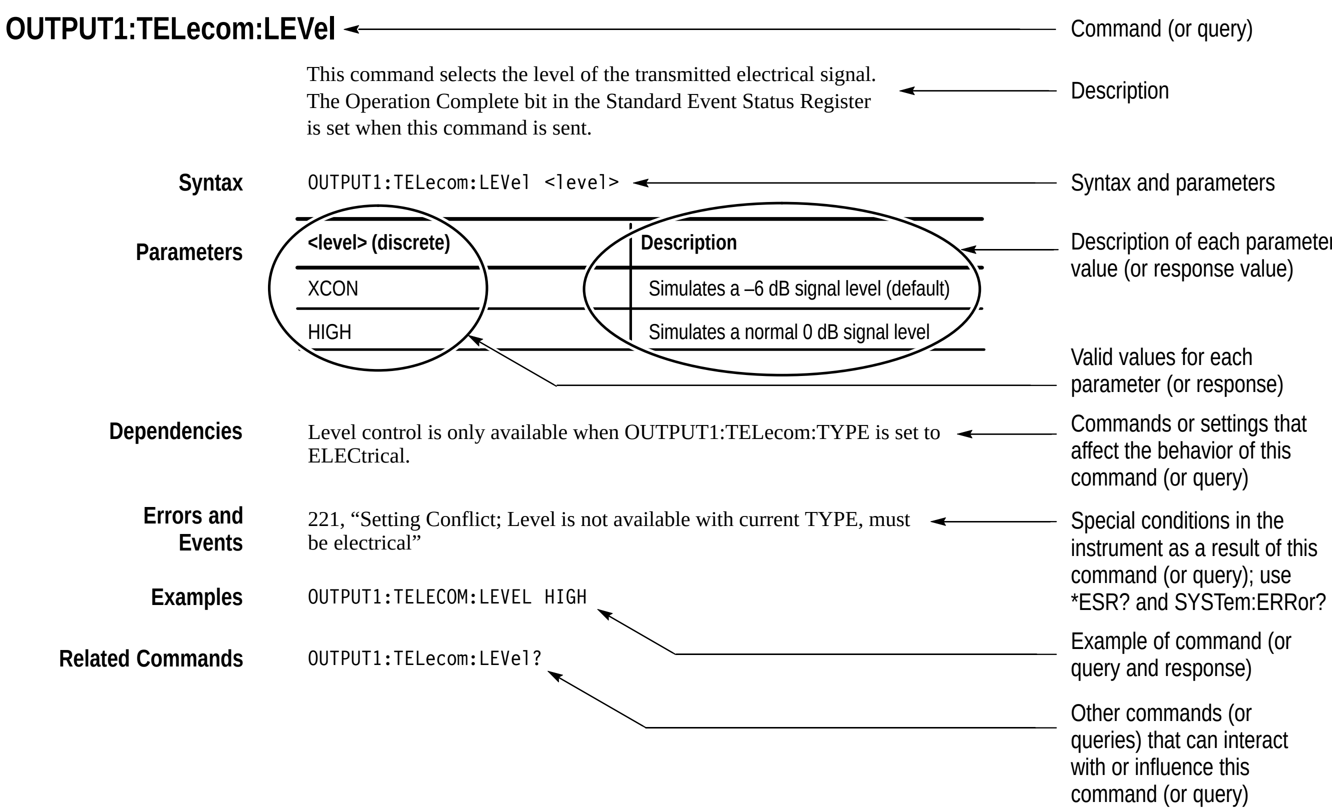


Figure 3–5: Example of command listing

***NOTE**. Some commands and queries follow a different format than shown in Figure 3–5 (for example, the* SENSe:DATA:TELecom:MEASure *queries). An explanation of this format is found at the beginning of the section containing the commands and queries.*

In the Syntax and Commands section you will see a different kind of Parameter or Response table for a few commands or queries. Figure 3–6 shows you an example of a <decimal value> response table. The parameter or response value returned is the sum of the decimal values listed in the left column and depends on which bits are set. Follow the step numbers in the example to interpret a <decimal value> parameter or response.

Table X–X: Response table

<decimal value> (NR1-numeric)	bit	definition
1	0	LOF
2	1	LOF
4	2	OOF
8	3	LOP
16	4	Line AIS
32	5	Path AIS
64	6	Error
128	7	Undefined
256	8	K1/K2 change
512	9	Line FERF
1024	10	Path FERF
2048	11	Pointer adjust
4096	12	NDF
8192	13	Pattern lock
16384	14	Not used
32768	15	Not used

1 A response of 9216 is received.

2 Find which decimal values add up to the response of 9216 (1024 + 8192 = 9216).

3 Read across the selected decimal values to the bit and definition columns to interpret the response. In this example, bits 10 and 13 are set indicating a path yellow and pattern lock.

Figure 3–6: How to interpret a <decimal value> parameter or response

Transmit Commands

The Transmit Commands allow you to set the conditions for the signal to be transmitted, including abnormal conditions. This section contains all of the commands and queries for each of the following Transmit subsystems:

- OUTPUT1
- OUTPUT2 (Add/Drop/Test Option Only)
- OUTPUT3 (Add/Drop/Test Option Only)
- SOURce:CLOCk
- SOURce:DATA:TELecom
- SOURce:DATA:TELecom:OVERhead and POVerhead
- SOURce:DATA:TELecom:ERRor, ALARm, and FAILure
- SOURce:DATA:TELecom:POINter
- SOURce:DATA:TELecom:PAYLoad:CUSTom
- SOURce:DATA:TELecom:TRIButary (Add/Drop/Test Option Only)
- SOURce:DATA:TELecom:TRIButary:ERRor, ALARm, and FAILure (Add/Drop/Test Option Only)
- SOURce:DATA:TELecom:TRIButary:POINter (Add/Drop/Test Option Only)

OUTPUT1 Subsystem

This section describes the commands and queries that set the rate, type, and level of the signal to be transmitted. Figure 3–7 shows the hierarchy tree for this subsystem.

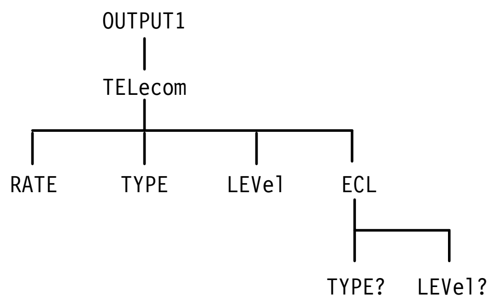


Figure 3–7: OUTPUT1 subsystem

OUTPUT1:TELecom:RATE

This command selects the output rate of the signal.

Syntax

```
OUTPUT1:TELecom:RATE <rate>
```

SONET Values

<rate> (discrete)	description
STS1	51.84 MHz (default)
STS3	155.52 MHz
STS12	622.08 MHz (requires the optical option)

SDH Values

<rate> (discrete)	description
STM0 (not supported)	51.84 MHz
STM1	155.52 MHz (default)
STM4	622.08 MHz

Dependencies

Set SYSTem:MODE to SONET for SONET rates. Set SYSTem:MODE to SDH for SDH rates.

Errors and Events

221, “Settings conflict; Rate is not available with current Line Interface module or operating mode”

221, “Settings conflict; Argument not valid in current instrument state”

Examples

`OUTPUT1:TELECOM:RATE STS1`

Related Commands

OUTPUT1:TELecom:TYPE
SOURce:DATA:TELecom:SOURce

OUTPUT1:TELecom:RATE?

This query returns the current setting of the transmitter rate.

Syntax

`OUTPUT1:TELecom:RATE?`

SONET Response

<rate> (discrete)	description
STS1	51.84 MHz (default)
STS3	155.52 MHz
STS12	622.08 MHz (requires the optical option)

SDH Response

<rate> (discrete)	description
STM0 (not supported)	51.84 MHz
STM1	155.52 MHz (default)
STM4	622.08 MHz

Dependencies

None

Errors and Events

None

Examples Query: `OUTPUT1:TELECOM:RATE?`

Response: `STS1`

Related Commands OUTPUT1:TELecom:RATE

OUTPUT1:TELecom:TYPE

This command selects the output signal type.

Syntax `OUTPUT1:TELecom:TYPE <type>`

SONET Values

<type> (discrete)	description
ELECtrical	Electrical signal output (default)
OPTical	Optical output (requires the optical option)
ECL	ECL output (Option 02 only)
NONE	No signal is output

SDH Values

<type> (discrete)	description
ELECtrical	Electrical signal output (default)
OPTical	Optical output (requires the optical option)
ECL	ECL output (Option 02 only)
NONE	No signal is output

Dependencies Selecting ECL requires the VX4610 Option 02 ECL Interface Module.

Errors and Events 221, “Settings conflict; Type is not available with current Line Interface module”
221, “Settings conflict; TYPE:ECL requires option –02”

Examples `OUTPUT1:TELECOM:TYPE ELECTRICAL`

Related Commands None

OUTPUT1:TELecom:TYPE?

This query returns the current setting of the transmitter type.

Syntax

`OUTPUT1:TELecom:TYPE?`

SONET Response

<type> (discrete)	description
ELECtrical	Electrical signal output
OPTical	Optical output
ECL	ECL output (Option 02 only)
NONE	No signal is output

SDH Response

<type> (discrete)	description
ELECtrical	Electrical signal output
OPTical	Optical output
ECL	ECL output (Option 02 only)
NONE	No signal is output

Dependencies

None

Errors and Events

None

Examples

Query: `OUTPUT1:TELECOM:TYPE?`

Response: `OPTICAL`

Related Commands

OUTPUT1:TELecom:TYPE
OUTPUT1:TELecom:RATE

OUTPUT1:TELecom:LEVel

This command selects the level of the transmitted electrical signal.

Syntax

```
OUTPUT1:TELecom:LEVel <level>
```

SONET Response

<level> (discrete)	description
XCONnect	Simulates a –6 dB signal level (default)
HIGH	Simulates a normal 0 dB signal level

SDH Response

<level> (discrete)	description
XCONnect	Simulates a –6 dB signal level (default)
HIGH	Simulates a normal 0 dB signal level

Dependencies

This command applies only when OUTPUT1:TELecom:TYPE is set to ELECtrical.

Errors and Events

221, "Settings conflict; Level is not available with current type, must be electrical"

Examples

```
OUTPUT1:TELECOM:LEVEL HIGH
```

Related Commands

None

OUTPUT1:TELecom:LEVel?

This query returns the current setting of the transmitter level.

Syntax `OUTPUT1:TELecom:LEVel?`

SONET Response

<level> (discrete)	description
XCONnect	Simulates a –6 dB signal level (default)
HIGH	Simulates a normal 0 dB signal level

SDH Response

<level> (discrete)	description
XCONnect	Simulates a –6 dB signal level (default)
HIGH	Simulates a normal 0 dB signal level

Dependencies None

Errors and Events None

Examples Query: `OUTPUT1:TELECOM:LEVEL?`

Response: `HIGH`

Related Commands OUTPUT1:TELecom:LEVel

OUTPUT1:TELecom:ECL:LEVel?

This query returns the current state of the Option 02 ECL Interface Module termination configuration switch located on the front panel of the module.

Syntax

`OUTPUT1:TELecom:ECL:LEVel?`

SONET Response

<ecl_level>	description
PECL	Positive ECL level
ECL	Standard ECL level
NONE	ECL Interface module not installed

SDH Response

<ecl_level>	description
PECL	Positive ECL level
ECL	Standard ECL level
NONE	ECL Interface module not installed

Dependencies

The front panel switch controls both the transmit and receive signals. Therefore, this command is equivalent to INPUT1:TELecom:ECL:LEVel?

Errors and Events

None

Examples

Query: `OUTPUT1:TELECOM:ECL:LEVel?`

Response: `ECL`

Related Commands

OUTPUT1:TELecom:ECL:TYPE?
INPUT1:TELecom:ECL:LEVel?

OUTPUT1:TELecom:ECL:TYPE?

This query returns the current state of the DIFF/SINGLE configuration switch located on the front panel of the Option 02 ECL Interface Module.

Syntax

`OUTPUT1:TELecom:ECL:TYPE?`

SONET Response

<ecl_type>	description
DIFFerential	Differential
SINGle	Single-ended
NONE	ECL module not installed

SDH Response

<ecl_type>	description
DIFFerential	Differential
SINGle	Single-ended
NONE	ECL module not installed

Dependencies

The front panel switch controls both the transmit and receive signals. Therefore, this command is equivalent to INPUT1:TELecom:ECL:TYPE?

Errors and Events

None

Examples

Query: `OUTPUT1:TELECOM:ECL:TYPE?`

Response: `SING`

Related Commands

OUTPUT1:TELecom:ECL:TYPE?
INPUT1:TELecom:ECL:TYPE?

OUTPUT2 Subsystem

Add/Drop/Test Option Only

This section describes the commands and queries that set the characteristics of the transmitted or dropped DS1 or 2 Mb/s tributary signal.

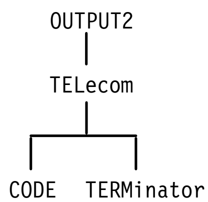


Figure 3–8: OUTPUT2 subsystem

OUTPUT2:TELecom:CODE

Add/Drop/Test Option Only

This command selects the signal coding of the DS1 or 2 Mb/s tributary signal.

Syntax

`OUTPUT2:TELecom:CODE <trib1 output code>`

SONET Values

<trib1 output code> (discrete)	description
AMI	Alternate Mark Inversion (default)
B8ZS	Bipolar 8 Zero Substitution

SDH Values

<trib1 output code> (discrete)	description
HDB3	High Density Bipolar 3 (default)

Dependencies

The instrument must be transmitting or dropping a DS1 or 2 Mb/s tributary signal for this command to apply.

Errors and Events

None

Examples `OUTPUT2:TELECOM:CODE AMI`

Related Commands SOURce:DATA:TELecom:SOURce
SENSe:DATA:TELecom:TRIButary:DROP

OUTPUT2:TELecom:CODE?

Add/Drop/Test Option Only

This query returns the current setting of the signal coding for the DS1 or 2 Mb/s tributary signal.

Syntax `OUTPUT2:TELecom:CODE?`

SONET Response

<trib1 output code> (discrete)	description
AMI	Alternate Mark Inversion (default)
B8ZS	Bipolar 8 Zero Substitution

SDH Response

<trib1 output code> (discrete)	description
HDB3	High Density Bipolar 3 (default)

Dependencies None

Errors and Events None

Examples Query: `OUTPUT2:TELECOM:CODE?`

Response: `AMI`

Related Commands OUTPUT2:TELecom:CODE

OUTPUT2:TELecom:TERMinator

Add/Drop/Test Option Only

This command selects the signal terminator for the DS1 or 2 Mb/s transmit connector.

Syntax

```
OUTPUT2:TELecom:TERMinator <trib1 output termin>
```

SONET Values

<trib1 output termin> (discrete)	description
BALanced	120 Ω connector (default)

SDH Values

<trib1 output termin> (discrete)	description
BALanced	120 Ω connector (default)
UNBALanced	75 Ω connector

Dependencies

The instrument must be transmitting or dropping a DS1 or 2 Mb/s tributary signal for this command to apply.

Errors and Events

None

Examples

```
OUTPUT2:TELECOM:TERMINATOR BALANCED
```

Related Commands

SOURce:DATA:TELecom:SOURce
SENSe:DATA:TELecom:TRIButary:DROP

OUTPUT2:TELecom:TERMinator?

Add/Drop/Test Option Only

This returns the current setting of the DS1 or 2 Mb/s transmit connector signal terminator.

Syntax

`OUTPUT2:TELecom:TERMinator?`

SONET Response

<trib1 output termin> (discrete)	description
BALanced	120 Ω connector (default)

SDH Response

<trib1 output termin> (discrete)	description
BALanced	120 Ω connector (default)
UNBALanced	75 Ω connector

Dependencies

None

Errors and Events

None

Examples

Query: `OUTPUT2:TELECOM:TERMINATOR?`

Response: `BALANCED`

Related Commands

OUTPUT2:TELecom:TERMinator

OUTPUT3 Subsystem

Add/Drop/Test Option Only

This section describes the commands and queries that set the characteristics of the transmitted or dropped DS3, 34 Mb/s or 140 Mb/s tributary signal.

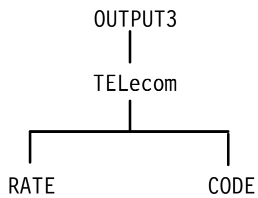


Figure 3–9: OUTPUT3 subsystem

OUTPUT3:TELecom:RATE

Add/Drop/Test Option Only

This command selects the DS3, 34 Mb/s or 140 Mb/s tributary output rate.

Syntax

```
OUTPUT3:TELecom:RATE <trib2 output rate>
```

SONET Values

<trib2 output rate> (discrete)	description
DS3	44.736 Mb/s (default)

SDH Values

<trib2 output rate> (discrete)	description
M34	34.368 Mb/s (default)
M140	139.264 Mb/s

Dependencies

Set SYSTem:MODE to SONET for DS3 rate. Set SYSTem:MODE to SDH for 34 Mb/s or 140 Mb/s rates.

Errors and Events

221, “Settings conflict; Rate is not available with current Line Interface module or operating mode”

Examples `OUTPUT3:TELECOM:RATE DS3`

Related Commands SOURce:DATA:TELecom:SOURce

OUTPUT3:TELecom:RATE?

Add/Drop/Test Option Only

This query returns the current setting of the DS3, 34 Mb/s or 140 Mb/s tributary output rate.

Syntax `OUTPUT3:TELecom:RATE?`

SONET Response

<trib2 output rate> (discrete)	description
DS3	44.736 Mb/s (default)

SDH Response

<trib2 output rate> (discrete)	description
M34	34.368 Mb/s (default)
M140	139.264 Mb/s

Dependencies None

Errors and Events None

Examples Query: `OUTPUT3:TELECOM:RATE?`

Response: `DS3`

Related Commands OUTPUT3:TELecom:RATE

OUTPUT3:TELecom:CODE

Add/Drop/Test Option 58 Only

This command selects the transmit line coding for the 140 Mb/s tributary output rate.

Syntax

```
OUTPUT3:TELecom:CODE <linecode>
```

SONET Values

None

SDH Values

<linecode> (discrete)	description
CMI	Code Mark Inversion (default)
NRZ	Non–return to Zero

Dependencies

Option 58 must be installed, and SDH Mode and 140 Mb/s rate must be selected.

Errors and Events

221, “Settings conflict; Rate is not available with current Line Interface module or operating mode”

Examples

```
OUTPUT3:TELECOM:CODE  NRZ
```

Related Commands

OUTPUT3:TELecom:RATE

OUTPUT3:TELecom:CODE?

Add/Drop/Test Option 58 Only

This query returns the current setting of the transmit line coding for the 140 Mb/s tributary output.

Syntax

`OUTPUT3:TELecom:CODE?`

SONET Values

None

SDH Response

<linecode> (discrete)	description
CMI	Code Mark Inversion (default)
NRZ	Non–return to Zero

Dependencies

Option 58 must be installed, and SDH Mode and 140 Mb/s rate must be selected.

Errors and Events

None

Examples

Query: `OUTPUT3:TELECOM:CODE?`

Response: `NRZ`

Related Commands

OUTPUT3:TELecom:RATE

SOURce:CLOCk Subsystem

This section describes the commands and queries that control the transmitter clock. You must set the SOURce:DATA:TELecom:POINter:MODE command to FOFFset for any of the SOURce:CLOCk subsystem commands to be valid. Table 3–4 shows the interaction between the major commands of this subsystem. Refer to this table to see which combinations of commands and parameters are valid. Figure 3–10 shows the hierarchy tree for this subsystem.

Table 3–4: Interaction between SOURce:CLOCk commands

To control:	Set SOURce:CLOCk: SOURce to:	Set SOURce:CLOCk: OFFSet:MODE to:	Set SOURce:CLOCk: OFFSet:LVALue to:	Set SOURce:CLOCk: OFFSet:PVALue to:
Pointer movements	INTernal, BITS, E2MB, or RECovered	POINters	Set to 0; no changes allowed	Any value from –100 ppm to +100 ppm in increments of 0.1 ppm
Line offset, no pointers	INTernal or RECovered	LOFFset	SONET rates: –100 ppm to +100 ppm DS1 rate: –130 ppm to +130 ppm DS3 rate: –130 ppm to +130 ppm SDH rates: –100 ppm to +100 ppm 2 Mb/s rate: –50 ppm to +50 ppm 34 Mb/s rate: –130 ppm to +130 ppm 140 Mb/s rate: –100 ppm to +100 ppm All ranges in increments of 0.1 ppm	Automatically set to the same value as LVALue; you can not directly change PVALue

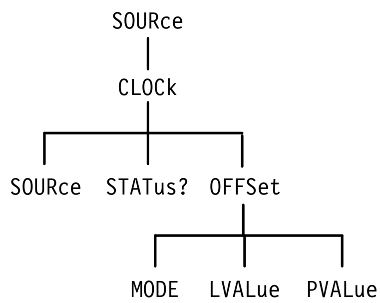


Figure 3–10: SOURce:CLOCk subsystem

SOURce:CLOCk:SOURce

This command selects the clock for the transmitter. The OPC bit in the Standard Event Status Register is set when this command has completed execution.

NOTE. *Before you select SOURce:CLOCk:SOURce EXTernal, the external clock source must be present and operating within the allowed range of settings described in Table A–3 or A–12. If the external clock goes out of range, the transmitted signal might not be valid; the following error message is generated:*

“Ext clock freq out of range. Adjust frequency and perform *RST”

Once you have completed testing with the external clock, send the SOURce: CLOCk:SOURce INTernal or *SOURce:CLOCk:SOURce RECovered command.*

Syntax

```
SOURce:CLOCk:SOURce <clock source>
```

SONET Values

<clock source> (discrete)	**description**
INTernal	Internal clock (default)
RECovered	Recovered from received signal
BITs	External BITS clock
EXTernal	External clock
TEXTernal	Tributary external clock (Add/Drop/Test Option Only)

SDH Values

<clock source> (discrete)	description
INTernal	Internal clock (default)
RECovered	Recovered from received signal
E2MB	External 2 Mb
EXTernal	External clock
TEXTernal	Tributary external clock (Add/Drop/Test Option Only)

Dependencies

RECovered is not allowed if you are set up to receive a tributary signal at the same time you are set up to transmit a SONET/SDH signal.

Errors and Events

None

Examples

`SOURCE:CLOCK:SOURCE INTERNAL`

Related Commands

None

SOURce:CLOCk:SOURce?

This query returns the selected clock for the transmitter.

Syntax

`SOURce:CLOCk:SOURce?`

SONET Response

<clock source> (discrete)	description
INTernal	Internal clock (default)
RECovered	Recovered from received signal
BITs	External BITS clock
EXTernal	External clock
TEXTernal	Tributary external clock (Add/Drop/Test Option Only)

SDH Response

<clock source> (discrete)	description
INTernal	Internal clock (default)
RECovered	Recovered from received signal
E2MB	External 2 Mb
EXTernal	External clock
TEXTernal	Tributary external clock (Add/Drop/Test Option Only)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:CLOCK:SOURCE?`

Response: `INTERNAL`

Related Commands SOURce:CLOCk:SOURce

SOURce:CLOCk:STATus?

This query returns the status of the clock phase locked loop. Use this query to determine if you have a lock on an external clock source or after you change the clock source.

Syntax `SOURce:CLOCk:STATus?`

SONET Response

<clock status> (boolean)	description
0	Unlocked
1	Locked

SDH Response

<clock status> (boolean)	description
0	Unlocked
1	Locked

Dependencies None

Errors and Events None

Examples Query: `SOURCE:CLOCK:STATUS?`

Response: 1

Related Commands SOURCe:CLOCk:OFFSet:MODE

SOURce:CLOCk:OFFSet:MODE

This command selects the clock offset mode and determines how the commands SOURce:CLOCk:OFFSet:MODE:LVALue and SOURce:CLOCk:OFFSet:MODE:PVALue interact. When you send the SOURce:CLOCk:OFFSet:MODE command, the values of LVALue and PVALue are reset to 0 which might create a discontinuity in the output signal for a brief time. Then you can change LVALue and PVALue to valid values (Table 3–4 on page 3–28 describes the interaction between the major SOURce:CLOCk commands).

Syntax `SOURce:CLOCk:OFFSet:MODE <clock offset mode>`

SONET Values

<clock offset mode> (discrete)	description
LOFFset	Changes to LVALue are tracked in PVALue
POINters	Changes to PVALue are allowed

SDH Values

<clock offset mode> (discrete)	description
LOFFset	Changes to LVALue are tracked in PVALue
POINters	Changes to PVALue are allowed

Dependencies

POINters is valid only for SONET/SDH rates and when SOURce:CLOCk:SOURce is set to INTernal, BITS/E2MB, or RECovered.

LOFFset is valid only when SOURce:CLOCk:SOURce is set to INTernal, BITS/E2MB, or RECovered. LOFFset does not apply when transmitting a tributary signal while using a RECovered clock source.

Errors and Events

None

Examples

```
SOURCE:CLOCK:OFFSET:MODE LOFFSET
```

Related Commands

SOURce:CLOCk:OFFSet:LVALue
SOURce:CLOCk:OFFSet:PVALue

SOURce:CLOCk:OFFSet:MODE?

This query returns the clock offset mode.

Syntax

```
SOURce:CLOCk:OFFSet:MODE?
```

SONET Response

<clock offset mode> (discrete)	description
LOFFset	Changes to LVALue are tracked in PVALue
POINters	Changes to PVALue are allowed

SDH Response

<clock offset mode> (discrete)	description
LOFFset	Changes to LVALue are tracked in PVALue
POINters	Changes to PVALue are allowed

Dependencies

None

Errors and Events

None

Examples Query: `SOURCE:CLOCK:OFFSET:MODE?`

Response: `LOFFSET`

Related Commands SOURce:CLOCk:OFFSet:MODE

SOURce:CLOCk:OFFSet:LVALue

This command selects the line clock offset value in ppm (parts per million).

Syntax `SOURce:CLOCk:OFFSet:LVALue <line clock offset>`

SONET Values

<line clock offset> (NR2-numeric)	description
SONET rates: –100 ppm to +100 ppm DS1 rate: –130 ppm to +130 ppm DS3 rate: –130 ppm to +130 ppm All ranges in increments of 0.1 ppm	The line clock offset is set to this value (default = 0)

SDH Values

<line clock offset> (NR2-numeric)	description
SDH rates: –100 ppm to +100 ppm 2 Mb/s rate: –50 ppm to +50 ppm 34 Mb/s rate: –130 ppm to +130 ppm 140 Mb/s rate: –100 ppm to +100 ppm All ranges in increments of 0.1 ppm	The line clock offset is set to this value (default = 0)

Dependencies This command applies only when SOURce:CLOCk:SOURce is set to INTernal or RECovered and SOURce:CLOCk:OFFSet:MODE is set to LOFFset.

Errors and Events 221, “Settings conflict; Frequency offset disabled with current transmit clock”

Examples `SOURCE:CLOCK:OFFSET:LVALUE 20`

Related Commands SOURce:CLOCk:OFFSet:MODE

SOURce:CLOCk:OFFSet:LVALue?

This query returns the value of the line clock offset in ppm (parts per million).

Syntax `SOURce:CLOCk:OFFSet:LVALue?`

SONET Response

<line clock offset> (NR2-numeric)	description
SONET rates: –100 ppm to +100 ppm DS1 rate: –130 ppm to +130 ppm DS3 rate: –130 ppm to +130 ppm All ranges in increments of 0.1 ppm	The line clock offset is set to this value (default = 0)

SDH Response

<line clock offset> (NR2-numeric)	description
SDH rates: –100 ppm to +100 ppm 2 Mb/s rate: –50 ppm to +50 ppm 34 Mb/s rate: –130 ppm to +130 ppm 140 Mb/s rate: –100 ppm to +100 ppm All ranges in increments of 0.1 ppm	The line clock offset is set to this value (default = 0)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:CLOCK:OFFSET:LVALUE?`

Response: `-10.1`

Related Commands SOURce:CLOCk:OFFSet:LVALue

SOURce:CLOCk:OFFSet:PVALue

This command selects the payload clock offset value in ppm (parts per million).

Syntax

```
SOURce:CLOCk:OFFSet:PVALue <payload clock offset>
```

SONET Values

<payload clock offset> (NR2-numeric)	description
Any decimal number in the range –100 ppm to +100 ppm in increments of 0.1 ppm	The payload clock offset is set to this value (default = 0)

SDH Values

<payload clock offset> (NR2-numeric)	description
Any decimal number in the range –100 ppm to +100 ppm in increments of 0.1 ppm	The payload clock offset is set to this value (default = 0)

Dependencies

This command is valid only when SOURce:CLOCk:OFFSet:MODE is set to POINters and when transmitting or receiving a SONET/SDH signal.

Errors and Events

None

Examples

```
SOURCE:CLOCK:OFFSET:PVALUE 20
```

Related Commands

SOURce:CLOCk:OFFSet:MODE

SOURce:CLOCk:OFFSet:PVALue?

This query returns the value of the payload clock offset in ppm (parts per million).

Syntax `SOURce:CLOCk:OFFSet:PVALue?`

SONET Response

<payload clock offset> (NR2-numeric)	description
Any decimal number in the range –100 ppm to +100 ppm in increments of 0.1 ppm	The payload clock offset is set to this value (default = 0)

SDH Response

<payload clock offset> (NR2-numeric)	description
Any decimal number in the range –100 ppm to +100 ppm in increments of 0.1 ppm	The payload clock offset is set to this value (default = 0)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:CLOCK:OFFSET:PVALUE?`

Response: 0

Related Commands SOURce:CLOCk:OFFSet:LVALue

SOURce:DATA:TELecom Subsystem

This section describes the commands and queries that set up the structure of the signal to be transmitted for both active and inactive channels. Figure 3–11 shows the hierarchy tree for this subsystem.

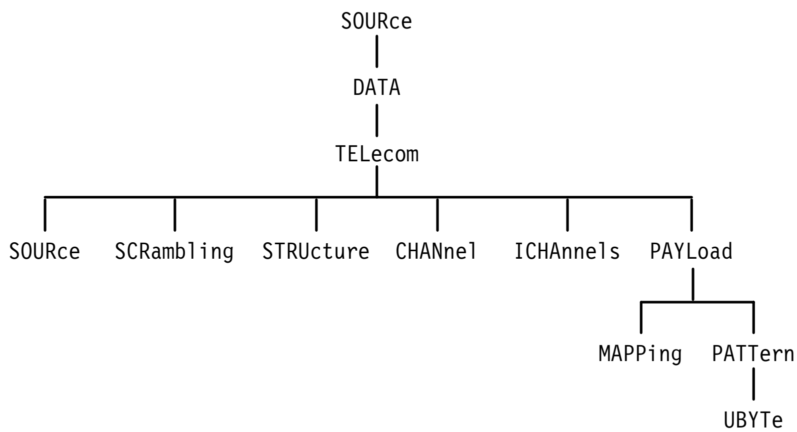


Figure 3–11: SOURce:DATA:TELecom subsystem

SOURce:DATA:TELecom:SOURce

This command selects the output signal source.

Syntax SOURce:DATA:TELecom:SOURce <source>

SONET Values

<source> (discrete)	description
OUTPUT1	All SONET rates; normal mode (default)
OUTPUT2	DS1 tributary signal (Add/Drop/Test Option Only)
OUTPUT3	DS3 tributary signal (Add/Drop/Test Option Only)
INPUT1	Through mode

SDH Values

<source> (discrete)	description
OUTPUT1	All SDH rates; normal mode (default)
OUTPUT2	2 Mb/s tributary signal (Add/Drop/Test Option Only)
OUTPUT3	34 Mb/s or 140 Mb/s tributary signal (Add/Drop/Test Option Only)
INPUT1	Through mode

Dependencies None

Errors and Events 221, "Settings conflict; Not available without tributary option"

Examples `SOURCE:DATA:TELECOM:SOURCE OUTPUT1`

Related Commands OUTPUT1:TELecom:RATE

SOURce:DATA:TELecom:SOURce?

This query returns the current setting of the output signal source.

Syntax `SOURce:DATA:TELecom:SOURce?`

SONET Response

<source> (discrete)	description
OUTPUT1	All SONET rates; normal mode (default)
OUTPUT2	DS1 tributary signal (Add/Drop/Test Option Only)
OUTPUT3	DS3 tributary signal (Add/Drop/Test Option Only)
INPUT1	Through mode

SDH Response

<source> (discrete)	description
OUTPUT1	All SDH rates; normal mode (default)
OUTPUT2	2 Mb/s tributary signal (Add/Drop/Test Option Only)
OUTPUT3	34 Mb/s or 140 Mb/s tributary signal (Add/Drop/Test Option Only)
INPUT1	Through mode

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:SOURCE?`

Response: `OUTPUT1`

Related Commands SOURce:DATA:TELecom:SOURce

SOURce:DATA:TELecom:SCRambling

This command enables output signal scrambling.

Syntax `SOURce:DATA:TELecom:SCRambling <output scrambling>`

SONET Values

<output scrambling> (boolean)	description
ON or 1	Output signal scrambled (default)
OFF or 0	Output signal not scrambled

SDH Values

<output scrambling> (boolean)	description
ON or 1	Output signal scrambled (default)
OFF or 0	Output signal not scrambled

Dependencies None

Errors and Events None

Examples `SOURCE:DATA:TELECOM:SCRAMBLING ON`

Related Commands None

SOURce:DATA:TELecom:SCRambling?

This query returns the current setting of output signal scrambling.

Syntax `SOURce:DATA:TELecom:SCRambling?`

SONET Response

<output scrambling> (boolean)	description
1	Output signal scrambled (default)
0	Output signal not scrambled

SDH Response

<output scrambling> (boolean)	description
1	Output signal scrambled (default)
0	Output signal not scrambled

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:SCRAMBLING?`

Response: `0`

Related Commands SOURce:DATA:TELecom:SCRambling

SOURce:DATA:TELecom:STRUcture

This command selects the structure of a signal.

Syntax `SOURce:DATA:TELecom:STRUcture <output structure>`

SONET Values

<output structure>(discrete)	description
STS1	STS-1 structure (default)
STS3C	STS-3c structure

SDH Values

<output structure>(discrete)	description
AU4	AU-4 structure (default)
AU3	AU-3 structure

Dependencies SOURce:DATA:TELecom:STRUcture STS3C is not valid at an STS-1 rate.

Errors and Events None

Examples `SOURCE:DATA:TELECOM:STRUCTURE STS1`

Related Commands OUTPUT1:TELecom:RATE

SOURce:DATA:TELecom:STRUcture?

This query returns the selected rate structure.

Syntax `SOURce:DATA:TELecom:STRUcture?`

SONET Response

<output structure>(discrete)	description
STS1	STS-1 structure (default)
STS3C	STS-3c structure

SDH Response

<output structure>(discrete)	description
AU4	AU-4 structure (default)
AU3	AU-3 structure

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:STRUCTURE?`

Response: `STS1`

Related Commands SOURce:DATA:TELecom:STRUcture

SOURce:DATA:TELecom:CHANnel

This command selects the active channel. For example, a SONET STS-3 signal can have three STS-1 signals multiplexed into it. This command allows you to choose which of the three to test.

Syntax `SOURce:DATA:TELecom:CHANnel <channel>`

SONET Values

<channel> (NR1-numeric)	description
1	STS-1 rate or STS-3 rate with STS-3c structure (default)
1 to 3	STS-3 rate with STS-1 structure
1 to 4	STS-12 rate with STS-3c structure
1 to 12	STS-12 rate with STS-1 structure

SDH Values

<channel> (NR1-numeric)	description
1	STM-1 rate (default)
1 to 4	STM-4 rate

Dependencies OUTPUT1:TELecom:RATE must be set to STS3 or STS12 (SONET) or STM4 (SDH) if you choose a channel value greater than one.

Errors and Events 221, “Settings conflict; Only one channel is available”

500, “Execution warning; Numeric value greater than maximum limit”

Examples `SOURCE:DATA:TELECOM:CHANNEL 1`

Related Commands OUTPUT1:TELecom:RATE
SOURce:DATA:TELecom:STRUcture

SOURce:DATA:TELecom:CHANnel?

This query returns the selected active channel.

Syntax `SOURce:DATA:TELecom:CHANnel?`

SONET Response

<channel> (NR1-numeric)	description
1	STS-1 rate or STS-3 rate with STS-3c structure (default)
1 to 3	STS-3 rate with STS-1 structure
1 to 4	STS-12 rate with STS-3c structure
1 to 12	STS-12 rate with STS-1 structure

SDH Response

<channel> (NR1-numeric)	description
1	STM-1 rate (default)
1 to 4	STM-4 rate

Dependencies None

Errors and Events None

Examples

Query: `SOURCE:DATA:TELECOM:CHANNEL?`

Response: 1

Related Commands

SOURce:DATA:TELecom:CHANnel

SOURce:DATA:TELecom:ICHannels

This command selects the payload pattern of the inactive channels.

Syntax

`SOURce:DATA:TELecom:ICHannels <inactive channel>,<pattern>`

SONET Values

<inactive channel> (NR1-numeric)	description
1 to 3	STS-1 rate or STS-3 rate with STS-3c structure (default)
1 to 12	STS-12 rate and STS-1 structure
1 to 4	STS-12 rate and STS-3c structure
<pattern> (NR1-numeric)[1]	**description**
A number in the range 0 to 255 (hexadecimal 00 to FF)	The inactive channel is filled with this pattern; the C2 byte is set to 0

1 **A hexadecimal value is also acceptable.**

SDH Values

<inactive channel> (NR1-numeric)	description
1 to 4	STM-4 rate (default)
<pattern> (NR1-numeric)[1]	**description**
A number in the range 0 to 255 (hexadecimal 00 to FF)	The inactive channel is filled with this pattern; the C2 byte is set to 0

1 **A hexadecimal value is also acceptable.**

Dependencies

The rate must be greater than STS-1 or STM-1 (two or more channels are multiplexed together).

Errors and Events

None

Examples `SOURCE:DATA:TELECOM:ICHANNELS 1,#HAA`

Related Commands None

SOURce:DATA:TELecom:ICHannels?

This query returns the payload pattern of the selected inactive channel.

Syntax `SOURce:DATA:TELecom:ICHannels? <inactive channel>`

SONET Values

<inactive channel> (NR1-numeric)	description
1 to 3	STS-1 rate or STS-3 rate with STS-3c structure (default)
1 to 12	STS-12 rate and STS-1 structure
1 to 4	STS-12 rate and STS-3c structure

SONET Response

<pattern> (NR1-numeric)[1]	description
A number in the range 0 to 255 (hexadecimal 00 to FF)	The inactive channel is filled with this pattern; the C2 byte is set to 0

[1] **A hexadecimal value is also acceptable.**

SDH Values

<inactive channel> (NR1-numeric)	description
1 to 4	STM-4 rate (default)

SDH Response

<pattern> (NR1-numeric)[1]	description
A number in the range 0 to 255 (hexadecimal 00 to FF)	The inactive channel is filled with this pattern; the C2 byte is set to 0

[1] **A hexadecimal value is also acceptable.**

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:ICHANNELS? 1`

Response: 5

Related Commands SOURce:DATA:TELecom:ICHannels

SOURce:DATA:TELecom:PAYLoad:MAPPing

This command selects the payload mapping. The parameter changes the value in the C2 byte and fills the STS/AU with the pattern selected by the SOURce:DATA:TELecom:PAYLoad:PATTern command. Or, the STS/AU can be filled with a tributary payload.

Syntax `SOURce:DATA:TELecom:PAYLoad:MAPPing <mapping>`

SONET Values

<mapping> (discrete)	description
EQUipped	C2 Path Overhead byte set to 01 (default)
UNEQuipped	C2 Path Overhead byte set to 00
CUSTom	Custom payload frame data
TRIButary	Allows tributary payload mapping (Add/Drop/Test Option Only)

SDH Values

<mapping> (discrete)	description
EQUipped	C2 Path Overhead byte set to 01 (default)
UNEQuipped	C2 Path Overhead byte set to 00
CUSTom	Custom payload frame data
TRIButary	Allows tributary payload mapping (Add/Drop/Test Option Only)

Dependencies Select EQUipped or UNEQuipped to use the SOURce:DATA:PAYLoad:PATTern command.

Errors and Events 221, "Settings conflict; Not available without tributary option"

Examples `SOURCE:DATA:TELECOM:PAYLOAD:MAPPING EQUIPPED`

Related Commands None

SOURce:DATA:TELecom:PAYLoad:MAPPing?

This query returns the current setting of the payload mapping.

Syntax `SOURce:DATA:TELecom:PAYLOAD:MAPPing?`

SONET Response

<mapping> (discrete)	description
EQUipped	C2 Path Overhead byte set to 01 (default)
UNEQuipped	C2 Path Overhead byte set to 00
CUSTom	Custom payload frame data
TRIButary	Allows tributary payload mapping (Add/Drop/Test Option Only)

SDH Response

<mapping> (discrete)	description
EQUipped	C2 Path Overhead byte set to 01 (default)
UNEQuipped	C2 Path Overhead byte set to 00
CUSTom	Custom payload frame data
TRIButary	Allows tributary payload mapping (Add/Drop/Test Option Only)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:PAYLOAD:MAPPING?`

Response: `EQUIPPED`

Related Commands SOURce:DATA:TELecom:PAYLoad:MAPPing

SOURce:DATA:TELecom:PAYLoad:PATTern

This command selects the test pattern to be placed in the payload of the active channel. For information on generating custom patterns, refer to page 3–116.

Syntax `SOURce:DATA:TELecom:PAYLoad:PATTern <pattern>`

SONET Values

<pattern> (discrete)	description
PRBS23	A pseudo-random binary sequence of length 2^{23}–1 is placed in the payload (default)
PRBS9	A pseudo-random binary sequence of length 2^{9}–1 is placed in the payload
PRBS15	A pseudo-random binary sequence of length 2^{15}–1 is placed in the payload
PRBS20	A pseudo-random binary sequence of length 2^{20}–1 is placed in the payload
AZEROs	All zeros are placed in the payload
AONEs	All ones are placed in the payload
UBYTe	A user-defined byte is placed in the payload

SDH Values

<pattern> (discrete)	description
PRBS23	A pseudo-random binary sequence of length 2^{23}–1 is placed in the payload (default)
PRBS9	A pseudo-random binary sequence of length 2^{9}–1 is placed in the payload
PRBS15	A pseudo-random binary sequence of length 2^{15}–1 is placed in the payload
PRBS20	A pseudo-random binary sequence of length 2^{20}–1 is placed in the payload
AZEROs	All zeros are placed in the payload
AONEs	All ones are placed in the payload
UBYTe	A user-defined byte is placed in the payload

Dependencies None

Errors and Events None

Examples `SOURCE:DATA:TELECOM:PAYLOAD:PATTERN PRBS23`

Related Commands SOURce:DATA:TELecom:PAYLoad
SOURce:DATA:TELecom:PAYLoad:PATTern:UBYTe

SOURce:DATA:TELecom:PAYLoad:PATTern?

This query returns the current test pattern for the active channel payload.

Syntax `SOURce:DATA:TELecom:PAYLoad:PATTern?`

SONET Response

<pattern> (discrete)	description
PRBS23	A pseudo-random binary sequence of length 2^{23}–1 is in the payload (default)
PRBS9	A pseudo-random binary sequence of length 2^{9}–1 is in the payload
PRBS15	A pseudo-random binary sequence of length 2^{15}–1 is in the payload
PRBS20	A pseudo-random binary sequence of length 2^{20}–1 is in the payload
AZEROs	All zeros are in the payload
AONEs	All ones are in the payload
UBYTe	A user-defined byte is in the payload

SDH Response

<pattern> (discrete)	description
PRBS23	A pseudo-random binary sequence of length 2^{23}–1 is in the payload (default)
PRBS9	A pseudo-random binary sequence of length 2^{9}–1 is in the payload
PRBS15	A pseudo-random binary sequence of length 2^{15}–1 is in the payload
PRBS20	A pseudo-random binary sequence of length 2^{20}–1 is in the payload

<pattern> (discrete)	description
AZEROs	All zeros are in the payload
AONEs	All ones are in the payload
UBYTe	A user-defined byte is in the payload

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:PAYLOAD:PATTERN?`

Response: `PRBS23`

Related Commands SOURce:DATA:TELecom:PAYLoad:PATTern

SOURce:DATA:TELecom:PAYLoad:PATTern:UBYTe

This command selects the internally generated payload fixed pattern.

Syntax `SOURce:DATA:TELecom:PAYLoad:PATTern:UBYTe <fixed pattern>`

SONET Values

<fixed pattern> (NR1-numeric)[1]	description
Any integer in the range 0 to 255 (hexadecimal 00 to FF)	The payload pattern is set to this value (default = 0)

1 **A hexadecimal value is also acceptable.**

SDH Values

<fixed pattern> (NR1-numeric)[1]	description
Any integer in the range 0 to 255 (hexadecimal 00 to FF)	The payload pattern is set to this value (default = 0)

1 **A hexadecimal value is also acceptable.**

Dependencies SOURce:DATA:TELecom:PAYLoad:PATTern must be set to UBYTE for this command to apply.

Errors and Events None

Examples `SOURCE:DATA:TELECOM:PAYLOAD:PATTERN:UBYTE 104`

Related Commands SOURce:DATA:TELecom:PAYLoad:PATTern

SOURce:DATA:TELecom:PAYLoad:PATTern:UBYTe?

This query returns the current setting of the internally generated payload fixed pattern.

Syntax `SOURce:DATA:TELecom:PAYLoad:PATTern:UBYTe?`

SONET Response

<fixed pattern> (NR1-numeric)	description
Any integer in the range 0 to 255	The current setting of the payload (default = 00)

SDH Response

<fixed pattern> (NR1-numeric)	description
Any integer in the range 0 to 255	The current setting of the payload (default = 00)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:PAYLOAD:PATTERN:UBYTE?`

Response: `123`

Related Commands SOURce:DATA:TELecom:PAYLoad:PATTern:UBYTe

SOURce:DATA:TELecom:OVERhead and POVerhead Subsystem

This section describes the commands and queries that set up the transport overhead and path overhead. Figure 3–12 shows the hierarchy tree for this subsystem.

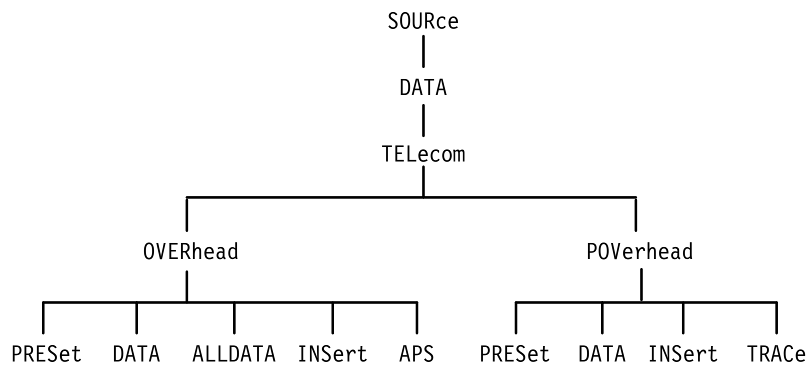


Figure 3–12: SOURce:DATA:TELecom:OVERhead and POVerhead subsystem

Figures 3–14 and 3–15 list the bytes in the Transport and Path Overhead and the value of each byte after a *RST command is sent or a rate change occurs. As shown in Figure 3–13, each box can contain as many as three numbers: the overhead byte name in the upper left corner, the hexadecimal value of the byte at the bottom, and a circled number in the upper right corner. More information about these circled numbers is shown in the legend. General information is listed below the table in Notes.

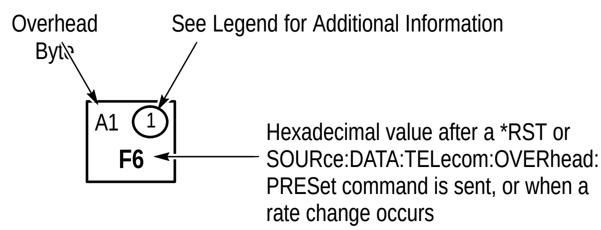


Figure 3–13: How to read the overhead default values table

STS-1 transport overhead

A1 **F6**	A2 **28**	C1 1 **01**
B1 2 **HW**	E1 **00**	F1 **00**
D1 **00**	D2 **00**	D3 **00**
H1 3 **HW**	H2 3 **HW**	H3 **HW**
B2 **HW**	K1 **00**	K2 **00**
D4 **00**	D5 **00**	D6 **00**
D7 **00**	D8 **00**	D9 **00**
D10 **00**	D11 **00**	D12 **00**
Z1 **00**	Z2 **00**	E2 **00**

Path overhead

J1 4 **00**
B3 **HW**
C2 5 **00**
G1 **HW**
F2 **00**
H4 **HW**
Z3 **00**
Z4 **00**
Z5 **00**

Legend

1 See Bellcore Specification TR-NWT-000253 for a description.

2 Only the B1 byte in the first STS-1 channel will be set by the hardware; the rest will be set to 0.

3 Default pointer value for H1 and H2 is hexadecimal 20A.
The s-bits of H1 are set to 00. The n-bits of H1 are set to 0110.
The default for H1 is 01100010.
The default for H2 is 00001010.

4 The default for J1 is 64 nulls.

5 The C2 value is set by mapping.

Notes

- All values are in hexadecimal.
- “HW” indicates that the hexadecimal value is determined dynamically by the hardware.
- For multiplexed signals, all bytes except B1, C1, and, possibly, Z2 are duplicated.
- Only one path overhead exists for all SONET rates.
- When a rate change occurs, the overhead will be reset to the above default values.

Figure 3–14: SONET STS-1 overhead default values

STS-3c and STM-1 transport overhead

	A1 **F6**	A1 **F6**	A1 **F6**	A2 **28**	A2 **28**	A2 **28**	C1 1 **01**	NU **00**	NU **00**
	B1 **HW**	– **00**	– **00**	E1 **00**	– **00**	– **00**	F1 **00**	NU **00**	NU **00**
	D1 **00**	– **00**	– **00**	D2 **00**	– **00**	– **00**	D3 **00**	– **00**	– **00**
	H1 2 **HW**	H1 **93**	H1 **93**	H2 2 **HW**	H2 **FF**	H2 **FF**	H3 **HW**	H3 **HW**	H3 **HW**
	B2 **HW**	B2 **HW**	B2 **HW**	K1 **00**	– **00**	– **00**	K2 **00**	– **00**	– **00**
	D4 **00**	– **00**	– **00**	D5 **00**	– **00**	– **00**	D6 **00**	– **00**	– **00**
	D7 **00**	– **00**	– **00**	D8 **00**	– **00**	– **00**	D9 **00**	– **00**	– **00**
	D10 **00**	– **00**	– **00**	D11 **00**	– **00**	– **00**	D12 **00**	– **00**	– **00**
	Z1 **00**	Z1 **00**	Z1 **00**	Z2 **00**	Z2 **00**	Z2 3 **00**	E2 **00**	NU **00**	NU **00**
Offset Value	0	1	2	0	1	2	0	1	2

Path overhead

J1 4 **00**
B3 **HW**
C2 5 **00**
G1 **HW**
F2 **00**
H4 **HW**
Z3 **00**
Z4 **00**
Z5 **00**

Legend

1. C1 in STM-4 indicates the order of appearance of the STM-1 within the STM-4 frame. (SDH only)
2. Default pointer value for H1 and H2 is hexadecimal 20A.
   The s-bits of H1 are set to 10. The n-bits of H1 are set to 0110.
   The default for H1 is 01101010.
   The default for H2 is 00001010.
3. The third Z2 of an STS-3c or STM-1can be set by hardware Line FEBE (determined by error rate and type).
4. The default for J1 is 64 nulls.
5. The C2 value is set by mapping.

Notes

- All values are in hexadecimal.
- "NU" indicates a National Use Byte.
- "–" indicates an unnamed byte.
- "HW" indicates that the hexadecimal value is determined dynamically by the hardware.
- The offset value at the bottom of each column is used with the SOURce:DATA:TELecom:OVERhead:DATA and SENSe:DATA:TELecom:OVERhead:DATA commands (concatenated structures only).
- For multiplexed signals, all bytes except B1, C1, and possibly Z2 are duplicated.
- Only one path overhead exists for all SDH rates.
- When a rate change occurs, the overhead will be reset to the above default values.

Figure 3–15: SONET STS-3c and SDH Overhead default values

SOURce:DATA:TELecom:OVERhead:PRESet

This command resets the entire overhead to the default (see Figures 3–14 and 3–15 on pages 3–54 and 3–55 for the default values).

Syntax `SOURce:DATA:TELecom:OVERhead:PRESet`

SONET Values None

SDH Values None

Dependencies None

Errors and Events None

Examples `SOURCE:DATA:TELECOM:OVERHEAD:PRESET`

Related Commands SOURce:DATA:TELecom:OVERhead:DATA

SOURce:DATA:TELecom:OVERhead:DATA

This command sets the bytes in the transport overhead. Bytes B1, B2, B3, H1, H2, and H3 are not accessible because they are controlled directly by the hardware.

Use the <offset> parameter to set unnamed or ambiguous bytes in concatenated structures (STS-3c and STM-1). See Figure 3–15 for the offset values.

Syntax

```
SOURce:DATA:TELecom:OVERhead:DATA <channel>,<byte>,<offset>,
<value>
```

SONET Values

<channel> (NR1-numeric)	description
1	Rate is STS-1 or STS-3 rate with STS-3c structure
1 to 3	Rate is STS-3 with STS-1 structure
1 to 4	Rate is STS-12 with STS-3c structure
1 to 12	Rate is STS-12 with STS-1 structure

<byte> (discrete)	description
A1, A2, C1, E1, F1, D1, D2, D3, K1, K2, D4, D5, D6, D7, D8, D9, D10, D11, D12, S1/Z1, M1/Z2, E2	Only the bytes listed are available for selection
<offset> (NR1-numeric)	**description**
0	STS-1 structure
0 to 2	STS-3c structure
<value> (NR1-numeric)[2]	**description**
Any integer in the range 0 to 255 (hexadecimal 00 to FF)	The byte is set to this value

[2] **A hexadecimal value is also acceptable.**

SDH Values

<channel> (NR1-numeric)	description
1	Rate is STM-1
1 to 4	Rate is STM-4
<byte> (discrete)	**description**
A1, A2, C1, E1, F1, D1, D2, D3, K1, K2, D4, D5, D6, D7, D8, D9, D10, D11, D12, S1, M1, E2	Only the bytes listed are available for selection
<offset> (NR1-numeric)	**description**
0 to 2	All SDH rates
<value> (NR1-numeric)[1]	**description**
Any integer in the range 0 to 255 (hexadecimal 00 to FF)	The byte is set to this value

[1] **A hexadecimal value is also acceptable.**

Dependencies

None

Errors and Events

None

Examples

```
SOURCE:DATA:TELECOM:OVERHEAD:DATA 1,D3,2,#HAA    SONET
```

Sets the D3 byte in the first overhead of an STS-12 signal to hexadecimal AA.

```
SOURCE:DATA:TELECOM:OVERHEAD:DATA 4,D5,2,#H55    SDH
```

Sets the D5 byte in the fourth overhead of an STM-4 signal to hexadecimal 55.

Related Commands

None

SOURce:DATA:TELecom:OVERhead:DATA?

This query returns the value in the specified overhead byte from the transport overhead memory. You cannot set bytes B1, B2, B3, H1, H2, and H3 because they are controlled directly by the hardware.

Use <channel>, <byte>, and <offset> to address all named and unnamed bytes in the concatened structures.

***NOTE**. The SDH standard specifies three Section Overhead bytes per STM frame, which makes the addressing of the overhead bytes in SDH different from SONET.*

Syntax

```
SOURce:DATA:TELecom:OVERhead:DATA? <channel>,<byte>,<offset>
```

SONET Values

<channel> (NR1-numeric)	description
1	Rate is STS-1 or STS-3 rate with STS-3c structure
1 to 3	Rate is STS-3 with STS-1 structure
1 to 4	Rate is STS-12 with STS-3c structure
1 to 12	Rate is STS-12 with STS-1 structure
<byte>(discrete)	**description**
A1, A2, C1, E1, F1, D1, D2, D3, K1, K2, D4, D5, D6, D7, D8, D9, D10, D11, D12, S1/Z1, M1/Z2, E2	Only the bytes listed are available for selection no M0
<offset>(NR1-numeric)	**description**
0	STS-1 structure
0 to 2	STS-3c structure

SONET Response

<value> (NR1-numeric)	description
Any integer in the range 0 to 255	The byte is set to this value

SDH Values

<channel> (NR1-numeric)	description
1	Rate is STM-1
1 to 4	Rate is STM-4
<byte>(discrete)	**description**
A1, A2, C1, E1, F1, D1, D2, D3, K1, K2, D4, D5, D6, D7, D8, D9, D10, D11, D12, S1, M1, E2	Only the bytes listed are available for selection
<offset>(NR1-numeric)	**description**
0 to 2	All SDH rates

SDH Response

<value> (NR1-numeric)	description
Any integer in the range 0 to 255	The byte is set to this value

Dependencies None

Errors and Events None

Examples

Query: `SOURCE:DATA:TELECOM:OVERHEAD:DATA? 1,C1,0`

Response: `255`

Related Commands SOURce:DATA:TELecom:OVERhead:DATA

SOURce:DATA:TELecom:OVERhead:ALLData

This command allows 22 overhead bytes to be set at one time.

Syntax

```
SOURce:DATA:TELecom:OVERhead:ALLDATA <channel>,<offset>,<A1>,
<A2>,<C1>,<E1>,<F1>,<D1>,<D2>,<D3>,<K1>,<K2>,<D4>,<D5>,<D6>,<D7>,
<D8>,<D9>,<D10>,<D11>,<D12>,<S1/Z1>,<M1/Z2>,<E2>
```

SONET Values

<channel> (NR1-numeric)	**description**
Any integer in the range 1 to 12	This value indicates the desired channel setting
<offset> (NR1-numeric)	**description**
Any integer in the range 0 to 2	This value indicates the desired offset
<A1>,<A2>,<C1>,<E1>,<F1>,<D1>,<D2>, <D3>,<K1>,<K2>,<D4>,<D5>,<D6>,<D7>, <D8>,<D9>,<D10>,<D11>,<D12>,<S1/Z1>, <M1/Z2>,<E2> (NR1-numeric)[1]	**description**
Any integer in the range 0 to 255 for each parameter (hexadecimal 00 to FF)	These values indicate the desired setting for each overhead byte

1 **A hexadecimal value is also acceptable.**

SDH Values

<channel> (NR1-numeric)	**description**
Any integer in the range 1 to 12	This value indicates the desired channel setting
<offset> (NR1-numeric)	**description**
Any integer in the range 0 to 2	This value indicates the desired offset
<A1>,<A2>,<C1>,<E1>,<F1>,<D1>,<D2>, <D3>,<K1>,<K2>,<D4>,<D5>,<D6>,<D7>, <D8>,<D9>,<D10>,<D11>,<D12>,<S1>, <M1>,<E2> (NR1-numeric)[1]	**description**
Any integer in the range 0 to 255 for each parameter (hexadecimal 00 to FF)	These values indicate the desired setting for each overhead byte

1 **A hexadecimal value is also acceptable.**

Dependencies

<channel> and <offset> must be compatible with the current rate and structure settings.

Errors and Events

221, “Settings conflict; Parameter out of range”

Examples

```
SOURCE:DATA:TELECOM:OVER:ALLDATA 1,0,92,123,1,0,23,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0
```

This example sets the A1 byte to 92, the A2 byte to 123, the C1 byte to 1, the F1 byte to 23, and the rest of the bytes to 0 for channel 1.

Related Commands

SOURce:DATA:TELecom:OVERhead:DATA

SOURce:DATA:TELecom:OVERhead:ALLData?

This query returns overhead data in a command form that can be used to set the available overhead bytes. One command with 24 parameters will be produced. The first two parameters indicate channel and offset. The remaining 22 parameters are the data values for the overhead bytes in decimal number form.

Syntax

```
SOURce:DATA:TELecom:OVERhead:ALLData? <channel>,<offset>
```

SONET Values

<channel> (NR1-numeric)	description
Any integer in the range 1 to 12	This value indicates the desired channel setting
<offset> (NR1-numeric)	**description**
Any integer in the range 0 to 2	This value indicates the desired offset

SONET Response

<A1>,<A2>,<C1>,<E1>,<F1>,<D1>,<D2>, <D3>,<K1>,<K2>,<D4>,<D5>,<D6>,<D7>, <D8>,<D9>,<D10>,<D11>,<D12>,<S1/Z1>, <M1/Z2>,<E2><22 overhead byte values> (NR1-numeric)	description
Any integer in the range 0 to 255 for each parameter	These values indicate the desired setting for each overhead byte

SDH Values

<channel> (NR1-numeric)	description
Any integer in the range 1 to 12	This value indicates the desired channel setting
<offset> (NR1-numeric)	**description**
Any integer in the range 0 to 2	This value indicates the desired offset

SDH Response

<A1>,<A2>,<C1>,<E1>,<F1>,<D1>,<D2>, <D3>,<K1>,<K2>,<D4>,<D5>,<D6>,<D7>, <D8>,<D9>,<D10>,<D11>,<D12>,<S1>, <M1>,<E2><22 overhead byte values> (NR1-numeric)	description
Any integer in the range 0 to 255 for each parameter	These values indicate the desired setting for each overhead byte

Dependencies None

Errors and Events 118, "Query not allowed"

Examples

Query: `SOURCE:DATA:TELECOM:OVERHEAD:ALLDATA? 1,0`

Response: `SOURCE:DATA:TELECOM:OVERHEAD:ALLDATA 1, 0, 92,123, 1, 0, 23, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0`

Related Commands SOURce:DATA:TELecom:OVERhead:ALLDATA

SOURce:DATA:TELecom:OVERhead:INSert

This command controls the insertion of data into the overhead from an external protocol analyzer into the specific overhead bytes.

Syntax `SOURce:DATA:TELecom:OVERhead:INSert <insert>`

SONET Values

<insert> (discrete)	description
NONE	Off (default)
SDCC	Section DCC
LDCC	Line DCC
F1	F1 byte

SDH Values

<insert> (discrete)	description
NONE	Off (default)
SDCC	RS DCC

<insert> (discrete)	description
LDCC	MS DCC
F1	F1 byte

Dependencies

You can insert data into the overhead or the path overhead by using the SOURce:DATA:TELecom:OVERhead:INSert and SOURce:DATA:TELecom:POVerhead:INSert commands. The last command sent applies.

Errors and Events

None

Examples

`SOURCE:DATA:TELECOM:OVERHEAD:INSERT SDCC`

Related Commands

None

SOURce:DATA:TELecom:OVERhead:INSert?

This query returns the channel being inserted into the overhead from an external protocol analyzer.

Syntax

`SOURce:DATA:TELecom:OVERhead:INSert?`

SONET Response

<insert> (discrete)	description
NONE	Off (default)
SDCC	Section DCC
LDCC	Line DCC
F1	F1 byte

SDH Response

<insert> (discrete)	description
NONE	Off (default)
SDCC	RS DCC
LDCC	MS DCC
F1	F1 byte

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:OVERHEAD:INSERT?`

Response: `F1`

Related Commands SOURce:DATA:TELecom:OVERhead:INSert

SOURce:DATA:TELecom:OVERhead:APS

This command simultaneously sets the K1 and K2 bytes in the same frame. Use the SENSe:DATA:TELecom:OVERhead:DATA? query to find out the value of the K1 and K2 bytes in the received signal.

Syntax `SOURce:DATA:TELecom:OVERhead:APS <APS value>`

SONET Values

<APS value> (NR1-numeric)[1]	description
Any integer in the range 0 to 65535 (hexadecimal 0 to FFFF)	The 16-bit value of the K1 and K2 APS bytes

[1] **A hexadecimal value is also acceptable.**

SDH Values

<APS value> (NR1-numeric)[1]	description
Any integer in the range 0 to 65535 (hexadecimal 0 to FFFF)	The 16-bit value of the K1 and K2 MSP bytes

[1] **A hexadecimal value is also acceptable.**

Dependencies None

Errors and Events None

Examples

SOURCE:DATA:TELECOM:OVERHEAD:APS #HFFFF

This example sets both K1 and K2 bytes to the maximum value (binary 1111111111111111).

SOURCE:DATA:TELECOM:OVERHEAD:APS #HFF00

This example sets the K1 byte to the maximum value (binary 11111111) and the K2 byte to 0 (binary 00000000).

Related Commands

None

SOURce:DATA:TELecom:OVERhead:APS?

This query returns the 16-bit value of the K1 and K2 bytes.

Syntax

SOURce:DATA:TELecom:OVERhead:APS?

SONET Response

<APS value> (NR1-numeric)	description
Any integer in the range 0 to 65535	The 16-bit value of the K1 and K2 APS bytes

SDH Response

<APS value> (NR1-numeric)	description
Any integer in the range 0 to 65535	The 16-bit value of the K1 and K2 MSP bytes

Dependencies

None

Errors and Events

None

Examples

Query: SOURCE:DATA:TELECOM:OVERHEAD:APS?

Response: 65535

Related Commands

None

SOURce:DATA:TELecom:POVerhead:PRESet

This command resets the path overhead to the default (see Tables 3–14 and 3–15 on pages 3–54 and 3–55 for the default values).

Syntax `SOURce:DATA:TELecom:POVerhead:PRESet`

SONET Values None

SDH Values None

Dependencies None

Errors and Events None

Examples `SOURCE:DATA:TELECOM:POVERHEAD:PRESET`

Related Commands SOURce:DATA:TELecom:POVerhead:DATA

SOURce:DATA:TELecom:POVerhead:DATA

This command sets the bytes in the path overhead.

Syntax `SOURce:DATA:TELecom:POVerhead:DATA <byte>,<value>`

SONET Values

<byte> (discrete)	description
C2, F2, Z3, Z4, Z5	Only the bytes listed are available for selection[1]
<value> (NR1-numeric)[2]	**description**
Any integer in the range 0 to 255 (hexadecimal 00 to FF)	The selected byte is set to this value

[1] **The J1 path trace overhead byte is controlled through the SOURce:DATA:TELecom:POVerhead:TRACe command.**

[2] **A hexadecimal value is also acceptable.**

SDH Values

<byte> (discrete)	description
C2, F2, F3, K3, N1	Only the bytes listed are available for selection[1]
<value> (NR1-numeric)[2]	**description**
Any integer in the range 0 to 255 (hexadecimal 00 to FF)	The selected byte is set to this value

[1] **The J1 path trace overhead byte is controlled through the SOURce:DATA:TELecom:POVerhead:TRACe command.**

[2] **A hexadecimal value is also acceptable.**

Dependencies

This command is ignored if SOURce:DATA:TELecom:POVerhead:INSert is set to F2.

Errors and Events

None

Examples

`SOURCE:DATA:TELECOM:POVERHEAD:DATA D1,#H55`

Related Commands

SOURce:DATA:TELecom:POVerhead:TRACe
SOURce:DATA:TELecom:PAYLoad:MAPPing (sets the C2 byte)

SOURce:DATA:TELecom:POVerhead:DATA?

This query returns the value in the specified path overhead bytes.

Syntax

`SOURce:DATA:TELecom:POVerhead:DATA? <byte>`

SONET Values

<byte> (discrete)	description
C2, F2, G1, Z3, Z4, Z5	Only the bytes listed to available for selection

SONET Response

<value> (NR1-numeric)	description
Any integer in the range 0 to 255	The selected byte is set to this value

SDH Values

<byte> (discrete)	description
C2, F2, G1, F3, K3, N1	Only the bytes listed are available for selection

SDH Response

<value> (NR1-numeric)	description
Any integer in the range 0 to 255	The selected byte is set to this value

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:POVERHEAD:DATA? C2`

Response: `255`

Related Commands SOURce:DATA:TELecom:POVerhead:DATA

SOURce:DATA:TELecom:POVerhead:INSert

This command controls the insertion of data into the path overhead from an external protocol analyzer into the specific overhead bytes.

Syntax `SOURce:DATA:TELecom:POVerhead:INSert <path insert>`

SONET Values

<path insert>(discrete)	description
NONE	Off
F2	F2 byte

SDH Values

<path insert>(discrete)	description
NONE	Off
F2	F2 byte

Dependencies You can insert data into the overhead or the path overhead by using the SOURce:DATA:TELecom:OVERhead:INSert and SOURce:DATA:TELecom:POVerhead:INSert commands. The last command sent applies.

Errors and Events None

Examples `SOURCE:DATA:TELECOM:POVERHEAD:INSERT F2`

Related Commands None

SOURce:DATA:TELecom:POVerhead:INSert?

This query returns the channel being inserted into the path overhead from an external protocol analyzer.

Syntax `SOURce:DATA:TELecom:POVerhead:INSert?`

SONET Response

<path insert>(discrete)	description
NONE	Off
F2	F2 byte

SDH Response

<path insert>(discrete)	description
NONE	Off
F2	F2 byte

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:POVERHEAD:INSERT?`

Response: `F2`

Related Commands SOURce:DATA:TELecom:POVerhead:INSert

SOURce:DATA:TELecom:POVerhead:TRACe

This command sets the path trace overhead bytes that appear in J1 as a repeating 64-byte sequence. The string must not exceed 64 ASCII characters in length. Unprintable characters will be accepted and inserted directly.

Syntax

```
SOURce:DATA:TELecom:POVerhead:TRACe <path trace>
```

SONET Values

<path trace> (string)	description
Length is a maximum of 64 bytes; if length is less than 64 bytes, the buffer is padded with nulls to a length of 64 bytes; the string will be terminated with a CR/LF (carriage return/line feed)	The J1 byte is set to this value (default is 64 null characters)

SDH Values

<path trace> (string)	description
Length is a maximum of 64 bytes; if length is less than 64 bytes, the buffer is padded with nulls to a length of 64 bytes; the string will be terminated with a CR/LF (carriage return/line feed)	The J1 byte is set to this value (default is 64 null characters)

Dependencies None

Errors and Events 223, “Too much data; Path trace string truncated”

Examples

```
SOURCE:DATA:TELECOM:POVERHEAD:TRACE "TESTING 1 . 2 . 3"
```

Related Commands SOURce:DATA:TELecom:POVerhead:DATA?

SOURce:DATA:TELecom:POVerhead:TRACe?

This query returns the current path trace string that repeats in the J1 byte as a 64-byte repeating sequence.

Syntax `SOURce:DATA:TELecom:POVerhead:TRAce?`

SONET Response

<path trace> (string)	description
Length is a maximum of 64 bytes; if length is less than 64 bytes, the buffer is padded with nulls to a length of 64 bytes	The J1 byte is set to this value (default is 64 null characters)

SDH Response

<path trace> (string)	description
Length is a maximum of 64 bytes; if length is less than 64 bytes, the buffer is padded with nulls to a length of 64 bytes	The J1 byte is set to this value (default is 64 null characters)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:POVERHEAD:TRACE?`

Response: `"THIS IS A TEST"`

Related Commands SOURce:DATA:TELecom:POVerhead:TRAce

SOURce:DATA:TELecom:ERRor, ALARm, and FAILure Subsystem

This section describes the commands and queries that control abnormal conditions such as errors, alarms, and failures in the transmitted signal. Figure 3–16 shows the hierarchy tree for this subsystem.

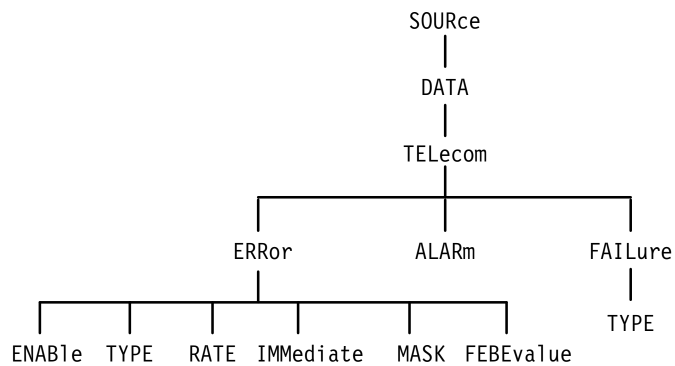


Figure 3–16: SOURce:DATA:TELecom:ERRor, ALARm, and FAILure subsystem

SOURce:DATA:TELecom:ERRor:ENABle

This command enables errors to be inserted into the output signal.

Syntax

```
SOURce:DATA:TELecom:ERRor:ENABle <error rate state>
```

SONET Values

<error rate state> (boolean)	description
0 or OFF	Error rate disabled (default)
1 or ON	Errors specified by rate

SDH Values

<error rate state> (boolean)	description
0 or OFF	Error rate disabled (default)
1 or ON	Errors specified by rate

Dependencies None

Errors and Events None

Examples `SOURCE:DATA:TELECOM:ERROR:ENABLE 0`

Related Commands SOURce:DATA:TELecom:ERRor:RATE

SOURce:DATA:TELecom:ERRor:ENABle?

This query returns the current enable setting of the error rate.

Syntax `SOURce:DATA:TELecom:ERRor:ENABle?`

SONET Response

<error rate state> (boolean)	description
0	Error rate off (OFF)
1	Errors specified by rate (ON)

SDH Response

<error rate state> (boolean)	description
0	Error rate off (OFF)
1	Errors specified by rate (ON)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:ERROR:ENABLE?`

Response: `0`

Related Commands SOURce:DATA:TELecom:ERRor:MODE

SOURce:DATA:TELecom:ERRor:TYPE

This command selects the error type.

Syntax

```
SOURce:DATA:TELecom:ERRor:TYPE <error type>
```

SONET Values

<error type> (discrete)	description
SCV	Section B1 BIP error; B1 will be errored across all bits (default)
LCV	Line B2 BIP error; B2 will be errored across all bits
PCV	Path B3 BIP error; the active channel B3 will be errored across all bits
PFEBe	Path Far End Block Error (path FEBE at specified rate); a value of 1 is inserted in the G1 byte when the SOURce:DATA:TELecom: ERRor:IMMediate command is given
DATA	Payload data bit error (payload data will be errored but B3 will not)
TRIButary	Allows selection of tributary errors (Add/ Drop/Test Option Only)

SDH Values

<error type> (discrete)	description
SCV	RS B1 BIP error; B1 will be errored across all bits (default)
LCV	MS B2 BIP error; B2 will be errored across all bits
PCV	Path B3 BIP error; the active channel B3 will be errored across all bits
PFEBe	Path Far End Block Error (path FEBE at specified rate); a value of 1 is inserted in the G1 byte when the SOURce:DATA:TELecom: ERRor:IMMediate command is given
DATA	Payload data bit error (payload data will be errored but B3 will not)
TRIButary	Allows selection of tributary errors (Add/ Drop/Test Option Only)

Dependencies None

Errors and Events None

Examples `SOURCE:DATA:TELECOM:ERROR:TYPE SCV`

Related Commands SOURce:DATA:TELecom:ERRor:RATE
SOURce:DATA:TELecom:TRIButary:ERRor

SOURce:DATA:TELecom:ERRor:TYPE?

This query returns the current setting of the selected error type.

Syntax `SOURce:DATA:TELecom:ERRor:TYPE?`

SONET Response

<error type> (discrete)	description
SCV	Section B1 BIP error; B1 will be errored across all bits (default)
LCV	Line B2 BIP error; B2 will be errored across all bits
PCV	Path B3 BIP error; the active channel B3 will be errored across all bits
PFEBe	Path Far End Block Error (path FEBE at specified rate); a value of 1 appears in the G1 byte if the SOURce:DATA:TELecom: ERRor:IMMediate command has been given
DATA	Payload data bit error (payload data will be errored but B3 will not)
TRIButary	Tributary errors selected (Add/Drop/Test Option Only)

SDH Response

<error type> (discrete)	description
SCV	RS B1 BIP error; B1 will be errored across all bits (default)
LCV	MS B2 BIP error; B2 will be errored across all bits
PCV	Path B3 BIP error; the active channel B3 will be errored across all bits

<error type> (discrete)	description
PFEBe	Path Far End Block Error (path FEBE at specified rate); a value of 1 appears in the G1 byte if the SOURce:DATA:TELecom: ERRor:IMMediate command has been given
DATA	Payload data bit error (payload data will be errored but B3 will not)
TRIButary	Tributary errors selected (Add/Drop/Test Option Only)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:ERROR:TYPE?`

Response: `SCV`

Related Commands SOURce:DATA:TELecom:ERRor:TYPE

SOURce:DATA:TELecom:ERRor:RATE

This command selects the error rate. Resolution is limited to one digit. For example, 1E-6, 2E-9, and 1E-3 are valid values; 1.43E-4 and 2.7E-9 are not valid values. Invalid error rates will be changed to the nearest valid value. For example, 1.25E-5 (too many digits) will be changed to 1E-5, 1E-20 (below minimum) will be changed to 1E-10 (minimum), and 1 (above maximum) will be changed to 1E-3 (maximum).

To disable error generation at any specified rate, use the SOURce:DATA: TELecom:ERRor:ENABle OFF command.

Syntax `SOURce:DATA:TELecom:ERRor:RATE <error rate>`
(see Tables 3–5 through 3–8 for <error rate> limits)

Table 3–5: Error insertion rate limits for SOURce:DATA:TELecom:ERRor:RATE (SONET)

If rate and structure set to:	If error type set to SCV	If error type set to LCV	If error type set to PCV	If error type set to PFEBE	If error type set to DATA
STS1 rate and STS1 structure	1E–10 to 1E–3	1E–10 to 1E–3	1E–10 to 1E–3	1E–10 to 1E–3	1E–10 to 1E–3
STS3 rate and STS1 structure	1E–10 to 1E–4	1E–10 to 1E–4	1E–10 to 1E–3	1E–10 to 1E–3	1E–10 to 1E–3
STS3 rate and STS3c structure	1E–10 to 1E–4	1E–10 to 1E–4	1E–10 to 1E–4	1E–10 to 1E–4	1E–10 to 1E–3
STS12 rate and STS1 structure	1E–10 to 1E–5	1E–10 to 1E–4	1E–10 to 1E–3	1E–10 to 1E–3	1E–10 to 1E–3
STS12 rate and STS3c structure	1E–10 to 1E–5	1E–10 to 1E–4	1E–10 to 1E–4	1E–10 to 1E–4	1E–10 to 1E–3

The table lists the minimum and maximum rates.

All error rates are NR3-numeric.

Table 3–6: Error insertion rate limits for SOURce:DATA:TELecom:ERRor:RATE (SONET) (Add/Drop/Test Option Only)

If rate set to:	If error type set to VTBIP	If error type set to VTFEBE	If error type set to PARITY	If error type set to CRC	If error type set to FRAME	If error type set to DATA
DS1	1E–10 to 1E–3	1E–10 to 1E–3	not applicable	1E–8 to 1E–4	1E–5 to 1E–2	1E–8 to 1E–2
DS3	not applicable	not applicable	1E–9 to 1E–4	not applicable	1E–7 to 1E–2	1E–9 to 1E–2

The table lists the minimum and maximum rates.

All error rates are NR3-numeric.

Table 3–7: Error insertion rate limits for SOURce:DATA:TELecom:ERRor:RATE (SDH)

If rate set to:	If error type set to SCV	If error type set to LCV	If error type set to PCV	If error type set to PFEBE	If error type set to DATA
STM1	1E–10 to 1E–4	1E–10 to 1E–4	1E–10 to 1E–4	1E–10 to 1E–4	1E–10 to 1E–3
STM4	1E–10 to 1E–5	1E–10 to 1E–4	1E–10 to 1E–4	1E–10 to 1E–4	1E–10 to 1E–3

The table lists the minimum and maximum rates.

All error rates are NR3-numeric.

Table 3–8: Error insertion rate limits for SOURce:DATA:TELecom:ERRor:RATE (SDH) (Add/Drop/Test Option Only)

If rate set to:	If error type set to TUBIP	If error type set to TUFEBE	If error type set to CRC	If error type set to FRAME	If error type set to DATA
M2	1E–10 to 1E–4	1E–10 to 1E–4	1E–8 to 1E–4	1E–7 to 1E–2	1E–8 to 1E–2
M34	1E–10 to 1E–4	1E–10 to 1E–4	not applicable	1E–7 to 1E–2	1E–9 to 1E–2
M140	not applicable	not applicable	not applicable	1E–8 to 1E–2	1E–9 to 1E–2

The table lists the minimum and maximum rates.

All error rates are NR3-numeric.

Dependencies None

Errors and Events 500, “Execution warning; Numeric value greater than maximum limit”

500, “Execution warning; Numeric value less than minimum limit”

Examples `SOURCE:DATA:TELECOM:ERROR:RATE 1E-6`

Related Commands SOURce:DATA:TELecom:ERRor:TYPE
SOURce:DATA:TELecom:TRIButary:ERRor

SOURce:DATA:TELecom:ERRor:RATE?

This query returns the current setting of the error rate.

Syntax `SOURce:DATA:TELecom:ERRor:RATE?`

SONET Response

<error rate> (NR3-numeric)	description
See tables 3–5 and 3–6 on page 3–77 for valid ranges	Error rate is set to a value in this range

SDH Response

<error rate> (NR3-numeric)	description
See table 3–7 and 3–8 on page 3–77 for valid ranges	Error rate is set to a value in this range

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:ERROR:RATE?`

Response: `1E-10`

Related Commands SOURce:DATA:TELecom:ERRor:RATE

SOURce:DATA:TELecom:ERRor:IMMediate

This command is used to force an error insertion. The error is defined by SOURce:DATA:TELecom:DATA:ERRor:TYPE.

Syntax `SOURce:DATA:TELecom:ERRor:IMMediate`

SONET Values None

SDH Values None

Dependencies SOURce:DATA:TELecom:ERRor:ENABle must be set to ON.

Errors and Events None

Examples `SOURCE:DATA:TELECOM:ERROR:IMMEDIATE`

Related Commands SOURce:DATA:TELecom:ERRor:TYPE
SOURce:DATA:TELecom:TRIButary:ERRor

SOURce:DATA:TELecom:ERRor:MASK

This command selects a mask for error insertion. The mask specifies which bits of the BIP-8 value will be errored.

Syntax

```
SOURce:DATA:TELecom:ERRor:MASK <error mask>
```

SONET Values

<error mask> (NR1-numeric)[1]	description
Any integer in the range 1 to 255 (hexadecimal 1 to FF)	Error mask (default = #H01)

[1] **A hexadecimal value is also acceptable.**

SDH Values

<error mask> (NR1-numeric)[1]	description
Any integer in the range 1 to 255 (hexadecimal 1 to FF)	Error mask (default = #H01)

[1] **A hexadecimal value is also acceptable.**

Dependencies

This command applies only for immediate error insertion using the SOURce:DATA:TELecom:ERRor:IMMediate command. Error mask does not apply for error insertions at a specific rate.

Errors and Events

None

Examples

```
SOURCE:DATA:TELECOM:ERROR:MASK #H03
```

Related Commands

SOURce:DATA:TELecom:ERRor:TYPE

SOURce:DATA:TELecom:ERRor:MASK?

This query returns the current setting of the error mask that specifies which bits of the BIP-8 value will be errored.

Syntax

`SOURce:DATA:TELecom:ERRor:MASK?`

SONET Response

<error mask> (NR1-numeric)	description
Any integer in the range 1 to 255	Error mask

SDH Response

<error mask> (NR1-numeric)	description
Any integer in the range 1 to 255	Error mask

Dependencies

None

Errors and Events

None

Examples

Query: `SOURCE:DATA:TELECOM:ERROR:MASK?`

Response: 12

Related Commands

SOURce:DATA:TELecom:ERRor:MASK

SOURce:DATA:TELecom:ERRor:FEBEvalue

This command selects a value for single FEBE error insertions. This value is inserted into the G1 byte when SOURce:DATA:TELecom:ERRor:TYPE is set to PFEBe and the SOURce:DATA:TELecom:ERRor:IMMediate command is sent.

Syntax

`SOURce:DATA:TELecom:ERRor:FEBEvalue <FEBE value>`

SONET Values

<FEBE value> (NR1-numeric)	description
Any integer in the range 1 through 8	Value for single FEBE error insertion (default = 1)

SDH Values

<FEBE value> (NR1-numeric)	description
Any integer in the range 1 through 8	Value for single FEBE error insertion (default = 1)

Dependencies

This command applies only for immediate error insertion using the SOURce:DATA:TELecom:ERRor:IMMediate command. FEBE error insertion does not apply for error insertions at a specific rate.

Errors and Events

None

Examples

`SOURCE:DATA:TELECOM:ERROR:FEBEVALUE 2`

Related Commands

SOURce:DATA:TELecom:ERRor:TYPE

SOURce:DATA:TELecom:ERRor:FEBEvalue?

This query returns the current value for FEBE error insertions.

Syntax

`SOURce:DATA:TELecom:ERRor:FEBEvalue?`

SONET Response

<FEBE value> (NR1-numeric)	description
Any integer in the range 1 through 8	Value for single FEBE error insertion (default = 1)

SDH Response

<FEBE value> (NR1-numeric)	description
Any integer in the range 1 through 8	Value for single FEBE error insertion (default = 1)

Dependencies

None

Errors and Events

None

Examples Query: `SOURCE:DATA:TELECOM:ERROR:FEBEVALUE?`

Response: `5`

Related Commands SOURce:DATA:TELecom:ERRor:FEBEvalue

SOURce:DATA:TELecom:ALARm

This command selects an alarm to transmit.

Syntax `SOURce:DATA:TELecom:ALARm <alarm>`

SONET Values

<alarm> (discrete)	description
NONE	No alarms (default)
LAIS	Line AIS
PAIS	Path AIS
LFERf	Line FERF
PFERf	Path FERF
TRIButary	Allows selection of tributary alarms (Add/ Drop/Test Option Only)

SDH Values

<alarm> (discrete)	description
NONE	No alarms (default)
LAIS	MS AIS
PAIS	Path AIS
LFERf	MS FERF
PFERf	Path FERF
TRIButary	Allows selection of tributary alarms (Add/ Drop/Test Option Only)

Dependencies SOURce:DATA:TELecom:FAILure:TYPE must be set to NONE for this command to apply.

Errors and Events None

Examples `SOURCE:DATA:TELECOM:ALARM LAIS`

Related Commands SOURce:DATA:TELecom:TRIButary:ALARm

SOURce:DATA:TELecom:ALARm?

This query returns the current setting of the transmitted alarm type.

Syntax `SOURce:DATA:TELecom:ALARm?`

SONET Response

<alarm> (discrete)	description
NONE	No alarms (default)
LAIS	Line AIS
PAIS	Path AIS
LFERf	Line FERF
PFERf	Path FERF
TRIButary	Tributary alarms selected (Add/Drop/Test Option Only)

SDH Response

<alarm> (discrete)	description
NONE	No alarms (default)
LAIS	MS AIS
PAIS	Path AIS
LFERf	MS FERF
PFERf	Path FERF
TRIButary	Tributary alarms selected (Add/Drop/Test Option Only)

Dependencies None

Errors and Events None

Examples

Query: `SOURCE:DATA:TELECOM:ALARM?`

Response: `LAIS`

Related Commands

SOURce:DATA:TELecom:ALARm

SOURce:DATA:TELecom:FAILure:TYPE

This command selects a failure type to transmit. Selecting a failure type overrides all errors and alarms.

Syntax

`SOURce:DATA:TELecom:FAILure:TYPE <failure>`

SONET Values

<failure> (discrete)	description
NONE	No failures (default)
LOSignal	Loss of Signal (disconnects the output signal)
LOFrame	Loss of Frame (changes the most significant bit of A1 resulting in a hexadecimal value of 76)
LOPointer	Loss of Pointer (generates continuous NDFs)
TRIButary	Allows selection of tributary failures (Add/Drop/Test Option Only)

SDH Values

<failure> (discrete)	description
NONE	No failures (default)
LOSignal	Loss of Signal (disconnects the output signal)
LOFrame	Loss of Frame (changes the most significant bit of A1 resulting in a hexadecimal value of 76)
LOPointer	Loss of Pointer (generates continuous NDFs)
TRIButary	Allows selection of tributary failures (Add/Drop/Test Option Only)

Dependencies

None

Errors and Events None

Examples `SOURCE:DATA:TELECOM:FAILURE:TYPE LOS`

Related Commands SOURce:DATA:TELecom:TRIButary:FAILure

SOURce:DATA:TELecom:FAILure:TYPE?

This query returns the current setting of the failure type.

Syntax `SOURce:DATA:TELecom:FAILure:TYPE?`

SONET Response

<failure> (discrete)	description
NONE	No failures (default)
LOSignal	Loss of Signal (output signal is disconnected)
LOFrame	Loss of Frame (A1 is set to hexadecimal 76)
LOPointer	Loss of Pointer (continuous NDFs generated)
TRIButary	Tributary failures selected (Add/Drop/Test Option Only)

SDH Response

<failure> (discrete)	description
NONE	No failures (default)
LOSignal	Loss of Signal (output signal is disconnected)
LOFrame	Loss of Frame (A1 is set to hexadecimal 76)
LOPointer	Loss of Pointer (continuous NDFs generated)
TRIButary	Tributary failures selected (Add/Drop/Test Option Only)

Dependencies None

Errors and Events None

Examples

Query: `SOURCE:DATA:TELECOM:FAILURE:TYPE?`

Response: `LOSIGNAL`

Related Commands

SOURce:DATA:TELecom:FAILure:TYPE

SOURce:DATA:TELecom:POINter Subsystem

This section describes the commands and queries adjust pointers. Figure 3–17 shows the hierarchy tree for this subsystem.

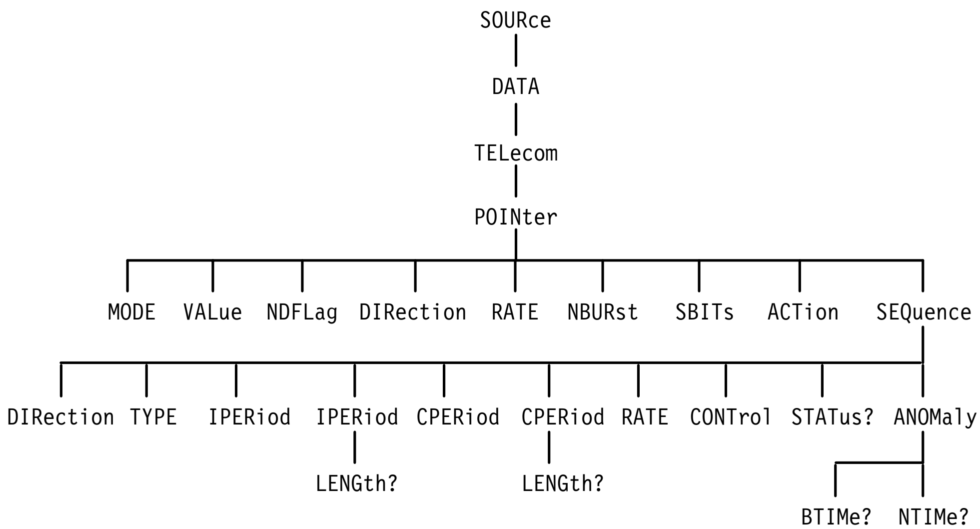


Figure 3–17: SOURce:DATA:TELecom:POINter subsystem

SOURce:DATA:TELecom:POINter:MODE

This command controls the pointer manipulation modes.

Syntax

```
SOURce:DATA:TELecom:POINter:MODE <mode>
```

SONET Values

<mode> (discrete)	description
MANual	Pointers are controlled by SOURce:DATA: TELecom:POINter:VALue and SOURce:DATA: TELecom:NDFlag (default)
SINGle	When the SOURce:DATA:TELecom: POINter:ACTion command is given, pointer adjustments will alternately increment and decrement
BURSt	When the SOURce:DATA:TELecom: POINter:ACTion command is given, a burst of pointer adjustments sent at the maximum rate (1 in 4 frames) and with a count defined by SOURce:DATA:TELecom:POINter:NBURst

<mode> (discrete)	description
FOFFset	Frequency offset pointers are controlled by the SOURce:CLOCk:OFFSet: commands
CONTinuous	Pointers are continuously adjusted according to the SOURce:DATA:TELecom: POINter:RATE and SOURce:DATA: TELecom:POINter:DIRection commands
TRIButary	Pointers are controlled by the SOURce:DATA: TELecom:TRIButary:POINter subsystem (Add/Drop/Test Option Only)
SEQuences	When the SOURce:DATA:TELecom: POINter:SEQuence:CONTrol START command is given, a pointer measurement period will begin. For isolated and burst pointer movements, there is an initialization period, then a 30 second cool down period, after which the measurement period starts. For frequency offset simulation, there is no cool down period. The measurement periods start immediately after initialization.

SDH Values

<mode> (discrete)	description
MANual	Pointers are controlled by SOURce:DATA: TELecom:POINter:VALue and SOURce:DATA: TELecom:NDFlag (default)
SINGle	When the SOURce:DATA:TELecom: POINter:ACTion command is given, pointer adjustments will alternately increment and decrement
BURSt	When the SOURce:DATA:TELecom: POINter:ACTion command is given, a burst of pointer adjustments sent at the maximum rate (1 in 4 frames) and with a count defined by SOURce:DATA:TELecom:POINter:NBURst
FOFFset	Frequency offset pointers are controlled by the SOURce:CLOCk:OFFSet: commands
CONTinuous	Pointers are continuously adjusted according to the SOURce:DATA:TELecom: POINter:RATE and SOURce:DATA: TELecom:POINter:DIRection commands

<mode> (discrete)	description
TRIButary	Pointers are controlled by the SOURce:DATA:TELecom:TRIButary:POINter subsystem (Add/Drop/Test Option Only)
SEQuences	When the SOURce:DATA:TELecom:POINter:SEQuence:CONTrol START command is given, a pointer measurement period will begin. For isolated and burst pointer movements, there is an initialization period, then a 30 second cool down period, after which the measurement period starts. For frequency offset simulation, there is no cool down period. The measurement periods start immediately after initialization.

Dependencies None

Errors and Events None

Examples `SOURCE:DATA:TELECOM:POINTER:MODE FOFFSET`

Related Commands None

SOURce:DATA:TELecom:POINter:MODE?

This query returns the current setting of the pointer mode.

Syntax `SOURce:DATA:TELecom:POINter:MODE?`

SONET Response

<mode> (discrete)	description
MANual	Pointers are controlled by SOURce:DATA:TELecom:POINter:VALue and SOURce:DATA:TELecom:NDFlag (default)
SINGle	When the SOURce:DATA:TELecom:POINter:ACTion command is given, pointer adjustments will alternately increment and decrement
BURSt	When the SOURce:DATA:TELecom:POINter:ACTion command is given, a burst of pointer adjustments sent at the maximum rate (1 in 4 frames) and with a count defined by SOURce:DATA:TELecom:POINter:NBURst

<mode> (discrete)	description
FOFFset	Frequency offset pointers are controlled by the SOURce:CLOCk:OFFSet: commands
CONTinuous	Pointers are continuously adjusted according to the SOURce:DATA:TELecom: POINter:RATE and SOURce:DATA: TELecom:POINter:DIRection commands
TRIButary	Pointers are controlled by the SOURce:DATA: TELecom:TRIButary:POINter subsystem (Add/Drop/Test Option Only)
SEQuences	When the SOURce:DATA:TELecom: POINter:SEQuence:CONTrol START command is given, a pointer measurement period will begin. For isolated and burst pointer movements, there is an initialization period, then a 30 second cool down period, after which the measurement period starts. For frequency offset simulation, there is no cool down period. The measurement periods start immediately after initialization.

SDH Response

<mode> (discrete)	description
MANual	Pointers are controlled by SOURce:DATA: TELecom:POINter:VALue and SOURce:DATA: TELecom:NDFlag (default)
SINGle	When the SOURce:DATA:TELecom: POINter:ACTion command is given, pointer adjustments will alternately increment and decrement
BURSt	When the SOURce:DATA:TELecom: POINter:ACTion command is given, a burst of pointer adjustments sent at the maximum rate (1 in 4 frames) and with a count defined by SOURce:DATA:TELecom:POINter:NBURSt
FOFFset	Frequency offset pointers are controlled by the SOURce:CLOCk:OFFSet: commands
CONTinuous	Pointers are continuously adjusted according to the SOURce:DATA:TELecom: POINter:RATE and SOURce:DATA: TELecom:POINter:DIRection commands

<mode> (discrete)	description
TRIButary	Pointers are controlled by the SOURce:DATA:TELecom:TRIButary:POINter subsystem (Add/Drop/Test Option Only)
SEQuences	When the SOURce:DATA:TELecom:POINter:SEQuence:CONTrol START command is given, a pointer measurement period will begin. For isolated and burst pointer movements, there is an initialization period, then a 30 second cool down period, after which the measurement period starts. For frequency offset simulation, there is no cool down period. The measurement periods start immediately after initialization.

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:POINTER:MODE?`

Response: `MANUAL`

Related Commands SOURce:DATA:TELecom:POINter:MODE

SOURce:DATA:TELecom:POINter:VALue

This command directly sets the pointer value. To obtain an illegal pointer value, use a value greater than 782. If SOURce:DATA:TELecom:POINter:NDFlag is set to ON, a New Data Flag (NDF) is sent with each new value received.

Syntax `SOURce:DATA:TELecom:POINter:VALue <pointer value>`

SONET Values

<pointer value> (NR1-numeric)	description
Any integer in the range 0 to 1023	Pointer set to this value (default = 522)

SDH Values

<pointer value> (NR1-numeric)	description
Any integer in the range 0 to 1023	Pointer set to this value (default = 522)

Dependencies

SOURce:DATA:TELecom:POINter:MODE must be set to MANual for this command to apply.

Errors and Events

None

Examples

`SOURCE:DATA:TELECOM:POINTER:VALUE 10`

Related Commands

SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:NDFlag

SOURce:DATA:TELecom:POINter:VALue?

This query returns the current pointer value being transmitted.

Syntax

`SOURce:DATA:TELecom:POINter:VALue?`

SONET Response

<pointer value> (NR1-numeric)	description
Any integer in the range 0 to 1023	Pointer set to this value (default = 522)

SDH Response

<pointer value> (NR1-numeric)	description
Any integer in the range 0 to 1023	Pointer set to this value (default = 522)

Dependencies

None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:POINTER:VALUE?`

Response: `310`

Related Commands SOURce:DATA:TELecom:POINter:VALue

SOURce:DATA:TELecom:POINter:NDFLag

This command controls the generation of a New Data Flag (NDF) when pointer adjustments occur.

Syntax `SOURce:DATA:TELecom:POINter:NDFLag <NDF state>`

SONET Values

<NDF state> (boolean)	description
1 or ON	On (default)
0 or OFF	Off

SDH Values

<NDF state> (boolean)	description
1 or ON	On (default)
0 or OFF	Off

Dependencies SOURce:DATA:TELecom:POINter:MODE must be set to MANual for this command to apply.

Errors and Events None

Examples `SOURCE:DATA:TELECOM:POINTER:NDFLag ON`

Related Commands SOURce:DATA:TELecom:POINter:VALue

SOURce:DATA:TELecom:POINter:NDFLag?

This query returns the current setting of the New Data Flag (NDF) generator.

Syntax `SOURce:DATA:TELecom:POINter:NDFLag?`

SONET Response

<NDF state> (boolean)	description
1	On (default)
0	Off

SDH Response

<NDF state> (boolean)	description
1	On (default)
0	Off

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:POINTER:NDFLAG?`

Response: 0

Related Commands SOURce:DATA:TELecom:POINter:NDFLag

SOURce:DATA:TELecom:POINter:DIRection

This command sets the direction of continuous pointer adjustments.

Syntax

```
SOURce:DATA:TELecom:POINter:DIRection <direction>
```

SONET Values

<direction> (discrete)	description
ALTernate	Pointer adjustments alternate between up and down (default)
DOWN	Pointers adjusted down
UP	Pointers adjusted up

SDH Values

<direction> (discrete)	description
ALTernate	Pointer adjustments alternate between up and down (default)
DOWN	Pointers adjusted down
UP	Pointers adjusted up

Dependencies

SOURce:DATA:TELecom:POINTer:MODE must be set to CONTinuous for this command to apply.

Errors and Events

None

Examples

```
SOURCE:DATA:TELECOM:POINTER:DIRECTION UP
```

Related Commands

SOURce:DATA:TELecom:POINter:RATE

SOURce:DATA:TELecom:POINter:DIRection?

This query returns the current setting for continuous pointer adjustment direction.

Syntax

`SOURce:DATA:TELecom:POINter:DIRection?`

SONET Response

<direction> (discrete)	description
ALTernate	Pointer adjustments alternate between up and down (default)
DOWN	Pointers adjusted down
UP	Pointers adjusted up

SDH Response

<direction> (discrete)	description
ALTernate	Pointer adjustments alternate between up and down (default)
DOWN	Pointers adjusted down
UP	Pointers adjusted up

Dependencies

None

Errors and Events

None

Examples

Query: `SOURCE:DATA:TELECOM:POINTER:DIRECTION?`

Response: `UP`

Related Commands

SOURce:DATA:TELecom:POINter:DIRection

SOURce:DATA:TELecom:POINter:RATE

This command sets the continuous pointer adjustment rate.

Syntax `SOURce:DATA:TELecom:POINter:RATE <rate>`

SONET Values

<rate> (NR1-numeric)	description
Any integer in the range 2 to 10,000 ms (resolution of 1 ms)	The pointer adjustment rate is set to this value

SDH Values

<rate> (NR1-numeric)	description
Any integer in the range 2 to 10,000 ms (resolution of 1 ms)	The pointer adjustment rate is set to this value

Dependencies SOURce:DATA:TELecom:POINTer:MODE must be set to CONTinuous for this command to apply.

Errors and Events None

Examples `SOURCE:DATA:TELECOM:POINTER:RATE 10`

Related Commands SOURce:DATA:TELecom:POINter:DIRection
SOURce:DATA:TELecom:POINter:MODE

SOURce:DATA:TELecom:POINter:RATE?

This query returns the current setting of the continuous pointer adjustment rate.

Syntax `SOURce:DATA:TELecom:POINter:RATE?`

SONET Response

<rate> (NR1-numeric)	description
Any integer in the range 2 to 10,000 ms (resolution of 1 ms)	The pointer adjustment rate is set to this value

SDH Response

<rate> (NR1-numeric)	description
Any integer in the range 2 to 10,000 ms (resolution of 1 ms)	The pointer adjustment rate is set to this value

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:POINTER:RATE?`

Response: 3

Related Commands SOURce:DATA:TELecom:POINter:RATE

SOURce:DATA:TELecom:POINter:NBURst

This command sets the number of pointer adjustments in a burst of pointer adjustments. The SOURce:DATA:TELecom:POINTer:ACTion command controls when the burst occurs.

Syntax `SOURce:DATA:TELecom:POINter:NBURst <pointer burst number>`

SONET Values

<pointer burst number> (NR1-numeric)	description
Any integer in the range 2 to 8	This value determines the number of pointer adjustments in a burst of pointer adjustments (default = 2)

SDH Values

<pointer burst number> (NR1-numeric)	description
Any integer in the range 2 to 8	This value determines the number of pointer adjustments in a burst of pointer adjustments (default = 2)

Dependencies SOURce:DATA:TELecom:POINter:MODE must be set for BURSt for this command to apply.

Errors and Events None

Examples `SOURCE:DATA:TELECOM:POINTER:NBURST 2`

Related Commands SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:ACTion

SOURce:DATA:TELecom:POINter:NBURst?

This query returns the number of pointer adjustments in a burst of pointer adjustments.

Syntax `SOURce:DATA:TELecom:POINter:NBURst?`

SONET Response

<pointer burst number> (NR1-numeric)	description
Any integer in the range 2 to 8	This value determines the number of pointer adjustments in a burst of pointer adjustments (default = 2)

SDH Response

<pointer burst number> (NR1-numeric)	description
Any integer in the range 2 to 8	This value determines the number of pointer adjustments in a burst of pointer adjustments (default = 2)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:POINTER:NBURST?`

Response: 3

Related Commands SOURce:DATA:TELecom:POINter:NBURst

SOURce:DATA:TELecom:POINter:SBITs

This command sets static value of the S-bits (bits 5 and 6) in the H1 byte.

Syntax

```
SOURce:DATA:TELecom:POINter:SBITs <pointer sbits>
```

SONET Values

<pointer sbits> (NR1-numeric)	description
Any integer in the range 0 to 3	This value is the S-bit in the H1 byte (default = 0)

SDH Values

<pointer sbits> (NR1-numeric)	description
Any integer in the range 0 to 3	This value is the S-bit in the H1 byte (default = binary 10)

Dependencies None

Errors and Events 500, “Execution warning; Numeric value greater than maximum limit”

Examples

```
SOURCE:DATA:TELECOM:POINTER:SBITS 0
```

Related Commands None

SOURce:DATA:TELecom:POINter:SBITs?

This query returns the static value of the S-bits (bits 5 and 6) in the H1 byte.

Syntax

```
SOURce:DATA:TELecom:POINter:SBITs?
```

SONET Response

<pointer sbits> (NR1-numeric)	description
Any integer in the range 0 to 3	This value is the S-bit in the H1 byte (default = 0)

SDH Response

<pointer sbits> (NR1-numeric)	description
Any integer in the range 0 to 3	This value is the S-bit in the H1 byte (default = binary 10)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:POINTER:SBITS?`

Response: 3

Related Commands SOURce:DATA:TELecom:POINter:SBITs

SOURce:DATA:TELecom:POINter:ACTion

This command invokes a pointer adjustment for SONET/SDH or tributary signals.

Syntax `SOURce:DATA:TELecom:POINter:ACTion`

SONET Values None

SDH Values None

Dependencies SOURce:DATA:TELecom:POINter:MODE or SOURce:DATA:TELecom:TRIButary:POINter:MODE must be set to SINGle or BURst for this command to apply.

Errors and Events 221, “Settings conflict; Mode must be single or burst”
200, “Execution error; Pointer burst active, request ignored”

Examples `SOURCE:DATA:TELECOM:POINTER:ACTION`

Related Commands SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:NBURst

SOURce:DATA:TELecom:TRIButary:POINter:MODE
SOURce:DATA:TELecom:TRIButary:POINter:NBURst

SOURce:DATA:TELecom:POINter:SEQuence:DIRection

This command sets the pointer sequence movement direction.

Setting this parameter when a sequence is running returns an error.

Syntax

```
SOURce:DATA:TELecom:POINter:SEQuence:DIRection
<pointer seq direction>
```

Parameters

<pointer seq direction> (discrete)	description
DOWN	(default)
UP	

Dependencies

Pointer sequences must not be running.

Errors and Events

221, “Settings conflict; TYPE:ECL requires option –02”

Examples

```
SOURCE:DATA:TELECOM:POINTER:SEQUENCE:DIRECTION UP
SOUR:DATA:TEL:POIN:SEQ:DIR DOWN
```

Related Commands

SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:SEQuence:CONTrol

SOURce:DATA:TELecom:POINter:SEQuence:DIRection?

This query returns the direction for pointer sequence movements.

Syntax

`SOURce:DATA:TELecom:POINter:SEQuence:DIRection?`

Parameters

<pointer seq direction> (discrete)	description
DOWN	(default)
UP	

Dependencies

None

Errors and Events

None

Examples

Query: `SOURCE:DATA:TELECOM:POINTER:SEQUENCE:DIRECTION?`

Response: `UP`

Related Commands

SOURce:DATA:TELecom:POINter:SEQuence:DIRection

SOURce:DATA:TELecom:POINter:SEQuence:RATE

This command sets the pointer sequence movement rate in milliseconds.

Setting this parameter when a sequence is running returns an error.

Syntax

`SOURce:DATA:TELecom:POINter:SEQuence:RATE <pointer seq rate>`

Parameters

<pointer seq rate> (NR1-numeric)	description
Any integer in the range 34 to 30,000 ms	Resolution is 1 ms (default = 34 ms)

Dependencies

Pointer sequences must not be running. Some sequence types (such as single, burst, phase, sinalt, and dblalt) set the rate to 30,000 ms. With these types, you cannot change the rate.

Errors and Events

221, “Settings conflict; commanded to start but not in sequence mode”

Examples

```
SOURCE:DATA:TELECOM:POINTER:SEQUENCE:RATE 50
SOUR:DATA:TEL:POIN:SEQ:RATE 1000
```

Related Commands

SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:SEQuence:CONTrol
SOURce:DATA:TELecom:POINter:SEQuence:TYPE

SOURce:DATA:TELecom:POINter:SEQuence:RATE?

This query returns the rate for pointer sequence movements in milliseconds.

Syntax

```
SOURce:DATA:TELecom:POINter:SEQuence:RATE?
```

Parameters

<pointer seq rate> (discrete)	description
Any integer in the range 34 to 30,000 ms	Resolution is 1 ms (default = 34 ms)

Dependencies

Some sequence types (like single, burst, phase, sinalt, and dblalt) set the rate to 30,000 ms. With these types, you cannot change the rate.

Errors and Events

None

Examples

Query: `SOURCE:DATA:TELECOM:POINTER:SEQUENCE:RATE?`

Response: `34`

Related Commands

SOURce:DATA:TELecom:POINter:SEQuence:RATE

SOURce:DATA:TELecom:POINter:SEQuence:TYPE

This command sets the pointer sequence type.

Setting this parameter when a sequence is running returns an error.

Syntax

```
SOURce:DATA:TELecom:POINter:SEQuence:TYPE <pointer seq type>
```

Parameters

<pointer seq type> (discrete)	description	standard
SINGle	Single pointer adjustment	ANSI
BURSt	Burst pointer adjustment	ANSI
PHASE	Phase transient pointer adjustment	ANSI
P873	Periodic 87–3 pointer adjustment	ANSI
P873CAN	Periodic 87–3 with cancel	ANSI
P873ADD	Periodic 87–3 with add	ANSI
PCONtinuous	Periodic continuous pointer adjustment	ANSI
PCONCAN	Periodic continuous with cancel	ANSI
PCONADD	Periodic continuous with add	ANSI
SINALT	Single alternating pointer	ITU-T
DBLALT	Double alternating pointer	ITU-T

Dependencies

Pointer sequences must not be running.

Errors and Events

221, “Settings conflict; stop sequences before setting the type”

Examples

```
SOURCE:DATA:TELECOM:POINTER:SEQUENCE:TYPE BURST
SOUR:DATA:TEL:POIN:SEQ:TYPE BURS
```

Related Commands

SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:SEQuence:CONTrol

SOURce:DATA:TELecom:POINter:SEQuence:TYPE?

This query returns the pointer sequence type.

Syntax

`SOURce:DATA:TELecom:POINter:SEQuence:TYPE?`

Response

<pointer seq type> (discrete)	description
SINGle	Single pointer adjustment
BURSt	Burst pointer adjustment
PHASE	Phase transient pointer adjustment
P873	Periodic 87–3 pointer adjustment
P873CAN	Periodic 87–3 with cancel
P873ADD	Periodic 87–3 with add
PCONtinuous	Periodic continuous pointer adjustment
PCONCAN	Periodic continuous with cancel
PCONADD	Periodic continuous with add
SINALT	Single alternating pointer
DBLALT	Double alternating pointer

Dependencies

None

Errors and Events

None

Examples

Query: `SOURCE:DATA:TELECOM:POINTER:SEQUENCE:TYPE?`

Response: `PCONCAN`

Related Commands

SOURce:DATA:TELecom:POINter:SEQuence:TYPE

SOURce:DATA:TELecom:POINter:SEQuence:IPERiod

This command enables or disables the pointer sequence initialization period.

Setting this parameter when a sequence is running returns an error.

Syntax

`SOURce:DATA:TELecom:POINter:SEQuence:IPERiod <pointer seq init>`

Parameters

<pointer seq init> (discrete)	description
0 (or OFF)	Disables the pointer sequence initialization period
1 (or ON)	Enables the pointer sequence initialization period (default)

Dependencies Pointer sequences must not be running.

Errors and Events 221, “Settings conflict; commanded to start but not in sequence mode”

Examples `SOURCE:DATA:TELECOM:POINTER:SEQUENCE:IPERIOD ON`

Related Commands SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:SEQuence:CONTrol

SOURce:DATA:TELecom:POINter:SEQuence:IPERiod?

This query returns the enable/disable condition of the pointer sequence initialization period.

Syntax `SOURce:DATA:TELecom:POINter:SEQuence:IPERiod?`

Response

<pointer seq init> (discrete)	description
0	Disabled
1	Enabled (default)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:POINTER:SEQUENCE:IPERIOD?`

Response: `0`

Related Commands SOURce:DATA:TELecom:POINter:SEQuence:IPERiod

SOURce:DATA:TELecom:POINter:SEQuence:IPERiod:LENGth?

This query returns the pointer sequence initialization period in seconds.

Syntax `SOURce:DATA:TELecom:POINter:SEQuence:IPERiod:LENGth?`

Response

<pointer seq init> (NR1-numeric)	description
Any integer	Pointer sequence initialization period in seconds

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:POINTER:SEQUENCE:IPERIOD:LENGTH`

Response: 30

Related Commands SOURce:DATA:TELecom:POINter:SEQuence:IPERiod
SOURce:DATA:TELecom:POINter:SEQuence:RATE
SOURce:DATA:TELecom:POINter:SEQuence:TYPE

SOURce:DATA:TELecom:POINter:SEQuence:CPERiod

This command enables or disables the pointer sequence cool down period.

Setting this parameter when a sequence is running returns an error.

Syntax `SOURce:DATA:TELecom:POINter:SEQuence:CPERiod <pointer seq init>`

Parameters

<pointer seq init> (discrete)	description
0 (or OFF)	Disables the pointer sequence cool down period
1 (or ON)	Enables the pointer sequence cool down period (default)

Dependencies Pointer sequences must not be running.

Errors and Events 221, “Settings conflict; commanded to start but not in sequence mode”

Examples `SOURCE:DATA:TELECOM:POINTER:SEQUENCE:CPERIOD OFF`

Related Commands SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:SEQuence:CONTrol

SOURce:DATA:TELecom:POINter:SEQuence:CPERiod?

This query returns the pointer sequence cool down period enable/disable condition.

Syntax `SOURce:DATA:TELecom:POINter:SEQuence:CPERiod?`

Response

<pointer seq init> (discrete)	description
0	Disabled
1	Enabled (default)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:POINTER:SEQUENCE:CPERIOD?`

Response: `0`

Related Commands SOURce:DATA:TELecom:POINter:SEQuence:CPERiod

SOURce:DATA:TELecom:POINter:SEQuence:CPERiod:LENGth?

This query returns the pointer sequence cool down period in seconds.

Syntax `SOURce:DATA:TELecom:POINter:SEQuence:CPERiod:LENGth?`

Response

<pointer seq init> (NR1-numeric)	description
Any integer	Pointer sequence cool down period in seconds

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:POINTER:SEQUENCE:CPERIOD:LENGTH`

Response: 675

Related Commands SOURce:DATA:TELecom:POINter:SEQuence:CPERiod
SOURce:DATA:TELecom:POINter:SEQuence:RATE
SOURce:DATA:TELecom:POINter:SEQuence:TYPE

SOURce:DATA:TELecom:POINter:SEQuence:CONTrol

This command starts or stops the pointer sequences and tributary pointer sequences.

A sequence begins with an initialization or cool down period, if enabled, and then enters operation. You may stop a pointer sequence at any time.

Syntax

```
SOURce:DATA:TELecom:POINter:SEQuence:CONTrol
<pointer seq control>
```

Parameters

<pointer seq control> (discrete)	description
STARt	Starts a pointer sequence
STOP	Stops a pointer sequence

Dependencies POINTer:MODE SEQuence or POINter:MODE TRIButary and TRIButary:POINter:MODE SEQuence must be selected.

Errors and Events 221, “Settings conflict; commanded to start but not in sequence mode”

Examples `SOURCE:DATA:TELECOM:POINTER:SEQUENCE:CONtrol START`

Related Commands SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:SEQuence:STATUS?

SOURce:DATA:TELecom:POINter:SEQuence:CONTrol?

This query returns the pointer sequences control status.

A sequence begins with an initialization and cool down period, and then enters operation. You may stop a pointer sequence at any time.

Syntax `SOURce:DATA:TELecom:POINter:SEQuence:CONTrol?`

Response

<pointer seq control> (discrete)	description
STARt	Starts a pointer sequence
STOP	Stops a pointer sequence

Dependencies POINTer:MODE SEQuence or POINter:MODE TRIButary and TRIButary:POINter:MODE SEQuence must be selected.

Errors and Events 221, “Settings conflict; commanded to start but not in sequence mode”

Examples Query: `SOURCE:DATA:TELECOM:POINTER:SEQUENCE:CONtrol?`

Response: `START`

Related Commands

SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:SEQuence:CONTrol
SOURce:DATA:TELecom:POINter:SEQuence:STATUS?

SOURce:DATA:TELecom:POINter:SEQuence:STATus?

This query returns the pointer sequence status.

Syntax

`SOURce:DATA:TELecom:POINter:SEQuence:STATus?`

Response

<pointer seq status> (discrete)	description
STOPPED	Not running sequences
INITIALizing	Initialization period
COOLdown	Cool down period
OPERating	Running sequences

Dependencies

None

Errors and Events

None

Examples

Query: `SOURCE:DATA:TELECOM:POINTER:SEQUENCE:STATUS?`

Response: `INIT`

Related Commands

SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:SEQuence:CONTrol?

SOURce:DATA:TELecom:POINter:SEQuence:ANOMaly:BTIMe?

This query returns the pointer sequence time between anomalies in seconds.

Sequences do not have to be running. This calculation is based upon sequence type and rate.

Syntax

`SOURce:DATA:TELecom:POINter:SEQuence:ANOMaly:BTIMe?`

Response

<pointer seq btime> (NR1-numeric)	description
Any positive integer	Time between anomalies in seconds
–1	Returned for sequences with an invalid BTIME. Example: continuous without anomalies

Dependencies

None

Errors and Events

None

Examples

Query: `SOURCE:DATA:TELECOM:POINTER:SEQUENCE:ANOMALY:BTIME?`

Response: `30`

Related Commands

SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:SEQuence:CONTrol
SOURce:DATA:TELecom:POINter:SEQuence:TYPE
SOURce:DATA:TELecom:POINter:SEQuence:RATE

SOURce:DATA:TELecom:POINter:SEQuence:ANOMaly:NTIMe?

This query returns the pointer sequence time until the next anomaly in seconds.

This query is only meaningful if sequences are running (STATus? is "OPERATING").

Syntax

`SOURce:DATA:TELecom:POINter:SEQuence:ANOMaly:NTIMe?`

Response

<pointer seq ntime> (NR1-numeric)	description
Any positive integer	Time until the next anomaly in seconds
–1	Returned for sequences with an invalid NTIME (Example: continuous without anomalies) or if in the following states: STOPPED, INITIALiz-ing, or COOLdown

Dependencies

None

Errors and Events

None

Examples

Query: `SOURCE:DATA:TELECOM:POINTER:SEQUENCE:ANOMALY:NTIME?`

Response: 4

Related Commands

SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:SEQuence:CONTrol
SOURce:DATA:TELecom:POINter:SEQuence:TYPE
SOURce:DATA:TELecom:POINter:SEQuence:RATE

SOURce:DATA:TELecom:PAYLoad:CUSTom Subsystem

This subsystem allows you to generate a sequence of custom payloads that can be mapped directly into the active channel. Figure 3–18 shows the hierarchy tree for this subsystem.

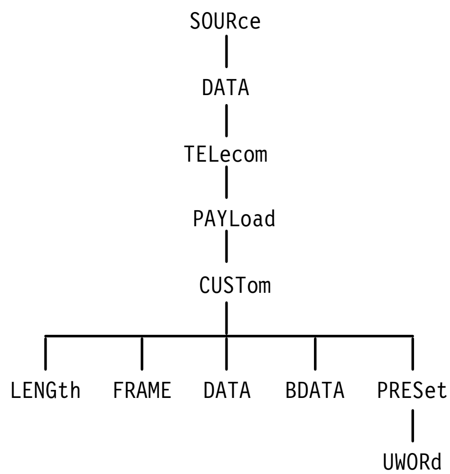


Figure 3–18: SOURce:DATA:TELecom:PAYLoad:CUSTom subsystem

Figures 3–19 and 3–20 show the layout of SONET STS-1 and STS-3c and SDH custom payloads. SONET allows a maximum of 64 frames; SDH allows a maximum of 54 frames.

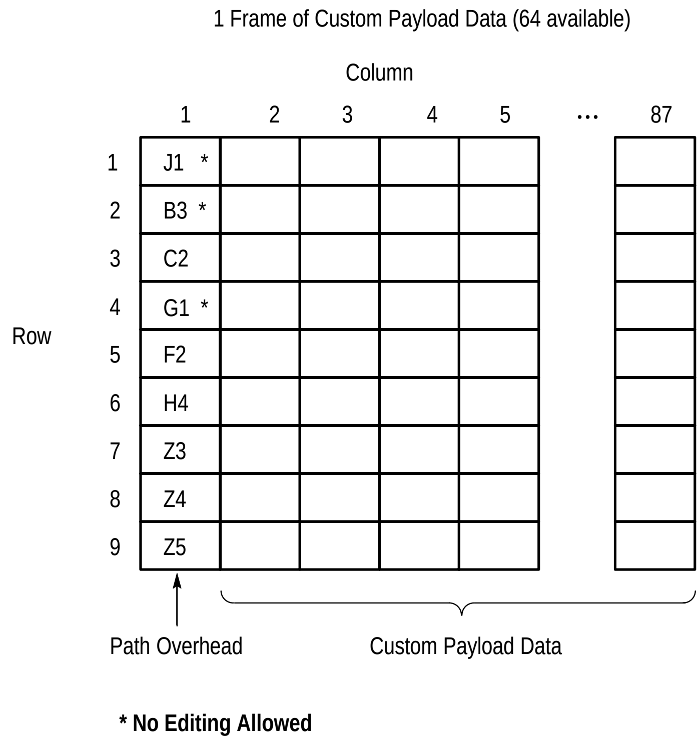


Figure 3–19: SONET STS-1 custom payload

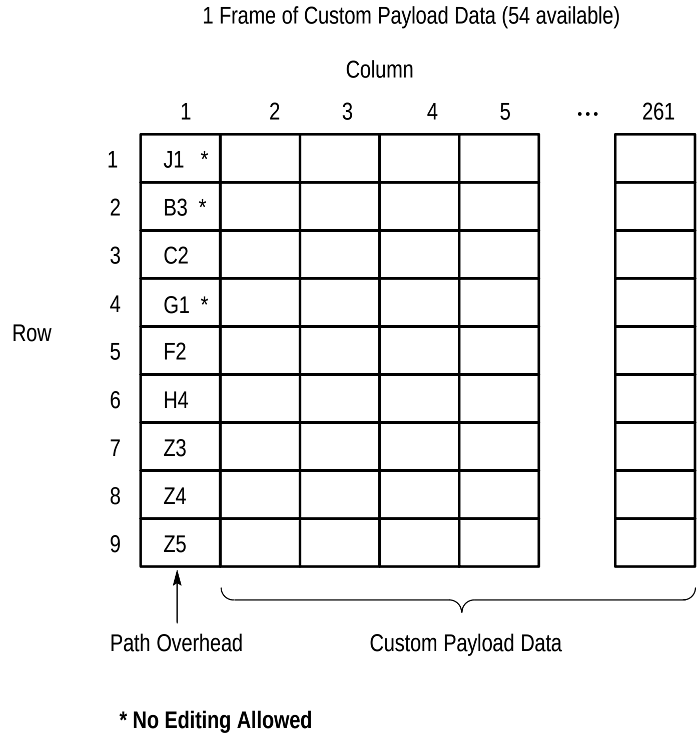


Figure 3–20: SONET STS-3c and SDH custom payload

SOURce:DATA:TELecom:PAYLoad:CUSTom:LENGth

This command selects the number of custom payloads that are mapped into the active channel.

Syntax

```
SOURce:DATA:TELecom:PAYload:CUSTom:LENGth <custom length>
```

SONET Values

<custom length> (NR1-numeric)	description
Any integer from 1 through 64	STS-1 structure (default = 1)
Any integer from 1 through 54	STS-3c structure (default = 1)

SDH Values

<custom length> (NR1-numeric)	description
Any integer from 1 through 54	Any SDH structure (default = 1)

Dependencies None

Errors and Events None

Examples `SOURCE:DATA:TELECOM:PAYLOAD:CUSTOM:LENGTH 3`

Related Commands None

SOURce:DATA:TELecom:PAYLoad:CUSTom:LENGth?

This query returns the number of custom payloads that are mapped into the active channel.

Syntax `SOURce:DATA:TELecom:PAYload:CUSTom:LENGth?`

SONET Response

<custom length> (NR1-numeric)	description
Any integer from 1 through 64	STS-1 structure (default = 1)
Any integer from 1 through 54	STS-3c structure (default = 1)

SDH Response

<custom length> (NR1-numeric)	description
Any integer from 1 through 54	Any SDH structure (default = 1)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:PAYLOAD:CUSTOM:LENGTH?`

Response: 5

Related Commands SOURce:DATA:TELecom:PAYLoad:CUSTom:LENGth

SOURce:DATA:TELecom:PAYLoad:CUSTom:FRAME

This command selects a custom payload frame to edit.

Syntax

```
SOURce:DATA:TELecom:PAYload:CUSTom:FRAME <custom frame>
```

SONET Values

<custom frame> (NR1-numeric)	description
Any integer from 1 through 64	STS-1 structure (default = 1)
Any integer from 1 through 54	STS-3c structure (default = 1)

SDH Values

<custom frame> (NR1-numeric)	description
Any integer from 1 through 54	Any SDH structure (default = 1)

Dependencies None

Errors and Events None

Examples

```
SOURCE:DATA:TELECOM:PAYLOAD:CUSTOM:FRAME 1
```

Related Commands None

SOURce:DATA:TELecom:PAYLoad:CUSTom:FRAME?

This query returns the custom payload frame number that is currently selected for edit.

Syntax

```
SOURce:DATA:TELecom:PAYload:CUSTom:FRAME?
```

SONET Response

<custom frame> (NR1-numeric)	description
Any integer from 1 through 64	STS-1 structure (default = 1)
Any integer from 1 through 54	STS-3c structure (default = 1)

SDH Response

<custom frame> (NR1-numeric)	description
Any integer from 1 through 54	Any SDH structure (default = 1)

Dependencies None

Errors and Events None

Examples

Query: `SOURCE:DATA:TELECOM:PAYLOAD:CUSTOM:FRAME?`

Response: 5

Related Commands SOURce:DATA:TELecom:PAYLoad:CUSTom:FRAME

SOURce:DATA:TELecom:PAYLoad:CUSTom:DATA

This command sets a specific byte value in the selected custom payload frame. Figure 3–19 on page 3–117 and Figure 3–20 on page 3–118 show the layout of the custom payload frame. The custom payload data cannot be modified while it is being mapped into the active channel.

Syntax

```
SOURce:DATA:TELecom:PAYload:CUSTom:DATA <custom row>,
<custom column>,<byte value>
```

SONET Values

<custom row> (NR1-numeric)[1]	description
Any integer from 1 through 9	Row of payload (default = 1)
<custom column> (NR1-numeric)	**description**
Any integer from 1 through 87	Column of payload; STS-1 structure (default = 1)
Any integer from 1 through 261	Column of payload; STS-3c structure (default = 1)
<byte value> (NR1-numeric)[2]	**description**
Any integer from 0 through 255 (hexadecimal 0 through FF)	Byte value (default = 0)

1 **The following bytes cannot be set: J1 (1,1), B3 (2,1), and G1 (4,1).**

2 **A hexadecimal value is also acceptable.**

SDH Values

<custom row> (NR1-numeric)[1]	description
Any integer from 1 through 9	Row of payload (default = 1)

<custom column> (NR1-numeric)	description
Any integer from 1 through 261	Column of payload; any SDH structure (default = 1)

<byte value> (NR1-numeric)[2]	description
Any integer from 0 through 255 (hexadecimal 0 through FF)	Byte value (default = 0)

[1] **The following bytes cannot be set: J1 (1,1), B3 (2,1), and G1 (4,1).**

[2] **A hexadecimal value is also acceptable.**

Dependencies

Use the SOURce:DATA:TELecom:PAYLoad:CUSTom:FRAME command to set the frame number.

Errors and Events

None

Examples

```
SOURCE:DATA:TELECOM:PAYLOAD:CUSTOM:DATA 1,12,#HAA
```

Related Commands

SOURce:DATA:TELecom:PAYLoad:CUSTom:FRAME

SOURce:DATA:TELecom:PAYLoad:CUSTom:DATA?

This query returns the value of the specified byte in the selected custom payload frame. Figure 3–19 on page 3–117 and Figure 3–20 on page 3–118 show the layout of the custom payload frame.

Syntax

```
SOURce:DATA:TELecom:PAYload:CUSTom:DATA? <custom row>,
<custom column>
```

SONET Values

<custom row> (NR1-numeric)	description
Any integer from 1 through 9	Row of payload (default = 1)
<custom column> (NR1-numeric)	**description**
Any integer from 1 through 87	Column of payload; STS-1 structure (default = 1)
Any integer from 1 through 261	Column of payload; STS-3c structure (default = 1)

SONET Response

<byte value> (NR1-numeric)	description
Any integer from 0 through 255	Byte value

SDH Values

<custom row> (NR1-numeric)	description
Any integer from 1 through 9	Row of payload (default = 1)
<custom column> (NR1-numeric)	**description**
Any integer from 1 through 261	Column of payload; any SDH structure (default = 1)

SDH Response

<byte value> (NR1-numeric)	description
Any integer from 0 through 255	Byte value

Dependencies

Use the SOURce:DATA:TELecom:PAYLoad:CUSTom:FRAME command to set the frame number.

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:PAYLOAD:CUSTOM:DATA? 3,3`

Response: `32`

Related Commands SOURce:DATA:TELecom:PAYLoad:CUSTom:DATA

SOURce:DATA:TELecom:PAYLoad:CUSTom:BDATA

This command sets the contents of the selected custom payload frame.

Syntax `SOURce:DATA:TELecom:PAYload:CUSTom:BDATA <custom frame data>`

SONET Values

<custom frame data> (binary block)	description
#3783xxxxxx . . . where xxxxxx is the binary representation of the data bytes	Values for 783 data bytes (STS-1 structure)
#42349xxxxxx . . . where xxxxxx is the binary representation of the data bytes	Values for 2349 data bytes (STS-3c structure)

The data bytes are ordered by row: all row 1 values, all row 2 values, and so on.

SDH Values

<custom frame data> (binary block)	description
#42349xxxxxx . . . where xxxxxx is the binary representation of the data bytes	Values for 2349 data bytes (any SDH structure)

The data bytes are ordered by row: all row 1 values, all row 2 values, and so on.

Dependencies Use the SOURce:DATA:TELecom:PAYLoad:CUSTom:FRAME command to set the frame number.

Errors and Events None

Examples `SOURCE:DATA:TELECOM:PAYLOAD:CUSTOM:BDATA #3783 ...` (SONET)

`SOURCE:DATA:TELECOM:PAYLOAD:CUSTOM:BDATA #42349 ...` (SDH)

Related Commands SOURce:DATA:TELecom:PAYLoad:CUSTom:FRAME

SOURce:DATA:TELecom:PAYLoad:CUSTom:BDATA?

This query returns the contents of the selected custom payload frame.

Syntax `SOURce:DATA:TELecom:PAYload:CUSTom:BDATA?`

SONET Response

<custom frame data> (binary block)	description
#3783xxxxxx . . . where xxxxxx is the binary representation of the data bytes	Values for 783 data bytes (STS-1 structure)
#42349xxxxxx . . . where xxxxxx is the binary representation of the data bytes	Values for 2349 data bytes (STS-3c structure)

The data bytes are ordered by row: all row 1 values, all row 2 values, and so on.

SDH Response

<custom frame data> (binary block)	description
#42349xxxxxx . . . where xxxxxx is the binary representation of the data bytes	Values for 2349 data bytes (any SDH structure)

The data bytes are ordered by row: all row 1 values, all row 2 values, and so on.

Dependencies Use the SOURce:DATA:TELecom:PAYLoad:CUSTom:FRAME command to set the frame number.

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:PAYLOAD:CUSTOM:BDATA?`

Response: `#37830101 . . .` (SONET)

Response: `#423490001 . . .` (SDH)

Related Commands SOURce:DATA:TELecom:PAYLoad:CUSTom:BDATA

SOURce:DATA:TELecom:PAYLoad:CUSTom:PRESet

This command fills the custom payload frame with the specified pattern. All path overhead bytes are set to zero except for the J1, B3, and G1 bytes which are set by the hardware.

Syntax

```
SOURce:DATA:TELecom:PAYload:CUSTom:PRESet <preset pattern>
```

SONET Values

<preset pattern> (discrete)	description
INCrement	Incrementing pattern (default)
UWORd	User-specified pattern

SDH Values

<preset pattern> (discrete)	description
INCrement	Incrementing pattern (default)
UWORd	User-specified pattern

Dependencies

Use the SOURce:DATA:TELecom:PAYLoad:CUSTom:FRAME command to set the frame number. If you choose UWORd, use the SOURce:DATA:TELecom: PAYLoad:CUSTom:PRESet:UWORd command to set the user-specified pattern.

Errors and Events

None

Examples

```
SOURCE:DATA:TELECOM:PAYLOAD:CUSTOM:PRESET INC
```

Related Commands

SOURce:DATA:TELecom:PAYLoad:CUSTom:FRAME
SOURce:DATA:TELecom:PAYLoad:CUSTom:PRESet:UWORd

SOURce:DATA:TELecom:PAYLoad:CUSTom:PRESet:UWORd

This command specifies the pattern used when SOURce:DATA:TELecom:PAYLoad:CUSTom:PRESet UWORd is selected.

Syntax

```
SOURce:DATA:TELecom:PAYload:CUSTom:PRESet:UWORd <user pattern>
```

SONET Values

<user pattern> (NR1-numeric)[1]	description
Any integer from 0 through 65535 (hexadecimal 0 through FFFF)	User-specified pattern (default = 0)

[1] **A hexadecimal value is also acceptable.**

SDH Values

<user pattern> (NR1-numeric)[1]	description
Any integer from 0 through 65535 (hexadecimal 0 through FFFF)	User-specified pattern (default = 0)

[1] **A hexadecimal value is also acceptable.**

Dependencies

SOURce:DATA:TELecom:PAYLoad:CUSTom:PRESet must be set to UWORd for this command to apply.

Errors and Events

None

Examples

```
SOURCE:DATA:TELECOM:PAYLOAD:CUSTOM:PRESET:UWORD 45
```

Related Commands

SOURce:DATA:TELecom:PAYLoad:CUSTom:PRESet:UWORd

SOURce:DATA:TELecom:PAYLoad:CUSTom:PRESet:UWORd?

This returns the current setting of the pattern used when SOURce:DATA:TELecom:PAYLoad:CUSTom:PRESet UWORd is selected.

Syntax

`SOURce:DATA:TELecom:PAYload:CUSTom:PRESet:UWORd?`

SONET Response

<user pattern> (NR1-numeric)	description
Any integer from 0 through 65535	User-specified pattern

SDH Response

<user pattern> (NR1-numeric)	description
Any integer from 0 through 65535	User-specified pattern

Dependencies

SOURce:DATA:TELecom:PAYLoad:CUSTom:PRESet must be set to UWORd for this query to apply.

Errors and Events

None

Examples

Query: `SOURCE:DATA:TELECOM:PAYLOAD:CUSTOM:PRESET:UWORD?`

Response: `0`

Related Commands

SOURce:DATA:TELecom:PAYLoad:CUSTom:PRESet:UWORd

SOURce:DATA:TELecom:TRIButary Subsystem

Add/Drop/Test Option Only

This section describes the commands and queries that control the tributary signals. Figure 3–21 shows the hierarchy tree for this subsystem.

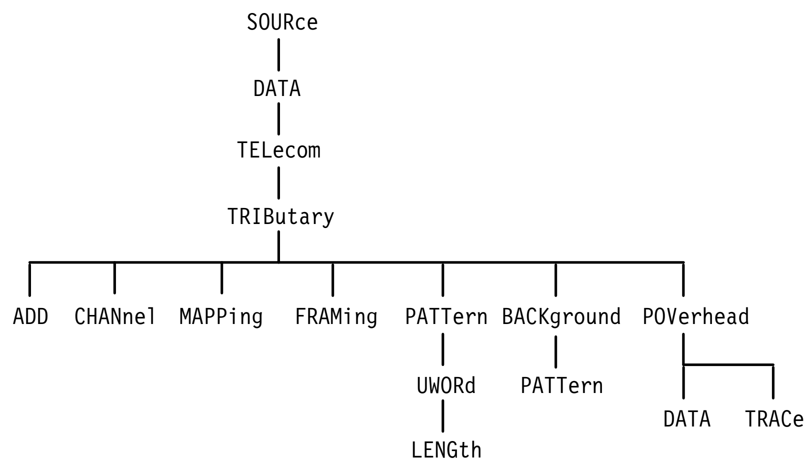


Figure 3–21: SOURce:DATA:TELecom:TRIButary subsystem

SOURce:DATA:TELecom:TRIButary:ADD

Add/Drop/Test Option Only

This command selects the source for the tributary payload data.

Syntax `SOURce:DATA:TELecom:TRIButary:ADD <trib add>`

SONET Values

<trib add> (boolean)	description
OFF or 0	Internal source; an internally generated data pattern is placed in the payload (default)
ON or 1	External tributary signal mapped into the signal; signal mapping is determined by the SOURce:DATA:TELecom:TRIButary: MAPPing command; if no signal is present, AIS is mapped into the payload

SDH Values

<trib add> (boolean)	description
OFF or 0	Internal source; an internally generated data pattern is placed in the payload (default)
ON or 1	External tributary signal mapped into the signal; signal mapping is determined by the SOURce:DATA:TELecom:TRIButary: MAPPing command; if no signal is present, AIS is mapped into the payload

Dependencies None

Errors and Events None

Examples `SOURCE:DATA:TELECOM:TRIBUTARY:ADD ON`

Related Commands INPUT2 and INPUT3 subsystems

SOURce:DATA:TELecom:TRIButary:ADD?

Add/Drop/Test Option Only

This query returns the source for the tributary payload data.

Syntax `SOURce:DATA:TELecom:TRIButary:ADD?`

SONET Response

<trib add> (boolean)	description
0	Internal source; an internally generated data pattern is placed in the payload (default)
1	External tributary signal mapped into the signal; signal mapping is determined by the SOURce:DATA:TELecom:TRIButary: MAPPing command; if no signal is present, AIS is mapped into the payload

SDH Response

<trib add> (boolean)	description
0	Internal source; an internally generated data pattern is placed in the payload (default)
1	External tributary signal mapped into the signal; signal mapping is determined by the SOURce:DATA:TELecom:TRIButary: MAPPing command; if no signal is present, AIS is mapped into the payload

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIBUTARY:ADD?`

Response: `0`

Related Commands SOURce:DATA:TELecom:TRIButary:ADD

SOURce:DATA:TELecom:TRIButary:CHANnel

Add/Drop/Test Option Only

This command selects the VTASYNC/TUASYNC channel.

Syntax `SOURce:DATA:TELecom:TRIButary:CHANnel <trib channel>`

SONET Values

<trib channel> (NR1-numeric)	description
Any integer between 1 and 28	VTASYNC (VT 1.5) mapping (default = 1)
1	DS3 mapping

SDH Values

<trib channel> (NR1-numeric)	description
Any integer between 1 and 63	TUASYNC (TU-12) mapping (default = 1)
Any integer between 1 and 3	TU-3 mapping (default = 1)
1	M140 mapping

Dependencies

SOURce:DATA:TELecom:TRIButary:MAPPing determines the number of channels available for selection.

Errors and Events

None

Examples

`SOURCE:DATA:TELECOM:TRIBUTARY:CHANNEL 1`

Related Commands

SOURce:DATA:TELecom:TRIButary:MAPPing

SOURce:DATA:TELecom:TRIButary:CHANnel?

Add/Drop/Test Option Only

This query returns the current VTASYNC/TUASYNC channel.

Syntax

`SOURce:DATA:TELecom:TRIButary:CHANnel?`

SONET Response

<trib channel> (NR1-numeric)	description
Any integer between 1 and 28	VTASYNC (VT 1.5) mapping (default = 1)
1	DS3 mapping

SDH Response

<trib channel> (NR1-numeric)	description
Any integer between 1 and 63	TUASYNC (TU-12) mapping (default = 1)
Any integer between 1 and 3	TU-3 mapping (default = 1)
1	M140 mapping

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIBUTARY:CHANNEL?`

Response: 1

Related Commands SOURce:DATA:TELecom:TRIButary:CHANnel

SOURce:DATA:TELecom:TRIButary:MAPPing

Add/Drop/Test Option Only

This command selects the tributary payload mapping. When you are actively mapping and demapping a tributary signal, the SOURce:DATA:TELecom:TRIButary:MAPPing and SENSe:DATA:TELecom:TRIButary:MAPPing functions are coupled; a change to one causes the same change to the other. When this command is sent, the C2 byte of the path overhead is set.

Syntax `SOURce:DATA:TELecom:TRIButary:MAPPing <trib mapping>`

SONET Values

<trib mapping> (discrete)	description
VTASYNC	Mapped DS1 signal into a VTASYNC (default)
DS3	Mapped DS3 signal

SDH Values

<trib mapping> (discrete)	description
TUASYNC	Mapped 2 Mb/s signal into TU-12 floating async (default)
TU3	Mapped 34 Mb/s signal
M140	Mapped 140 Mb/s signal

Dependencies None

Errors and Events None

Examples `SOURCE:DATA:TELECOM:TRIBUTARY:MAPPING TUASYNC`

Related Commands SOURce:DATA:TELecom:PAYLoad:CHANnel

SOURce:DATA:TELecom:TRIButary:MAPPing?

Add/Drop/Test Option Only

This query returns the current tributary payload mapping.

Syntax `SOURce:DATA:TELecom:TRIButary:MAPPing?`

SONET Response

<trib mapping> (discrete)	description
VTASYNC	Mapped DS1 signal into a VTASYNC (default)
DS3	Mapped DS3 signal

SDH Response

<trib mapping> (discrete)	description
TUASYNC	Mapped 2 Mb/s signal into TU-12 floating async (default)
TU3	Mapped 34 Mb/s signal
M140	Mapped 140 Mb/s signal

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIBUTARY:MAPPING?`

Response: `TUASYNC`

Related Commands SOURce:DATA:TELecom:TRIButary:MAPPing

SOURce:DATA:TELecom:TRIButary:FRAMing

Add/Drop/Test Option Only

This command selects the framing of the transmitted tributary signal.

Syntax

`SOURce:DATA:TELecom:TRIButary:FRAMing <trib framing>`

SONET Values

<trib framing> (discrete)	description
UNFRamed	No framing (default)
SF	DS1 superframe
ESF	DS1 extended superframe
CBIT	CBIT framing
M13	M13 framing

SDH Values

<trib framing> (discrete)	description
UNFRamed	No framing (default)
PCM30	2 Mb/s, PCM, 30 channels, no CRC checking
PCM31	2 Mb/s, PCM, 31 channels, no CRC checking
PCM30CRC	2 Mb/s, PCM, 30 channels, with CRC checking
PCM31CRC	2 Mb/s, PCM 31 channels, with CRC checking
FRAMed	34 Mb/s or 140 Mb/s framing

Dependencies

None

Errors and Events

None

Examples

`SOURCE:DATA:TELECOM:TRIBUTARY:FRAMING UNFRAMED`

Related Commands

None

SOURce:DATA:TELecom:TRIButary:FRAMing?

Add/Drop/Test Option Only

This query returns the current framing of the transmitted tributary signal.

Syntax `SOURce:DATA:TELecom:TRIButary:FRAMing?`

SONET Response

<trib framing> (discrete)	description
UNFRamed	No framing (default)
SF	DS1 superframe
ESF	DS1 extended superframe
CBIT	CBIT framing
M13	M13 framing

SDH Response

<trib framing> (discrete)	description
UNFRamed	No framing (default)
PCM30	2 Mb/s, PCM, 30 channels, no CRC checking
PCM31	2 Mb/s, PCM, 31 channels, no CRC checking
PCM30CRC	2 Mb/s, PCM, 30 channels, with CRC checking
PCM31CRC	2 Mb/s, PCM 31 channels, with CRC checking
FRAMed	34 Mb/s or 140 Mb/s framing

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIBUTARY:FRAMING?`

Response: `UNFRAMED`

Related Commands SOURce:DATA:TELecom:TRIButary:FRAMing

SOURce:DATA:TELecom:TRIButary:PATTern

Add/Drop/Test Option Only

This command selects the internally generated pattern that is placed in the tributary payload.

Syntax

```
SOURce:DATA:TELecom:TRIButary:PATTern <trib pattern>
```

SONET Values

<trib pattern> (discrete)	description
PRBS23	A pseudo-random binary sequence of length 2^{23}–1 is placed in the tributary payload (default)
QRSS	Quasi-random signal source pattern (DS1 rate only)
PRBS15	A pseudo-random binary sequence of length 2^{15}–1 is placed in the tributary payload
PRBS20	A pseudo-random binary sequence of length 2^{20}–1 is placed in the tributary payload
AZEROs	All zeros are placed in the payload
AONEs	All ones are placed in the payload
UWORd	A user-defined pattern is placed in the payload
FIXED_1_8	1 bit in 8 set; #H40 (DS1 rate only)
FIXED_3_24	3 bits in 24; #H440004 (DS1 rate only)

SDH Values

<trib pattern> (discrete)	description
PRBS23	A pseudo-random binary sequence of length 2^{23}–1 is placed in the tributary payload (default)
PRBS15	A pseudo-random binary sequence of length 2^{15}–1 is placed in the tributary payload
PRBS20	A pseudo-random binary sequence of length 2^{20}–1 is placed in the tributary payload
AZEROs	All zeros are placed in the payload
AONEs	All ones are placed in the payload
UWORd	A user-defined pattern is placed in the payload
FIXED_1_8	1 bit in 8 set; #H80 (all PDH rates)

Dependencies SOURce:DATA:TELecom:TRIButary:ADD must be set to OFF for this command to apply.

Errors and Events None

Examples `SOURCE:DATA:TELECOM:TRIBUTARY:PATTERN PRBS15`

Related Commands SOURce:DATA:TELecom:TRIButary:PATTern:UWORd

SOURce:DATA:TELecom:TRIButary:PATTern?

Add/Drop/Test Option Only

This query returns the current internally generated tributary payload pattern.

Syntax `SOURce:DATA:TELecom:TRIButary:PATTern?`

SONET Response

<trib pattern> (discrete)	description
PRBS23	A pseudo-random binary sequence of length $2^{23}–1$ is in the tributary payload (default)
QRSS	Quasi-random signal source pattern (DS1 rate only)
PRBS15	A pseudo-random binary sequence of length $2^{15}–1$ is in the tributary payload
PRBS20	A pseudo-random binary sequence of length $2^{20}–1$ is in the tributary payload
AZEROs	All zeros are in the payload
AONEs	All ones are in the payload
UWORd	A user-defined pattern is in the payload
FIXED_1_8	1 bit in 8 set; #H40 (DS1 rate only)
FIXED_3_24	3 bits in 24; #H440004 (DS1 rate only)

SDH Response

<trib pattern> (discrete)	description
PRBS23	A pseudo-random binary sequence of length 2^{23}–1 is in the tributary payload (default)
PRBS15	A pseudo-random binary sequence of length 2^{15}–1 is in the tributary payload
PRBS20	A pseudo-random binary sequence of length 2^{20}–1 is in the tributary payload
AZEROs	All zeros are in the payload
AONEs	All ones are in the payload
UWORd	A user-defined pattern is in the payload
FIXED_1_8	1 bit in 8 set; #H80 (all PDH rates)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIBUTARY:PATTERN?`

Response: `PRBS23`

Related Commands SOURce:DATA:TELecom:TRIButary:PATTern

SOURce:DATA:TELecom:TRIButary:PATTern:UWORd

Add/Drop/Test Option Only

This command sets the user-defined pattern that is placed in the tributary payload.

Syntax `SOURce:DATA:TELecom:TRIButary:PATTern:UWORd <trib user pattern>`

SONET Values

<trib user pattern> (hexadecimal)	description
Any 8, 16, or 24 bit hexadecimal number in the range #H00 to #HFFFFFF	Repeating pattern is placed in the tributary payload (default = #H00)

SDH Values

<trib user pattern> (hexadecimal)	description
Any 8, 16, or 24 bit hexadecimal number in the range #H00 to #HFFFFFF	Repeating pattern is placed in the tributary payload (default = #H00)

Dependencies

SOURce:DATA:TELecom:TRIButary:PATTern must be set to UWORd for this command to apply. Use the SOURce:DATA:TELecom:TRIButary:PATTern:UWORd:LENgth command to set the length of the repeating pattern.

Errors and Events

None

Examples

```
SOURCE:DATA:TELECOM:TRIBUTARY:PATTERN:UWORD #HAA5500
```

Related Commands

SOURce:DATA:TELecom:TRIButary:PATTern
SOURce:DATA:TELecom:TRIButary:PATTern:UWORd:LENgth

SOURce:DATA:TELecom:TRIButary:PATTern:UWORd?

Add/Drop/Test Option Only

This query returns the user-defined pattern that is placed in the tributary payload.

Syntax

```
SOURce:DATA:TELecom:TRIButary:PATTern:UWORd?
```

SONET Response

<trib user pattern> (hexadecimal)	description
Any 8, 16, or 24 bit hexadecimal number in the range #H00 to #HFFFFFF	Repeating pattern is placed in the tributary payload (default = #H00)

SDH Response

<trib user pattern> (hexadecimal)	description
Any 8, 16, or 24 bit hexadecimal number in the range #H00 to #HFFFFFF	Repeating pattern is placed in the tributary payload (default = #H00)

Dependencies SOURce:DATA:TELecom:TRIButary:PATTern must be set to UWORd for this query to apply. Use the SOURce:DATA:TELecom:TRIButary:PATTern:UWORd:LENgth command to set the length of the repeating pattern.

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIBUTARY:PATTERN:UWORD?`

Response: `#HAA5500`

Related Commands SOURce:DATA:TELecom:TRIButary:PATTern:UWORd

SOURce:DATA:TELecom:TRIButary:PATTern:UWORd:LENgth

Add/Drop/Test Option Only

This command sets the number of bytes of the user-defined pattern that are repeated in the tributary payload.

Syntax

```
SOURce:DATA:TELecom:TRIButary:PATTern:UWORd:LENgth <trib user pattern length>
```

SONET Values

<trib user pattern length> (NR1-numeric)	description
Any integer in the range 1 to 3	Number of bytes of user-defined pattern that are repeated in the tributary payload (default = 1)

SDH Values

<trib user pattern length> (NR1-numeric)	description
Any integer in the range 1 to 3	Number of bytes of user-defined pattern that are repeated in the tributary payload (default = 1)

Dependencies SOURce:DATA:TELecom:TRIButary:PATTern must be set to UWORd for this command to apply. Use the SOURce:DATA:TELecom:TRIButary:PATTern:UWORd command to set the repeating pattern.

Errors and Events None

Examples `SOURCE:DATA:TELECOM:TRIBUTARY:PATTERN:UWORD:LENGTH 3`

Related Commands SOURce:DATA:TELecom:TRIButary:PATTern:UWORd

SOURce:DATA:TELecom:TRIButary:PATTern:UWORd:LENgth?

Add/Drop/Test Option Only

This query returns the number of bytes of the user-defined pattern that are repeated in the tributary payload.

Syntax `SOURce:DATA:TELecom:TRIButary:PATTern:UWORd:LENgth?`

SONET Response

<trib user pattern length> (NR1-numeric)	description
Any integer in the range 1 to 3	Number of bytes of user-defined pattern that are repeated in the tributary payload (default = 1)

SDH Response

<trib user pattern length> (NR1-numeric)	description
Any integer in the range 1 to 3	Number of bytes of user-defined pattern that are repeated in the tributary payload (default = 1)

Dependencies SOURce:DATA:TELecom:TRIButary:PATTern must be set to UWORd for this query to apply. Use the SOURce:DATA:TELecom:TRIButary:PATTern:UWORd:LENgth command to set the length of the repeating pattern.

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIBUTARY:PATTERN:UWORD:LENGTH?`

Response: 3

Related Commands SOURce:DATA:TELecom:TRIButary:PATTern:UWORd:LENgth

SOURce:DATA:TELecom:TRIButary:BACKground:PATTern

Add/Drop/Test Option Only

This command selects the internally generated pattern that is placed in the tributary payload for inactive channels.

Syntax

```
SOURce:DATA:TELecom:TRIButary:BACKground:PATTern <trib background pattern>
```

SONET Values

<trib background pattern> (discrete)	description
QRSS	Quasi-random signal source pattern (VTASYNC only) (default)
IDLE	An idle pattern is placed in the tributary payload of inactive channels

SDH Values

<trib background pattern> (discrete)	description
PRBS	A pseudo-random binary sequence of length $2^{15}-1$ is placed in the tributary payload of inactive channels (TUASYNC only) (default)
IDLE	An idle pattern is placed in the tributary payload of inactive channels

Dependencies None

Errors and Events None

Examples

```
SOURCE:DATA:TELECOM:TRIBUTARY:BACKGROUND:PATTERN IDLE
```

Related Commands None

SOURce:DATA:TELecom:TRIButary:BACKground:PATTern?

Add/Drop/Test Option Only

This query returns the current internally generated tributary payload pattern placed in inactive channels.

Syntax `SOURce:DATA:TELecom:TRIButary:BACKground:PATTern?`

SONET Response

<trib background pattern> (discrete)	description
QRSS	Quasi-random signal source pattern (VTASYNC only) (default)
IDLE	An idle pattern is placed in the tributary payload of inactive channels

SDH Response

<trib background pattern> (discrete)	description
PRBS	A pseudo-random binary sequence of length 2^{15}–1 is placed in the tributary payload of inactive channels (TUASYNC only) (default)
IDLE	An idle pattern is placed in the tributary payload of inactive channels

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIBUTARY:BACKGROUND:PATTERN?`

Response: `IDLE`

Related Commands SOURce:DATA:TELecom:TRIButary:BACKground:PATTern

SOURce:DATA:TELecom:TRIButary:POVerhead:DATA

This command sets or queries the bytes in the tributary path overhead.

Syntax

```
SOURce:DATA:TELecom:TRIButary:POVerhead:DATA <byte name>,<value>
SOURce:DATA:TELecom:TRIButary:POVerhead:DATA? <byte>
```

SONET Values

<byte name> (discrete)	description
V5	(VT1.5)
<value> (NR1-numeric)[1]	**description**
Any integer in the range 0 to 255 (hexadecimal 00 to FF)	The selected byte is set to this value

[1] **A hexadecimal value is also acceptable.**

SDH Values

<byte name> (discrete)	description
C2	Signal label (TU3)
F2	User channel (TU3)
F3	Growth bytes (TU3)
H4	Indicator (TU3)
K3	(TU3)
K4	(TU12)
N1	(TU3)
N2	(TU12)
V5	(TU12)
<value> (NR1-numeric)[2]	**description**
Any integer in the range 0 to 255 (hexadecimal 00 to FF)	The selected byte is set to this value

[2] **A hexadecimal value is also acceptable.**

Dependencies None

Errors and Events None

Examples

```
SOURCE:DATA:TELECOM:TRIBUTARY:POVERHEAD:DATA V5,#H55
```

Related Commands SOURce:DATA:TELecom:TRIButary:POVerhead:TRACe

SOURce:DATA:TELecom:TRIButary:POVerhead:DATA?

This query returns the value in the specified tributary path overhead bytes. (Applies to TU3, TU12, and VT1.5 mappings.)(Applies to VT1.5 mapping.)

Syntax `SOURce:DATA:TELecom:TRIButary:POVerhead:DATA? <byte>`

SONET Response

<byte> (discrete)	description
V5	(VT1.5)
<value> (NR1-numeric)[1]	**description**
Any integer in the range 0 to 255 (hexadecimal 00 to FF)	The selected byte is set to this value

[1] **A hexadecimal value is also acceptable.**

SDH Response

<byte name> (discrete)	description
C2	Signal label (TU3)
F2	User channel (TU3)
F3	Growth bytes (TU3)
H4	Indicator (TU3)
K3	(TU3)
K4	(TU12)
N1	(TU3)
N2	(TU12)
V5	(TU12)
<value> (NR1-numeric)[2]	**description**
Any integer in the range 0 to 255 (hexadecimal 00 to FF)	The selected byte is set to this value

[2] **A hexadecimal value is also acceptable.**

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIBUTARY:POVERHEAD:DATA? V5`

Response: `255`

Related Commands SOURce:DATA:TELecom:TRIButary:POVerhead:DATA

SOURce:DATA:TELecom:TRIButary:POVerhead:TRACe?

This query returns the current path trace string that repeats in the J1 byte, for TU3, and the J2 byte for TU12 mapping, as a 16 character repeating sequence.

Syntax `SOURce:DATA:TELecom:TRIButary:POVerhead:TRACe?`

Response

<path trace> (string)	description
A 16 character string	The J1 or J2 path trace string

Dependencies SDH mode only

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIBUTARY:POVERHEAD:TRACE?`

Response: `"TEK VX4610"`

Related Commands None

SOURce:DATA:TELecom:TRIButary:ERRor, ALARm, FAILure Subsystem

This section describes subsystem commands that control abnormal conditions in the transmitted tributary signal.

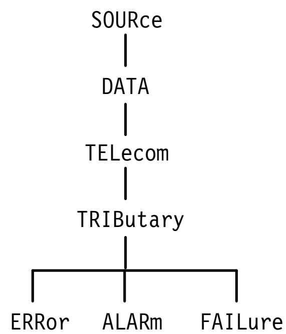


Figure 3–22: SOURce:DATA:TELecom:TRIButary:ERRor, ALARm, FAILure subsystem

SOURce:DATA:TELecom:TRIButary:ERRor

Add/Drop/Test Option Only

This command selects the type of tributary error that is transmitted at a rate specified by SOURce:DATA:TELecom:ERRor:RATE. Use the SOURce: DATA:TELecom:ERRor:IMMediate command to insert the error.

Syntax

```
SOURce:DATA:TELecom:TRIButary:ERRor <trib error>
```

SONET Values

<trib error> (discrete)	description
NONE	No error transmitted
DATA	Error in pattern
FRAME	Frame error
CRC	CRC error; you must be transmitting a DS1 tributary signal and framing must be set to ESF
PARity	Parity error; you must be transmitting a DS3 tributary signal
VTFEBe	VT FEBE
VTBIP	VT BIP

SDH Values

<trib error> (discrete)	description
NONE	No error transmitted
DATA	Error in pattern
FRAME	Frame error
CRC	CRC error; you must be transmitting a 2 Mb/s tributary signal (PCM30CRC and PCM31CRC framing only)
TUFEBe	TU FEBE
TUBIP	TU BIP

Dependencies

SOURce:DATA:TELecom:ERRor:TYPE must be set to TRIButary for this query to apply.

Errors and Events

None

Examples

`SOURCE:DATA:TELECOM:ERROR DATA`

Related Commands

SOURce:DATA:TELecom:ERRor:TYPE
SOURce:DATA:TELecom:ERRor:RATE
SOURce:DATA:TELecom:ERRor:IMMediate

SOURce:DATA:TELecom:TRIButary:ERRor?

Add/Drop/Test Option Only

This query returns the current setting of the tributary error type.

Syntax

`SOURce:DATA:TELecom:TRIButary:ERRor?`

SONET Response

<trib error> (discrete)	description
NONE	No error transmitted
DATA	Error in pattern
FRAME	Frame error
CRC	CRC error; you must be transmitting a DS1 tributary signal and framing must be set to ESF
PARity	Parity error; you must be transmitting a DS3 tributary signal
VTFEbe	VT FEBE
VTBIP	VT BIP

SDH Response

<trib error> (discrete)	description
NONE	No error transmitted
DATA	Error in pattern
FRAME	Frame error
CRC	CRC error; you must be transmitting a 2 Mb/s tributary signal (PCM30CRC and PCM31CRC framing only)
TUFEBe	TU FEBE
TUBIP	TU BIP

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIB:ERROR?`

Response: `DATA`

Related Commands SOURce:DATA:TELecom:TRIButary:ERRor

SOURce:DATA:TELecom:TRIButary:ALARm

Add/Drop/Test Option Only

This command selects a tributary alarm to transmit.

Syntax `SOURce:DATA:TELecom:TRIButary:ALARm <trib alarm>`

SONET Values

<trib alarm> (discrete)	description
NONE	No alarm transmitted (default)
VTPAIS	VT path AIS
VTFErf	VT FERF
AIS	Tributary AIS
YELlow	Tributary yellow
IDLE	DS3 idle

SDH Values

<trib alarm> (discrete)	description
NONE	No alarm transmitted (default)
AIS	Tributary AIS
TUFERF	TU FERF
TUAIS	TU AIS
RAI	Remote Alarm Indication

Dependencies None

Errors and Events None

Examples `SOURCE:DATA:TELECOM:TRIBUTARY:ALARM NONE`

Related Commands None

SOURce:DATA:TELecom:TRIButary:ALARm?

Add/Drop/Test Option Only

This query returns the current setting of the transmitted tributary alarm type.

Syntax `SOURce:DATA:TELecom:TRIButary:ALARm?`

SONET Response

<trib alarm> (discrete)	description
NONE	No alarm transmitted (default)
VTPAIS	VT path AIS
VTFErf	VT FERF
AIS	Tributary AIS
YELlow	Tributary yellow
IDLE	DS3 idle

SDH Response

<trib alarm> (discrete)	description
NONE	No alarm transmitted (default)
AIS	Tributary AIS
TUFERF	TU FERF
TUAIS	TU AIS
RAI	Remote Alarm Indication

Dependencies None

Errors and Events None

Examples

Query: `SOURCE:DATA:TELECOM:TRIB:ALARM?`

Response: `NONE`

Related Commands

SOURce:DATA:TELecom:TRIButary:ALARm

SOURce:DATA:TELecom:TRIButary:FAILure

Add/Drop/Test Option Only

This command selects a tributary failure to transmit.

Syntax

`SOURce:DATA:TELecom:TRIButary:FAILure <trib failure>`

SONET Values

<trib failure> (discrete)	description
NONE	No failure transmitted (default)
VTLOP	VT Loss of Pointer
VTLOM	VT Loss of Multiframe

SDH Values

<trib failure> (discrete)	description
NONE	No failure transmitted (default)
TULOP	TU Loss of Pointer
TULOM	TU Loss of Multiframe

Dependencies

None

Errors and Events

None

Examples

`SOURCE:DATA:TELECOM:TRIBUTARY:FAILURE NONE`

Related Commands

None

SOURce:DATA:TELecom:TRIButary:FAILure?

Add/Drop/Test Option Only

This query returns the current setting of the transmitted tributary failure type.

Syntax

`SOURce:DATA:TELecom:TRIButary:FAILure?`

SONET Response

<trib failure> (discrete)	description
NONE	No failure transmitted (default)
VTLOP	VT Loss of Pointer
VTLOM	VT Loss of Multiframe

SDH Response

<trib failure> (discrete)	description
NONE	No failure transmitted (default)
TULOP	TU Loss of Pointer
TULOM	TU Loss of Multiframe

Dependencies

None

Errors and Events

None

Examples

Query: `SOURCE:DATA:TELECOM:TRIB:FAILURE?`

Response: `NONE`

Related Commands

SOURce:DATA:TELecom:TRIButary:FAILure

SOURce:DATA:TELecom:TRIButary:POINter Subsystem

Add/Drop/Test Option Only

This section describes the commands and queries that adjust pointers for the transmitted VT/TU mapped signal. Figure 3–23 shows the hierarchy tree for this subsystem.

***NOTE**. SOURce:DATA:TELecom:POINter:MODE must be set to TRIButary for any command or query in this section to apply.*

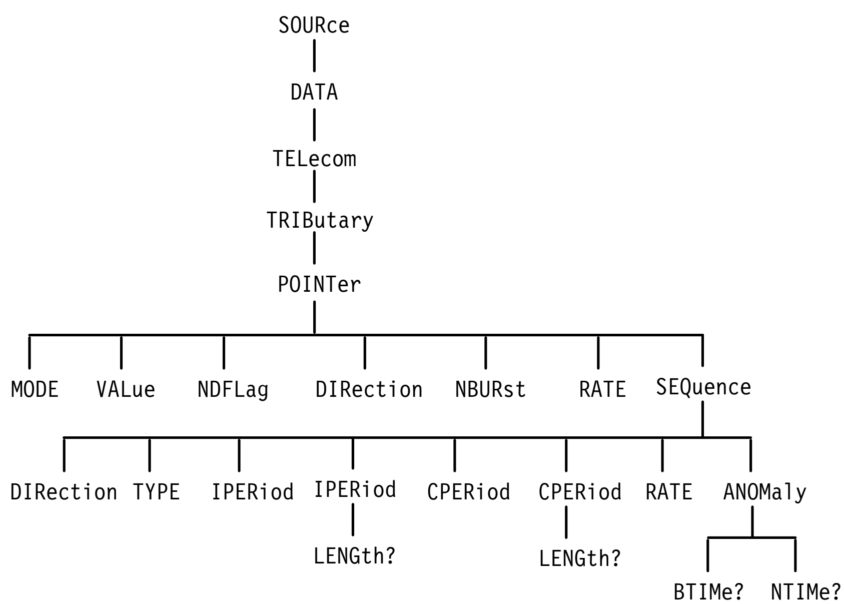


Figure 3–23: SOURce:DATA:TELecom:TRIButary:POINTer subsystem

SOURce:DATA:TELecom:TRIButary:POINter:MODE

Add/Drop/Test Option Only

This command controls the VT/TU pointer manipulation modes.

Syntax `SOURce:DATA:TELecom:TRIButary:POINter:MODE <trib pointer mode>`

SONET Values

<trib pointer mode> (discrete)	description
MANual	Pointers are controlled by SOURce:DATA:TRIButary:POINter:VALue and SOURce:DATA:TRIButary:POINter:NDFLag (default)
SINGle	Pointer adjustments alternately increment and decrement when the SOURce:DATA:TELecom:POINter:ACTion command is given
BURSt	When the SOURce:DATA:TELecom:POINter:ACTion command is given, a burst of pointer adjustments is sent at the maximum rate (1 in 4 frames) with a count defined by SOURce:DATA:TRIButary:POINter:NBURst
CONTinuous	Pointers are continuously adjusted according to the SOURce:DATA:TRIButary:POINter:DIRection and SOURce:DATA:TRIButary:POINter:RATE commands
SEQuence	Pointers are stressed according to sequences in T1.105.03–1994 or G.783

SDH Values

<trib pointer mode> (discrete)	description
MANual	Pointers are controlled by SOURce:DATA:TRIButary:POINter:VALue and SOURce:DATA:TRIButary:POINter:NDFLag (default)
SINGle	Pointer adjustments alternately increment and decrement when the SOURce:DATA:TELecom:POINter:ACTion command is given
BURSt	When the SOURce:DATA:TELecom:POINter:ACTion command is given, a burst of pointer adjustments is sent at the maximum rate (1 in 4 frames) with a count defined by SOURce:DATA:TRIButary:POINter:NBURst
CONTinuous	Pointers are continuously adjusted according to the SOURce:DATA:TRIButary:POINter:DIRection and SOURce:DATA:TRIButary:POINter:RATE commands
SEQuence	Pointers are stressed according to sequences in T1.105.03–1994 or G.783

Dependencies SOURce:DATA:TELecom:POINter:MODE must be set to TRIButary for this command to apply. You can control only STS/AU or VT/TU pointer adjustments at any one time.

Errors and Events None

Examples `SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:MODE MANUAL`

Related Commands SOURce:DATA:TELecom:POINter:MODE

SOURce:DATA:TELecom:TRIButary:POINter:MODE?

Add/Drop/Test Option Only

This query returns the current setting of the VT/TU pointer mode.

Syntax `SOURce:DATA:TELecom:TRIButary:POINter:MODE?`

SONET Response

<trib pointer mode> (discrete)	description
MANual	Pointers are controlled by SOURce:DATA:TRIButary:POINter:VALue and SOURce:DATA:TRIButary:POINter:NDFLag (default)
SINGle	Pointer adjustments alternately increment and decrement when the SOURce:DATA:TELecom:POINter:ACTion command is given
BURSt	When the SOURce:DATA:TELecom:POINter:ACTion command is given, a burst of pointer adjustments is sent at the maximum rate (1 in 4 frames) with a count defined by SOURce:DATA:TRIButary:POINter:NBURst
CONTinuous	Pointers are continuously adjusted according to the SOURce:DATA:TRIButary:POINter:DIRection and SOURce:DATA:TRIButary:POINter:RATE commands
SEQuence	Pointers are stressed according to sequences in T1.105.03–1994 or G.783

SDH Response

<trib pointer mode> (discrete)	description
MANual	Pointers are controlled by SOURce:DATA:TRIButary:POINter:VALue and SOURce:DATA:TRIButary:POINter:NDFLag (default)
SINGle	Pointer adjustments alternately increment and decrement when the SOURce:DATA:TELecom:POINter:ACTion command is given
BURSt	When the SOURce:DATA:TELecom:POINter:ACTion command is given, a burst of pointer adjustments is sent at the maximum rate (1 in 4 frames) with a count defined by SOURce:DATA:TRIButary:POINter:NBURst
CONTinuous	Pointers are continuously adjusted according to the SOURce:DATA:TRIButary:POINter:DIRection and SOURce:DATA:TRIButary:POINter:RATE commands
SEQuence	Pointers are stressed according to sequences in T1.105.03–1994 or G.783

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:MODE?`

Response: `MANUAL`

Related Commands SOURce:DATA:TELecom:TRIButary:POINter:MODE

SOURce:DATA:TELecom:TRIButary:POINter:VALue

Add/Drop/Test Option Only

This command sets the VT/TU pointer value. If SOURce:DATA:TELecom:TRIButary:POINter:NDFLag is set to ON, a New Data Flag (NDF) is sent with each new value received.

Syntax `SOURce:DATA:TELecom:TRIButary:POINter:VALue <trib pointer value>`

SONET Values

<trib pointer value> (NR1-numeric)	description
Any integer in the range 0 to 1023	VTASYNC (default = 78, illegal > 103)

SDH Values

<trib pointer value> (NR1-numeric)	description
Any integer in the range 0 to 1023	TUASYNC (default = 105, illegal > 139) TU3 (default = 595, illegal > 764)

Dependencies

SOURce:DATA:TELecom:POINter:MODE must be set to TRIButary for this command to apply. You can control only STS/AU or VT/TU pointer adjustments at any one time.

SOURce:DATA:TELecom:TRIButary:POINter:MODE must be set to MANual for this command to apply.

Errors and Events

None

Examples

`SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:VALUE 10`

Related Commands

SOURce:DATA:TELecom:TRIButary:POINter:MODE

SOURce:DATA:TELecom:TRIButary:POINter:VALue?

Add/Drop/Test Option Only

This query returns the current VT/TU pointer value transmitted.

Syntax

`SOURce:DATA:TELecom:TRIButary:POINter:VALue?`

SONET Response

<trib pointer value> (NR1-numeric)	description
Any integer in the range 0 to 1023	VTASYNC (default = 78, illegal > 103)

SDH Response

<trib pointer value> (NR1-numeric)	description
Any integer in the range 0 to 1023	TUASYNC (default = 105, illegal > 139) TU3 (default = 595, illegal > 764)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:VALUE?`

Response: `102`

Related Commands SOURce:DATA:TELecom:TRIBxutary:POINter:VALue

SOURce:DATA:TELecom:TRIButary:POINter:NDFLag

Add/Drop/Test Option Only

This command controls the generation of a New Data Flag (NDF) when VT/TU pointer adjustments occur.

Syntax `SOURce:DATA:TELecom:TRIButary:POINter:NDFLag <trib NDF state>`

SONET Values

<trib NDF state> (boolean)	description
1 or ON	On (default)
0 or OFF	Off

SDH Values

<trib NDF state> (boolean)	description
1 or ON	On (default)
0 or OFF	Off

Dependencies

SOURce:DATA:TELecom:POINter:MODE must be set to TRIButary for this command to apply. You can control only STS/AU or VT/TU pointer adjustments at any one time.

SOURce:DATA:TELecom:TRIButary:POINter must be set to MANual for this command to apply.

Errors and Events

None

Examples

`SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:NDFLAG ON`

Related Commands

SOURce:DATA:TELecom:TRIButary:POINter:VALue
SOURce:DATA:TELecom:TRIButary:POINter:MODE

SOURce:DATA:TELecom:TRIButary:POINter:NDFLag?

Add/Drop/Test Option Only

This query returns the current setting of the VT/TU New Data Flag (NDF) generator.

Syntax

`SOURce:DATA:TELecom:TRIButary:POINter:NDFLag?`

SONET Response

<trib NDF state> (boolean)	description
1	On (default)
0	Off

SDH Response

<trib NDF state> (boolean)	description
1	On (default)
0	Off

Dependencies

None

Errors and Events

None

Examples

Query: `SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:NDFLAG?`

Response: `0`

Related Commands

SOURce:DATA:TELecom:TRIButary:POINter:NDFLag

SOURce:DATA:TELecom:TRIButary:POINter:DIRection

Add/Drop/Test Option Only

This command sets the direction of continuous VT/TU pointer adjustments.

Syntax

`SOURce:DATA:TELecom:TRIButary:POINter:DIRection <trib pointer direction>`

SONET Values

<trib pointer direction> (discrete)	description
ALTernate	Pointer adjustments alternate between up and down (default)
DOWN	Pointers adjusted down
UP	Pointers adjusted up

SDH Values

<trib pointer direction> (discrete)	description
ALTernate	Pointer adjustments alternate between up and down (default)
DOWN	Pointers adjusted down
UP	Pointers adjusted up

Dependencies

SOURce:DATA:TELecom:POINter:MODE must be set to TRIButary for this command to apply. You can control only STS/AU or VT/TU pointer adjustments at any one time.

SOURce:DATA:TELecom:TRIButary:POINTer:MODE must be set to CONTinuous for this command to apply.

Errors and Events

None

Examples `SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:DIRECTION UP`

Related Commands SOURce:DATA:TELecom:TRIButary:POINter:MODE
SOURce:DATA:TELecom:TRIButary:POINter:RATE

SOURce:DATA:TELecom:TRIButary:POINter:DIRection?

Add/Drop/Test Option Only

This query returns the current setting for the direction of continuous VT/TU pointer adjustments.

Syntax `SOURce:DATA:TELecom:TRIButary:POINter:DIRection?`

SONET Response

<trib pointer direction> (discrete)	description
ALTernate	Pointer adjustments alternate between up and down (default)
DOWN	Pointers adjusted down
UP	Pointers adjusted up

SDH Response

<trib pointer direction> (discrete)	description
ALTernate	Pointer adjustments alternate between up and down (default)
DOWN	Pointers adjusted down
UP	Pointers adjusted up

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:DIRECTION?`

Response: `ALTERNATE`

Related Commands SOURce:DATA:TELecom:TRIButary:POINter:DIRection

SOURce:DATA:TELecom:TRIButary:POINter:RATE

Add/Drop/Test Option Only

This command sets the continuous VT/TU pointer adjustment rate.

Syntax

```
SOURce:DATA:TELecom:TRIButary:POINter:RATE <trib pointer rate>
```

SONET Values

<trib pointer rate> (NR1-numeric)	description
Any integer in the range 2 to 10,000 ms (resolution of 1 ms)	The pointer adjustment rate is set to this value

SDH Values

<trib pointer rate> (NR1-numeric)	description
Any integer in the range 2 to 10,000 ms (resolution of 1 ms)	The pointer adjustment rate is set to this value

Dependencies

SOURce:DATA:TELecom:POINter:MODE must be set to TRIButary for this command to apply. You can control only STS/AU or VT/TU pointer adjustments at any one time.

SOURce:DATA:TELecom:TRIButary:POINter:MODE must be set to CONTinuous for this command to apply.

Errors and Events

None

Examples

```
SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:RATE 9
```

Related Commands

SOURce:DATA:TELecom:TRIButary:POINter:DIRection
SOURce:DATA:TELecom:TRIButary:POINter:MODE
SOURce:DATA:TELecom:POINter:MODE

SOURce:DATA:TELecom:TRIButary:POINter:RATE?

Add/Drop/Test Option Only

This query returns the current setting of the VT/TU pointer adjustment rate.

Syntax `SOURce:DATA:TELecom:TRIButary:POINter:RATE?`

SONET Response

<trib pointer rate> (NR1-numeric)	description
Any integer in the range 2 to 10,000 ms (resolution of 1 ms)	The pointer adjustment rate is set to this value

SDH Response

<trib pointer rate> (NR1-numeric)	description
Any integer in the range 2 to 10,000 ms (resolution of 1 ms)	The pointer adjustment rate is set to this value

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:RATE?`

Response: 3

Related Commands SOURce:DATA:TELecom:TRIButary:POINter:RATE

SOURce:DATA:TELecom:TRIButary:POINter:NBURst

Add/Drop/Test Option Only

This command sets the number of pointer adjustments in a burst of VT/TU pointer adjustments. Send the SOURce:DATA:TELecom:POINter:ACTion command to create the burst of pointer adjustments.

Syntax `SOURce:DATA:TELecom:TRIButary:POINter:NBURst <trib pointer burst>`

SONET Values

<trib pointer burst> (NR1-numeric)	description
Any integer in the range 2 to 8	This value determines the number of pointer adjustments in a burst of pointer adjustments (default = 2)

SDH Values

<trib pointer burst> (NR1-numeric)	description
Any integer in the range 2 to 8	This value determines the number of pointer adjustments in a burst of pointer adjustments (default = 2)

Dependencies

SOURce:DATA:TELecom:POINter:MODE must be set to TRIButary for this command to apply. You can control only STS/AU or VT/TU pointer adjustments at any one time.

SOURce:DATA:TELecom:TRIButary:POINter:MODE must be set to BURSt for this command to apply.

Errors and Events

None

Examples

`SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:NBURST 2`

Related Commands

SOURce:DATA:TELecom:TRIButary:POINter:MODE
SOURce:DATA:TELecom:POINter:ACTion
SOURce:DATA:TELecom:POINter:MODE

SOURce:DATA:TELecom:TRIButary:POINter:NBURst?

Add/Drop/Test Option Only

This query returns the number of pointer adjustments in a burst of VT/TU pointer adjustments.

Syntax

`SOURce:DATA:TELecom:TRIButary:POINter:NBURst?`

SONET Response

<trib pointer burst> (NR1-numeric)	description
Any integer in the range 2 to 8	This value determines the number of pointer adjustments in a burst of pointer adjustments (default = 2)

SDH Response

<trib pointer burst> (NR1-numeric)	description
Any integer in the range 2 to 8	This value determines the number of pointer adjustments in a burst of pointer adjustments (default = 2)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:NBURST?`

Response: 3

Related Commands SOURce:DATA:TELecom:TRIButary:POINter:NBURst

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:DIRection

Add/Drop/Test Option Only

This command sets the pointer movement direction.

Setting this parameter when a sequence is running returns an error.

Syntax

```
SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:DIRection
<pointer seq direction>
```

Parameters

<pointer seq direction> (discrete)	description
DOWN	(default)
UP	

Dependencies Pointer sequences must not be running.

Errors and Events None

Examples

```
SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:SEQuence:DIRECTION UP
SOUR:DATA:TEL:TRIB:POIN:SEQ:DIR DOWN
```

Related Commands

SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:SEQuence:CONTrol

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:DIRection?

Add/Drop/Test Option Only

This query returns the direction for sequence pointer movements.

Syntax

```
SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:DIRection?
```

Response

<pointer seq direction> (discrete)	description
DOWN	(default)
UP	

Dependencies

None

Errors and Events

None

Examples

Query: `SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:SEQUENCE:DIRECTION?`

Response: `UP`

Related Commands

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:DIRection

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:RATE

Add/Drop/Test Option Only

This command sets the pointer sequence movement rate in milliseconds.

Setting this parameter when a sequence is running returns an error.

Syntax

```
SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:RATE
<pointer seq rate>
```

Parameters

<pointer seq rate> (NR1-numeric)	description
Any integer from 34 to 30,000 ms	Resolution is 1 ms (default depends on mapping and type)

Dependencies

Pointer sequences must not be running. Some sequence types (like single, burst, phase, sinalt, and dblalt) set the rate to 30,000 ms. With these types, you cannot change the rate.

Errors and Events

221, “Settings conflict; stop sequences before setting the rate”

Examples

```
SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:SEQUENCE:RATE 2000
SOUR:DATA:TEL:TRIB:POIN:SEQ:RATE 1000
```

Related Commands

SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:SEQuence:CONTrol
SOURce:DATA:TELecom:POINter:SEQuence:TYPE

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:RATE?

Add/Drop/Test Option Only

This query returns the pointer movement rate in milliseconds.

Syntax

```
SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:RATE?
```

Response

<pointer seq rate> (NR1-numeric)	description
Any integer from 34 to 30,000 ms	Resolution is 1 ms (default depends on mapping and type)

Dependencies

Some sequence types (like single, burst, phase, sinalt, and dblalt) set the rate to 30,000 ms. With these types, you cannot change the rate.

Errors and Events

None

Examples

Query: `SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:SEQUENCE:RATE?`

Response: `2000`

Related Commands

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:RATE

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:TYPE

Add/Drop/Test Option Only

This command sets the pointer sequence type.

Setting this parameter when a sequence is running returns an error.

Syntax

```
SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:TYPE
<pointer seq type>
```

SONET Parameters

<pointer seq type> (discrete)	description	standard
SINGle	Single pointer adjustment	ANSI
BURSt	Burst pointer adjustment	ANSI

(continued on next page)

<pointer seq type> (discrete)	description	standard
PHASe	Phase transient pointer adjustment	ANSI
P261	Periodic 26–1 pointer adjustment	ANSI
P261CAN	Periodic 26–1 with cancel	ANSI
P261ADD	Periodic 26–1 with add	ANSI
PCONtinuous	Periodic continuous pointer adjustment	ANSI
PCONCAN	Periodic continuous with cancel	ANSI
PCONADD	Periodic continuous with add	ANSI
SINALT	Single alternating pointer	ITU-T
DBLALT	Double alternating pointer	ITU-T

SDH Parameters

<ptr seq type> (discrete)	description
SINGle	Single pointer adjustment (G.783 e)
BURSt	Burst pointer adjustment (G.783 f)
PHASe	Phase transient pointer adjustment
P351	Periodic 35-1 pointer adjustment (TU-12 only)
P351CAN	Periodic 35-1 with cancel (TU-12 only)
P351ADD	Periodic 35-1 with add (TU-12 only)
P855	Periodic 85-5 pointer adjustment (TU-3 only)
P855CAN	Periodic 85-5 with cancel (TU-3 only)
P855ADD	Periodic 85-5 with add (TU-3 only)
PCONtinuous	Periodic continuous pointer adjustment (G.783 h1)
PCONCAN	Periodic continuous with cancel (G.783 h3)
PCONADD	Periodic continuous with add (G.783 h2)
SINALT	Single alternating pointer (G.783 a) (default)
DBLALT	Double alternating pointer (G.783 d)

Dependencies

Pointer sequences must not be running.

G.783 only applies to TU mappings.

Errors and Events

221, “Settings conflict; stop sequences before setting type”

Examples

```
SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:SEQUENCE:TYPE BURST
SOUR:DATA:TEL:TRIB:POIN:SEQ:TYPE BURS
```

Related Commands

SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:SEQuence:CONTrol

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:TYPE?

Add/Drop/Test Option Only

This query returns the pointer sequence type.

Syntax

```
SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:TYPE?
```

SONET Response

<pointer seq type> (discrete)	description
SINGle	Single pointer adjustment
BURSt	Burst pointer adjustment
PHASe	Phase transient pointer adjustment
P261	Periodic 26–1 pointer adjustment
P261CAN	Periodic 26–1 with cancel
P261ADD	Periodic 26–1 with add
PCONtinuous	Periodic continuous pointer adjustment
PCONCAN	Periodic continuous with cancel
PCONADD	Periodic continuous with add
SINALT	Single alternating pointer
DBLALT	Double alternating pointer

SDH Response

<ptr seq type> (discrete)	description
SINGle	Single pointer adjustment (G.783 e)
BURSt	Burst pointer adjustment (G.783 f)
PHASe	Phase transient pointer adjustment
P351	Periodic 35-1 pointer adjustment (TU-12 only)
P351CAN	Periodic 35-1 with cancel (TU-12 only)

(continued on next page)

<ptr seq type> (discrete)	description
P351ADD	Periodic 35-1 with add (TU-12 only)
P855	Periodic 85-5 pointer adjustment (TU-3 only)
P855CAN	Periodic 85-5 with cancel (TU-3 only)
P855ADD	Periodic 85-5 with add (TU-3 only)
PCONtinuous	Periodic continuous pointer adjustment (G.783 h1)
PCONCAN	Periodic continuous with cancel (G.783 h3)
PCONADD	Periodic continuous with add (G.783 h2)
REGDBL	Regular pointer plus one double (G.783 b)
REGMIS	Regular pointer with one missing (G.783 c)
SINALT	Single alternating pointer (G.783 a) (default)
DBLALT	Double alternating pointer (G.783 d)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:SEQUENCE:TYPE?`

Response: `PCONCAN`

Related Commands SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:TYPE

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:IPERiod

Add/Drop/Test Option Only

This command enables or disables the pointer sequence initialization period.

Setting this parameter when a sequence is running returns an error.

Syntax

```
SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:IPERiod
<pointer seq init>
```

Parameters

<pointer seq init> (discrete)	description
0 (or OFF)	Disables the pointer sequence initialization period
1 (or ON)	Enables the pointer sequence initialization period (default)

Dependencies Pointer sequences must not be running.

Errors and Events 221, “Settings conflict; stop sequences before setting the period”

Examples `SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:SEQUENCE:IPERIOD ON`

Related Commands
SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:SEQuence:CONTrol

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:IPERiod?

Add/Drop/Test Option Only

This query returns the pointer sequence initialization period enable/disable condition.

Syntax `SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:IPERiod?`

Response

<pointer seq init> (discrete)	description
0	Disabled
1	Enabled (default)

Dependencies None

Errors and Events None

Examples

Query: `SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:SEQUENCE:IPERIOD?`

Response: `0`

Related Commands

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:IPERiod

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:IPERiod:LENGth?

Add/Drop/Test Option Only

This query returns the pointer sequence initialization period in seconds.

Syntax

`SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:IPERiod:LENGth?`

Response

<pointer seq init> (NR1-numeric)	description
Any integer	Pointer sequence initialization period in seconds

Dependencies

None

Errors and Events

None

Examples

Query: `SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:SEQUENCE:IPERIOD:LENGTH`

Response: `30`

Related Commands

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:IPERiod
SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:RATE
SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:TYPE

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:CPERiod

Add/Drop/Test Option Only

This command enables or disables the pointer sequence cool down period.

Setting this parameter when a sequence is running returns an error.

Syntax

```
SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:CPERiod
<pointer seq init>
```

Parameters

<pointer seq init> (discrete)	description
0 (or OFF)	Disables the pointer sequence cool down period
1 (or ON)	Enables the pointer sequence cool down period (default)

Dependencies

Pointer sequences must not be running.

Errors and Events

221, “Settings conflict; stop sequences before setting the period”

Examples

```
SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:SEQUENCE:CPERIOD OFF
```

Related Commands

SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:SEQuence:CONTrol

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:CPERiod?

Add/Drop/Test Option Only

This query returns the pointer sequence cool down period enable/disable condition.

Syntax `SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:CPERiod?`

Response

<pointer seq init> (discrete)	description
0	Disabled
1	Enabled (default)

Dependencies None

Errors and Events None

Examples Query: `SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:SEQUENCE:CPERIOD?`

Response: `0`

Related Commands SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:CPERiod

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:CPERiod:LENGth?

Add/Drop/Test Option Only

This query returns the pointer sequence cool down period in seconds.

Syntax `SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:CPERiod:LENGth?`

Response

<pointer seq init> (NR1-numeric)	description
Any integer from 900 to 60	Pointer sequence cool down period in seconds

Dependencies None

Errors and Events None

Examples

Query: `SOURCE:DATA:TELECOM:TRIBUTARY:POINTER:SEQUENCE:CPERIOD:LENGTH`

Response: `235`

Related Commands

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:CPERiod
SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:RATE
SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:TYPE

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:ANOMaly:BTIMe?

This query returns the pointer sequence time between anomalies in seconds.

Sequences do not have to be running. This calculation is based upon sequence type and rate.

Syntax `SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:ANOMaly:BTIMe?`

Response

<pointer seq btime> (NR1-numeric)	description
Any positive integer	Time between anomalies in seconds
–1	Returned for sequences with an invalid BTIME. Example: continuous without anomalies

Dependencies None

Errors and Events None

Examples

Query: `SOURCE:DATA:TELECOM:TRIButary:POINTER:SEQUENCE:ANOMALY:BTIME?`

Response: `30`

Related Commands

SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:SEQuence:CONTrol
SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:TYPE
SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:RATE

SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:ANOMaly:NTIMe?

This query returns the pointer sequence time until the next anomaly in seconds.

This query is only meaningful if sequences are running.

Syntax

```
SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:ANOMaly:NTIMe?
```

Response

<pointer seq ntime> (NR1-numeric)	description
Any positive integer	Time until the next anomaly in seconds
–1	Returned for sequences with an invalid NTIME (Example: continuous without anomalies) or if in the following states: STOPPED, INITIALizing, or COOLdown

Dependencies None

Errors and Events None

Examples

Query: `SOURCE:DATA:TELECOM:TRIButary:POINTER:SEQUENCE:ANOMALY:NTIME?`

Response: `4`

Related Commands

SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:SEQuence:CONTrol
SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:TYPE
SOURce:DATA:TELecom:TRIButary:POINter:SEQuence:RATE

Receive Commands

The Receive Commands allow you to set up the physical connections of a received signal and measure the signal. This section contains all of the commands and queries for each of the following Receive subsystems:

- INPUT1
- INPUT2 (Add/Drop/Test Option Only)
- INPUT3 (Add/Drop/Test Option Only)
- SENSe:DATA:TELecom
- SENSe:DATA:TELecom:TEST
- SENSe:DATA:TELecom:OVERhead and POVerhead
- SENSe:DATA:TELecom:MEASure
- SENSe:DATA:TELecom:MEASure:HISTory
- SENSe:DATA:TELecom:MEASure:STESts
- SENSe:DATA:TELecom:PAYLoad:CUSTom
- SENSe:DATA:TELecom:AUTOscan
- SENSe:DATA:TELecom:TRIButary (Add/Drop/Test Option Only)
- SENSe:DATA:TELecom:MEASure:TRIButary (Add/Drop/Test Option Only)

INPUT1 Subsystem

This section describes the commands and queries that allow you to set the rate, type, and level of the incoming signal. Figure 3–24 shows the hierarchy tree for this subsystem.

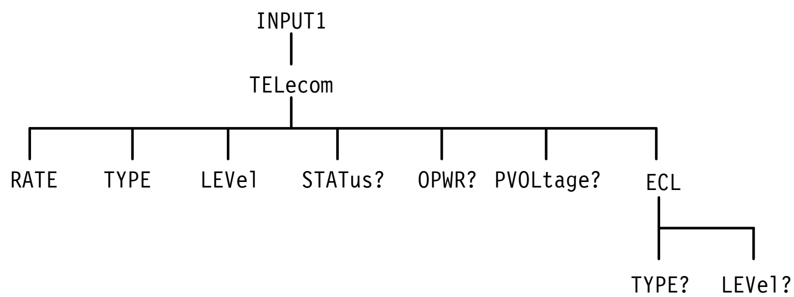


Figure 3–24: INPUT1 subsystem

INPUT1:TELecom:RATE

This command selects the signal rate of the receiver. The signal connected to INPUT1 is passed to the receiver by the SENSe:DATA:TELecom:SOURce INPUT1 command.

Syntax

```
INPUT1:TELecom:RATE <rate>
```

SONET Values

<rate> (discrete)	description
STS1	51.84 MHz (default)
STS3	155.52 MHz
STS12	622.08 MHz

SDH Values

<rate> (discrete)	description
STM0	51.84 MHz
STM1	155.52 MHz (default)
STM4	622.08 MHz

Dependencies SYSTem:MODE must be set to SONET for STS rates or SDH for STM rates.

Errors and Events 221, “Settings conflict; Rate is not available with current Line Interface module or operating mode”

Examples `INPUT1:TELECOM:RATE STM1`

Related Commands SENSe:DATA:TELecom:SOURce

INPUT1:TELecom:RATE?

This query returns the current setting of the input signal rate.

Syntax `INPUT1:TELecom:RATE?`

SONET Response

<rate> (discrete)	description
STS1	51.84 MHz (default)
STS3	155.52 MHz
STS12	622.08 MHz

SDH Response

<rate> (discrete)	description
STM0	51.84 MHz
STM1	155.52 MHz (default)
STM4	622.08 MHz

Dependencies None

Errors and Events None

Examples Query: `INPUT1:TELecom:RATE?`

Response: `STM1`

Related Commands INPUT1:TELecom:RATE

INPUT1:TELecom:TYPE

This command selects the input signal type. The Operation Complete bit in the Standard Event Status Register is set to 1 when this command is executed.

Syntax `INPUT1:TELecom:TYPE <type>`

SONET Response

<type> (discrete)	description
ELECtrical	Electrical signal input
OPTical	Optical input
ECL	ECL input (Option 02 only)

SDH Response

<type> (discrete)	description
ELECtrical	Electrical signal input
OPTical	Optical input
ECL	ECL input (Option 02 only)

Dependencies Selecting ECL requires the VX4610 Option 02 ECL Interface Module.

Errors and Events 221, “Settings conflict; Type is not available with current Line Interface module”
221, “Settings conflict; TYPE:ECL requires option –02”

Examples `INPUT1:TELECOM:TYPE ELECTRICAL`

Related Commands None

INPUT1:TELecom:TYPE?

This query returns the selected input signal type.

Syntax `INPUT1:TELecom:TYPE?`

SONET Response

<type> (discrete)	description
NONE	No signal is input (default)
ELECtrical	Electrical signal input
OPTical	Optical signal input
ECL	ECL input (Option 02 only)

SDH Response

<type> (discrete)	description
NONE	No signal is input (default)
ELECtrical	Electrical signal input
OPTical	Optical signal input
ECL	ECL input (Option 02 only)

Dependencies None

Errors and Events None

Examples Query: `INPUT1:TELECOM:TYPE?`

Response: `OPTICAL`

Related Commands INPUT1:TELecom:TYPE

INPUT1:TELecom:LEVel

This command selects the expected level of the received electrical signal.

Syntax

```
INPUT1:TELecom:LEVel <level>
```

SONET Values

<level> (discrete)	description
XCONnect	Simulates cross connect level (default)
LOW	Input level is low (for STS-1 rate)
HIGH	Input level is high (for STS-1 rate); not valid on some O/E modules

SDH Values

<level> (discrete)	description
XCONnect	Simulates cross connect level (default)
LOW	Input level is low
HIGH	Input level is high; not valid on some O/E modules

Dependencies

INPUT1:TELecom:TYPE must be set to ELECtrical for this command to apply. INPUT1:TELecom:LEVel can be set to LOW for STS-1 rate only.

Errors and Events

221, “Settings conflict; Level is not available with current type, must be electrical”

Examples

```
INPUT1:TELECOM:LEVEL XCON
```

Related Commands

INPUT1:TELecom:TYPE

INPUT1:TELecom:LEVel?

This query returns the expected level of the received electrical signal.

Syntax `INPUT1:TELecom:LEVel?`

SONET Response

<level> (discrete)	description
XCONnect	Simulates cross connect level (default)
LOW	Input level is low (for STS-1 rate)
HIGH	Input level is high; not valid on some O/E modules

SDH Response

<level> (discrete)	description
XCONnect	Simulates cross connect level (default)
LOW	Input level is low
HIGH	Input level is high; not valid on some O/E modules

Dependencies None

Errors and Events None

Examples Query: `INPUT1:TELECOM:LEVEL?`

Response: `XCONNECT`

Related Commands INPUT1:TELecom:LEVel

INPUT1:TELecom:STATus?

This query returns the status of the received signal connected to INPUT1.

Syntax `INPUT1:TELecom:STATus?`

SONET Response

<status> (discrete)	description
NORMal	Normal signal received
MONitor	Monitor point signal received (electrical only)
LOSignal	No signal received

SDH Response

<status> (discrete)	description
NORMal	Normal signal received
MONitor	Monitor point signal received (electrical only)
LOSignal	No signal received

Dependencies None

Errors and Events None

Examples Query: `INPUT1:TELECOM:STATUS?`

Response: `MONITOR`

Related Commands INPUT1:TELecom:LEVel

INPUT1:TELecom:OPWR?

This query returns the optical signal level in dBm.

Syntax `INPUT1:TELecom:OPWR?`

SONET Response

<optical level>(NR3-numeric)	description
Any floating point number	The optical signal level of the received signal in dBm

SDH Response

<optical level>(NR3-numeric)	description
Any floating point number	The optical signal level of the received signal in dBm

Dependencies INPUT1:TELecom:TYPE must be set to OPTical.

Errors and Events None

Examples Query: `INPUT1:TELECOM:OPWR?`

Response: `–25.0`

Related Commands INPUT1:TELecom:TYPE

INPUT1:TELecom:PVOLtage?

This query returns the peak electrical voltage in volts.

Syntax `INPUT1:TELecom:PVOLtage?`

SONET Response

<peak voltage>(NR3-numeric)	description
Any floating point number	The peak voltage of the received signal in volts

SDH Response

<peak voltage>(NR3-numeric)	description
Any floating point number	The peak voltage of the received signal in volts

Dependencies INPUT1:TELecom:TYPE must be set to ELECtrical.

Errors and Events None

Examples Query: `INPUT1:TELECOM:PVOLTAGE?`

Response: `0.52`

Related Commands INPUT1:TELecom:TYPE

INPUT1:TELecom:ECL:TYPE?

This query returns the current state of the DIFF/SINGLE configuration switch located on the front panel of the Option 02 ECL Interface Module.

Syntax `INPUT1:TELecom:ECL:TYPE?`

SONET Response

<ecl_type>	description
DIFFerential	Differential
SINGle	Single-ended
NONE	ECL Interface not installed

SDH Response

<ecl_type>	description
DIFFerential	Differential
SINGle	Single-ended
NONE	ECL Interface not installed

Dependencies The front panel switch controls both the transmit and receive signals. Therefore, this command is equivalent to OUTPUT1:TELecom:ECL:TYPE?

Errors and Events None

Examples Query: `INPUT1:TELECOM:ECL:TYPE?`

Response: `SING`

Related Commands OUTPUT1:TELecom:ECL:LEVEL?

INPUT1:TELecom:ECL:LEVel?

This query returns the current state of the termination configuration switch located on the front panel of the Option 02 ECL Interface Module.

Syntax

`INPUT1:TELecom:ECL:LEVel?`

SONET Response

<ecl_level>	description
PECL	Positive ECL level
ECL	Standard ECL level
NONE	ECL Interface not installed

SDH Response

<ecl_level>	description
PECL	Positive ECL level
ECL	Standard ECL level
NONE	ECL Interface not installed

Dependencies

The front panel switch controls both the transmit and receive signals. Therefore, this command is equivalent to OUTPUT1:TELecom:ECL:LEVel?

Errors and Events

None

Examples

Query: `INPUT1:TELECOM:ECL:LEVel?`

Response: `ECL`

Related Commands

INPUT1:TELecom:ECL:TYPE?
OUTPUT1:TELecom:ECL:LEVel?

INPUT2 Subsystem

Add/Drop/Test Option Only

This section describes the commands and queries that set the characteristics of the received or added DS1 or 2 Mb/s tributary signal.

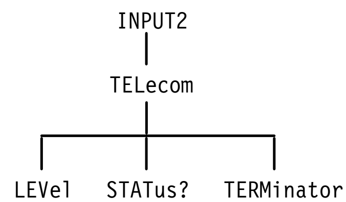


Figure 3–25: INPUT2 subsystem

INPUT2:TELecom:LEVel

Add/Drop/Test Option Only

This command selects the expected signal level at the DS1 or 2 Mb/s receive connector.

Syntax

```
INPUT2:TELecom:LEVel <trib1 input level>
```

SONET Values

<trib1 input level> (discrete)	description
NORMal	Normal input levels (default)
MONitor	Monitor level
BRIDge	Bridged input

SDH Values

<trib1 input level> (discrete)	description
NORMal	Normal input levels (default)
MONitor	Monitor level
BRIDge	Bridged input

Dependencies

The instrument must be set up to receive or add a DS1 or 2 Mb/s tributary signal for this command to apply.

Errors and Events None

Examples `INPUT2:TELECOM:LEVEL NORMAL`

Related Commands SENSe:DATA:TELecom:SOURce
SOURce:DATA:TELecom:TRIButary:ADD

INPUT2:TELecom:LEVel?

Add/Drop/Test Option Only

This query returns the expected signal level at the DS1 or 2 Mb/s receive connector.

Syntax `INPUT2:TELecom:LEVel?`

SONET Response

<trib1 input level> (discrete)	description
NORMal	Normal input levels (default)
MONitor	Monitor level
BRIDge	Bridged input

SDH Response

<trib1 input level> (discrete)	description
NORMal	Normal input levels (default)
MONitor	Monitor level
BRIDge	Bridged input

Dependencies None

Errors and Events None

Examples Query: `INPUT2:TELECOM:LEVEL?`

Response: `NORMAL`

Related Commands INPUT2:TELecom:LEVel

INPUT2:TELecom:STATus?

Add/Drop/Test Option Only

This query returns the status of the received or added DS1 or 2 Mb/s tributary signal.

Syntax `INPUT2:TELecom:STATus?`

SONET Response

<trib1 input status> (discrete)	description
NORMal	Signal is of acceptable quality
LOSignal	Loss of Signal (no signal connected)

SDH Response

<trib1 input status> (discrete)	description
NORMal	Signal is of acceptable quality
LOSignal	Loss of Signal (no signal connected)

Dependencies SENSe:DATA:TELecom:SOURce must be set to INPUT2 for this command to apply.

Errors and Events None

Examples Query: `INPUT2:TELECOM:STATUS?`

Response: `NORMAL`

Related Commands SENSe:DATA:TELecom:SOURce

INPUT2:TELecom:TERMinator

Add/Drop/Test Option Only

This command selects the signal terminator for the DS1 or 2 Mb/s receive connector.

Syntax

`INPUT2:TELecom:TERMinator <trib1 input termin>`

SONET Values

<trib1 input termin> (discrete)	description
BALanced	120 Ω connector (default)

SDH Values

<trib1 input termin> (discrete)	description
BALanced	120 Ω connector (default)
UNBALanced	75 Ω connector

Dependencies

The instrument must be set up to receive or add a DS1 or 2 Mb/s tributary signal for this command to apply.

Errors and Events

None

Examples

`INPUT2:TELECOM:TERMINATOR BALANCED`

Related Commands

SENSe:DATA:TELecom:SENSe
SOURce:DATA:TELecom:TRIButary:ADD

INPUT2:TELecom:TERMinator?

Add/Drop/Test Option Only

This returns the current setting of the DS1 or 2 Mb/s transmit connector signal terminator.

Syntax

`INPUT2:TELecom:TERMinator?`

SONET Response

<trib1 input termin> (discrete)	description
BALanced	120 Ω connector (default)

SDH Response

<trib1 input termin> (discrete)	description
BALanced	120 Ω connector (default)
UNBALanced	75 Ω connector

Dependencies

None

Errors and Events

None

Examples

Query: `INPUT2:TELECOM:TERMINATOR?`

Response: `BALANCED`

Related Commands

INPUT2:TELecom:TERMinator

INPUT3 Subsystem

Add/Drop/Test Option Only

This section describes the commands and queries that set the characteristics of the received or added DS3, 34 Mb/s or 140 Mb/s tributary signal.

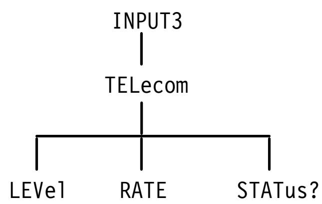


Figure 3–26: INPUT3 subsystem

INPUT3:TELecom:LEVel

Add/Drop/Test Option Only

This command selects the expected signal level at the DS3, 34 Mb/s or 140 Mb/s receive connector.

Syntax

INPUT3:TELecom:LEVel <trib2 input level>

SONET Values

<trib2 input level> (discrete)	description
NORMal	Normal input level
MONitor	Monitor level

SDH Values

<trib2 input level> (discrete)	description
NORMal	Normal input level
MONitor	Monitor level

Dependencies

The instrument must be set up to receive or add a DS3, 34 Mb/s or 140 Mb/s tributary signal for this command to apply.

Errors and Events

None

Examples `INPUT3:TELECOM:LEVEL NORMAL`

Related Commands None

INPUT3:TELecom:LEVel?

Add/Drop/Test Option Only

This query returns the expected signal level at the DS3, 34 Mb/s or 140 Mb/s receive connector.

Syntax `INPUT3:TELecom:LEVel?`

SONET Response

<trib2 input level> (discrete)	description
NORMal	Normal input level
MONitor	Monitor level

SDH Response

<trib2 input level> (discrete)	description
NORMal	Normal input level
MONitor	Monitor level

Dependencies None

Errors and Events None

Examples Query: `INPUT3:TELECOM:LEVEL?`

Response: `NORMAL`

Related Commands INPUT3:TELecom:LEVel

INPUT3:TELecom:RATE

Add/Drop/Test Option Only

This command selects the DS3, 34 Mb/s or 140 Mb/s tributary input rate.

Syntax

```
INPUT3:TELecom:RATE <trib2 input rate>
```

SONET Values

<trib2 input rate> (discrete)	description
DS3	44.736 Mb/s (default)

SDH Values

<trib2 input rate> (discrete)	description
M34	34.368 Mb/s (default)
M140	139.264 Mb/s

Dependencies

Set SYSTem:MODE to SONET for DS3 rate or SDH for 34 Mb/s or 140 Mb/s rates.

The instrument must be set up to receive or add a DS3, 34 Mb/s or 140 Mb/s tributary signal for this command to apply.

Errors and Events

None

Examples

```
INPUT3:TELECOM:RATE DS3
```

Related Commands

SENSe:DATA:TELecom:SOURce

INPUT3:TELecom:RATE?

Add/Drop/Test Option Only

This query returns the current setting of the DS3, 34 Mb/s or 140 Mb/s tributary input rate.

Syntax

`INPUT3:TELecom:RATE?`

SONET Response

<trib2 input rate> (discrete)	description
DS3	44.736 Mb/s (default)

SDH Response

<trib2 input rate> (discrete)	description
M34	34.368 Mb/s (default)
M140	139.264 Mb/s

Dependencies

None

Errors and Events

None

Examples

Query: `INPUT3:TELECOM:RATE?`

Response: `DS3`

Related Commands

INPUT3:TELecom:RATE

INPUT3:TELecom:STATus?

Add/Drop/Test Option Only

This query returns the status of the received or added DS3, 34 Mb/s or 140 Mb/s tributary signal.

Syntax

`INPUT3:TELecom:STATus?`

SONET Response

<trib2 input status> (discrete)	description
NORMal	Signal is of acceptable quality
LOSignal	Loss of Signal (no signal connected)

SDH Response

<trib2 input status>(discrete)	description
NORMal	Signal is of acceptable quality
LOSignal	Loss of Signal (no signal connected)

Dependencies

SENSe:DATA:TELecom:SOURce must be set to INPUT3 for this query to apply.

Errors and Events

None

Examples

Query: `INPUT3:TELECOM:STATUS?`

Response: `NORMAL`

Related Commands

SENSe:DATA:TELecom:SOURce

SENSe:DATA:TELecom Subsystem

This section describes the commands and queries that set up the structure of the signal to be received. Figure 3–27 shows the hierarchy tree for this subsystem.

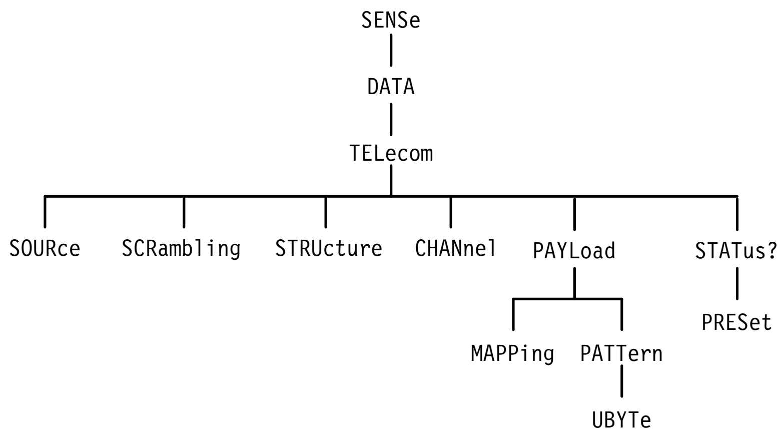


Figure 3–27: SENSe:DATA:TELecom subsystem

SENSe:DATA:TELecom:SOURce

This command selects the input signal source.

Syntax

SENSe:DATA:TELecom:SOURce <source>

SONET Values

<source> (discrete)	description
INPUT1	SONET rates (default)
INPUT2	DS1 rate (Add/Drop/Test Option Only)
INPUT3	DS3 rate (Add/Drop/Test Option Only)

SDH Values

<source> (discrete)	description
INPUT1	SDH rates (default)
INPUT2	2 Mb/s rate (Add/Drop/Test Option Only)
INPUT3	34 Mb/s or 140 Mb/s rate (Add/Drop/Test Option Only)

Dependencies None

Errors and Events None

Examples `SENSE:DATA:TELECOM:SOURCE INPUT1`

Related Commands INPUT1:TELecom:RATE

SENSe:DATA:TELecom:SOURce?

This query returns the current setting of the input signal source.

Syntax `SENSe:DATA:TELecom:SOURce?`

SONET Response

<source> (discrete)	description
INPUT1	SONET rates (default)
INPUT2	DS1 rate (Add/Drop/Test Option Only)
INPUT3	DS3 rate (Add/Drop/Test Option Only)

SDH Response

<source> (discrete)	description
INPUT1	SDH rates (default)
INPUT2	2 Mb/s rate (Add/Drop/Test Option Only)
INPUT3	34 Mb/s or 140 Mb/s rate (Add/Drop/Test Option Only)

Dependencies None

Errors and Events None

Examples

Query: `SENSe:DATA:TELECOM:SOURce?`

Response: `INPUT1`

Related Commands

SENSe:DATA:TELecom:SOURce

SENSe:DATA:TELecom:SCRambling

This command enables scrambling of the input signal.

Syntax

`SENSe:DATA:TELecom:SCRambling <signal scrambling>`

SONET Values

<signal scrambling> (boolean)	description
1 or ON	Input signal scrambling is on (default)
0 or OFF	Input signal scrambling is off

SDH Values

<signal scrambling> (boolean)	description
1 or ON	Input signal scrambling is on (default)
0 or OFF	Input signal scrambling is off

Dependencies

None

Errors and Events

None

Examples

`SENSE:DATA:TELECOM:SCRAMBLING OFF`

Related Commands

None

SENSe:DATA:TELecom:SCRambling?

This query returns the setting of input signal scrambling.

Syntax `SENSe:DATA:TELecom:SCRambling?`

SONET Response

<signal scrambling> (boolean)	description
1 or ON	Input signal scrambling is on (default)
0 or OFF	Input signal scrambling is off

SDH Response

<signal scrambling> (boolean)	description
1 or ON	Input signal scrambling is on (default)
0 or OFF	Input signal scrambling is off

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:SCRAMBLING?`

Response: 1

Related Commands SENSe:DATA:TELecom:SCRambling

SENSe:DATA:TELecom:STRUcture

This command selects the input signal structure.

Syntax `SENSe:DATA:TELecom:STRUcture <input structure>`

SONET Values

<input structure> (discrete)	description
STS1	STS-1 structure (default)
STS3C	STS-3c structure

SDH Values

<input structure> (discrete)	description
AU4	AU-4 structure (default)
AU3	AU-3 structure

Dependencies Selection of STS3C requires OUTPUT1:TELecom:RATE to be set to STS3 or STS12.

Errors and Events 221, "Settings conflict; Argument not valid in current instrument state"

Examples `SENSE:DATA:TELECOM:STRUCTURE AU4`

Related Commands OUTPUT1:TELecom:RATE

SENSe:DATA:TELecom:STRUcture?

This query returns the selected input signal structure.

Syntax `SENSe:DATA:TELecom:STRUcture?`

SONET Response

<input structure> (discrete)	description
STS1	STS-1 structure (default)
STS3C	STS-3c structure

SDH Response

<input structure> (discrete)	description
AU4	AU-4 structure (default)
AU3	AU-3 structure

Dependencies None

Errors and Events None

Examples

Query: `SENSE:DATA:TELECOM:STRUCTURE?`

Response: `AU4`

Related Commands

SENSe:DATA:TELecom:STRUcture

SENSe:DATA:TELecom:STATus?

This query returns the historical or accumulated status of the received signal.

Syntax

`SENSe:DATA:TELecom:STATus?`

SONET Response

<decimal value> (NR1-numeric)	bit	definition
1	0	LOS
2	1	LOF
4	2	OOF
8	3	LOP
16	4	Line AIS
32	5	Path AIS
64	6	Error
128	7	Undefined
256	8	K1/K2 change
512	9	Line FERF
1024	10	Path FERF
2048	11	Pointer adjust
4096	12	NDF
8192	13	Pattern lock
16384	14	Not used
32768	15	Not used

SDH Response

<decimal value> (NR1-numeric)	bit	definition
1	0	LOS
2	1	LOF

<decimal value> (NR1-numeric)	bit	definition
4	2	OOF
8	3	LOP
16	4	MS AIS
32	5	Path AIS
64	6	Error
128	7	Undefined
256	8	K1/K2 change
512	9	MS FERF
1024	10	Path FERF
2048	11	Pointer adjust
4096	12	NDF
8192	13	Pattern lock
16384	14	Not used
32768	15	Not used

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:STATUS?`

Response: `1024`

Related Commands SENSe:DATA:TELecom:STATus:PRESet

SENSe:DATA:TELecom:STATus:PRESet

This command clears the status of the received SONET/SDH and tributary signals by setting each status bit to 0. After this command is given, the status information is accumulated until another SENSe:DATA:TELecom:STATus:PRESet command is given. To get the current signal status without any history information, send the SENSe:DATA:TELecom:STATus:PRESet;:SENSe:DATA:TELecom:STATus? chained command.

Syntax `SENSe:DATA:TELecom:STATus:PRESet`

SONET Values None

SDH Values None

Dependencies None

Errors and Events None

Examples `SENSE:DATA:TELECOM:STATUS:PRESET`

Related Commands SENSe:DATA:TELecom:STATus?

SENSe:DATA:TELecom:CHANnel

This command selects the active channel to test (an STS structure with its pointers for SONET rates or an AU for SDH rates). For example, in SONET, an STS-3 signal may have three STS-1 signals multiplexed into it. This command allows you to choose one of these three to test.

Syntax `SENSe:DATA:TELecom:CHANnel <channel>`

SONET Values

<channel> (NR1-numeric)	description
1	STS-1 rate (default)
1 to 3	STS-3 rate
1 to 4	STS-12 rate with STS-3c structure
1 to 12	STS-12 rate

SDH Values

<channel> (NR1-numeric)	description
1	STM-0 rate
1	STM-1 (default)
1 to 4	STM-4 rate

Dependencies Selection of a <channel> greater than 1 implies a rate and structure with multiple STS/VCs.

Errors and Events 221, “Settings conflict; Channel is out of range”

Examples `SENSE:DATA:TELECOM:CHANNEL 1`

Related Commands INPUT1:TELecom:RATE
SENSe:DATA:TELecom:STRUcture

SENSe:DATA:TELecom:CHANnel?

This returns the selected active channel under test.

Syntax `SENSe:DATA:TELecom:CHANnel?`

SONET Response

<channel> (NR1-numeric)	description
1	STS-1 rate (default)
1 to 3	STS-3 rate
1 to 4	STS-12 rate with STS-3c structure
1 to 12	STS-12 rate

SDH Values

<channel> (NR1-numeric)	description
1	STM-0 rate
1	STM-1 rate (default)
1 to 4	STM-4 rate

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:CHANNEL?`

Response: 1

Related Commands SENSe:DATA:TELecom:CHANnel

SENSe:DATA:TELecom:PAYLoad:MAPPing

This command selects the payload mapping of the received structure.

Syntax `SENSe:DATA:TELecom:PAYLoad:MAPPing <mapping>`

SONET Values

<mapping> (discrete)	description
EQUipped	Expecting equipped payload mapping (default)
UNEQuipped	Expecting unequipped payload mapping
CUSTom	Expecting custom payload data
TRIButary	Expecting tributary payload mapping (Add/Drop/Test Option Only)

SDH Values

<mapping> (discrete)	description
EQUipped	Expecting equipped payload mapping (default)
UNEQuipped	Expecting unequipped payload mapping
CUSTom	Expecting custom payload data
TRIButary	Expecting tributary payload mapping (Add/Drop/Test Option Only)

Dependencies Select EQUipped or UNEQuipped to use the SENSe:DATA:TELecom:PAYLoad:PATTern command.

Errors and Events 221, "Settings conflict; Not available without tributary option"

Examples `SENSE:DATA:TELECOM:PAYLOAD:MAPPing EQUIPPED`

Related Commands SENSe:DATA:TELecom:PAYLoad:PATTern

SENSe:DATA:TELecom:PAYLoad:MAPPing?

This query returns the current setting of payload mapping for the received signal.

Syntax `SENSe:DATA:TELecom:PAYLoad:MAPPing?`

SONET Response

<mapping> (discrete)	description
EQUipped	Expecting equipped payload mapping (default)
UNEQuipped	Expecting unequipped payload mapping
CUSTom	Expecting custom payload data
TRIButary	Expecting tributary payload mapping (Add/Drop/Test Option Only)

SDH Response

<mapping> (discrete)	description
EQUipped	Expecting equipped payload mapping (default)
UNEQuipped	Expecting unequipped payload mapping
CUSTom	Expecting custom payload data
TRIButary	Expecting tributary payload mapping (Add/Drop/Test Option Only)

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:PAYLOAD:MAPPING?`

Response: `EQUIPPED`

Related Commands SENSe:DATA:TELecom:PAYload:MAPPing

SENSe:DATA:TELecom:PAYLoad:PATTern

This command selects the payload pattern that will be used to calculate the payload BER of the incoming data.

Syntax `SENSe:DATA:TELecom:PAYLoad:PATTern <pattern>`

SONET Values

<pattern> (discrete)	description
PRBS23	A pseudo-random binary sequence of length 2^{23}–1 (default)
PRBS9	A pseudo-random binary sequence of length 2^{9}–1
PRBS15	A pseudo-random binary sequence of length 2^{15}–1
PRBS20	A pseudo-random binary sequence of length 2^{20}–1
AZERos	All zeros
AONEs	All ones
UBYTe	A user-defined byte
UNKNown	Disable BER calculations on incoming data

SDH Values

<pattern> (discrete)	description
PRBS23	A pseudo-random binary sequence of length 2^{23}–1 (default)
PRBS9	A pseudo-random binary sequence of length 2^{9}–1
PRBS15	A pseudo-random binary sequence of length 2^{15}–1
PRBS20	A pseudo-random binary sequence of length 2^{20}–1
AZERos	All zeros
AONEs	All ones
UBYTe	A user-defined byte
UNKNown	Disable BER calculations on incoming data

Dependencies None

Errors and Events None

Examples `SENSE:DATA:TELECOM:PAYLOAD:PATTERN PRBS23`

Related Commands SENSe:DATA:TELecom:CHANnel
SENSe:DATA:TELecom:PAYLoad:PATTern:UBYTe

SENSe:DATA:TELecom:PAYLoad:PATTern?

This query returns the selected payload pattern that is being used to calculate the payload BER in incoming data.

Syntax `SENSe:DATA:TELecom:PAYLoad:PATTern?`

SONET Response

<pattern> (discrete)	description
PRBS23	A pseudo-random binary sequence of length $2^{23}–1$ (default)
PRBS9	A pseudo-random binary sequence of length $2^{9}–1$
PRBS15	A pseudo-random binary sequence of length $2^{15}–1$
PRBS20	A pseudo-random binary sequence of length $2^{20}–1$
AZERos	All zeros
AONEs	All ones
UBYTe	A user-defined byte
UNKNown	Disable BER calculations on incoming data

SDH Response

<pattern> (discrete)	description
PRBS23	A pseudo-random binary sequence of length $2^{23}–1$ (default)
PRBS9	A pseudo-random binary sequence of length $2^{9}–1$
PRBS15	A pseudo-random binary sequence of length $2^{15}–1$
PRBS20	A pseudo-random binary sequence of length $2^{20}–1$

<pattern> (discrete)	description
AZERos	All zeros
AONEs	All ones
UBYTe	A user-defined byte
UNKNown	Disable BER calculations on incoming data

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:PAYLOAD:PATTERN?`

Response: `PRBS23`

Related Commands SENSe:DATA:TELecom:PAYLoad:PATTern

SENSe:DATA:TELecom:PAYLoad:PATTern:UBYTe

This command selects the internally generated payload fixed pattern to be detected in the incoming signal.

Syntax `SENSe:DATA:TELecom:PAYLoad:PATTern:UBYTe <fixed pattern>`

SONET Values

<fixed pattern> (NR1-numeric)[1]	description
A number in the range 0 to 255 (hexadecimal 00 to FF)	The payload pattern to be detected is set to this value (default = 0)

1 **A hexadecimal value is also acceptable.**

SDH Values

<fixed pattern> (NR1-numeric)[1]	description
A number in the range 0 to 255 (hexadecimal 00 to FF)	The payload pattern to be detected is set to this value (default = 0)

1 **A hexadecimal value is also acceptable.**

Dependencies SENSe:DATA:TELecom:PAYLoad:PATTern must be set to UBYTe for this command to apply.

Errors and Events None

Examples

```
SENSE:DATA:TELECOM:PAYLOAD:PATTERN:UBYTE 01
SENSE:DATA:TELECOM:PAYLOAD:PATTERN:UBYTE #HA5
```

Related Commands SENSe:DATA:TELecom:PAYLoad:PATTern

SENSe:DATA:TELecom:PAYLoad:PATTern:UBYTe?

This query returns the selected internally generated payload fixed pattern to be detected in the incoming signal.

Syntax `SENSe:DATA:TELecom:PAYLoad:PATTern:UBYTe?`

SONET Response

<fixed pattern> (NR1-numeric)	description
A number in the range 0 to 255	The payload pattern to be detected is set to this value (default = 0)

SDH Response

<fixed pattern> (NR1-numeric)	description
A number in the range 0 to 255	The payload pattern to be detected is set to this value (default = 0)

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:PAYLOAD:PATTERN:UBYTE?`

Response: `123`

Related Commands SENSe:DATA:TELecom:PAYLoad:PATTern:UBYTe

SENSe:DATA:TELecom:TEST Subsystem

This section describes each of the commands and queries used to control measurements. Figure 3–28 shows the hierarchy tree for this subsystem.

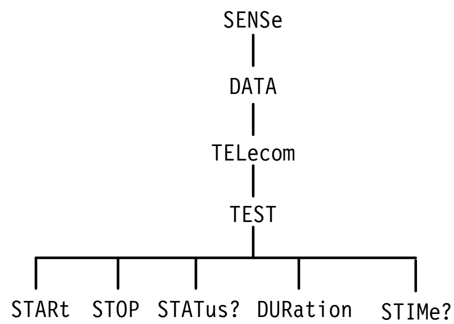


Figure 3–28: SENSe:DATA:TELecom:TEST subsystem

SENSe:DATA:TELecom:TEST:STARt

This command starts the test measurements.

Syntax `SENSe:DATA:TELecom:TEST:STARt`

SONET Values None

SDH Values None

Dependencies Any instrument settings can be changed after a test is started, but the measurements are restarted when any change is made to the receiver rate, level, structure, or pattern.

Errors and Events None

Examples `SENSE:DATA:TELECOM:TEST:START`

Related Commands SENSe:DATA:TELecom:TEST:STOP

SENSe:DATA:TELecom:TEST:STOP

This command stops the test measurements.

Syntax `SENSe:DATA:TELecom:TEST:STOP`

SONET Values None

SDH Values None

Dependencies None

Errors and Events None

Examples `SENSE:DATA:TELECOM:TEST:STOP`

Related Commands SENSe:DATA:TELecom:TEST:STARt

SENSe:DATA:TELecom:TEST:STATus?

This query returns the state of the measurement process and how long the test has been running.

Syntax `SENSe:DATA:TELecom:TEST:STATus?`

SONET Response

<status>(boolean)	description
1	Test is running
0	Test is stopped
<days> (NR1-numeric)	**description**
Any number in the range 0 to 999	Number of days the test has been running
<hours> (NR1-numeric)	**description**
Any number in the range 0 to 23	Number of hours the test has been running
<minutes> (NR1-numeric)	**description**
Any number in the range 0 to 59	Number of minutes the test has been running
<seconds> (NR1-numeric)	**description**
Any number in the range 0 to 59	Number of seconds the test has been running

SDH Response

<status>(boolean)	description
1	Test is running
0	Test is stopped
<days>	**description**
Any number in the range 0 to 999	Number of days the test has been running
<hours>	**description**
Any number in the range 0 to 23	Number of hours the test has been running
<minutes>	**description**
Any number in the range 0 to 59	Number of minutes the test has been running
<seconds> (NR1-numeric)	**description**
Any number in the range 0 to 59	Number of seconds the test has been running

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:TEST:STATUS?`

Response: `1,0,0,13,5`

This response indicates that the test has been running for 13 minutes and 5 seconds and is still running.

Related Commands None

SENSe:DATA:TELecom:TEST:DURation

This command specifies the length of the test. If all four parameters are set to 0, the test will run continuously.

Syntax

```
SENSe:DATA:TELecom:TEST:DURation <days>,<hours>,<minutes>,
<seconds>
```

SONET Values

<days> (NR1-numeric)	description
Any number in the range 0 to 99	Specifies the number of days the test is to be run (default = 0)
<hours> (NR1-numeric)	**description**
Any number in the range 0 to 23	Specifies the number of hours the test is to be run (default = 0)
<minutes> (NR1-numeric)	**description**
Any number in the range 0 to 59	Specifies the number of minutes the test is to be run (default = 0)
<seconds> (NR1-numeric)	**description**
Any number in the range 0 to 59	Specifies the number of seconds the test is to be run (default = 0)

SDH Values

<days> (NR1-numeric)	description
Any number in the range 0 to 99	Specifies the number of days the test is to be run (default = 0)
<hours> (NR1-numeric)	**description**
Any number in the range 0 to 23	Specifies the number of hours the test is to be run (default = 0)
<minutes> (NR1-numeric)	**description**
Any number in the range 0 to 59	Specifies the number of minutes the test is to be run (default = 0)
<seconds> (NR1-numeric)	**description**
Any number in the range 0 to 59	Specifies the number of seconds the test is to be run (default = 0)

Dependencies

None

Errors and Events

None

Examples

```
SENSE:DATA:TELECOM:TEST:DURATION 1,12,30,0
```

This test duration is set to 1 day, 12 hours, 30 minutes, and 0 seconds.

Related Commands

None

SENSe:DATA:TELecom:TEST:DURation?

This query returns the value of the test length. If all four parameters are set to 0, the test will run continuously.

Syntax `SENSe:DATA:TELecom:TEST:DURation?`

SONET Response

<days> (NR1-numeric)	description
Any number in the range 0 to 99	Specifies the number of days the test is to be run
<hours> (NR1-numeric)	**description**
Any number in the range 0 to 23	Specifies the number of hours the test is to be run
<minutes> (NR1-numeric)	**description**
Any number in the range 0 to 59	Specifies the number of minutes the test is to be run
<seconds> (NR1-numeric)	**description**
Any number in the range 0 to 59	Specifies the number of seconds the test is to be run

SDH Values

<days> (NR1-numeric)	description
Any number in the range 0 to 99	Specifies the number of days the test is to be run
<hours> (NR1-numeric)	**description**
Any number in the range 0 to 23	Specifies the number of hours the test is to be run
<minutes> (NR1-numeric)	**description**
Any number in the range 0 to 59	Specifies the number of minutes the test is to be run
<seconds> (NR1-numeric)	**description**
Any number in the range 0 to 59	Specifies the number of seconds the test is to be run

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:TEST:DURATION?`

Response: `0,0,15,0`

Related Commands SENSe:DATA:TELecom:TEST:DURation

SENSe:DATA:TELecom:TEST:STIMe?

This query returns the date and time the test was started.

Syntax `SENSe:DATA:TELecom:TEST:STIMe?`

SONET Response

<year> (NR1-numeric)	**description**
Any number in the range 00 to 99	Specifies the year the test was started; “92” indicates that the test was started in 1992, “01” indicates the year 2001
<month> (NR1-numeric)	**description**
Any number in the range 1 to 12	Specifies the month the test was started; “09” indicates that the test was started in September
<day> (NR1-numeric)	**description**
Any number in the range 1 to 31	Specifies the day of the month the test was started
<hours> (NR1-numeric)	**description**
Any number in the range 0 to 23	Specifies the hour the test was started
<minutes> (NR1-numeric)	**description**
Any number in the range 0 to 59	Specifies the minute the test was started
<seconds> (NR1-numeric)	**description**
Any number in the range 0 to 59	Specifies the seconds the test was started

SDH Response

<year> (NR1-numeric)	description
Any number in the range 00 to 99	Specifies the year the test was started; “92” indicates that the test was started in 1992, “01” indicates the year 2001
<month> (NR1-numeric)	**description**
Any number in the range 1 to 12	Specifies the month the test was started; “09” indicates that the test was started in September
<day> (NR1-numeric)	**description**
Any number in the range 1 to 31	Specifies the day of the month the test was started
<hours> (NR1-numeric)	**description**
Any number in the range 0 to 23	Specifies the hour the test was started
<minutes> (NR1-numeric)	**description**
Any number in the range 0 to 59	Specifies the minute the test was started
<seconds> (NR1-numeric)	**description**
Any number in the range 0 to 59	Specifies the seconds the test was started

Dependencies None

Errors and Events None

Examples

Query: `SENSE:DATA:TELECOM:TEST:STIME?`

Response: `93,10,25,22,15,00`

This test was started on October 25, 1993 at 10:15 pm.

Related Commands SENSe:DATA:TELecom:TEST:STARt

SENSe:DATA:TELecom:OVERhead and POVerhead Subsystem

This section describes each of the commands and queries used to analyze the transport overhead and path overhead. Figure 3–29 shows the hierarchy tree for this subsystem.

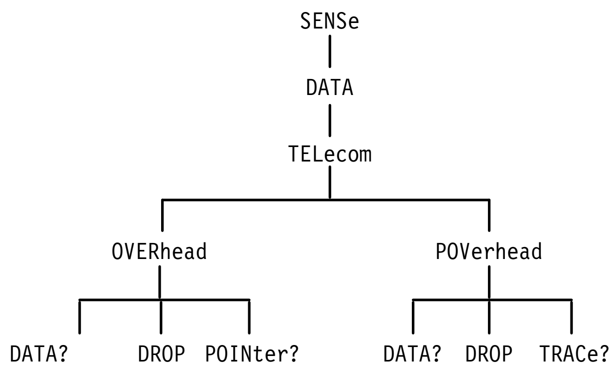


Figure 3–29: SENSe:DATA:TELecom:OVERhead and POVerhead subsystem

SENSe:DATA:TELecom:OVERhead:DATA?

This query returns the value in the transport overhead byte of the specified channel. See Figures 3–14 and 3–15 on pages 3–54 and 3–55 for the definition of offset values.

Syntax

```
SENSe:DATA:TELecom:OVERhead:DATA? <channel>,<byte>,<offset>
```

SONET Values

<channel> (NR1-numeric)	description
1	Rate is STS-1
1 to 3	Rate is STS-3 with STS-1 structure
1 to 4	Rate is STS-12 with STS-3c structure
1 to 12	Rate is STS-12 with STS-1 structure
<byte> (discrete)	**description**
A1, A2, B1, B2, H1, H2, H3, C1, E1, F1, D1, D2, D3, K1, K2, D4, D5, D6, D7, D8, D9, D10, D11, D12, S1/Z1, M1/Z2, E2	Only the bytes listed return a valid response
<offset> (NR1-numeric)	**description**
0	STS-1 structure
0 to 2	STS-3c structure

SONET Response

<value> (NR1-numeric)	description
Any number in the range 0–255	The byte is set to this value
–1	Instrument is waiting for a trigger

SDH Values

<channel> (NR1-numeric)	description
1	Rate is STM-1
1 to 4	Rate is STM-4
<byte> (discrete)	**description**
A1, A2, B1, B2, H1, H2, H3, C1, E1, F1, D1, D2, D3, K1, K2, D4, D5, D6, D7, D8, D9, D10, D11, D12, S1, M1, E2	Only the bytes listed return a valid response
<offset> (NR1-numeric)	**description**
0 to 2	Any SDH rate

SDH Response

<value> (NR1-numeric)	description
Any number in the range 0–255	The byte is set to this value
–1	Instrument is waiting for a trigger

Dependencies None

Errors and Events

221, “Settings conflict; Channel is out of range”
200, “Execution error; Waiting for trigger, cannot read captured data”

Examples

Query: `SENSE:DATA:TELECOM:OVERHEAD:DATA? 1,C1,0`

Response: `123`

Related Commands

INITiate
TRIGger:IMMediate

SENSe:DATA:TELecom:OVERhead:DROP

This command selects the transport overhead bytes to be dropped to an external protocol analyzer.

Syntax

```
SENSe:DATA:TELecom:OVERhead:DROP <dropped overhead>
```

SONET Values

<dropped overhead> (discrete)	description
NONE	No overhead bytes dropped (default)
SDCC	Section DCC
LDCC	Line DCC
F1	F1 User Byte

SDH Values

<dropped overhead> (discrete)	description
NONE	No overhead bytes dropped (default)
SDCC	Regenerator section DCC
LDCC	Multiplexer section DCC
F1	F1 User Byte

Dependencies

You can drop the transport overhead or the path overhead by using the SENSe:DATA:TELecom:OVERhead:DROP and SENSe:DATA:TELecom: POVerhead:DROP commands. The last command sent applies.

Errors and Events

None

Examples

```
SENSE:DATA:TELECOM:OVERHEAD:DROP SDCC
```

Related Commands

SENse:DATA:TELecom:POVerhead:DROP

SENSe:DATA:TELecom:OVERhead:DROP?

This query returns the current setting of the transport overhead bytes to be dropped to an external protocol analyzer.

Syntax

```
SENSe:DATA:TELecom:OVERhead:DROP?
```

SONET Response

<dropped overhead> (discrete)	description
NONE	No overhead bytes dropped (default)
SDCC	Section DCC
LDCC	Line DCC
F1	F1 User Byte

SDH Response

<dropped overhead> (discrete)	description
NONE	No overhead bytes dropped (default)
SDCC	Regenerator section DCC
LDCC	Multiplexer section DCC
F1	F1 User Byte

Dependencies

None

Errors and Events

None

Examples

Query: `SENSE:DATA:TELECOM:OVERHEAD:DROP?`

Response: `NONE`

Related Commands

SENSe:DATA:TELecom:OVERhead:DROP

SENSe:DATA:TELecom:OVERhead:POINter?

This query returns the current value of the H1 and H2 overhead bytes of the active channel. If the instrument is receiving a LOS, LOF, or LOP, the last valid pointer value will be returned.

Syntax

`SENSe:DATA:TELecom:OVERhead:POINter?`

SONET Response

<pointer value> (NR1-numeric)	description
Any integer in the range 0 to 1023	H1 and H2 are set to this value

SDH Response

<pointer value> (NR1-numeric)	description
Any integer in the range 0 to 1023	H1 and H2 are set to this value

Dependencies

You must have a test running for a valid pointer value to be returned (use the SENSe:DATA:TELecom:TEST:STARt command to start a test).

Errors and Events

None

Examples

Query: `SENSE:DATA:TELECOM:OVERHEAD:POINTER?`

Response: `123`

Related Commands

SENSe:DATA:TELecom:OVERhead:DATA?
SENSe:DATA:TELecom:TEST:STARt

SENSe:DATA:TELecom:POVerhead:DATA?

This query returns the value in the specified path overhead byte.

Syntax

`SENSe:DATA:TELecom:POVerhead:DATA? <byte>`

SONET Values

<byte> (discrete)	description
J1, B3, C2, G1, F2, H4, Z3, Z4, Z5	Only the bytes listed are available for selection

SONET Response

<value> (NR1-numeric)	description
Any number in the range 0 to 255	The byte is set to this value (the value for J1 is the ASCII representation of the string value)

SDH Values

<byte> (discrete)	description
J1, B3, C2, G1, F2, H4, F3, K3, N1	Only the bytes listed are available for selection

SDH Response

<value> (NR1-numeric)	description
Any number in the range 0 to 255	The byte is set to this value (the value for J1 is the ASCII representation of the string value)

Dependencies

Use the SENSe:DATA:TELecom:CHANNel command to specify which path trace to query.

Errors and Events

200, "Execution error; Waiting for trigger, cannot read captured data"

Examples

Query: `SENSE:DATA:TELECOM:POVERHEAD:DATA? C2`

Response: `123`

Related Commands

INITiate
TRIGger:IMMediate

SENSe:DATA:TELecom:POVerhead:DROP

This command selects the path overhead channels to be dropped to an external protocol analyzer.

Syntax

```
SENSe:DATA:TELecom:POVerhead:DROP <dropped overhead>
```

SONET Values

<dropped overhead> (discrete)	description
NONE	Nothing is dropped (default)
F2	F2 User Byte

SDH Values

<dropped overhead> (discrete)	description
NONE	Nothing is dropped (default)
F2	F2 User Byte

Dependencies

You can drop the transport overhead or the path overhead by using the SENSe:DATA:TELecom:OVERhead:DROP and SENSe:DATA:TELecom:POVerhead:DROP commands. The last command sent applies.

Errors and Events

None

Examples

```
SENSE:DATA:TELECOM:POVERHEAD:DROP F2
```

Related Commands

SENSe:DATA:TELecom:OVERhead:DROP

SENSe:DATA:TELecom:POVerhead:DROP?

This query returns the current state of the dropped path overhead.

Syntax `SENSe:DATA:TELecom:POVerhead:DROP?`

SONET Response

<dropped overhead> (discrete)	description
NONE	Nothing is dropped (default)
F2	F2 User Byte

SDH Response

<dropped overhead> (discrete)	description
NONE	Nothing is dropped (default)
F2	F2 User Byte

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:POVERHEAD:DROP?`

Response: `NONE`

Related Commands SENSe:DATA:TELecom:POVerhead:DROP

SENSe:DATA:TELecom:POVerhead:TRACe?

This query returns the current path trace string that repeats in the J1 byte as a repeating byte sequence. The response is created in the following way: the first character after a null is read as the first byte and is followed by 63 J1 bytes from consecutive frames.

Syntax

`SENSe:DATA:TELecom:POVerhead:TRACe?`

SONET Response

<path trace> (string)	description
Length is a maximum of 64 bytes; if length is less than 64 bytes, the buffer is padded with nulls	The J1 byte is set to this value

SDH Values

<path trace> (string)	description
Length is a maximum of 64 bytes; if length is less than 64 bytes, the buffer is padded with nulls	The J1 byte is set to this value

Dependencies

The SENSe:DATA:TELecom:CHANnel command specifies which path trace to query.

Errors and Events

200, “Execution error; Waiting for trigger, cannot read captured data”

Examples

Query: `SENSE:DATA:TELECOM:POVERHEAD:TRACE?`

Response: `"THIS IS THE FIRST RUN OF TEST ABC"`

Related Commands

SENSe:DATA:TELecom:POVerhead:DATA?
INITiate
TRIGger:IMMediate

SENSe:DATA:TELecom:MEASure Subsystem

This section describes the commands and queries that access error, alarm, failure, and pointer measurements for current and previous tests. Figures 3–30 through 3–35 show the hierarchy trees for this subsystem.

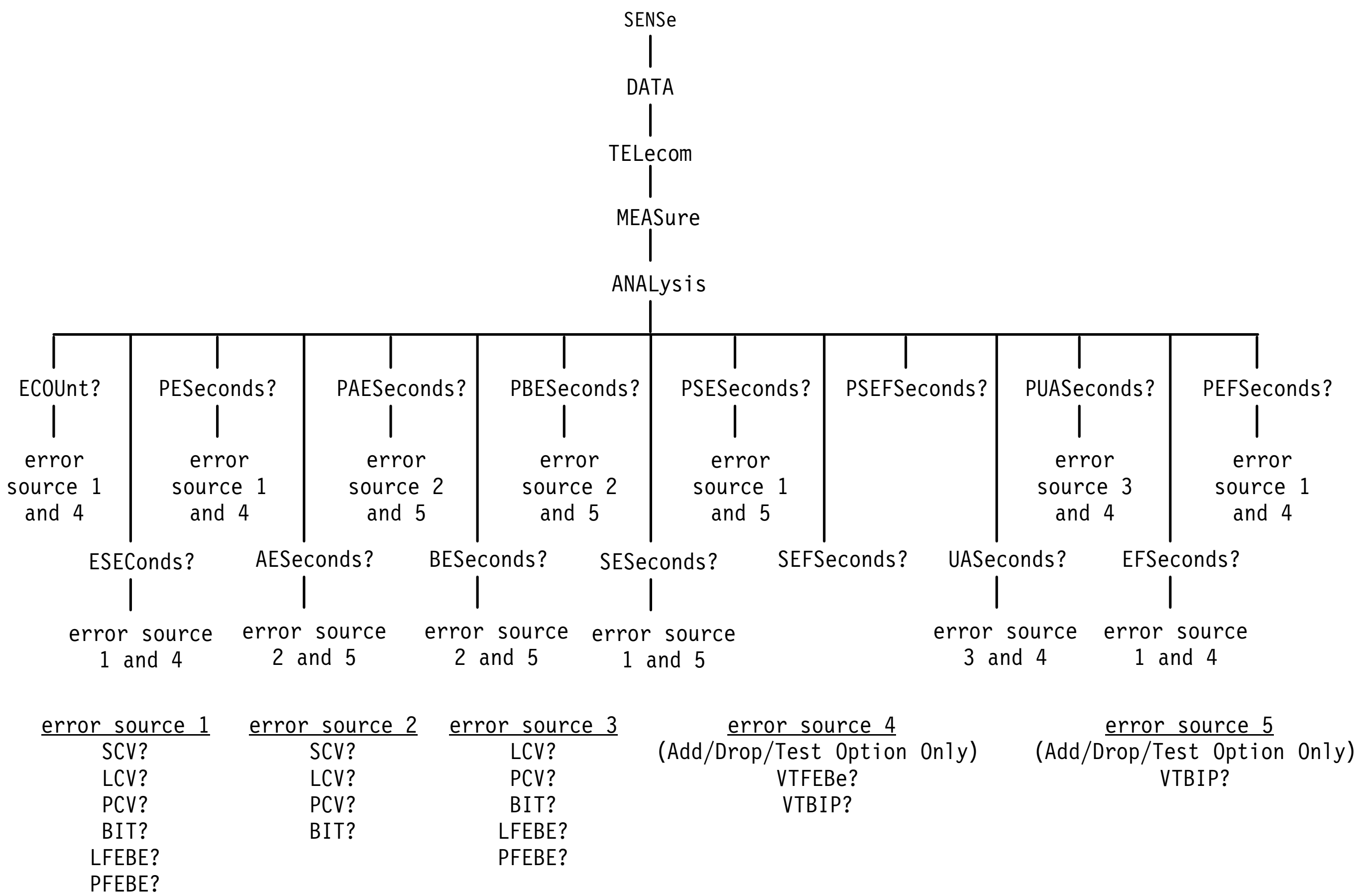


Figure 3–30: SENSe:DATA:TELecom:MEASure:ANALysis subsystem (SONET)

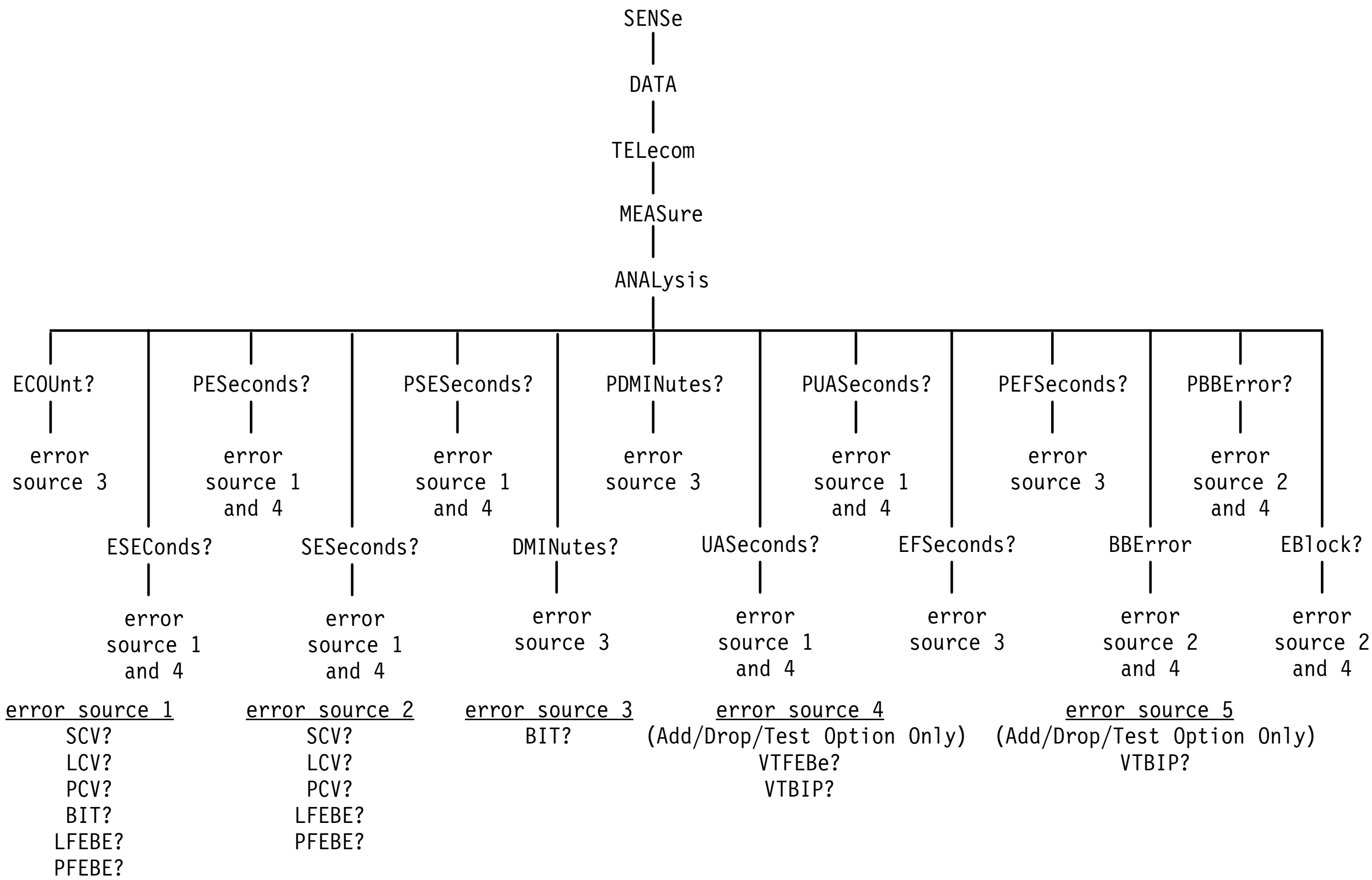


Figure 3–31: SENSe:DATA:TELecom:MEASure:ANALysis subsystem (SDH)

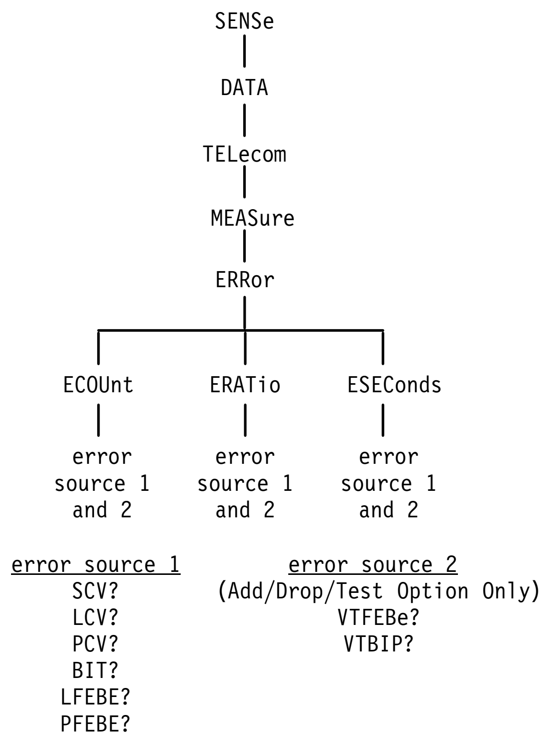


Figure 3–32: SENSe:DATA:TELecom:MEASure:ERRor subsystem

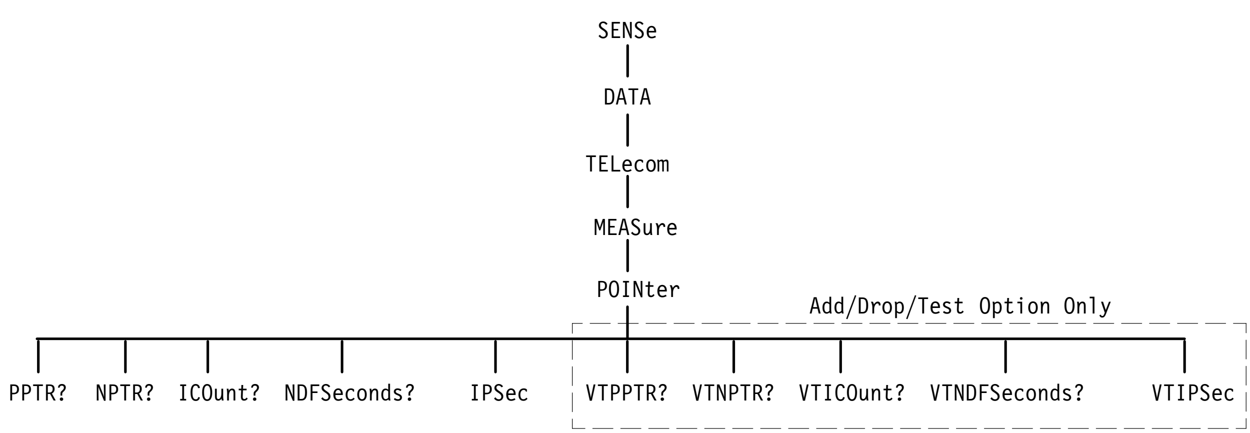


Figure 3–33: SENSe:DATA:TELecom:MEASure:POINter subsystem

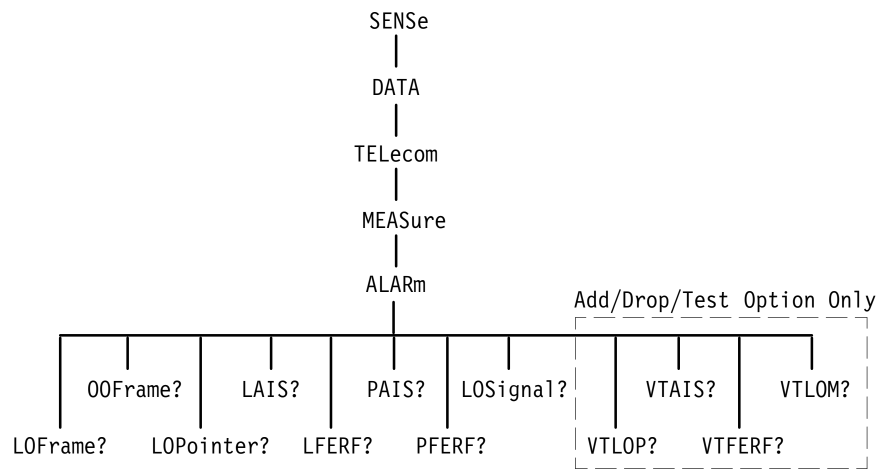


Figure 3–34: SENSe:DATA:TELecom:MEASure:ALARm subsystem

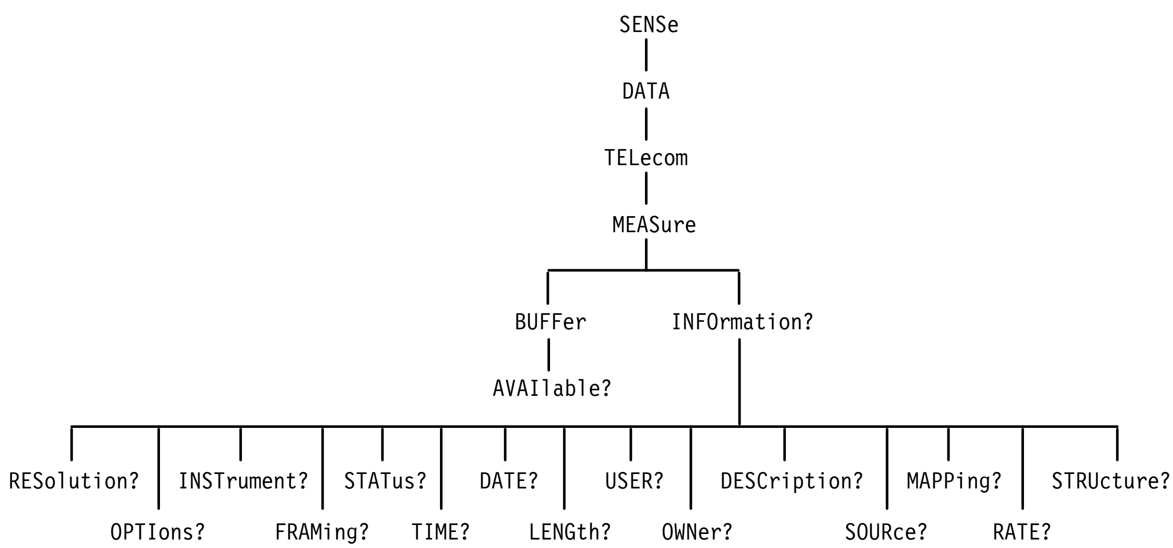


Figure 3–35: SENSe:DATA:TELecom:MEASure:BUFFer and INFOrmation subsystems

A variety of error, alarm, failure, and pointer measurements are reported through this subsystem. Table 3–9 shows how error, alarm, and failure measurements are calculated. Tables 3–10, 3–11, and 3–12 show how the analysis measurements are calculated. These calculations are based on T1M1.93 and ITU-T G.821 specifications.

Table 3–9: How error, alarm, and pointer measurements are calculated

Type of measurement	Method of calculation
Error count	Number of bit errors that were errored in the signal
Bit Error Ratio (BER)	Ratio of error count to the total number of received bits
Errored seconds	Number of seconds that had any error counts or failures such as Loss of Signal (LOS) or Severely Errored Frame (SEF)
Pointer measurements	Number of events that occur in the H1 and H2 pointer bytes
New Data Flag Seconds	Number of one-second intervals that contain new data flags
Illegal Pointer Seconds	Number of one-second intervals that contain illegal pointers
Positive Pointer Justifications	Number of times the pointer value is incremented
Negative Pointer Justifications	Number of times the pointer value is decremented
Alarms	Number of one-second intervals that contained a specific alarm such as Loss of Signal (LOS), Loss of Pointer (LOP), and Path Alarm Indication Signal (PAIS)

Table 3–10: How analysis measurements are calculated

Type of measurement	Method of calculation
Error count	Number of bit errors not occurring during periods of unavailability (see Unavailable seconds)
Errored seconds	Total number of type A, type B, and severely errored seconds not occurring during a period of unavailability (see Unavailable seconds)
Type A errored seconds	Number of seconds that had exactly one error count
Type B errored seconds	Number of seconds that had more than one error count and less than N errors (see Tables 3–11 and 3–12)
Severely errored seconds	Number of seconds with more than N errors (see Tables 3–11 and 3–12)
Severely errored framing seconds	Number of seconds where the incoming signal could not be framed (applies only to the Section layer)
Unavailable seconds	Number of seconds that the signal had too many errors to be available for use; unavailability starts at the onset of ten contiguous severely errored seconds
Error free seconds	Number of seconds that contained zero errors

Table 3–11: Value of N for analysis measurements (SONET)

Rate	N (Section B1 errors)	N (Line B2 errors)
STS-1	2500	2500
STS-3	2500	2500
STS-12	8800	10000

Table 3–12: Value of N for analysis measurements (SDH)

Rate	N (Section B1 errors)	N (Line B2 errors)
STM-1	2500	2500
STM-4	8800	10000

Some of the queries in this section have their information presented in a way that is different from queries in the rest of the manual. The syntax and examples are in table format. Figure 3–36 shows you how to read the Syntax Tables in this section. Follow the step numbers to create any query. Table 3–13 explains the acronyms used in the SENSe:DATA:TELecom:MEASure Syntax Tables.

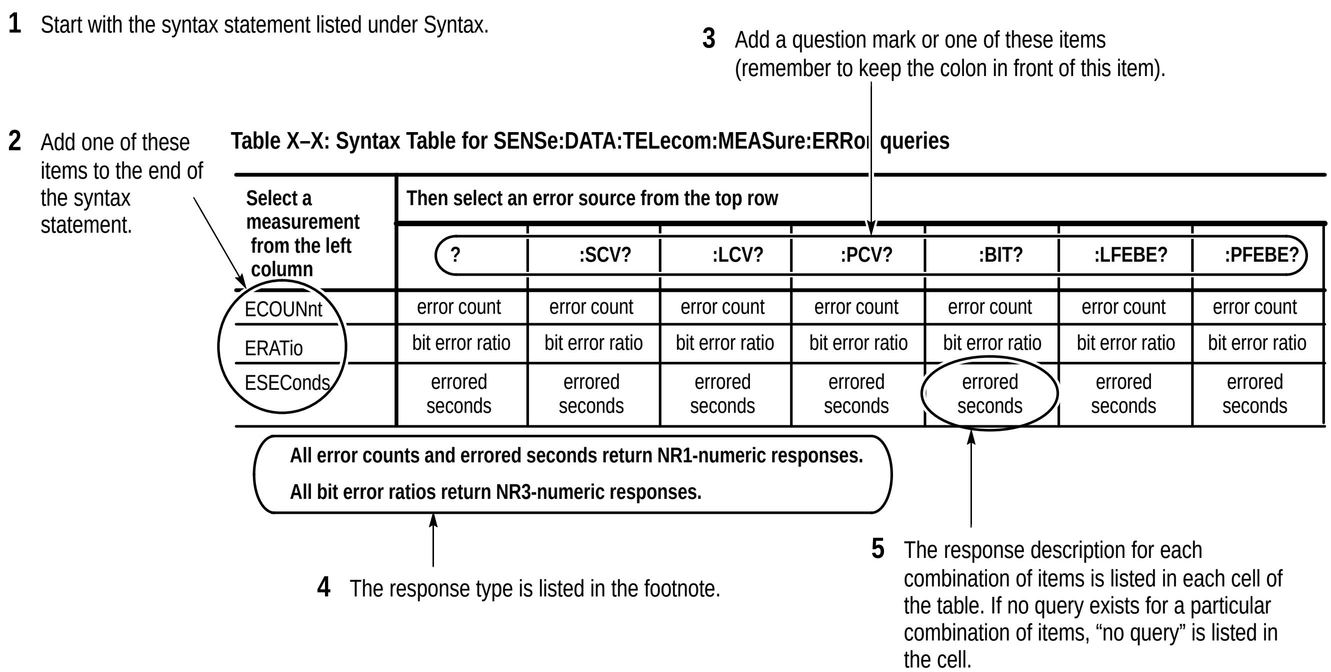


Figure 3–36: How to read the syntax tables in the SENSe:DATA:TELecom:MEASure subsystem section

Table 3–13: Acronyms used in the SENSe:DATA:TELecom:MEASure queries

Acronym	Meaning
SCV	Section/RS Code Violation
LCV	Line/MS Code Violation
PCV	Path Code Violation
BIT error (not an acronym)	Pattern bit error
LFEBE	Line/MS Far End Block Error
PFEBE	Path Far End Block Error
VTBIP	VT/TU BIP (Add/Drop/Test Option Only)
VTFEBE	VT/TU FEBE (Add/Drop/Test Option Only)

Figure 3–37 shows you how to read the Example Tables in this section.

Table X–X: Example table for SENSe:DATA:TELecom:MEASure:ERRor queries

Query	Response
`SENSE:DATA:TELECOM:MEASURE:ERROR:ECOUNT:SCV?`	`60904`
`SENSE:DATA:TELECOM:MEASURE:ERROR:ERATIO:PCV?`	`9.23E–6`
`SENSE:DATA:TELECOM:MEASURE:ERROR:ESECONDS:PFEBE?`	`6`

Selected examples of queries are shown in the left column

A typical response is shown in the right column for each example

Figure 3–37: How to read the example tables in the SENSe:DATA:TELecom:MEASure subsystem section

SENSe:DATA:TELecom:MEASure:ERRor Queries

These queries return error measurements. When you use the high-level queries (for example, SENSe:DATA:TELecom:MEASure:ERRor? or SENSe:DATA:TELecom:MEASure:ERRor:ECOUnt?), it is helpful to turn the headers on (SYSTem:HEADers ON) so you can identify each response value in the response string.

Syntax

`SENSe:DATA:TELecom:MEASure:ERRor?`

`SENSe:DATA:TELecom:MEASure:ERRor:[measurement]:[error source]`
(see Tables 3–14 and 3–15 to complete the query)

Table 3–14: Syntax for SENSe:DATA:TELecom:MEASure:ERRor queries

Select a measurement from the left column	Then select an error source from the top row						
	?	**:SCV?**	**:LCV?**	**:PCV?**	**:BIT?**	**:LFEBE?**	**:PFEBE?**
ECOUnt	all error counts	error count	error count	error count	error count	error count	error count
ERATio	all bit error ratios	bit error ratio	bit error ratio	bit error ratio	bit error ratio	bit error ratio	bit error ratio
ESEConds	all errored seconds	errored seconds	errored seconds	errored seconds	errored seconds	errored seconds	errored seconds

All error counts and errored seconds return NR1-numeric responses.

All bit error ratios return NR3-numeric responses.

Table 3–15: Syntax for SENSe:DATA:TELecom:MEASure:ERRor queries (Add/Drop/Test Option Only)

Select a measurement from the left column	Then select an error source from the top row	
	:VTFEBe?	:VTBIP?
ECOUnt	error count	error count
ERATio	bit error ratio	bit error ratio
ESEConds	errored seconds	errored seconds

All error counts and errored seconds return NR1-numeric responses.

All bit error ratios return NR3-numeric responses.

SONET Response

See Tables 3–14 and 3–15.

SDH Response

See Tables 3–14 and 3–15.

Dependencies

These measurement queries can be sent at any time. But, if a test is currently running, the responses to the queries might not represent the final error measurements. After a test has been stopped or the test duration has expired, you can send these measurement queries again to get the final error measurements.

Errors and Events

None

Examples

See Table 3–16.

Table 3–16: Examples for SENSe:DATA:TELecom:MEASure:ERRor queries

Query	Response
`SENSE:DATA:TELECOM:MEASURE:ERROR:ECOUNT:SCV?`	`60904`
`SENSE:DATA:TELECOM:MEASURE:ERROR:ERATIO:PCV?`	`9.23E−6`
`SENSE:DATA:TELECOM:MEASURE:ERROR:ESECONDS:PFEBE?`	`6`

Related Commands

SENSe:DATA:TELecom:TEST:STARt
SENSe:DATA:TELecom:TEST:STOP

SENSe:DATA:TELecom:MEASure:ANALysis Queries

These queries return an analysis of section, line, path, and payload errors. When you use the high-level queries (for example, SENSe:DATA:TELecom: MEASure:ANALysis? or SENSe:DATA:TELecom:MEASure: ANALysis:ECOUnt?), it is helpful to turn the headers on (SYSTem:HEADers ON) so you can identify each response value in the response string.

Syntax `SENSe:DATA:TELecom:MEASure:ANALysis?`

`SENSe:DATA:TELecom:MEASure:ANALysis:[measurement]:[error source]`
(see Tables 3–17 through 3–20 to complete the query)

Table 3–17: Syntax for SENSe:DATA:TELecom:MEASure:ANALysis queries (SONET)

Select a measurement from the left column	Then select an error source from the top row						
	?	:SCV?	:LCV?	:PCV?	:BIT?	:LFEBE?	:PFEBE?
ECOUnt	all error counts	error count	error count	error count	error count	error count	error count
ESEConds	all errored seconds	errored seconds	errored seconds	errored seconds	errored seconds	errored seconds	errored seconds
PESeconds	all percent errored seconds	percent errored seconds	percent errored seconds	percent errored seconds	percent errored seconds	percent errored seconds	percent errored seconds
AESeconds	all type A errored seconds	type A errored seconds	type A errored seconds	type A errored seconds	type A errored seconds	no query	no query
PAESeconds	all percent type A errored seconds	percent type A errored seconds	percent type A errored seconds	percent type A errored seconds	percent type A errored seconds	no query	no query
BESeconds	all type B errored seconds	type B errored seconds	type B errored seconds	type B errored seconds	type B errored seconds	no query	no query
PBESeconds	all percent type B errored seconds	percent type B errored seconds	percent type B errored seconds	percent type B errored seconds	percent type B errored seconds	no query	no query
SESeconds	all severely errored seconds	severely errored seconds	severely errored seconds	severely errored seconds	severely errored seconds	severely errored seconds	severely errored seconds
PSESeconds	all percent severely errored seconds	percent severely errored seconds	percent severely errored seconds	percent severely errored seconds	percent severely errored seconds	percent severely errored seconds	percent severely errored seconds
SEFSeconds	severely errored framing seconds	no query	no query	no query	no query	no query	no query

Table 3–17: Syntax for SENSe:DATA:TELecom:MEASure:ANALysis queries (SONET) (cont.)

Select a measurement from the left column	Then select an error source from the top row						
	?	:SCV?	:LCV?	:PCV?	:BIT?	:LFEBE?	:PFEBE?
PSEFseconds	percent severely errored framing seconds	no query	no query	no query	no query	no query	no query
UASeconds	all unavailable seconds	no query	unavailable seconds	unavailable seconds	unavailable seconds	unavailable seconds	unavailable seconds
PUASeconds	all percent unavailable seconds	no query	percent unavailable seconds	percent unavailable seconds	percent unavailable seconds	percent unavailable seconds	percent unavailable seconds
EFSeconds	all error free seconds	error free seconds	error free seconds	error free seconds	error free seconds	error free seconds	error free seconds
PEFSeconds	all percent error free seconds	percent error free seconds	percent error free seconds	percent error free seconds	percent error free seconds	percent error free seconds	percent error free seconds

All percent measurements return NR3-numeric responses.

All other measurements return NR1-numeric responses.

Table 3–18: Syntax for SENSe:DATA:TELecom:MEASure:ANALysis queries (SDH)

Select a measurement from the left column	Then select an error source from the top row						
	?	:SCV?	:LCV?	:PCV?	:BIT?	:LFEBE?	:PFEBE?
ECOUnt	all error counts	no query	no query	no query	all error counts	no query	no query
ESEConds	all errored seconds	errored seconds	errored seconds	errored seconds	errored seconds	errored seconds	errored seconds
PESeconds	all ratio errored seconds	ratio errored seconds	ratio errored seconds	ratio errored seconds	percent errored seconds	ratio errored seconds	ratio errored seconds
SESeconds	all severely errored seconds	severely errored seconds	severely errored seconds	severely errored seconds	severely errored seconds	severely errored seconds	severely errored seconds
PSESeconds	all ratio severely errored seconds	ratio severely errored seconds	ratio severely errored seconds	ratio severely errored seconds	percent severely errored seconds	ratio severely errored seconds	ratio severely errored seconds
UASeconds	all unavailable seconds	unavailable seconds	unavailable seconds	unavailable seconds	unavailable seconds	unavailable seconds	unavailable seconds

Table 3–18: Syntax for SENSe:DATA:TELecom:MEASure:ANALysis queries (SDH) (cont.)

Select a measurement from the left column	Then select an error source from the top row						
	?	:SCV?	:LCV?	:PCV?	:BIT?	:LFEBE?	:PFEBE?
PUASeconds	all ratio unavailable seconds	ratio unavailable seconds	ratio unavailable seconds	ratio unavailable seconds	percent unavailable seconds	ratio unavailable seconds	ratio unavailable seconds
EFSeconds	all error free seconds	no query	no query	no query	error free seconds	no query	no query
PEFSeconds	all percent error free seconds	no query	no query	no query	percent error free seconds	no query	no query
DMINutes	all degraded minutes	no query	no query	no query	degraded minutes	no query	no query
PDMINutes	all percent degraded minutes	no query	no query	no query	percent degraded minutes	no query	no query
EBLock	all block errors	block errors	block errors	block errors	no query	block errors	block errors
BBError	all background block errors	background block errors	background block errors	background block errors	no query	background block errors	background block errors
PBBError	all ratio background block errors	ratio background block errors	ratio background block errors	ratio background block errors	no query	ratio background block errors	ratio background block errors

All percent measurements return NR3-numeric responses.

All other measurements return NR1-numeric responses.

Table 3–19: Syntax for SENSe:DATA:TELecom:MEASure:ANALysis queries (SONET and Add/Drop/Test Option Only)

Select a measurement from the left column	Then select an error source from the top row	
	:VTFEBe?	:VTBIP?
ECOUnt	all error counts	all error counts
ESEConds	errored seconds	errored seconds
PESeconds	percent errored seconds	percent errored seconds
AESeconds	no query	type A errored seconds
PAESeconds	no query	percent type A errored seconds
BESeconds	no query	type B errored seconds
PBESeconds	no query	percent type B errored seconds

Table 3–19: Syntax for SENSe:DATA:TELecom:MEASure:ANALysis queries (SONET and Add/Drop/Test Option Only) (cont.)

Select a measurement from the left column	Then select an error source from the top row	
	:VTFEBe?	:VTBIP?
SESeconds	no query	severely errored seconds
PSESeconds	no query	percent severely errored seconds
UASeconds	unavailable seconds	unavailable seconds
PUASeconds	percent unavailable seconds	percent unavailable seconds
EFSeconds	error free seconds	error free seconds
PEFSeconds	percent error free seconds	percent error free seconds

All bit error ratios and percent measurements return NR3-numeric responses.

All other measurements return NR1-numeric responses.

Table 3–20: Syntax for SENSe:DATA:TELecom:MEASure:ANALysis queries (SDH and Add/Drop/Test Option Only)

Select a measurement from the left column	Then select an error source from the top row	
	:VTFEBe?	:VTBIP?
ESEConds	errored seconds	errored seconds
PESeconds	ratio errored seconds	ratio errored seconds
EBLock	block errors	block errors
BBError	background block errors	background block errors
PBBError	ratio background block errors	ratio background block errors
SESeconds	severely errored seconds	severely errored seconds
PSESeconds	ratio severely errored seconds	ratio severely errored seconds
UASeconds	unavailable seconds	unavailable seconds
PUASeconds	ratio unavailable seconds	ratio unavailable seconds

All bit error ratios and percent measurements return NR3-numeric responses.

All other measurements return NR1-numeric responses.

SONET Response See Tables 3–17 and 3–19.

SDH Response See Tables 3–18 and 3–20.

Dependencies These measurement queries can be sent at any time. However, if a test is currently running, the responses to the queries might not represent the final error measurements. After a test has been stopped or the test duration has expired, you can send these measurement queries again to get the final error measurements.

Errors and Events None

Examples See Tables 3–21 and 3–22.

Table 3–21: Example for SENSe:DATA:TELecom:MEASure:ANALysis queries (SONET)

Query	Response
SENSE:DATA:TELECOM:MEASURE:ANALYSIS:ECOUNT:LCV?	76824
SENSE:DATA:TELECOM:MEASURE:ANALYSIS:ESECONDS:BIT?	26
SENSE:DATA:TELECOM:MEASURE:ANALYSIS:PUASECONDS:PFEBE?	6.5E–3
SENSE:DATA:TELECOM:MEASURE:ANALYSIS:SESECONDS:PCV?	0

Table 3–22: Example for SENSe:DATA:TELecom:MEASure:ANALysis queries (SDH)

Query	Response
SENSE:DATA:TELECOM:MEASURE:ANALYSIS:SESECONDS:LCV?	23
SENSE:DATA:TELECOM:MEASURE:ANALYSIS:BBERROR:SCV?	103
SENSE:DATA:TELECOM:MEASURE:ANALYSIS:PUASECONDS:LFEBE?	1.2E–1

Related Commands SENSe:DATA:TELecom:TEST:STARt
SENSe:DATA:TELecom:TEST:STOP

SENSe:DATA:TELecom:MEASure:ALARm Queries

These queries return alarm measurements. When you use the SENSe:DATA:TELecom:MEASure:ALARm? query, it is helpful to turn the headers on (SYSTem:HEADers ON) so you can identify each response value in the response string.

Syntax All valid queries are listed in the Syntax column of Tables 3–23 and 3–24.

Table 3–23: Syntax for SENSe:DATA:TELecom:MEASure:ALARm queries

Syntax	Response
SENSe:DATA:TELecom:MEASure:ALARm?	All alarm measurements
SENSe:DATA:TELecom:MEASure:ALARm:LOSignal?	Number of seconds of Loss of Signal
SENSe:DATA:TELecom:MEASure:ALARm:LOFrame?	Number of seconds of Loss of Frame
SENSe:DATA:TELecom:MEASure:ALARm:OOFrame?	Number of seconds of Out of Frame
SENSe:DATA:TELecom:MEASure:ALARm:LOPointer?	Number of seconds of Loss of Pointer
SENSe:DATA:TELecom:MEASure:ALARm:LAIS?	Number of seconds of Line/MS AIS
SENSe:DATA:TELecom:MEASure:ALARm:LFERf?	Number of seconds of Line/MS FERF
SENSe:DATA:TELecom:MEASure:ALARm:PFERf?	Number of seconds of Path FERF
SENSe:DATA:TELecom:MEASure:ALARm:PAIS?	Number of seconds of Path AIS

All responses are in NR3-numeric format.

Table 3–24: Syntax for SENSe:DATA:TELecom:MEASure:ALARm queries (Add/Drop/Test Option Only)

Syntax	Response
SENSe:DATA:TELecom:MEASure:ALARm:VTLOP?	Number of seconds of tributary Loss of Pointer
SENSe:DATA:TELecom:MEASure:ALARm:VTAIS?	Number of seconds of tributary AIS
SENSe:DATA:TELecom:MEASure:ALARm:VTFERF?	Number of seconds of tributary FERF
SENSe:DATA:TELecom:MEASure:ALARm:VTLOM?	Number of seconds of tributary Loss of Multiframe

All responses are in NR3-numeric format.

SONET Response See the Response column of Tables 3–23 and 3–24.

SDH Response See the Response column of Tables 3–23 and 3–24.

Dependencies These measurement queries can be sent at any time. However, if a test is currently running, the responses to the queries might not represent the final error measurements. After a test has been stopped or the test duration has expired, you can send these measurement queries again to get the final error measurements.

Errors and Events None

Examples See Table 3–25.

Table 3–25: Examples of SENSe:DATA:TELecom:MEASure:ALARm queries

Query	Response
SENSE:DATA:TELECOM:MEASURE:ALARM:LOPOINTER?	20
SENSE:DATA:TELECOM:MEASURE:ALARM:OOFRAME?	13

Related Commands SENSe:DATA:TELecom:TEST:STARt
SENSe:DATA:TELecom:TEST:STOP

SENSe:DATA:TELecom:MEASure:POINter Queries

These queries return pointer-related measurements. When you use the SENSe:DATA:TELecom:MEASure:POINter? query, it is helpful to turn the headers on (SYSTem:HEADers ON) so you can identify each response value in the response string.

Syntax All valid queries are listed in the Syntax column of Tables 3–26 and 3–27.

Table 3–26: Syntax for SENSe:DATA:TELecom:MEASure:POINter queries

Syntax	Response
SENSe:DATA:TELecom:MEASure:POINter?	All pointer measurements
SENSe:DATA:TELecom:MEASure:POINter:NDFSeconds?	Number of seconds in which one or more NDFs (new data flags) occurred
SENSe:DATA:TELecom:MEASure:POINter:IPSec	Number of seconds in which one or more illegal pointer adjustments occurred
SENSe:DATA:TELecom:MEASure:POINter:PPTR?	Number of positive pointer justifications
SENSe:DATA:TELecom:MEASure:POINter:NPTR?	Number of negative pointer justifications
SENSe:DATA:TELecom:MEASure:POINter:ICOunt?	Number of invalid pointers

All responses are in NR1-numeric format.

Table 3–27: Syntax for SENSe:DATA:TELecom:MEASure:POINter queries (Add/Drop/Test Option Only)

Syntax	Response
SENSe:DATA:TELecom:MEASure:POINter:VTPPTR?	Number of tributary positive pointer justifications
SENSe:DATA:TELecom:MEASure:POINter:VTNPTR?	Number of tributary negative pointer justifications
SENSe:DATA:TELecom:MEASure:POINter:VTICOunt?	Number of tributary invalid pointers

Table 3–27: Syntax for SENSe:DATA:TELecom:MEASure:POINter queries (Add/Drop/Test Option Only) (cont.)

Syntax	Response
`SENSe:DATA:TELecom:MEASure:POINter:VTNDFSeconds?`	Number of seconds in which one or more tributary NDFs (new data flags) occurred
`SENSe:DATA:TELecom:MEASure:POINter:VTIPSec`	Number of seconds in which one or more illegal tributary pointer adjustments occurred

All responses are in NR1-numeric format.

SONET Response See the Response column of Tables 3–26 and 3–27.

SDH Response See the Response column of Tables 3–26 and 3–27.

Dependencies These measurement queries can be sent at any time. However, if a test is currently running, the responses to the queries might not represent the final error measurements. After a test has been stopped or the test duration has expired, you can send these measurement queries again to get the final error measurements.

Errors and Events None

Examples See Table 3–28.

Table 3–28: Examples of SENSe:DATA:TELecom:MEASure:POINter queries

Query	Response
`SENSE:DATA:TELECOM:MEASURE:POINTER:PPTR?`	12
`SENSE:DATA:TELECOM:MEASURE:POINTER:ICOUNT?`	0

Related Commands SENSe:DATA:TELecom:TEST:STARt
SENSe:DATA:TELecom:TEST:STOP

SENSe:DATA:TELecom:MEASure:BUFFer

This command sets the buffer that is read with the measurement queries. The following buffers are available for use: buffer number 1 contains results from the most recent test, and buffer number 2 contains results from the previous test. The current test results might overflow into the previous test results buffer (buffer number 2). In that case, only buffer number 1 is available for use. Use the SENSe:DATA:TELecom:MEASure:BUFFer:AVAIlable? query to determine the oldest available buffer.

Syntax

```
SENSe:DATA:TELecom:MEASure:BUFFer <results buffer>
```

SONET Values

<results buffer> (NR1-numeric)	description
1 or 2	Buffer number read with the measurement queries (default = 1)

SDH Values

<results buffer> (NR1-numeric)	description
1 or 2	Buffer number read with the measurement queries (default = 1)

Dependencies

None

Errors and Events

200, “Execution error; Temporary buffer is empty”

Examples

```
SENSE:DATA:TELECOM:MEASURE:BUFFER 2
```

Related Commands

SENSe:DATA:TELecom:MEASure:INFOrmation?
SENSe:DATA:TELecom:MEASure:BUFFer:AVAIlable
SENSe:DATA:TELecom:MEASure:HISTory: commands and queries
SENSe:DATA:TELecom:MEASure:HISTory:TRIButary queries

SENSe:DATA:TELecom:MEASure:BUFFer?

This query returns the buffer number that is read with the measurement queries. If the buffer number is set to 1, the measurement queries will return measurement information for the most recent test. If the buffer number is set to 2, the measurement queries will return measurement information for the previous test. The recent test results might overflow into the previous test results buffer (buffer number 2). In that case, only buffer number 1 is available for use. Use the SENSe:DATA:TELecom:MEASure:BUFFer:AVAIlable? query to determine the oldest available buffer.

Syntax

`SENSe:DATA:TELecom:MEASure:BUFFer?`

SONET Response

<results buffer> (NR1-numeric)	description
1 or 2	Buffer number read with the measurement queries (default = 1)

SDH Response

<results buffer> (NR1-numeric)	description
1 or 2	Buffer number read with the measurement queries (default = 1)

Dependencies

None

Errors and Events

None

Examples

Query: `SENSE:DATA:TELECOM:MEASURE:BUFFER?`

Response: 1

Related Commands

SENSe:DATA:TELecom:MEASure:BUFFer

SENSe:DATA:TELecom:MEASure:BUFFer:AVAIlable?

This query returns the oldest buffer accessible with the measurement and history queries. The value returned by this query is the maximum value you can use in the SENSe:DATA:TELecom:MEASure:BUFFer command.

Buffer number 1 contains results from the most recent test. Buffer number 2 contains results from the previous test. The current results might overflow into the previous test results buffer (buffer number 2). In that case, only buffer number 1 is available for use.

While a test is running, the response to this query is always 1 because only current test results can be displayed at that time.

Syntax

`SENSe:DATA:TELecom:MEASure:BUFFer:AVAIlable?`

SONET Response

<oldest buffer> (NR1-numeric)	description
1 or 2	Oldest buffer number read with the measurement queries (default = 1)

SDH Response

<oldest buffer> (NR1-numeric)	description
1 or 2	Oldest buffer number read with the measurement queries (default = 1)

Dependencies

None

Errors and Events

None

Examples

Query: `SENSE:DATA:TELECOM:MEASURE:BUFFER?`

Response: 2

Related Commands

SENSe:DATA:TELecom:MEASure:BUFFer

SENSe:DATA:TELecom:MEASure:INFOrmation Queries

This query returns information on the buffer accessed with the measurement and history queries.

Syntax All valid queries are listed in the Syntax column of Table 3–29.

Table 3–29: Syntax for SENSe:DATA:TELecom:MEASure:INFOrmation queries

Syntax	Response
SENSe:DATA:TELecom:MEASure:INFOrmation?	[All measurement information]
SENSe:DATA:TELecom:MEASure:INFOrmation:DATE?	year,month,day [the date the test starts]
SENSe:DATA:TELecom:MEASure:INFOrmation:DESCription?	[Description of the test]
SENSe:DATA:TELecom:MEASure:INFOrmation:FRAMing?	[Tributary framing]
SENSe:DATA:TELecom:MEASure:INFOrmation:INSTrument?	[Instrument identity]
SENSe:DATA:TELecom:MEASure:INFOrmation:LENGth?	[Length of the test information in minutes]
SENSe:DATA:TELecom:MEASure:INFOrmation:MAPPing?	EQUIpped, UNEQuipped, VTASYNC, DS3, TUASYNC, TU3, M140
SENSe:DATA:TELecom:MEASure:INFOrmation:OPTIons?	[Installed instrument options]
SENSe:DATA:TELecom:MEASure:INFOrmation:OWNer?	[Same information as the SYSTem:OWNer? query]
SENSe:DATA:TELecom:MEASure:INFOrmation:RATE?	STS1, STS3, STS12 STM1, STM4 DS1, DS3 (Add/Drop/Test Option Only) M1, M34, M140 (Add/Drop/Test Option Only)
SENSe:DATA:TELecom:MEASure:INFOrmation:RESolution?	MIN1 , MIN15, SEC1 [Resolution of acquired data]
SENSe:DATA:TELecom:MEASure:INFOrmation:SOURce?	INPUT1, INPUT2, INPUT3 [SONET/SDH or tributary signal]
SENSe:DATA:TELecom:MEASure:INFOrmation:STATus?	EMPTY, RECORDING, COMPLETE
SENSe:DATA:TELecom:MEASure:INFOrmation:STRUcture?	STS1, STS3C, AU4
SENSe:DATA:TELecom:MEASure:INFOrmation:TIME?	hour,minute [the time the test starts]
SENSe:DATA:TELecom:MEASure:INFOrmation:USER?	[Same information as the SYSTem:USER? query]

The status, time, date, and length responses are in NR1-numeric format.

All other responses are in string format.

If structure, mapping, and framing do not apply to the received signal, the response is NONE.

SONET Response See the Response column of Table 3–29.

SDH Response See the Response column of Table 3–29.

Dependencies Information is valid only when a test is completed. Set SENSe:DATA:TELecom:MEASure:BUFFer to the buffer for which you want information.

Errors and Events 200, "Execution error; Test is still running"

Examples See Table 3–30.

Table 3–30: Example table for SENSe:DATA:TELecom:MEASure:INFOrmation queries

Query	Response
SENSE:DATA:TELECOM:MEASURE:INFORMATION:TIME?	14,22,0
SENSE:DATA:TELECOM:MEASURE:INFORMATION:DESCRIPTION?	"PORTLAND TO SEATTLE NETWORK TEST"
SENSE:DATA:TELECOM:MEASURE:INFORMATION:MAPPING?	EQUIPPED

Related Commands SENSe:DATA:TELecom:MEASure:BUFFer

SENSe:DATA:TELecom:MEASure:HISTory Subsystem

This subsystem allows you to access measurement histories from the instrument. Measurements are stored for the current and most recently run tests. Set SENSe:DATA:TELecom:MEASure:BUFFer to 1 to access history measurements for the current test, and to 2 to access history measurements for the most recently run test. Figure 3–38 shows the hierarchy tree for this subsystem. Figure 3–39 shows how the measurement history is stored and how you can use the commands of this subsystem to retrieve these measurement values.

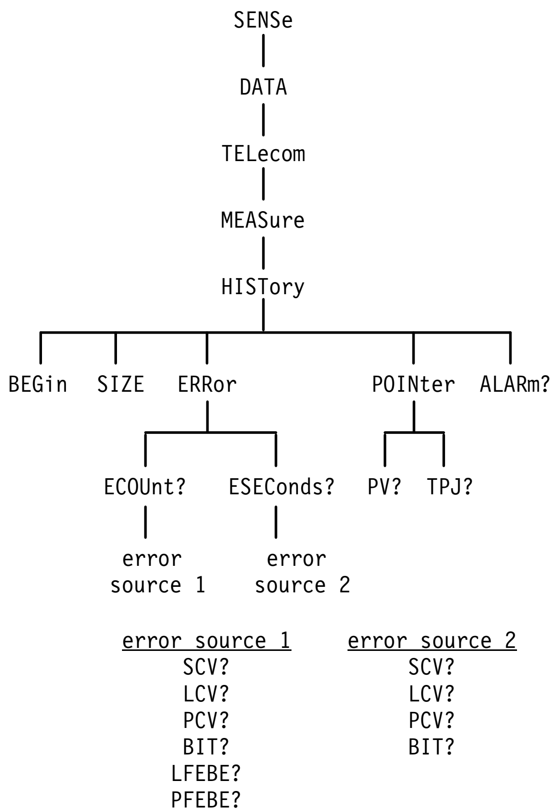


Figure 3–38: SENSe:DATA:TELecom:MEASure:HISTory subsystem

Step **1**	To set where you want to begin retrieving the measurement history, use the SENSe:DATA:TELecom:MEASure:HISTory:BEGin command.	Example:	SENSe:DATA:TELecom:MEASure:HISTory:BEGin 3 sets up to begin retrieving measurement data at minute 3.
Step **2**	To set the total amount of measurement history returned, use the SENSe:DATA:TELecom:MEASure:HISTory:SIZe command.	Example:	SENSe:DATA:TELecom:MEASure:HISTory:SIZe 10 sets up to retrieve a total of 10 minutes of measurement data.
Step **3**	To retrieve the measurement values for the time set, use one of the SENSe:DATA:TELecom:MEASure:HISTory queries.	Example:	SENSe:DATA:TELecom:MEASure:HISTory:ERRor:ECOUnt:SCV? returns a block of SCV error count data for minutes 3 through 12.
Step **4**	The binary block header indicates how much data is returned.	Example:	A header response of #42345 indicates that 2,345 bytes of data follow the header; a response of #3728 indicates 728 data bytes following the header.
Step **5**	The response from the SENSe:DATA:TELecom:MEASure:HISTory queries is in one of the three formats shown below.	Example:	A typical data value for an SCV error count is 1132 indicating $113x10^2$ errors occurred in the first minute of the requested error history.

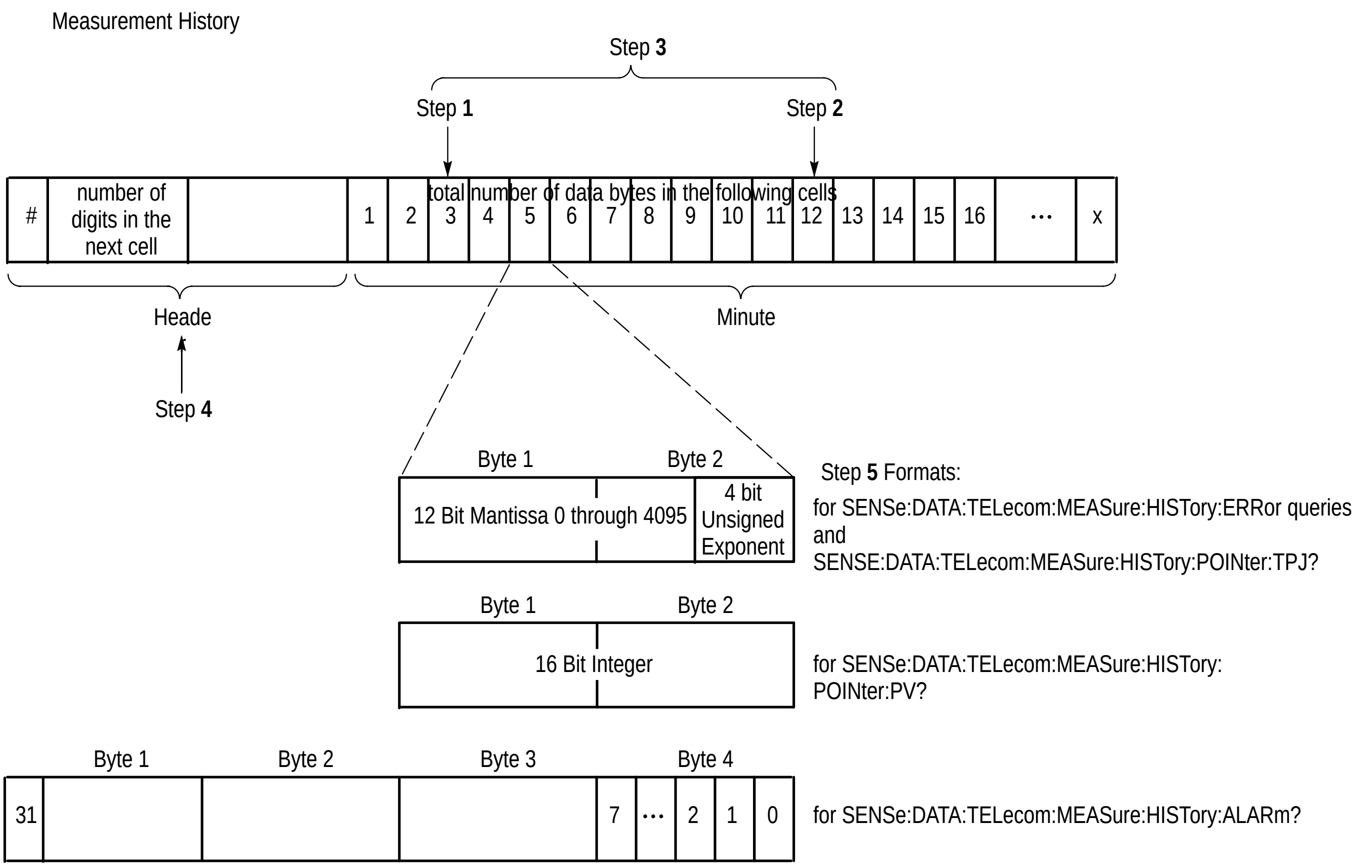


Figure 3–39: How measurement history is stored and retrieved

SENSe:DATA:TELecom:MEASure:HISTory:BEGin

This command sets the minute that measurement history retrieval begins. Set the <history begin> parameter to 1 if you want to start at the beginning of the test.

Syntax

```
SENSe:DATA:TELecom:MEASure:HISTory:BEGin <history begin>
```

SONET Values

<history begin> (NR1-numeric)	description
Any integer greater than 0	The minute of the measurement history to begin retrieving

SDH Values

<history begin> (NR1-numeric)	description
Any integer greater than 0	The minute of the measurement history to begin retrieving

Dependencies

To set the total size of the measurement history retrieved, use the SENSe:DATA:TELecom:MEASure:HISTory:SIZe command.

Errors and Events

None

Examples

```
SENSE:DATA:TELECOM:MEASURE:HISTORY:BEGIN 1
```

Related Commands

SENSe:DATA:TELecom:MEASure:HISTory:SIZe
SENSe:DATA:TELecom:MEASure:HISTory:TRIButary queries

SENSe:DATA:TELecom:MEASure:HISTory:BEGin?

This query returns the minute that measurement history retrieval begins.

Syntax

```
SENSe:DATA:TELecom:MEASure:HISTory:BEGin?
```

SONET Response

<history begin> (NR1-numeric)	description
Any integer greater than 0	The minute of the measurement history to begin retrieving

SDH Response

<history begin> (NR1-numeric)	description
Any integer greater than 0	The minute of the measurement history to begin retrieving

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:MEASURE:HISTORY:BEGIN?`

Response: 3

Related Commands SENSe:DATA:TELecom:MEASure:HISTory:BEGin

SENSe:DATA:TELecom:MEASure:HISTory:SIZe

This command sets the length of the measurement history, in minutes, that is retrieved with one of the SENSe:DATA:TELecom:MEASure:HISTory or SENSe:DATA:TELecom:MEASure:HISTory:TRIButary queries. To retrieve measurements for the entire test, set the <history size> parameter to the total number of minutes the test ran. (Once a test has stopped, the response to the SENSe:DATA:TELecom:TEST:STATus? query returns the number of days, hours, minutes, and seconds the test ran. Use the response from this :TEST:STATus? query to calculate the total number of minutes.)

Syntax `SENSe:DATA:TELecom:MEASure:HISTory:SIZe <history size>`

SONET Values

<history size> (NR1-numeric)	description
Any integer greater than 0	The total number of measurement history minutes to retrieve

SDH Values

<history size> (NR1-numeric)	description
Any integer greater than 0	The total number of measurement history minutes to retrieve

Dependencies To set the minute to begin retrieving measurement history, use the SENSe:DATA:TELecom:MEASure:HISTory:BEGin command.

Errors and Events None

Examples `SENSE:DATA:TELECOM:MEASURE:HISTORY:SIZE 10`

Related Commands SENSe:DATA:TELecom:MEASure:HISTory:BEGin
SENSe:DATA:TELecom:MEASure:HISTory:TRIButary queries

SENSe:DATA:TELecom:MEASure:HISTory:SIZe?

This query returns the length of the measurement history, in minutes, that is retrieved with one of the SENSe:DATA:TELecom:MEASure:HISTory or SENSe:DATA:TELecom:MEASure:HISTory:TRIButary queries.

Syntax `SENSe:DATA:TELecom:MEASure:HISTory:SIZe?`

SONET Response

<history size> (NR1-numeric)	description
Any integer greater than 0	The total number of measurement history minutes to retrieve

SDH Response

<history size> (NR1-numeric)	description
Any integer greater than 0	The total number of measurement history minutes to retrieve

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:MEASURE:HISTORY:SIZE?`

Response: `10`

Related Commands SENSe:DATA:TELecom:MEASure:HISTory:SIZe

SENSe:DATA:TELecom:MEASure:HISTory:ERRor Queries

These queries return history error measurement values for the time period specified by the SENSe:DATA:TELecom:MEASure:HISTory:SIZe and SENSe:DATA:TELecom:MEASure:HISTory:BEGin commands. Refer to Figure 3–39 on page 3–257 for information on reading the response.

Syntax

`SENSe:DATA:TELecom:MEASure:HISTory:ERRor?`

`SENSe:DATA:TELecom:MEASure:HISTory:ERRor:` (see Table 3–31 to complete the query)

Table 3–31: Syntax for SENSe:DATA:TELecom:MEASure:HISTory:ERRor queries

Select a measurement from the left column	Then select a error source from the top row						
	?	:SCV?	:LCV?	:PCV?	:BIT?	:LFEBE?	:PFEBE?
ECOUnt	all error counts	error counts	error counts	error counts	error counts	error counts	error counts
ESEConds	all errored seconds	errored seconds	errored seconds	errored seconds	errored seconds	no query	no query

All bit error counts and errored seconds return binary block responses.

SONET Response See Table 3–31.

SDH Response See Table 3–31.

Dependencies These history measurement queries can be sent at any time. But, if a test is currently running, the responses to the queries might not represent the final history error measurements. After a test has been stopped or the test duration has expired, you can send these history measurement queries again to get the final history error measurement values.

Errors and Events None

Examples See Table 3–32.

Table 3–32: Examples for SENSe:DATA:TELecom:MEASure:HISTory:ERRor queries

Query	Response
`SENSE:DATA:TELECOM:MEASURE:HISTORY:ERROR:ECOUNT:SCV?`	`#41234 ...`
`SENSE:DATA:TELECOM:MEASURE:HISTORY:ERROR:ESECONDS:BIT?`	`#31236 ...`

Related Commands SENSe:DATA:TELecom:MEASure:HISTory:SIZe
SENSe:DATA:TELecom:MEASure:HISTory:BEGin

SENSe:DATA:TELecom:MEASure:HISTory:POINter Queries

These queries return pointer-related history measurement values for the time period specified by the SENSe:DATA:TELecom:MEASure:HISTory:SIZe and SENSe:DATA:TELecom:MEASure:HISTory:BEGin commands. Refer to Figure 3–39 on page 3–257 for information on reading the response.

Syntax All valid queries are listed in the Syntax column of Table 3–33.

Table 3–33: Syntaxs for SENSe:DATA:TELecom:MEASure:POINter queries

Syntax	Response
`SENSe:DATA:TELecom:MEASure:HISTory:POINter:PV?`	Pointer value
`SENSe:DATA:TELecom:MEASure:HISTory:POINter:TPJ?`	Total pointer justifications

All pointer history measurements return binary block responses.

SONET Response See the Response column of Table 3–33.

SDH Response See the Response column of Table 3–33.

Dependencies These history measurement queries can be sent at any time. But, if a test is currently running, the responses to the queries might not represent the final history error measurements. After a test has been stopped or the test duration has expired, you can send these history measurement queries again to get the final history error measurement values.

Errors and Events None

Examples See Table 3–34.

Table 3–34: Examples for SENSe:DATA:TELecom:MEASure:HISTory:POINter queries

Query	Response
`SENSE:DATA:TELECOM:MEASURE:POINTER:PV?`	`#215 ...`
`SENSE:DATA:TELECOM:MEASURE:POINTER:TPJ?`	`#3101 ...`

Related Commands

SENSe:DATA:TELecom:MEASure:HISTory:SIZe
SENSe:DATA:TELecom:MEASure:HISTory:BEGin

SENSe:DATA:TELecom:MEASure:HISTory:ALARm?

This query returns alarm and failure history measurement values for the time period specified by the SENSe:DATA:TELecom:MEASure:HISTory:SIZe and SENSe:DATA:TELecom:MEASure:HISTory:BEGin commands. The response consists of four consecutive bytes. Refer to Figure 3–39 on page 3–257 for more information on reading the response.

Syntax

`SENSe:DATA:TELecom:MEASure:HISTory:ALARm?`

SONET Response

<decimal value> (NR1-numeric)	bit	definition
1	0	Power failure
2	1	Loss of Signal
4	2	Loss of Frame
8	3	Out of Frame (OOF)
16	4	STS Loss of Pointer
32	5	VT Loss of Pointer
64	6	Pattern lock
128	7	Unused
256	8	Line AIS
512	9	Line FERF
1024	10	Unused
2048	11	Unused
4096	12	Path AIS
8192	13	Path FERF
16384	14	Unused
32768	15	Unused

<decimal value> (NR1-numeric)	bit	definition
2^{16}	16	VT AIS
2^{17}	17	VT FERF
2^{18}	18	VT LOM
2^{19} through 2^{31}	19 through 31	Unused

SDH Response

<decimal value> (NR1-numeric)	bit	definition
1	0	Power failure
2	1	Loss of Signal
4	2	Loss of Frame
8	3	Out of Frame (OOF)
16	4	STM Loss of Pointer
32	5	TU Loss of Pointer
64	6	Pattern lock
128	7	Unused
256	8	MS AIS
512	9	MS FERF
1024	10	Unused
2048	11	Unused
4096	12	Path AIS
8192	13	Path FERF
16384	14	Path RAI
2^{15}	15	Unused
2^{16}	16	TU AIS
2^{17}	17	TU FERF
2^{18}	18	TU LOM
2^{19} through 2^{31}	19 through 31	Unused

Dependencies

These history measurement queries can be sent at any time. But, if a test is currently running, the responses to the queries might not represent the final history error measurements. After a test has been stopped or the test duration has expired, you can send these history measurement queries again to get the final history error measurement values.

Errors and Events

None

Examples

Query: `SENSE:DATA:TELECOM:MEASURE:HISTORY:ALARM?`

Response: `#512345 ...`

Related Commands

SENSe:DATA:TELecom:MEASure:HISTory:SIZe
SENSe:DATA:TELecom:MEASure:HISTory:BEGin

SENSe:DATA:TELecom:MEASure:STESts Subsystem

This section describes each of the commands and queries that allow you to apply predefined criteria to test results and determine if the tests passed or failed. Figure 3–40 shows the hierarchy tree for this subsystem.

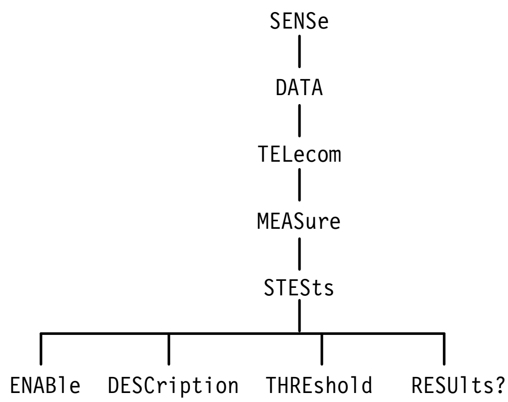


Figure 3–40: SENSe:DATA:TELecom:MEASure:STESts subsystem

SENSe:DATA:TELecom:MEASure:STESts:ENABle

This command enables the evaluation of pass/fail tests.

Syntax

```
SENSe:DATA:TELecom:MEASure:STESts:ENABle <stests enable>
```

SONET Values

<stests enable> (boolean)	description
OFF or 0	No evaluation (default)
ON or 1	Measurements evaluated

SDH Values

<stests enable> (boolean)	description
OFF or 0	No evaluation (default)
ON or 1	Measurements evaluated

Dependencies None

Errors and Events None

Examples `SENSE:DATA:TELECOM:MEASURE:STESTS:ENABLE ON`

Related Commands None

SENSe:DATA:TELecom:MEASure:STESts:ENABle?

This query returns the current setting of the pass/fail tests enable.

Syntax `SENSe:DATA:TELecom:MEASure:STESts:ENABle?`

SONET Response

<stests enable> (boolean)	description
0	No evaluation (OFF) (default)
1	Measurements evaluated (ON)

SDH Response

<stests enable> (boolean)	description
0	No evaluation (OFF) (default)
1	Measurements evaluated (ON)

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:MEASURE:STESTS:ENABLE?`

Response: 0

Related Commands SENSe:DATA:TELecom:MEASure:STESts:ENABle

SENSe:DATA:TELecom:MEASure:STESts:DESCription

This command sets the pass/fail test description.

Syntax

```
SENSe:DATA:TELecom:MEASure:STESts:DESCription <description>,
<start prompt>,<end prompt>
```

SONET Values

<description> (string)	description
An ASCII string, maximum length of 25 bytes	The pass/fail test description
<start prompt> (string)	**description**
An ASCII string, maximum length of 75 bytes	Text to prompt the operator at the start of the test
<end prompt> (string)	**description**
An ASCII string, maximum length of 75 bytes	Text to prompt the operator at the end of the test

SDH Values

<description> (string)	description
An ASCII string, maximum length of 25 bytes	The pass/fail test description
<start prompt> (string)	**description**
An ASCII string, maximum length of 75 bytes	Text to prompt the operator at the start of the test
<end prompt> (string)	**description**
An ASCII string, maximum length of 75 bytes	Text to prompt the operator at the end of the test

Dependencies None

Errors and Events None

Examples

```
SENSE:DATA:TELECOM:MEASURE:STESTS:DESCRIPTION "THIS TESTS AN XYZ
ADM","CONNECT TO EQUIPMENT","REMEMBER TO DISCONNECT FROM
EQUIPMENT"
```

Related Commands None

SENSe:DATA:TELecom:MEASure:STESts:DESCription?

This query returns the pass/fail test description.

Syntax `SENSe:DATA:TELecom:MEASure:STESts:DESCription?`

SONET Response

<description> (string)	description
An ASCII string, maximum length of 25 bytes	The pass/fail test description
<start prompt> (string)	**description**
An ASCII string, maximum length of 75 bytes	Text to prompt the operator at the start of the test
<end prompt> (string)	**description**
An ASCII string, maximum length of 75 bytes	Text to prompt the operator at the end of the test

SDH Response

<description> (string)	description
An ASCII string, maximum length of 25 bytes	The pass/fail test description
<start prompt> (string)	**description**
An ASCII string, maximum length of 75 bytes	Text to prompt the operator at the start of the test
<end prompt> (string)	**description**
An ASCII string, maximum length of 75 bytes	Text to prompt the operator at the end of the test

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:MEASURE:STESTS:DESCRIPTION?`

Response: `"THIS TESTS AN XYZ ADM","CONNECT TO EQUIPMENT",`
`"REMEMBER TO DISCONNECT FROM EQUIPMENT"`

Related Commands SENSe:DATA:TELecom:MEASure:STESts:DESCription

SENSe:DATA:TELecom:MEASure:STESts:THREshold

This command sets the pass/fail test criteria. The pass/fail result is determined by applying the criteria given by this command after the current test is completed. You can set up a maximum of four sets of pass/fail criteria.

Syntax

```
SENSe:DATA:TELecom:MEASure:STESts:THREshold <criteria number>,
<type>,<source>,<threshold>
```

SONET Values

<criteria number> (discrete)	description
1	First set of pass/fail criteria
2	Second set of pass/fail criteria
3	Third set of pass/fail criteria
4	Fourth set of pass/fail criteria
<type> (discrete)	**description**
NONE	No pass/fail criteria
ALARm	Alarms are the pass/fail criteria
FAILure	Failures are the pass/fail criteria
ERATio	Bit error ratio is the pass/fail criterion
ECOUnt	Error count is the pass/fail criterion
ESEConds	Errored seconds are the pass/fail criteria
POINter	Pointer movements are the pass/fail criteria

if <type> = NONE

<source> (discrete)	description
NONE	No pass/fail criteria
<threshold> (discrete)	**description**
0	No threshold

if <type> = ALARm

<source> (discrete)	description
ANY	Any alarm
LAIS	Line alarm indication signal

if <type> = ALARm

<source> (discrete)	description
LFERf	Line FERF
PAIS	Path AIS
PFERf	Path FERF
AIS	DS1/DS3 AIS (Add/Drop/Test Option Only)
YELlow	DS1/DS3 AIS (Add/Drop/Test Option Only)
VTAIS	VT AIS (Add/Drop/Test Option Only)
VTFErf	VT FERF (Add/Drop/Test Option Only)
<threshold> (discrete)	**description**
DETected	Threshold is detected
NDETected	Threshold is not detected

if <type> = FAILure

<source> (discrete)	description
ANY	Any of the failures below
LOSignal	Loss of Signal
LOFrame	Loss of Frame
LOPointer	STS Loss of Pointer
LOPS	DS1/DS3 loss of pattern sync (Add/Drop/Test Option Only)
VTLOPointer	VT Loss of Pointer (Add/Drop/Test Option Only)
VTLOM	VT Loss of Multiframe (Add/Drop/Test Option Only)
<threshold> (discrete)	**description**
DETected	Threshold is detected
NDETected	Threshold is not detected

if <type> = ERATio, ECOUnt, or ESEConds

<source> (discrete)	description
ANY	Any of the errors below
SCV	B1 error
LCV	B2 error
PCV	B3 error
BIT	BIT error
CRC	Cyclic redundancy check (DS1 ESF only)
PARITY	Parity error (DS3 CBIT or M13 only)
VTBIP	VT BIP (Add/Drop/Test Option Only)
VTFEBe	VT far end block error (Add/Drop/Test Option Only)
<threshold> (NR3-numeric)	**description**
Any number	The test will fail for any level greater than this value

if <type> = POINter

<source> (discrete)	description
SPENdf	STS new data flag
SPEJust	STS pointer justification
VTNDf	VT new data flag (Add/Drop/Test Option Only)
VTJUst	VT pointer justification (Add/Drop/Test Option Only)
<threshold> (NR3-numeric)	**description**
Any number	The test will fail for any level greater than this value

SDH Values

<criteria number> (discrete)	description
1	First set of pass/fail criteria
2	Second set of pass/fail criteria
3	Third set of pass/fail criteria
4	Fourth set of pass/fail criteria
<type> (discrete)	**description**
NONE	No pass/fail criteria

<type> (discrete)	description
ALARm	Alarms are the pass/fail criteria
FAILure	Failures are the pass/fail criteria
ERATio	Bit error ratio is the pass/fail criterion
ECOUnt	Error count is the pass/fail criterion
ESEConds	Errored seconds are the pass/fail criteria
POINter	Pointer movements are the pass/fail criteria

if <type> = NONE

<source> (discrete)	description
NONE	No pass/fail criteria
<threshold> (discrete)	**description**
0	No threshold

if <type> = ALARm

<source> (discrete)	description
ANY	Any alarm
LAIS	MS alarm indication signal
LFERf	MS FERF
PAIS	Path AIS
PFERf	Path FERF
AIS	PDH AIS (Add/Drop/Test Option Only)
RAI	PDH RAI (Add/Drop/Test Option Only)
VTAIS	TU AIS (Add/Drop/Test Option Only)
VTFErf	TU FERF (Add/Drop/Test Option Only)
<threshold> (discrete)	**description**
DETected	Threshold is detected
NDETected	Threshold is not detected

if <type> = FAILure

<source> (discrete)	**description**
ANY	Any of the failures below
LOSignal	Loss of Signal
LOFrame	Loss of Frame
LOPointer	AU Loss of Pointer
LOPS	PDH loss of pattern sync (Add/Drop/Test Option Only)
VTLOPointer	TU Loss of Pointer (Add/Drop/Test Option Only)
VTLOM	TU Loss of Multiframe (Add/Drop/Test Option Only)
<threshold> (discrete)	**description**
DETected	Threshold is detected
NDETected	Threshold is not detected

if <type> = ERATio, ECOUnt, or ESEConds

<source> (discrete)	**description**
ANY	Any of the errors below
SCV	B1 error
LCV	B2 error
PCV	B3 error
BIT	BIT error
CRC	Cyclic redundancy check (2 Mb/s PCM30CRC or PCM31CRC only)
VTBIP	TU BIP (Add/Drop/Test Option Only)
VTFEBe	TU far end block error (Add/Drop/Test Option Only)
<threshold> (NR3-numeric)	**description**
Any number	The test will fail for any level greater than this value

if <type> = POINter

<source> (discrete)	description
SPENdf	AU new data flag
SPEJust	AU pointer justification
VTNdf	TU new data flag (Add/Drop/Test Option Only)
VTJust	TU pointer justification (Add/Drop/Test Option Only)

<threshold> (NR3-numeric)	description
Any number	The test will fail for any level greater than this value

Dependencies SENSe:DATA:TELecom:STESts:ENABle must be set to ON for this command to apply.

Errors and Events None

Examples `SENSE:DATA:TELECOM:MEASURE:STESTS:THRESHOLD 1,ALARM,ANY,DETECTED`

Related Commands SENSe:DATA:TELecom:STESts:ENABle

SENSe:DATA:TELecom:MEASure:STESts:THREshold?

This query returns the pass/fail test criteria. The pass/fail result is determined by applying the criteria given by this command after the current test is completed. You can set up a maximum of four sets of pass/fail criteria.

Syntax `SENSe:DATA:TELecom:MEASure:STESts:THREshold? <criteria number>`

SONET Values

<criteria number> (discrete)	description
1	First set of pass/fail criteria
2	Second set of pass/fail criteria
3	Third set of pass/fail criteria
4	Fourth set of pass/fail criteria

SONET Response

<type> (discrete)	description
NONE	No pass/fail criteria
ALARm	Alarms are the pass/fail criteria
FAILure	Failures are the pass/fail criteria
ERATio	Bit error ratio is the pass/fail criterion
ECOUnt	Error count is the pass/fail criterion
ESEConds	Errored seconds are the pass/fail criteria
POINter	Pointer movements are the pass/fail criteria

if <type> = NONE

<source> (discrete)	description
NONE	No pass/fail criteria
<threshold> (discrete)	**description**
0	No threshold

if <type> = ALARm

<source> (discrete)	description
ANY	Any alarm
LAIS	Line alarm indication signal
LFERf	Line FERF
PAIS	Path AIS
PFERf	Path FERF
AIS	DS1/DS3 AIS (Add/Drop/Test Option Only)
YELlow	DS1/DS3 AIS (Add/Drop/Test Option Only)
VTAIS	VT AIS (Add/Drop/Test Option Only)
VTFErf	VT FERF (Add/Drop/Test Option Only)
<threshold> (discrete)	**description**
DETected	Threshold is detected
NDETected	Threshold is not detected

if <type> = FAILure

<source> (discrete)	description
ANY	Any of the failures below
LOSignal	Loss of Signal
LOFrame	Loss of Frame
LOPointer	STS Loss of Pointer
LOPS	DS1/DS3 loss of pattern sync (Add/Drop/Test Option Only)
VTLOPointer	VT Loss of Pointer (Add/Drop/Test Option Only)
VTLOM	VT Loss of Multiframe (Add/Drop/Test Option Only)
<threshold> (discrete)	**description**
DETected	Threshold is detected
NDETected	Threshold is not detected

if <type> = ERATio, ECOUnt, or ESEConds

<source> (discrete)	description
ANY	Any of the errors below
SCV	B1 error
LCV	B2 error
PCV	B3 error
BIT	BIT error
CRC	Cyclic redundancy check (DS1 ESF only)
PARITY	Parity error (DS3 CBIT or M13 only)
VTBIP	VT BIP (Add/Drop/Test Option Only)
VTFEBe	VT far end block error (Add/Drop/Test Option Only)
<threshold> (NR3-numeric)	**description**
Any number	The test will fail for any level greater than this value

if <type> = POINter

<source> (discrete)	description
SPENdf	STS new data flag
SPEJust	STS pointer justification
VTNDf	VT new data flag (Add/Drop/Test Option Only)
VTJUst	VT pointer justification (Add/Drop/Test Option Only)
<threshold> (NR3-numeric)	**description**
Any number	The test will fail for any level greater than this value

SDH Values

<criteria number> (discrete)	description
1	First set of pass/fail criteria
2	Second set of pass/fail criteria
3	Third set of pass/fail criteria
4	Fourth set of pass/fail criteria

SDH Response

<type> (discrete)	description
NONE	No pass/fail criteria
ALARm	Alarms are the pass/fail criteria
FAILure	Failures are the pass/fail criteria
ERATio	Bit error ratio is the pass/fail criterion
ECOUnt	Error count is the pass/fail criterion
ESEConds	Errored seconds are the pass/fail criteria
POINter	Pointer movements are the pass/fail criteria

if <type> = NONE

<source> (discrete)	description
NONE	No pass/fail criteria
<threshold> (discrete)	**description**
0	No threshold

if <type> = ALARm

<source> (discrete)	description
ANY	Any alarm
LAIS	MS alarm indication signal
LFERf	MS FERF
PAIS	Path AIS
PFERf	Path FERF
AIS	PDH AIS (Add/Drop/Test Option Only)
RAI	PDH RAI (Add/Drop/Test Option Only)
VTAIS	TU AIS (Add/Drop/Test Option Only)
VTFErf	TU FERF (Add/Drop/Test Option Only)
<threshold> (discrete)	**description**
DETected	Threshold is detected
NDETected	Threshold is not detected

if <type> = FAILure

<source> (discrete)	description
ANY	Any of the failures below
LOSignal	Loss of Signal
LOFrame	Loss of Frame
LOPointer	AU Loss of Pointer
LOPS	PDH loss of pattern sync (Add/Drop/Test Option Only)
VTLOPointer	TU Loss of Pointer (Add/Drop/Test Option Only)
VTLOM	TU Loss of Multiframe (Add/Drop/Test Option Only)

if <type> = FAILure

<threshold> (discrete)	description
DETected	Threshold is detected
NDETected	Threshold is not detected

if <type> = ERATio, ECOUnt, or ESEConds

<source> (discrete)	description
ANY	Any of the errors below
SCV	B1 error
LCV	B2 error
PCV	B3 error
BIT	BIT error
CRC	Cyclic redundancy check (2 Mb/s PCM30CRC or PCM31CRC only)
VTBIP	TU BIP (Add/Drop/Test Option Only)
VTFEBe	TU far end block error (Add/Drop/Test Option Only)
<threshold> (NR3-numeric)	**description**
Any number	The test will fail for any level greater than this value

if <type> = POINter

<source> (discrete)	description
SPENdf	AU new data flag
SPEJust	AU pointer justification
VTNdf	TU new data flag (Add/Drop/Test Option Only)
VTJust	TU pointer justification (Add/Drop/Test Option Only)
<threshold> (NR3-numeric)	**description**
Any number	The test will fail for any level greater than this value

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:MEASURE:STESTS:THRESHOLD? 1`

Response: `ALARM,ANY,DETECTED`

Related Commands SENSe:DATA:TELecom:MEASure:STESts:THREshold

SENSe:DATA:TELecom:MEASure:STESts:RESUlts?

This query returns the results of applying the pass/fail criteria to the pass/fail test measurements.

Syntax `SENSe:DATA:TELecom:MEASure:STESts:RESUlts?`

SONET Response

<test results>(discrete)	description
NONE	Test is still running or no pass/fail test measurements have been requested
PASSED	Test passed
FAILED	Test failed

SDH Response

<test results>(discrete)	description
NONE	Test is still running or no pass/fail test measurements have been requested
PASSED	Test passed
FAILED	Test failed

Dependencies The test must be completed for the results to be valid.

Errors and Events 200, “Execution error; Results not available”

Examples

Query: `SENSE:DATA:TELECOM:MEASURE:STESTS:RESULTS?`

Response: `PASSED`

Related Commands

SENSe:DATA:TELecom:MEASure:STESts:THREshold

SENSe:DATA:TELecom:PAYLoad:CUSTom Subsystem

This subsystem allows you to capture a sequence of custom payloads, retrieve one of the payloads from memory, and then view the data. Figure 3–41 shows the hierarchy tree for this subsystem.

To start the capture of the payload data, send the INITiate command. To view the payload data, stop the capture manually with the ABORt command or wait until a hardware trigger stops the capture. Then, use the SENSe:DATA:TELecom: PAYLoad:CUSTom queries to view the data.

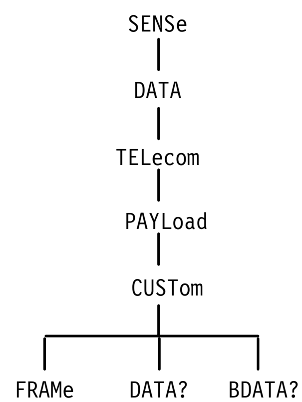


Figure 3–41: SENSe:DATA:TELecom:PAYLoad:CUSTom subsystem

Figures 3–42 and 3–43 show the layout of SONET STS-1 and STS-3c and SDH custom payloads. SONET allows a maximum of 64 frames; SDH allows a maximum of 54 frames.

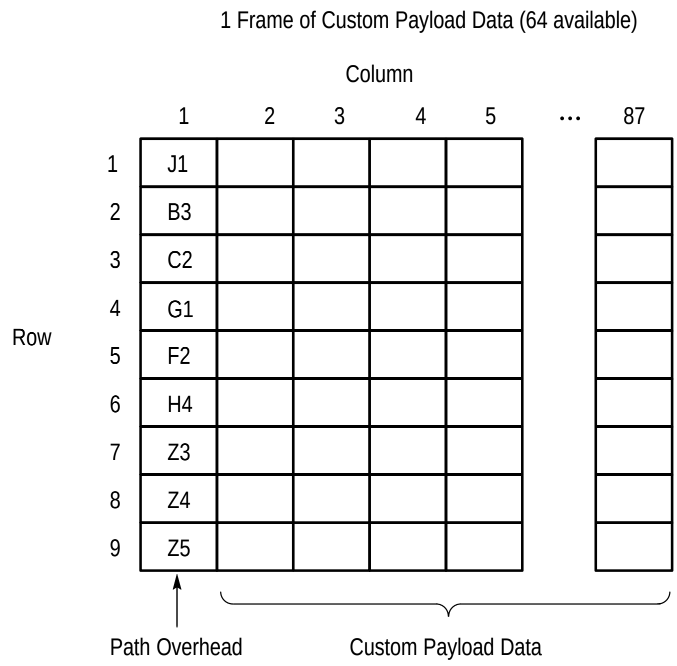


Figure 3–42: SONET STS-1 custom payload

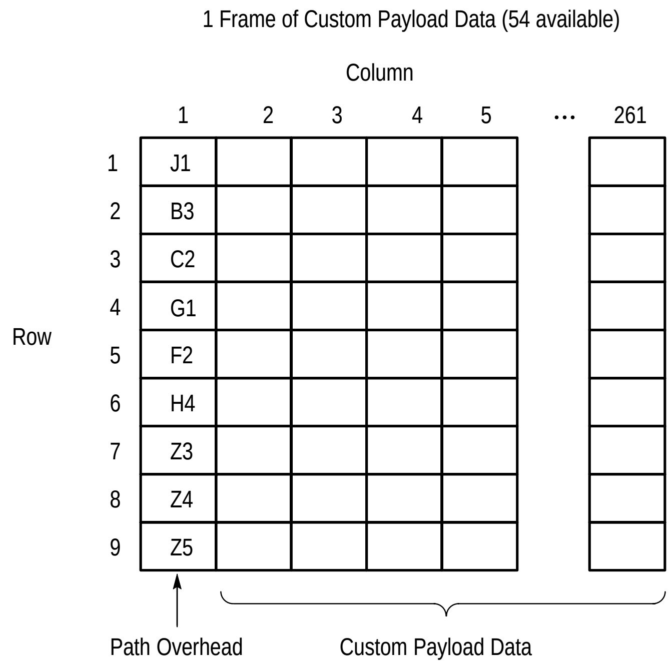


Figure 3–43: SONET STS-3c and SDH custom payload

SENSe:DATA:TELecom:PAYLoad:CUSTom:FRAMe

This command selects a custom payload frame to view.

Syntax `SENSe:DATA:TELecom:PAYload:CUSTom:FRAMe <custom frame>`

SONET Values

<custom frame> (NR1-numeric)	description
Any integer from 1 through 64	For STS-1 structure (default = 1)
2	Corresponds to the BEGIN trigger point
32	Corresponds to the MIDDLE trigger point
63	Corresponds to the END trigger point
Any integer from 1 through 54	For STS-3c structure (default = 1)
2	Corresponds to the BEGIN trigger point
27	Corresponds to the MIDDLE trigger point
53	Corresponds to the END trigger point

SDH Values

<custom frame> (NR1-numeric)	description
Any integer from 1 through 54	Any SDH structure (default = 1)
2	Corresponds to the BEGIN trigger point
27	Corresponds to the MIDDLE trigger point
53	Corresponds to the END trigger point

Dependencies None

Errors and Events None

Examples `SENSE:DATA:TELECOM:PAYLOAD:CUSTOM:FRAME 2`

Related Commands None

SENSe:DATA:TELecom:PAYLoad:CUSTom:FRAMe?

This query returns the custom payload frame number that is currently selected to view.

Syntax `SENSe:DATA:TELecom:PAYload:CUSTom:FRAMe?`

SONET Response

<custom frame> (NR1-numeric)	description
Any integer from 1 through 64	For STS-1 structure (default = 1)
2	Corresponds to the BEGIN trigger point
32	Corresponds to the MIDDLE trigger point
63	Corresponds to the END trigger point
Any integer from 1 through 54	For STS-3c structure (default = 1)
2	Corresponds to the BEGIN trigger point
27	Corresponds to the MIDDLE trigger point
53	Corresponds to the END trigger point

SDH Response

<custom frame> (NR1-numeric)	description
Any integer from 1 through 54	Any SDH structure (default = 1)
2	Corresponds to the BEGIN trigger point
27	Corresponds to the MIDDLE trigger point
53	Corresponds to the END trigger point

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:PAYLOAD:CUSTOM:FRAME?`

Response: 1

Related Commands SENSe:DATA:TELecom:PAYLoad:CUSTom:FRAMe

SENSe:DATA:TELecom:PAYLoad:CUSTom:DATA?

This query returns the value of the specified byte in the selected custom payload. Figures 3–42 on page 3–284 and 3–43 on page 3–284 show the layout of the custom payload. The custom data cannot be read while the capture mechanism is running and waiting for a trigger.

Syntax

```
SENSe:DATA:TELecom:PAYload:CUSTom:DATA? <custom row>,
<custom column>
```

SONET Values

<custom row> (NR1-numeric)	description
Any integer from 1 through 9	Row of payload (default = 1)
<custom column> (NR1-numeric)	**description**
Any integer from 1 through 87	Column of payload; STS-1 structure (default = 1)
Any integer from 1 through 261	Column of payload; STS-3c structure (default = 1)

SONET Response

<byte value> (NR1-numeric)	description
Any integer from 0 through 255	Byte value (default = 0)

SDH Values

<custom row> (NR1-numeric)	description
Any integer from 1 through 9	Row of payload (default = 1)
<custom column> (NR1-numeric)	**description**
Any integer from 1 through 261	Column of payload; any SDH structure (default = 1)

SDH Response

<byte value> (NR1-numeric)	description
Any integer from 0 through 255	Byte value (default = 0)

Dependencies Use the SENSe:DATA:TELecom:PAYLoad:CUSTom:FRAMe command to set the frame number.

Errors and Events 200, “Execution error; Waiting for trigger, cannot read captured data”

Examples Query: `SENSE:DATA:TELECOM:PAYLOAD:CUSTOM:DATA? 3,3`

Response: `32`

Related Commands SENSe:DATA:TELecom:PAYLoad:CUSTom:FRAMe
INITiate
TRIGger:IMMediate

SENSe:DATA:TELecom:PAYLoad:CUSTom:BDATA?

This query returns the data contents of the selected custom payload. The custom data cannot be read while the capture mechanism is running and waiting for a trigger.

Syntax `SENSe:DATA:TELecom:PAYload:CUSTom:BDATA?`

SONET Response

<custom frame data> (binary block)	description
#3783xxxxxx . . . where xxxxxx is the binary representation of the data bytes	Values for 783 data bytes (STS-1 structure)
#42349xxxxxx . . . where xxxxxx is the binary representation of the data bytes	Values for 2349 data bytes (STS-3c structure)

SDH Response

<custom frame data> (binary block)	description
#42349xxxxxx . . . where xxxxxx is the binary representation of the data bytes	Values for 2349 data bytes (any SDH structure)

Dependencies

Use the SENSe:DATA:TELecom:PAYLoad:CUSTom:FRAMe command to set the frame number.

Errors and Events

200, “Execution error; Waiting for trigger, cannot read captured data”

Examples

Query: `SENSE:DATA:TELECOM:PAYLOAD:CUSTOM:BDATA?`

Response: `#3783 . . .` (SONET)

Response: `#42349 . . .` (SDH)

Related Commands

SENSe:DATA:TELecom:PAYLoad:CUSTom:FRAMe
INITiate
TRIGger:IMMediate

SENSe:DATA:TELecom:AUTOscan Subsystem

This section describes the command that automatically configures the receiver to the attached signal on any of the input connectors. Figure 3–44 shows the hierarchy tree for this subsystem.

```
  SENSe
    |
   DATA
    |
 TELecom
    |
 AUTOscan
```

Figure 3–44: SENSe:DATA:TELecom:AUTOscan subsystem

SENSe:DATA:TELecom:AUTOscan

This command starts the autoscan function which sets up the receiver based on the connected signal. The Operation Complete bit is set when this command has completed. Use the SYSTem:ERRor? query to see if the autoscan completed successfully.

Syntax `SENSe:DATA:TELecom:AUTOscan`

SONET Values None

SDH Values None

Dependencies A valid signal should be connected.

Errors and Events
361, “Autoscan failed; Instrument returned to previous setup”
361, “Autoscan failed; Autoscan already in progress”
402, “Operation complete; Autoscan complete”
200, “Execution error; Autoscan incomplete — no signals connected”

Examples `SENSE:DATA:TELECOM:AUTOSCAN`

Related Commands SYSTem:ERRor?

SENSe:DATA:TELecom:TRIButary Subsystem

Add/Drop/Test Option Only

This section describes the commands and queries that allow you to view a dropped tributary signal. Figure 3–44 shows the hierarchy tree for this subsystem.

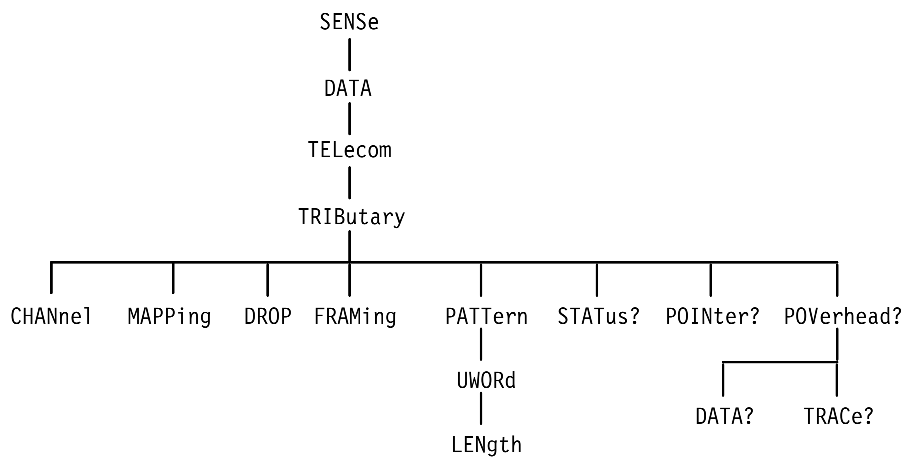


Figure 3–45: SENSe:DATA:TELecom:TRIButary subsystem

SENSe:DATA:TELecom:TRIButary:DROP

Add/Drop/Test Option Only

This command enables the tributary drop capability. If enabled, the demapped signal is available on the output connector specified by mapping.

Syntax SENSe:DATA:TELecom:TRIButary:DROP <trib drop>

SONET Values

<trib drop> (boolean)	description
OFF or 0	Tributary signal not available on output connector (default)
ON or 1	Tributary signal available on output connector

SDH Values

<trib drop> (boolean)	description
OFF or 0	Tributary signal not available on output connector (default)
ON or 1	Tributary signal available on output connector

Dependencies

SENSe:DATA:TELecom:SOURce must be set to INPUT1.
SENSe:DATA:TELecom:MAPPing must be set to TRIButary.

Errors and Events

221, “Settings conflict; Instrument unable to drop signal while transmitting current rate”
221, “Settings conflict; Instrument unable to drop while transmitter not externally adding 140Mb”

Examples

`SENSE:DATA:TELECOM:TRIBUTARY:DROP ON`

Related Commands

SOURce:DATA:TELecom:SOURce
SENSe:DATA:TELecom:SOURce
SENSe:DATA:TELecom:MAPPing

SENSe:DATA:TELecom:TRIButary:DROP?

Add/Drop/Test Option Only

This query returns the tributary drop status.

Syntax

`SENSe:DATA:TELecom:TRIButary:DROP?`

SONET Response

<trib drop> (boolean)	description
0	Tributary signal not available on output connector (default)
1	Tributary signal available on output connector

SDH Response

<trib drop> (boolean)	description
0	Tributary signal not available on output connector (default)
1	Tributary signal available on output connector

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:TRIBUTARY:DROP?`

Response: 1

Related Commands SENSe:DATA:TELecom:TRIButary:DROP

SENSe:DATA:TELecom:TRIButary:CHANnel

Add/Drop/Test Option Only

This command selects the VTASYNC/TUASYNC channel. Use the SENSe:DATA:TELecom:TRIButary:MAPPing command to set the tributary demapping.

Syntax `SENSe:DATA:TELecom:TRIButary:CHANnel <trib channel>`

SONET Values

<trib channel> (NR1-numeric)	description
Any integer between 1 and 28	VTASYNC mapping for the active channel (default = 1)
1	DS3 mapping for the active channel

SDH Values

<trib channel> (NR1-numeric)	description
Any integer between 1 and 63	TUASYNC mapping for the active channel (default = 1)
Any integer between 1 and 3	TU3 mapping for the active channel
1	M140 mapping for the active channel

Dependencies None

Errors and Events None

Examples `SENSE:DATA:TELECOM:TRIBUTARY:CHANNEL 1`

Related Commands SENSe:DATA:TELecom:TRIButary:MAPPing

SENSe:DATA:TELecom:TRIButary:CHANnel?

Add/Drop/Test Option Only

This returns the current tributary channel.

Syntax `SENSe:DATA:TELecom:TRIButary:CHANnel?`

SONET Response

<trib channel> (NR1-numeric)	description
Any integer between 1 and 28	VTASYNC mapping for the active channel (default = 1)
1	DS3 mapping for the active channel

SDH Response

<trib channel> (NR1-numeric)	description
Any integer between 1 and 63	TUASYNC mapping for the active channel (default = 1)
Any integer between 1 and 3	TU3 mapping for the active channel
1	M140 mapping for the active channel

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:TRIBUTARY:CHANNEL?`

Response: 1

Related Commands SENSe:DATA:TELecom:TRIButary:CHANnel

SENSe:DATA:TELecom:TRIButary:MAPPing

Add/Drop/Test Option Only

This command selects the tributary payload demapping. When you are actively mapping and demapping a tributary signal, the SOURce:DATA:TELecom:TRIButary:MAPPing and SENSe:DATA:TELecom:TRIButary:MAPPing functions are coupled; a change to one causes the same change to the other.

Syntax `SENSe:DATA:TELecom:TRIButary:MAPPing <trib mapping>`

SONET Values

<trib mapping> (discrete)	description
VTASYNC	Demapped DS1 signal into a VTASYNC (default)
DS3	Demapped DS3 signal

SDH Values

<trib mapping> (discrete)	description
TUASYNC	Demapped 2 Mb/s signal into TU-12 floating async (default)
TU3	Demapped 34 Mb/s signal
M140	Demapped 140 Mb/s signal

Dependencies None

Errors and Events None

Examples `SENSE:DATA:TELECOM:TRIBUTARY:MAPPING VTASYNC`

Related Commands SOURce:DATA:TELecom:TRIButary:MAPPing

SENSe:DATA:TELecom:TRIButary:MAPPing?

Add/Drop/Test Option Only

This query returns the current tributary payload demapping.

Syntax `SENSe:DATA:TELecom:TRIButary:MAPPing?`

SONET Response

<trib mapping> (discrete)	description
VTASYNC	Demapped DS1 signal into a VTASYNC (default)
DS3	Demapped DS3 signal

SDH Response

<trib mapping> (discrete)	description
TUASYNC	Demapped 2 Mb/s signal into TU-12 floating async (default)
TU3	Demapped 34 Mb/s signal
M140	Demapped 140 Mb/s signal

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:TRIBUTARY:MAPPING?`

Related Commands SENSe:DATA:TELecom:TRIButary:MAPPing

SENSe:DATA:TELecom:TRIButary:FRAMing

Add/Drop/Test Option Only

This command selects the framing of the received tributary signal.

Syntax

```
SENSe:DATA:TELecom:TRIButary:FRAMing <trib framing>
```

SONET Values

<trib framing> (discrete)	description
UNFRamed	No framing (default)
SF	DS1 superframe
ESF	DS1 extended superframe
CBIT	DS3 C–bit format
M13	DS3 M13 format

SDH Values

<trib framing> (discrete)	description
UNFRamed	No framing (default)
PCM30	2 Mb/s, PCM, 30 channels, no CRC checking
PCM31	2 Mb/s, PCM, 31 channels, no CRC checking
PCM30CRC	2 Mb/s, PCM, 30 channels, with CRC checking
PCM31CRC	2 Mb/s, PCM 31 channels, with CRC checking
FRAMed	34 Mb/s or 140 Mb/s framing

Dependencies None

Errors and Events None

Examples

```
SENSE:DATA:TELECOM:TRIBUTARY:FRAMING UNFRAMED
```

Related Commands None

SENSe:DATA:TELecom:TRIButary:FRAMing?

Add/Drop/Test Option Only

This query returns the current framing option of the received tributary signal.

Syntax `SENSe:DATA:TELecom:TRIButary:FRAMing?`

SONET Response

<trib framing> (discrete)	description
UNFRamed	No framing (default)
SF	DS1 superframe
ESF	DS1 extended superframe
CBIT	DS3 C–bit format
M13	DS3 M13 format

SDH Response

<trib framing> (discrete)	description
UNFRamed	No framing (default)
PCM30	2 Mb/s, PCM, 30 channels, no CRC checking
PCM31	2 Mb/s, PCM, 31 channels, no CRC checking
PCM30CRC	2 Mb/s, PCM, 30 channels, with CRC checking
PCM31CRC	2 Mb/s, PCM 31 channels, with CRC checking
FRAMed	34 Mb/s or 140 Mb/s framing

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:TRIBUTARY:FRAMING?`

Response: `UNFRAMED`

Related Commands SENSe:DATA:TELecom:TRIButary:FRAMing

SENSe:DATA:TELecom:TRIButary:PATTern

Add/Drop/Test Option Only

This command selects the internally generated pattern that is placed in the tributary payload.

Syntax

```
SENSe:DATA:TELecom:TRIButary:PATTern <trib pattern>
```

SONET Values

<trib pattern> (discrete)	description
PRBS23	A pseudo-random binary sequence of length 2^{23}–1 is placed in the tributary payload (default)
QRSS	Quasi-random signal source pattern; DS1 rate only
PRBS15	A pseudo-random binary sequence of length 2^{15}–1 is placed in the tributary payload
PRBS20	A pseudo-random binary sequence of length 2^{20}–1 is placed in the tributary payload
AZEROs	All zeros are placed in the payload
AONEs	All ones are placed in the payload
UWORd	A user-defined pattern is placed in the payload
UNKNown	Unknown pattern
FIXED_1_8	1 bit in 8 (DS1, Add/Drop/Test Option Only)
FIXED_3_24	3 bits in 24 (DS1, Add/Drop/Test Option Only)

SDH Values

<trib pattern> (discrete)	description
PRBS23	A pseudo-random binary sequence of length 2^{23}–1 is placed in the tributary payload (default)
PRBS15	A pseudo-random binary sequence of length 2^{15}–1 is placed in the tributary payload
PRBS20	A pseudo-random binary sequence of length 2^{20}–1 is placed in the tributary payload
AZEROs	All zeros are placed in the payload
AONEs	All ones are placed in the payload
UWORd	A user-defined pattern is placed in the payload
UNKNown	Unknown pattern
FIXED_1_8	1 bit in 8 (Add/Drop/Test Option Only)

Dependencies None

Errors and Events None

Examples `SENSE:DATA:TELECOM:TRIBUTARY:PATTERN PRBS15`

Related Commands None

SENSe:DATA:TELecom:TRIButary:PATTern?

Add/Drop/Test Option Only

This query returns the current internally generated tributary payload pattern.

Syntax `SENSe:DATA:TELecom:TRIButary:PATTern?`

SONET Response

<trib pattern> (discrete)	description
PRBS23	A pseudo-random binary sequence of length $2^{23}–1$ is placed in the tributary payload (default)
QRSS	Quasi-random signal source pattern; DS1 rate only
PRBS15	A pseudo-random binary sequence of length $2^{15}–1$ is placed in the tributary payload
PRBS20	A pseudo-random binary sequence of length $2^{20}–1$ is placed in the tributary payload
AZEROs	All zeros are placed in the payload
AONEs	All ones are placed in the payload
UWORd	A user-defined pattern is placed in the payload
UNKNown	Unknown pattern
FIXED_1_8	1 bit in 8 (DS1, Add/Drop/Test Option Only)
FIXED_3_24	3 bits in 24 (DS1, Add/Drop/Test Option Only)

SDH Response

<trib pattern> (discrete)	description
PRBS23	A pseudo-random binary sequence of length $2^{23}–1$ is placed in the tributary payload (default)
PRBS15	A pseudo-random binary sequence of length $2^{15}–1$ is placed in the tributary payload
PRBS20	A pseudo-random binary sequence of length $2^{20}–1$ is placed in the tributary payload
AZEROs	All zeros are placed in the payload
AONEs	All ones are placed in the payload
UWORd	A user-defined pattern is placed in the payload
UNKNown	Unknown pattern
FIXED_1_8	1 bit in 8 (Add/Drop/Test Option Only)

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:TRIBUTARY:PATTERN?`

Response: `AONES`

Related Commands SENSe:DATA:TELecom:TRIButary:PATTern

SENSe:DATA:TELecom:TRIButary:PATTern:UWORd

Add/Drop/Test Option Only

This command sets the user-defined pattern that is placed in the tributary payload.

Syntax

```
SENSe:DATA:TELecom:TRIButary:PATTern:UWORd <trib user pattern>
```

SONET Values

<trib user pattern> (hexadecimal)	description
Any 8, 16, or 24 bit hexadecimal number in the range #H00 to #HFFFFFF	Repeating pattern is placed in the tributary payload (default = #H00)

SDH Values

<trib user pattern> (hexadecimal)	description
Any 8, 16, or 24 bit hexadecimal number in the range #H00 to #HFFFFFF	Repeating pattern is placed in the tributary payload (default = #H00)

Dependencies

SENSe:DATA:TELecom:TRIButary:PATTern must be set to UWORd for this command to apply. Use the SENSe:DATA:TELecom:TRIButary:PATTern:UWORd:LENgth command to set the length of the repeating pattern.

Errors and Events

None

Examples

```
SENSE:DATA:TELECOM:TRIBUTARY:PATTERN:UWORD #HAA5500
```

Related Commands

SENSe:DATA:TELecom:TRIButary:PATTern
SENSe:DATA:TELecom:TRIButary:PATTern:UWORd:LENgth

SENSe:DATA:TELecom:TRIButary:PATTern:UWORd?

Add/Drop/Test Option Only

This query returns the user-defined pattern that is placed in the tributary payload.

Syntax

`SENSe:DATA:TELecom:TRIButary:PATTern:UWORd?`

SONET Response

<trib user pattern> (hexadecimal)	description
Any 8, 16, or 24 bit hexadecimal number in the range #H00 to #HFFFFFF	Repeating pattern is placed in the tributary payload (default = #H00)

SDH Response

<trib user pattern> (hexadecimal)	description
Any 8, 16, or 24 bit hexadecimal number in the range #H00 to #HFFFFFF	Repeating pattern is placed in the tributary payload (default = #H00)

Dependencies

SENSe:DATA:TELecom:TRIButary:PATTern must be set to UWORd for this query to apply.

Errors and Events

None

Examples

Query: `SENSE:DATA:TELECOM:TRIBUTARY:PATTERN:UWORD?`

Response: `#HAA5500`

Related Commands

SENSe:DATA:TELecom:TRIButary:PATTern:UWORd

SENSe:DATA:TELecom:TRIButary:PATTern:UWORd:LENgth

Add/Drop/Test Option Only

This command sets the number of bytes of the user-defined pattern that are repeated in the tributary payload.

Syntax

```
SENSe:DATA:TELecom:TRIButary:PATTern:UWORd:LENgth <trib user
pattern length>
```

SONET Values

<trib user pattern length> (NR1-numeric)	description
Any integer in the range 1 to 3	Number of bytes of user-defined pattern that are repeated in the tributary payload (default = 1)

SDH Values

<trib user pattern length> (NR1-numeric)	description
Any integer in the range 1 to 3	Number of bytes of user-defined pattern that are repeated in the tributary payload (default = 1)

Dependencies

SENSe:DATA:TELecom:TRIButary:PATTern must be set to UWORd for this command to apply. Use the SENSe:DATA:TELecom:TRIButary:PATTern:UWORd command to set the repeating pattern.

Errors and Events

None

Examples

```
SENSE:DATA:TELECOM:TRIBUTARY:PATTERN:UWORD:LENGTH 3
```

Related Commands

SENSe:DATA:TELecom:TRIButary:PATTern
SENSe:DATA:TELecom:TRIButary:PATTern:UWORd

SENSe:DATA:TELecom:TRIButary:PATTern:UWORd:LENgth?

Add/Drop/Test Option Only

This query returns the number of bytes of the user-defined pattern that are repeated in the tributary payload.

Syntax `SENSe:DATA:TELecom:TRIButary:PATTern:UWORd:LENgth?`

SONET Response

<trib user pattern length> (NR1-numeric)	description
Any integer in the range 1 to 3	Number of bytes of user-defined pattern that are repeated in the tributary payload (default = 1)

SDH Response

<trib user pattern length> (NR1-numeric)	description
Any integer in the range 1 to 3	Number of bytes of user-defined pattern that are repeated in the tributary payload (default = 1)

Dependencies SENSe:DATA:TELecom:TRIButary:PATTern must be set to UWORd for this query to apply.

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:TRIBUTARY:PATTERN:UWORD:LENGTH?`

Response: 3

Related Commands SENSe:DATA:TELecom:TRIButary:PATTern:UWORd:LENgth

SENSe:DATA:TELecom:TRIButary:POINter?

Add/Drop/Test Option Only

This query returns the current tributary pointer value.

Syntax

`SENSe:DATA:TELecom:TRIButary:POINter?`

SONET Response

<trib pointer> (NR1-numeric)	description
Any integer in the range 0 to 1023	Tributary pointer value for VTASYNC mapping (default = 78, illegal > 103)

SDH Response

<trib pointer> (NR1-numeric)	description
Any integer in the range 0 to 1023	Tributary pointer value for TUASYNC mapping (default = 105, illegal > 139) Tributary pointer value for TU3 mapping (default = 595, illegal > 764)

Dependencies None

Errors and Events None

Examples

Query: `SENSE:DATA:TELECOM:TRIBUTARY:POINTER?`

Response: `12`

Related Commands None

SENSe:DATA:TELecom:TRIButary:STATus?

Add/Drop/Test Option Only

This query returns the status of the received tributary signal. The returned status is not an accumulated status; the response reflects only the status of the tributary signal at the time the query is sent.

Syntax

```
SENSe:DATA:TELecom:TRIButary:STATus?
```

SONET Response

<decimal value> (NR1-numeric)	bit	definition
1	0	INPUT2/INPUT3 LOS
2	1	INPUT2/INPUT3 LOF
4	2	Unused
8	3	Unused
16	4	VT LOP
32	5	VT AIS
64	6	DS1/DS3 AIS
128	7	DS1/DS3 Yellow
256	8	Frame error
512	9	DS1/DS3 error
1024	10	VT FERF
2048	11	VT pointer adjustment
4096	12	VT NDF
8192	13	Pattern lock
16384	14	DS3 idle
32768	15	VT LOM

SDH Response

<decimal value> (NR1-numeric)	bit	definition
1	0	INPUT2/INPUT3 LOS
2	1	INPUT2/INPUT3 LOF
4	2	Unused
8	3	Unused
16	4	TU LOP

<decimal value> (NR1-numeric)	bit	definition
32	5	TU AIS
64	6	2 Mb/s, 34 Mb/s, 140 Mb/s AIS
128	7	2 Mb/s, 34 Mb/s, 140 Mb/s RAI
256	8	Frame error
512	9	2 Mb/s, 34 Mb/s, 140 Mb/s error
1024	10	TU FERF
2048	11	TU pointer adjustment
4096	12	TU NDF
8192	13	Pattern lock
16384	14	Not used
32768	15	TU LOM

Dependencies None

Errors and Events None

Examples Query: `SENSE:DATA:TELECOM:TRIBUTARY:STATUS?`

Response: `32`

Related Commands SENSe:DATA:TELecom:TRIButary:STATus

SENSe:DATA:TELecom:TRIButary:POVerhead:DATA?

SDH Add/Drop/Test Option

This query returns the value in the specified VT1.5, TU3, or TU12 path overhead byte.

Syntax

```
SENSe:DATA:TELecom:TRIButary:POVerhead:DATA? <byte name>
```

SONET Values

<byte> (discrete)	description
B3	Parity (VT1.5)
C2	Signal Label (VT1.5)
G1	Path Status (VT1.5)
F2	User Channel (VT1.5)
H4	Indicator (VT1.5)
Z3	Growth (VT1.5)
Z4	Growth (VT1.5)
Z5	Network Operator TCM (VT1.5)
V5	Signal Label (VT1.5)

SONET Response

<value> (NR1-numeric)	description
Any integer in the range 0 to 255	The selected byte is set to this value

SDH Values

<byte> (discrete)	description
B3	Parity (TU3)
C2	Signal Label (TU3)
G1	Path Status (TU3)
F2	User Channel (TU3)
H4	Indicator (TU3)
F3	Growth Byte (TU3)
K3	APS (TU3)
K4	(TU12)

(continued on next page)

<byte> (discrete)	description
N1	Network Operator TCM (TU3)
N2	(TU12)
V5	Signal Label (TU12)

SDH Response

<value> (NR1-numeric)	description
Any integer in the range 0 to 255	The selected byte is set to this value

Dependencies

Use the SENSe:DATA:TELecom:TRIButary:CHANNel command to specify which path trace to query. INITiate and TRIGGer:IMMediate affect these bytes.

Examples

Query: `SENSE:DATA:TELECOM:TRIBUTARY:POVERHEAD:DATA? V5`

Response: `123`

Related Commands

INITiate
TRIGger:IMMediate

SENSe:DATA:TELecom:TRIButary:POVerhead:TRACe?

SDH Add/Drop/Test Option

This query returns the current tributary path trace string that repeats in the J1 byte, for TU3 mapping, and the J2 byte, for TU12 mapping, as a 16 character repeating sequence. The response is created in the following way: the first character after a null is read as the first byte and is followed by 15 J1/J2 bytes from consecutive frames.

Syntax

`SENSe:DATA:TELecom:TRIButary:POVerhead:TRACe?`

SDH Response

<path trace> (string)	description
A 16 character string	The current tributary path trace string

Dependencies

The SENSe:DATA:TELecom:CHANNel command specifies which path trace to query.

Examples

Query: `SENSE:DATA:TELECOM:TRIBUTARY:POVERHEAD:TRACE?`

Response: `"TEK VX4610"`

Related Commands

SENSe:DATA:TELecom:TRIButary:POVerhead:DATA?
INITiate
TRIGger:IMMediate

SENSe:DATA:TELecom:MEASure:TRIButary Subsystem

Add/Drop/Test Option Only

This section describes the commands and queries that access tributary error, alarm, failure, and pointer measurements for current and previous tests. Figures 3–46, 3–47, 3–48, 3–49, 3–50, and 3–51 show the hierarchy trees for this subsystem.

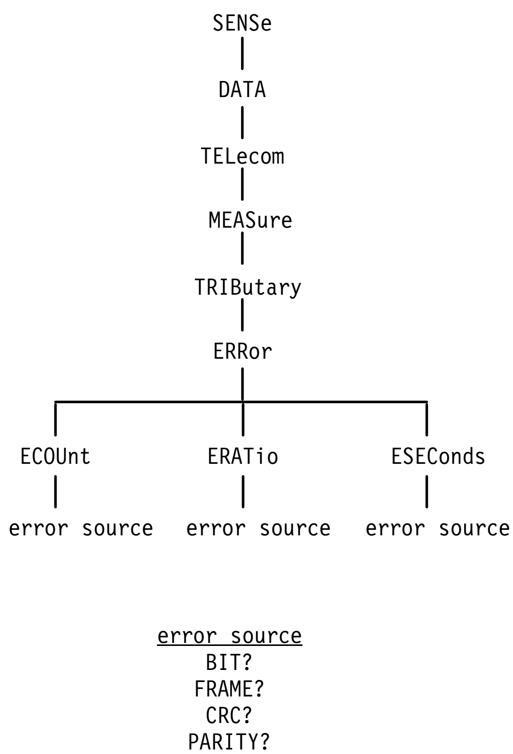


Figure 3–46: SENSe:DATA:TELecom:MEASure:TRIButary:ERRor subsystem (DS1/DS3)

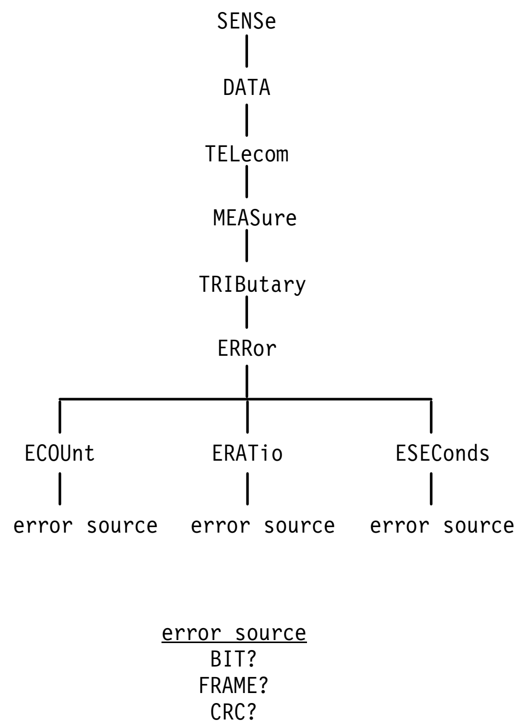


Figure 3–47: SENSe:DATA:TELecom:MEASure:TRIButary:ERRor subsystem (PDH)

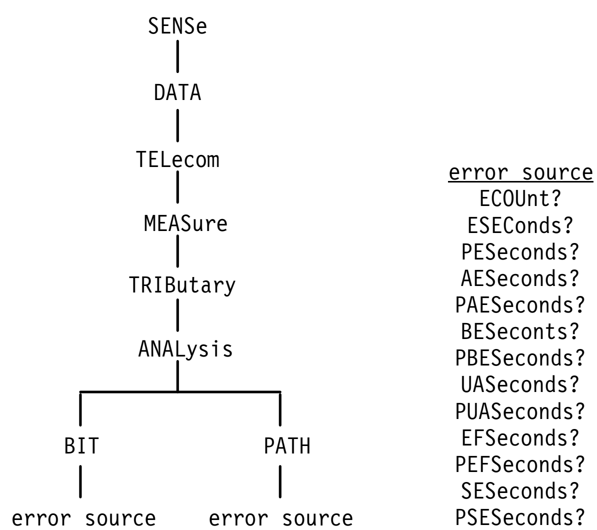


Figure 3–48: SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis subsystem (DS1/DS3)

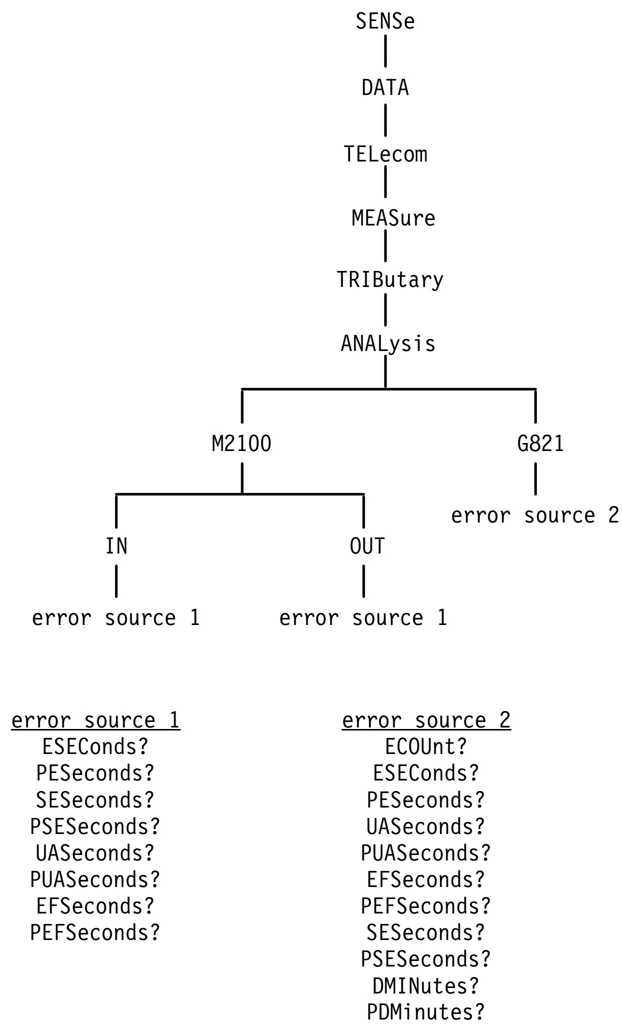


Figure 3–49: SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis subsystem (PDH)

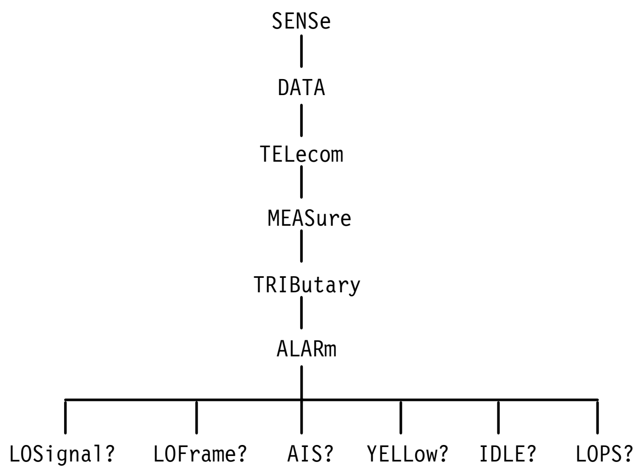


Figure 3–50: SENSe:DATA:TELecom:MEASure:TRIButary:ALARm subsystems (DS1/DS3)

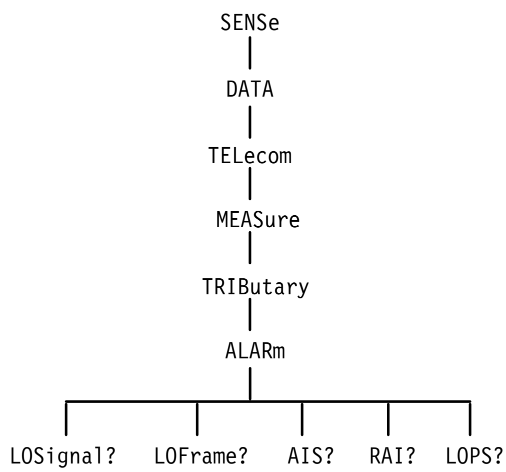


Figure 3–51: SENSe:DATA:TELecom:MEASure:TRIButary:ALARm subsystems (PDH)

A variety of tributary error, alarm, and failure measurements are reported through this subsystem. Table 3–35 shows how error, alarm, and failure measurements are calculated. Tables 3–36, 3–37, and 3–38 show how the analysis measurements are calculated. These calculations are based on T1M1.93 and ITU-T G.821 specifications.

Table 3–35: How error and alarm measurements are calculated

Type of measurement	Method of calculation
Error count	Number of bit errors that were errored in the signal
Bit Error Ratio (BER)	Ratio of error count to the total number of received bits
Errored seconds	Number of seconds that had any error counts
Alarms	Number of one-second intervals that contained a specific alarm such as Loss of Signal (LOS) and Loss of Frame (LOF)

Table 3–36: How analysis measurements are calculated

Type of measurement	Method of calculation
Error count	Number of bit errors not occurring during periods of unavailability (see Unavailable seconds)
Errored seconds	Total number of seconds that had any error count; does not include any period of unavailability (see Unavailable seconds)
Type A errored seconds	Number of seconds that had exactly one error count
Type B errored seconds	Number of seconds that had more than one error count and less than N errors (see Tables 3–37 and 3–38)
Degraded minutes	Number of minutes that had a bit error ratio (BER) in the range $1x10^{-6}$ to $1x10^{-3}$; degraded minutes do not accumulate during periods of unavailability
Severely errored seconds	Number of seconds with more than N errors (see Tables 3–37 and 3–38)
Unavailable seconds	Number of seconds that the signal had too many errors to be available for use; unavailability starts at the onset of ten contiguous severely errored seconds
Error free seconds	Number of seconds that contained zero errors

Table 3–37: Value of N for analysis measurements (DS1/DS3)

Tributary rate	Framing	Type of error	N
DS1	SF (superframe)	Frame error	8
	ESF (extended superframe)	CRC	320
DS3	M13	Parity (P-bit parity)	45
	CBIT	Parity (C-bit parity)	45

Table 3–38: Value of N for analysis measurements (PDH)

Tributary rate	Type of error	N
2 Mb/s	Bit error	> 1E–3
	Frame error	28
	CRC error	830
34 Mb/s	Bit error	> 1E–3
	Frame error	223
140 Mb/s	Bit error	> 1E–3
	Frame error	568

Some of queries in this section have their information presented in a way that is different from queries in the rest of the manual. The syntax and examples are in table format. Figure 3–52 shows you how to read the Syntax Tables in this section. Follow the step numbers to create any query. Table 3–39 explains the terms used in the SENSe:DATA:TELecom:MEASure Syntax Tables.

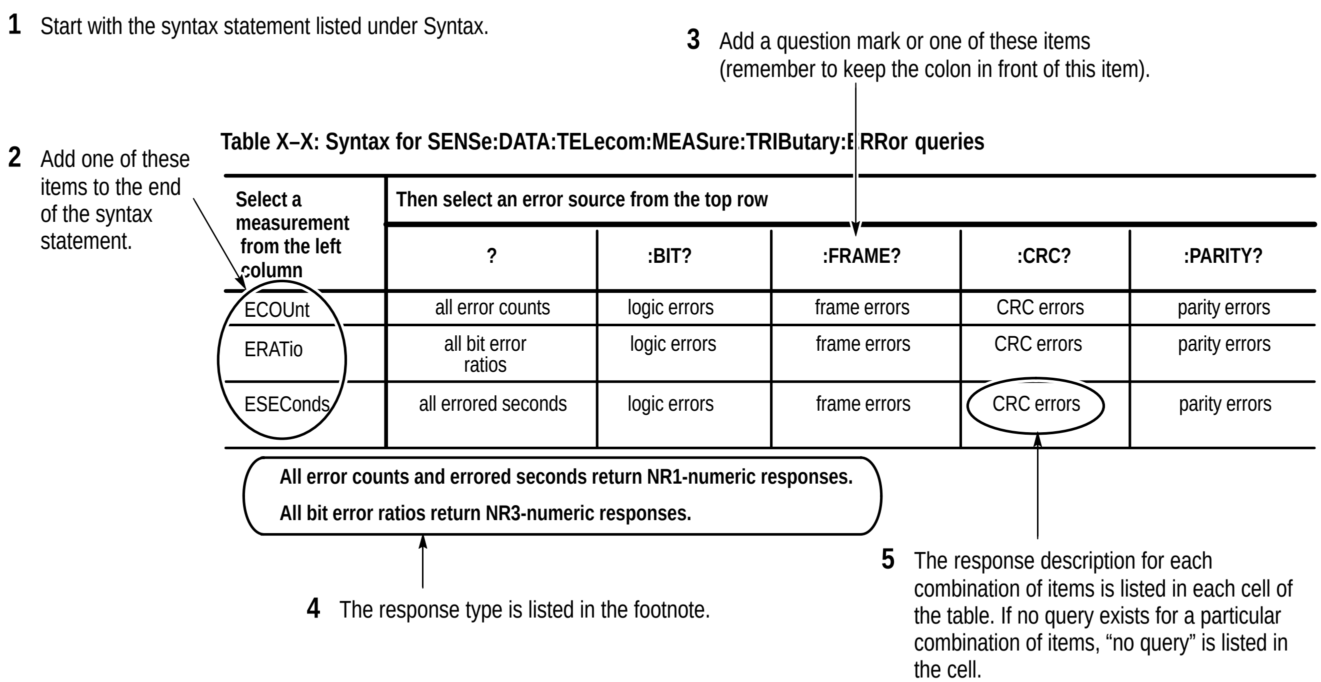


Figure 3–52: How to read the syntax tables in the SENSe:DATA:TELecom:MEASure:TRIButary subsystem section

Table 3–39: Terms used in the SENSe:DATA:TELecom:MEASure:TRIButary queries

Term	Meaning
BIT	Pattern bit error
FRAME	Frame bit error
CRC	CRC error
PARITY	Parity error

Figure 3–53 shows you how to read the Example Tables in this section.

Table X–X: Example Table for SENSe:DATA:TELecom:MEASure:TRIButary:ERRor:queries

Query	Response
`SENSE:DATA:TELECOM:MEASURE:TRIBUTARY:ERROR:ECOUNT:BIT?`	`714`
`SENSE:DATA:TELECOM:MEASURE:TRIBUTARY:ERROR:ERATIO:FRAME?`	`1.0E–8`
`SENSE:DATA:TELECOM:MEASURE:TRIBUTARY:ERROR:ESECONDS:CRC?`	`3`

Selected examples of queries are shown in the left column

A typical response is shown in the right column for each example

Figure 3–53: How to read the example tables in the SENSe:DATA:TELecom:MEASure:TRIButary subsystem section

SENSe:DATA:TELecom:MEASure:TRIButary:ERRor Queries

Add/Drop/Test Option Only

These queries return tributary error measurements. When you use the high-level queries (for example, SENSe:DATA:TELecom:MEASure:TRIButary:ERRor? or SENSe:DATA:TELecom:MEASure:TRIButary:ERRor:ECOUnt?), it is helpful to turn the headers on (SYSTem:HEADers ON) so you can identify each response value in the response string.

Syntax `SENSe:DATA:TELecom:MEASure:TRIButary:ERRor?`

`SENSe:DATA:TELecom:MEASure:TRIButary:ERRor:[measurement]:[error source]` (see Tables 3–40 and 3–41 to complete the query)

Table 3–40: Syntax for SENSe:DATA:TELecom:MEASure:TRIButary:ERRor queries (DS1/DS3)

Select a measurement from the left column	Then select an error source from the top row				
	?	:BIT?	:FRAME?[1]	:CRC?[2]	:PARITY?[3]
ECOUnt	all error counts	logic errors	frame errors	CRC errors	parity errors
ERATio	all bit error ratios	logic errors	frame errors	CRC errors	parity errors
ESEConds	all errored seconds	logic errors	frame errors	CRC errors	parity errors

All error counts and errored seconds return NR1-numeric responses.

All bit error ratios return NR3-numeric responses.

1 **The FRAME error source is valid only for DS1/DS3 framed signals.**

2 **The CRC error source is valid only for DS1 rate and ESF framing.**

3 **The PARITY error source is valid only for DS3 rate and CBIT or M13 framing.**

Table 3–41: Syntax for SENSe:DATA:TELecom:MEASure:TRIButary:ERRor queries (PDH)

Select a measurement from the left column	Then select an error source from the top row			
	?	:BIT?[4]	:FRAME?[5]	:CRC?[6]
ECOUnt	all error counts	logic errors	frame errors	CRC errors
ERATio	all bit error ratios	logic errors	frame errors	CRC errors
ESEConds	all errored seconds	logic errors	frame errors	CRC errors

All error counts and errored seconds return NR1-numeric responses.

All bit error ratios return NR3-numeric responses.

4 **The ESEConds:BIT error source reports M2100 out-of-service and G.821 measurements.**

5 **The FRAME error source is valid only for PDH framed signals.**

6 **The CRC error source is valid only for 2 Mb/s rate and PCM30CRC or PCM31CRC framing.**

SONET Response See Table 3–40

SDH Response See Table 3–41

Dependencies These measurement queries can be sent at any time. But, if a test is currently running, the responses to the queries might not represent the final error measurements. After a test has been stopped or the test duration has expired, you can send these measurement queries again to get the final error measurements.

Do not set SENSe:DATA:TELecom:TRIButary:PAYLoad:PATTern to UNKNown if you want to use these queries.

Errors and Events None

Examples See Table 3–42.

Table 3–42: Examples for SENSe:DATA:TELecom:MEASure:TRIButary:ERRor queries

Query	Response
SENSE:DATA:TELECOM:MEASURE:TRIBUTARY:ERROR:ECOUNT:BIT?	714
SENSE:DATA:TELECOM:MEASURE:TRIBUTARY:ERROR:ERATIO:FRAME?	1.0E–8
SENSE:DATA:TELECOM:MEASURE:TRIBUTARY:ERROR:ESECONDS:CRC?	3

Related Commands SENSe:DATA:TELecom:TEST:STARt
SENSe:DATA:TELecom:TEST:STOP
SENSe:DATA:TELecom:TRIButary:PAYLoad:PATTern
SYSTem:HEADers

SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis Queries

Add/Drop/Test Option Only

These queries return an analysis of section, line, path, and payload errors for tributary signals. When you use the high-level queries (for example, SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis? or SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis:ECOUnt?), it is helpful to turn the headers on (SYSTem:HEADers ON) so you can identify each response value in the response string.

Syntax `SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis?`

`SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis:T1M1?`

`SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis:T1M1:BIT:[error source]` (see Table 3–43 to complete the query)

`SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis:T1M1:PATH:[error source]` (see Table 3–43 to complete the query)

`SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis:M2100?`

`SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis:M2100:IN:[error source]` (see Table 3–44 to complete the query)

`SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis:M2100:OUT:[error source]` (see Table 3–44 to complete the query)

`SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis:G821?`

`SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis:G821:[error source]` (see Table 3–45 to complete the query)

Table 3–43: Syntax for SENSe:DATA:TELecom:MEASure:TRIButary: ANALysis:T1M1:BIT and :PATH queries (DS1/DS3)

Select one of these error sources	Response
?	All T1M1 payload bit analysis responses below
ECOUnt	Error count
ESECondс	Errored seconds
PESeconds	Percent errored seconds
AESeconds	Type A errored seconds
PAESeconds	Percent Type A errored seconds
BESeconds	Type B errored seconds
PBESeconds	Percent Type B errored seconds
UASeconds	Unavailable seconds
PUASeconds	Percent unavailable seconds
EFSeconds	Error free seconds
PEFSeconds	Percent error free seconds
SESeconds	Severely errored seconds
PSESeconds	Percent severely errored seconds

All percent measurements return NR3-numeric responses.

All other measurements return NR1-numeric responses.

Table 3–44: SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis:M2100:IN and M2100:OUT queries (PDH)

Select one of these error sources	Response
?	All M2100 in- and out-of-service analysis responses below
ESECónds	Errored seconds
PESeconds	Percent errored seconds
UASeconds	Unavailable seconds
PUASeconds	Percent unavailable seconds
EFSeconds	Error free seconds
PEFSeconds	Percent error free seconds
SESeconds	Severely errored seconds
PSESeconds	Percent severely errored seconds

All percent measurements return NR3-numeric responses.

All other measurements return NR1-numeric responses.

Table 3–45: SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis:G821 queries (PDH)

Select one of these error sources	Response
ECOUnt	Error count
ESECónds	Errored seconds
PESeconds	Percent errored seconds
UASeconds	Unavailable seconds
PUASeconds	Percent unavailable seconds
EFSeconds	Error free seconds
PEFSeconds	Percent error free seconds
SESeconds	Severely errored seconds
PSESeconds	Percent severely errored seconds
DMINutes	Degraded minutes
PDMinutes	Percent degraded minutes

All percent measurements return NR3-numeric responses.

All other measurements return NR1-numeric responses.

SONET Response See Table 3–43.

SDH Response See Table 3–44 and 3–45.

Dependencies These measurement queries can be sent at any time. However, if a test is currently running, the responses to the queries might not represent the final error measurements. After a test has been stopped or the test duration has expired, you can send these measurement queries again to get the final error measurements.

Do not set SENSe:DATA:TELecom:TRIButary:PAYLoad:PATTern to UNKNown if you want to use these queries.

Errors and Events None

Examples See Tables 3–46 and 3–47.

Table 3–46: Examples for SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis queries (DS1/DS3)

Query	Response
SENSE:DATA:TELECOM:MEASURE:TRIBUTARY:ANALYSIS:T1M1:BIT:AESECONDS?	76824
SENSE:DATA:TELECOM:MEASURE:TRIBUTARY:ANALYSIS:T1M1:PATH:PEFSECONDS?	6.5E–3

Table 3–47: Examples for SENSe:DATA:TELecom:MEASure:TRIButary:ANALysis queries (PDH)

Query	Response
SENSE:DATA:TELECOM:MEASURE:TRIBUTARY:ANALYSIS:M2100:IN:UASECONDS?	23
SENSE:DATA:TELECOM:MEASURE:TRIBUTARY:ANALYSIS:M2100:OUT:PSESECONDS?	1.2E–1
SENSE:DATA:TELECOM:MEASURE:TRIBUTARY:ANALYSIS:G821:DMINUTES?	103

Related Commands SENSe:DATA:TELecom:TEST:STARt
SENSe:DATA:TELecom:TEST:STOP
SENSe:DATA:TELecom:TRIButary:PAYLoad:PATTern
SYSTem:HEADers

SENSe:DATA:TELecom:MEASure:TRIButary:ALARm Queries

Add/Drop/Test Option Only

These queries return tributary alarm measurements. When you use the SENSe:DATA:TELecom:MEASure:TRIButary:ALARm? query, it is helpful to turn the headers on (SYSTem:HEADers ON) so you can identify each response value in the response string.

Syntax All valid queries are listed in the Syntax column of Table 3–48.

Table 3–48: Syntax for SENSe:DATA:TELecom:MEASure:TRIButary:ALARm queries

Syntax	Response
`SENSe:DATA:TELecom:MEASure:TRIButary:ALARm?`	All tributary alarm measurements
`SENSe:DATA:TELecom:MEASure:TRIButary:ALARm:LOSignal?`	Number of seconds of tributary Loss of Signal
`SENSe:DATA:TELecom:MEASure:TRIButary:ALARm:LOFrame?`	Number of seconds of tributary Loss of Frame
`SENSe:DATA:TELecom:MEASure:TRIButary:ALARm:AIS?`	Number of seconds of tributary AIS
`SENSe:DATA:TELecom:MEASure:TRIButary:ALARm:YELLow?`	Number of seconds of tributary Path Yellow (DS1/DS3 only)
`SENSe:DATA:TELecom:MEASure:TRIButary:ALARm:RAI?`	Number of seconds of tributary RAI (PDH only)
`SENSe:DATA:TELecom:MEASure:TRIButary:ALARm:IDLE?`	Number of seconds of tributary idle (DS3 only)
`SENSe:DATA:TELecom:MEASure:TRIButary:ALARm:LOPS?`	Number of seconds of loss of pattern sync

All responses are in NR1-numeric format.

SONET Response See the Response column of Table 3–48.

SDH Response See the Response column of Table 3–48.

Dependencies These measurement queries can be sent at any time. However, if a test is currently running, the responses to the queries might not represent the final error measurements. After a test has been stopped or the test duration has expired, you can send these measurement queries again to get the final error measurements.

Errors and Events None

Examples See Table 3–49.

Table 3–49: Examples for SENSe:DATA:TELecom:MEASure:TRIButary:ALARm queries

Query	Response
SENSE:DATA:TELECOM:MEASURE:TRIBUTARY:ALARM:LOSIGNAL?	20
SENSE:DATA:TELECOM:MEASURE:TRIBUTARY:ALARM:AIS?	13

Related Commands SENSe:DATA:TELecom:TEST:STARt
SENSe:DATA:TELecom:TEST:STOP
SENSe:DATA:TELecom:TRIButary:PAYLoad:PATTern
SYSTem:HEADers

Generator/Receiver Setup Commands

The Generator/Receiver Setup Commands allow you to control the interaction between Generator and Receiver settings. This section contains all of the commands and queries for the following Generator/Receiver Setup subsystem:

- INSTrument

INSTrument Subsystem

This section describes the command and query that control the coupling between the Generator and Receiver setups. Figure 3–54 shows the hierarchy tree for this subsystem.

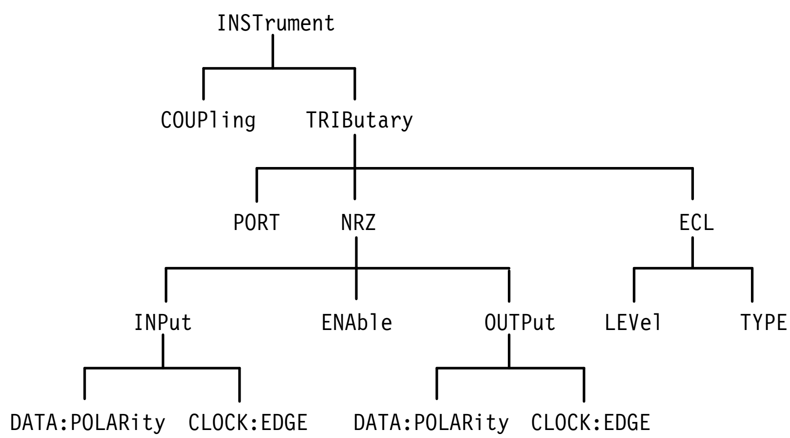


Figure 3–54: INSTrument subsystem

INSTrument:COUPling

This command sets the Generator and Receiver setup coupling. NONE allows the Generator and Receiver to be independently controlled. TXRX establishes interaction between the Generator and Receiver parameters shown in Table 3–50 with the Generator governing the *initial* Receiver setup. RXTX establishes interaction between the Generator and Receiver parameters shown in Table 3–50 with the Receiver governing the *initial* Generator setup.

Table 3–50: Parameters interacting through instrument coupling

Receiver	Generator
INPUT1:RATe	OUTPUT1:RATE
INPUT1:TYPE	OUTPUT1:TYPE
SENSE:DATA:TELecom:SOURce	SOURce:DATA:TELecom:SOURce
SENSe:DATA:TELecom:CHANnel	SOURce:DATA:TELecom:CHAnnel
SENSe:DATA:TELecom:PAYLoad:MAPPing	SOURce:DATA:TELecom:PAYLoad:MAPPing
SENSe:DATA:TELecom:PAYLoad:PATTern	SOURce:DATA:TELecom:PAYLoad:PATTern
SENSe:DATA:TELecom:PAYLoad:UBYTe	SOURce:DATA:TELecom:PAYLoad:UBYTe
SENSe:DATA:TELecom:SCRambling	SOURce:DATA:TELecom:SCRambling
SENSe:DATA:TELecom:STRucture	SOURce:DATA:TELecom:STRucture

NOTE*. A change to one of the parameters listed in Table 3–50 might cause a change to the INSTrument:COUPling parameter value. For example, if you set INSTrument:COUPling to TXRX then change OUTPUT1:RATE, the value of INSTrument:COUPling is changed to RXTX.*

Syntax `INSTrument:COUPling <coupling>`

SONET Values

<coupling> (discrete)	description
NONE	Setups are independent
TXRX	Generator sets initial condition of the Receiver
RXTX	Receiver sets initial condition of the Generator

SDH Values

<coupling> (discrete)	description
NONE	Setups are independent
TXRX	Generator sets initial condition of the Receiver
RXTX	Receiver sets initial condition of the Generator

Dependencies None

Errors and Events None

Examples `INSTRUMENT:COUPLING TXRX`

Related Commands None

INSTrument:COUPling?

This query returns the current setting of the Generator and Receiver setup coupling. NONE allows the Generator and Receiver to be independently controlled. TXRX establishes interaction between the Generator and Receiver parameters listed in Table 3–50 with the Generator governing the *initial* Receiver setup. RXTX establishes interaction between certain Generator and Receiver parameters listed in Table 3–50 with the Receiver governing the *initial* Generator setup.

Syntax `INSTrument:COUPling?`

SONET Response

<coupling> (discrete)	description
NONE	Setups are independent
TXRX	Generator sets initial condition of the Receiver
RXTX	Receiver sets initial condition of the Generator

SDH Response

<coupling> (discrete)	description
NONE	Setups are independent
TXRX	Generator sets initial condition of the Receiver
RXTX	Receiver sets initial condition of the Generator

Dependencies None

Errors and Events None

Examples

Query: `INSTRUMENT:COUPLING?`

Response: `TXRX`

Related Commands

None

INSTrument:TRIButary:PORT

This command is used to select the Option 58 tributary interface module connectors carrying the signal to be received.

Syntax

`INSTrument:TRIButary:PORT <line_connect>`

SONET Response

<line_connect>	description
LINE	connectors for signal data in line–coded format (default)
NRZ	connectors for signal data in NRZ format

SDH Response

<line_connect>	description
LINE	connectors for signal data in line-coded format (default)
NRZ	connectors for signal data in NRZ format

Dependencies

Instrument must be receiving/transmitting or adding/dropping a tributary rate for this command to take effect.

Comments

This command requires that Option 58 be installed. The transmitter always outputs data on both line and NRZ data connectors.

*RST sets line_connect to its default value.

Errors and Events

“Settings Conflict; Not available without Opt. 58 tributary module.” if NRZ is chosen and option 58 is not present.

Examples

`INSTrument:TRIButary:PORT NRZ`

Related Commands

OUTPUT2:TELecom:TERMinator
INPUT2:TELecom:TERMinator
SOURce:DATA:TELecom:SOURce
SENSe:DATA:TELecom:SOURce
SOURce:DATA:TELecom:PAYLoad:MAPPing
SOURce:DATA:TELecom:TRIButary:ADD
SENSe:DATA:TELecom:PAYLoad:MAPPing
SENSe:DATA:TELecom:TRIButary:DROP

INSTrument:TRIButary:PORT?

This query returns the selected Option 58 tributary Interface module connectors carrying the signal to be received.

Syntax

`INSTrument:TRIButary:PORT?`

SONET Response

<line_connect>	description
LINE	connectors for signal data in line–coded format (default)
NRZ	connectors for signal data in NRZ format

SDH Response

<line_connect>	description
LINE	connectors for signal data in line–coded format (default)
NRZ	connectors for signal data in NRZ format

Dependencies

None.

Comments

If NRZ is selected but not active, make sure that INSTrument:TRIButary:NRZ:ENAble is set to ON.

Errors and Events

None.

Examples

Query: `INSTrument:TRIButary:PORT?`

Response: `LINE`

Related Commands INSTrument:TRIButary:NRZ:ENAble

INSTrument:TRIButary:NRZ:ENAble

This command is used to enable or disable the tributary NRZ signal being received and transmitted by the Option 58 tributary interface module.

Syntax `INSTrument:TRIButary:NRZ:ENAble <nrz_enable>`

SONET Response

<nrz_enable>	description
ON	enable signals
OFF	disable signals (default)

SDH Response

<nrz_enable>	description
ON	enable signals
OFF	disable signals (default)

Dependencies Instrument must be receiving/transmitting or adding/dropping a tributary rate for this command to take effect.

INSTrument:TRIButary:PORT must be set to NRZ for this command to take effect.

For 140 Mb/s, INSTrument:TRIButary:ECL:LEVel should be set to the appropriate level before enabling NRZ interface.

Comments This command requires that Option 58 be installed.

*RST sets nrz_enable to its default value.

Errors and Events None.

Examples `INSTrument:TRIButary:NRZ:ENAble ON`

Related Commands INSTrument:TRIButary:PORT

INSTrument:TRIButary:NRZ:ENAble?

This query returns the enable/disable state of the tributary NRZ signal into and out of the Option 58 tributary Interface module.

Syntax `INSTrument:TRIButary:NRZ:ENAble?`

SONET Response

<nrz_enable>	description
ON	enable signals
OFF	disable signals (default)

SDH Response

<nrz_enable>	description
ON	enable signals
OFF	disable signals (default)

Dependencies None.

Errors and Events None.

Examples Query: `INSTrument:TRIButary:NRZ:ENAble?`

Response: `OFF`

Related Commands None.

INSTrument:TRIButary:NRZ:INPut:DATA:POLARity

This command is used to set the data polarity of the received tributary NRZ signal into the Option 58 tributary Interface module.

Syntax

```
INSTrument:TRIButary:NRZ:INPut:DATA:POLARity <data_polarity>
```

SONET Response

<data_polarity>	description
HIGH	high polarity (default)
LOW	low polarity

SDH Response

<data_polarity>	description
HIGH	high polarity (default)
LOW	low polarity

Dependencies

The instrument must be receiving or adding a tributary rate for this command to take effect.

INSTrument:TRIButary:PORT must be set to NRZ for this command to take effect.

INSTrument:TRIButary:NRZ:ENAble must be set to ON to enable signals.

Comments

This command requires that Option 58 be installed.

*RST sets data_polarity to its default value.

Errors and Events

None.

Examples

```
INSTrument:TRIButary:NRZ:INPut:DATA:POLARity HIGH
```

Related Commands

INSTrument:TRIButary:PORT
INSTrument:TRIButary:NRZ:ENAble

INSTrument:TRIButary:NRZ:INPut:DATA:POLARity?

This query returns the selected data polarity of the received tributary NRZ signal into the Option 58 tributary Interface module.

Syntax

`INSTrument:TRIButary:NRZ:INPut:DATA:POLARity?`

SONET Response

<data_polarity>	description
HIGH	high polarity (default)
LOW	low polarity

SDH Response

<data_polarity>	description
HIGH	high polarity (default)
LOW	low polarity

Dependencies

None.

Comments

If the polarity returned by this query is correct but the ECL interface does not seem to be active, verify that INSTrument:ECL:ENAble is set to ON and INPut:TELecom:TYPE is set to ECL.

Errors and Events

None.

Examples

Query: `INSTrument:TRIButary:NRZ:INPut:DATA:POLARity?`

Response: `LOW`

Related Commands

INSTrument:TRIButary:PORT
INSTrument:TRIButary:NRZ:ENAble

INSTrument:TRIButary:NRZ:INPut:CLOCk:EDGE

This command is used to set the clock edge significance (on which edge the data is sampled) of the transmitted tributary NRZ signal out of the Option 58 tributary Interface module.

Syntax

```
INSTrument:TRIButary:NRZ:INPut:CLOCk:EDGE <clock_edge>
```

SONET Response

<clock_edge>	description
RISing	rising edge (default)
FALLing	falling edge

SDH Response

<clock_edge>	description
RISing	rising edge (default)
FALLing	falling edge

Dependencies

The instrument must be receiving or adding a tributary rate for this command to take effect.

INSTrument:TRIButary:PORT mmust be set to NRZ for this command to take effect.

INSTrument:TRIButary:NRZ:ENAble must be set to ON to enable signals.

Comments

This command requires that Option 58 be installed.

*RST sets clock_edge to its default value.

Errors and Events

None.

Examples

```
INSTrument:TRIButary:NRZ:INPut:CLOCk:EDGE RISing
```

Related Commands

INSTrument:TRIButary:PORT
INSTrument:TRIButary:NRZ:ENAble

INSTrument:TRIButary:NRZ:INPut:CLOCk:EDGE?

This query returns the selected clock edge significance (on which edge the input NRZ data is sampled) of the received tributary NRZ signal into the Option 58 tributary Interface module.

Syntax `INSTrument:TRIButary:NRZ:INPut:CLOCk:EDGE?`

SONET Response

<clock_edge>	description
RISing	rising edge (default)
FALLing	falling edge

SDH Response

<clock_edge>	description
RISing	rising edge (default)
FALLing	falling edge

Dependencies None.

Errors and Events None.

Examples Query: `INSTrument:TRIButary:NRZ:INPut:CLOCk:EDGE?`

Response: `FALLing`

Related Commands None.

INSTrument:TRIButary:NRZ:OUTPut:DATA:POLARity

This command is used to set the data polarity of the transmitted tributary NRZ signal (except 140Mb) out of the Option 58 tributary Interface module.

Syntax

```
INSTrument:TRIButary:NRZ:OUTPut:DATA:POLARity <data_polarity>
```

SONET Response

<data_polarity>	description
HIGH	high polarity (default)
LOW	low polarity

SDH Response

<data_polarity>	description
HIGH	high polarity (default)
LOW	low polarity

Dependencies

Instrument must be transmitting or dropping a tributary rate for this command to take effect.

INSTrument:TRIButary:PORT mmust be set to NRZ for this command to take effect.

INSTrument:TRIButary:NRZ:ENAble must be set to ON to enable signals.

This command does not apply to 140Mb.

Comments

This command requires that Option 58 be installed.

*RST sets data_polarity to its default value.

Errors and Events

None.

Examples

```
INSTrument:TRIButary:NRZ:OUTPut:DATA:POLARity HIGH
```

Related Commands

INSTrument:TRIButary:PORT
INSTrument:TRIButary:NRZ:ENAble

INSTrument:TRIButary:NRZ:OUTPut:DATA:POLARity?

This query returns the selected data polarity of the transmitted tributary NRZ signal (except 140Mb) out of the Option 58 tributary Interface module.

Syntax `INSTrument:TRIButary:NRZ:OUTPut:DATA:POLARity?`

SONET Response

<data_polarity>	description
HIGH	high polarity (default)
LOW	low polarity

SDH Response

<data_polarity>	description
HIGH	high polarity (default)
LOW	low polarity

Dependencies None.

Comments None.

Errors and Events None.

Examples Query: `INSTrument:TRIButary:NRZ:OUTPut:DATA:POLARity?`

Response: `LOW`

Related Commands None.

INSTrument:TRIButary:NRZ:OUTPut:CLOCk:EDGE

This command is used to set the clock edge significance (on which edge the data is valid) of the transmitted tributary NRZ signal (except 140Mb) out of the Option 58 tributary Interface module.

Syntax

```
INSTrument:TRIButary:NRZ:OUTPut:CLOCk:EDGE <clock_edge>
```

SONET Response

<clock_edge>	description
RISing	rising edge (default)
FALLing	falling edge

SDH Response

<clock_edge>	description
RISing	rising edge (default)
FALLing	falling edge

Dependencies

Instrument must be transmitting or dropping a tributary rate for this command to take effect.

INSTrument:TRIButary:PORT must be set to NRZ for this command to take effect.

INSTrument:TRIButary:NRZ:ENAble must be set to ON to enable signals.

This command does not apply to 140Mb.

Comments

This command requires that Option 58 be installed.

*RST sets clock_edge to its default value.

Errors and Events

None.

Examples

```
INSTrument:TRIButary:NRZ:INPut:CLOCk:EDGE RISing
```

Related Commands

INSTrument:TRIButary:PORT
INSTrument:TRIButary:NRZ:ENAble

INSTrument:TRIButary:NRZ:OUTPut:CLOCk:EDGE?

This query returns the selected clock edge significance (on which edge the data is valid) of the transmitted tributary NRZ signal (except 140Mb) out of the Option 58 tributary Interface module.

Syntax

`INSTrument:TRIButary:NRZ:OUTPut:CLOCk:EDGE?`

SONET Response

<clock_edge>	description
RISing	rising edge (default)
FALLing	falling edge

SDH Response

<clock_edge>	description
RISing	rising edge (default)
FALLing	falling edge

Dependencies

None.

Errors and Events

None.

Examples

Query: `INSTrument:TRIButary:NRZ:OUTPut:CLOCk:EDGE?`

Response: `FALLing`

Related Commands

INSTrument:TRIButary:PORT
INSTrument:TRIButary:NRZ:ENAble

INSTrument:TRIButary:ECL:LEVel

This command is used to set the logic level of the 140 Mb tributary ECL signal being received and transmitted by the Option 58 tributary Interface Module.

Syntax

```
INSTrument:TRIButary:ECL:LEVel <ecl_level>
```

SONET Response

<ecl_level>	description
ECL	standard ECL level (default)
PECL	positive ECL level

SDH Response

<ecl_level>	description
ECL	standard ECL level (default)
PECL	positive ECL level

Dependencies

Instrument must be receiving/transmitting or adding/dropping 140Mb for this command to take effect.

INSTrument:TRIButary:PORT must be set to NRZ for this command to take effect.

Comments

This command requires that Option 58 be installed.

*RST sets ecl_level to its default value.

***NOTE**. You should set the ECL level to the desired value before setting INSTrument:TRIButary:NRZ:ENAble to ON.*

Errors and Events

None.

Examples

```
INSTrument:TRIButary:ECL:LEVEL ECL
```

Related Commands

INSTrument:TRIButary:ECL:TYPE
INSTrument:TRIButary:PORT
INSTrument:TRIButary:NRZ:ENAble

INSTrument:TRIButary:ECL:LEVel?

This query returns the selected logic level of the 140 Mb tributary signal being received and transmitted by the Option 58 tributary Interface Module.

Syntax `INSTrument:TRIButary:ECL:LEVel?`

SONET Response

<ecl_level>	description
ECL	standard ECL level (default)
PECL	positive ECL level

SDH Response

<ecl_level>	description
ECL	standard ECL level (default)
PECL	positive ECL level

Dependencies None.

Errors and Events None.

Examples Query: `INSTrument:TRIButary:ECL:LEVEL?`

Response: `ECL`

Related Commands None.

INSTrument:TRIButary:ECL:TYPE

This command is used to set the signal type of the140Mb tributary being received and transmitted by the Option 58 tributary Interface Module.

Syntax

```
INSTrument:ECL:TYPE <ecl_type>
```

SONET Response

<ecl_type>	description
SINGle	single–ended (default)
DIFFerential	differential

SDH Response

<ecl_type>	description
SINGle	single–ended (default)
DIFFerential	differential

Dependencies

Instrument must be receiving/transmitting or adding/dropping 140Mb for this command to take effect.

INSTrument:TRIButary:PORT mmust be set to NRZ for this command to take effect.

INSTrument:TRIButary:NRZ:ENAble must be set to ON to enable signals.

Comments

This command requires that Option 58 be installed.

*RST sets ecl_type to its default value.

Errors and Events

None.

Examples

```
INSTrument:TRIButary:ECL:TYPE  SING
```

Related Commands

INSTrument:TRIButary:ECL:LEVel
INSTrument:TRIButary:PORT
INSTrument:TRIButary:NRZ:ENAble

INSTrument:TRIButary:ECL:TYPE?

This query returns the selected signal type of the 140 Mb tributary signal being received and transmitted by the Option 58 tributary Interface Module.

Syntax

`INSTrument:TRIButary:ECL:TYPE?`

SONET Response

<ecl_type>	description
SINGle	single–ended (default)
DIFFerential	differential

SDH Response

<ecl_type>	description
SINGle	single–ended (default)
DIFFerential	differential

Dependencies

None.

Errors and Events

None.

Examples

Query: `INSTrument:TRIButary:ECL:TYPE?`

Response: `SING`

Related Commands

INSTrument:TRIButary:ECL:LEVel?

Trigger and Capture Commands

The Trigger and Capture commands allow you to capture overhead and payload data. This section contains all of the commands and queries for each of the following Trigger and Capture subsystems:

- ABORt, INITiate, and TRIGger
- TRIGger2

Using Triggers starting on page 2–28 describes how to use the Trigger and Capture commands to export and generate triggers. Figure 3–55 illustrates the interaction between the functional areas of the VX4610 and the commands you can use to program the instrument.

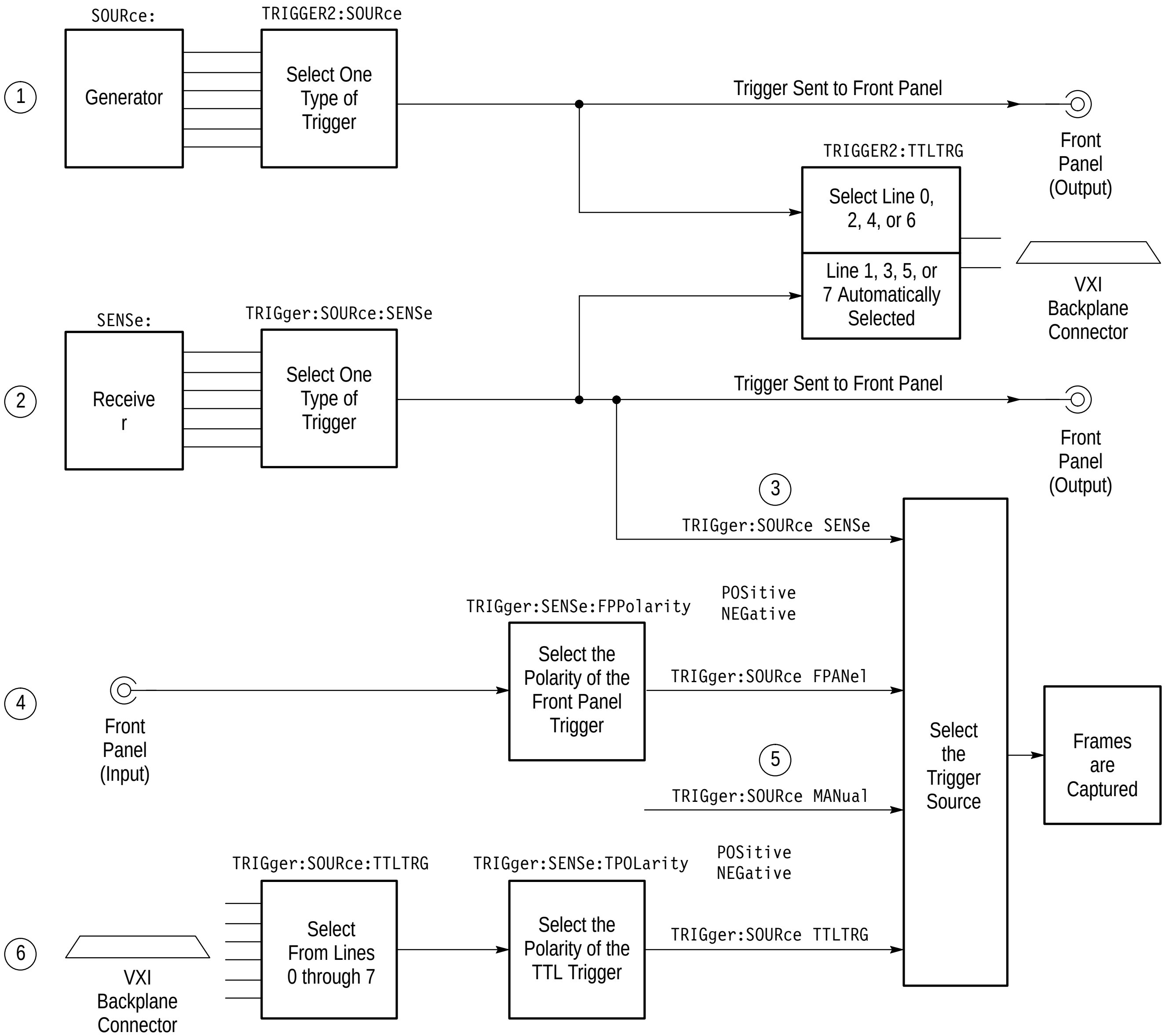


Figure 3–55: Trigger system in the VX4610

ABORt, INITiate, and TRIGger Subsystem

This section describes each of the commands and queries that allow you to arm the trigger system, stop the capture of overhead and payload data, and set up triggering information. Figure 3–56 shows the hierarchy tree for this subsystem.

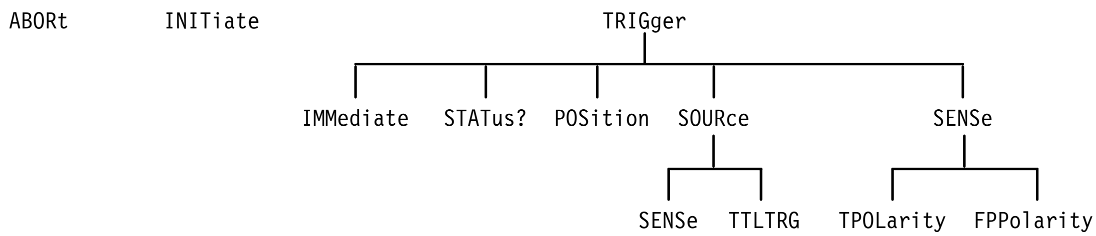


Figure 3–56: ABORt, INITiate, and TRIGger subsystem

ABORt

This command forces the capture of overhead and payload data to stop (normally, a trigger stops the capture). While the capture is stopped, the acquired data can be retrieved and new trigger selections can be made. The capture can be restarted with the INITiate command.

Syntax `ABORt`

SONET Values None

SDH Values None

Dependencies None

Errors and Events None

Examples `ABORT`

Related Commands INITiate

INITiate

This command causes the capture mechanism to start and the trigger system to arm. After receiving this command, the instrument will acquire data until the programmed trigger event occurs or the capture is stopped manually with the ABORt or TRIGger:IMMediate command.

Syntax `INITiate`

SONET Values None

SDH Values None

Dependencies None

Errors and Events None

Examples `INITIATE`

Related Commands TRIGger:IMMediate
SENSe:DATA:TELecom:OVERhead:DATA?
SENSe:DATA:TELecom:POVerhead:DATA?
SENSe:DATA:TELecom:PAYLoad:CUSTom:DATA?
SENSe:DATA:TELecom:PAYLoad:CUSTom:BDATA?

TRIGger:IMMediate

This command forces a trigger to occur, which stops the capture of data.

Syntax `TRIGger:IMMediate`

SONET Values None

SDH Values None

Dependencies Before the TRIGger:IMMediate command is sent, an INITiate command must be sent first to arm the trigger system.

Errors and Events None

Examples `TRIGGER:IMMEDIATE`

Related Commands INITiate
SENSe:DATA:TELecom:OVERhead:DATA?
SENSe:DATA:TELecom:POVerhead:DATA?
SENSe:DATA:TELecom:PAYLoad:CUSTom:DATA?
SENSe:DATA:TELecom:PAYLoad:CUSTom:BDATA?

TRIGger:STATus?

This query returns the trigger status.

Syntax `TRIGger:STATus?`

SONET Response

<trigger status> (discrete)	description
RUN	Waiting for a trigger
STOP	Either triggered or aborted

SDH Response

<trigger status> (discrete)	description
RUN	Waiting for a trigger
STOP	Either triggered or aborted

Dependencies None

Errors and Events None

Examples Query: `TRIGGER:STATUS?`

Response: `STOP`

Related Commands INITiate
ABORt

TRIGger:POSition

This command selects the the location of the trigger event. Both the number of frames and their relative position in the acquired data buffer are set with this command.

Syntax

```
TRIGger:POSition <trigger position>
```

SONET Values

<trigger position> (discrete)	description
BEGin	For STS-1 structure: 1 pretrigger frame and 62 posttrigger frames acquired (default) For STS-3c structure: 1 pretrigger frame and 52 posttrigger frames acquired
MIDdle	For STS-1 structure: 31 pretrigger frames and 32 posttrigger frames acquired For STS-3c structure: 26 pretrigger frames and 27 posttrigger frames acquired
END	For STS-1 structure: 62 pretrigger frames and 1 posttrigger frame acquired For STS-3c structure: 52 pretrigger frames and 1 posttrigger frame acquired

SDH Values

<trigger position> (discrete)	description
BEGin	1 pretrigger frame and 52 posttrigger frames acquired (default)
MIDdle	26 pretrigger frames and 27 posttrigger frames acquired
END	52 pretrigger frames and 1 posttrigger frame acquired

Dependencies None

Errors and Events None

Examples

```
TRIGGER:POSITION BEGIN
```

Related Commands None

TRIGger:POSition?

This query returns the current setting for the location of the trigger event in the captured data.

Syntax

`TRIGger:POSition?`

SONET Response

<trigger position> (discrete)	description
BEGin	For STS-1 structure: 1 pretrigger frame and 62 posttrigger frames acquired (default) For STS-3c structure: 1 pretrigger frame and 52 posttrigger frames acquired
MIDdle	For STS-1 structure: 31 pretrigger frames and 32 posttrigger frames acquired For STS-3c structure: 26 pretrigger frames and 27 posttrigger frames acquired
END	For STS-1 structure: 62 pretrigger frames and 1 posttrigger frame acquired For STS-3c structure: 52 pretrigger frames and 1 posttrigger frame acquired

SDH Response

<trigger position> (discrete)	description
BEGin	1 pretrigger frame and 52 posttrigger frames acquired (default)
MIDdle	26 pretrigger frames and 27 posttrigger frames acquired
END	52 pretrigger frames and 1 posttrigger frame acquired

Dependencies

None

Errors and Events

None

Examples

Query: `TRIGGER:POSITION?`

Response: `BEGIN`

Related Commands

TRIGger:POSition

TRIGger:SOURce

This command selects the trigger source that is used to stop the capture of frame data.

Syntax

```
TRIGger:SOURce <trigger source>
```

SONET Values

<trigger source> (discrete)	description
MANual	Use the TRIGger:IMMediate or ABORt command (default)
SENSe	Receiver
TTLTRG	VXI TTL trigger
FPANel	Front panel

SDH Values

<trigger source> (discrete)	description
MANual	Use the TRIGger:IMMediate or ABORt command (default)
SENSe	Receiver
TTLTRG	VXI TTL trigger
FPANel	Front panel

Dependencies

None

Errors and Events

None

Examples

```
TRIGGER:SOURCE TTLTRG
```

Related Commands

TRIGger:IMMediate
ABORt

TRIGger:SOURce?

This query returns the current setting of the trigger source that is used to stop the capture of frame data.

Syntax

`TRIGger:SOURce?`

SONET Response

<trigger source> (discrete)	description
MANual	Use the TRIGger:IMMediate or ABORt command (default)
SENSe	Receiver
TTLTRG	VXI TTL trigger
FPANel	Front panel

SDH Response

<trigger source> (discrete)	description
MANual	Use the TRIGger:IMMediate or ABORt command (default)
SENSe	Receiver
TTLTRG	VXI TTL trigger
FPANel	Front panel

Dependencies

None

Errors and Events

None

Examples

Query: `TRIGGER:SOURCE?`

Response: `TTLTRG`

Related Commands

TRIGger:SOURce

TRIGger:SOURce:SENSe

This command selects the type of trigger generated by the Receiver (SENSe subsystem). These trigger signals control the capture of frame data.

Syntax

```
TRIGger:SOURce:SENSe <trigger sense>
```

SONET Values

<trigger sense> (discrete)	description
FPULse	Generator frame pulse (default)
LOFTRUE	LOF
OOFTRUE	OOF
LOPTRUE	LOP[1]
IPTR	Illegal pointer
NDF	NDF change
POSSTUFF	Positive stuffing
NEGSTUFF	Negative stuffing
INDF	Invalid NDF TRUE
APS	K1/K2 change
LAIS	Line AIS
LFERF	Line FERF
PFEBE	Receiver path FEBE[2]
PAIS	Receiver path AIS
PFERF	Receiver path FERF
SBIP	Section BIP error
LBIP	Line BIP error
PBIP	Path BIP error

1 **The VX4610 does not use the status of S-bits to detect the LOP trigger event.**

2 **This trigger event has an uncertainty of one frame when used to capture overhead or payload.**

SDH Values

<trigger sense> (discrete)	description
FPULse	Generator frame pulse (default)
LOFTRUE	LOF
OOFTRUE	OOF

<trigger sense> (discrete)	description
LOPTRUE	LOP[1]
IPTR	Illegal pointer
NDF	NDF change
POSSTUFF	Positive stuffing
NEGSTUFF	Negative stuffing
INDF	Invalid NDF TRUE
APS	K1/K2 change
LAIS	MS AIS
LFERF	MS FERF
PFEBE	Receiver path FEBE[2]
PAIS	Receiver path AIS
PFERF	Receiver path FERF
SBIP	RS BIP error
LBIP	MS BIP error
PBIP	Path BIP error

1 **The VX4610 does not use the status of S-bits to detect the LOP trigger event.**

2 **This trigger event has an uncertainty of one frame when used to capture overhead or payload.**

Dependencies TRIGger:SOURce must be set to SENSe for this command to apply.

Errors and Events None

Examples `TRIGGER:SOURCE:SENSE FPULSE`

Related Commands TRIGGer:SOURce

TRIGger:SOURce:SENSe?

This query returns the current setting of the type of trigger generated by the Receiver (SENSe subsystem). These trigger signals control the capture of frame data.

Syntax `TRIGger:SOURce:SENSe?`

SONET Response

<trigger sense> (discrete)	description
FPULse	Generator frame pulse (default)
LOFTRUE	LOF
OOFTRUE	OOF
LOPTRUE	LOP[1]
IPTR	Illegal pointer
NDF	NDF change
POSSTUFF	Positive stuffing
NEGSTUFF	Negative stuffing
INDF	Invalid NDF TRUE
APS	K1/K2 change
LAIS	Line AIS
LFERF	Line FERF
PFEBE	Receiver path FEBE[2]
PAIS	Receiver path AIS
PFERF	Receiver path FERF
SBIP	Section BIP error
LBIP	Line BIP error
PBIP	Path BIP error

[1] **The VX4610 does not use the status of S-bits to detect the LOP trigger event.**

[2] **This trigger event has an uncertainty of one frame when used to capture overhead or payload.**

SDH Response

<trigger sense> (discrete)	description
FPULse	Generator frame pulse (default)
LOFTRUE	LOF
OOFTRUE	OOF
LOPTRUE	LOP[1]
IPTR	Illegal pointer
NDF	NDF change
POSSTUFF	Positive stuffing
NEGSTUFF	Negative stuffing
INDF	Invalid NDF TRUE
APS	K1/K2 change

<trigger sense> (discrete)	description
LAIS	MS AIS
LFERF	MS FERF
PFEBE	Receiver path FEBE[2]
PAIS	Receiver path AIS
PFERF	Receiver path FERF
SBIP	RS BIP error
LBIP	MS BIP error
PBIP	Path BIP error

[1] **The VX4610 does not use the status of S-bits to detect the LOP trigger event.**

[2] **This trigger event has an uncertainty of one frame when used to capture overhead or payload.**

Dependencies None

Errors and Events None

Examples Query: `TRIGGER:SOURCE:SENSE?`

Response: `TTLTRG`

Related Commands TRIGGer:SOURce:SENSe

TRIGger:SOURce:TTLTRG

This command selects a VXI TTL line on which to import a trigger. These trigger signals control the capture of custom frame data.

Syntax `TRIGger:SOURce:TTLTRG <trigger VXI input>`

SONET Values

<trigger VXI input> (discrete)	description
NONE	No trigger signals imported (default)
TTL0	Trigger signal imported on line 0
TTL1	Trigger signal imported on line 1
TTL2	Trigger signal imported on line 2
TTL3	Trigger signal imported on line 3

<trigger VXI input> (discrete)	description
TTL4	Trigger signal imported on line 4
TTL5	Trigger signal imported on line 5
TTL6	Trigger signal imported on line 6
TTL7	Trigger signal imported on line 7

SDH Values

<trigger VXI input> (discrete)	description
NONE	No trigger signals imported (default)
TTL0	Trigger signal imported on line 0
TTL1	Trigger signal imported on line 1
TTL2	Trigger signal imported on line 2
TTL3	Trigger signal imported on line 3
TTL4	Trigger signal imported on line 4
TTL5	Trigger signal imported on line 5
TTL6	Trigger signal imported on line 6
TTL7	Trigger signal imported on line 7

Dependencies TRIGger:SOURce must be set to TTLTRG for this command to apply.

Errors and Events None

Examples `TRIGGER:SOURCE:TTLTRG TTL1`

Related Commands TRIGger:SOURce

TRIGger:SOURce:TTLTRG?

This query returns the current setting of the VXI TTL trigger line.

Syntax `TRIGger:SOURce:TTLTRG?`

SONET Response

<trigger VXI input> (discrete)	description
NONE	No trigger signals imported (default)
TTL0	Trigger signal imported on line 0
TTL1	Trigger signal imported on line 1
TTL2	Trigger signal imported on line 2
TTL3	Trigger signal imported on line 3
TTL4	Trigger signal imported on line 4
TTL5	Trigger signal imported on line 5
TTL6	Trigger signal imported on line 6
TTL7	Trigger signal imported on line 7

SDH Response

<trigger VXI input> (discrete)	description
NONE	No trigger signals imported (default)
TTL0	Trigger signal imported on line 0
TTL1	Trigger signal imported on line 1
TTL2	Trigger signal imported on line 2
TTL3	Trigger signal imported on line 3
TTL4	Trigger signal imported on line 4
TTL5	Trigger signal imported on line 5
TTL6	Trigger signal imported on line 6
TTL7	Trigger signal imported on line 7

Dependencies None

Errors and Events None

Examples

Query: `TRIGGER:SOURCE:TTLTRG?`

Response: `TTL1`

Related Commands TRIGger:SOURce:TTLTRG

TRIGger:SENSe:TPOLarity

This command selects the polarity of the Receiver VXI TTL triggers that control the capture of custom frame data.

Syntax

```
TRIGger:SENSe:TPOLarity <trigger TTL polarity>
```

SONET Values

<trigger TTL polarity> (discrete)	description
POSitive	Positive polarity (default)
NEGative	Negative polarity

SDH Values

<trigger TTL polarity> (discrete)	description
POSitive	Positive polarity (default)
NEGative	Negative polarity

Dependencies TRIGger:SOURce must be set to TTLTRG for this command to apply.

Errors and Events None

Examples

```
TRIGGER:SENSE:TPOLARITY POSITIVE
```

Related Commands TRIGger:SOURce

TRIGger:SENSe:TPOLarity?

This query returns the current setting of the polarity of the Receiver VXI TTL triggers that control the capture of custom frame data.

Syntax

```
TRIGger:SENSe:TPOLarity?
```

SONET Response

<trigger TTL polarity> (discrete)	description
POSitive	Positive polarity (default)
NEGative	Negative polarity

SDH Response

<trigger TTL polarity> (discrete)	description
POSitive	Positive polarity (default)
NEGative	Negative polarity

Dependencies None

Errors and Events None

Examples Query: `TRIGGER:SENSE:TPOLARITY?`

Response: `POSITIVE`

Related Commands TRIGger:SENSe:TPOLarity

TRIGger:SENSe:FPPolarity

This command selects the polarity of the front panel triggers that control the capture of custom frame data.

Syntax `TRIGger:SENSe:FPPolarity <trigger fpanel polarity>`

SONET Values

<trigger fpanel polarity> (discrete)	description
POSitive	Positive polarity (default)
NEGative	Negative polarity

SDH Values

<trigger fpanel polarity> (discrete)	description
POSitive	Positive polarity (default)
NEGative	Negative polarity

Dependencies TRIGger:SOURce must be set to FPANel for this command to apply.

Errors and Events None

Examples `TRIGGER:SENSE:FPPOLARITY NEGATIVE`

Related Commands TRIGger:SOURce

TRIGger:SENSe:FPPolarity?

This query returns the current setting of the polarity of the front panel triggers that control the capture of custom frame data.

Syntax `TRIGger:SENSe:FPPolarity?`

SONET Response

<trigger fpanel polarity> (discrete)	description
POSitive	Positive polarity (default)
NEGative	Negative polarity

SDH Response

<trigger fpanel polarity> (discrete)	description
POSitive	Positive polarity (default)
NEGative	Negative polarity

Dependencies TRIGger:SOURce must be set to FPANel for this command to apply.

Errors and Events None

Examples Query: `TRIGGER:SENSE:FPPOLARITY?`

Response: `POSITIVE`

Related Commands TRIGger:SENSe:FPPolarity

TRIGger2 Subsystem

The TRIGger2 subsystem exports triggers from the Generator.

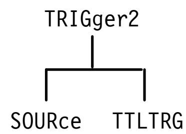


Figure 3–57: TRIGger2 subsystem

TRIGger2:SOURce

This command selects the trigger source output by the Generator and exported to the front panel connector and, if requested, to the VXI TTL trigger bus.

Syntax

```
TRIGger2:SOURce <trigger source>
```

SONET Values

<trigger source> (discrete)	description
FPULse	Frame pulse (default)
PACTion	Pointer action
BIP	Section, line, and path BIP
DATA	PRBS/pattern error
APS	APS change
LAIS	Line AIS
LFERF	Line FERF
PFEBE	Path far end block error
PAIS	Path AIS
PFERF	Path FERF

SDH Values

<trigger source> (discrete)	description
FPULse	Frame pulse (default)
PACTion	Pointer action
BIP	Section, MS, and path BIP
DATA	PRBS/pattern error
APS	APS change

<trigger source> (discrete)	description
LAIS	MS AIS
LFERF	MS FERF
PFEBE	Path far end block error
PAIS	Path AIS
PFERF	Path FERF

Dependencies None

Errors and Events None

Examples `TRIGGER2:SOURCE FPULSE`

Related Commands None

TRIGger2:SOURce?

This query returns the current setting of the trigger source generated by the Generator. This trigger source is exported to the front panel connector and, if requested, to the VXI TTL trigger bus.

Syntax `TRIGger2:SOURce?`

SONET Response

<trigger source> (discrete)	description
FPULse	Frame pulse (default)
PACTion	Pointer action
BIP	Section, line, and path BIP
DATA	PRBS/pattern error
APS	APS change
LAIS	Line AIS
LFERF	Line FERF
PFEBE	Path far end block error
PAIS	Path AIS
PFERF	Path FERF

SDH Response

<trigger source> (discrete)	description
FPULse	Frame pulse (default)
PACTion	Pointer action
BIP	Section, MS, and path BIP
DATA	PRBS/pattern error
APS	APS change
LAIS	MS AIS
LFERF	MS FERF
PFEBE	Path far end block error
PAIS	Path AIS
PFERF	Path FERF

Dependencies None

Errors and Events None

Examples Query: `TRIGGER2:SOURCE?`

Response: `APS`

Related Commands TRIGger2:SOURce

TRIGger2:TTLTRG

This command selects the VXI TTL trigger lines used to export triggers from the Generator. The trigger lines are automatically exported in pairs: one odd-numbered line and one even-numbered line. For example, if you select TTL0, a trigger from the Generator is exported on line 0, and a trigger from the Receiver is exported on line 1.

Syntax

```
TRIGger2:TTLTRG <trigger VXI input>
```

SONET Values

<trigger VXI input> (discrete)	description
NONE	No trigger signals exported (default)
TTL0	Trigger signal exported on line 0
TTL2	Trigger signal exported on line 2
TTL4	Trigger signal exported on line 4
TTL6	Trigger signal exported on line 6

SDH Values

<trigger VXI input> (discrete)	description
NONE	No trigger signals exported (default)
TTL0	Trigger signal exported on line 0
TTL2	Trigger signal exported on line 2
TTL4	Trigger signal exported on line 4
TTL6	Trigger signal exported on line 6

Dependencies None

Errors and Events None

Examples

```
TRIGGER2:TTLTRG TTL0
```

Related Commands None

TRIGger2:TTLTRG?

This query returns the current setting of theVXI TTL trigger lines used to export triggers from the Generator.

Syntax

TRIGger2:TTLTRG?

SONET Response

<trigger VXI input> (discrete)	description
NONE	No trigger signals exported (default)
TTL0	Trigger signal exported on line 0
TTL2	Trigger signal exported on line 2
TTL4	Trigger signal exported on line 4
TTL6	Trigger signal exported on line 6

SDH Response

<trigger VXI input> (discrete)	description
NONE	No trigger signals exported (default)
TTL0	Trigger signal exported on line 0
TTL2	Trigger signal exported on line 2
TTL4	Trigger signal exported on line 4
TTL6	Trigger signal exported on line 6

Dependencies

None

Errors and Events

None

Examples

Query: TRIGGER2:TTLTRG?

Response: TTL2

Related Commands

TRIGger2:TTLTRG

Instrument Control Commands

The Instrument Control commands allow you to access utility functions and settings such as errors, query headers, serial number, system time, date, owner, and operator. This section contains all of the commands and queries for the following Instrument Control subsystem:

- SYSTem

SYSTem Subsystem

This section describes each of the commands and queries that allow you to access general utility functions and settings in the instrument. Figure 3–58 shows the hierarchy tree for this subsystem.

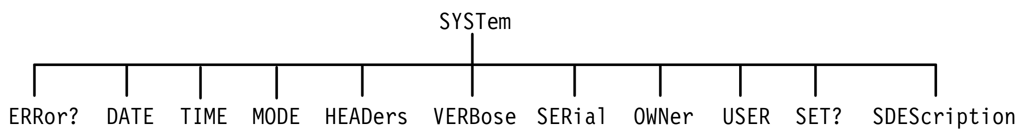


Figure 3–58: SYSTem subsystem

SYSTem:ERRor?

This query returns the errors and events that have accumulated in the instrument. If no errors are present in the instrument, the response is: 0,“No Error”.

Syntax

```
SYSTem:ERRor?
```

SONET Response

<error number> NR1-numeric	**description**
Any integer in the range 0 to 999	This value indicates the error number
<error description> (string)	**description**
Primary error message and, optionally, a secondary error message	This string describes the error

SDH Response

<error number> (NR1-numeric)	description
Any integer in the range 0 to 999	This value indicates the error number
<error description> (string)	**description**
Primary error message and, optionally, a secondary error message	This string describes the error

Dependencies None

Errors and Events See the *Messages* tables in the *Status and Events* section.

Examples Query: `SYSTEM:ERROR?`

Response: 200, "Execution error; Pointer burst active, request ignored"

Related Commands None

SYSTem:DATE

This command sets the date for the instrument.

Syntax `SYSTem:DATE <year>,<month>,<day>`

SONET Values

<year> (NR1-numeric)	description
Any integer in the range 0 to 99	The system year is set to this value
<month> (NR1-numeric)	**description**
Any integer in the range 1 to 12	The system month is set to this value
<day> (NR1-numeric)	**description**
Any integer in the range 1 to 31	The system day is set to this value

SDH Values

<year> (NR1-numeric)	description
Any integer in the range 0 to 99	The system year is set to this value
<month> (NR1-numeric)	**description**
Any integer in the range 1 to 12	The system month is set to this value
<day> (NR1-numeric)	**description**
Any integer in the range 1 to 31	The system day is set to this value

Dependencies None

Errors and Events None

Examples `SYSTEM:DATE 93,12,1`

Related Commands SYSTem:TIME

SYSTem:DATE?

This query returns the date in the instrument.

Syntax `SYSTem:DATE?`

SONET Response

<year> (NR1-numeric)	description
Any integer in the range 0 to 99	The system year is set to this value
<month> (NR1-numeric)	**description**
Any integer in the range 1 to 12	The system month is set to this value
<day> (NR1-numeric)	**description**
Any integer in the range 1 to 31	The system day is set to this value

SDH Response

<year> (NR1-numeric)	description
Any integer in the range 0 to 99	The system year is set to this value
<month> (NR1-numeric)	**description**
Any integer in the range 1 to 12	The system month is set to this value
<day> (NR1-numeric)	**description**
Any integer in the range 1 to 31	The system day is set to this value

Dependencies None

Errors and Events None

Examples Query: `SYSTEM:DATE?`

Response: `95,12,1`

Related Commands SYSTem:DATE

SYSTem:TIME

This command sets the time for the instrument. Time is kept in a 24-hour format.

Syntax `SYSTem:TIME <hour>,<minute>,<second>`

SONET Values

<hour> (NR1-numeric)	description
Any integer in the range 0 to 23	The system hour is set to this value
<minute> (NR1-numeric)	**description**
Any integer in the range 0 to 59	The system minute is set to this value
<second> (NR1-numeric)	**description**
Any integer in the range 0 to 59	The system second is set to this value

SDH Values

<hour> (NR1-numeric)	description
Any integer in the range 0 to 23	The system hour is set to this value
<minute> (NR1-numeric)	**description**
Any integer in the range 0 to 59	The system minute is set to this value
<second> (NR1-numeric)	**description**
Any integer in the range 0 to 59	The system second is set to this value

Dependencies None

Errors and Events None

Examples `SYSTEM:TIME 13,7,56`

Related Commands SYSTem:DATE

SYSTem:TIME?

This query returns the time in the instrument. Time is kept in a 24-hour format.

Syntax `SYSTem:TIME?`

SONET Response

<hour> (NR1-numeric)	description
Any integer in the range 0 to 23	The system hour is set to this value
<minute> (NR1-numeric)	**description**
Any integer in the range 0 to 59	The system minute is set to this value
<second> (NR1-numeric)	**description**
Any integer in the range 0 to 59	The system second is set to this value

SDH Response

<hour> (NR1-numeric)	description
Any integer in the range 0 to 23	The system hour is set to this value
<minute> (NR1-numeric)	**description**
Any integer in the range 0 to 59	The system minute is set to this value
<second> (NR1-numeric)	**description**
Any integer in the range 0 to 59	The system second is set to this value

Dependencies None

Errors and Events None

Examples Query: `SYSTEM:TIME?`

Response: `10,15,3`

Related Commands SYSTem:TIME

SYSTem:MODE

This command sets the operating mode of the instrument. Instrument mode affects the emphasis of the user interface and the defaults that are used at instrument power-on or after the *RST command is given. When you power off the system, the instrument mode setting is saved and used when you power on.

When the SYSTem:MODE command is given, all instrument defaults that are affected by the *RST command are reset to values that are consistent with the mode. See *Appendix E* for a list of default values for each mode.

Syntax `SYSTem:MODE <system mode>`

SONET Values

<system mode> (discrete)	description
SDH	Instrument operates in SDH mode (default)
SONet	Instrument operates in SONET mode

SDH Values

<system mode> (discrete)	description
SDH	Instrument operates in SDH mode (default)
SONet	Instrument operates in SONET mode

Dependencies None

Errors and Events None

Examples `SYSTEM:MODE SDH`

Related Commands *RST

SYSTem:MODE?

This query returns the mode of the instrument.

Syntax `SYSTem:MODE?`

SONET Response

<system mode> (discrete)	description
SDH	Instrument is set to SDH mode (default)
SONet	Instrument is set to SONET mode

SDH Response

<system mode> discrete	description
SDH	Instrument is set to SDH mode (default)
SONet	Instrument is set to SONET mode

Dependencies None

Errors and Events None

Examples

Query: `SYSTEM:MODE?`

Response: `SONETSDH`

Related Commands

SYSTem:MODE

SYSTem:HEADers

This command controls the presence of headers in query responses.

Syntax

`SYSTem:HEADers <system headers>`

SONET Values

<system headers> (boolean)	description
0 or OFF	No system headers are returned (default)
1 or ON	System headers are returned

SDH Values

<system headers> (boolean)	description
0 or OFF	No system headers are returned (default)
1 or ON	System headers are returned

Dependencies

None

Errors and Events

None

Examples

`SYSTEM:HEADERS OFF`

Related Commands

None

SYSTem:HEADers?

This query returns the current setting of header control.

Syntax `SYSTem:HEADers?`

SONET Response

<system headers> (boolean)	description
0	No system headers are returned (default)
1	System headers are returned

SDH Response

<system headers> (boolean)	description
0	No system headers are returned (default)
1	System headers are returned

Dependencies None

Errors and Events None

Examples Query: `SYSTEM:HEADERS 1;SYSTEM:HEADERS?`

Response: `SYST:HEAD 1` **or** `SYSTEM:HEADERS 1`

Related Commands SYSTem:HEADers

SYSTem:VERBose

This command controls the length of headers in query responses. If verbose is ON, the long form of headers is returned. If verbose is OFF, the short form is returned.

Syntax

```
SYSTem:VERBose <system verbose>
```

SONET Values

<system verbose> (boolean)	description
0 or OFF	Short form of headers (default)
1 or ON	Long form of headers

SDH Values

<system verbose> (boolean)	description
0 or OFF	Short form of headers (default)
1 or ON	Long form of headers

Dependencies SYSTem:HEADers must be set to ON for headers to be returned.

Errors and Events None

Examples

```
SYSTEM:VERBOSE OFF
```

Related Commands None

SYSTem:VERBose?

This query returns the current setting of verbose control.

Syntax `SYSTem:VERBose?`

SONET Response

<system verbose> (boolean)	description
0	Short form of headers (OFF) (default)
1	Long form of headers (ON)

SDH Response

<system verbose> (boolean)	description
0	Short form of headers (OFF) (default)
1	Long form of headers (ON)

Dependencies SYSTem:HEADers must be set to ON for headers to be returned.

Errors and Events None

Examples

Query: `SYSTEM:VERBOSE OFF;SYSTEM:VERBOSE?`

Response: `SYST:VERB 0`

Query: `SYSTEM:VERBOSE ON;SYSTEM:VERBOSE?`

Response: `SYSTEM:VERBOSE 1`

Related Commands SYSTem:VERBose

SYSTem:SERial

This command sets the instrument serial number. The factory assigns the serial number; however, you may alter the serial number. Only ASCII alphanumeric characters are accepted.

Syntax

`SYSTem:SERIal <serial number>`

SONET Values

<serial number> (string)	description
Any ASCII string, maximum length of 16	The instrument serial number is set to this value

SDH Values

<serial number> (string)	description
Any ASCII string, maximum length of 16	The instrument serial number is set to this value

Dependencies

None

Errors and Events

None

Examples

`SYSTEM:SERIAL "B010100"`

Related Commands

*IDN?

SYSTem:SERial?

This query returns the instrument serial number.

Syntax

`SYSTem:SERIal?`

SONET Response

<serial number> (string)	description
Any ASCII string, maximum length of 16	The instrument serial number is set to this value

SDH Response

<serial number> (string)	description
Any ASCII string, maximum length of 16	The instrument serial number is set to this value

Dependencies None

Errors and Events None

Examples Query: `SYSTEM:SERIAL?`

Response: `"B010100"`

Related Commands SYSTem:SERIal
*IDN?

SYSTem:OWNer

This command sets the instrument owner. This information is saved in the results buffer.

Syntax `SYSTem:OWNer <system owner>`

SONET Values

<system owner> (string)	description
Any ASCII string, maximum length of 64	The instrument system owner is set to this value

SDH Values

<system owner> (string)	description
Any ASCII string, maximum length of 64	The instrument system owner is set to this value

Dependencies None

Errors and Events None

Examples `SYSTEM:OWNER "The ABC TELECOM COMPANY"`

Related Commands None

SYSTem:OWNer?

This query returns the instrument owner.

Syntax `SYSTem:OWNer?`

SONET Response

<system owner> (string)	description
Any ASCII string, maximum length of 64	The instrument system owner is set to this value

SDH Response

<system owner> (string)	description
Any ASCII string, maximum length of 64	The instrument system owner is set to this value

Dependencies None

Errors and Events None

Examples Query: `SYSTEM:OWNER?`

Response: `"The ABC TELECOM COMPANY"`

Related Commands SYSTem:OWNer

SYSTem:USER

This command sets the instrument operator name. This information is saved in the results buffer and printed in hardcopy reports.

Syntax `SYSTem:USER <operator name>`

SONET Values

<operator name> (string)	description
Any ASCII string, maximum length of 64	The instrument operator name is set to this value

SDH Values

<operator name> (string)	description
Any ASCII string, maximum length of 64	The instrument operator name is set to this value

Dependencies None

Errors and Events None

Examples `SYSTEM:USER "JOHN DOE"`

Related Commands SYSTem:OWNer

SYSTem:USER?

This query returns the instrument operator name.

Syntax `SYSTem:USER?`

SONET Response

<operator name> (string)	description
Any ASCII string, maximum length of 64	The instrument operator name is set to this value

SDH Response

<operator name> (string)	description
Any ASCII string, maximum length of 64	The instrument operator name is set to this value

Dependencies None

Errors and Events None

Examples Query: `SYSTEM:USER?`

Response: `"JOHN DOE"`

Related Commands SYSTem:USER

SYSTem:SET?

This query returns the current instrument state and performs the same function as the *LRN? query.

Syntax `SYSTem:SET?`

SONET Response A list of commands and their parameter values separated by semicolons (;) (see *Appendix D* for a complete list).

SDH Response A list of commands and their parameter values separated by semicolons (;) (see *Appendix D* for a complete list).

Dependencies None

Errors and Events None

Examples Query: `SYSTEM:SET?`

Response:
```
:OUTPUT1:TELECOM:RATE STM1;TYPE ELECTRICAL;LEVEL
XCONNECT;:SOURCE:CLOCK:SOURCE INTERNAL;OFFSET:MODE
LOFFSET;LVALUE 0;:SOURCE:DATA:TELECOM:SOURCE OUTPUT1;
...
```

Related Commands *LRN?

SYSTem:SDEScription

This command sets the description for the stored settings in the current buffer.

Syntax `SYSTem:SDEScription <description>`

SONET Values

<description> (string)	description
Any string, maximum length of 24 characters	Description of the stored strings in the current buffer

SDH Values

<description> (string)	description
Any string, maximum length of 24 characters	Description of the stored strings in the current buffer

Dependencies After you set the description with this command, use the *SAV command to save the description and settings in memory.

Errors and Events None

Examples `SYSTEM:SDESCRIPTION "PASS/FAIL TEST A001"`

Related Commands *SAV
*RCL
MMEMory:STORe:SETTings

SYSTem:SDEScription?

This query returns the description for the stored settings in the current buffer.

Syntax

`SYSTem:SDEScription?`

SONET Response

<description> (string)	description
Any string, maximum length of 24 characters	Description of the stored strings in the current buffer

SDH Response

<description> (string)	description
Any string, maximum length of 24 characters	Description of the stored strings in the current buffer

Dependencies

None

Errors and Events

None

Examples

Query: `SYSTEM:SDESCRIPTION?`

Response: `"PASS/FAIL TEST A001"`

Related Commands

SYSTem:SDEScription

Diagnostic Commands

The Diagnostic commands allow control of the diagnostic self tests provided with your instrument. This section contains all of the commands and queries for the DIAGnostic subsystem.

DIAGnostic Subsystem

This section describes each of the commands and queries that allow access and control of the diagnostic self tests provided with your instrument. Figure 3–59 shows the hierarchy tree for this subsystem.

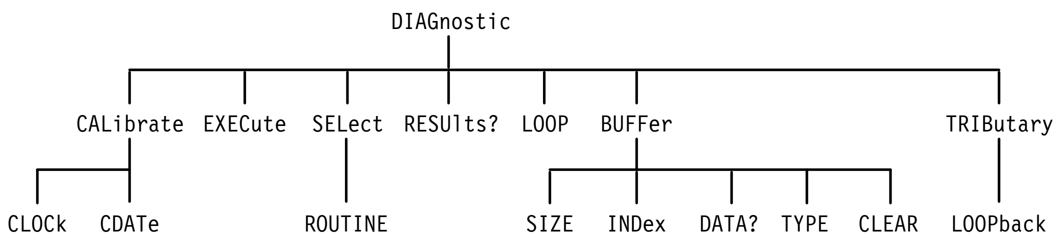


Figure 3–59: DIAGnostic subsystem

DIAGnostic:EXECute

This command executes the selected diagnostic routines and sets the OPC bit when completed. Use DIAGnostic:SELect to select routines to run.

Syntax `DIAGnostic:EXECute`

SONET Values None

SDH Values None

Dependencies The routines executed are determined by the DIAGnostic:SELect command.

Errors and Events

200, “Execution error; Diagnostics invalid while disk or autoscan busy”
402, “Operation complete; Internal diagnostics completed – passed”
402, “Operation complete; Internal diagnostics completed – failed”

Examples

```
DIAGNOSTIC:EXECUTE
```

Related Commands

DIAGnostic:SELect
*TST?

DIAGnostic:SELect

This command selects the diagnostic groups to run when the DIAGnostic:EXECute command is sent.

Syntax

```
DIAGnostic:SELect <diagnostic group>
```

SONET Values

<diagnostic group> (discrete)	description
STANdard	Standard self test; same as the *TST? query (default)
PROCessor	Processor board
PROTocol	Protocol board
CLOCk	Clock generator board
TRIButary	Tributary board (Add/Drop/Test Option Only)
INTERFACE	Line interface module
SYSINTERNAL	Complete system (internal loopback)
SYSEXTERNAL	Complete system (external loopback)
ECL	Option 02 ECL Interface Module (external loopback)

SDH Values

<diagnostic group> (discrete)	description
STANdard	Standard self test; same as the *TST? query (default)
PROCessor	Processor board
PROTocol	Protocol board
CLOCk	Clock generator board
TRIButary	Tributary board (Add/Drop/Test Option Only)

<diagnostic group> (discrete)	description
INTERFACE	Line interface module
SYSINTERNAL	Complete system, internal loopback
SYSEXTERNAL	Complete system, external loopback
ECL	Option 02 ECL Interface Module (external loopback)

Dependencies The external loopback tests require external connections between the transmit and receive connectors.

Errors and Events None

Examples `DIAGNOSTIC:SELECT STANDARD`

Related Commands DIAGnostic:EXECute

DIAGnostic:SELect?

This query reports the diagnostic groups selected to run when the DIAGnostic:EXECute command is sent.

Syntax `DIAGnostic:SELect?`

SONET Response

<diagnostic group> (discrete)	description
STANdard	Standard self test (default)
PROCessor	Processor board
PROTocol	Protocol board
CLOCk	Clock generator board
TRIButary	Tributary board (Add/Drop/Test Option Only)
INTERFACE	Line interface module
SYSINTERNAL	Complete system, internal loopback
SYSEXTERNAL	Complete system, external loopback
ECL	Option 02 ECL Interface Module (external loopback)

SDH Response

<diagnostic group> (discrete)	description
STANdard	Standard self test (default)
PROCessor	Processor board
PROTocol	Protocol board
CLOCk	Clock generator board
TRIButary	Tributary board (Add/Drop/Test Option Only)
INTERFACE	Line interface module
SYSINTERNAL	Complete system (internal loopback)
SYSEXTERNAL	Complete system (external loopback)
ECL	Option 02 ECL Interface Module (external loopback)

Dependencies

External loopback tests require external connections between the transmit and receive connections.

Errors and Events

None

Examples

Query: `DIAGNOSTIC:SELECT?`

Response: `STANDARD`

Related Commands

DIAGnostic:SELect

DIAGnostic:SELect:ROUTINE

CAUTION. *To avoid disabling your VX4610 or its interface modules or Add/Drop/ Test Modules, do not run the diagnostic routines described here unless you are qualified to perform service or maintenance on this product.*

This command selects the diagnostic routines to run when the DIAGnostic:EXECute command is sent.

Syntax

```
DIAGnostic:SELect:ROUTINE <diagnostic routine>
```

SONET Values

<diagnostic routine> (discrete)	description
These commands are intended for, and restricted to, Service and Maintenance use.	

SDH Values

<diagnostic routine> (discrete)	description
These commands are intended for, and restricted to, Service and Maintenance use.	

Dependencies

Errors and Events None

Examples

```
DIAGNOSTIC:SELECT:ROUTINE
```

Related Commands DIAGnostic:EXECute

DIAGnostic:RESults?

This query returns the results from the last diagnostics execution. Diagnostics could have run at the power-on self test or as a result of sending the DIAGnostic:EXECute command or *TST? query.

Sending any SCPI-derived or IEEE 488.2 Common Command while the diagnostics are running will stop the diagnostics. Use the DIAGnostic:RESults? query to determine if the selected diagnostic test passed or failed.

Syntax

`DIAGnostic:RESults?`

SONET Response

<diagnostic results> (discrete)	description
PASSED	Test passed
FAILED	Test failed

SDH Response

<diagnostic results> (discrete)	description
PASSED	Test passed
FAILED	Test failed

Dependencies

None

Errors and Events

None

Examples

Query: `DIAGNOSTIC:RESULTS?`

Response: `PASSED`

Related Commands

DIAGnostic:SELect
DIAGnostic:EXECute

DIAGnostic:LOOP

This command specifies the looping control for diagnostic routines when started with the DIAGnostics:EXECute command.

Syntax

```
DIAGnostic:LOOP <loop control>
```

SONET Values

<loop control> (discrete)	description
ONCE	One pass (default)
TEN	Loop ten times
THOUSAND	Loop one thousand times
ERROR	Loop until an error is detected
FOREver	Loop until any command is sent

SDH Values

<loop control> (discrete)	description
ONCE	One pass (default)
TEN	Loop ten times
THOUSAND	Loop one thousand times
ERROR	Loop until an error is detected
FOREver	Loop until any command is sent

Dependencies None

Errors and Events None

Examples

```
DIAGNOSTIC:LOOP TEN
```

Related Commands DIAGnostic:EXECute

DIAGnostic:LOOP?

This query returns the current setting of the looping control used for diagnostic routines started with the DIAGnostics:EXECute command.

Syntax `DIAGnostic:LOOP?`

SONET Values

<loop control> (discrete)	description
ONCE	One pass (default)
TEN	Loop ten times
THOUSAND	Loop one thousand times
ERROR	Loop until error detected
FOREver	Loop until any command is sent

SDH Values

<loop control> (discrete)	description
ONCE	One pass (default)
TEN	Loop ten times
THOUSAND	Loop one thousand times
ERROR	Loop until error detected
FOREver	Loop until any command is sent

Dependencies None

Errors and Events None

Examples Query: `DIAGNOSTIC:LOOP?`

Response: `ONCE`

Related Commands DIAGnostic:LOOP

DIAGnostic:BUFFer:SIZE?

This query returns the number of entries in the diagnostic results buffer. The <buffer size> is the maximum value you can use in the DIAGnostic:BUFFer: INDex command.

Syntax

```
DIAGnostic:BUFFer:SIZE?
```

SONET Response

<buffer size> (NR1-numeric)	description
Any integer	The number of entries in the results buffer (0 indicates that no errors were found in the diagnostics)

SDH Response

<buffer size> (NR1-numeric)	description
Any integer	The number of entries in the results buffer (0 indicates that no errors were found in the diagnostics)

Dependencies

None

Errors and Events

None

Examples

Query: `DIAGNOSTIC:BUFFER:SIZE?`

Response: 5

Related Commands

DIAGnostic:BUFFer:INDex

DIAGnostic:BUFFer:INDex

This command selects the results buffer that is used by the DIAGnostic: BUFFer:DATA? query. The <buffer number> must be less than or equal to the <buffer size> value returned from the DIAGnostic:BUFFer:SIZE? query. When the DIAGnostic:EXECute command is given, the <buffer number> is reset to 1.

Syntax

```
DIAGnostic:BUFFer:INDex <buffer number>
```

SONET Values

<buffer number> (NR1-numeric)	description
Any integer; must be less than or equal to the integer returned from the DIAGnostic:BUFFer: SIZE? query	Buffer used by the DIAGnostic:BUFFer: DATA? query (default = 1)

SDH Values

<buffer number> (NR1-numeric)	description
Any integer; must be less than or equal to the integer returned from the DIAGnostic:BUFFer: SIZE? query	Buffer used by the DIAGnostic:BUFFer: DATA? query (default = 1)

Dependencies

None

Errors and Events

None

Examples

```
DIAGNOSTIC:BUFFER:INDEX 1
```

Related Commands

DIAGnostic:BUFFer:SIZE?
DIAGnostic:BUFFer:DATA?
DIAGnostic:BUFFer:EXECute

DIAGnostic:BUFFer:INDex?

This query indicates the currently selected results buffer that is used by the DIAGnostic:BUFFer:DATA? query. When the DIAGnostic:EXECute command is given, the <buffer number> is reset to 1.

Syntax

```
DIAGnostic:BUFFer:INDEX?
```

SONET Response

<buffer number> (NR1-numeric)	description
Any integer	This buffer number is used by the DIAGnostic: BUFFer:DATA? query (default = 1)

SDH Response

<buffer number> (NR1-numeric)	description
Any integer	This buffer number is used by the DIAGnostic: BUFFer:DATA? query (default = 1)

Dependencies

None

Errors and Events

None

Examples

Query: `DIAGNOSTIC:BUFFER:INDEX?`

Response: 1

Related Commands

DIAGnostic:BUFFer:INDex

DIAGnostic:BUFFer:DATA?

This query returns a detailed description of the diagnostic results from the selected results buffer. Use the DIAGnostic:BUFFer:SIZE? query to determine the number of buffers of results information. Use the DIAGnostic:BUFFer:INDex command to select a buffer.

Syntax

`DIAGnostic:BUFFer:DATA?`

SONET Response

<diagnostic description> (string)	description
An ASCII string, maximum length 160	A detailed description of the diagnostic results

SDH Response

<diagnostic description> (string)	description
An ASCII string, maximum length 160	A detailed description of the diagnostic results

Dependencies

None

Errors and Events

None

Examples

Query: `DIAGNOSTIC:BUFFER:DATA?`

Response: `"MEMORY TEST FAILED – WROTE AA READ 55"`

Related Commands

DIAGnostic:BUFFer:INDex
DIAGnostic:SELect
DIAGnostic:EXECute

DIAGnostic:BUFFer:TYPE

This command selects the output buffer mode used by the DIAGnostics to buffer the test results. The result includes responses to the diagnostic queries SIZE?, INDex? and DATA? and is in integer form.

Syntax

```
DIAGnostic:BUFFer:TYPE <buffer type>
```

SONET Values

<buffer type> (discrete)	description
TESTS	Selects the TESTS output buffer mode. The diagnostic results are stored in the buffer with a detailed description of the diagnostic failure, which can be returned as an ASCII string.
ERRLOG	Selects the error log output mode. The Error Log is a history of all the diagnostics tests that have been executed since the last time the log was cleared. Listed below are all of the events which are currently expected to reside in the error log: *Diagnostic Failures (Both Self–Test and the Extended Diags)

SDH Values

<buffer type> (discrete)	description
TESTS	Selects the TESTS output buffer mode. The diagnostic results are stored in the buffer with a detailed description of the diagnostic failure, which can be returned as an ASCII string.
ERRLOG	Selects the error log output mode. The Error Log is a history of all the diagnostics tests that have been executed since the last time the log was cleared. Listed below are all of the events which are currently expected to reside in the error log: *Diagnostic Failures (Both Self–Test and the Extended Diags)

Dependencies None

Errors and Events None

Examples `DIAGNOSTIC:BUFFer:TYPE TESTS`

Related Commands DIAGnostic:BUFFer:TYPE?

DIAGnostic:BUFFer:TYPE?

This query reports the current output buffer mode used by the DIAGnostics for the test results.

Syntax `DIAGnostic:BUFFer:TYPE?`

SONET Response

<buffer type> (discrete)	description
TESTS	The TESTS output buffer mode. The diagnostic results are stored in the buffer with a detailed description of the diagnostic failure, which can be returned as an ASCII string.
ERRLOG	The error log output mode. The Error Log is a history of all the diagnostics tests that have been executed since the last time the log was cleared. Listed below are all of the events which are currently expected to reside in the error log: *Diagnostic Failures (Both Self–Test and the Extended Diags)

SDH Response

<buffer type> (discrete)	description
TESTS	The TESTS output buffer mode. The diagnostic results are stored in the buffer with a detailed description of the diagnostic failure, which can be returned as an ASCII string.
ERRLOG	The error log output mode. The Error Log is a history of all the diagnostics tests that have been executed since the last time the log was cleared. Listed below are all of the events which are currently expected to reside in the error log: *Diagnostic Failures (Both Self–Test and the Extended Diags)

Dependencies None

Errors and Events None

Examples Query: `DIAGNOSTIC:BUFFER:TYPE?`

Response: `TESTS`

Related Commands DIAGnostic:BUFFer:TYPE
DIAGnostic:BUFFer:DATA?

DIAGnostic:BUFFer:CLEAR

This command clears the contents of the selected buffer.

Syntax `DIAGnostic:BUFFer:CLEAR`

SONET Values None

SDH Values None

Dependencies None

Errors and Events None

Examples `DIAGNOSTIC:BUFFER:CLEAR`
`DIAGNOSTIC:BUFFER:DATA?`

Response: `"No Failures"`

Related Commands DIAGnostic:BUFFer:SIZE?
DIAGnostic:BUFFer:DATA?

DIAGnostic:CALibrate:CDATe

This command sets the date of the last internal clock calibration.

Syntax

```
DIAGnostic:CALibrate:CDATe <date_string>
```

SONET Values

<date string> (string)	description
An ASCII string, maximum length 8	Date information in <year>,<month>,<day>.

SDH Values

<date string> (string)	description
An ASCII string, maximum length 8	Date information in <year>,<month>,<day>.

Dependencies None

Errors and Events None

Examples

```
DIAGNOSTIC:CALIBRATE:CDATE 97,1,1
```

Related Commands

DIAGnostic:CALibrate:CDATE?
DIAGnostic:CALibrate:CLOCk

DIAGnostic:CALibrate:CDATe?

This query returns the last internal clock calibration.

Syntax `DIAGnostic:CALibrate:CDATe?`

SONET Response

<date string> (string)	description
An ASCII string, maximum length 8	Date information in <year>,<month>,<day>.

SDH Response

<date string> (string)	description
An ASCII string, maximum length 8	Date information in <year>,<month>,<day>.

Dependencies None

Errors and Events None

Examples `DIAGNOSTIC:CALIBRATE:CDATE?`

Response: `97,1,1`

Related Commands DIAGnostic:CALibrate:CDATE
DIAGnostic:CALibrate:CLOCk

DIAGnostic:CALibrate:CLOCk

This command sets the clock calibration offset constant in parts per million (PPM) if the clock hardware is present. Limits are 10.0 to –10.0.

Syntax

```
DIAGnostic:CALibrate:CLOCk <offset_data>
```

SONET Values

<offset_data> (string)	description
An ASCII string, maximum length 5	Offset value in PPM

SDH Values

<offset_data> (string)	description
An ASCII string, maximum length 5	Offset value in PPM

Dependencies None

Errors and Events None

Examples

```
DIAGNOSTIC:CALIBRATE:CLOCK 05.00
```

Related Commands

DIAGnostic:CALibrate:CLOCk?
DIAGnostic:CALibrate:CDATE

DIAGnostic:CALibrate:CLOCk?

This query returns the clock calibration offset constant in parts per million (PPM) if the clock hardware is present. Limits are 10.0 to –10.0.

Syntax

`DIAGnostic:CALibrate:CLOCk?`

SONET Values

<time_string> (string)	description
An ASCII string, maximum length 5	

SDH Values

<time_string> (string)	description
An ASCII string, maximum length 5	

Dependencies

None

Errors and Events

None

Examples

`DIAGNOSTIC:CALIBRATE:CLOCK?`

Response: `5.00`

Related Commands

DIAGnostic:CALibrate:CLOCk
DIAGnostic:CALibrate:CDATe

DIAGnostic:TRIButary:LOOPBack

This command turns on or off the tributary external loopback mode.

Syntax

```
DIAGnostic:TRIButary:LOOPBack <loopback>
```

SONET Values

<loopback> (boolean)	description
OFF	Loopback is off.
ON	Loopback is on.

SDH Values

<loopback> (boolean)	description
OFF	Loopback is off.
ON	Loopback is on.

Dependencies

None

Errors and Events

None

Examples

```
DIAGNOSTIC:TRIBUTARY:LOOPBACK ON
```

Related Commands

DIAGnostic:TRIButary:LOOPBack?

DIAGnostic:TRIButary:LOOPBack?

This query returns the current setting of tributary external loopback.

Syntax

```
DIAGnostic:TRIButary:LOOPBack?
```

SONET Values

<loopback> (boolean)	description
OFF	Loopback is off
ON	Loopback is on

SDH Values

<loopback> (boolean)	description
OFF	Loopback is off
ON	Loopback is on

Dependencies

None

Errors and Events

None

Examples

```
DIAGNOSTIC:TRIBUTARY:LOOPBACK?
```

Response: `ON`

Related Commands

DIAGnostic:TRIButary:LOOPBack

Common Commands

This section describes each of the IEEE 488.2 Common Commands in detail. See page 3–9 for information on reading the <decimal value> tables contained in this section.

*CLS

This command clears all status registers and error queues.

Syntax `*CLS`

SONET Values None

SDH Values None

Dependencies None

Errors and Events None

Examples `*CLS`

Related Commands None

*ESE

This command sets the contents of the Event Status Enable Register. This register controls the reporting of specific errors through the status register and the interrupt mechanism.

Syntax `*ESE <decimal value>`

SONET Values

<decimal value> (NR1-numeric)	bit	definition
1	0	Operation complete
2	1	Request control

<decimal value> (NR1-numeric)	bit	definition
4	2	Query error
8	3	Device dependent error
16	4	Execution error
32	5	Command error
64	6	User request
128	7	Power on

SDH Values

<decimal value> (NR1-numeric)	bit	definition
1	0	Operation complete
2	1	Request control
4	2	Query error
8	3	Device dependent error
16	4	Execution error
32	5	Command error
64	6	User request
128	7	Power on

Dependencies

None

Errors and Events

None

Examples

`*ESE 16`

Related Commands

*ESE?

*ESE?

This query returns the contents of the Event Status Enable Register.

Syntax `*ESE?`

SONET Response

<decimal value> (NR1-numeric)	bit	definition
1	0	Operation complete
2	1	Request control
4	2	Query error
8	3	Device dependent error
16	4	Execution error
32	5	Command error
64	6	User request
128	7	Power on

SDH Response

<decimal value> (NR1-numeric)	bit	definition
1	0	Operation complete
2	1	Request control
4	2	Query error
8	3	Device dependent error
16	4	Execution error
32	5	Command error
64	6	User request
128	7	Power on

Dependencies None

Errors and Events None

Examples Query: `*ESE?`

Response: `64`

Related Commands *ESE

*ESR?

This query returns the contents of the Standard Event Status Register. This register shows the status of general instrument-related events as bits encoded into a number.

Syntax `*ESR?`

SONET Response

<decimal value> (NR1-numeric)	bit	definition
1	0	Operation complete
2	1	Request control
4	2	Query error
8	3	Device dependent error
16	4	Execution error
32	5	Command error
64	6	User request
128	7	Power on

SDH Response

<decimal value> (NR1-numeric)	bit	definition
1	0	Operation complete
2	1	Request control
4	2	Query error
8	3	Device dependent error
16	4	Execution error
32	5	Command error
64	6	User request
128	7	Power on

Dependencies None

Errors and Events None

Examples

Query: `*ESR?`

Response: `64`

Related Commands *ESE

*IDN?

This query returns the identity of the instrument.

Syntax `*IDN?`

SONET Response <manufacturer>,<model>,<serial number>,<firmware version>

SDH Response <manufacturer>,<model>,<serial number>,<firmware version>

Dependencies None

Errors and Events None

Examples

Query: `*IDN?`

Response: `TEKTRONIX,VX4610,B010000,CF:91.1C FV1.10`

Related Commands None

*LRN?

This query returns an ASCII representation of the current instrument setup.

Syntax `*LRN?`

SONET Response A list of commands and their parameter values separated by semicolons (;) (see *Appendix D* for a complete list).

SDH Response A list of commands and their parameter values separated by semicolons (;) (see *Appendix D* for a complete list).

Dependencies None

Errors and Events None

Examples Query: `*LRN?`

Response: `":OUTPUT1:TELECOM:RATE STM1;TYPE ELECTRICAL;LEVEL XCONNECT;:SOURCE:CLOCK:SOURCE INTERNAL;OFFSET:MODE LOFFSET;LVALUE 0;:SOURCE:DATA:TELECOM:SOURCE OUTPUT1; ..."`

Related Commands None

*RST

This command resets the instrument and puts it into a default state, which is independent of past historical setups. *Appendix E* summarizes the effect of *RST on the instrument; the effect is determined by SYTem:MODE. This command sets the Operation Complete bit in the Standard Event Status Register.

Syntax `*RST`

SONET Values None

SDH Values None

Dependencies None

Errors and Events 402, “Operation complete; Instrument factory reset complete”

Examples `*RST`

Related Commands None

*SRE

This command sets the contents of the Service Request Enable Register. This register controls the reporting of specific errors through the status register and the interrupt mechanism.

Syntax

```
*SRE <decimal value>
```

SONET Values

<decimal value> (NR1-numeric)	bit	definition
1	0	Not used
2	1	Not used
4	2	Not used
8	3	Not used
16	4	Message available
32	5	Event status summary
64	6	Not used
128	7	Not used

SDH Values

<decimal value> (NR1-numeric)	bit	definition
1	0	Not used
2	1	Not used
4	2	Not used
8	3	Not used
16	4	Message available
32	5	Event status summary
64	6	Not used
128	7	Not used

Dependencies None

Errors and Events None

Examples

```
*SRE 64
```

Related Commands *SRE?

*SRE?

This query returns the contents of the Service Request Enable Register.

Syntax `*SRE?`

SONET Response

<decimal value> (NR1-numeric)	bit	definition
1	0	Not used
2	1	Not used
4	2	Not used
8	3	Not used
16	4	Message available
32	5	Event status summary
64	6	Not used
128	7	Not used

SDH Response

<decimal value> (NR1-numeric)	bit	definition
1	0	Not used
2	1	Not used
4	2	Not used
8	3	Not used
16	4	Message available
32	5	Event status summary
64	6	Not used
128	7	Not used

Dependencies None

Errors and Events None

Examples

Query: `*SRE?`

Response: `64`

Related Commands

*SRE

*STB?

This query returns the contents of the Status Byte Register.

Syntax

`*STB?`

SONET Response

<decimal value> (NR1-numeric)	bit	definition
1	0	Not used
2	1	Not used
4	2	Error/event queue not empty
8	3	Not used
16	4	Message available
32	5	Event status summary
64	6	Request service/Master status summary
128	7	Not used

SDH Response

<decimal value> (NR1-numeric)	bit	definition
1	0	Not used
2	1	Not used
4	2	Error/event queue not empty
8	3	Not used
16	4	Message available
32	5	Event status summary
64	6	Request service/Master status summary
128	7	Not used

Dependencies None

Errors and Events None

Examples Query: `*STB?`

Response: `64`

Related Commands *SRE
*SRE?

*OPC

This command causes the instrument to generate the Operation Complete message in the Standard Event Status Register when all pending instrument operations have been finished.

Syntax `*OPC`

SONET Values None

SDH Values None

Dependencies None

Errors and Events None

Examples `*OPC`

Related Commands *OPC?

*OPC?

This query returns a 1 when all pending device operations have finished.

Syntax `*OPC?`

SONET Response `1`

SDH Response `1`

Dependencies None

Errors and Events None

Examples Query: `*OPC?`

Response: `1`

Related Commands None

*OPT?

This query returns the installed hardware options and the instrument and option configuration information. <option name> is repeated for each option; <instrument configuration> and <option configuration> are listed only once.

Syntax `*OPT?`

SONET Response `<option name>,<instrument configuration>,<option configuration>`

SDH Response `<option name>,<instrument configuration>,<option configuration>`

Dependencies None

Errors and Events None

Examples

Query: `*OPT?`

Response: `"OPT/ELEC: 55/155/622,E1/E3/E4: ADD/DROP/TEST, [C201:P-:K0:X2.93],[I13:T3:TX0.318:J-]"`

Related Commands

None

*RCL

This command recalls the instrument state from an internal storage buffer. Five buffers are available for use. This command sets the Operation Complete bit in the Standard Event Status Register.

Syntax

`*RCL <buffer number>`

SONET Values

<buffer number>	description
1 to 5	Storage buffers 1 to 5

SDH Values

<buffer number>	description
1 to 5	Storage buffers 1 to 5

Dependencies

None

Errors and Events

230, “Data corrupt or stale; Recall buffer is empty”
221, “Settings conflict; Internal buffer is empty”

Examples

`*RCL 1`

Related Commands

*SAV

*SAV

This command saves the instrument state into an internal storage buffer. Five buffers are available for use. This command sets the Operation Complete bit in the Standard Event Status Register.

Syntax

`*SAV <buffer number>`

SONET Values

<buffer number>	description
1 to 5	Storage buffers 1 to 5

SDH Values

<buffer number>	description
1 to 5	Storage buffers 1 to 5

Dependencies

None

Errors and Events

None

Examples

`*SAV 1`

Related Commands

*RCL

*TST?

This query invokes the instrument self-test routines and returns the result when they complete. The OPC bit in the Standard Event Status Register is set when the self-test routines are complete.

Syntax

`*TST?`

SONET Response

<test results>	description
0	Test complete and successful
1	Test complete and failed

SDH Response

<test results>	description
0	Test complete and successful
1	Test complete and failed

Dependencies

None

Errors and Events

402, "Operation complete; Internal diagnostics completed – passed"
402, "Operation complete; Internal diagnostics completed – failed"

Examples

Query: `*TST?`

Response: `0`

Related Commands

DIAGnostics:RESults?
DIAGnostics:EXECute

*WAI

This command prevents any commands or queries from executing until the command that is currently executing sets the OPC bit.

Syntax `*WAI`

SONET Values None

SDH Values None

Dependencies None

Errors and Events None

Examples `*WAI`

Related Commands None

Status and Events

Status and Events

The Status and Event Reporting System reports asynchronous events and errors that occur in the VX4610 SDH/SONET Generator/Receiver. This system consists of four 8-bit registers and two queues that you access through the command language. You can use these registers and queues to query the instrument status and control the interrupts that report events.

In general, after an interrupt occurs, first conduct a serial poll, query the registers to see why the interrupt occurred, and then send the SYSTem:ERROr? query to see a descriptive error message.

This section describes the four registers and two queues of the Status and Event Reporting System. For each register, you are given a description, a table describing all of the bits, and an example of how to use the register. Also described in this section is the Status and Event Reporting process, synchronizing programming commands, and the system messages.

Status and Event Reporting System

The Status and Event Reporting System monitors and reports such events as an error occurring or the availability of a response to a query. This system includes descriptions of the following registers and queues:

- Status Byte Register
- Service Request Enable Register
- Standard Event Status Register
- Event Status Enable Register
- Output Queue
- System Error and Event Queue

Status Byte Register

The Status Byte Register, shown in Table 4–1, summarizes information from other registers. Use a serial poll or a *STB? query to read the contents of the Status Byte Register. The response is the sum of the decimal values for all bits set. When you use a serial poll, bit 6 shows Request Service information. When you use the *STB? query, bit 6, the Master Status Summary bit, indicates that bits 4 or 5 may be set. Using the *STB? query clears all bits in the Status Byte Register.

Table 4–1: The Status Byte Register

Bit	Decimal value	Function
0–1	–	Not used
2	4	**Error/Event Queue not empty** indicates that information is contained in the error/event queue and is waiting to be read.
3	–	Not used
4	16	**Message Available** shows that output is available in the Output Queue.
5	32	**Event Status Bit** indicates that one or more events have occurred and the corresponding bits in the Standard Event Status Register have been set.
6	64	**Request Service** (obtained from a serial poll) shows that the VX4610 has requested service from the GPIB controller. **Master Status Summary** (obtained from *STB? query) summarizes the event status bit and message available bits in the Status Byte Register.
7	–	Not used

A common example of using the Status Byte Register is to enable only the Event Status and Request Service bits. Enable bits 5 and 6 using the Service Request Enable Register (see the next section for information about this register). If the *STB? query returns a value of 96, bit 5 (decimal value of 32) and bit 6 (decimal value of 64) have been set (giving a decimal value sum of 96). Bit 5 indicates that information is available in the Standard Event Status Register, and bit 6 indicates that bits 4 or 5 are set in the Status Byte Register.

Service Request Enable Register

The Service Request Enable Register, shown in Table 4–2, controls which bits in the Status Byte Register will generate a service request. Use the *SRE command to set bits in the Service Request Enable Register. Use the *SRE? query to see which bits in this register are enabled. The response from this query is the sum of the decimal values for all bits set.

Table 4–2: The Service Request Enable Register

Bit	Decimal value	Function
0–3	–	Not used
4	16	**Message Available** indicates that a message available will generate a service request.

Table 4–2: The Service Request Enable Register (cont.)

Bit	Decimal value	Function
5	32	**Event Status Bit** indicates that events summarized in bit 5 of the Status Byte Register will generate a service request.
6–7	–	Not used

If, for example, the *SRE? query returns a value of 48, bits 4 and 5 are set in the Service Request Enable Register. Any event that causes the Message Available bit (bit 4) or Event Status bit (bit 5) to be set in the Status Byte Register now generates an interrupt. If you want an interrupt to be generated only when the Event Status bit (bit 5) is set, use the *SRE 32 command.

Standard Event Status Register

The Standard Event Status Register, shown in Table 4–3, records many types of events that can occur in the VX4610. Use the *ESR? query to read the contents of this register. The response is the sum of the decimal values for all bits set. Reading this register clears all bits so the register can accumulate information about new events.

Table 4–3: The Standard Event Status Register

Bit	Decimal value	Function
0	1	**Operation Complete** shows that the operation is complete. This bit is set when all pending operations complete following a *OPC command. Table C–1 in the Appendix lists the commands and queries that set the OPC bit upon completion of execution.
1	–	Not used
2	4	**Query Error** shows that the VX4610 attempted to read the Output Queue when no data was present or pending, or that data in the Output Queue was lost.
3	8	**Device Dependent Error** shows that a device error occurred. Table 4–7 on page 4–10 lists the device error messages.
4	16	**Execution Error** shows that an error occurred while the VX4610 was executing a command or query. Table 4–6 on page 4–9 lists the execution error messages.
5	32	**Command Error** shows that an error occurred while the VX4610 was parsing a command or query. Table 4–5 on page 4–8 lists the command error messages.
6	–	Not used
7	128	**Power On** shows that the VX4610 was powered on. The completion of the diagnostic tests also sets this bit.

The following example assumes that all bits have been enabled using the Event Status Enable Register (see the next section for information about this register). If a *ESR? query returns a value of 128, bit 7 (decimal value of 128) is set indicating that the instrument is in the initial power-on state.

Table C–1 in the Appendix lists the commands and queries that set the OPC bit (bit 0 of the Standard Event Status Register) upon completion of execution. Some of these commands and queries may require more than 200 ms to complete execution.

Event Status Enable Register

The Event Status Enable Register, shown in Table 4–4, controls which events are summarized in the event status bit (bit 5) of the Status Byte Register. Note that the Event Status Enable Register has the same content as the Standard Event Status Register. Use the *ESE command to set bits in the Event Status Enable Register. Use the *ESE? query to see what bits in the Event Status Enable Register are set. The response from this query is the sum of the decimal values for all bits summarized in the event status bit of the Status Byte Register.

Table 4–4: The Event Status Enable Register

Bit	Decimal value	Function
0	1	**Operation Complete** shows that the operation is complete. This bit is set when all pending operations complete following a *OPC command. Table C–1 in the Appendix lists the commands and queries that set the OPC bit upon completion of execution.
1	–	Not used
2	4	**Query Error** shows that the VX4610 attempted to read the Output Queue when no data was present or pending, or that data in the Output Queue was lost.
3	8	**Device Dependent Error** shows that a device error occurred. Table 4–7 on page 4–10 lists the device error messages.
4	16	**Execution Error** shows that an error occurred while the VX4610 was executing a command or query. Table 4–6 on page 4–9 lists the execution error messages.
5	32	**Command Error** shows that an error occurred while the VX4610 was parsing a command or query. Table 4–5 on page 4–8 lists the command error messages.
6	–	Not used
7	128	**Power On** shows that the VX4610 was powered on. The completion of the diagnostic tests also sets this bit.

If, for example, the *ESE? query returns a value of 255, all bits are set indicating that all events will set the event status bit (bit 5) of the Status Byte Register.

The Output Queue

The VX4610 stores query responses in the Output Queue. It empties this queue each time it receives a new command or query message after an End Of Message (EOM). The controller must read a query response before it sends the next command (or query) or it loses responses to earlier queries.

***NOTE**. When a controller sends a query, an EOM, and a second query, the VX4610 normally clears the first response and outputs the second while reporting a Query Error (bit 2 in the Standard Event Status Register) to indicate the lost response.*

The System Error and Event Queue

The VX4610 error and event messages are stored in the System Error and Event Queue. Use the SYSTem:ERROr? query to get the event number and a text description of the event. Reading an event removes it from the queue. The Event Queue stores detailed information for up to 20 events; the events are stored in first-in first-out order.

Before reading an event from the Event Queue, use the *ESR? query to read the summary of the event from the Standard Event Status Register. The events summarized by the *ESR? query are made available to the SYSTem:ERROr? query, and the Standard Event Status Register is emptied.

Reading the Standard Event Status Register erases any events that were summarized by previous *ESR? queries but not read from the Event Queue. Events that follow an *ESR? query are put in the Event Queue but are not available until *ESR? is given again.

Status and Event Reporting Process

Figure 4–1 shows how to use the Status and Event Reporting system. In the explanation that follows, numbers in parentheses refer to the circled numbers in Figure 4–1.

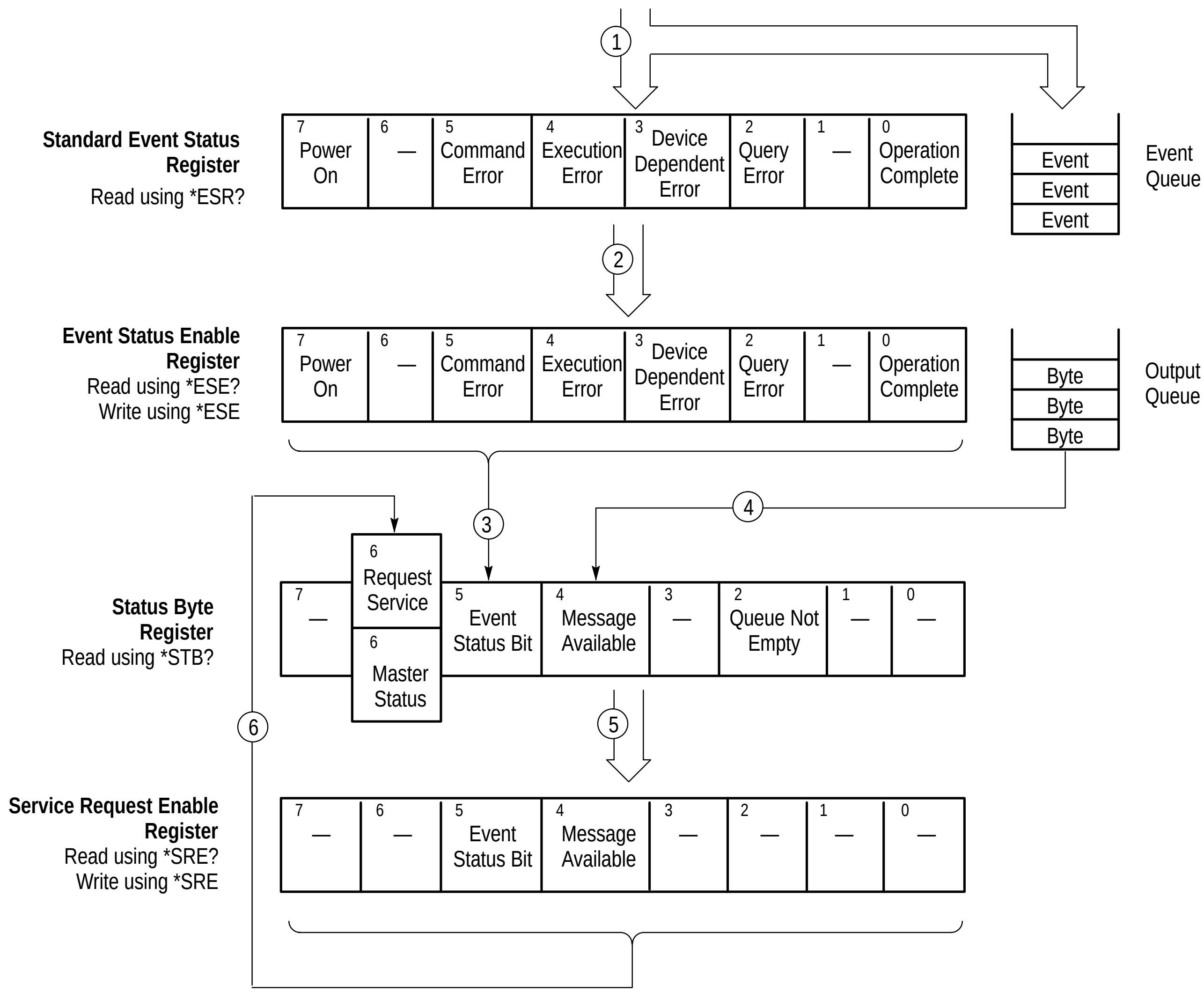


Figure 4–1: Status and event reporting process

When an event occurs the appropriate bit in the Standard Event Status Register is set to one and the event is recorded in the Event Queue (1). If the corresponding bit in the Event Status Enable Register is also enabled (2), then the event status bit in the Status Byte Register is set to one (3).

When output is sent to the Output Queue (for example, a response to a query), the message available bit in the Status Byte Register is set to one (4).

When a bit in the Status Byte Register is set to one and the corresponding bit in the Service Request Enable Register is enabled (5), the master status summary bit in the Status Byte Register is set to one and a service request is generated (6).

Synchronization Methods

Although most GPIB commands are completed almost immediately after being received by the VX4610, some commands initiate processes requiring additional time. For example, after you send a SENSe:DATA:TELecom:AUTOscan command, you must wait until it has completed execution before you give another command or query.

Sometimes the result of an operation depends on the result of an earlier operation (the first operation must be completed before the next one is initiated). The status and event reporting system of the VX4610 provides this capability.

Using the *OPC? Query

Use the *OPC? query to synchronize commands. The *OPC? query places a 1 in the Output Queue once an operation is complete. A timeout could occur if you try to read the output queue before there is any data in it.

The same command sequence using the *OPC? query for synchronization looks like this:

```
/* Set up a chained message */
SENSE:DATA:TELECOM:AUTOSCAN;*OPC?
```

Messages

The VX4610 generates error messages in response to events caused by commands or queries. Each type of event sets a specific bit in the Standard Event Status Register. Thus, each message is associated with a specific Standard Event Status Register bit. In the message tables that follow, the associated Standard Event Status Register bit is specified in the table title. Not shown in the tables are secondary messages giving more detail about the cause of the error or the meaning of the message. These secondary messages are shown for each command and query in *Syntax and Commands*.

Table 4–5 shows the error messages generated by improper command syntax. Check to see that the command is properly formatted and that it follows the rules in *Syntax and Commands*.

Table 4–5: Command error messages (bit 5 in Standard Event Status Register)

Code	Message
100	Command error
101	Invalid character
102	Syntax error
103	Invalid separator
104	Data type error
105	Get not allowed
106	Invalid program data separator
108	Parameter not allowed
109	Missing parameter
110	Command header error
111	Header separator error
112	Mnemonic too long
113	Undefined header
118	Query not allowed
120	Numeric data error
121	Invalid char in number
123	Exponent too large
124	Too many digits
128	Numeric data not allowed
130	Suffix error
131	Invalid suffix
134	Suffix too long

Table 4–5: Command error messages (bit 5 in Standard Event Status Register) (cont.)

Code	Message
138	Suffix not allowed
140	Character data error
141	Invalid character data
144	Character data too long
148	Character data not allowed
150	String data error
151	Invalid string data
158	String data not allowed
160	Block data error
161	Invalid block data
168	Block data not allowed

Table 4–6 lists the execution error messages that can occur during execution of a command.

Table 4–6: Execution error messages (bit 4 in Standard Event Status Register)

Code	Message
200	Execution error
220	Parameter error
221	Settings conflict
222	Data out of range
223	Too much data
224	Illegal parameter value
230	Data corrupt or stale
240	Hardware error
241	Hardware missing
250	Mass storage error
252	Missing mass storage
252	Missing media
253	Corrupt media
254	Media full
255	Directory full
256	File name not found

Table 4–6: Execution error messages (bit 4 in Standard Event Status Register) (cont.)

Code	Message
257	File name error
258	Media protected

Table 4–7 lists the device dependent error messages that can occur during VX4610 operation.

Table 4–7: Device dependent error messages (bit 3 in Standard Event Status Register)

Code	Message
300	Device specific error
310	System error
361	Autoscan failed

Table 4–8 lists the system events.

Table 4–8: System events

Code	Message
401	Power on[1]
402	Operation complete[2]

[1] **Sets bit 7 in the Standard Event Status Register.**

[2] **Sets bit 0 in the Standard Event Status Register.**

Table 4–9 lists the execution warnings that can occur during execution of a command.

Table 4–9: Execution warning messages (bit 3 in Standard Event Status Register)

Code	Message
500	Execution warnings

Examples

Examples

The following sample program sets up the VX4610 to perform a one minute bit error rate test. The program is written in Microsoft C and uses a National Instruments GPIB driver. Note that the program verifies communication with the instrument, inserts section code violation errors at a rate of 10^{-5}, loops until the test completes, and prints the BER for the section code violations. Use this program as a basis for programs that perform more advanced tasks. This example program assumes that the instrument is configured to device 16.

```
/*-----------------------------------------------------------------
* Program: BER.C
* Description: This program will set up the instrument to perform
*             a 1 minute BER test. The generator may be looped
*             back to the receiver. Errors will be inserted
*             during the test. The results will be printed at
*             the completion of the test.
* Prerequisites:
*             The instrument must be configured at device 16 in
*             IBCONF.
*             The language is Microsoft C using National
*             Instruments GPIB drivers.
*-----------------------------------------------------------------
*/
#include "stdio.h"
#include "string.h"
#include "decl.h"
main()
{
   char buffer[255];
   int  count = 0;
```

```
int  status = 0;
int device;
/* announce start of program */
printf("VX4610 BER Program Starting\n");
/* verify instrument is connected */
device = ibfind ("DEV16");
ibclr( device);
buffer[0] = 0;             /* initialize the string */
ibwrt(device,"*IDN?",5);   /* send query to instrument */
ibrd(device, buffer, 255); /* get response from instrument */
buffer[ibcnt-1] = 0;       /* add null to terminate string */
if( ibcnt > 1 )
{
   printf("Instrument at Address 16\n %s\n ", buffer);
}
else
{
   printf("Instrument at Address 16 did not respond");
   return( 1 ); /* error and exit */
}
/* initialize instrument */
ibwrt( device,"SYSTEM:MODE SONET",17);
ibwrt( device "*RST",4);
ibwrt( device "*OPC?",5);
ibrd(device,buffer,255);
/* setup transmitter - B1 errors at 1e-5 rate */
ibwrt( device,"SYSTEM:HEADER 0", 15);
ibwrt( device,"INPUT1:TEL:RATE STS1", 20);
```

```
    ibwrt( device,"OUTPUT1:TEL:RATE STS1", 21);
    ibwrt( device, "SOURCE:DATA:TEL:ERROR:ENABLE ON", 31);
    ibwrt( device, "SOURCE:DATA:TEL:ERROR:TYPE SCV", 30);
    ibwrt( device, "SOURCE:DATA:TEL:ERROR:RATE 1E-5", 31);
    /* setup receiver - test duration of 1 minute */
    ibwrt( device, "SENSE:DATA:TEL:TEST:DURATION 0,0,1,0", 36);
    /* start test */
    ibwrt( device, "SENSE:DATA:TEL:TEST:START", 25);
    /* wait until test is complete */
    do
    {
       ibwrt( device, "SENSE:DATA:TEL:TEST:STATUS?", 27 );
       ibrd( device, buffer, 255 );
       buffer[ibcnt-1] = 0;    /* add null to terminate string */
       printf(">> Elapsed Time =  %s       \r", buffer );
       sscanf( buffer, "%d", &status );
    }while( status == 1 );
    /* query and print results */
    ibwrt( device, "SENSE:DATA:TEL:MEAS:ERROR:ERATIO:SCV?", 37 );
    ibrd( device, buffer, 255 );
    buffer[ibcnt+1] = 0;       /* add null to terminate string */
    printf( "\n>> BER =  %s\n", buffer );
    /* announce end of program */
    printf("End of Test\n");
    /* exit */
    return(0);
}
```

Appendices

Appendix A: Specifications

This section contains the complete specifications for the VX4610 SDH/SONET Generator/Receiver. The first section contains the VX4610 specifications as they pertain to the ANSI and Bellcore SONET standards. The next section, beginning on page A–24, covers the same specifications for the VX4610 with reference to the ITU-T SDH standards. Within each section, the specifications are arranged in functional groups: *Transmit Output*, *Receive Input*, *Transmitter Clock*, *Miscellaneous Input/Output*, *Functional Specifications*, and *General Specifications*.

All specifications are warranted unless they are designated *typical*. Warranted characteristics that are directly checked by a procedure contained in the *Performance Verification* section of this manual are listed in **boldface** in the **Characteristic** column.

If the characteristic is noted as *nominal*, the characteristic is warranted and is guaranteed by the design of the product. Nominal characteristics are not checked in the *Performance Verification* section of this manual because they are guaranteed by design.

If the characteristic is noted as *typical*, the characteristic is not warranted. Typical characteristics describe typical or average performance and provide useful reference information.

Performance Conditions

The electrical characteristics found in these tables apply when the VX4610 has been adjusted at an ambient temperature between +20° C and +30° C, has been warmed up for at least 20 minutes, and is being operated at an ambient temperature between 0° C and +50° C (unless otherwise noted).

VX4610 SONET Specification Tables

The VX4610 specifications, as referenced to the ANSI and Bellcore SONET standards, are arranged by functional groups in Tables A–1 through A–9.

Table A–1: Plug-in interface module, transmit output — SONET

Characteristic	Description	
Electrical Output		
Data Rates	STS-1	51.84 Mb/s
	STS-3	155.52 Mb/s

Table A–1: Plug-in interface module, transmit output — SONET (cont.)

Characteristic	Description	
Data Formats	STS-1	AMI, B3ZS coded
	STS-3	CMI
Signal Level at Transmit Output	STS-1	Cross Connect Level = ± 0.5 V_{pk} ± 10% into 75 Ω (0.80 $V_{p\text{-}p}$ into 50 Ω)
	STS-3	High Level = ± 0.5 V_{pk} ± 10% into 75 Ω (0.80 $V_{p\text{-}p}$ into 50 Ω)
Pulse Shape at Transmit Output (High Level)	STS-3	Meets ANSI T1.102 and Bellcore TR-NWT-000253 Eye Masks
Pulse Shape at Cross Connect	STSX-1	Meets ANSI T1.102 and Bellcore TR-NWT-000253 Eye Masks
	STSX-3	Meets ANSI T1.102 and Bellcore TR-NWT-000253 Eye Masks
Return Loss	STS-1	> 15 dB (2 MHz to 78 MHz)
	STS-3	> 15 dB (7 MHz to 234 MHz)
Output Impedance	Unbalanced, 75 Ω to ground	
Output Protection	Open and short circuit protected	
Connector	BNC connector	
Optical Output		
Data Rates*	OC-1	51.84 Mb/s
	OC-3	155.52 Mb/s, for STS-1 or STS-3c structure
	OC-12†	622.08 Mb/s, for STS-1 or STS-3c structure
Data Formats*	Scrambled NRZ (scrambling can be enabled or disabled)	
Signal Level*, typical	Options 03 and 04	–10 dBm, reducing to –12 dBm at end of life
	Options 05 and 10	0 dBm
Pulse Shape*	OC-1	Meets Bellcore TR-NWT-000253 Eye Masks
	OC-3	Meets Bellcore TR-NWT-000253 Eye Masks
	OC-12†	Meets Bellcore TR-NWT-000253 Eye Masks
Wave Length*, typical	Options 03 and 04	1308 nm typical (within the range1260 nm to 1360 nm)
	Option 05	1550 nm typical (within the range1480 nm to 1580 nm)
	Option 10	1310 nm typical (within the range1280 nm to 1335 nm)
Spectral Width*, typical	Options 03 and 04	< 4.0 nm
	Options 05 and 10	< 1.0 nm
Laser Classification*	Class 1 laser, complies with 21 CFR 1040.10 and 1040.11, complies with IEC 825, Section 9.4	
Connectors*	Tektronix Universal Optical Output Connector with FC-PC Option (Other supplied connector options are ST, SC, and DIN 46256)	

* **Characteristic does not apply to the STS 1/3 Electrical Module.**

† **Characteristic does not apply to the OC 1/3 Optical/Electrical Module.**

Table A–2: Plug-in interface module, receive input — SONET

Characteristic	Description	
Electrical Input		
Data Rates	STS-1	51.84 Mb/s
	STS-3	155.52 Mb/s, for STS-1 or STS-3c structure
Data Formats	STS-1	AMI, B3ZS coded
	STS-3	CMI
Signal Sensitivity	STS-1	Maximum sensitivity ± 0.14 V_{pk} for BER ≤ 10^{-10} (Automatic gain control compensates for input signal amplitudes from ± 0.14 V_{pk} to ± 0.80 V_{pk})
	STS-3	Maximum sensitivity is ± 0.35 V_{pk} for BER ≤ 10^{-10}, with signal amplitude measured at the transmitter output and delivered to receiver through 450 ft of AT&T 728A cable
Signal Equalization	STS-1	Equalization for cross connect-compliant signal, per TA-NWT-000253, Issue 8.
	STS-3	Automatic equalization for up to 450 ft of AT&T 728A cable, per ANSI T.102-1991 and Bellcore TR-TSY-00253
Return Loss	STS-1	> 15 dB (2 MHz to 78 MHz)
	STS-3	> 15 dB (7 MHz to 234 MHz)
Input Impedance	Unbalanced, 75 Ω to ground	
Input Protection	Up to ± 5V, short term	
Voltage Measurement Accuracy, typical	Positive peak voltage of received signal is measured with ± 10% accuracy, typical.	
Connector	BNC connector	
Optical Input		
Data Rates*	OC-1	51.84 Mb/s
	OC-3	155.52 Mb/s, for STS-1 or STS-3c structure
	OC-12†	622.08 Mb/s, for STS-1 or STS-3c structure
Data Formats*	Descrambled NRZ (descrambling can be enabled or disabled)	
Maximum Optical Input Power*	–5 dBm without destruction of optical input sensor –7 dBm for BER ≤ 10^{-10}	
Signal Sensitivity*	OC-1	–28 dBm for BER ≤ 10^{-10}
	OC-3	–28 dBm for BER ≤ 10^{-10}
	OC-12†	–28 dBm for BER ≤ 10^{-10}

Table A–2: Plug-in interface module, receive input — SONET (cont.)

Characteristic	Description
Power Meter Accuracy*****, typical	± 3 dBm, for input power in the range from –28 dBm to –10 dBm
Connectors*****	Tektronix Universal Optical Connector with FC-PC Option (Other supplied connector options are ST, SC, and DIN 46256)

* **Characteristic does not apply to the STS 1/3 Electrical Module.**

† **Characteristic does not apply to the OC 1/3 Optical/Electrical Module.**

Table A–3: Transmitter clock — SONET

Characteristic	Description
Internal Clock	Unless another source is enabled, Transmit Line Clock is based on internal oscillator
Accuracy	± 4.6 ppm, for instrument calibrated within 24 months ± 1.0 ppm, for instrument ambient temperature of 25° ± 3° C and calibrated within one month
Line Output Jitter	$<$ 0.01 Unit Intervals$_{RMS}$ in the frequency band between 12 kHz and 5 MHz (complies with Bellcore TR-NWT-000253, Sections 5.6.1 and 5.6.5.2; and Bellcore TR-NWT-000499, Section 7.3.3)
Transmit Line Frequency Offset	± 100 ppm of nominal line rate
BITS Reference Input	When enabled, Transmit Line Clock synchronized to external 1.544 Mb/s BITS Reference
Frequency Lock Range, typical	1.544 Mb/s ± 40 ppm
Input Impedance, typical	Balanced, 100 Ω ± 5%
Maximum Signal without Destruction, typical	± 5 V (DC + peak AC)
Connector	DS1 Bantam connector
Transmit Line Frequency Offset	± 100 ppm of line rate referenced to external source
Recovered Clock (Loop)	Clock is recovered from received SONET signal
Input Jitter Tolerance	Meets Bellcore TR-NWT-000499, Section 7; Bellcore TR-NWT-000253, Section 5.6.4.1 and Figure 5-15; and EIA T1A-526-15 (as Standards Proposal Number 2266-A, dated 9/91)
Jitter Transfer	Meets Bellcore TR-NWT-000499, Section 7; Bellcore TR-NWT-000253, Section 5.6.3 and Figure 5-14; and EIA T1X1.3/93-006R1
Frequency Lock Range	Nominal line rate ± 125 ppm
Transmit Line Frequency Offset	± 100 ppm of recovered clock rate
External Clock	When enabled, the Transmit Line Clock is driven directly by an External Clock reference. The selected line rate determines the appropriate nominal External Clock frequency. Apply a valid External Clock signal before you enable the External Clock.

Table A–3: Transmitter clock — SONET (cont.)

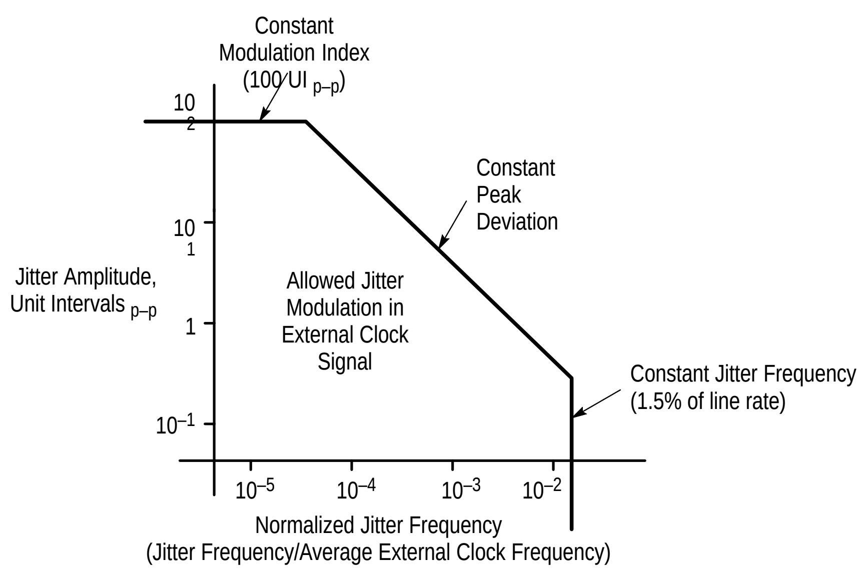
Characteristic	Description
Input Frequency	*Line Rate* — *External Clock Frequency* STS-1, OC-1***** — 51.84 MHz OC-3***** — 155.52 MHz STS-3 — 311.04 MHz OC-12*****† — 622.08 MHz
Input Frequency Lock Range, Tributary Mapped into Payload	External Clock frequency averaged over any 100 ms time interval = nominal line rate ± 125 ppm
Input Frequency Lock Range, Tributary Not Mapped into Payload	External Clock frequency averaged over any 100 ms time interval = nominal line rate ± 1000 ppm
Jitter Frequency and Amplitude	Maximum jitter frequency = 1.5% of nominal line rate Maximum jitter amplitude = 100 UI $_{p\text{-}p}$, derated by jitter frequency Allowed jitter frequency and amplitude range is defined by the boundaries in the graph below 
Maximum Signal without Destruction	± 5 V (DC + peak AC)
Input Impedance	Unbalanced, 50 Ω (DC coupled)
Input Amplitude Requirement, typical	≥ 600 $mV_{p\text{-}p}$, centered at 0.0 V
Input Slew Rate Requirement, typical	dV_{in}/dt > 250 mV/ns (At 51.84 MHz nominal line rate, apply square wave or ≥ 1.6 $V_{p\text{-}p}$ sine wave to External Clock input to meet slew rate requirement. At all other line rates, ≥ 600 $mV_{p\text{-}p}$ sine wave is sufficient.)
Input Symmetry Requirement, typical	45% to 55% duty cycle, measured at 0.0 V

Table A–3: Transmitter clock — SONET (cont.)

Characteristic	Description
Connector	SMA connector
Transmit Line Frequency Offset	± 100 ppm of line rate referenced to External Clock frequency

* **Characteristic does not apply to the STS 1/3 Electrical Module.**

† **Characteristic does not apply to the OC 1/3 Optical/Electrical Module.**

Table A–4: Miscellaneous input/output specifications — SONET

Characteristic	Description			
DCC Add/Drop Interface	A DB-37 female connector provides the I/O interface to transfer added signals from or dropped signals to an external protocol analyzer. Clock and data signals are differential TTL, conform to RS-422 specifications, and are also compatible with single-ended TTL signals. The connector pinout is listed below:			
	Signal Characteristic	*Non-Inverted*	*Inverted*	
	Insert (Add) Data	pin 4	pin 22	
	Insert (Add) Clock	pin 5	pin 23	
	Drop Data	pin 6	pin 24	
	Drop Clock	pin 8	pin 26	
Signal Levels	V_{IH} (minimum)	2.0 V		
	V_{IL} (maximum)	0.8 V		
	V_{OH} (minimum)	2.4 V		
	V_{OL} (maximum)	0.4 V		
Clock Frequency	The Add/Drop Clock is a gapped clock with requirements depending on the specific Add/Drop signal as listed below:			
	Add/Drop Signal	*Average Clock Rate*	*Minimum Period*	*Maximum Period*
	Section DCC	192 kHz	4.4 µs	10 µs
	Line DCC	576 kHz	460 ns	1 µs
	F1 Byte	64 kHz	12 µs	30 µs
	F2 Byte	64 kHz	12 µs	30 µs

Table A–4: Miscellaneous input/output specifications — SONET (cont.)

Characteristic	Description	
Trigger Outputs	Front-panel Tx SECTION and Rx SECTION trigger output signals are TTL level into a high impedance load. Minimum pulse width is 50 ns.	
	V_{OH} (minimum)	2.4 V
	V_{OL} (maximum)	0.4 V
	The front-panel trigger outputs provide > 1 V pulses when terminated with 50 Ω. TTL-level trigger outputs are also available on the TTLTRG***** lines of the VXIbus backplane.	
Trigger Input	Front-panel TRIGGER IN is a standard TTL input.	
	V_{IH} (minimum)	2.0 V
	V_{IL} (maximum)	0.8 V
	Trigger inputs are also available from the TTLTRG***** lines of the VXIbus backplane.	

Table A–5: Transmit and receive functional specifications — SONET‡

Characteristic	Description	
Data Scrambling	Complies with scrambling pattern described in ANSI T1.105-1991, page 72, Figure 43. Scrambling can be disabled.	
Overhead Structure	For all line rates and signal structures, the Section, Line, and Path Overhead bytes meet the requirements of ANSI T1.105A, Section 8.	
Channel (SPE) Selection	*Signal Rate and Structure*	*Allowed Channels*
	STS-1	1
	STS-3 containing STS-1	1, 2, 3
	STS-3 containing STS-3c	1
	OC-1*****	1
	OC-3 containing STS-1*****	1, 2, 3
	OC-3 containing STS-3c*****	1
	OC-12 containing STS-3c*****†	1, 2, 3, 4
	OC-12 containing STS-1*****†	1, 2, 3, . . . 11, 12

Table A–5: Transmit and receive functional specifications — SONET[‡] (cont.)

Characteristic	Description
Framing Methods	For transmitted signals, the framing method depends on the transmit rate. *Transmit Rate* — *Transmitted Framing Byte Sequence* STS-1 or OC-1 — One A1 byte followed by one A2 byte STS-3 (including STS-3c) or OC-3 — Three A1 bytes followed by three A2 bytes OC-12 — Twelve A1 bytes followed by twelve A2 bytes For received signals, the signal is considered framed when the following byte sequences are detected. Four or more consecutive frameword errors cause an OOF condition. An OOF condition lasting for 3 ms or more causes an LOF failure. *Receive Rate* — *Expected Framing Byte Sequence* STS-1 or OC-1 — One A1 byte followed by first four bits of A2 byte STS-3 (including STS-3c) or OC-3 — First frame: first three A1 bytes followed by first three A2 bytes. Subsequent frames: first A1 byte followed by first four bits of first A2 byte OC-12 — First frame: first three A1 bytes followed by first three A2 bytes. Subsequent frames: first A1 byte followed by first four bits of first A2 byte
Equipped and Unequipped Payload (transmitter only)	Equipped or unequipped payload is user selectable. The VX4610 sets the C2 byte to 00 for unequipped, 01 for equipped.
PRBS Payload Patterns	A PRBS pattern, as defined in ITU-T 0.151, is transmitted sequentially in all bytes of the payload except for the Path Overhead bytes. Four pattern lengths are selectable: 2^9–1, 2^{15}–1, 2^{20}–1, and 2^{23}–1. The receiver synchronizes to the incoming pattern and counts bit errors when the incoming pattern does not match the expected pattern.
User Byte Payload Pattern	A user-defined byte, in the range of hexadecimal 00 to FF, is transmitted in all bytes of the payload except for the Path Overhead bytes. The receiver counts bit errors when the incoming pattern does not match the expected pattern.
Multi-frame Payload Sequence Generation (transmitter only)	If enabled, the VX4610 transmits user-defined payload data sequences. For STS-1 structure, the payload data sequence can be set from 1 to 64 frames in length. For STS-3c structure, the payload data sequence can be set from 1 to 54 frames in length. When the end of the payload data sequence is reached, it repeats. For convenience, the payload data sequence can be set to an incrementing pattern or to a user-specified 16-bit word. Any byte in the sequence can be individually edited. (Editing capability includes all path overhead bytes except J1, B3, and G1, which are under hardware control. You can affect the J1 in the form of a 64-byte string. You can affect the G1 byte if you set a FEBE count or Path yellow alarm.
Transport Overhead Bytes	All Transport Overhead bytes except for B1, B2, H1, H2, and H3, can be set to any value from hexadecimal 00 to FF. (You can control H1, H2, and H3 with pointer adjustments.) All received Transport Overhead bytes can be examined.
DCC	If enabled, the transmitter inserts data from the Overhead Port connector into the Section or Line DCC bytes. If enabled, the receiver drops data from the Section or Line DCC bytes to the Overhead Port connector. Only one DCC or User byte can be added or dropped at a time.

Table A–5: Transmit and receive functional specifications — SONET[‡] (cont.)

<table>
<tr><th>Characteristic</th><th>Description</th></tr>
<tr><td>F1 Byte</td><td>If enabled, the transmitter inserts data from the DCC Add/Drop connector into the F1 User byte. If enabled, the receiver drops data from the F1 User byte to the Overhead Port connector. Only one DCC or User byte can be added or dropped at a time.</td></tr>
<tr><td>Path Overhead Bytes</td><td>All Path Overhead bytes except B3, G1, and H4, can be set to any value from hexadecimal 00 to FF. (You can set the J1 byte in the form of a 64-bit string. You can also set the H4 byte to any value if part of a custom payload sequence.) All received Path Overhead bytes can be displayed.</td></tr>
<tr><td>F2 Byte</td><td>If enabled, the transmitter inserts data from the Overhead Port connector into the F2 byte. If enabled, the receiver drops data from the F2 byte to the Overhead Port connector. Only one DCC or User byte can be added or dropped at a time.</td></tr>
<tr><td>J1 Byte</td><td>If unequipped, the Path Trace Byte J1 is set to all nulls (hexadecimal 00). Alternatively, a user-defined string can be transmitted in a 64-byte sequence. The user-defined string consists of up to 62 ASCII characters followed by a carriage return and line feed. If the user-defined string has less than 62 characters, the remainder of the string is padded with null characters. The receiver returns the Path Trace bytes as a text string.</td></tr>
<tr><td>Generated Errors
(transmitter only)</td><td>If enabled, the transmitter can generate errors on a one-time or continuous basis. For single error insertions, you can select the errored bit with a mask. For each error type, the affected byte(s) and the insertion rate range are listed below:
<table>
<tr><th>Error Type</th><th>Affected Byte(s)</th><th>Error Insertion Rate Range</th></tr>
<tr><td>Section Code Violation</td><td>B1</td><td>10^{-3} to 10^{-10} (STS-1, OC-1)
10^{-4} to 10^{-10} (STS-3, OC-3)
10^{-5} to 10^{-10} (OC-12)</td></tr>
<tr><td>Line Code Violation</td><td>B2</td><td>10^{-3} to 10^{-10} (STS-1, OC-1)
10^{-4} to 10^{-10} (STS-3, OC-3, OC-12)</td></tr>
<tr><td>Path Code Violation</td><td>B3</td><td>10^{-3} to 10^{-10}</td></tr>
<tr><td>Path FEBE</td><td>G1</td><td>10^{-3} to 10^{-10}</td></tr>
<tr><td>Data</td><td>payload</td><td>10^{-3} to 10^{-10}</td></tr>
</table>
The accuracy of the (continuous) error insertion rate is 1%. The rate is adjustable with a resolution of two significant digits.</td></tr>
<tr><td>Error Mask
(transmitter only)</td><td>For single error insertions, you can apply an 8-bit error mask to B1, B2, B3, or payload data errors. The mask can have any value between 1 and 255 (decimal).</td></tr>
</table>

Table A–5: Transmit and receive functional specifications — SONET‡ (cont.)

Characteristic	Description			
Error Measurement (receiver only)	The receiver measures incoming occurrences of all error types according to the methods described in ANSI T1M1.3. The accuracy, range, and resolution for the different types of measurements are listed below:			
	Basic Measurement Type	*Accuracy*	*Range*	*Resolution*
	Error Count	± 1 count ± 0.1% of count	0 to 10^7 10^7 to 10^{32}	1 count 3 digits
	Errored Seconds	± 1 second ± 0.1% of count	0 to 10^7 10^7 to 10^{32}	1 second 3 digits
	Percent Error-Free Seconds	± (1 second / total meas. seconds)	0.00% to 100.00%	2 digits after decimal point
	Bit Error Ratio	± 0.1% of ratio	0 to 1.00	3 digits
Generated Alarms (transmitter only)	If enabled, the transmitter generates alarm conditions. For each alarm type, the affected byte(s) are listed below:			
	Alarm Type	*Affected Byte(s)*		
	Line AIS	All bytes in frame except Transport Overhead		
	Path AIS	All bytes in SPE and H1, H2, and H3 in Line Overhead		
	Line FERF	K2 in Line Overhead		
	Path Yellow	G1 in Path Overhead		
Alarm Measurement (receiver only)	If enabled, the receiver measures the duration of the alarm condition. The measurement accuracy, range, and resolution are listed below:			
	Measurement Type	*Accuracy*	*Range*	*Resolution*
	Alarm Seconds	± 1 second ± 0.1% of count	0 to 10^7 10^7 to 10^{32}	1 second 3 digits
Generated Failures (transmitter only)	If enabled, the transmitter generates failure conditions. For each failure type, the affected byte(s) are listed below:			
	Failure Type	*Affected Byte(s)*		
	LOS	All bytes (transmit output attenuated ≥ 28 dB)		
	LOF	A1 and A2		
	LOP	H1		
Failure Measurement (receiver only)	If enabled, the receiver measures the duration of the failure condition. The measurement accuracy, range, and resolution are listed below:			
	Measurement Type	*Accuracy*	*Range*	*Resolution*
	Failure Seconds	± 1 second ± 0.1% of count	0 to 10^7 10^7 to 10^{32}	1 second 3 digits

Table A–5: Transmit and receive functional specifications — SONET‡ (cont.)

Characteristic	Description
Pointer Movements	
Single (transmitter only)	If enabled, a one-location pointer adjustment occurs once each time a SOUR:DATA:TEL:POIN:ACT command is sent over the GPIB. The direction of the adjustment alternates each time the command is sent.
Burst (transmitter only)	If enabled, the SOUR:DATA:TEL:POIN:ACT command starts a burst of pointer movements. Each burst consists of two to eight one-location pointer adjustments spaced four frames apart. All adjustments within a given burst are in the same direction. Subsequent bursts are in alternating directions.
Continuous (transmitter only)	If enabled, pointer adjustments occur continuously at a specified rate in an incrementing, decrementing, or alternating direction. The rate can be set within the range from 1 ms to 10 s between movements, with a resolution of 1 ms.
Set to Value (transmitter only)	If enabled, the pointer is immediately set to a new location with or without the NDF being set. The available range of pointer values is from 0 to 1023 (783 – 1023 are illegal values).
Pointer Test Sequences	
Single pointer adjustment	Time between pointer adjustments: 30 s.
Alternating pointer adjustment	Alternating, single Alternate, double
Pointer adjustment burst	Time between 3 pointers is 0.5 ms, 0.5 ms Time between pointer burst: 30 s
Phase transient pointer adjustment burst	Time between 7 pointers is 0.25 s, 0.25 s, 0.5 s, 0.5 s, 0.5 s, 0.5 s. Time between pointer burst: 30 s.
Periodic pointer adjustment – 87–3 pattern	– 87–3 pattern – 87–3 pattern with Cancelled pointer movement number 87 – 87–3 pattern with Added pointer after the 43rd pointer
Periodic pointer adjustment – continuous pattern	– continuous pattern – continuous pattern with cancellation of one pointer – continuous pattern with added pointer
Pointer Direction	Positive or Negative
Initialization Period	On or Off Thirty second burst of 1 pointer per second in the same direction as the selected test
Cool Down Period	On or Off This will last at least 60 seconds

Table A–5: Transmit and receive functional specifications — SONET‡ (cont.)

Characteristic	Description
Pointer Measurement (receiver only)	If enabled, the receiver measures incoming pointer movements. The available measurements with their accuracy, range and resolution are listed below: *Measurement Type* / *Accuracy, typical* / *Range* / *Resolution* Positive Pointer Justifications: ± 1 count, 0 to 10^7, 1 count; ± 0.1% of count, 10^7 to 10^{32}, 3 digits Negative Pointer Justifications: ± 1 count, 0 to 10^7, 1 count; ± 0.1% of count, 10^7 to 10^{32}, 3 digits NDF (New Data Flag) Count: ± 1 count, 0 to 10^7, 1 count; ± 0.1% of count, 10^7 to 10^{32}, 3 digits Invalid Pointer Count: ± 1 count, 0 to 10^7, 1 count; ± 0.1% of count, 10^7 to 10^{32}, 3 digits Illegal Pointer Count: ± 1 count, 0 to 10^7, 1 count; ± 0.1% of count, 10^7 to 10^{32}, 3 digits
Trigger Output	The VX4610 produces triggers based on internally generated or detected events. Trigger events sourced from the Transmit section result in trigger output pulses to the front-panel Tx SECTION connector and, if enabled, to VXIbus backplane signals TTLTRG0, TTLTRG2, TTLTRG4, or TTLTRG6. Trigger events sourced from the Receive section result in trigger output pulses to the front-panel Rx SECTION connector and, if enabled, to VXIbus backplane signals TTLTRG1, TTLTRG3, TTLTRG5, or TTLTRG7.
Trigger Events Sourced from Transmit Section	The VX4610 produces triggers based on generated frames, errors, alarms, failures, pointer movements, or changes in APS bytes.
Trigger Events Sourced from Receive Section	The VX4610 produces triggers based on detected frames, errors, alarms, failures, pointer movements, or changes in APS bytes.
Front-Panel Trigger Output Signals	The front-panel Tx SECTION and Rx SECTION trigger outputs are active-high TTL signals. Instantaneous events, such as the beginning of the frame or occurrence of a Path Code Violation result in an active-high trigger output pulse. Extended events, such as an LOP failure or a Line AIS, result in a high-level trigger output while the event is occurring. The trigger output signal returns to low-level after the event is no longer present.
VXIbus Backplane Trigger Output Signals	If enabled, the VXIbus backplane TTLTRG trigger output signals are active-low pulses. Instantaneous events, such as the beginning of the frame or occurrence of a Path Code Violation result in an active-low trigger output pulse. Extended events, such as an LOP failure or a Line AIS, result in a low-level trigger output while the event is occurring. The trigger output signal returns to a high level after the event is no longer present. The backplane trigger outputs are enabled to a specific pair of TTLTRG lines, one sourced from the Transmit section and one sourced from the Receive section. Backplane triggers follow the VXIbus TTLTRG Synchronous Trigger Protocol; an acknowledgement from an acceptor is not required.

Table A–5: Transmit and receive functional specifications — SONET[‡] (cont.)

<table>
<tr><th>Characteristic</th><th>Description</th></tr>
<tr><td>Overhead Capture (receiver only)</td><td>If enabled, the VX4610 acquires one Transport Overhead and one Path Overhead into memory. The overhead capture process is triggered by one of the following: a TTL-level pulse from the front-panel TRIGGER IN connector, any one of the eight VXIbus backplane TTLTRG signals, an IMMediate command over the GPIB, or any one of the trigger events sourced from the Receive section. Rising-edge or falling-edge polarity is selectable for the front-panel or backplane trigger inputs. Capture memory acquires the Transport Overhead from the frame containing the trigger event. Capture memory acquires the Path Overhead that begins just prior to the trigger event.</td></tr>
<tr><td>Payload Capture (receiver only)</td><td>If enabled, the VX4610 acquires a sequence of 64 (STS-1 structure) or 54 (STS-3c structure) payloads into memory. The payload capture process is triggered by one of the following: a TTL-level pulse from the front-panel TRIGGER IN connector, any one of the eight VXIbus backplane TTLTRG signals, an IMMediate command over the GPIB, or any one of the trigger events sourced from the Receive section. Rising-edge or falling-edge polarity is selectable for the front-panel or backplane trigger inputs.</td></tr>
<tr><td>Trigger Position (receiver only)</td><td>A trigger event controls the timing of the payload and overhead capture process. The trigger event can be located at the beginning, the middle, or the end of the sequence of captured payloads. For each trigger location, the table below shows the frame in which the trigger occurs:
<table>
<tr><th>Trigger Location</th><th>STS-1 Structure</th><th>STS-3c Structure</th></tr>
<tr><td>Beginning</td><td>2</td><td>2</td></tr>
<tr><td>Middle</td><td>32</td><td>27</td></tr>
<tr><td>End</td><td>63</td><td>53</td></tr>
</table></td></tr>
</table>

*** Characteristic does not apply to the STS 1/3 Electrical Module.**

† Characteristic does not apply to the OC 1/3 Optical/Electrical Module.

‡ The functional specifications describe characteristics of both the transmitter and receiver unless noted otherwise.

Table A–6: DS1 and DS3 add/drop/test (Options 22 and 58) specifications — SONET

Characteristic	Description	
DS1/DS3 Electrical Output (Drop/ Transmit)		
Data Rates (drop)	DS1	1.544 Mb/s ± 130 ppm
	DS3	44.736 Mb/s ± 130 ppm
Data Rates (transmit)	DS1	1.544 Mb/s ± 150 ppm
	DS3	44.736 Mb/s ± 150 ppm
Data Formats	DS1	AMI or B8ZS coding, selectable
	DS3	B3ZS coding
Signal Level	DS1	3 V_{pk} ± 0.6 V into 100 Ω
	DS3	0.6 V_{pk} ± 0.24 V into 75 Ω, typical DSX-3 signal meets ANSI T1.102-1991 with predistortion equivalent of 450 ft of AT&T 728A cable
Pulse Shape at Cross Connect	DS1	Meets ANSI T1.102-1991 pulse template for DSX-1 signals measured into 100 Ω ± 5% test load
	DS3	Meets ANSI T1.102-1991 pulse template for DSX-3 signals measured into 75 Ω ± 5% test load
Jitter	DS1	Meets network interface limit jitter specifications in T1.102-1987.
	DS3	Meets network interface limit jitter specifications in T1.102-1987.
Output Protection	Open and short circuit protected	
Connectors	DS1	Bantam, 100 Ω jack
	DS3	BNC, 75 Ω
Data Source	DS1	SONET VT1.5 drop or Internal pattern generator
	DS3	SONET SPE drop or Internal pattern generator
NRZ Electrical Outputs (Option 58 only)		
Data Rates	DS1	Drop: 1.544 MHz ±130 ppm Transmit: 1.544 MHz ±150 ppm
	DS3	Drop: 44.736 MHz ±130 ppm Transmit: 44.736 MHz ±150 ppm
Connectors	DS1	SMB
	DS3	SMB and 75 Ω BNC, software selectable
Data Format	NRZ	
Impedance	75 Ω	
Termination	Internal on DS1 and DS3 input connectors	

Table A–6: DS1 and DS3 add/drop/test (Options 22 and 58) specifications — SONET (cont.)

Characteristic	Description	
Signal Type	DS3 and DS1	Single ended
DS3, DS1 Voltage Levels	TTL	
DS3, DS1 Clock to Data Skew	Max ± 6.0 ns	
Data Source	DS1	SONET VT1.5 drop or Internal pattern generator
	DS3	SONET SPE drop or Internal pattern generator
DS1/DS3 Electrical Input (Add/Receive)		
Data Rates	DS1	1.544 Mb/s ± 130 ppm
	DS3	44.736 Mb/s ± 130 ppm
Data Formats	DS1	Coding automatically selected
	DS3	B3ZS coding
Signal Level	DS1	DSX1: 3 V_{pk} ± 0.6 V into 100 Ω DSX1 Monitor: 20 dB flat loss below DSX1
	DS3	DS3X: 0.6 V_{pk} ± 0.24 V into 75 Ω
Pulse Shape	DS1	Signal must meet ANSI T1.102-1991 pulse template for DSX-1 signals
	DS3	Signal must meets ANSI T1.102-1991 pulse template for DSX-3 signals
Input Impedance	DS1	Balanced, 100 Ω ± 5%
	DS1 Bridged	Balanced, 1 k Ω nominal
	DS3	Unbalanced, 75 Ω ± 5% to ground
Input Protection	Up to ± 5 V, short term	
Input Connectors	DS1	Opt 22 – Bantam jack, 100 Ω Opt 58 – SMB, 100 Ω
	DS3	Opt 22 and Opt 58 – BNC, 75 Ω Opt 58 – SMB, 100 Ω
NRZ Electrical Inputs (Option 58 only)		
Data Rates	DS1	Add: 1.544 MHz ±130 ppm Terminate: 1.544 MHz ±150 ppm
	DS3	Add: 44.736 MHz ±130 ppm Terminate: 44.736 MHz ±150 ppm
Data Format	NRZ	
Connectors	DS1	SMB
	DS3	SMB and 75 Ω BNC, software selectable
Termination	Internal on all input connectors	

Table A–6: DS1 and DS3 add/drop/test (Options 22 and 58) specifications — SONET (cont.)

Characteristic	Description	
Signal Type	DS3 and DS1	Single ended
DS3, DS1 Voltage Levels	TTL/CMOS	
DS3, DS1 Setup and Hold Times (with respect to selected clock edge)	Setup	3.0 ns
	Hold	3.0 ns
Required Clock Symmetry	42% or 58%	
Loss of Clock	Loss of clock = no signal transitions for at least 250 ms At loss of clock, to maintain operation of the synchronous logic, the data path is replaced with 0 and alternate clock source is used: DS3 – 44.736 MHz, DS1 – 1.544 MHz At clock recovery (clock transitions recognized), normal operation resumes after a brief delay.	
External Clock Input		
Nominal Frequency	DS1	1.544 MHz
	DS3	44.736 MHz
Frequency Range	Nominal frequency ± 150 ppm	
Input Impedance	Unbalanced, 75 Ω, AC coupled	
Connector	BNC	
Signal Level	0.5 V_{p-p} to 1.5 V_{p-p}	
Internal Pattern Generator		
Clock Source	DS1	Internal reference, DS1 Rx Clock, NRZ-RX Clock (Opt 58), or DS1 External Clock
	DS3	Internal reference, DS3 Rx Clock, , NRZ-RX Clock (Opt 58), or DS3 External Clock
Framing	DS1	SF(D4), ESF, or Unframed
	DS3	M13, C-bit, or Unframed
Patterns	PRBS 2^{15}–1 PRBS 2^{20}–1 PRBS 2^{23}–1 QRSS (DS1 only) 1 in 8 (DS1 only) 3 in 24 (DS1 only) All 1s, All 0s Fixed Pattern 8 bit Fixed Pattern 16 bit Fixed Pattern 24 bit	
Error Types	DS1	None, Frame Bit Error (SF or ESF framing only), CRC Error (ESF framing only), or Pattern Bit Error
	DS3	None, Frame Bit Error (M13 or C-bit framing only), P Parity Bit Error (M13 framing only), C Parity Error (C-bit framing only), or Pattern Bit Error

Table A–6: DS1 and DS3 add/drop/test (Options 22 and 58) specifications — SONET (cont.)

Characteristic	Description		
Error Rate Range		DS1	DS3
	Frame Bit Error	10^{-2} to 10^{-5}	10^{-2} to 10^{-7}
	CRC Error	10^{-4} to 10^{-8}	NA
	P Parity Error	NA	10^{-4} to 10^{-9}
	C Parity Error	NA	10^{-4} to 10^{-9}
	Pattern Bit Error	10^{-2} to 10^{-8}	10^{-2} to 10^{-9}
Error Rate Resolution	One digit to the left of the decimal point		
Error Rate Accuracy	1%		
Alarm Types	DS1	Yellow or AIS	
	DS3	Yellow (DS3 FERF), AIS (DS3 Blue), or Idle	
Internal Pattern Receiver			
Pattern Receiver Source	DS1	DS1 Rx Signal, NRZ–RX Data (Opt 58 only), or VT1.5 Drop	
	DS3	DS3 Rx Signal, NRZ–RX Data (Opt 58 only), or SONET SPE Drop	
Framing	DS1	SF(D4), ESF, or Unframed	
	DS3	M13, C-bit, or Unframed	
Patterns	PRBS 2^{15}–1 PRBS 2^{20}–1 PRBS 2^{23}–1 QRSS (DS1 only) 1 in 8 (DS1 only) 3 in 24 (DS1 only) All 1s, All 0s Fixed Pattern 8 bit Fixed Pattern 16 bit Fixed Pattern 24 bit		
Error Types	DS1	Frame Bit Error, CRC Error (ESF mode only), and Pattern Bit Error	
	DS3	Frame Bit Error, P Parity Bit Error (M13 framing only), C Parity Error (C-bit framing only), and Pattern Bit Error	
Error Count Range	$0 \le$ value $\le 10^{32}$		
Error Count Resolution	Two digits after the decimal point		
Error Count Accuracy	± 1%		
Alarm Types	DS1	Yellow and AIS	
	DS3	Yellow (DS3 FERF), AIS (DS3 Blue), and Idle	

Table A–6: DS1 and DS3 add/drop/test (Options 22 and 58) specifications — SONET (cont.)

Characteristic	Description	
Status Types	DS1	Loss of Pattern Sync, Loss of Frame, and Loss of Signal
	DS3	Loss of Pattern Sync, Loss of Frame, and Loss of Signal
SONET VT1.5 Drop		
Frequency Lock Status	Locked or Unlocked	
Mapping	Floating Async	
VT Control	Allows selection of any one of 28 VT channels	
VT Size	VT1.5, VT2, VT3, and VT6.	
VT Signal Label	$0 \leq$ value ≤ 7	
VT Alarm Types	VT AIS, VT FERF	
VT Failure Types	VT Loss of Pointer, VT Loss of Multiframe	
VT Error Types	VT BIP-2, VT FEBE	
VT Error Ratio Range	VT BIP-2	$0 \leq$ value $\leq 2.40 \times 10^{-3}$
	VT FEBE	$0 \leq$ value $\leq 1.20 \times 10^{-3}$
VT Error Ratio Resolution	Two digits after the decimal point	
VT Error Ratio Accuracy	± 1%	
SPE Pointer Movement Jitter	Jitter of dropped DS1 signal must meet the network interface jitter requirements in T1X1.3-006R3 SONET Jitter at Network Interfaces.	
VT1.5 Pointer Movement Jitter	Jitter of dropped DS1 signal must meet the network interface jitter requirements in T1X1.3-006R3 SONET Jitter at Network Interfaces.	
VT Pointer Value	$0 \leq$ value ≤ 103	
VT Pointer Increment Count	$0 \leq$ value $\leq 10^{32}$	
VT Pointer Decrement Count	$0 \leq$ value $\leq 10^{32}$	
Illegal VT Pointer Count	$0 \leq$ value $\leq 10^{32}$	
VT Pointer NDF Count	$0 \leq$ value $\leq 10^{32}$	
SPE/VT Pointer Movement Interaction	The VT1.5 Drop allows both SPE and VT pointer movements simultaneously	
SONET VT1.5 Add		
Frequency Lock Status	Locked or Unlocked	
VT1.5 Add Source	Internal Pattern Generator or DS1 Rx Signal	
VT1.5 Active Channel Selection	Allows selection of any one of 28 VT channels	
VT1.5 Background Channel Content	*Active Channel Source*	*Background Channel Content*
	Internal Pattern Generator	QRSS or fixed-byte pattern 0x7F (SF or ESF framing only)
	External Add	Unframed QRSS

Table A–6: DS1 and DS3 add/drop/test (Options 22 and 58) specifications — SONET (cont.)

Characteristic	Description	
VT1.5 Background Channel Framing	*Active Channel Source*	*Background Channel Framing*
	Internal Pattern Generator	Matches active channel framing
	External Add	Unframed QRSS
VT Signal Label	0 ≤ default value ≤ 7, as specified in ANSI T1.105, not user settable (set to 2 for Floating Async).	
VT Alarm and Failure Types	VT AIS, VT FERF, VT Loss of Pointer, VT Loss of Multiframe	
VT Error Types	VT BIP-2, VT FEBE	
VT Error Rate Range	VT BIP-2 10^{-3} to 10^{-10}	
	VT FEBE 10^{-4} to 10^{-10}	
VT Error Ratio Resolution	One digit to the left of the decimal point	
VT Error Ratio Accuracy	± 1%	
VT1.5 Pointer Movement Modes	Single, Burst, Set value, Continuous, Pointer Sequence Generation	
VT1.5 Pointer Burst Count	Value ≤ 8, direction is not selectable	
VT1.5 Pointer Generation	Time between pointer movements ≥ 48 ms, both increment and decrement	
VT1.5 Time Interval Resolution	1 ms	
SPE Pointer Movement Modes	Single, Burst, Set Value, Continuous, Pointer Sequence Generation	
SPE Pointer Burst Count	Value ≤ 8, increment and decrement directions	
Frequency Offset Range for SPE Pointer Movement	*Pattern*	*Range*
	87/3	± 100 ppm
Frequency Offset Resolution for SPE Pointer Movement	*Pattern*	*Resolution*
	87/3	0.1 ppm
Frequency Offset Accuracy for SPE Pointer Movement	*Pattern*	*Accuracy*
	87/3	1.0 ppm
SPE/VT Pointer Movement Interaction	Simultaneous VT and SPE pointer movements are not allowed	
VT Pointer Test Sequences		
Single pointer adjustment	Time between pointer adjustments: 30 s	
Alternating pointer adjustment	Single Double	
Pointer adjustment burst	Time between 3 pointers is 2 ms, 2 ms Time between pointer burst: 30 s	
Phase transient pointer adjustment burst	Time between 7 pointers is 0.25 s, 0.25 s, 0.5 s, 0.5 s, 0.5 s, 0.5 s Time between pointer burst: 30 s	
Periodic pointer adjustment test sequence – 26–1 pattern	– 26–1 pattern – 26–1 pattern with Cancelled pointer movement number 26 – 26–1 pattern with Added pointer after the 13th pointer	

Table A–6: DS1 and DS3 add/drop/test (Options 22 and 58) specifications — SONET (cont.)

Characteristic	Description	
Periodic pointer adjustment – continuous pattern	– continuous pattern – continuous pattern with cancellation of one pointer – continuous pattern with added pointer	
Pointer Direction	Positive or Negative	
Initialization Period	On or Off Thirty second burst of 1 pointer per second in the same direction as the selected test.	
Cool Down Period	On or Off This will last at least 60 seconds.	
SONET DS3 SPE Drop		
DS3 Frequency Lock Status	Locked for frequencies of 44.736 ± 150 ppm. May be unlocked outside that range.	
SPE Pointer Movement Jitter	Jitter of dropped DS1 signal must meet the network interface jitter requirements in T1X1.3-006R3 SONET Jitter at Network Interfaces.	
SONET DS3 SPE Add		
DS3 SPE Add Source	Internal Pattern Generator or DS3 Rx Signal	
DS3 Lock Status	Locked or Unlocked	
SPE Pointer Movement Modes	Single, Burst, Set Value, Continuous, Pointer Sequence Generation	
SPE Pointer Burst Count	Value ≤ 8, direction is not selectable	
Frequency Offset Range for SPE Pointer Movement	*Pattern* 87/3	*Range* ± 100 ppm
Frequency Offset Resolution for SPE Pointer Movement	*Pattern* 87/3	*Resolution* 0.1 ppm
Frequency Offset Accuracy for SPE Pointer Movement	*Pattern* 87/3	*Accuracy* 1.0 ppm
Pointer sequences	Single Burst Phase Transient Periodic Continuous Periodic Continuous with Add Periodic Continuous with Cancel Periodic 87–3 Periodic 87–3 With Add Periodic 87–3 With Cancel Periodic 26–1 Periodic 26–1 With Add Periodic 26–1 With Cancel Single Alternating Double Alternating	

Table A–7: General specifications — SONET

Characteristic	Description	
Power Requirements	Maximum power consumption is 90 W with Option 22 or 58 Module attached. For each supply voltage, the current requirement from the VXIbus mainframe is listed below:	
	Voltage	*Average Current*
	+24 V	0.0 A
	–24 V	0.0 A
	+12 V	0.8 A
	–12 V	0.3 A
	+5 V	9.4 A
	–5.2 V	5.3 A
	–2 V	0.5 A
Cooling Requirement	With Option 22 or 58 module attached: 3.0 l/s airflow with 0.05 mm H_2O pressure drop for 10° C temperature rise	
Temperature	Operating Range	0° C to +50° C, with +15° C temperature rise
	Nonoperating Range	–40° C to +71° C
Humidity	≤ 90% relative humidity for continuous operation at ≤ 30° C, ambient ≤ 75% relative humidity for continuous operation from 30° C to 40° C, ambient ≤ 45% relative humidity for continuous operation from 40° C to 50° C, ambient	
EC Declaration of Conformity – EMC	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities: EN 50081-1 Emissions: EN 55011* Class A Radiated and Conducted Emissions EN 60555-2 Powerline Harmonic Emissions EN 50082-1 Immunity: IEC 801-2 Electrostatic Discharge Immunity IEC 801-3 RF Electromagnetic Field Immunity IEC 801-4 Electrical Fast Transient/Burst Immunity IEC 801-5 Power Line Surge Immunity	
Physical Characteristics	Net Weight	Approximately 4 kg (8.7 lb)
	Height	262 mm (10.3 in)
	Width	90.5 mm (3.57 in)
	Depth	366 mm (14.4 in)

* **When an Option 58 Add/Drop/Test Module is installed on a VX4610, the resultant system does not comply with EN 55011 Class A Limits.**

Table A–8: ECL interface (Option 02) functional specifications — SONET and SDH

Characteristic	Description		
Interface	Controlled by the VX4610 over the local bus		
Connector Type	SMA		
Transmit/Receive Data Rates	Determined by VX4610, refer to VX4610 output data rates		
Transmit/Receive Data Formats	NRZ		
Input/Output Impedance	50 Ω		
Signal Types	Single or Differential, ECL or PECL (Frame Pulse output is single-ended only)		
ECL Output Voltage Levels (50 Ω to –2.0 V termination)	*Characteristic* Minimum high level output Maximum low level output		*Output Level* –1.1 V –1.6 V
ECL Input Voltage Levels (50 Ω to –2.0 V termination)	*Characteristic* Minimum high level input Maximum low level input		*Input Level* –1.175 V –1.475 V
PECL Output Voltage Levels (50 Ω to +3.0 V termination)	*Characteristic* Minimum high level output Maximum low level output		*Output Level* 3.9 V 3.4 V
PECL Input Voltage Levels (50 Ω to +3.0 V termination)	*Characteristic* Minimum high level input Maximum low level input		*Input Level* 3.825 V 3.525 V
Clock to Data Delay (Measured from the falling edge of the clock pulse.)	Minimum: Maximum:	–300 ps +300 ps	
Frame Pulse Position (51.84 Mb/s rate only)	The rising edge of the Frame Pulse is coincident with the most significant bit of frame byte A2.		
Clock to Frame Pulse Delay (Measured from the rising edge of the clock pulse at the 51.84 Mb/s rate only.)	Minimum: Maximum:	8 ns 10 ns	
Receiver Data Setup and Hold Times (Setup and Hold times are measured with respect to the rising edge of the clock pulse.)	Setup: Hold :	250 ps 250 ps	

Table A–9: ECL interface (Option 02) general specifications — SONET and SDH

Characteristic	Description	
Power Requirements	Maximum power consumption is 17 W with the Option 02 module attached. For each supply voltage, the current requirement from the VXIbus mainframe is listed below:	
	Voltage	*Average Current*
	+24 V	0.0 A
	–24 V	0.0 A
	+12 V	0.3 A
	–12 V	0.1 A
	+5 V	0.4 A
	–5.2 V	1.8 A
	–2 V	0.0 A
Cooling Requirement	With Option 02 module attached: 1.361 l/s airflow with 0.03 mm H_2O pressure drop for 10° C temperature rise	
Temperature	Operating Range	0° C to +50° C
	Nonoperating Range	–40° C to +71° C
Humidity	≤ 90% relative humidity for continuous operation at ≤ 30° C, ambient	
	≤ 75% relative humidity for continuous operation from 30° C to 40° C, ambient	
	≤ 45% relative humidity for continuous operation from 40° C to 50° C, ambient	
Electromagnetic Compatibility	A VX4610 with Option 02 installed meets EC Council Directive 89/336/EEC, as specified in the Generic Emissions Standard EN 50081-1: Class A for radiated and EN 50082-1: Class A for conducted emissions.	
Bench Handling: Nonoperating	Meets MIL–T–28800E for Type III equipment with shield covers removed or in place.	
Electrostatic Discharge	Meets IEC 801-2 up to 8 kV with no change to control settings or impairment of normal operation; up to 15 kV with no damage that prevents recovery of normal operation by the user.	
Physical Characteristics	Net Weight	1.25 kg (2.75 lb)
	Height	262 mm (10.3 in)
	Width	30.2 mm (1.19 in)
	Depth	366 mm (14.4 in)

VX4610 SDH Specification Tables

The VX4610 specifications, as referenced to the ITU-T SDH standards, are arranged by functional groups in Tables A–10 through A–16.

Table A–10: Plug-in interface module, transmit output — SDH

Characteristic	Description	
Electrical Output		
Data Rates	STM-0E	51.84 Mb/s
	STM-1E	155.52 Mb/s
Data Formats	STM-0E	AMI
	STM-1E	CMI
Signal Level at Transmit Output (0 dB Level)	STM-0E, STM-1E	± 0.5 V_{pk} ± 10% into 75 Ω (0.80 V_{p-p} into 50 Ω)
Pulse Shape at Transmit Output (0 dB Level)	STM-1E	Meets ITU-T G.703 Eye Masks
Pulse Shape at –6 dB Level	STMX-1	Meets ITU-T G.703 Eye Masks
Return Loss	STM-1E	> 15 dB (7 MHz to 234 MHz)
Output Impedance	Unbalanced, 75 Ω to ground	
Output Protection	Open and short circuit protected	
Connector	BNC connector	
Optical Output		
Data Rates*	STM-1	155.52 Mb/s
	STM-4†	622.08 Mb/s
Data Formats*	Scrambled NRZ (scrambling can be enabled or disabled)	
Signal Level*, typical	Options 03 and 04	–10 dBm, reducing to –12 dBm at end of life
	Options 05 and 10	0 dBm
Pulse Shape*	STM-1	Meets ITU-T G.957 Eye Masks
	STM-4†	Meets ITU-T G.957 Eye Masks
Wave Length*, typical	Options 03 and 04	1308 nm typical (within the range1260 nm to 1360 nm)
	Option 05	1550 nm typical (within the range1480 nm to 1580 nm)
	Option 10	1310 nm typical (within the range1280 nm to 1335 nm)
Spectral Width*, typical	Options 03 and 04	< 4.0 nm
	Options 05 and 10	< 1.0 nm
Laser Classification*	Class 1 laser, complies with 21 CFR 1040.10 and 1040.11, complies with IEC 825, Section 9.4	

Table A–10: Plug-in interface module, transmit output — SDH (cont.)

Characteristic	Description
Connectors*	Tektronix Universal Optical Output Connector with FC-PC Option (other supplied connector options are ST, SC, and DIN 46256)

*** Characteristic does not apply to the STM-0E and STM-1E Electrical Modules.**

† Characteristic does not apply to the STM-0 and STM-1 Optical/Electrical Modules.

Table A–11: Plug-in interface module, receive input — SDH

Characteristic	Description	
Electrical Input		
Data Rates	STM-0E	51.84 Mb/s
	STM-1E	155.52 Mb/s
Data Formats	STM-0E	AMI
	STM-1E	CMI
Signal Sensitivity	STM-1E	Maximum sensitivity is ± 0.35 V_{pk} for BER ≤ 10^{-10}, with signal amplitude measured at the transmitter output and delivered to receiver through 137.2 m of AT&T 728A cable
Signal Equalization	STM-1E	Automatic equalization for up to 137.2 m of AT&T 728A cable per ITU-T G.703
Return Loss	STM-1E	> 15 dB (7 MHz to 234 MHz)
Input Impedance	Unbalanced, 75 Ω to ground	
Input Protection	Up to ± 5V, short term	
Voltage Measurement Accuracy, typical	Positive peak voltage of received signal is measured with ± 10% accuracy, typical.	
Connector	BNC connector	
Optical Input		
Data Rates*	STM-1	155.52 Mb/s
	STM-4†	622.08 Mb/s
Data Formats*	Descrambled NRZ (descrambling can be enabled or disabled)	
Maximum Optical Input Power*	–5 dBm without destruction –7 dBm for BER ≤ 10^{-10}	
Signal Sensitivity*	STM-1	–28 dBm for BER ≤ 10^{-10}
	STM-4†	–28 dBm for BER ≤ 10^{-10}

Table A–11: Plug-in interface module, receive input — SDH (cont.)

Characteristic	Description
Power Meter Accuracy*, typical	± 3 dBm, for input power in the range from –28 dBm to –10 dBm
Connectors	Tektronix Universal Optical Connector with FC-PC Option (other supplied connector options are ST, SC, and DIN 46256)

*** Characteristic does not apply to the STM-0E and STM-1E Electrical Modules.**

† Characteristic does not apply to the STM-0 and STM-1 Optical/Electrical Modules.

Table A–12: Transmitter clock — SDH

Characteristic	Description
Internal Clock	Unless other sources are enabled, Transmit Line Clock is based on internal oscillator
Accuracy	± 4.6 ppm, for instrument calibrated within 24 months ± 1.0 ppm, for instrument ambient temperature of 25° ± 3° C and calibrated within one month
Line Output Jitter	< 0.01 Unit Intervals$_{RMS}$ in the frequency band between 12 kHz and 5 MHz
Transmit Line Frequency Offset	± 100 ppm of nominal line rate
2 Mb/s Reference	When enabled, Transmit Line Clock synchronized to a clock recovered from an external 2.048 Mb/s signal
Frequency Lock Range, typical	2.048 Mb/s ± 40 ppm
Input Impedance	Unbalanced, 75 Ω ± 5%
Maximum Signal without Destruction, typical	± 5 V (DC + peak AC)
Input Connector	BNC connector
Transmit Line Frequency Offset	± 100 ppm of line rate referenced to external source
Recovered Clock (Loop)	Clock is recovered from received SDH signal
Input Jitter Tolerance	Meets EIA T1A-526-15 (as Standards Proposal Number 2266-A, dated 9/91)
Jitter Transfer	Meets EIA T1X1.3/93-006R1
Frequency Lock Range	Nominal line rate ± 125 ppm
Transmit Line Frequency Offset	± 100 ppm of recovered clock rate
External Clock	When enabled, the Transmit Line Clock is driven directly by an External Clock reference. The selected line rate determines the appropriate nominal External Clock frequency. Apply a valid External Clock signal before you enable the External Clock.
Input Frequency	*Line Rate* — *External Clock Frequency* STM-1* — 155.52 MHz STM-1E — 311.04 MHz STM-4*† — 622.08 MHz

Table A–12: Transmitter clock — SDH (cont.)

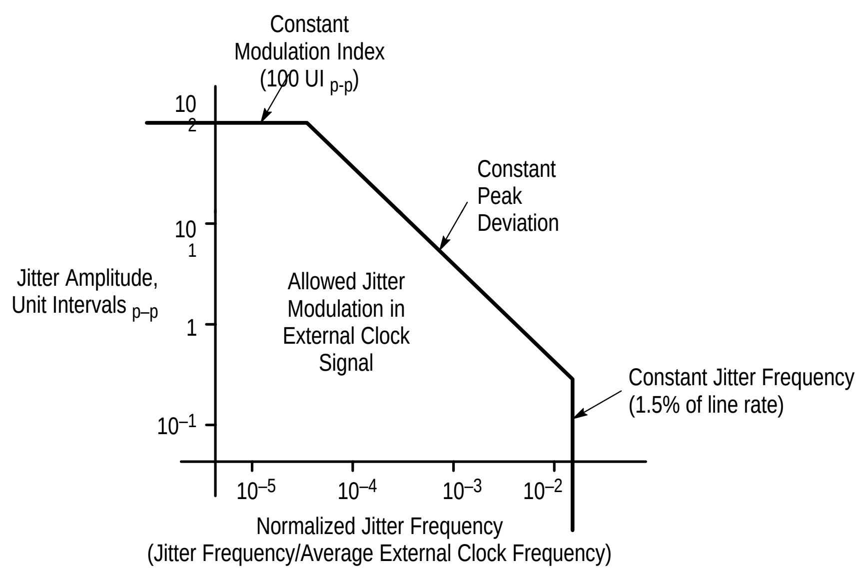
Characteristic	Description
Input Frequency Lock Range, Tributary Mapped into Payload	External Clock frequency averaged over any 100 ms time interval = nominal line rate ± 125 ppm
Input Frequency Lock Range, Tributary Not Mapped into Payload	External Clock frequency averaged over any 100 ms time interval = nominal line rate ± 1000 ppm
Jitter Frequency and Amplitude	Maximum jitter frequency = 1.5% of nominal line rate Maximum jitter amplitude = 100 UI $_{p\text{-}p}$, derated by jitter frequency Allowed jitter frequency and amplitude range is defined by the boundaries in the graph below 
Maximum Signal without Destruction	± 5 V (DC + peak AC)
Input Impedance	Unbalanced, 50 Ω (DC coupled)
Input Amplitude Requirement, typical	≥ 600 $mV_{p\text{-}p}$, centered at 0.0 V
Input Slew Rate Requirement, typical	dV_{in}/dt > 250 mV/ns (slew rate requirement is met by sine or square wave signal ≥ 600 $mV_{p\text{-}p}$)
Input Symmetry Requirement, typical	45% to 55% duty cycle, measured at 0.0 V
Connector	SMA connector
Transmit Line Frequency Offset	± 100 ppm of line rate referenced to External Clock frequency

Table A–13: Miscellaneous input/output specifications — SDH

Characteristic	Description
DCC Add/Drop Interface	A DB-37 female connector provides the I/O interface to transfer added signals from or dropped signals to an external protocol analyzer. Clock and data signals are differential TTL, conform to RS-422 specifications, and are also compatible with single-ended TTL signals. The connector pinout is listed below: *Signal Characteristic* — *Non-Inverted* — *Inverted* Insert (Add) Data — pin 4 — pin 22 Insert (Add) Clock — pin 5 — pin 23 Drop Data — pin 6 — pin 24 Drop Clock — pin 8 — pin 26
Signal Levels	V_{IH} (minimum) 2.0 V V_{IL} (maximum) 0.8 V V_{OH} (minimum) 2.4 V V_{OL} (maximum) 0.4 V
Clock Frequency	The Add/Drop Clock is a gapped clock with requirements depending on the specific Add/Drop signal as listed below: *Add/Drop Signal* — *Average Clock Rate* — *Minimum Period* — *Maximum Period* Section DCC — 192 kHz — 4.4 µs — 10 µs Line DCC — 576 kHz — 460 ns — 1 µs F1 Byte — 64 kHz — 12 µs — 30 µs F2 Byte — 64 kHz — 12 µs — 30 µs
Trigger Outputs	Front-panel Tx SECTION and Rx SECTION trigger output signals are TTL level into a high impedance load. Minimum pulse width is 50 ns. V_{OH} (minimum) 2.4 V V_{OL} (maximum) 0.4 V The front-panel trigger outputs provide > 1 V pulses when terminated with 50 Ω. TTL-level trigger outputs are also available on the TTLTRG* lines of the VXIbus backplane.
Trigger Input	Front-panel TRIGGER IN is a standard TTL input. V_{IH} (minimum) 2.0 V V_{IL} (maximum) 0.8 V Trigger inputs are also available from the TTLTRG* lines of the VXIbus backplane.

Table A–14: Transmit and receive functional specifications — SDH‡

Characteristic	Description
Data Scrambling	Complies with scrambling pattern described in ITU-T G.709. Scrambling can be disabled.
Overhead Structure	For all line rates, the Regenerator Section, Multiplexer Section, and Path Overhead bytes meet the requirements of ITU-T G.708.
Channel (AU) Selection	*Signal Rate and Structure* — *Allowed Channels* STM-1 — 1 STM-4 — 1, 2, 3, 4
Framing Methods	For transmitted signals, the framing method depends on the transmit rate. *Transmit Rate* — *Transmitted Framing Byte Sequence* STM-1E or STM-1 — Three A1 bytes followed by three A2 bytes STM-4 — Twelve A1 bytes followed by twelve A2 bytes For received signals, the signal is considered framed when the following byte sequences are detected. Four or more consecutive frameword errors cause an OOF condition. An OOF condition lasting for 3 ms or more causes an LOF failure. *Receive Rate* — *Expected Framing Byte Sequence* All rates — First frame: first three A1 bytes followed by first three A2 bytes. Subsequent frames: first A1 byte followed by first four bits of first A2 byte.
Equipped and Unequipped Payload (transmitter only)	Equipped or unequipped payload is user selectable. The VX4610 sets the C2 byte to 00 for unequipped, 01 for equipped.
PRBS Payload Patterns	A PRBS pattern, as defined in ITU-T 0.151, is transmitted sequentially in all bytes of the payload except for the Path Overhead bytes. Four pattern lengths are selectable: 2^9–1, 2^{15}–1, 2^{20}–1, and 2^{23}–1. The receiver synchronizes to the incoming pattern and counts bit errors when the incoming pattern does not match the expected pattern.
User Byte Payload Pattern	A user-defined byte, in the range of hexadecimal 00 to FF, is transmitted in all bytes of the payload except for the Path Overhead bytes. The receiver counts bit errors when the incoming pattern does not match the expected pattern.
Multi-frame Payload Sequence Generation (transmitter only)	If enabled, the VX4610 transmits user-defined payload data sequences. For STM-1 structure, the payload data sequence can be set from 1 to 54 frames in length. When the end of the payload data sequence is reached, it repeats. For convenience, the payload data sequence can be set to an incrementing pattern or to a user-specified 16-bit word. Any byte in the sequence can be individually edited. (Editing capability includes all path overhead bytes except J1, B3, and G1, which are under hardware control. You can affect the J1 in the form of a 64-byte string. You can affect the G1 byte if you set a FEBE count or Path RAI.)
Section Overhead Bytes	All Section Overhead bytes except for B1, B2, H1, H2, and H3, can be set to any value from hexadecimal 00 to FF. (You can control H1, H2, and H3 with pointer adjustments.) All received Section Overhead bytes can be examined.
DCC	If enabled, the transmitter inserts data from the Overhead Port connector into the RS DCC or MS DCC bytes. If enabled, the receiver drops data from the RS DCC or MS DCC bytes to the Overhead Port connector. Only one DCC or User byte can be added or dropped at a time.

Table A–14: Transmit and receive functional specifications — SDH‡ (cont.)

Characteristic	Description
F1 Byte	If enabled, the transmitter inserts data from the Overhead Port connector into the F1 byte. If enabled, the receiver drops data from the F1 byte to the Overhead Port connector. Only one DCC or User byte can be added or dropped at a time.
Path Overhead Bytes	The following Path Overhead bytes can be set to any value from hexadecimal 00 to FF: C2, F2, Z3, Z4, and Z5. (You can set the J1 byte in the form of a 64-bit string. You can also set the H4 byte to any value if part of a custom payload sequence.) The received Path Overhead bytes can be displayed.
F2 Byte	If enabled, the transmitter inserts data from the Overhead Port connector into the F2 byte. If enabled, the receiver drops data from the F2 byte to the Overhead Port connector. Only one DCC or User byte can be added or dropped at a time.
J1 Byte	If unequipped, the Path Trace Byte J1 is set to all nulls (hexadecimal 00). Alternatively, a user-defined string can be transmitted in a 64-byte sequence. The user-defined string consists of up to 62 ASCII characters followed by a carriage return and line feed. If the user-defined string has less than 62 characters, the remainder of the string is padded with null characters. The receiver returns the Path Trace bytes as a text string.
Generated Errors (transmitter only)	If enabled, the transmitter can generate errors on a one-time or continuous basis. For each error type, the affected byte(s) and the insertion rate range are listed below: *Error Type* — *Affected Byte(s)* — *Error Insertion Rate Range* RS Code Violation — B1 — 10^{-4} to 10^{-10} (STM-1E, STM-1) 10^{-5} to 10^{-10} (STM-4) MS Code Violation — B2 — 10^{-4} to 10^{-10} Path Code Violation — B3 — 10^{-3} to 10^{-10} Path FEBE — G1 — 10^{-3} to 10^{-10} Data — payload — 10^{-3} to 10^{-10} The accuracy of the (continuous) error insertion rate is 1%. The rate is adjustable with a resolution of two significant digits.
Error Mask (transmitter only)	For single error insertions, you can apply an 8-bit error mask to B1, B2, B3, or payload data errors. The mask can have any value between 1 and 255 (decimal).

Table A–14: Transmit and receive functional specifications — SDH‡ (cont.)

Characteristic	Description			
Error Measurement (receiver only)	The receiver measures incoming occurrences of all error types according to the methods described in ITU-T G.821. The accuracy, range, and resolution for the different types of measurements are listed below:			
	Basic Measurement Type	*Accuracy*	*Range*	*Resolution*
	Error Count	± 1 count ± 0.1% of count	0 to 10^7 10^7 to 10^{32}	1 count 3 digits
	Errored Seconds	± 1 second ± 0.1% of count	0 to 10^7 10^7 to 10^{32}	1 second 3 digits
	Percent Error-Free Seconds	± (1 sec / total meas. seconds)	0.00% to 100.00%	2 digits after decimal point
	Degraded Minutes	± 1 minute	0 to 143,999	1 minute
	Bit Error Ratio	± 0.1% of ratio	0 to 1.00	3 digits
Generated Alarms (transmitter only)	If enabled, the transmitter generates alarm conditions. For each alarm type, the affected byte(s) are listed below:			
	Alarm Type	*Affected Byte(s)*		
	MS AIS	All bytes in frame except RS Overhead		
	Path AIS	All bytes in AU and H1, H2, and H3 in MS Overhead		
	MS FERF	K2 in MS Overhead		
	Path RAI	G1 in Path Overhead		
Alarm Measurement (receiver only)	If enabled, the receiver measures the duration of the alarm condition. The measurement accuracy, range, and resolution are listed below:			
	Measurement Type	*Accuracy*	*Range*	*Resolution*
	Alarm Seconds	± 1 second ± 0.1% of count	0 to 10^7 10^7 to 10^{32}	1 second 3 digits
Generated Failures (transmitter only)	If enabled, the transmitter generates failure conditions. For each failure type, the affected byte(s) are listed below:			
	Failure Type	*Affected Byte(s)*		
	LOS	All bytes (transmit output attenuated ≥ 28 dB)		
	LOF	A1 and A2		
	LOP	H1		
Failure Measurement (receiver only)	If enabled, the receiver measures the duration of the failure condition. The measurement accuracy, range, and resolution are listed below:			
	Measurement Type	*Accuracy*	*Range*	*Resolution*
	Failure Seconds	± 1 second ± 0.1% of count	0 to 10^7 10^7 to 10^{32}	1 second 3 digits

Table A–14: Transmit and receive functional specifications — SDH‡ (cont.)

Characteristic	Description
Pointer Movements	
Single (transmitter only)	If enabled, a one-location pointer adjustment occurs once each time a SOUR:DATA:TEL:POIN:ACT command is sent over the GPIB. The direction of the adjustment alternates each time the command is sent.
Burst (transmitter only)	If enabled, the SOUR:DATA:TEL:POIN:ACT command starts a burst of pointer movements. Each burst consists of two to eight one-location pointer adjustments spaced four frames apart. All adjustments within a given burst are in the same direction. Subsequent bursts are in alternating directions.
Continuous (transmitter only)	If enabled, pointer adjustments occur continuously at a specified rate in an incrementing, decrementing, or alternating direction. The rate can be set within the range from 1 ms to 10 s between movements, with a resolution of 1 ms.
Set to Value (transmitter only)	If enabled, the pointer is immediately set to a new location with or without the NDF being set. The available range of pointer values is from 0 to 1023 (783 – 1023 are illegal values).
AU Pointer sequences available	Single Alternating G.783(b) Regular + Double G.783(c) Regular + Missing Double Alternating Single Burst Periodic 87–3 Periodic 87–3 With Add Periodic 87–3 With Cancel Periodic Continuous Periodic Continuous with Add Periodic Continuous with Cancel Phase Transient
Pointer Measurement (receiver only)	If enabled, the receiver can measure incoming pointer movements. The available measurements with their accuracy, range, and resolution are listed below:

Measurement Type	*Accuracy, Typical*	*Range*	*Resolution*
Positive Pointer Justifications	± 1 count ± 0.1% of count	0 to 10^7 10^7 to 10^{32}	1 count 3 digits
Negative Pointer Justifications	± 1 count ± 0.1% of count	0 to 10^7 10^7 to 10^{32}	1 count 3 digits
NDF (New Data Flag) Count	± 1 count ± 0.1% of count	0 to 10^7 10^7 to 10^{32}	1 count 3 digits
Invalid Pointer Count	± 1 count ± 0.1% of count	0 to 10^7 10^7 to 10^{32}	1 count 3 digits
Illegal Pointer Count	± 1 count ± 0.1% of count	0 to 10^7 10^7 to 10^{32}	1 count 3 digits

Table A–14: Transmit and receive functional specifications — SDH‡ (cont.)

Characteristic	Description
Trigger Output	The VX4610 produces triggers based on internally generated or detected events. Trigger events sourced from the Transmit section result in trigger output pulses to the front-panel Tx SECTION connector and, if enabled, to VXIbus backplane signals TTLTRG0, TTLTRG2, TTLTRG4, or TTLTRG6. Trigger events sourced from the Receive section result in trigger output pulses to the front-panel Rx SECTION connector and, if enabled, to VXIbus backplane signals TTLTRG1, TTLTRG3, TTLTRG5, or TTLTRG7.
Trigger Events, Sourced from Transmit Section	The VX4610 produces triggers based on generated frames, errors, alarms, failures, pointer movements, or changes in APS bytes.
Trigger Events, Sourced from Receive Section	The VX4610 produces triggers based on detected frames, errors, alarms, failures, pointer movements, or changes in APS bytes.
Front-Panel Trigger Output Signals	The front-panel Tx SECTION and Rx SECTION trigger outputs are active-high TTL signals. Instantaneous events, such as the beginning of the frame or occurrence of a Path Code Violation result in an active-high trigger output pulse. Extended events, such as an LOP failure or an MS AIS, result in a high-level trigger output while the event is occurring. The trigger output signal returns to low level after the event is no longer present.
VXIbus Backplane Trigger Output Signals	If enabled, the VXIbus backplane TTLTRG trigger output signals are active-low pulses. Instantaneous events, such as the beginning of the Frame or occurrence of a Path Code Violation result in an active-low trigger output pulse. Extended events, such as an LOP failure or an MS AIS, result in a low-level trigger output while the event is occurring. The trigger output signal returns to a high level after the event is no longer present. The backplane trigger outputs are enabled to a specific pair of TTLTRG lines, one sourced from the Transmit section and one sourced from the Receive section. Backplane triggers follow the VXIbus TTLTRG Synchronous Trigger Protocol; an acknowledgement from an acceptor is not required.
Overhead Capture (receiver only)	If enabled, the VX4610 acquires one Section Overhead and one Path Overhead into memory. The overhead capture process is triggered by one of the following: a TTL-level pulse from the front-panel TRIGGER IN connector, any one of the eight VXIbus backplane TTLTRG signals, an IMMediate command over the GPIB, or any one of the trigger events sourced from the Receive section. Rising-edge or falling-edge polarity is selectable for the front-panel or backplane trigger inputs. Capture memory acquires the Section Overhead from the frame containing the trigger event. Capture memory acquires the Path Overhead that begins just prior to the trigger event.
Payload Capture (receiver only)	If enabled, the VX4610 acquires a sequence of 54 payloads into memory. The payload capture process is triggered by one of the following: a TTL-level pulse from the front-panel TRIGGER IN connector, any one of the eight VXIbus backplane TTLTRG signals, an IMMediate command over the GPIB, or any one of the trigger events sourced from the Receive section. Rising-edge or falling-edge polarity is selectable for the front-panel or backplane trigger inputs.

Table A–14: Transmit and receive functional specifications — SDH‡ (cont.)

Characteristic	Description	
Trigger Position (receiver only)	A trigger event controls the timing of the payload and overhead capture process. The trigger event can be located at the beginning, the middle, or the end of the sequence of captured payloads. For each trigger location, the table below shows the frame in which the trigger occurs:	
	Trigger Location	*AU-4 Structure*
	Beginning	2
	Middle	27
	End	53

‡ **The functional specifications describe characteristics of both the transmitter and receiver unless noted otherwise.**

Table A–15: 2 Mb/s, 34 Mb/s, 140 Mb/s add/drop/test (Options 36 and 58) specifications — SDH

Characteristic	Description	
2 Mb/s, 34 Mb/s, 140 Mb/s Electrical Output (Drop/Transmit)		
Data Rates (drop)	2 Mb/s	2.048 Mb/s ± 50 ppm
	34 Mb/s	34.368 Mb/s ± 130 ppm
	140 Mb/s	139.264 Mb/s ± 100 ppm
Data Rates (transmit)	2 Mb/s	2.048 Mb/s ± 150 ppm
	34 Mb/s	34.368 Mb/s ± 150 ppm
	140 Mb/s	139.264 Mb/s ± 150 ppm
Data Formats	2 Mb/s	HDB3 coding
	34 Mb/s	HDB3 coding
	140 Mb/s	CMI coding
Pulse Shape	2 Mb/s	Meets G.703 pulse template for 2 Mb/s signals
	34 Mb/s	Meets G.703 pulse template for 34 Mb/s signals
	140 Mb/s	Meets G.703 pulse template for 140 Mb/s signals
Output Impedance	2 Mb/s	Balanced 120 Ω, Unbalanced 75 Ω
	34 Mb/s	Unbalanced 75 Ω
	140 Mb/s	Unbalanced 75 Ω
Return Loss	140 Mb/s	> 15 dB from 7 MHz to 210 MHz
Jitter	Meets network interface specification in G.823 (November 1988), Figure 1	
Timing Tolerance	140 Mb/s drop meets specification in G.703 (November 1988), Table 9. (Positive transitions at unit interval boundaries ± 0.5 ns. Positive transitions at mid-interval ± 0.35 ns.)	

Table A–15: 2 Mb/s, 34 Mb/s, 140 Mb/s add/drop/test (Options 36 and 58) specifications — SDH (cont.)

Characteristic	Description	
Output Protection	Open and short circuit protected	
Connectors	2 Mb/s	Siemens, three-prong, 120 Ω jacks (Balanced) or BNC, 75 Ω (Unbalanced)
	34 Mb/s	BNC, 75 Ω
	140 Mb/s	BNC, 75 Ω
Data Sources	2 Mb/s	TU-12 dropped signal or internal pattern generator
	34 Mb/s	TU-3 dropped signal or internal pattern generator
	140 Mb/s	SDH AU-4 dropped signal or internal pattern generator
NRZ Electrical Outputs (Option 58 only)		
Data Rates	E1	Drop: 2.048 Mb/s ±50 ppm Transmit: 2.048 Mb/s ±150 ppm
	E3	Drop: 34.368 Mb/s ±130 ppm Transmit: 34.368 Mb/s ±150 ppm
	E4	Drop: 139.264 Mb/s ± 100 ppm Transmit: 139.264 Mb/s ±150 ppm
Connectors	E1	BNC or SMB, software selectable
	E3	BNC or SMB, software selectable
	E4	BNC or SMB, software selectable
Data Format	NRZ	
Impedance	75 Ω	
Termination	E1, E3: E4:	Internal External with 75 Ω to –2 V when NECL selected or 75 Ω to +3 V when PECL selected
Signal Type	E1, E3	Single ended
	E4	Differential (output levels are suitable for single-ended operation)
E4 Voltage Levels	NECL	With 75 Ω to –2 V, Min high –1.1 V, Max low –1.6 V. Differential termination using 150 Ω is not adequate.
	PECL	With 75 Ω to +3 V, Min high +3.9 V, Max low +3.4 V. Differential termination using 150 Ω is not adequate.
E4 Clock to Data Skew	Max ±1.0 ns	
E1, E3 Voltage Levels	TTL	
E1, E3 Clock to Data Skew	Max ±6.0 ns	
Data Sources	E1	TU-12 dropped signal or internal pattern generator
	E3	TU-3 dropped signal or internal pattern generator
	E4	SDH SPE dropped signal or internal pattern generator

Table A–15: 2 Mb/s, 34 Mb/s, 140 Mb/s add/drop/test (Options 36 and 58) specifications — SDH (cont.)

Characteristic	Description	
2 Mb/s, 34 Mb/s, 140 Mb/s Electrical Inputs (Add/Receive)		
Data Rates (add)	2 Mb/s	2.048 Mb/s ± 50 ppm
	34 Mb/s	34.368 Mb/s ± 130 ppm
	140 Mb/s	139.264 Mb/s ± 100 ppm
Data Rates (receive)	2 Mb/s	2.048 Mb/s ± 150 ppm
	34 Mb/s	34.368 Mb/s ± 150 ppm
	140 Mb/s	139.264 Mb/s ± 150 ppm
Data Formats	2 Mb/s	HDB3 coding
	34 Mb/s	HDB3 coding
	140 Mb/s	CMI coding
Signal Equalization	2 Mb/s	Nominal pulse as specified in G.703, modified by cable over a range corresponding to ≤6 dB attenuation at 1.024 MHz
	34 Mb/s	Nominal pulse as specified in G.703, modified by cable over a range corresponding to ≤6 dB attenuation at 17.184 MHz
	140 Mb/s	Nominal pulse as specified in G.703, modified by cable over a range corresponding to ≤12 dB attenuation at 70 MHz
Monitor Mode Signal Level	Supports ≤26 dB flat-loss attenuation of signal specified in G.703 and input connector	
Input Impedance	2 Mb/s	Balanced 120 Ω, Unbalanced 75 Ω
	34 Mb/s	Unbalanced 75 Ω
	140 Mb/s	Unbalanced 75 Ω
Return Loss	2 Mb/s	>12 dB, 51 kHz to 120 kHz >18 dB, 120 kHz to 2.048 MHz >14 dB, 2.048 MHz to 3.072 MHz
	34 Mb/s	>12 dB, 860 kHz to 1.72 MHz >18 dB, 1.72 MHz to 34.368 MHz >14 dB, 34.368 MHz to 51.550 MHz
	140 Mb/s	> 15 dB from 7 MHz to 210 MHz
Connectors	2 Mb/s	Siemens three-prong 120 Ω jacks (Balanced) or BNC, 75 Ω (Unbalanced)
	34 Mb/s	BNC, 75 Ω
	140 Mb/s	BNC, 75 Ω
NRZ Electrical Inputs (Option 58 only)		

Table A–15: 2 Mb/s, 34 Mb/s, 140 Mb/s add/drop/test (Options 36 and 58) specifications — SDH (cont.)

Characteristic	Description	
Data Rates	E1	Add: 2.048 Mb/s ±50 ppm Terminate: 2.048 Mb/s ±150 ppm
	E3	Add: 34.368 Mb/s ±130 ppm Terminate: 34.368 Mb/s ±150 ppm
	E4	Add: 139.264 Mb/s ±100 ppm Terminate: 139.264 Mb/s ±150 ppm
Connectors	E1	BNC or SMB, software selectable
	E3	BNC or SMB, software selectable
	E4	BNC or SMB, software selectable
Data Format	NRZ	
Impedance	75 Ω	
Termination	E1, E3: E4:	Internal External with 75 Ω to –2 V when NECL selected or 75 Ω to +3 V when PECL selected
Signal Type	E1, E3	Single-ended
	E4	Single-ended or differential
E4 Voltage Levels	NECL	Min high –1.175 V, Max low –1.475
	PECL	Min high +3.825, Max low +3.525
E4 Data Setup and Hold Time	Setup	1.0 ns
	Hold	1.0 ns
Required Clock Symmetry	42/58%	
E1, E3 Voltage Levels	TTL	
E1, E3 Data Setup and Hold Time	Setup	3.0 ns
	Hold	3.0 ns
Loss of Clock	Loss of clock = no signal transitions for at least 250 ms At loss of clock, to maintain operation of the synchronous logic, the data path is replaced with 0 and alternate clock source is used:	
	E1	2.048 MHz
	E3	34.368 MHz
	E4	17.408 MHz
	At clock recovery (clock transitions recognized), normal operation resumes after a brief delay.	
Data Sources	E1	TU-12 dropped signal or internal pattern generator
	E2	TU-3 dropped signal or internal pattern generator
	E4	SDH SPE dropped signal or internal pattern generator

Table A–15: 2 Mb/s, 34 Mb/s, 140 Mb/s add/drop/test (Options 36 and 58) specifications — SDH (cont.)

Characteristic	Description
External Clock Input	
Nominal Frequency	2 Mb/s 2.048 MHz 34 Mb/s 34.368 MHz 140 Mb/s 139.264 MHz $\times$ 2 = 278.528 MHz
Frequency Range	Nominal frequency $\pm$ 150 ppm
Input Impedance	Unbalanced, 75 Ω, AC coupled
Connector	BNC
Signal Level	0.5 V_{p-p} to 1.5 V_{p-p}
Internal Pattern Generator	
Clock Source	E1 (2 Mb/s) Clock: Internal reference, 2 Mb/s Rx Clock, NRZ–RX Data (Opt 58 only), or External Clock E3 (34 Mb/s): Internal reference, 34 Mb/s Rx Clock, NRZ–RX Data (Opt 58 only), or External Clock E4 (140 Mb/s): Internal reference, 140 Mb/s Rx Clock, NRZ–RX Data (Opt 58 only), or External Clock Loss of External Clock signal (<25 mV_{p-p} for at least 250 ms) results in a transmitted signal with no transitions.
Framing	2 Mb/s: Unframed, PCM30 with CRC, PCM30 without CRC, PCM31 with CRC, PCM31 without CRC 34 Mb/s: Framed or Unframed 140 Mb/s: Framed or Unframed
Patterns	PRBS 2^{15}–1 PRBS 2^{20}–1 PRBS 2^{23}–1 1 in 8 All 1s, All 0s Fixed Pattern 8 bit Fixed Pattern 16 bit Fixed Pattern 24 bit
Error Types	None, Frame Bit Error, CRC Error (2 Mb/s PCM30CRC and PCM31CRC only), or Pattern Bit Error
Error Rate Range	(see below)
Error Rate Resolution	One digit to the left of the decimal point

Error Rate Range:

	2 Mb/s	34 Mb/s	140 Mb/s
Frame Bit Error	10^{-2} to 10^{-7}	10^{-2} to 10^{-7}	10^{-2} to 10^{-8}
CRC Error	10^{-4} to 10^{-8}	NA	NA
Pattern Bit Error	10^{-2} to 10^{-8}	10^{-2} to 10^{-9}	10^{-2} to 10^{-9}

Table A–15: 2 Mb/s, 34 Mb/s, 140 Mb/s add/drop/test (Options 36 and 58) specifications — SDH (cont.)

Characteristic	Description	
Error Rate Accuracy	1%	
Alarm Types	AIS, RAI	
Internal Pattern Receiver		
Data Sources	E1 (2 Mb/s)	TU-12 dropped signal, 2 Mb/s received signal, or NRZ–RX Data (Opt 58 only)
	E3 (34 Mb/s)	TU-3 dropped signal, 34 Mb/s received signal, or NRZ–RX Data (Opt 58 only)
	E4 (140 Mb/s)	AU-4 dropped signal, 140 Mb/s received signal, or NRZ–RX Data (Opt 58 only)
Framing	2 Mb/s	Unframed, PCM30 with CRC, PCM30 without CRC, PCM31 with CRC, PCM31 without CRC
	34 Mb/s	Framed, or Unframed
	140 Mb/s	Framed, or Unframed
Patterns	PRBS 2^{15}–1 PRBS 2^{20}–1 PRBS 2^{23}–1 1 in 8 All 1s, All 0s Fixed Pattern 8 bit Fixed Pattern 16 bit Fixed Pattern 24 bit	
Error Types	Frame Bit Error, Pattern Bit Error, CRC Error (2Mb/s only)	
Error Rate Range	10^{-2} maximum	
Error Rate Resolution	Two digits after the decimal point	
Error Rate Accuracy	1%	
Alarm Types	AIS, RAI	
2 Mb/s SDH TU-12 Drop		
Frequency Lock Status	Locked or Unlocked	
Mapping	Floating Async	
TU-12 Control	Allows selection of any one of 63 TU-12 channels	
TU-12 Alarm Types	TU-12 AIS, TU-12 FERF	
TU-12 Failure Types	TU-12 Loss of Pointer, TU-12 LOM (loss of multiframe)	
TU-12 Error Types	TU-12 BIP-2, TU-12 FEBE	
TU-12 Error Count Range	$0 \leq$ value $\leq 10^{32}$	
TU-12 Error Ratio Range	TU-12 BIP-2	10^{-4} to 10^{-10}
	TU-12 FEBE	10^{-4} to 10^{-10}
TU-12 Error Ratio Resolution	Two digits after the decimal point	
TU-12 Error Ratio Accuracy	± 1%	

Table A–15: 2 Mb/s, 34 Mb/s, 140 Mb/s add/drop/test (Options 36 and 58) specifications — SDH (cont.)

Characteristic	Description	
AU-4 Pointer Movement Jitter	Jitter of dropped signal must meet the network interface jitter requirements in G.823 Jitter at Network Interfaces.	
TU-12 Pointer Movement Jitter	Jitter of dropped signal must meet the network interface jitter requirements in G.823 Jitter at Network Interfaces.	
TU-12 Pointer Value	$0 \leq$ value ≤ 139	
TU-12 Pointer Increment Count	$0 \leq$ value $\leq 10^{32}$	
TU-12 Pointer Decrement Count	$0 \leq$ value $\leq 10^{32}$	
Illegal TU-12 Pointer Count	$0 \leq$ value $\leq 10^{32}$	
TU-12 Pointer NDF Count	$0 \leq$ value $\leq 10^{32}$	
AU-4/TU-12 Pointer Movement Interaction	The TU-12 Drop allows both AU-4 and TU-12 pointer movements simultaneously	
2 Mb/s SDH TU-12 Add		
Frequency Lock Status	Locked or Unlocked	
Mapping	Floating Async	
TU-12 Add Source	Internal Pattern Generator or 2 Mb/s Rx Signal	
TU-12 Active Channel Selection	Allows selection of any one of 63 TU-12 channels	
TU-12 Background Channel Content	*Active Channel Source*	*Background Channel Content*
	Internal Pattern Generator	PRBS 2^{15}–1 or idle pattern 11010101 in each time slot if active channel is framed
	External Add	Unframed PRBS 2^{15}–1
TU-12 Background Channel Framing	*Active Channel Source*	*Background Channel Framing*
	Internal Pattern Generator	Same as Internal Pattern Generator
	External Add	Unframed
TU-12 Signal Label	Default values set as specified in G.709, not user settable (set to 2)	
TU-12 Alarm Types	TU-12 AIS, TU-12 FERF	
TU-12 Failure Types	TU-12 Loss of Pointer, TU-12 LOM (loss of multiframe)	
TU-12 Error Types	TU-12 BIP-2, TU-12 FEBE	
TU-12 Pointer Movement Modes	Single, Burst, Set Value, Continuous, Pointer Sequence Generation	
TU-12 Pointer Burst Count	Value ≤ 8	
TU-12 Pointer Generation	Time between pointer movements ≥ 36 ms, increment, decrement and alternate	
TU-12 Time Interval Resolution	1 ms	
AU-4 Pointer Movement Modes	87/3 Pattern (see base instrument specifications for additional modes)	

Table A–15: 2 Mb/s, 34 Mb/s, 140 Mb/s add/drop/test (Options 36 and 58) specifications — SDH (cont.)

Characteristic	Description
TU Pointer sequences available	Single Alternating G.783(b) Regular + Double G.783(c) Regular + Missing Double Alternating Single Burst Periodic 87–3 Periodic 87–3 With Add Periodic 87–3 With Cancel Periodic Continuous Periodic Continuous with Add Periodic Continuous with Cancel Phase Transient Periodic 85–5 Periodic 85–5 With Add Periodic 85–5 With Cancel Periodic 35–1 Periodic 35–1 With Add Periodic 35–1 With Cancel
Frequency Offset Range for AU-4 Pointer Movement	*Pattern* / *Range* 87/3: ± 100 ppm
Frequency Offset Resolution for AU-4 Pointer Movement	*Pattern* / *Resolution* 87/3: 0.1 ppm
AU-4/TU-12 Pointer Movement Interaction	Simultaneous TU-12 and AU-4 pointer movements are not allowed
34 Mb/s SDH TU-3 Drop	
Frequency Lock Status	Locked or Unlocked
Mapping	Floating Async
TU-3 Control	Allows selection of any one of three TU-3 channels
TU-3 Alarm Types	TU-3 AIS, TU-3 FERF
TU-3 Failure Types	TU-3 Loss of Pointer
TU-3 Error Types	TU-3 BIP-8, TU-3 FEBE
TU-3 Error Count Range	$0 \leq \text{value} \leq 10^{32}$
TU-3 Error Ratio Range	TU-3 BIP-8: $0 \leq \text{value} \leq 1 \times 10^{-3}$ TU-3 FEBE: $0 \leq \text{value} \leq 1 \times 10^{-3}$
TU-3 Error Ratio Resolution	Two digits after the decimal point
TU-3 Error Ratio Accuracy	± 1%
AU-4 Pointer Movement Jitter	Jitter of dropped signal must meet the network interface jitter requirements in G.823 Jitter at Network Interfaces.
TU-3 Pointer Movement Jitter	Jitter of dropped signal must meet the network interface jitter requirements in G.823 Jitter at Network Interfaces.

Table A–15: 2 Mb/s, 34 Mb/s, 140 Mb/s add/drop/test (Options 36 and 58) specifications — SDH (cont.)

Characteristic	Description	
TU-3 Pointer Value	0 ≤ value ≤ 764	
TU-3 Pointer Increment Count	0 ≤ value ≤ 10^{32}	
TU-3 Pointer Decrement Count	0 ≤ value ≤ 10^{32}	
Illegal TU-3 Pointer Count	0 ≤ value ≤ 10^{32}	
TU-3 Pointer NDF Count	0 ≤ value ≤ 10^{32}	
AU-4/TU-3 Pointer Movement Interaction	The TU-3 Drop allows both AU-4 and TU-3 pointer movements simultaneously	
34 Mb/s SDH TU-3 Add		
Frequency Lock Status	Locked or Unlocked	
Mapping	Floating Async	
TU-3 Add Source	Internal Pattern Generator or 34 Mb/s Rx Signal	
TU-3 Active Channel Selection	Allows selection of any one of three TU-3 channels	
TU-3 Background Channel Content	*Active Channel Source*	*Background Channel Content*
	Internal Pattern Generator	PRBS 2^{15}
	External Add	Unframed PRBS 2^{15}
TU-3 Background Channel Framing	*Active Channel Source*	*Background Channel Framing*
	Internal Pattern Generator	Same as Internal Pattern Generator
	External Add	Unframed
TU-3 Alarm Types	TU-3 AIS, TU-3 FERF	
TU-3 Failure Types	TU-3 Loss of Pointer	
TU-3 Error Types	TU-3 BIP-8, TU-3 FEBE	
TU-3 Pointer Value	0 ≤ value ≤ 764	
TU-3 Pointer Movement Modes	Single, burst, set value, continuous or pointer sequence generation	
TU-3 Pointer Burst Count	Value ≤ 8	
TU-3 Pointer Generator	Time between pointer movements ≥ 2 ms	
TU-3 Time Interval Resolution	1 ms	
AU-4 Pointer Movement Modes	87/3 Pattern (see base instrument specifications for additional modes)	
Frequency Offset Range for AU-4 Pointer Movement	*Pattern*	*Range*
	87/3	± 100 ppm
Frequency Offset Resolution for AU-4 Pointer Movement	*Pattern*	*Resolution*
	87/3	0.1 ppm
AU-4/TU-3 Pointer Movement Interaction	Simultaneous TU-3 and AU-4 pointer movements are not allowed	
140 Mb/s SDH AU-4 Drop		

Table A–15: 2 Mb/s, 34 Mb/s, 140 Mb/s add/drop/test (Options 36 and 58) specifications — SDH (cont.)

Characteristic	Description
Frequency Lock Status	Locked or Unlocked
SDH Structure	AU-4 in STM-1
Mapping	Floating Async
O-Bits (90 per frame)	Always zero
AU-4 Pointer Movement Jitter	Jitter of dropped signal must meet the network interface jitter requirements in G.823 Jitter at Network Interfaces.
140 Mb/s SDH AU-4 Add	
Frequency Lock Status	Locked or Unlocked
SDH Structure	AU-4 in STM-1
Mapping	Floating Async
AU-4 Pointer Burst Count	Value ≤ 8
AU-4 Pointer Movement Modes	87/3 Pattern (see base instrument specifications for additional modes)
TU Pointer sequences available	Single Alternating G.783(b) Regular + Double G.783(c) Regular + Missing Double Alternating Single Burst Periodic 87–3 Periodic 87–3 With Add Periodic 87–3 With Cancel Periodic Continuous Periodic Continuous with Add Periodic Continuous with Cancel Phase Transient Periodic 85–5 Periodic 85–5 With Add Periodic 85–5 With Cancel Periodic 35–1 Periodic 35–1 With Add Periodic 35–1 With Cancel
Frequency Offset Range for AU-4 Pointer Movement	*Pattern* / *Range* 87/3 / ± 100 ppm
Frequency Offset Resolution for AU-4 Pointer Movement	*Pattern* / *Resolution* 87/3 / 0.1 ppm
Stuffing Ratio at Nominal Frequency	2 bits per 9 opportunities

Table A–16: General specifications — SDH

Characteristic	Description	
Power Requirements	Maximum power consumption is 97 W with Option 36 or 58 module attached. For each supply voltage, the current requirement from the VXIbus mainframe is listed below:	
	Voltage	*Average Current*
	+24 V	0.0 A
	–24 V	0.0 A
	+12 V	0.8 A
	–12 V	0.3 A
	+5 V	10.1 A
	–5.2 V	6.3 A
	–2 V	0.5 A
Cooling Requirement	With Option 36 or 58 module attached: 3.0 l/s airflow with 0.05 mm H_2O pressure drop for 10° C temperature rise	
Temperature	Operating Range	0° C to +50° C
	Nonoperating Range	–40° C to +71° C
Humidity	≤ 90% relative humidity for continuous operation at ≤ 30° C, ambient	
	≤ 75% relative humidity for continuous operation from 30° C to 40° C, ambient	
	≤ 45% relative humidity for continuous operation from 40° C to 50° C, ambient	
Electromagnetic Compatibility	A VX4610 with Option 36 installed meets EC Council Directive 89/336/EEC (EC-92), as specified in the Generic Emissions Standard EN 50081-1: Class A for radiated and EN 50082-1: Class A for conducted emissions. When an Option 58 Add/Drop/Test Module is installed on a VX4610, the resultant system does not comply with EN 55011 Class A Limits.	
Electrostatic Discharge	Meets IEC 801-2 up to 8 kV with no change to control settings or impairment of normal operation; up to 15 kV with no damage that prevents recovery of normal operation by the user.	
Physical Characteristics	Net Weight	Approximately 4 kg (8.7 lb)
	Height	262 mm (10.3 in)
	Width	90.5 mm (3.57 in)
	Depth	366 mm (14.4 in)

Appendix B: ASCII & GPIB code chart

B7 B6 B5 BITS / B4 B3 B2 B1	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
	CONTROL		NUMBERS SYMBOLS		UPPER CASE		LOWER CASE	
0 0 0 0	0 NUL 0 0	20 DLE 10 16	40 LA0 SP 20 32	60 LA16 0 30 48	100 TA0 @ 40 64	120 TA16 P 50 80	140 SA0 ` 60 96	160 SA16 p 70 112
0 0 0 1	1 GTL SOH 1 1	21 LL0 DC1 11 17	41 LA1 ! 21 33	61 LA17 1 31 49	101 TA1 A 41 65	121 TA17 Q 51 81	141 SA1 a 61 97	161 SA17 q 71 113
0 0 1 0	2 STX 2 2	22 DC2 12 18	42 LA2 " 22 34	62 LA18 2 32 50	102 TA2 B 42 66	122 TA18 R 52 82	142 SA2 b 62 98	162 SA18 r 72 114
0 0 1 1	3 ETX 3 3	23 DC3 13 19	43 LA3 # 23 35	63 LA19 3 33 51	103 TA3 C 43 67	123 TA19 S 53 83	143 SA3 c 63 99	163 SA19 s 73 115
0 1 0 0	4 SDC EOT 4 4	24 DCL DC4 14 20	44 LA4 $ 24 36	64 LA20 4 34 52	104 TA4 D 44 68	124 TA20 T 54 84	144 SA4 d 64 100	164 SA20 t 74 116
0 1 0 1	5 PPC ENQ 5 5	25 PPU NAK 15 21	45 LA5 % 25 37	65 LA21 5 35 53	105 TA5 E 45 69	125 TA21 U 55 85	145 SA5 e 65 101	165 SA21 u 75 117
0 1 1 0	6 ACK 6 6	26 SYN 16 22	46 LA6 & 26 38	66 LA22 6 36 54	106 TA6 F 46 70	126 TA22 V 56 86	146 SA6 f 66 102	166 SA22 v 76 118
0 1 1 1	7 BEL 7 7	27 ETB 17 23	47 LA7 ' 27 39	67 LA23 7 37 55	107 TA7 G 47 71	127 TA23 W 57 87	147 SA7 g 67 103	167 SA23 w 77 119
1 0 0 0	10 GET BS 8 8	30 SPE CAN 18 24	50 LA8 (28 40	70 LA24 8 38 56	110 TA8 H 48 72	130 TA24 X 58 88	150 SA8 h 68 104	170 SA24 x 78 120
1 0 0 1	11 TCT HT 9 9	31 SPD EM 19 25	51 LA9) 29 41	71 LA25 9 39 57	111 TA9 I 49 73	131 TA25 Y 59 89	151 SA9 i 69 105	171 SA25 y 79 121
1 0 1 0	12 LF A 10	32 SUB 1A 26	52 LA10 * 2A 42	72 LA26 : 3A 58	112 TA10 J 4A 74	132 TA26 Z 5A 90	152 SA10 j 6A 106	172 SA26 z 7A 122
1 0 1 1	13 VT B 11	33 ESC 1B 27	53 LA11 + 2B 43	73 LA27 ; 3B 59	113 TA11 K 4B 75	133 TA27 [5B 91	153 SA11 k 6B 107	173 SA27 { 7B 123
1 1 0 0	14 FF C 12	34 FS 1C 28	54 LA12 , 2C 44	74 LA28 < 3C 60	114 TA12 L 4C 76	134 TA28 \ 5C 92	154 SA12 l 6C 108	174 SA28 ¦ 7C 124
1 1 0 1	15 CR D 13	35 GS 1D 29	55 LA13 – 2D 45	75 LA29 = 3D 61	115 TA13 M 4D 77	135 TA29] 5D 93	155 SA13 m 6D 109	175 SA29 } 7D 125
1 1 1 0	16 SO E 14	36 RS 1E 30	56 LA14 . 2E 46	76 LA30 > 3E 62	116 TA14 N 4E 78	136 TA30 ^ 5E 94	156 SA14 n 6E 110	176 SA30 ~ 7E 126
1 1 1 1	17 SI F 15	37 US 1F 31	57 LA15 / 2F 47	77 UNL ? 3F 63	117 TA15 O 4F 79	137 UNT _ 5F 95	157 SA15 o 6F 111	177 RUBOUT (DEL) 7F 127
	ADDRESSED COMMANDS	UNIVERSAL COMMANDS	LISTEN ADDRESSES		TALK ADDRESSES		SECONDARY ADDRESSES OR COMMANDS	

KEY

octal → 5	PPC	← GPIB code (with ATN asserted)
	ENQ	← ASCII character
hex → 5	5	← decimal

Tektronix
REF: ANSI STD X3.4-1977
IEEE STD 488.1-1987
ISO STD 646-2973

Appendix C: Commands and Queries Posting OPC

The commands and queries listed in Table C–1 set the OPC bit after execution. Some of these commands and queries may require more than 200 ms to complete execution.

Table C–1: Commands and queries that post OPC

Command or query
*RST
*RCL
*SAV
*TST?
DIAGnostic:EXECute
INPUT1:TELecom:TYPE
SOURce:CLOCk:SOURce
SENSe:DATA:TELecom:AUTOscan

Appendix D: *LRN? Response

Table D–1 lists the commands that are returned by the *LRN? and SYSTem: SET? queries. The response consists of these commands and their parameter values separated by semicolons (;).

Table D–1: Commands returned by *LRN?

Command
SYSTem:MODE
OUTPUT1:TELecom:RATE
OUTPUT1:TELecom:TYPE
OUTPUT1:TELEcom:LEVel
SOURce:CLOCk:SOURce
SOURce:CLOCk:OFFSet:MODE
SOURce:CLOCk:OFFSet:LVALue
SOURce:DATA:TELecom:SCRambling
SOURce:DATA:TELecom:SOURce
SOURce:DATA:TELecom:STRucture
SOURce:DATA:TELecom:CHANnel
SOURce:DATA:TELecom:PAYLoad:MAPPing
SOURce:DATA:TELecom:PAYLoad:PATTern
SOURce:DATA:TELecom:PAYLoad:PATTern:UBYTe
SOURce:DATA:TELecom:PAYLoad:CUSTom:FRAMe
SOURce:DATA:TELecom:PAYLoad:CUSTom:LENGth
SOURce:DATA:TELecom:PAYLoad:CUSTom:PRESet: UWORd
SOURce:DATA:TELecom:OVERhead:APS
SOURce:DATA:TELecom:OVERhead:INSert
SOURce:DATA:TELecom:POVerhead:INSert
SOURce:DATA:TELecom:POVerhead:TRAce
SOURce:DATA:TELecom:ERRor:ENABle
SOURce:DATA:TELecom:ERRor:TYPE
SOURce:DATA:TELecom:ERRor:RATE
SOURce:DATA:TELecom:ERRor:MASK
SOURce:DATA:TELecom:ERRor:FEBEvalue

Table D–1: Commands returned by *LRN? (cont.)

Command
SOURce:DATA:TELecom:ALARm
SOURce:DATA:TELecom:FAILure:TYPE
SOURce:DATA:TELecom:POINter:MODE
SOURce:DATA:TELecom:POINter:NDFlag
SOURce:DATA:TELecom:POINter:DIRection
SOURce:DATA:TELecom:POINter:RATE
SOURce:DATA:TELecom:POINter:NBURst
SOURce:DATA:TELecom:POINter:SBITs
INPUT1:TELecom:RATE
INPUT1:TELecom:TYPE
INPUT1:TELecom:LEVel
SENSe:DATA:TELecom:SCRambling
SENSe:DATA:TELecom:SOURce
SENSe:DATA:TELecom:STRUcture
SENSe:DATA:TELecom:CHANnel
SENSe:DATA:TELecom:PAYLoad:MAPPing
SENSe:DATA:TELecom:PAYLoad:PATTern
SENSe:DATA:TELecom:PAYLoad:PATTern:UBYTe
SENSe:DATA:TELcom:PAYLoad:CUSTom:FRAMe
SENSe:DATA:TELecom:TEST:DURation
SENSe:DATA:TELecom:OVERhead:DROP
SENSe:DATA:TELecom:POVerhead:DROP
INSTrument:COUPling
SYSTem:HEADers
SYSTem:VERBose
TRIGger:POSition
TRIGger:SOURce
TRIGger:SOURce:SENSe
TRIGger:TTLTRG
TRIGger:SENSe:FPPolarity
TRIGger:SENSe:TPOLarity

Table D–1: Commands returned by *LRN? (cont.)

Command
TRIGger2:SOURce
TRIGger2:TTLTRG

Appendix E: Default Parameter Values After *RST

Table E–1 lists the default parameter values after the *RST command is sent.

Table E–1: Default parameter values after *RST

Command	Default parameter values (SONET)	Default parameter values (SDH)
OUTPUT1:TELecom:RATE	STS1	STM1
OUTPUT1:TELecom:TYPE	ELECtrical	ELECtrical
OUTPUT1:TELEcom:LEVel	XCON	XCON
SOURce:CLOCk:SOURce	INTernal	INTernal
SOURce:CLOCk:OFFSet:MODE	LOFF	LOFF
SOURce:CLOCk:OFFSet:LVALue	0	0
SOURce:CLOCk:OFFSet:PVALue	0	0
SOURce:DATA:TELecom:SOURce	OUTPUT1	OUTPUT1
SOURce:DATA:TELecom:STRucture	STS1	AU4
SOURce:DATA:TELecom:CHANnel	1	1
SOURce:DATA:TELecom:PAYLoad:MAPPing	EQUIPPED	EQUIPPED
SOURce:DATA:TELecom:PAYLoad:PATTern	PRBS23	PRBS23
SOURce:DATA:TELecom:PAYLoad:PATTern:UBYTe	0	0
SOURce:DATA:TELecom:OVERhead:PRESet	(sets overhead to values listed in Figures 3–14 and 3–15 in *Syntax and Commands*)	(sets overhead to values listed in Figures 3–14 and 3–15 in *Syntax and Commands*)
SOURce:DATA:TELecom:POVerhead:TRAce	“ ” (64 null characters)	“ ” (64 null characters)
SOURce:DATA:TELecom:OVERhead:INSert	NONE	NONE
SOURce:DATA:TELecom:ERRor:ENABle	0	0
SOURce:DATA:TELecom:ERRor:RATE	1E–10	1E–10
SOURce:DATA:TELecom:ERRor:TYPE	SCV	SCV
SOURce:DATA:TELecom:ALARm	NONE	NONE
SOURce:DATA:TELecom:FAILure:TYPE	NONE	NONE
SOURce:DATA:TELecom:POINter:MODE	SINGle	SINGle
SOURce:DATA:TELecom:POINter:VALue	522	522

Table E–1: Default parameter values after *RST (cont.)

Command	Default parameter values (SONET)	Default parameter values (SDH)
SOURce:DATA:TELecom:POINter:NDFlag	ON	ON
SOURce:DATA:TELecom:POINter:DIRection	ALT	ALT
SOURce:DATA:TELecom:POINter:RATE	100	100
SOURce:DATA:TELecom:OVERhead:APS	0	0
INPUT1:TELecom:RATE	STS1	STM1
INPUT1:TELecom:TYPE	ELECtrical	ELECtrical
INPUT1:TELecom:LEVel	XCON	XCON
SENSe:DATA:TELecom:SOURce	INPUT1	INPUT1
SENSe:DATA:TELecom:STRUcture	STS1	AU4
SENSe:DATA:TELecom:CHANnel	1	1
SENSe:DATA:TELecom:PAYLoad:MAPPing	EQUIPPed	EQUIPPed
SENSe:DATA:TELecom:PAYLoad:PATTern	PRBS23	PRBS23
SENSe:DATA:TELecom:PAYLoad:PATTern:UBYTe	0	0
SENSe:DATA:TELecom:TEST:DURation	0,0,0,0	0,0,0,0
SENSe:DATA:TELecom:OVERhead:DROP	NONE	NONE
SENSe:DATA:TELecom:MEASure:STESts:	(all four commands set to NONE)	(all four commands set to NONE)
INITiate	(executed)	(executed)
SYSTem:HEADers	ON	ON
SYSTem:VERBose	ON	ON

Appendix F: SDH/SONET Terminology

This appendix provides a cross reference between SONET and SDH terminology used in this manual. Table F–1 lists terms side by side that have equivalent or similar meanings. Terms that have no direct equivalent in the other standard are marked with the words *no equivalent*. Acronyms and abbreviations in Table F–1 are defined in the *Glossary.*

Table F–1: SDH/SONET equivalent or similar terms

Category	SONET term	SDH term
Linc rates	STS-1	STM-0E (not supported)
	STS-3	STM-1E
	OC-1	STM-0 (not supported)
	OC-3	STM-1
	OC-12	STM-4
Structures	STS-1 SPE	AU-3 (not supported)
	STS-3c SPE	AU-4
Overhead	Transport overhead	Section overhead
	Section overhead	Regenerator section overhead
	Line overhead	Multiplexer section overhead
	Path overhead	Path overhead
	APS bytes	MSP bytes
	no equivalent	National use bytes
Payload	SPE	VC
	no equivalent	AU
Tributaries	VT	TU
Alarms	Line AIS	MS AIS
	RDI (was FERF)	RDI (was FERF)
	RDI-L (was Line FERF or LFERF)	MS-RDI (was MS-FERF)
	RDI-P (was Path FERF or PFERF)	P-RDI (was Path FERF or PFERF)
	RDI-V (was VTFERF)	TU-RDI (was TUFERF)
	Path AIS	Path AIS
	RAI-P (Path Yellow)	P-RAI (Path Yellow)

Table F–1: SDH/SONET equivalent or similar terms (cont.)

Category	SONET term	SDH term
Errors	Section code violation	RS code violation
	Line code violation	MS code violation
	Path code violation	Path code violation
	REI (was FEBE)	REI (was FEBE)
	REI-L (was Line FEBE or LFEBE)	MS-REI (was MS-FEBE)
	REI-P (was Path FEBE or PFEBE)	P-REI (was Path FEBE)
	REI-V (was VTFEBE)	TU-REI (was TUFEBE)
Error analysis	no equivalent	Degraded Minutes
	Type A errored seconds	no equivalent
	Type B errored seconds	no equivalent
External add/drop	Section DCC	RS DCC
	Line DCC	MS DCC
External clock references	no equivalent	2 Mb/s
	BITS	no equivalent

Appendix G: Optical Port Connectors

This appendix describes how to clean and install the optical connectors.

***NOTE**. The optical TRANSMIT output is produced by a Class 1 laser device. The output from a Class 1 laser is safe to view without special eye protection. However, because other optical signals in your environment may exceed the Class 1 limits, we recommend eye protection as a precaution.*

Cleaning the Optical Ports

If the VX4610 performance appears degraded, the optical fiber and optical port may be dirty. Clean the fiber connector with a clean cloth.

To clean an optical port:

1. Verify that power to the VX4610 has been turned off.
2. Remove the four screws that attach the bulkhead connector to the front panel (see Figure G–1).
3. Gently pull the bulkhead out of the unit and unscrew the fiber connector. Be careful not to pull beyond the fiber slack.
4. Using a soft, lint-free cloth with a high-quality glass cleaner, clean the tip of the fiber cable.
5. If available, use low-pressure compressed or canned air to blow any dirt out of the bulkhead connector. If compressed or canned air is not available, then the bulkhead will have to be taken apart and cleaned. Refer to the Changing the Optical Port Connectors procedure, on page G–2, for information about bulkhead disassembly.
6. After cleaning the bulkhead, reconnect the fiber and install the bulkhead. Be sure to reinstall the dustcap chain.

***NOTE**. To keep cleaning to a minimum, install the dustcap when no fiber is connected to the optical port.*

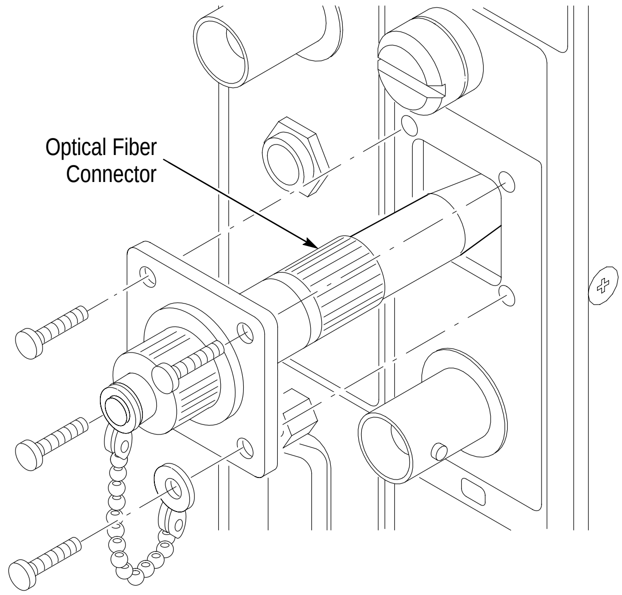


Figure G–1: Removing the optical bulkhead connector

Installing Optical Port Connectors

The VX4610 is shipped with the FC connector bulkhead and dustcap installed. If you wish to change to the ST, DIN 47256, or SC connectors perform the following procedure.

1. Verify that the VX4610 has been turned off with the principal power switch on the rear panel.
2. Remove the four screws that attach the bulkhead connector to the front panel (see Figure G–1).
3. Gently pull the bulkhead out of the unit and unscrew the fiber connector. Be careful not to pull beyond the fiber slack.
4. Disassemble the bulkhead as shown in Figures G–2 through G–5 for the type of connector you have in your instrument.

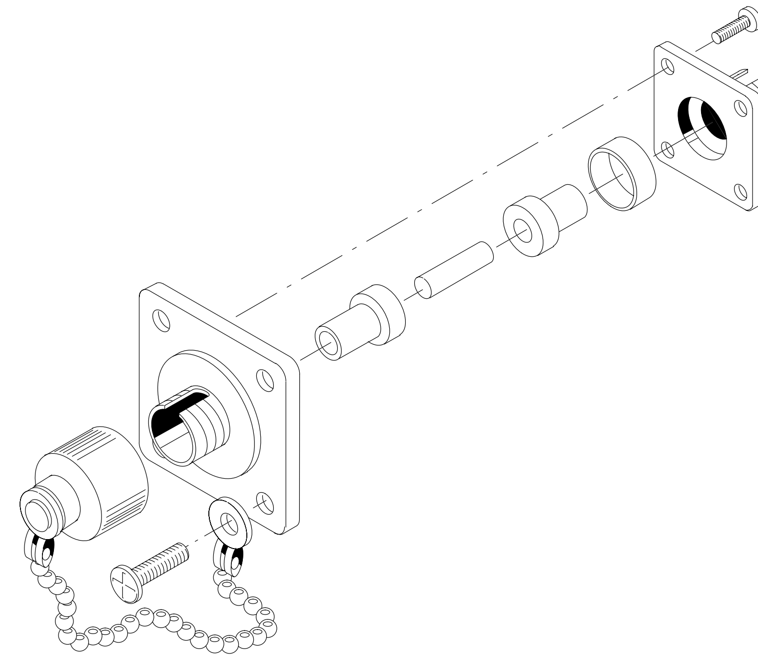


Figure G–2: FC optical bulkhead assembly

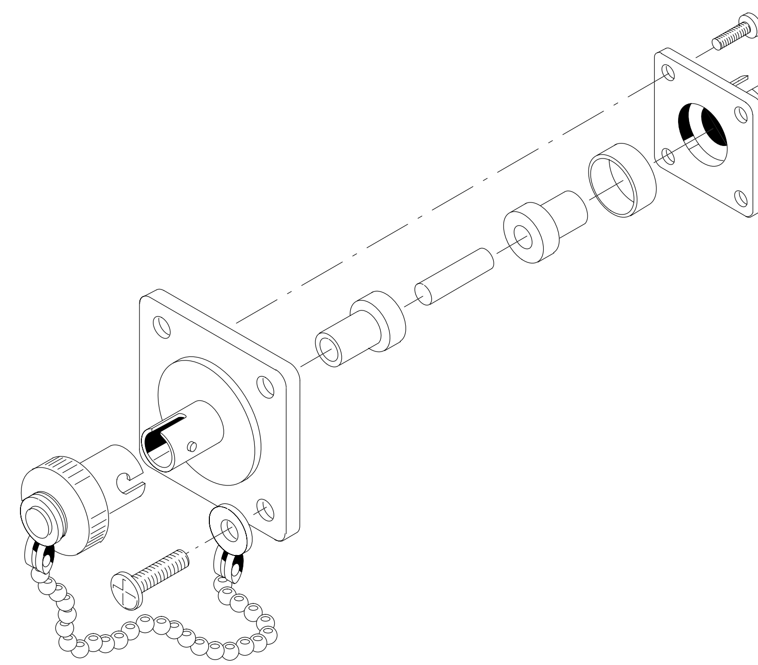


Figure G–3: ST optical bulkhead assembly

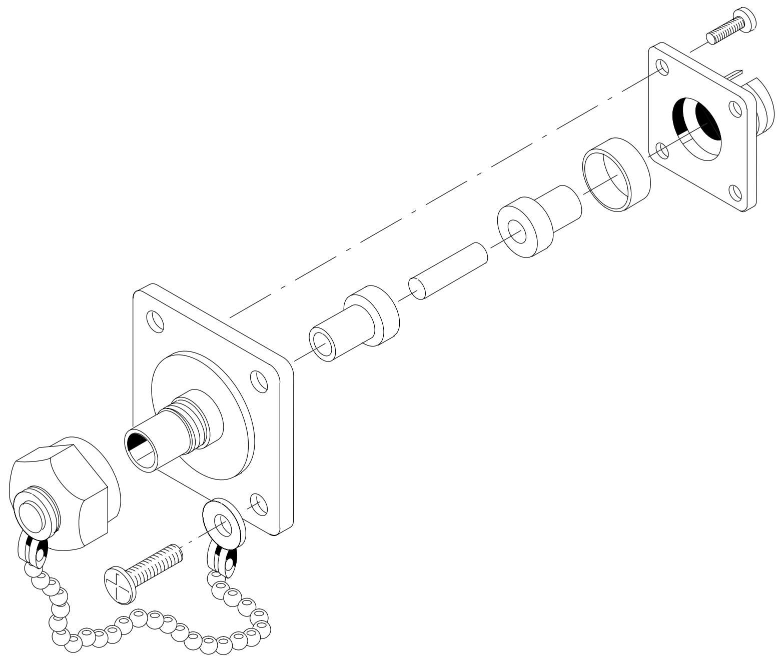


Figure G–4: DIN 47256 optical bulkhead assembly

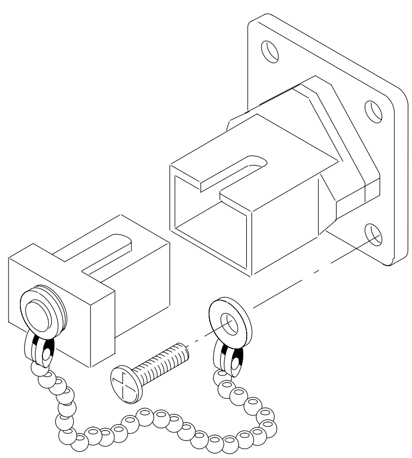


Figure G–5: SC optical bulkhead assembly

5. Replace the current bulkhead with the one you wish to use and re-assemble.
6. Installation is the reverse of steps 1 through 3.

Appendix H: User Service

This appendix contains service-related information for the VX4610 SDH/SONET Generator/Receiver that covers the following topics:

- Product and service options available for the VX4610
- Exchanging the Plug-in Interface Module
- Removing/installing the Option 22/36 Add/Drop/Test Module
- Removing/installing the Option 58 Add/Drop/Test Module
- Preventive maintenance
- Troubleshooting
- User-replaceable parts including fuses

Product and Service Options

Table H–1 lists the VX4610 options available at the time of initial instrument purchase.

Table H–1: VX4610 options

Option	Description
02	Adds ECL interface capability for all rates
03	Adds optical transmit and receive capability at 51.84 Mb/s and 155.52 Mb/s
04	Adds optical transmit and receive capability at 51.84 Mb/s, 155.52 Mb/s, and 622.08 Mb/s
05	Adds high-power (0 dBm) laser capability at 1550 nm
10	Adds high-power (0 dBm) laser capability at 1310 nm
22	Adds capability to add/drop/test at 1.544 Mb/s (DS1) and 44.736 Mb/s (DS3)
36	Adds capability to add/drop/test at 2 Mb/s, 34 Mb/s, and 140 Mb/s (PDH)
58	Combines Options 22 and 36 functions plus NRZ connections
X1	Adds one year of exchange service (concurrent with warranty)[1]
X2	Adds two years of exchange service (concurrent with warranty)[1]
X3	Adds three years of exchange service (concurrent with warranty)[1]

[1] **The goal of the exchange service options is to provide same-day shipment, which is delivered within 24 hours in the United States and Canada and 48 hours in Europe.**

Exchanging the Plug-in Interface Module

To upgrade the capability of your VX4610, you may need to remove the Plug-in Interface Module and install a new one. The only tool this procedure requires is a flat-blade, torque-limiting screwdriver.

CAUTION. *Some components in the Plug-in Interface Module are susceptible to static-discharge damage. Observe standard handling precautions for static-sensitive devices. Always wear a grounded wrist strap, or equivalent, while handling the Plug-in Interface Module.*

Removing a Plug-in Interface Module

Perform the following steps to remove a Plug-in Interface Module from the VX4610 (see Figure H–1):

1. Turn off power to the VX4610.
2. Remove any electrical or optical connections to the TRANSMIT outputs and RECEIVE inputs.
3. With the flat-blade screwdriver, loosen the two thumbscrews that fasten the Plug-in Interface Module to the VX4610. The thumbscrews are spring loaded and pop out when the threads are disengaged.
4. Grasping both thumbscrews, slide the Plug-in Interface Module out of the VX4610.
5. Store the removed Plug-in Interface Module in a static-dissipating bag or container.

Installing a Plug-in Interface Module

Perform the following steps to install a Plug-in Interface Module into the VX4610 (see Figure H–1):

1. Turn off power to the VX4610.
2. Align the Plug-in Interface Module edges with the guides and then slide the Plug-in Interface Module into the cavity of the VX4610.
3. Using both thumbs, press on the Plug-in Interface Module front panel until the module is completely seated in the VX4610.
4. Tighten both thumbscrews by hand.
5. With the screwdriver, tighten each thumbscrew to the recommended torque rating of 0.8 to 1.0 N-m (7 to 9 in-lbs).

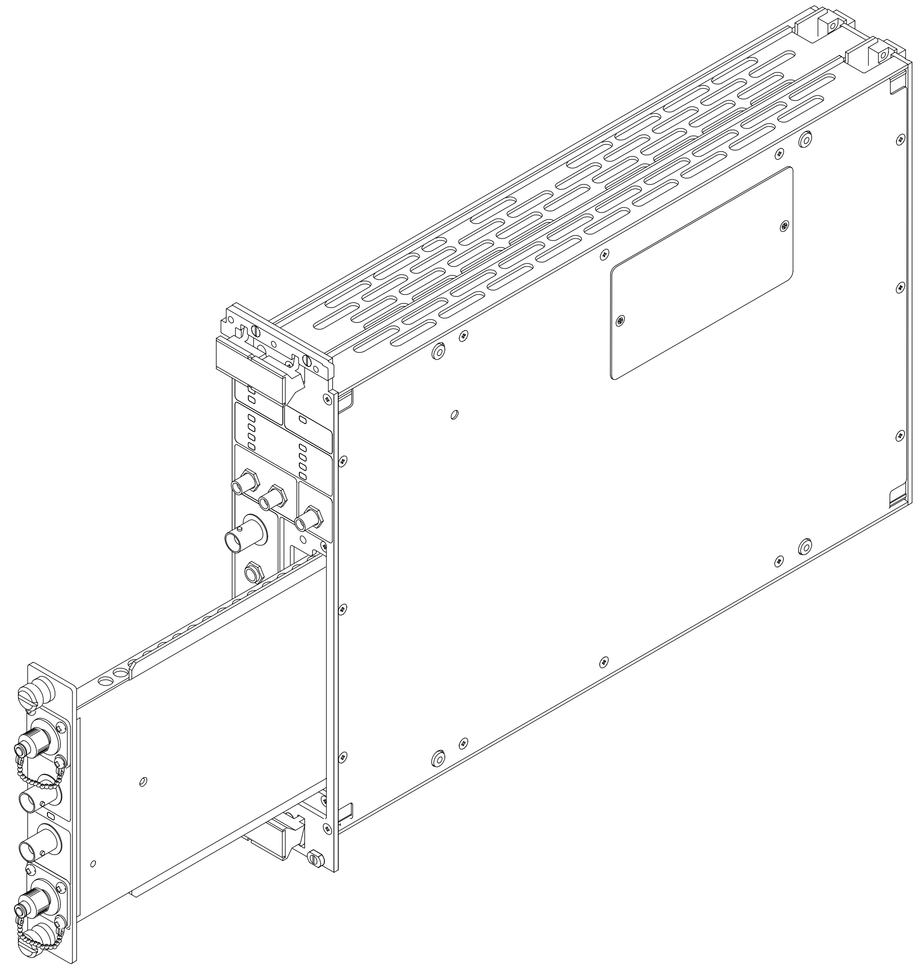


Figure H–1: Exchanging the Plug-in Interface Module

Removing Option 22/36/58 Add/Drop/Test Module

Perform the following steps to remove an Add/Drop/Test module from the VX4610 (see Figure H–2):

1. Turn off power to the VX4610.
2. Remove any connections to the OUT and IN connectors.
3. Remove the six (6) screws that secure the VX4610 Option 22, 36, or 58 to the mainframe. Then slide the module out of the mainframe.
4. Using a flat-blade screwdriver remove the four (4) screws that secure the Option to the VX4610 module. (See Figure H–2).
5. Disconnect both J8 and J15 ribbon cable connectors from the VX4610 module.
6. Remove the front screw that secures the side panel door. Loosen the rear screw.
7. To close the side panel door, pivot the side panel door towards the rear of the instrument. Secure the panel to the mounting hole using the screw removed in step 6. Then tighten the front screw.

To reinstall Option 22, 36, or 58 to the VX4610 module, perform steps 3–7 in reverse order.

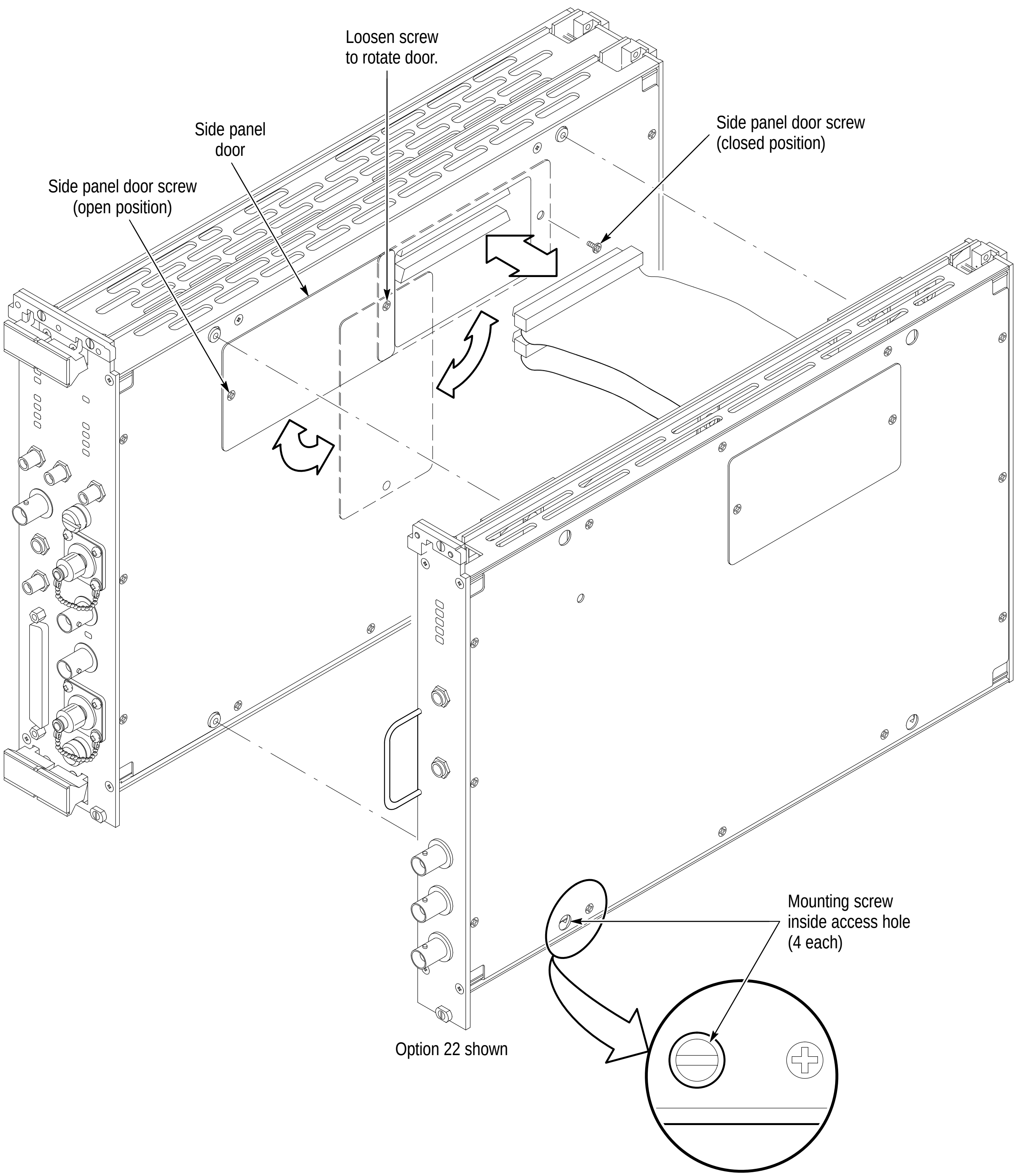


Figure H–2: Installation of Option 22, 36, or 58 assembly

Preventive Maintenance

You should perform inspection and cleaning as preventive maintenance. Preventive maintenance, when done regularly, can prevent VX4610 malfunction and enhance reliability. Inspect and clean the VX4610 as often as conditions require by following these steps:

1. Turn off power and remove the VX4610 from the VXIbus mainframe.
2. Remove loose dust on the outside of the instrument with a lint-free cloth.
3. Remove any remaining dirt with a lint-free cloth dampened in a general purpose detergent-and-water solution. Do not use abrasive cleaners.
4. Clean the optical connectors (if any) using the procedure on page G–1.

Troubleshooting

If you suspect a malfunction, first double check connections to and from the VX4610. If the trouble persists, built-in diagnostic routines can give you a good indication whether or not the problem is in the VX4610. You have two diagnostic alternatives, as described below:

- If you do not want to disconnect the VX4610 from external signals used in your application, you can run the *Self Test* described on page I–15. If you choose this test, the VX4610 creates an internal loop-back from the transmitter to the receiver. For this reason, the *Self Test* cannot detect faults in the transmit or receive input/output circuitry.
- If you can disconnect the VX4610 from all external signals, you can run the *System Diagnostics with External Loop-Back* described on page I–17. This test covers everything that is covered by the *Self Test* and extends coverage to the transmit and receive input/output circuitry.

If either diagnostic test indicates a failure, contact your Tektronix field office or representative for assistance. If no diagnostic failure is indicated, you can perform the *Functional Tests* and *Physical Layer Tests* in *Appendix I* to locate the problem.

User-Replaceable Parts

Table H–2 lists the user-replaceable parts of the VX4610. Refer to Figure H–3 on page H–9 to identify the locations of these parts.

Parts Ordering Information

Replacement parts are available through your local Tektronix field office or representative.

Occasionally, Tektronix changes instruments to accommodate improved components. Therefore, when ordering parts, it is important to include the following information in your order: Part number, instrument type or model number, instrument serial number, and instrument modification number, if applicable.

Table H–2: User-replaceable parts

Description	Quantity	Part number
Side panel door	1	200-4192-XX
Side panel door screw	2	211-0311-XX
Top ejector label	1	334-8628-XX
Bottom ejector label	1	334-8629-XX
Left side panel EMI gasket	1	348-1365-01
Module to mainframe mounting screw	4	213-1035-XX
Optical dust cover	2	200-3091-XX
Standard Plug-in Interface Module[1]	1	672-1426-XX
Option 02 ECL Interface Module	1	672-1406-XX
Option 03 Plug-in Interface Module	1	672-1405-XX
Option 04 Plug-in Interface Module[1]	1	672-1427-XX
Option 05 Plug-in Interface Module[1]	1	672-1478-XX
Option 10 Plug-in Interface Module[1]	1	672-1481-XX
Option 22 DS1/DS3 Add/Drop/Test Module[2]	1	672-1431-50
Option 36 2/34/140 MBS Add/Drop/Test Module[2]	1	672-1434-50
Option 58 DS1/DS3 & E1/E/E4 Add/Drop/Test Module[2]	1	644-0901-50
75 Ω BNC cable[1]	1	012-0991-XX
Universal Optical Connector kit[1]	2	020-1885-XX

Table H–2: User-replaceable parts (cont.)

Description	Quantity	Part number
VX4610 Reference[1]	1	070-8974-03
UI4610 User Interface Software Manual[1]	1	070-8856-04

[1] **Item is not shown in Figure H–3.**

[2] **Item is available on exchange only.**

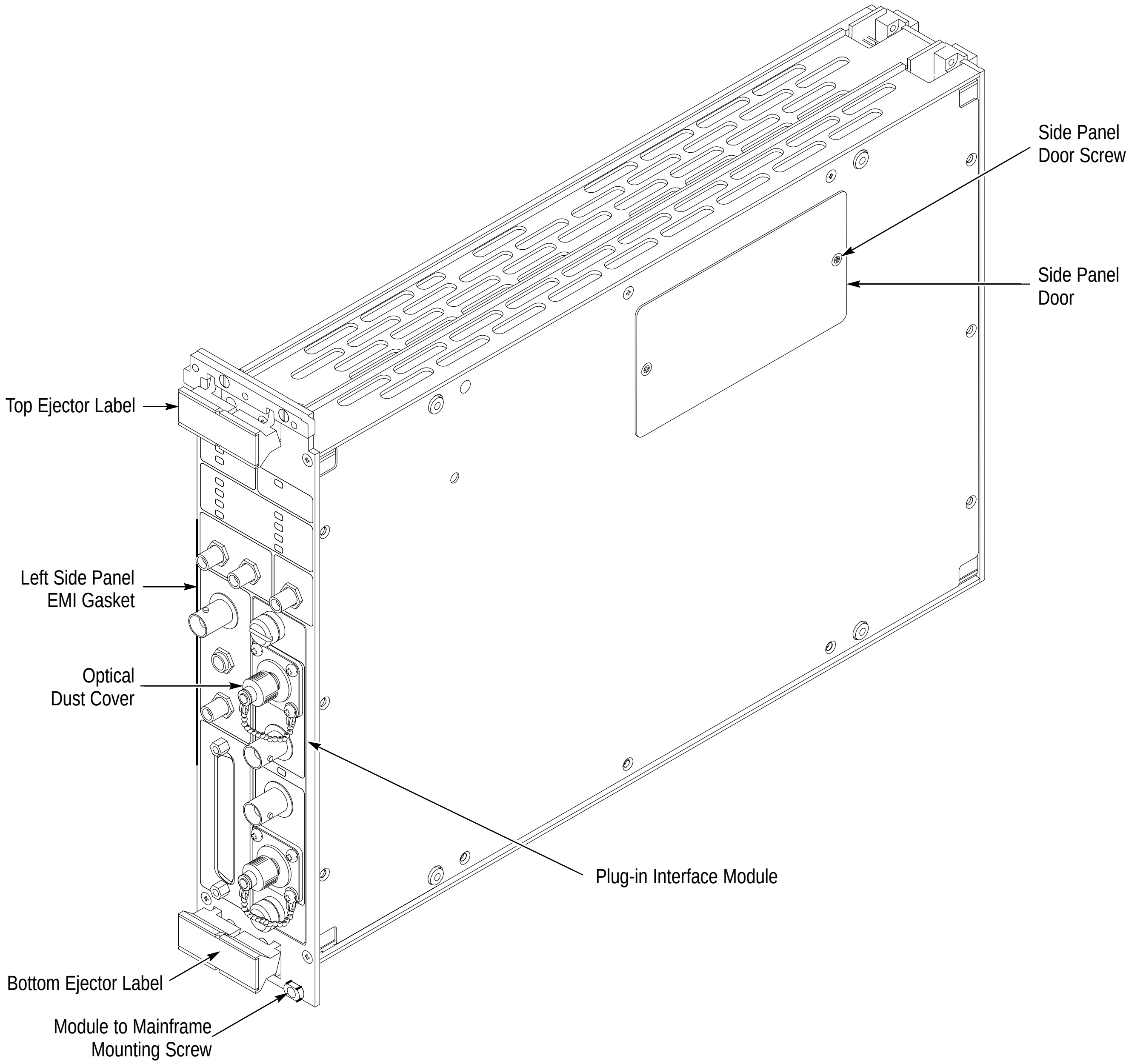


Figure H–3: Locations of user-replaceable parts

Module Fuses

The VX4610 contains fuses for voltage sources entering the circuit boards. Table H–3 lists the fuses and their ratings.

Table H–3: VX4610 fuses and their ratings

Fuse	Current rating	Voltage rating	Part number
CPU circuit board			
F760	2A	–12V	159-0208-02
F761	2A	+12V	159-0208-02
F763	2A	–2V	159-0208-02
F772	7A	+5V	159-0146-00
F770	2A	+24V	159-0208-02
F771	2A	–24V	159-0208-02
F762	3A	–5V	159-5243-00
DS1/DS3 and E1/E3 circuit boards			
F490	2A	+12V	159-0208-02
F491	2A	–12V	159-0208-02
F680	10A	+5V	159-0193-00
F690	7A	–5V	159-0146-00

Appendix I: Performance Verification

The procedures in this section verify the performance of the VX4610 SDH/SONET Generator/Receiver and its tributary and interface modules. You might need to perform only a few of these procedures, depending on what function you want to verify. Refer to Table I–1 to determine which procedures you need to perform.

Table I–1: VX4610 performance verification guide

To accomplish this	Perform these procedures	Approximate time to complete	Test equipment needed	Page number
Quick test of the VX4610 without removing it from your application setup	Self Test	Two minutes	None	I–15
More thorough test of the VX4610 functionality	Functional Tests	Thirty minutes	75 Ω Coaxial Cable (standard accessory), Optical Fiber Cable[1]	I–16
Complete verification of all warranted specifications	Functional Tests Physical Layer Tests	Thirty minutes Three hours	All test equipment listed in Table I–2	I–16 I–31
Verification of Option 22	All tests for Option 22	Two hours	Test equipment listed in Table I–2	I–66
Verification of Option 36	All tests for Option 36	Two hours	Test equipment listed in Table I–2	I–83
Verification of Option 58	All tests for Options 22 and 36 and NRZ tests	Four hours	Test equipment listed in Table I–2	I–66
Verification of Option 02	All tests for Option 02	Two hours	Test equipment listed in Table I–2	I–127

[1] **The optical fiber cable is required only if you have installed an optional Optical/Electrical Plug-in Interface Module.**

General Information and Conventions

Please read the following information and conventions, which apply throughout this appendix:

- Each test procedure begins with a table, similar to the one below, that provides information you need to know before starting the test.

Equipment required	Communications Signal Analyzer (item 5) SMA Male to BNC Female Adapter (item 24) Delay Line (item 25), three required
Prerequisites	Prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

  The item numbers after each piece of equipment refer to line numbers in Table I–2, *Required Test Equipment*, which begins on page I–3. The time estimates assume all the necessary equipment has been gathered and warmed up and is ready to use.

- The VX4610-under-test must be installed and operating in a VXIbus system. The system can be the same one that you are using in your application if it meets the requirements listed in the section *VX4610-Under-Test System Configuration*, beginning on page I–7.

- You will use the UI4610 Graphical User Interface Software to operate the VX4610 to perform the tests in this appendix. The procedures contain specific instructions for using the software to set up the VX4610 for each test. If necessary, refer to the *UI4610 Graphical User Interface Software User Manual* for additional information on how to install and run the UI4610 Software.

  Before beginning any tests, start the UI4610 Graphical User Interface Software using the brief procedure on page I–7.

- The setups for most tests are stored on the UI4610 Software disks included in the *UI4610 Graphical User Interface Software User Manual*. The test setups are in a directory named PVsetups. Check that this directory was installed with the UI4610 Graphical User Interface Software. If not, you will need to load these files from disk number two of the UI4610 Software. You will recall a test setup for the VX4610 from this directory during the set up for most procedures.

  The PVsetups directory contains two directories of test setups. The SONET directory contains all the setups to verify the VX4610 performance using SONET terminology and parameters. The SDH directory contains equivalent test setups using SDH terminology and parameters. You will be asked to choose the directory appropriate for your installation.

- Most procedures mention both SONET and SDH terminology in their settings instructions. Use the terminology that is appropriate in your application.

Equipment Required

The *Performance Verification Procedures* use traceable signal sources and measurement instruments to directly check performance. Table I–2 lists the required equipment. Specific items may not be required depending on the exact configuration of your VX4610 and whether you are verifying SONET or SDH performance. Use the table footnotes to help you determine the specific equipment needed to test your VX4610.

You can obtain an accuracy ratio of 4:1 or better by using the recommended equipment listed in the *Example* column of Table I–2. If your test equipment does not meet the minimum requirements listed in the table, your test results may be invalid.

Table I–2: Required test equipment

Item number and description		Minimum requirements	Example	Purpose
1	Universal Counter/Timer	160 MHz frequency measurement; frequency ratio B/A capability; 0.25 ppm time base accuracy; 9 digits; averaging to 10^8	Tektronix DC 5010 Digital Counter/Timer with TM 5000 mainframe	Checking Transmit Clock Accuracy
2	Frequency Synthesizer	750 kHz to 630 MHz frequency range; ≤ 10 Hz resolution below 30 MHz; ≤ 50 Hz resolution from 300 MHz to 320 MHz; ≤ 100 Hz resolution from 600 MHz to 630 MHz; ≤ 1 ppm frequency error; +13 dBm sine wave output into 50 Ω	Rohde & Schwarz Signal Generator SMX	Checking Recovered Clock Frequency Lock Range; Checking External Clock Frequency Lock Range
3	Function Generator	20 Hz to 3.5 MHz frequency range; Variable amplitude from 0.1 to 5 V_{p-p}	Tektronix AFG 5102 Function Generator	Checking Jitter Tolerance
4	Oscilloscope	500 MHz bandwidth; 50 Ω input impedance; ≤ 1.5% DC vertical accuracy	Tektronix TDS 540C or equivalent	Checking Trigger Output Signal

Table I–2: Required test equipment (cont.)

Item number and description		Minimum requirements	Example	Purpose
5	Communications Signal Analyzer	1 GHz bandwidth, mask testing capability with SONET masks for STS-1, STS-3, STSX-3, OC-1, OC-3, and OC-12, or SDH masks for STM-1 and STM-4	Tektronix CSA 803C Communication Signal Analyzer with SD-22 Sampling Head	Checking Transmit Signal Shape
6	SDH/SONET Analyzer	STS-1 and STS-3, or STM-1E transmit capability; ± 125 ppm line rate variability with external clock	Tektronix VX4610 with SDH/SONET modules[1]	Checking Recovered Clock Range
7	BITS Reference Signal Source[2]	Provide BITS clock or DS1 signal	TTC T-BERD Model 310 with Option 310-1	Checking BITS Reference Input
8	2 Mb/s Reference Signal Source[3]	Provide 2 Mb/s clock or signal	TTC Interceptor Model 1402	Checking 2 Mb/s Reference Input
9	Optical Attenuator[4]	Compatible with 62.5 μm multimode fiber; attenuation range from 0 dB to 50 dB for 1310 nm wavelength	Tektronix OA 5022 with TM 5000 mainframe	Check Receiver Sensitivity
10	SONET Reference Receiver and Power Meter[5]	Calibrated frequency response for OC-1 and OC-3; 0 dBm to –80 dBm dynamic range, ≤ 5% accuracy at 1310 nm wavelength	Tektronix ORS156, Option 31	Check Transmit Signal Power and Shape
11	SONET Reference Receiver and Power Meter[6]	Calibrated frequency response for OC-1, OC-3, and OC-12; 0 dBm to –80 dBm dynamic range, ≤ 5% accuracy at 1310 nm wavelength	Tektronix ORS622, Option 31 and Option 41	Check Transmit Signal Power and Shape
12	SDH Reference Receiver and Power Meter[7]	Calibrated frequency response for STM-1; 0 dBm to –80 dBm dynamic range, ≤ 5% accuracy at 1310 nm wavelength	Tektronix ORS156	Check Transmit Signal Power and Shape
13	SDH Reference Receiver and Power Meter[8]	Calibrated frequency response for STM-1 and STM-4; 0 dBm to –80 dBm dynamic range, ≤ 5% accuracy at 1310 nm wavelength	Tektronix ORS622, Option 41	Check Transmit Signal Power and Shape
14	Optical Fiber Cable[4] (two required)	62.5/125 μm multimode fiber; FC/PC connector on one end; compatible with VX4610 connector option on other end	FC/PC to FC/PC, Tektronix part number 174-2322-00	Interconnect optical signals
15	225 foot (68.6 m) length of 75 Ω Reference Cable (two required)	BNC connectors on each end	AT&T 728B reference cable	Check Receiver Sensitivity at cross connect level

Table I–2: Required test equipment (cont.)

Item number and description		Minimum requirements	Example	Purpose
16	656 foot (200 m) length of 75 Ω Reference Cable	BNC connectors on each end	AT&T 728B reference cable	Check Cable Equalization
17	Communications Analyzer	2 Mb/s signals at 0 and –6 dB	TTC Intercepter 1402	Check Cable Equalization
18	75 Ω to 50 Ω Impedance Converter (minimum loss pad)	Convert 75 Ω to 50 Ω impedance; 5.71 dB attenuation, BNC connectors	Mini-Circuits Matching Pad, part number BMP-5075	Provide impedance matching for Interconnected electrical signals
19	75 Ω Coaxial Cable (two required)	75 Ω impedance; ≈1 m length, BNC connectors	Tektronix part number 012-1338-00	Interconnect electrical signals
20	75 Ω 10X Attenuator	75 Ω impedance; 10X attenuation; BNC connectors	Tektronix part number 011-0061-00	Interconnect electrical signals
21	50 Ω Power Splitter	50 Ω impedance; SMA female connectors	Tektronix part number 015-0565-00	Interconnect electrical signals
22	50 Ω SMA Coaxial Cable (four required)	50 Ω impedance; SMA male connectors	Tektronix part number 174-1364-00	Interconnect electrical signals
23	Adapter, SMB Female to SMB Female six required)	50 Ω impedance	See recommendation for SMB Cables on page 1–4	Interconnect electrical signals on Option 58 NRZ connectors
24	Adapter, SMA Male to BNC Female (three required)	50 Ω impedance	Tektronix part number 015-1018-00	Interconnect electrical signals
25	Delay Line	50 Ω impedance; SMA connectors; 15 ns ≤ delay ≤ 48 ns	Tektronix part number 015-1006-00 (5 ns each, three required), or Tektronix DL-11 Delay Line with standard accessory 174-1427-00	Delay trigger signal
26	50 Ω BNC Coaxial Cable (three required)	50 Ω impedance; BNC male connectors	Tektronix part number 012-0057-01	Interconnect electrical signals
27	Adapter, BNC Male to BNC Male	50 Ω impedance; BNC male connectors	Tektronix part number 103-0029-00	Interconnect electrical signals
28	Adapter, Type N Male to BNC Female	50 Ω impedance	Tektronix part number 103-0045-00	Interconnect electrical signals
29	Adapter Cable, Miniature Phone Plug (Bantam) to WECO 310 Plug[2]	Three-conductor cable; miniature phone plug (Bantam) on one end; WECO 310 plug on other end	ADC Telecommunications Model PJ942 Conversion Patch Cord	Interconnect electrical signals
30	100 Ω Cable, Bantam-to-Bantam (two required)	72 inch, three-conductor cable; miniature phone plug (Bantam) on each end	Tektronix part number 012-1314-00	Interconnect electrical signals
31	100 Ω Cable, Bantam-to-Bantam (two required)	Twelve inch, three-conductor cable; miniature phone plug (Bantam) on each end	Tektronix part number 012-1500-00	Interconnect electrical signals
32	Adapter, Bantam Jack-to-WECo 310 Plug[9] (two required)	Three-conductor adapter; miniature phone jack (Bantam)-to-WECo 310 plug	Tektronix part number 103-0365-00	Interconnect electrical signals

Table I–2: Required test equipment (cont.)

Item number and description		Minimum requirements	Example	Purpose
33	Tributary Signal Converter/Attenuator (two required)	Convert impedance of 100 Ω DS1 and 120 Ω 2 Mb/s tributaries to 50 Ω and attenuate by 5X	Tektronix part number 067-0250-01	Interconnect electrical signals
34	120 Ω Cable, DIN41628L Male-to-DIN41628L Male[10] (two required)	Three-conductor cable; DIN41628L (Siemens) jack on both ends	Tektronix part number 012-1469-00	Interconnect electrical signals
35	120 Ω Cable, DIN41628L Male-to-DIN41628L Male[10] (two required)	Six inch, three-conductor cable; DIN41628L (Siemens) jack on both ends	Tektronix part number 012-1501-00	Interconnect electrical signals
36	10X Attenuator	75 Ω impedance; 10X attenuation; BNC connectors	Mini-Circuits part number CAT-20-75	Interconnect electrical signals
37	2X Attenuator	75 Ω impedance; 2X attenuation; BNC connectors	Mini-Circuits part number CAT-6-75	Interconnect electrical signals
38	10X Attenuator	50 Ω impedance; 10X attenuation; BNC connectors	Tektronix part number 011-0059-02	Interconnect electrical signals
39	2X Attenuator	50 Ω impedance; 2X attenuation; BNC connectors	Tektronix part number 011-0069-02	Interconnect electrical signals
40	50 Ω Termination	50 Ω impedance; BNC connectors	Tektronix part number 011-0049-01	Interconnect electrical signals
41	75 Ω Termination	75 Ω impedance; BNC connectors	Tektronix part number 011-0102-00	Interconnect electrical signals
42	Option 22 or 58	Option 22 or 58	Tektronix VX4610 Option 22 Module	Check Internal Clock Accuracy and Transmit Line Frequency Offset

[1] **The VX4610-under-test system cannot fill this requirement. An additional VX4610 system with SDH and SONET capabilities, or equivalent, is required.**

[2] **This equipment is required to test SONET performance. It is not required to test SDH performance.**

[3] **This equipment is required to test SDH performance. It is not required to test SONET performance.**

[4] **This equipment is required to test a VX4610 with any one of the optional Optical/Electrical Plug-in Interface Modules installed; otherwise, it is not required.**

[5] **This equipment is required to test SONET performance with the OC 1/3 Optical/Electrical Module installed; otherwise, it is not required.**

[6] **This equipment is only required to test SONET performance with the OC 1/3/12 Optical/Electrical Module installed.**

[7] **This equipment is only required to test SDH performance with the STM0 and STM1 Optical/Electrical Module installed.**

[8] **This equipment is only required to test SDH performance with the STM0, 1, 4 Optical/Electrical Module installed.**

[9] **This equipment is required to test Options 22 and 58 only.**

[10] **This equipment is required to test Options 36 and 58 only.**

VX4610-Under-Test System Configuration

In order to perform the Self Test, Functional Tests, or Physical Layer Tests, the VX4610-under-test must be installed in a VXIbus system. At a minimum, the system must contain the elements listed in Table I–3. Because these system elements are required equipment for all tests, they are not listed in Table I–2 with the specific equipment required for each individual test.

Table I–3: Elements of a minimum VX4610-under-test system

Description	Minimum requirements	Example	Purpose
VXIbus Mainframe	Two available slots for VX4610 and up to two slots for the Add/Drop/Test module; Slot 0 available for controller (if not already installed)	Tektronix VX1410A mainframe	Provides power, cooling, and backplane for VXIbus modules
Slot 0 Controller	GPIB or MXI Interface	National Instruments GPIB-VXI/C or MXI/VXI	Provides communications link between PC and VXIbus backplane
IBM PC or compatible	386 Processor; 4 Mbyte RAM; Microsoft Windows version 3.1 or greater; Mouse; VGA color display monitor; GPIB or MXI card, cable, and supporting software		Runs UI4610 Graphical User Interface Software
UI4610 Graphical User Interface Software	Not applicable	Not applicable	Controls VX4610-under-test and provides initial setups for procedures
VX4610-Under-Test	Not applicable	Not applicable	Verify its performance

Starting the UI4610 Graphical User Interface Software

Use this procedure to start the UI4610 Graphical User Interface Software and to prepare to recall test setups. Refer to the *UI4610 Graphical User Interface Software User Manual* for complete installation and operating information.

1. With Microsoft Windows running, start the UI4610 Graphical User Interface Software application by double clicking the UI4610 icon.
2. Check for GPIB communication with the VX4610 with the following steps:
   a. In the menu bar, select **Communications** → **Setup Bus**.
   b. Click the **Instrument Connected** check box if it is not already checked.
   c. Click the **ID** command button to verify connection. If connected, the word *Tektronix* and the VX4610 instrument ID will appear in the text box.

If you do not get the correct response, set up communications with the VX4610 using the information presented on page 1–11 in this manual.

d. Click **OK**.

3. Depending on your application, choose the SDH or SONET operating mode for the UI4610 Software. To make this choice, select **Setup** → **SDH Mode** or **Setup** → **SONET Mode** in the menu bar.

4. Click the **RECALL** icon in the Main window to display the Recall dialog box.

5. Click the **From Disk** command button to display the Open dialog box.

6. Double-click the **pvsetups** directory. Refer to page I–2 for information on the location of the pvsetup files.

7. You should now see three directories, nrz, sdh and sonet, in the Directories list box. If you want to perform the *Functional Tests* or *Physical Layer Tests* using SDH parameters and terminology, select the **sdh** directory and click **OK**. If you want to use SONET parameters and terminology, select the **sonet** directory and click **OK**. If you want to use NRZ parameters, select the **nrz** directory.

8. Select **Cancel** to close the pvsetup dialog box.

9. Select **Close** to close the Recall dialog box.

The test setups, using the SDH or SONET terminology of your choice, are now visible in the file list box. You will recall setups from this list during the functional and physical layer tests.

Test Record

Photocopy either Table I–4 (SONET) or Table I–5 (SDH), found on the next few pages, and use it to record the performance verification results for your instrument.

Table I–4: VX4610 SONET test record

VX4610 Serial Number:	Temperature and Relative Humidity:
Plug-in Interface Module Type:	Verification Performed by:
Plug-in Interface Module Serial Number:	Date of Verification:

VX4610 SONET functional tests

Test		Passed	Failed
System Self Test with External Loop-Back			
SONET Signal Rate	STS-1		
	STS-3		
	OC-1		
	OC-3		
	OC-12		
Patterns	PRBS 2^{9}–1		
	PRBS 2^{15}–1		
	PRBS 2^{20}–1		
	PRBS 2^{23}–1		
	HA5 sequence		
	H5A sequence		
Generated Errors	None		
	B1 Error		
	B2 Error		
	Path B3 Error		
	Path FEBE Error		
	Pattern Bit Error		
Generated Alarms	None		
	Line AIS		
	Path AIS		
	Line FERF		
	Path FERF		
Generated Failures	None		
	LOS		
	LOF		
	LOP		

Test		Passed	Failed
Pointer Movements	Burst		
	Continuous		

VX4610 SONET physical layer tests

Transmit output checks		Minimum	Measured value	Maximum
Electrical Signal Level at Transmit Output	STS-1 Cross Connect Level	680 mV		920 mV
	STS-3 High Level	720 mV		880 mV

		Passed	Failed
Electrical Output Pulse Shape	STS-1 High Level		
	STSX-1		
	STS-3 High Level		
	STSX-3		
Optical Output Pulse Shape	OC-1		
	OC-3		
	OC-12		
Receive input checks		**Passed**	**Failed**
Electrical Input Sensitivity	STSX-1		
	STS-3		
Optical Input Sensitivity	OC-1		
	OC-3		
	OC-12		

Transmit clock checks		Minimum	Measured value	Maximum
Internal Clock Accuracy		22,367,898 Hz		22,368,102 Hz
Transmit Line Frequency Offset	positive	22,370,134 Hz		22,370,340 Hz
	negative	22,365,660 Hz		22,365,866 Hz

Recovered Clock Frequency-Lock Range	51,840,000 Hz		
	51,846,500 Hz		
	51,833,500 Hz		
	311,040,000 Hz		
	311,078,880 Hz		
	311,001,120 Hz		

Transmit clock checks		Passed	Failed
BITS Reference Input			
External Clock Frequency-Lock Range	311,040,000 Hz		
	311,351,050 Hz		
	310,728,950 Hz		
	622,080,000 Hz		
	622,702,100 Hz		
	621,457,900 Hz		

Trigger checks		Passed	Failed
Trigger Output	from Tx SECTION		
	from Rx SECTION		
Trigger Input			

Tributary checks (Options 22 and 58 only)	Minimum	Measured value	Maximum
DS1 Signal Level	5.0 V		7.0 V

		Passed	Failed
DS1 Pulse Shape			
DS1 Bridged Receive Level			
DS1 Monitor Receive Level			
DS1 External Clock Input			
DS1 Data Formats	B8ZS Coding		
	AMI Coding		
	LOS		

	Minimum	Measured value	Maximum
DS3 Signal Level	0.29 V		0.55 V

		Passed	Failed
DS3 Pulse Shape			
DS3 Monitor Receive Level			
DS3 External Clock Input			
DS3 Data Formats	B3ZS Coding		
	LOS		

Table I–5: VX4610 SDH test record

VX4610 Serial Number:	Temperature and Relative Humidity:
Plug-in Interface Module Type:	Verification Performed by:
Plug-in Interface Module Serial Number:	Date of Verification:

VX4610 SDH functional tests

Test		Passed	Failed
System Self Test with External Loop-Back			
SDH Signal Rate	STM-1E		
	STM-1		
	STM-4		
Patterns	PRBS 2^9–1		
	PRBS 2^{15}–1		
	PRBS 2^{20}–1		
	PRBS 2^{23}–1		
	10100101 sequence		
	01011010 sequence		
Generated Errors	None		
	RS B1		
	MS B2		
	Path B3		
	MS FEBE		
	Pattern Bit		
Generated Alarms	None		
	MS AIS		
	Path AIS		
	MS FERF		
	Path FERF		
Generated Failures	None		
	LOS		
	LOF		
	LOP		
Pointer Movements	Burst		
	Continuous		

VX4610 SDH physical layer tests

Transmit output checks		**Minimum**	**Measured value**		**Maximum**
Electrical Signal Level at Transmit Output	STM-1E High Level	720 mV			880 mV
		Passed		**Failed**	
Electrical Output Pulse Shape	STM-1E				
Optical Output Pulse Shape	STM-1				
	STM-4				
Receive input checks		**Passed**		**Failed**	
Electrical Input Sensitivity	STM–1E				
Optical Input Sensitivity	STM-1				
	STM-4				
Transmit clock checks		**Minimum**	**Measured value**		**Maximum**
Internal Clock Accuracy		22,367,898 Hz			22,368,102 Hz
Transmit Line Frequency Offset	positive	22,370,134 Hz			22,370,340 Hz
	negative	22,365,660 Hz			22,365,866 Hz
Transmit clock checks		**Passed**		**Failed**	
Recovered Clock Frequency-Lock Range	51,840,000 Hz				
	51,846,500 Hz				
	51,833,500 Hz				
	311,040,000 Hz				
	311,078,880 Hz				
	311,001,120 Hz				
2 Mb/s Reference Input					
External Clock Frequency-Lock Range	311,040,000 Hz				
	311,351,050 Hz				
	310,728,950 Hz				
	622,080,000 Hz				
	622,702,100 Hz				
	621,457,900 Hz				
Trigger checks		**Passed**		**Failed**	
Trigger Output	from Tx SECTION				
	from Rx SECTION				
Trigger Input					

Tributary checks (Options 36 and 58 only)			
		Passed	**Failed**
2 Mb/s Balanced Pulse Mask			
2 Mb/s Balanced Monitor Receive Level			
2 Mb/s Balanced External Clock Input			
2 Mb/s Balanced Data Formats	HDB3 Coding		
	LOS		
		Passed	**Failed**
2 Mb/s Unbalanced Pulse Mask			
2 Mb/s Unbalanced Bridged Receive Level			
2 Mb/s Unbalanced Monitor Receive Level			
2 Mb/s Unbalanced External Clock Input			
2 Mb/s Unbalanced Data Formats	HDB3 Coding		
	LOS		
		Passed	**Failed**
34 Mb/s Pulse Pulse Mask			
34 Mb/s Bridged Receive Level			
34 Mb/s Monitor Receive Level			
34 Mb/s External Clock Input			
34 Mb/s Data Formats	HDB3 Coding		
	LOS		
		Passed	**Failed**
140 Mb/s Pulse Mask			
140 Mb/s Bridged Receive Level			
140 Mb/s Monitor Receive Level			
140 Mb/s External Clock Input			
140 Mb/s Data Formats	CMI Coding		
	LOS		
Jitter Tolerance			

Self Test

This procedure uses internal diagnostic routines to verify that the VX4610 is operating correctly. No test equipment is required. You can run the *Self Test* with external signals connected to any input or output of the VX4610. External connections will not affect the outcome of the *Self Test*.

Equipment required	No test equipment or connections are required
Prerequisites	Power on the VX4610 and allow a twenty minute warm-up period before running Self Test
Time required	Approximately two minutes (after warm-up time)

1. Install and start the UI4610 Graphical User Interface Software. For instructions, refer to page I–7 in this appendix or the *UI4610 Graphical User Interface Software User Manual*.
2. In the menu bar, select **Execute Self Test** in the **Setup** menu.
3. When the self test completes, the message PASSED appears in the display. If you see the message FAILED, repeat the self test. If the problem persists, contact your local Tektronix field office or representative for assistance.

There are advantages and disadvantages of this *Self Test*. One advantage is you do not have to disconnect the VX4610 from your application. A disadvantage is the electrical and optical I/O circuitry is not tested. If the *Self Test* passes and you are still experiencing difficulty, perform *System Diagnostics with External Loop-Back* on page I–17 to test the electrical or optical I/O circuitry.

Functional Tests

The purpose of the functional tests is to verify the functional specifications of the VX4610 SDH/SONET Generator/Receiver. Some functional tests rely on the front panel status lights to indicate the results of the test. Other tests rely on results reported in the display of the UI4610 Graphical User Interface Software. Figure I–1 shows the locations of the front panel status lights used in these procedures.

If the VX4610 fails any of these tests, it has failed the performance verification. Double check the electrical and optical connections and repeat any failed test. If the failure persists, contact your local Tektronix field office or representative for assistance.

After installing and starting the UI4610 Graphical User Interface Software, you may perform the functional tests in any order. Each test is independent and does not depend on the setup from the previous test.

***NOTE**. Before beginning the functional tests, power on the VX4610 and allow a 20 minute warm-up.*

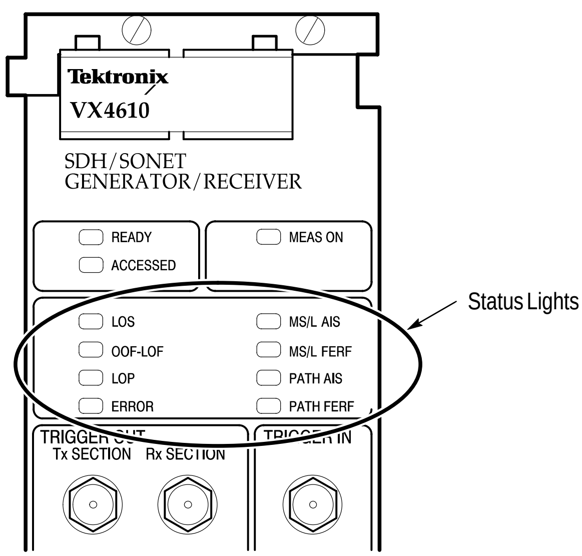


Figure I–1: VX4610 front-panel status lights

Loop-Back Connection

Each functional test requires an external loop-back connection from the TRANSMIT output to the RECEIVE input. For the electrical loop-back, you can use the 75 Ω BNC coaxial cable provided as a standard accessory to the VX4610. If one of the Electrical/Optical Plug-in Interface Modules is installed in your VX4610, you also need a short optical cable that is compatible with the optical connectors on your instrument. Optical cables are not included as standard accessories to the VX4610.100 W Cable, Bantam-to-Bantam (two required)

CAUTION. *To avoid damaging the Receive optical inputs, use a 10 dB attenuator with high-power optical sources, such as the Option 05 and 10 modules. Without adequate attenuation, these 0 dB optical sources will overdrive and damage the receiver inputs.*

System Diagnostics with External Loop-Back

This test runs the built-in diagnostic suite using loop-back connections from the TRANSMIT outputs to the RECEIVE inputs of the VX4610 and, if installed, Option 22, Option 36, or Option 58.

Equipment required	75 Ω BNC Coaxial Cable (item 19) for electrical loop-back, one required (two required when option 22, 36 or 58 installed) Optical Loop-back Cable (item 14), when Electrical/Optical Plug-in Interface Module is installed, one required Optical attenuator (item 9) set to10 dB when an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level) When Option 22 or 58 is installed, 100 Ω Bantam-to-Bantam Cable (item 30) for electrical loop-back When Option 58 is installed, electrical loop-back (item 23), six required for Option 58 When Option 36 or 58 is installed, 120 Ω DIN41628L cable (item 34) for electrical loop-back, two required
Prerequisites	VX4610 warmed up for at least twenty minutes
Time required	Approximately two minutes

1. Connect 75 Ω BNC and optical loop-back cables from the TRANSMIT outputs to the RECEIVE inputs. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.

***CAUTION.** To avoid damaging the receiver inputs when using the Option 05 or Option 10 optical module, use an optical attenuator set to 10 dB.*

2. If Option 22, 36, or 58 is installed, attach the electrical loop-back cables from the TRANSMIT/DROP outputs to the RECEIVE/ADD inputs. All corresponding outputs and inputs must be connected.
3. In the UI4610 Software menu bar, select **Tools** → **Command Builder...**.
4. Select **Command Group** → **:DIAGnostic:** → **:SELect** → **SYSEXTERNAL**, and then click the **SEND** command button.
5. Select **Command Group** → **:DIAGnostic:** → **:EXECute**, and then click the **SEND** command button.
6. After the MEAS LED goes out, select **Command Group** → **Common Commands** → ***OPC?**, and then click the **SEND** command button.
7. Wait for a the number **1** to appear in the Response text box. This response indicates that the diagnostic routine has finished.
8. Select **Command Group** → **:DIAGnostic:** → **:RESults?**, and then click the **SEND** command button.
9. Read the diagnostic result, PASSED or FAILED, in the Response box of the Command Builder window.
10. Select **Command Group** → **Exit** to exit the Command Builder.

SDH/SONET Signals

This test checks that the VX4610 transmits and receives error-free signals at all SDH/SONET rates.

Equipment required	75 Ω BNC Coaxial Cable (item 19) for electrical loop-back Optical Loop-back Cable (item 14) if Electrical/Optical Plug-in Interface Module is installed Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level)
Prerequisites	VX4610 warmed up for at least twenty minutes
Time required	Approximately five minutes

1. Attach electrical and optical loop-back cables from the TRANSMIT outputs to the RECEIVE inputs. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.

CAUTION. *To avoid damaging the receiver inputs when using the Option 05 or Option 10 optical module, use an optical attenuator set to 10 dB.*

2. If you are verifying the VX4610 using SDH terminology, skip to step 6. To recall the first SONET setup, click the **RECALL** icon, click the **From Disk** command button, select the file named **fntest01.set**, and then click **OK.**
3. To turn Auto Update on, click the **Auto Update** check box in the **RESULTS** group.
4. Click the **Start** button and wait two seconds for the test to complete.
5. Click the **Main Results...** command button and verify that no errors are reported in the Main Results window. Click **Close**.
6. Click the **RECALL** icon, click the **From Disk** command button, select the file named **fntest02.set**, and then click **OK.**
7. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.
8. Click the **Start** button and wait two seconds for the test to complete.
9. Click the **Main Results...** command button and verify that no errors are reported in the Main Results window. Click **Close**.
10. Steps 11 through 17 of this procedure apply only if one of the Electrical/Optical Plug-in Interface Modules is installed in your VX4610. If the Plug-in Interface Module has electrical input and output only, proceed to *Patterns* on page I–20.

11. If you are verifying the VX4610 using SDH terminology, skip to step 14. Click the **RECALL** icon, click the **From Disk** command button, select the file named **fntest03.set**, and then click **OK.**
12. Click the **Start** button and wait two seconds for the test to complete.
13. Click the **Main Results...** command button and verify that no errors are reported in the Main Results window. Click **Close**. Proceed to step 14.
14. Click the **RECALL** icon, click the **From Disk** command button, select the file named **fntest04.set**, and then click **OK.**
15. Click the **Start** button and wait two seconds for the test to complete.
16. Click the **Main Results...** command button and verify that no errors are reported in the Main Results window. Click **Close**.
17. If your VX4610 does not have OC-12 or STM-4 capability, proceed to the next test, *Patterns*. To check the OC-12 or STM-4 rate, click the **RECALL** icon, click the **From Disk** command button, select the file named **fntest05.set**, and then click **OK.**
18. Click the **Start** button and wait two seconds for the test to complete.
19. Click the **Main Results...** command button and verify that no errors are reported in the Main Results window. Click **Close**.

Patterns

This test checks that the VX4610 transmits and receives patterns without errors.

Equipment required	75 Ω BNC Coaxial Cable (item 19) for electrical loop-back Optical Loop-back Cable (item 14) if Electrical/Optical Plug-in Interface Module is installed Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level)
Prerequisites	VX4610 warmed up for at least twenty minutes
Time required	Approximately five minutes

1. Attach electrical and optical loop-back cables from the TRANSMIT outputs to the RECEIVE inputs. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.

CAUTION. *To avoid damaging the receiver inputs when using the Option 05 or Option 10 optical module, use an optical attenuator set to 10 dB.*

2. To test the PRBS of length 2^9–1, click the **RECALL** icon, click the **From Disk** command button, select the file named **fntest06.set**, and then click **OK.**
3. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.
4. Click the **Start** button and wait two seconds for the test to complete.
5. Click the **Error Analysis...** command button. Select **Pattern Bit** for SDH or **Payload** for Sonet from the **Analysis** drop-down list. Verify that no Payload errors are reported in the Error Analysis window.
6. To test the PRBS of length 2^{15}–1, select **2^15–1** in the Test Pattern drop-down list in the GENERATOR group.
7. Click the **Start** button and wait two seconds for the test to complete.
8. Click the **Error Analysis** window and verify that no Payload errors are reported in the Error Analysis window.
9. To test the PRBS of length 2^{20}–1, select **2^20–1** in the Test Pattern drop-down list in the GENERATOR group.
10. Click the **Start** button and wait two seconds for the test to complete.
11. Click the **Error Analysis** window and verify that no Payload errors are reported in the Error Analysis window.
12. To test the PRBS of length 2^{23}–1, select **2^23–1** in the Test Pattern drop-down list in the GENERATOR group.
13. Click the **Start** button and wait two seconds for the test to complete.
14. Click the **Error Analysis** window and verify that no Payload errors are reported in the Error Analysis window.
15. To test User Byte pattern sequences, click the **More ...** command button in the GENERATOR group.
16. Select **User Byte** in the Test Pattern drop-down list.
17. Enter the hexadecimal number **#HA5**, then click **Set**. Click **Close**.
18. Click the **Start** button and wait two seconds for the test to complete.
19. Click the **Error Analysis** window and verify that no Payload errors are reported in the Error Analysis window.
20. Click the **More ...** command button in the GENERATOR group to set another user-defined byte.
21. Select **User Byte** in the Test Pattern drop-down list.

22. Enter the hexadecimal number **#H5A**, then click **Set**. Click **Close**.
23. Click the **Start** button and wait two seconds for the test to complete.
24. Click the **Error Analysis** window and verify that no Payload errors are reported in the Error Analysis window. Click **Close**.

Generated Errors

This test checks that the VX4610 generates and measures errors correctly.

Equipment required	75 Ω BNC Coaxial Cable (item 19) for electrical loop-back Optical Loop-back Cable (item 14) if Electrical/Optical Plug-in Interface Module is installed Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level)
Prerequisites	VX4610 warmed up for at least twenty minutes
Time required	Approximately five minutes

1. Attach electrical and optical loop-back cables from the TRANSMIT outputs to the RECEIVE inputs. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.

CAUTION. *To avoid damaging the receiver inputs when using the Option 05 or Option 10 optical module, use an optical attenuator set to 10 dB.*

2. To test the no-error condition, click the **RECALL** icon, click the **From Disk** command button, select the file named **fntest07.set**, and then click **OK.**
3. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.
4. Click the **Start** button and wait six seconds for the test to complete.
5. Click the **Main Results...** command button and verify that no errors are reported in the Main Results window. Click **Close**.
6. To transmit and receive a generated B1 Error at a 10^{-6} error rate, perform the following steps:
   a. Select the **Err/Alarm/Ptr...** command button in the GENERATOR group.
   b. Select **B1 Error** in the Error Type drop-down list.
   c. Click the **Rate** option button.
   d. Select **1.E–6** in the Error Rate drop-down list.

e. Click **Close**.

7. Click the **Start** button and wait six seconds for the test to complete.

8. Click the **Main Results...** command button and verify that a B1 Error Rate between 9.98E–7 and 1.02E–6 is reported in the Main Results window, and that there are no other errors. Click **Close**.

9. To transmit and receive a generated B2 Error at a 10^{-4} error rate, perform the following steps:

   a. Select the **Err/Alarm/Ptr...** command button in the GENERATOR group.

   b. Select **B2 Error** in the Error Type drop-down list.

   c. Select **1.E–4** in the Error Rate drop-down list.

   d. Click **Close**.

10. Click the **Start** button and wait six seconds for the test to complete.

11. Click the **Main Results...** window and verify that a B2 Error Rate between 9.98E–5 and 1.02E–4 is reported in the Main Results window, and that there are no other errors. Click **Close**.

12. To transmit and receive a generated B3 Error at a 10^{-6} error rate, perform the following steps:

    a. Select the **Err/Alarm/Ptr...** command button in the GENERATOR group.

    b. Select **B3 Error** in the Error Type drop-down list.

    c. Select **1.0E–06** in the Error Rate drop-down list.

    d. Click **Close**.

13. Click the **Start** button and wait six seconds for the test to complete.

14. Click the **Main Results...** command button and verify that a Path B3 Error Rate between 9.98E–7 and 1.02E–6 is reported in the Main Results window, and that there are no other errors. Click **Close**.

15. To transmit and receive a generated Path FEBE Error at a 10^{-6} error rate, perform the following steps:

    a. Select the **Err/Alarm/Ptr...** command button in the GENERATOR group.

    b. Select **Path FEBE** in the Error Type drop-down list.

    c. Select **1.E–6** in the Error Rate drop-down list.

   d. Click **Close**.

16. Click the **Start** button and wait six seconds for the test to complete.
17. Click the **Main Results...** command button and verify that a Path FEBE error rate between 9.98E–7 and 1.02E–6 is reported in the Main Results window and that there are no other errors. Click **Close**.
18. To transmit and receive a generated Payload Bit Error at a 10^{-6} error rate, perform the following steps:
    a. Select the **Err/Alarm/Ptr...** command button in the GENERATOR group.
    b. Select **Pattern Bit** in the Error Type drop-down list.
    c. Select **1.0E–06** in the Error Rate drop-down list.
    d. Click **Close**.
19. Click the **Start** button and wait six seconds for the test to complete.
20. Click the **Main Results...** command button and verify that a Pattern Bit Error Rate between 9.98E–7 and 1.02E–6 is reported in the Main Results window and that there are no other errors. Click **Close**.

Generated Alarms

This test checks that the VX4610 generates and measures alarms correctly.

Equipment required	75 Ω BNC Coaxial Cable (item 19) for electrical loop-back Optical Loop-back Cable (item 14) if Electrical/Optical Plug-in Interface Module is installed Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level)
Prerequisites	VX4610 warmed up for at least twenty minutes
Time required	Approximately five minutes

1. Attach electrical and optical loop-back cables from the TRANSMIT outputs to the RECEIVE inputs. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.

CAUTION. *To avoid damaging the receiver inputs when using the Option 05 or Option 10 optical module, use an optical attenuator set to 10 dB.*

2. To test the no-alarm condition, click the **RECALL** icon, click the **From Disk** command button, select the file named **fntest08.set**, and then click **OK.**

3. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.

4. Click the **Start** button and wait two seconds for the test to complete.

5. Click the **Main Results...** command button and verify that no errors are reported in the Main Results window. Click **Close**.

6. To transmit and receive a generated Line AIS or MS AIS alarm, perform the following steps:

   a. Select the **Err/Alarm/Ptr...** command button in the GENERATOR group.

   b. Select **Line AIS** or **MS AIS** in the Alarm Type drop-down list.

   c. Click **Close**.

7. Click the **Start** button and wait two seconds for the test to complete.

8. Click the **Main Results...** command button.

9. In the Main Results window, click **Alarms**.

10. Verify that two Line AIS or MS AIS alarm seconds are counted in the Main Results window, and that there are no other alarms counted. Click **Close**.

11. To transmit and receive a generated Path AIS alarm, perform the following steps:

    a. Select the **Err/Alarm/Ptr...** command button in the GENERATOR group.

    b. Select **Path AIS** in the Alarm Type drop-down list.

    c. Click **Close**.

12. Click the **Start** button and wait two seconds for the test to complete.

13. Click the **Main Results** window.

14. Verify that two Path AIS alarm seconds are counted in the Main Results window, and that there are no other alarms counted. Click **Close**.

15. To transmit and receive a generated Line FERF or MS FERF alarm, perform the following steps:

    a. Select the **Err/Alarm/Ptr...** command button in the GENERATOR group.

b. Select **Line FERF** or **MS FERF** in the Alarm Type drop-down list.

c. Click **Close**.

16. Click the **Start** button and wait two seconds for the test to complete.

17. Click the **Main Results** window.

18. Verify that two Line FERF or MS FERF alarm seconds are counted in the Main Results window, and that there are no other alarms counted. Click **Close**.

19. To transmit and receive a generated Path FERF alarm, perform the following steps:

a. Select the **Err/Alarm/Ptr...** command button in the GENERATOR group.

b. Select **Path FERF** in the Alarm Type drop-down list.

c. Click **Close**.

20. Click the **Start** button and wait two seconds for the test to complete.

21. Click the **Main Results...** command button and select the **Alarms** button in the Main Results window.

22. Verify that two Path FERF alarm seconds are counted in the Main Results window, and that there are no other alarms counted. Click **Close**.

Generated Failures

This test checks that the VX4610 generates and measures failures correctly.

Equipment required	75 Ω BNC Coaxial Cable (item 19) for electrical loop-back Optical Loop-back Cable (item 14) if Electrical/Optical Plug-in Interface Module is installed Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level)
Prerequisites	VX4610 warmed up for at least twenty minutes
Time required	Approximately five minutes

1. Attach electrical and optical loop-back cables from the TRANSMIT outputs to the RECEIVE inputs. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.

CAUTION. *To avoid damaging the receiver inputs when using the Option 05 or Option 10 optical module, use an optical attenuator set to 10 dB.*

2. To test the no-alarm condition, click the **RECALL** icon, click the **From Disk** command button, select the file named **fntest09.set**, and then click **OK**.
3. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.
4. Click the **Start** button and wait two seconds for the test to complete.
5. Click the **Main Results...** command button and verify that no errors reported in the Main Results window.
6. In the Main Results window, click **Failures**. Verify that there are no alarms or failures reported. Click **Close**.
7. To transmit and receive a generated LOS failure, perform the following steps:
   a. Select the **Err/Alarm/Ptr...** command button in the GENERATOR group.
   b. Select **Loss of Signal** in the Failure Type drop-down list.
   c. Click **Close**.
8. Click the **Start** button and wait two seconds for the test to complete.
9. Click the **Main Results** window.
10. Verify that two Loss of Signal failure seconds are counted in the Main Results window. Ignore any other failures or alarms that are reported. Click **Close**.
11. To transmit and receive a generated LOF failure, perform the following steps:
    a. Select the **Err/Alarm/Ptr...** command button in the GENERATOR group.
    b. Select **Loss of Frame** in the Failure Type drop-down list.
    c. Click **Close**.
12. Click the **Start** button and wait two seconds for the test to complete.
13. Click the **Main Results** window.

14. Verify that two Loss of Frame failure seconds are counted in the Main Results window. Ignore any other failures or alarms that are reported. Click **Close**.

15. To transmit and receive a generated LOP failure, perform the following steps:

    a. Select the **Err/Alarm/Ptr...** command button in the GENERATOR group.

    b. Select **Loss of AU Pointer** or **Loss of STS Pointer** in the Failure Type drop-down list.

    c. Click **Close**.

16. Click the **Start** button and wait two seconds for the test to complete.

17. Click the **Main Results** window.

18. Click the **Pointers** command button.

19. Verify that two Loss of Pointer seconds are counted in the Main Results window. Ignore any other failures or alarms that are reported. Click **Close**.

Pointer Movements

This test checks that the VX4610 generates and measures pointer movement correctly.

Equipment required	75 Ω BNC Coaxial Cable (item 19) for electrical loop-back Optical Loop-back Cable (item 14) if Electrical/Optical Plug-in Interface Module is installed Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level)
Prerequisites	VX4610 warmed up for at least twenty minutes
Time required	Approximately five minutes

1. Attach electrical and optical loop-back cables from the TRANSMIT outputs to the RECEIVE inputs. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.

CAUTION. *To avoid damaging the receiver inputs when using the Option 05 or Option 10 optical module, use an optical attenuator set to 10 dB.*

2. To verify Burst Pointer Movements, click the **RECALL** icon, click the **From Disk** command button, select pvsetups, sdh or sonet and the file

named **fntest10.set**, and then click **OK**. Wait approximately 30 seconds for the settings to load.

3. Click the **Auto Update** check box in the **RESULTS** group, if it is not already checked.
4. Click the **Start** button to start a test.
5. Click the **Main Results...** command button.
6. In the Main Results window, click the **Pointers** command button. Relocate the Main Results window to the lower-right side of the display.
7. To transmit a burst of pointer movements, perform the following steps:
   a. In the menu bar, select **Tools** → **Command Builder...**.
   b. Select **Command Group** → **:SOURce:** → **:DATA:** → **:TELecom:** → **:POINter** → **:NBURst**
   c. Under **PARAMETERS** select **<Enter Integer Data>**. In the dialog box that appears enter **5** and click **OK**. Click **SEND**.
   d. Select **Command Group** → **:SOURce:** → **:DATA:** → **:TELecom:** → **:POINter** → **:MODE** →**BURst**. Click **SEND**.
   e. Select **Command Group** → **:SOURce:** → **:DATA:** → **:TELecom:** → **:POINter** → **:ACTion**
   f. Click **Send**.
8. Click the Main Results window and verify that there are either 5 Positive Pointer Justifications or 5 Negative Pointer Justifications, but not both.
9. To transmit a burst of alternate positive and negative pointer movements, perform the following steps:
   a. In the **Command Builder...**.
   b. Select **Command Group** → **:SOURce:** → **:DATA:** → **:TELecom:** → **:POINter** → **:ACTion**
   c. Click the **Send** command button.
10. Verify that there are now 5 Positive Pointer Justifications and 5 Negative Pointer Justifications in the Main Results window.
11. Click the **Stop** button to stop the test.
12. To verify Continuous Movement, click the **RECALL** icon, click the **From Disk** command button, select the file named **fntest11.set**, and then click **OK**. Wait approximately 30 seconds for the settings to load.

13. Click the **Main Results...** command button.
14. In the Main Results window, click the **Pointers** command button. Relocate the Main Results window to the lower-right side of the display.
15. Click the **Start** button to start the test.
16. Click the **Main Results...** command button.
17. Wait 32 seconds for the test to complete.
18. Verify that 3 or 4 Positive Pointer Justifications have been recorded.

Physical Layer Tests

This section contains a set of procedures that verify the VX4610 physical layer specifications. These procedures check performance of the standard instrument as well as two optional Plug-in Interface Modules, so some steps may not apply to your VX4610. The steps that apply only to optional Plug-in Interface Modules are identified in the procedures.

The procedures contain setup instructions for the example equipment listed in Table I–2, *Required Test Equipment,* which begins on page I–3. You may use equipment other than the recommended examples if it meets the minimum requirements listed. However, if you do, the interconnect diagrams and setup instructions in this section may not apply without modification.

Prerequisites

The procedures in this section are a valid test of the VX4610 performance when the following requirements are met:

- The VX4610 is installed in a VXIbus mainframe according to the installation instructions presented in the section *Getting Started* on page 1–7.
- The VX4610 has passed all the *Functional Tests*, which begin on page I–16.
- The VX4610 has warmed up for at least 20 minutes and is operating in an ambient temperature between 0° C and +50° C.

Sequence of Tests

Most tests are dependent on those that precede them, so perform all the procedures in sequential order.

Electrical Output Signal Level at Transmit Output (High Level)

This test checks the signal amplitude directly at the TRANSMIT output connector. The amplitude value measured in this test accounts for the difference between the 75 Ω source impedance of the TRANSMIT output and the 50 Ω input impedance of the Communications Signal Analyzer.

Equipment required	Communications Signal Analyzer (item 5) 75 Ω Coaxial Cable (item 19) SMA Male to BNC Female Adapter (item 24)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 TRANSMIT output to the Communications Signal Analyzer input as shown in Figure I–2.

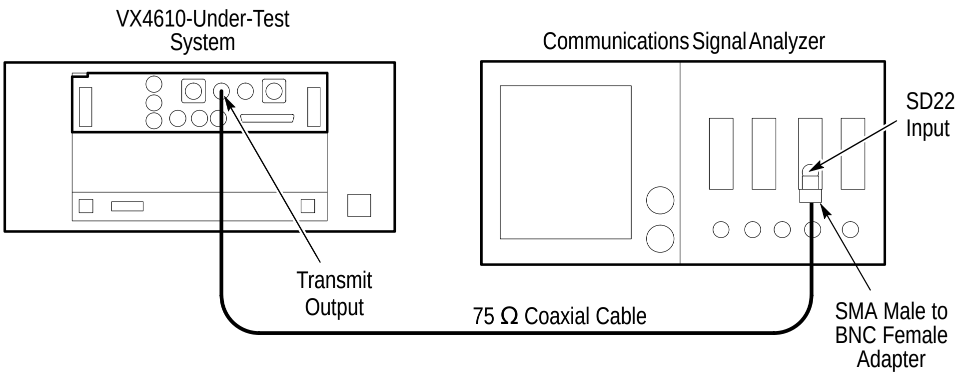


Figure I–2: Transmit electrical output amplitude check

2. Perform the initial setup of the Communications Signal Analyzer with the following steps:

   a. To initialize the Communications Signal Analyzer, select the **UTILITY** menu, the **Initialize** pop-up menu, and then select **Initialize** in the pop-up menu.

   b. Press the **SELECT CHANNEL** button next to the input connector on the sampling head channel you are using.

   c. Select the **TRIGGER** menu. Set the **Source** to **Internal Clock**.

3. If you are verifying SDH performance, skip to step 5. To measure the SONET STS-1 signal level, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest01.set**, and then click **OK**.

4. Use the following sequence to set up the Communications Signal Analyzer and perform the test:

   a. Press the **AUTOSET** button.

   b. Select the **MEASURE** menu and then the **Measurements** pop-up menu.

   c. Select the **Peak-peak** measurement then select **Exit**.

   d. Select the **Peak-peak** measurement selector to display the Peak-peak pop-up menu.

   e. Verify that the **mean value** measurement in the Peak-peak pop-up menu is 800 mV ± 120 mV (680 to 920 mV). Proceed to step 5.

5. To measure the STS-3 or STM-1E signal level, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest02.set**, and then click **OK**.

6. Perform the test with the following sequence on the Communications Signal Analyzer:

   a. Press the **AUTOSET** button. The waveform does not appear triggered, but the following measurement is still valid.

   b. Select the **MEASURE** menu then the **Measurements** pop-up menu.

   c. Select the **Peak-peak** measurement then select **Exit**.

   d. Select the **Peak-peak** measurement selector to display the Peak-peak pop-up menu.

   e. Verify that the **mean value** measurement in the Peak-peak pop-up menu is 800 mV ± 80 mV (720 to 880 mV).

Electrical Output Pulse Shape at Transmit Output (High Level) and at Cross Connect

This test checks the high-level and cross-connect-level signal pulse shapes. The signals are equalized through specified lengths of reference cable for comparison with eye masks specified in ANSI T1.102, Bellcore TR-NWT-000253, and ITU-T G.703.

Equipment required	Communications Signal Analyzer (item 5)
	225 ft (68.6 m) length of 75 Ω Reference Cable (item 15), two required
	75 Ω to 50 Ω Converter (item 18)
	75 Ω Coaxial Cable (item 19)
	50 Ω Power Splitter (item 21)
	50 Ω SMA Coaxial Cable (item 22), two required
	SMA Male to BNC Female Adapter (item 24)
	Delay Line (item 25)
	BNC male to BNC male Adapter (item 27)
Prerequisites	All prerequisites listed on page I–31
	All previous Physical Layer Tests
Time required	Approximately twenty minutes

1. Perform automatic gain and offset calibrations with the following steps:

   a. Connect a coaxial cable from the **CALIBRATE OUTPUT** to the channel to be used.

   b. Select the Waveform Menu.

   c. Select the **UTILITY** menu, the **Initialize** pop-up menu, and then select the **Initialize** menu item in the pop-up menu.

   d. Press the **SELECT CHANNEL** button next to the input connector on the sampling head channel you are using.

   e. Select the **UTILITY** menu, and the **Page to Enhanced Accuracy** pop-up menu.

   f. Select the **Gain** menu, **Automatic Calibrate**, and then **Proceed**.

   g. Select **Store Constants**, and then **Exit**.

   h. Disconnect the coaxial cable.

   i. Connect a 50 Ω terminator to the channel to be used.

   j. Select the **Offset** menu, **Automatic Calibrate**, and then **Proceed**.

   k. Select **Store Constants**, and then **Exit**.

2. Connect the VX4610 TRANSMIT output to the Communications Signal Analyzer as shown in Figure I–3.

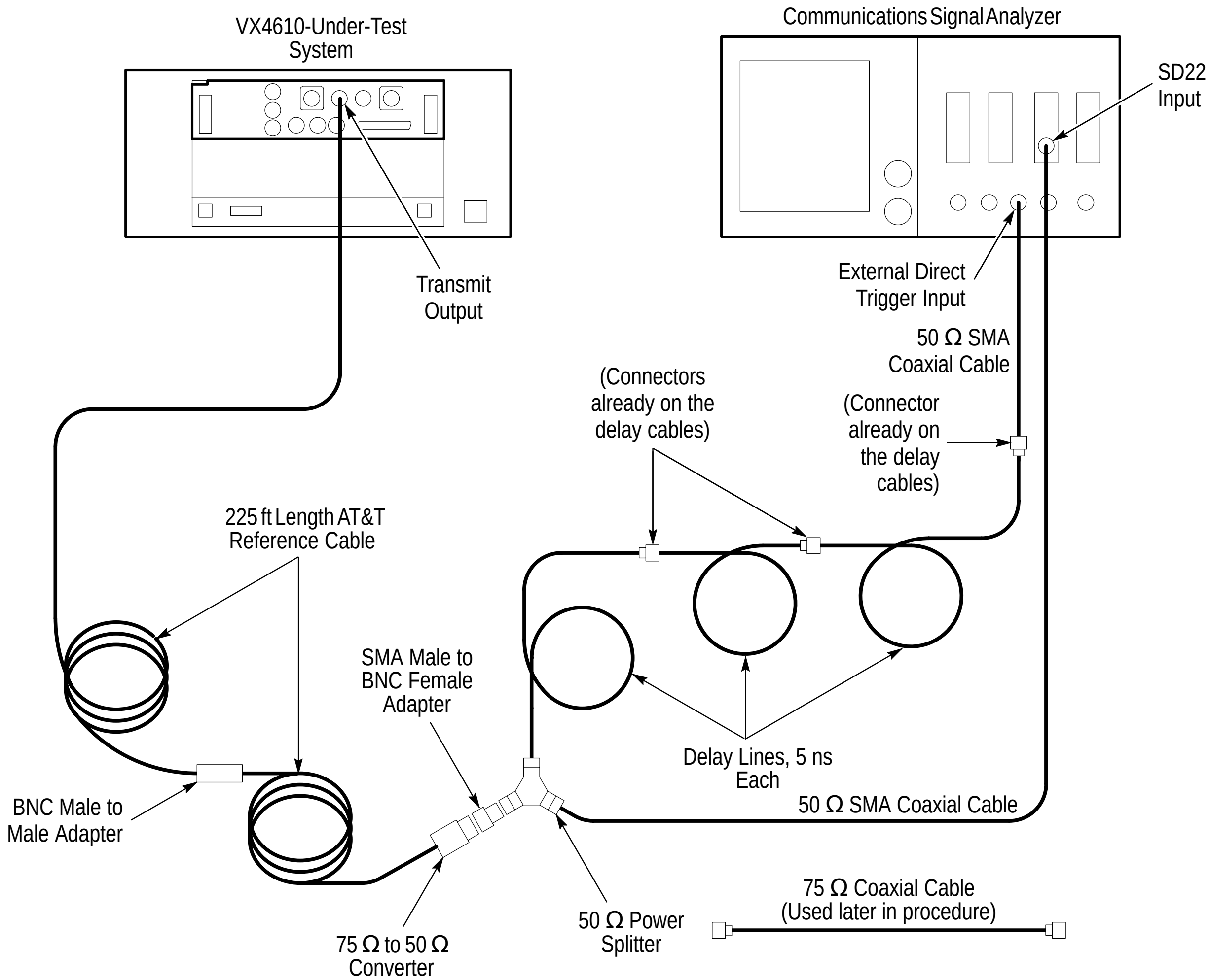


Figure I–3: Transmit electrical output pulse shape setup

3. Perform the initial setup of the Communications Signal Analyzer with the following steps:

   a. To initialize the Communications Signal Analyzer, select the **UTILITY** menu, the **Initialize** pop-up menu, and then select the **Initialize** menu item in the pop-up menu.

   b. Press the **SELECT CHANNEL** button next to the input connector on the sampling head channel you are using.

   c. Select the **TRIGGER** menu, set the **Slope** to **–**, and then select **Exit**.

   d. Select the **DISPLAY MODES** menu.

   e. Select the **Persist/Histograms** pop-up menu, select the **Color Grading** menu item, and then select **Exit**.

f. Select **Mask Testing** pop-up menu and then the **Set N Waveforms** menu item.

g. Select the **Waveform N** pop-up menu (red boxes located just to the left of the two front panel knobs) then enter the numeric value **100** followed by **Enter**.

h. If you are verifying SDH performance, skip to step 21. To verify the STS-1 pulse shape (SONET only), select the **Standard Masks** pop-up menu and then the **STS-1 51.840 Mb** menu item from the set of built-in ANSI T1.102 Electrical Standards masks.

4. To generate the STS-1 signal, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest03.set**, and then click **OK**.

5. Perform the test with the following sequence on the Communications Signal Analyzer:

   a. Select the **DISPLAY MODES** menu.

   b. Press the **AUTOSET** button on the front panel of the Communications Signal Analyzer.

   c. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.

   d. Select the **Stop N Waveforms** menu item.

   e. After 100 waveforms have been acquired the acquisition stops automatically. Verify that the test has passed, which is indicated by the green Passing message displayed in the Mask Testing pop-up menu selector.

6. Remove both 225 ft (68.6 m) lengths of 75 Ω reference cable and the BNC male to BNC male adapter. Reconnect the VX4610 to the 75 Ω to 50 Ω Converter with the short (≈1 m) 75 Ω coaxial cable cable that has not been used until this step in the procedure.

7. To verify the STSX-1 pulse shape, click the **More ...** command button in the GENERATOR group.

8. Select the **X-Connect** option button.

9. Perform the test with the following sequence on the Communications Signal Analyzer:

   a. Press the **AUTOSET** button on the front panel of the Communications Signal Analyzer.

   b. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.

   c. Select the **Stop N Waveforms** menu item.

   d. After 100 waveforms have been acquired the acquisition stops automatically. Verify that the test has passed, which is indicated by the green Passing message displayed in the Mask Testing pop-up menu selector.

10. To verify the STS-3 pulse shape at the High output level, click the **More ...** command button in the GENERATOR group.

11. Select **STS-3** in the Tx Rate drop-down list.

12. Select the **High** option button.

13. Set up and perform the test with the following sequence on the Communications Signal Analyzer:

    a. Select the **TRIGGER** menu, set the **Slope** to **+**, and then select **Exit**.

    b. Select the **DISPLAY MODES** menu.

    c. Select the **Standard Masks** pop-up menu and then the **STS-3 155.52 Mb** menu item from the set of built-in ANSI T1.102 Electrical Standards masks.

    d. Press the **AUTOSET** button on the front panel of the Communications Signal Analyzer.

    e. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.

    f. Select the **Stop N Waveforms** menu item.

    g. After acquiring 100 waveforms, the acquisition stops automatically. Verify that the test has passed, which is indicated by the green Passing message displayed in the Mask Testing pop-up menu selector.

14. To verify the STSX-3 pulse shape, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest04.set**, and then click **OK.**

15. Set up and perform the test with the following sequence on the Communications Signal Analyzer:

    a. Select the **Standard Masks** pop-up menu and then the **STSX-3 155.52 Mb** menu item from the set of built-in ANSI T1.102 Electrical Standards masks.

    b. Press the **AUTOSET** button on the front panel of the Communications Signal Analyzer.

    c. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.

    d. Select the **Stop N Waveforms** menu item.

e. After 100 waveforms have been acquired the acquisition stops automatically. Verify that the test has passed, which is indicated by the green Passing message displayed in the Mask Testing pop-up menu selector.

16. Remove the short (≈ 1 m) length of 75 Ω coaxial cable and replace it with one 225 ft (68.6 m) length of 75 Ω reference cable.

17. To verify the STS-3 pulse shape at cross connect, click the **More ...** command button in the GENERATOR group.

18. Select the **High** option button.

19. Set up and perform the test with the following sequence on the Communications Signal Analyzer:

    a. Press the **AUTOSET** button on the front panel of the Communications Signal Analyzer.

    b. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.

    c. Select the **Stop N Waveforms** menu item.

***NOTE**. In some instances, AutoSet may not adjust the waveform amplitude, offset, and/or horizontal positioning to the most optimum settings for a particular mask test; if the test fails, slightly readjust the vertical scale and offset, and also the horizontal position to improve waveform alignment.*

---

    d. After 100 waveforms have been acquired the acquisition stops automatically. Verify that the test has passed, which is indicated by the green Passing message displayed in the Mask Testing pop-up menu selector.

20. If you are only verifying SONET performance, you are finished with this test; continue with the next test, *Optical Output Pulse Shape*, on page I–39. If you are verifying SDH performance, proceed with the following steps.

21. Remove the 225 ft (68.6 m) length of 75 Ω reference cable and replace it with the short (≈1 m) 75 Ω coaxial cable cable.

22. To verify the STM-1 pulse shape, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest05.set**, and then click **OK**.

23. Set up and perform the test with the following sequence on the Communications Signal Analyzer:

    a. Select the **TRIGGER** menu, set the **Slope** to **+**, and then select **Exit**..

    b. Select the **DISPLAY MODES** menu.

c. Select the **Standard Masks** pop-up menu and then the **STM-1 155.52 Mb** menu item from the set of built-in ITU-T G.703 Electrical Standards masks.

d. Press the **AUTOSET** button on the front panel of the Communications Signal Analyzer.

e. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.

f. Select the **Stop N Waveforms** menu item.

***NOTE**. In some instances, AutoSet may not adjust the waveform amplitude, offset, and/or horizontal positioning to the most optimum settings for a particular mask test; if the test fails, slightly readjust the vertical scale and offset, and also the horizontal position to improve waveform alignment.*

g. After 100 waveforms have been acquired the acquisition stops automatically. Verify that the test has passed, which is indicated by the green Passing message displayed in the Mask Testing pop-up menu selector.

Optical Output Pulse Shape

These tests verify the signal shape of the transmitted optical output pulse by comparing with eye masks as specified in Bellcore TR-NWT-000253 and ITU-T G.703. These tests apply only if your VX4610 has one of the optional Electrical/Optical Plug-in Interface Modules installed. If your VX4610 does not have optical capability, proceed to *Electrical Input Sensitivity*, which begins on page I–43.

Equipment required	Communications Signal Analyzer (item 5) SDH/SONET Reference Receiver and Power Meter (item 10, 11, 12, or 13, depending on VX4610 configuration) Optical Attenuator (item 9) Optical Fiber Cable (item 14) 50 Ω Power Splitter (item 21) 50 Ω SMA Coaxial Cable (item 22) SMA Male to BNC Female Adapter (item 24) Delay Line (item 25) 50 Ω BNC Coaxial Cable (item 26)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately twenty minutes

1. Connect the VX4610, Optical Attenuator, Reference Receiver, Optical Power Meter, and Communications Signal Analyzer as shown in Figure I–4.

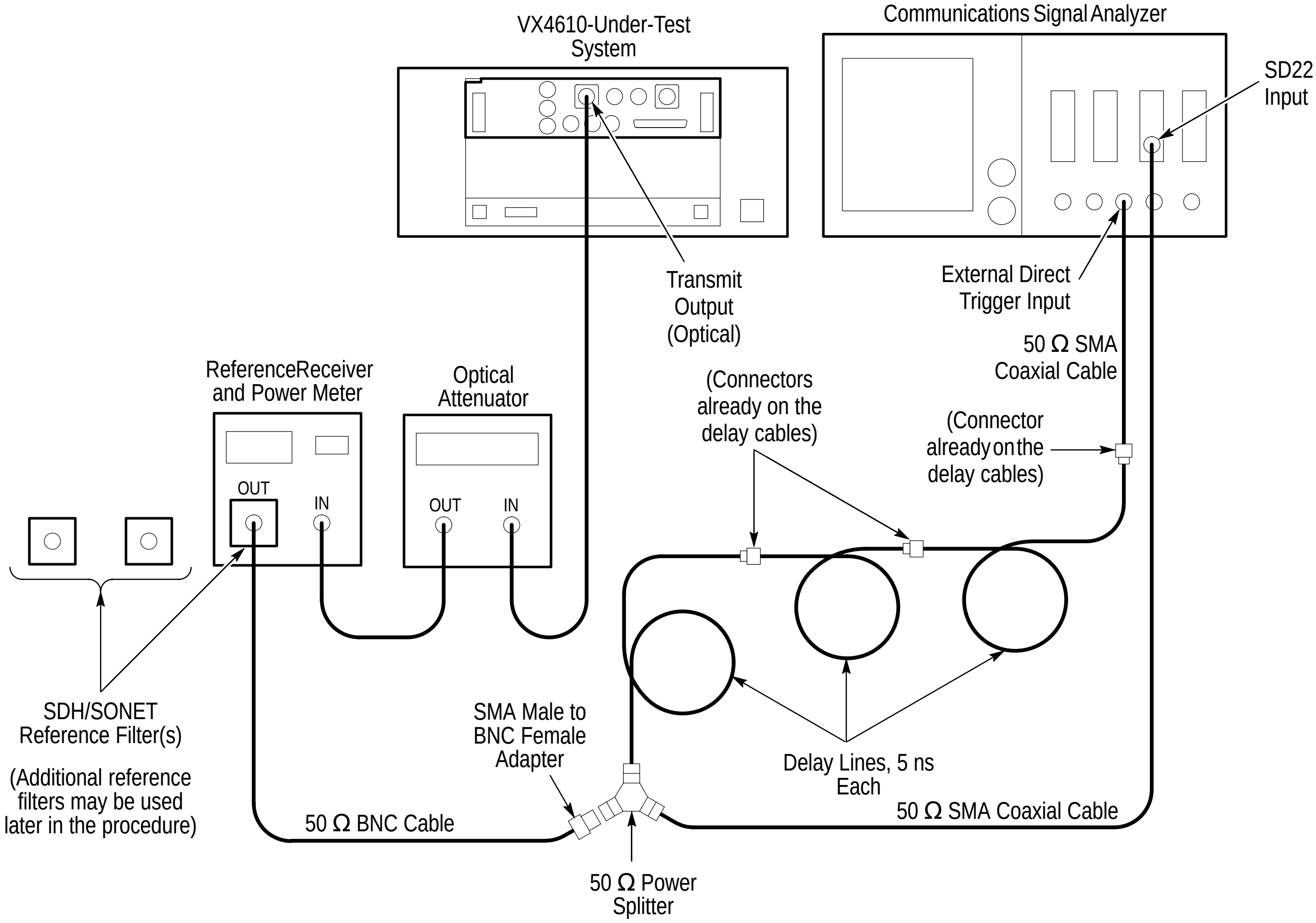


Figure I–4: Transmit optical output pulse shape setup

2. Perform the initial setup of the Communications Signal Analyzer with the following steps:

   a. To initialize the Communications Signal Analyzer, select the **UTILITY** menu, the **Initialize** pop-up menu, and then select the **Initialize** menu item in the pop-up menu**.**

   b. Press the **SELECT CHANNEL** button next to the input connector on the sampling head channel you are using.

   c. Select the **TRIGGER** menu, set the **Slope** to **+**, and then select **Exit**.

   d. Select the **DISPLAY MODES** menu.

e. Select the **Persist/Histograms** pop-up menu, select the **Color Grading** menu item, and then select **Exit**.

f. Select **Mask Testing** pop-up menu and then the **Set N Waveforms** menu item.

g. Select the **Waveform N** pop-up menu (red boxes located just to the left of the two front panel knobs) then enter the numeric value **100** followed by **Enter**.

h. If you are verifying SDH performance, skip to step 7. To verify the SONET OC-1 pulse shape, select the **Standard Masks** pop-up menu and then the **OC-1 51.84 Mb** menu item from the set of built-in ANSI SONET Optical Standards masks.

3. Install the FS52 Filter at the OUTPUT of the SDH/SONET Reference Receiver and Power Meter then connect the 50 Ω Coaxial Cable to the FS52 Filter.

4. To set up the VX4610, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest06.set**, and then click **OK.**

5. Verify that the measurement on the Optical Power Meter is in the range from –7 dBm to –12 dBm. Adjust the optical attenuator as required. Check that the selected wavelength on the Power Meter matches the wavelength of the O/E module.

6. Set up and perform the test with the following sequence on the Communications Signal Analyzer:

   a. Press the **AUTOSET** button on the front panel of the Communications Signal Analyzer.

   b. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.

   c. Select the **Stop N Waveforms** menu item.

   d. After 100 waveforms have been acquired the acquisition stops automatically. Verify that the test has passed, which is indicated by the green **Passing** message displayed in the **Mask Testing** pop-up menu selector.

7. To check the OC-3 or STM-1 optical signal shape, install the FS156 Filter at the OUTPUT of the SDH/SONET Reference Receiver and Power Meter (in place of the FS52 filter, if already installed) and then connect the 50 Ω Coaxial Cable to the FS156 Filter.

8. To set up the VX4610, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest07.set**, and then click **OK**.

9. Verify that the measurement on the Optical Power Meter is in the range from –7 dBm to –12 dBm. Adjust the optical attenuator as required. Check that the selected wavelength on the Power Meter matches the wavelength of the O/E module.

10. Set up and perform the test with the following sequence on the Communications Signal Analyzer:

    a. Select the **Standard Masks** pop-up menu and then the **OC-3/STM-1 155.52 Mb** menu item from the set of built-in ANSI SONET Optical Standards masks.

    b. Press the **AUTOSET** button on the front panel of the Communications Signal Analyzer.

    c. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.

    d. Select the **Stop N Waveforms** menu item.

    e. After 100 waveforms have been acquired the acquisition stops automatically. Verify that the test has passed, which is indicated by the green Passing message displayed in the Mask Testing pop-up menu selector.

11. If your VX4610 does not have OC-12 or STM-4 capability, proceed to *Electrical Input Sensitivity*, which begins on page I–43. To check the OC-12 or STM-4 optical signal shape, install the FS622 Filter in place of the FS156 filter previously installed, and then connect the 50 Ω Coaxial Cable to the FS622 Filter.

12. To set up the VX4610, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest08.set**, and then click **OK**.

13. Verify that the measurement on the Optical Power Meter is in the range from –7 dBm to –12 dBm. Adjust the optical attenuator as required. Check that the selected wavelength on the Power Meter matches the wavelength of the O/E module.

14. Setup and perform the test with the following sequence on the Communications Signal Analyzer:

    a. Select the **Standard Masks** pop-up menu and then the **OC-12/STM-4 622.08 Mb** menu item from the set of built-in ANSI SONET Optical Standards masks.

    b. Press the **AUTOSET** button on the front panel of the Communications Signal Analyzer.

    c. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.

d. Select the **Stop N Waveforms** menu item.

e. After 100 waveforms have been acquired the acquisition stops automatically. Verify that the test has passed, which is indicated by the green Passing message displayed in the Mask Testing pop-up menu selector.

Electrical Input Sensitivity

This test verifies the receiver electrical sensitivity by receiving an error-free signal at the lowest specified level.

Equipment required	225 ft (68.6 m) length of 75 Ω Reference Cable (item 15), two required BNC male to BNC male Adapter (item 27)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately fifteen minutes

1. Connect the VX4610 TRANSMIT output through the reference cables and adapter to the RECEIVE input as shown in Figure I–5.

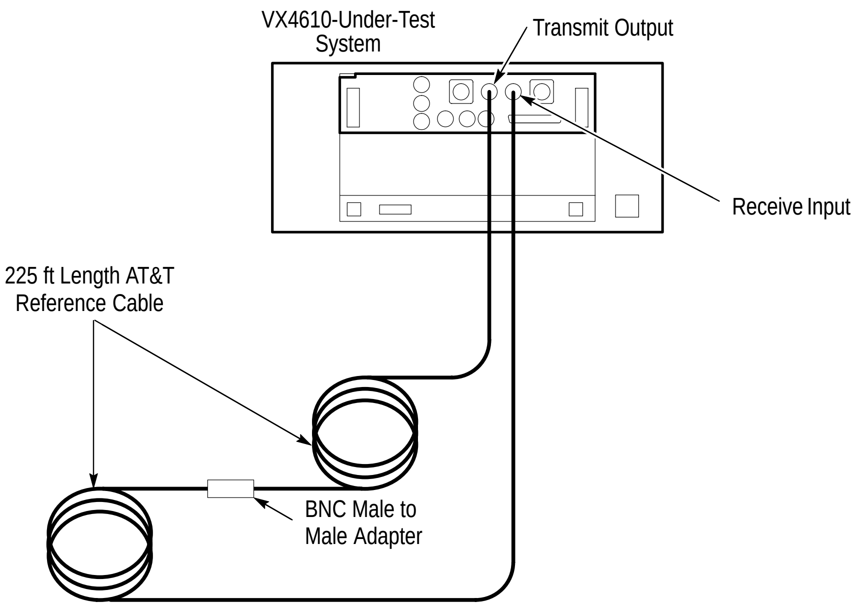


Figure I–5: Setup for electrical input sensitivity

2. If you are verifying SDH performance, skip to step 7. To verify the SONET STSX-1 sensitivity, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest09.set**, and then click **OK**.

3. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.
4. Click the **Start** button.
5. Click the **Error Analysis...** command button.
6. Wait two minutes for the test to complete. When the test is complete, verify that all Error Ratios shown in the Error Analysis window are either 0.00 or less than 10^{-10}.
7. To verify the STS-3 or STM-1 sensitivity, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest11.set**, and then click **OK**.
8. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.
9. Click the **Start** button.
10. Click the **Error Analysis...** command button.
11. Wait two minutes for the test to complete. When the test is complete, verify that all Error Ratios shown in the Error Analysis window are either 0.00 or less than 10^{-10}.

Optical Input Sensitivity

These tests verify the sensitivity of the optical receiver. These tests apply only if your VX4610 has one of the optional Electrical/Optical Plug-in Interface Modules installed. If your VX4610 does not have optical capability, proceed to *Internal Clock Accuracy*, which begins on page I–47.

Equipment required	Optical Attenuator (item 9) SONET Reference Receiver and Power Meter (item 10, 11, 12, or 13, depending on VX4610 configuration) Optical Fiber Cable (item 14), two required
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately thirty minutes

1. Connect the VX4610 TRANSMIT output through the Optical Attenuator to the SDH/SONET Reference Receiver and Power Meter as shown in Figure I–6.

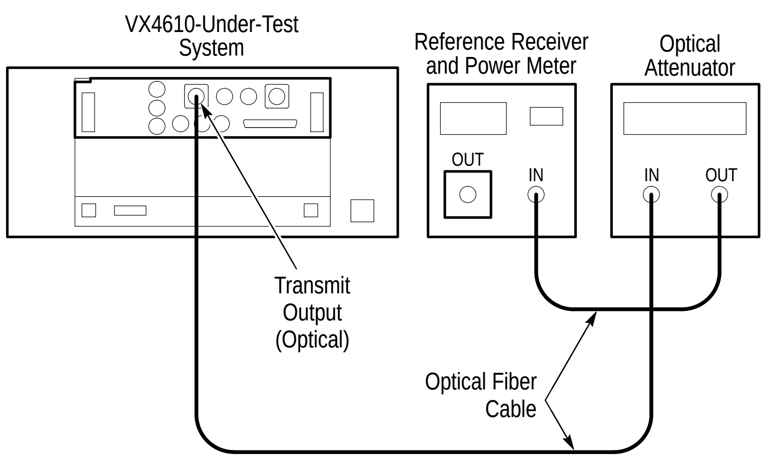


Figure I–6: Receive optical input sensitivity setup

2. Set the Optical Power Meter measurement units to **dBm**.
3. Set the Optical Attenuator wavelength to **1310 nm** or**1550 nm** to match the wavelength of the installed O/E module.
4. If you are verifying SDH performance, skip to step 13. To verify the SONET OC-1 sensitivity, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest12.set**, and then click **OK**.

5. Set the Optical Attenuator attenuation so that the Optical Power Meter reading is **–28 dBm**.

6. Remove the fiber connection from the Optical Power Meter and connect it to the RECEIVE input of the VX4610.

7. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.

8. Click the **Start** button.

9. Click the **Error Analysis...** command button.

10. Wait two minutes for the test to complete.

11. When the test is complete, verify that all measured Error Ratios are 0.00 or less than 10^{-10}.

12. Remove the fiber connection from the RECEIVE input of the VX4610 and connect it to the Optical Power Meter. Proceed to step 13.

13. To verify OC-3 or STM-1 sensitivity, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest13.set**, and then click **OK**.

14. Set the Optical Attenuator attenuation so that the Optical Power Meter reading is **–28 dBm**.

15. Remove the fiber connection from the Optical Power Meter and connect it to the RECEIVE input of the VX4610.

16. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.

17. Click the **Start** button.

18. Click the **Error Analysis...** command button.

19. Wait two minutes for the test to complete.

20. When the test is complete, verify that all measured Error Ratios are 0.00 or less than 10^{-10}.

21. Remove the fiber connection from the RECEIVE input of the VX4610 and connect it to the Optical Power Meter.

22. If your VX4610 does not have OC-12 or STM-4 capability, proceed to *Internal Clock Accuracy*, which begins on page I–47. To verify the OC-12 or STM-4 sensitivity, click the **RECALL** icon, select the file named **pltest14.set**, and then click **OK.**

23. Set the Optical Attenuator attenuation so that the Optical Power Meter reading is **–28 dBm**.

24. Remove the fiber connection from the Optical Power Meter and connect it to the RECEIVE input of the VX4610.

25. Click the **Start** button.

26. Click the **Error Analysis...** command button.

27. Wait two minutes for the test to complete.

28. When the test is complete, verify that all measured Error Ratios are 0.00 or less than 10^{-10}.

Internal Clock Accuracy

This test verifies the accuracy of the internal clock. All internally generated transmit clock rates are derived from exact harmonics (1x, 3x, or 12x) of an internal 51.84 MHz base clock frequency. Therefore, the accuracies of all transmit line rates are indirectly verified by this test.

Equipment required	Universal Counter/Timer (item 1) VX4610 Option 22 or 58 module (item 42) 75 Ω coaxial cable (item 19)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Turn power off to the VX4610-under-test and then install the Option 22 module. Connect the DS3 output to the Universal Counter/Timer input as shown in Figure I–7.

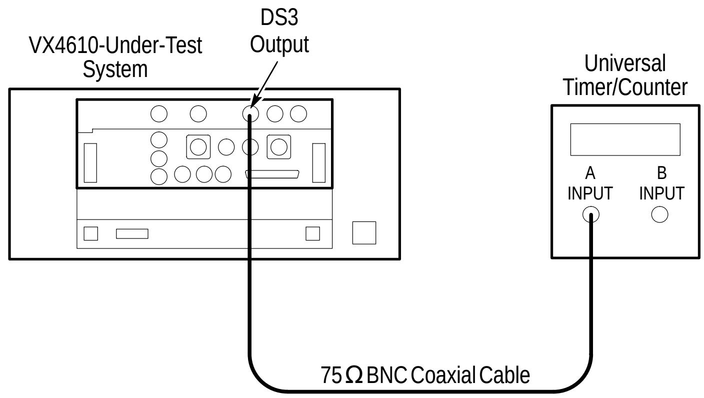


Figure I–7: Internal clock accuracy setup

2. Set up the VX4610 with the following sequence:

a. From the **Setup** pull down menu, select **Reset to Defaults**.

b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

d. Select **DS3** in the Tx Rate drop-down list.

e. Select **UnFramed** in the Framing drop-down list.

f. Select **All Ones** in the Test Pattern drop-down list.

3. Make the following settings on the Universal Counter/Timer:

a. Set input impedance to **50 Ω**.

b. Set input coupling to **AC**.

c. Set number of averages to **10^8**.

d. Set measurement mode to **Frequency**.

4. Verify that the Universal Counter/Timer reads between 22.368102 MHz and 22.367898 MHz (inclusive).

Transmit Line Frequency Offset

This test verifies the transmit line frequency offset. All internally generated transmit clock rates are derived from exact harmonics (1x, 3x, or 12x) of an internal 51.84 MHz base clock frequency. Therefore, the frequency offset of all transmit line rates are indirectly verified by this test.

Equipment required	Universal Counter/Timer (item 1) VX4610 Option 22 or 58 module (item 42) 75 Ω coaxial cable (item 19)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. With the Option 22 or 58 Module installed in the VX4610-under-test, connect the DS3 output to the Universal Counter/Timer input as shown in Figure I–8 (same as previous test).

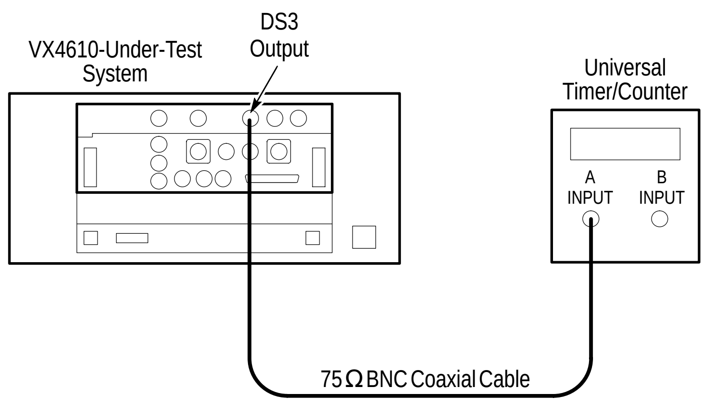


Figure I–8: Transmit line frequency offset setup

2. Set up the VX4610:

   a. From the **Setup** pull down menu, select **Reset to Defaults**.

   b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

   c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

   d. Select **DS3** in the Tx Rate drop-down list.

   e. Select **UnFramed** in the Framing drop-down list.

   f. Select **All Ones** in the Test Pattern drop-down list.

3. Set to test positive transmit line frequency offset:

   a. Select **Err/Alm/Ptr** in the GENERATOR group.

   b. Enter 100 in the field **Offset (ppm)** and click **Set Offset**.

   c. Click **Close**.

4. Make the following settings on the Universal Counter/Timer:

   a. Set input impedance to **50 Ω**.

   b. Set input coupling to **AC**.

   c. Set number of averages to $\mathbf{10^8}$.

   d. Set measurement mode to **Frequency**.

5. Verify that the Universal Counter/Timer reads between 22.370340 MHz and 22.370134 MHz (inclusive).

6. To test negative transmit line frequency offset, select **Err/Alm/Ptr** and enter –100 ppm in the field **Offset (ppm)**. Click **Set Offset** and **Close**.

7. Verify that the Universal Counter/Timer reads between 22.365866 MHz and 22.365660 MHz (inclusive).

Recovered Clock Frequency-Lock Range

This test verifies the clock recovery range when the transmit clock is derived from the received signal. The test verifies that the recovered clock frequency tracks variations in the received line frequency when the line frequency is varied through the specification range. To verify that the clock is recovered from the received signal, an internal phase-locked loop is polled to determine a locked or unlocked status.

Equipment required	Frequency Synthesizer (item 2) SDH/SONET Analyzer (item 6) 75 Ω Coaxial Cable (item 19) SMA Male to BNC Female Adapter (item 24) 50 Ω BNC Coaxial Cable (item 26) Type N Male to BNC Female Adapter (item 28)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately twenty minutes

1. Connect the Frequency Synthesizer, SDH/SONET Generator/Receiver, and VX4610-under-test as shown in Figure I–9.

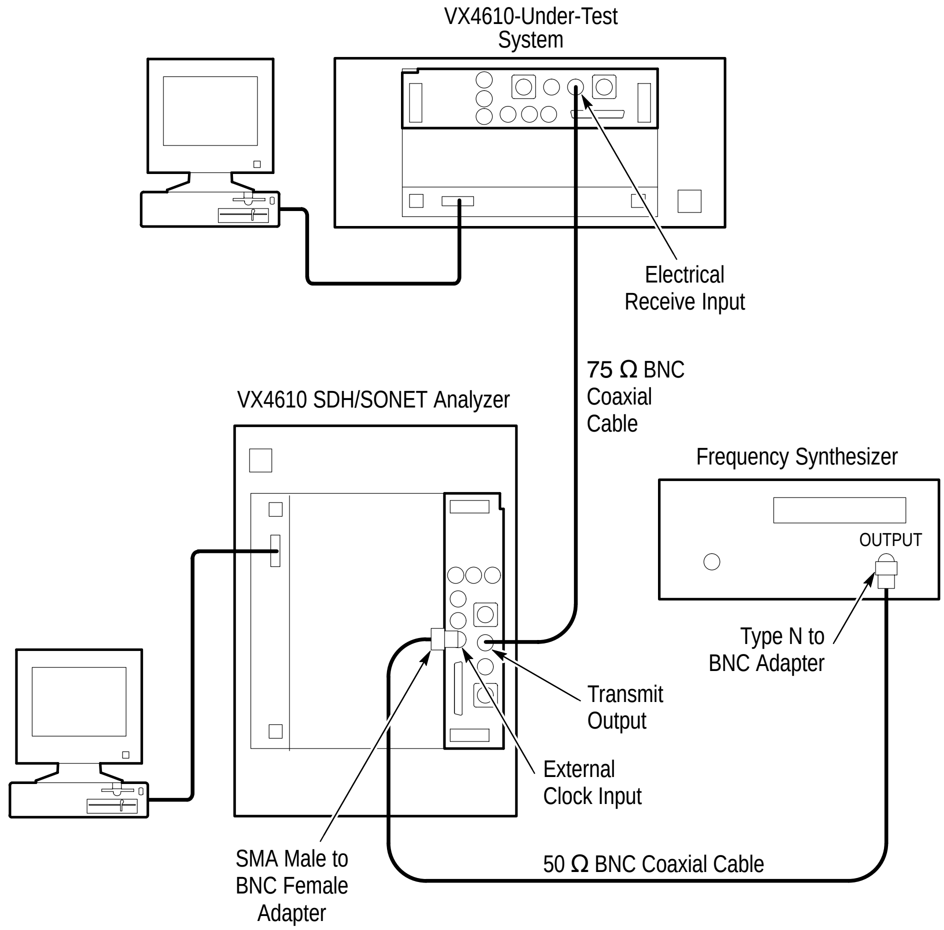


Figure I–9: Recovered clock frequency lock setup

2. If you are verifying SDH clock recovery, skip to step 14. To verify clock recovery from a SONET STS-1 signal, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest15.set**, and then click **OK**.

3. Make the following settings on the Frequency Synthesizer:

   a. Set output frequency to **51,840,000 Hz**.

   b. Set output power to **+4 dBm** (≈1 $V_{p\text{-}p}$ into 50 Ω).

   c. Set the RF output to **On**.

***NOTE**. Before setting the Transmit Clock source to External, you must apply a valid external clock signal to the VX4610 SDH/SONET Analyzer.*

4. Make the following settings on the VX4610 SDH/SONET Analyzer.

a. Set Transmit Rate to **STS-1**.

b. Verify that the Frequency Synthesizer settings are correct, and then set the VX4610 SDH/SONET Analyzer Transmit Clock to **External**.

c. Set Transmit Line Frequency Offset to **0 ppm**.

d. Turn off all generated errors, alarms, and failures.

5. Perform the following steps to verify the VX4610-under-test is recovering the clock from the received signal:

a. In the menu bar, select **Tools** → **Command Builder...**.

b. Select **Command Group** → **:SOURce:** → **:CLOCk:** → **:STATus?**

c. Click the **Send** command button.

d. Verify that a 1 is returned in the Response text box indicating that the phase-locked loop is recovering the received clock. If a 0 response is returned, the clock is not being recovered and the test has failed.

e. Verify that the ALARM and ERROR status lights on the front panel of the VX4610-under-test are off.

6. Set the VX4610 SDH/SONET Analyzer Transmit Clock to **Internal**.

7. Set the Frequency Synthesizer to **51,846,500 Hz**.

8. Verify that the Frequency Synthesizer settings are correct, and then set the VX4610 SDH/SONET Analyzer Transmit Clock to **External**.

9. Perform the following steps to verify the VX4610-under-test is recovering the clock from the received signal:

a. Click the **Send** command button.

b. Verify that a 1 is returned in the Response text box indicating that the phase-locked loop is recovering the received clock. If a 0 response is returned, the clock is not being recovered and the test has failed.

c. Verify that the ALARM and ERROR status lights on the front panel of the VX4610-under-test are off.

10. Set the VX4610 SDH/SONET Analyzer Transmit Clock to **Internal**.

11. Set the Frequency Synthesizer to **51,833,500 Hz**.

12. Verify that the Frequency Synthesizer settings are correct, and then set the VX4610 SDH/SONET Analyzer Transmit Clock to **External**.

13. Perform the following steps to verify the VX4610-under-test is recovering the clock from the received signal:

    a. Click the **Send** command button.

    b. Verify that a 1 is returned in the Response text box indicating that the phase-locked loop is recovering the received clock. If a 0 response is returned, the clock is not being recovered and the test has failed.

    c. Verify that the ALARM and ERROR status lights on the front panel of the VX4610-under-test are off.

14. To verify clock recovery from an STS-3 or STM-1E signal, set the VX4610 SDH/SONET Analyzer Transmit Clock to **Internal**.

15. Make the following settings on the Frequency Synthesizer:

    a. Set output frequency to **311,040,000 Hz**.

    b. Set output power to **+4 dBm** (≈1 V_{p-p} into 50 Ω).

    c. Set the RF output to **On**.

NOTE. *Before setting the Transmit Clock source to External, you must apply a valid external clock signal to the VX4610 SDH/SONET Analyzer.*

16. Make the following settings on the VX4610 SDH/SONET Analyzer.

    a. Set Transmit Rate to **STS-3** or **STM-1**.

    b. Set Transmit Clock to **External**.

    c. Turn off all generated errors, alarms, and failures.

17. To set up the VX4610-under-test, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest16.set**, and then click **OK.**

18. Verify that the ALARM and ERROR status lights on the front panel of the VX4610-under-test are off.

19. Set the VX4610 SDH/SONET Analyzer Transmit Clock to **Internal**.

20. Set the Frequency Synthesizer to **311,078,900 Hz**.

21. Verify that the Frequency Synthesizer settings are correct, and then set the VX4610 SDH/SONET Analyzer Transmit Clock to **External**.

22. Verify that the ALARM and ERROR status lights on the front panel of the VX4610-under-test are off.

23. Set the VX4610 SDH/SONET Analyzer Transmit Clock to **Internal**.

24. Set the Frequency Synthesizer to **311,001,100 Hz**.

25. Verify that the Frequency Synthesizer settings are correct, and then set the VX4610 SDH/SONET Analyzer Transmit Clock to **External**.

26. Verify that the ALARM and ERROR status lights on the front panel of the VX4610-under-test are off.

27. Set the VX4610 SDH/SONET Analyzer Transmit Clock to **Internal**.

Frequency Lock to BITS Reference (SONET only)

This test only applies if you are verifying SONET performance. If you are verifying only SDH performance, proceed to the next test, *Frequency Lock to 2 Mb/s Reference*, on page I–57.

This test verifies that the transmit clock in the VX4610 is able to lock to the 1.544 Mb/s BITS Reference Input. To verify this ability, an internal phase-locked loop is polled to determine its locked or unlocked status.

Equipment required	BITS Reference Signal Source (item 7) Miniature Phone Plug to WECo 310 Plug Adapter Cable (item 29)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the BITS Reference signal to VX4610-under-test as shown in Figure I–10. (As an alternative to the BITS Reference source, any valid DS1 signal source can provide the reference signal required to perform this test.)

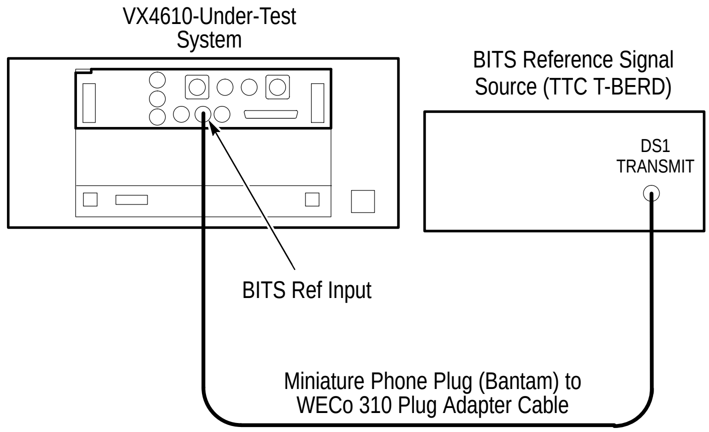


Figure I–10: BITS reference frequency-lock setup

2. To set up the VX4610, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest17.set**, and then click **OK.**
3. Set the BITS Reference source to generate a BITS clock or a valid DS1 signal.
4. Perform the following steps to verify the VX4610-under-test is generating the clock from the BITS Reference Input:
   a. In the menu bar, select **Tools** → **Command Builder...**.
   b. Select **Command Group** → **:SOURce:** → **:CLOCk:** → **:STATus?**.
   c. Click the **Send** command button.
   d. Verify that a 1 is returned in the Response text box indicating that the phase-locked loop is locked to the BITS Reference. If a 0 response is returned, the test has failed.

Frequency Lock to 2 Mb/s Reference (SDH only)

This test only applies if you are verifying SDH performance. If you are verifying only SONET performance, proceed to the next test, *External Clock Frequency Lock Range*, which begins on page I–58.

This test verifies that the transmit clock in the VX4610 is able to lock to the 2 Mb/s (2.048 Mb/s) Reference Input. To verify this ability, an internal phase-locked loop is polled to determine its locked or unlocked status.

Equipment required	2 Mb/s Reference Signal Source (item 8) 75 Ω BNC Coaxial Cable (item 19) Type N Male to BNC Female Adapter (item 28)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the 2 Mb/s Reference signal to the VX4610-under-test as shown in Figure I–11. (As an alternative to the 2 Mb/s Reference source, any valid 2 Mb/s signal can provide the reference signal required to perform this test.)

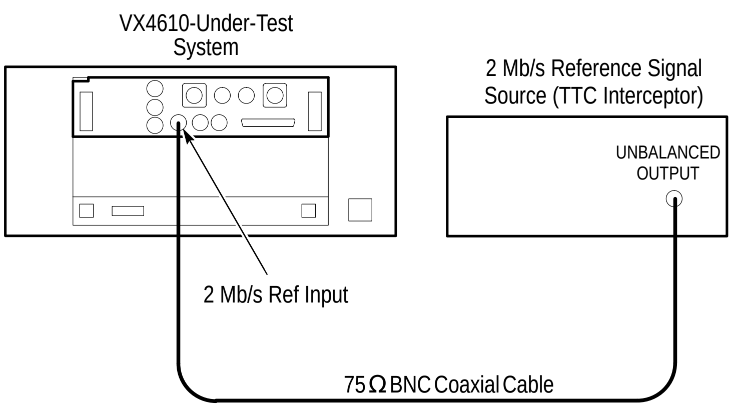


Figure I–11: 2 Mb/s reference frequency-lock setup

2. To set up the VX4610, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest18.set**, and then click **OK.**

3. Set the 2 Mb/s Reference source to generate a 2 Mb/s clock or a valid 2 Mb/s signal.

4. Perform the following steps to verify the VX4610-under-test is generating the clock from the 2 Mb/s Reference Input:

a. In the menu bar, select **Tools** → **Command Builder...**.

b. Select **Command Group** → **:SOURce:** → **:CLOCk:** → **:STATus?**.

c. Click the **Send** command button.

d. Verify that a 1 is returned in the Response text box indicating that the phase-locked loop is locked to the 2 MB/s Reference. If a 0 response is returned, the test has failed.

External Clock Frequency-Lock Range

This test verifies that the EXT CLOCK input operates over its specified frequency range.

Equipment required	Frequency Synthesizer (item 2) 75 Ω Coaxial Cable (item 19) 50 Ω BNC Coaxial Cable (item 26) SMA Male to BNC Female Adapter (item 24) Type N Male to BNC Female Adapter (item 28) Optical Loop-back Cable (item 14) if Electrical/Optical Plug-in Interface Module is installed Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately fifteen minutes

1. Connect the Frequency Synthesizer and VX4610-under-test as shown in Figure I–12. Connect an optical loop-back cable if your VX4610 has optical capability. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.

CAUTION. *To avoid damaging the receiver inputs when using the Option 05 or Option 10 optical module, use an optical attenuator set to 10 dB.*

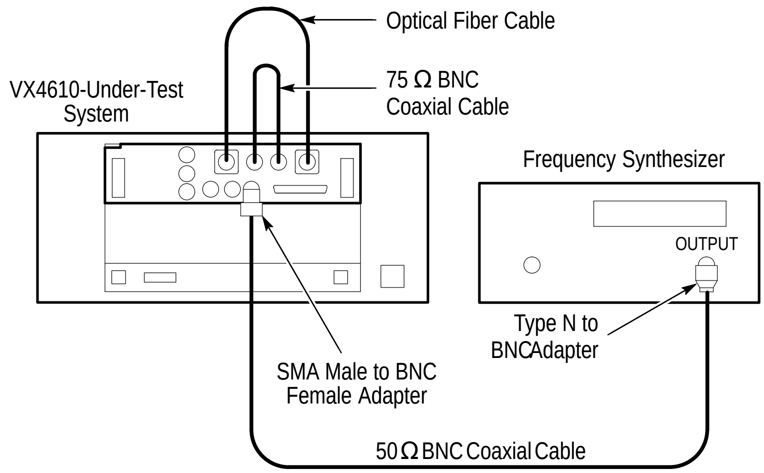


Figure I–12: External clock setup

2. Make the following settings on the Frequency Synthesizer:

   a. Set output frequency to **311,040,000 Hz**.

   b. Set output power to **+4 dBm** (≈1 V_{p-p} into 50 Ω).

   c. Set the RF output to **On**.

3. To set up the VX4610, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest19.set**, and then click **OK**.

4. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.

5. Click the **Start** button and wait two seconds for the test to complete.

6. Click the **Main Results...** command button and verify that no errors are reported in the Main Results window.

7. Set the clock source to Internal with the following steps:

   a. In the menu bar, select **Tools** → **Command Builder...**.

   b. Select **Command Group** → **:SOURce:** → **:CLOCk:** → **:SOURce**.

   c. Select the parameter **INTernal**.

   d. Click the **Send** command button.

8. Change the Frequency Synthesizer output frequency to **311,351,050 Hz**.

***NOTE**. Before setting the VX4610 Transmit Clock source to External, you must apply a valid external clock signal.*

9. Verify that the Frequency Synthesizer settings are correct and then set the clock source to External with the following steps:

a. Select **Command Group** → **:SOURce:** → **:CLOCk:** → **:SOURce**.

b. Select the parameter **EXTernal**.

c. Click the **Send** command button.

10. Click the **Start** button and wait two seconds for the test to complete.

11. Click the **Main Results...** window and verify that no errors are reported in the Main Results window.

12. Set the clock source to Internal with the following steps:

a. In the menu bar, select **Tools** → **Command Builder...**.

b. Select **Command Group** → **:SOURce:** → **:CLOCk:** → **:SOURce**.

c. Select the parameter **INTernal**.

d. Click the **Send** command button.

13. Change the Frequency Synthesizer output frequency to **310,728,950 Hz**.

14. Verify that the Frequency Synthesizer settings are correct and then set the clock source to External with the following steps:

a. Select **Command Group** → **:SOURce:** → **:CLOCk:** → **:SOURce**.

b. Select the parameter **EXTernal**.

c. Click the **Send** command button.

15. Click the **Start** button and wait two seconds for the test to complete.

16. Click the **Main Results...** window and verify that no errors are reported in the Main Results window.

17. Set the clock source to Internal with the following steps:

a. In the menu bar, select **Tools** → **Command Builder...**.

b. Select **Command Group** → **:SOURce:** → **:CLOCk:** → **:SOURce**.

c. Select the parameter **INTernal**.

d. Click the **Send** command button.

18. The next steps apply only if your VX4610 has one of the optional Electrical/ Optical Plug-in Interface Modules installed. If your VX4610 does not have optical capability, proceed to the next test, *Trigger Output*, which begins on page I–62.
19. Change the Frequency Synthesizer output frequency to **622,080,000 Hz**.
20. To set up the VX4610, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest20.set**, and then click **OK**.
21. Click the **Start** button and wait two seconds for the test to complete.
22. Click the **Main Results...** window and verify that no errors are reported in the Main Results window.
23. Set the clock source to Internal with the following steps:
    - **a.** In the menu bar, select **Tools** → **Command Builder...**.
    - **b.** Select **Command Group** → **:SOURce:** → **:CLOCk:** → **:SOURce**.
    - **c.** Select the parameter **INTernal**.
    - **d.** Click the **Send** command button.
24. Change the Frequency Synthesizer output frequency to **622,702,100 Hz**.
25. Verify that the Frequency Synthesizer settings are correct and then set the clock source to External with the following steps:
    - **a.** Select **Command Group** → **:SOURce:** → **:CLOCk:** → **:SOURce**.
    - **b.** Select the parameter **EXTernal**.
    - **c.** Click the **Send** command button.
26. Click the **Start** button and wait two seconds for the test to complete.
27. Click the **Main Results...** window and verify that no errors are reported in the Main Results window.
28. Set the clock source to Internal with the following steps:
    - **a.** In the menu bar, select **Tools** → **Command Builder...**.
    - **b.** Select **Command Group** → **:SOURce:** → **:CLOCk:** → **:SOURce**.
    - **c.** Select the parameter **INTernal**.
    - **d.** Click the **Send** command button.
29. Change the Frequency Synthesizer output frequency to **621,457,900 Hz**.

30. Verify that the Frequency Synthesizer settings are correct and then set the clock source to External with the following steps:

    a. Select **Command Group** → **:SOURce:** → **:CLOCk:** → **:SOURce**.

    b. Select the parameter **EXTernal**.

    c. Click the **Send** command button.

31. Click the **Start** button and wait two seconds for the test to complete.

32. Click the **Main Results...** window and verify that no errors are reported in the Main Results window.

33. Set the clock source to Internal with the following steps:

    a. In the menu bar, select **Tools** → **Command Builder...**.

    b. Select **Command Group** → **:SOURce:** → **:CLOCk:** → **:SOURce**.

    c. Select the parameter **INTernal**.

    d. Click the **Send** command button.

Trigger Output

This test verifies that the driver circuitry for the Tx SECTION and Rx SECTION Trigger Outputs produces output pulses. Only one trigger event selection, Start of Frame, needs to be tested to verify complete trigger output operation.

Equipment required	Oscilloscope (item 4) 75 Ω Coaxial Cable (item 19) SMA Male to BNC Female Adapter (item 24) 50 Ω Coaxial Cable (item 26)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 to the oscilloscope input as shown in Figure I–13.

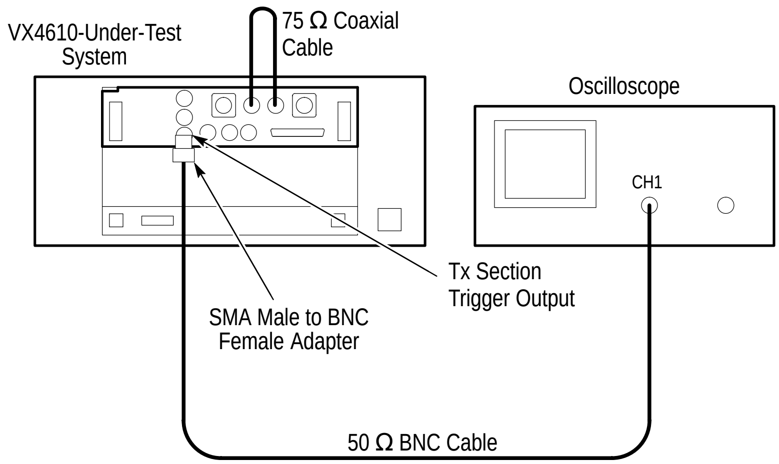


Figure I–13: Trigger output setup

2. To set up the VX4610, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest21.set**, and then click **OK**.

3. Make the following settings on the oscilloscope:

   a. Set the input impedance to **1 MΩ**.

   b. Set the vertical sensitivity to **1 V/div**.

   c. Set the horizontal sweep speed to **50 ns/div**.

   d. Center the waveform on the oscilloscope display and adjust the triggering and holdoff to obtain a stable waveform.

4. Verify that an active-high trigger pulse is displayed on the oscilloscope. The pulse should have typical TTL levels and be approximately 50 ns wide.

5. Move the connection from the Tx SECTION trigger output to the Rx SECTION trigger output.

6. Verify that an active-high trigger pulse is displayed on the oscilloscope. The pulse should have typical TTL levels and be approximately 50 ns wide.

Trigger Input

This test uses the Tx SECTION trigger output signal to verify operation of the external TRIGGER IN. The Transmit section is programmed to generate a trigger pulse when given a command to generate a SCV B1 error. The Receiver is armed to capture data and the VX4610 is polled to verify that the system is armed. Then the command to generate the error is given and the VX4610 is polled to verify that that the capture has occurred, which indirectly verifies that the external trigger input functions properly.

Equipment required	75 Ω Coaxial Cable (item 19) 50 Ω SMA Coaxial Cable (item 22)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately five minutes

1. Make connections to the VX4610 as shown in Figure I–14.

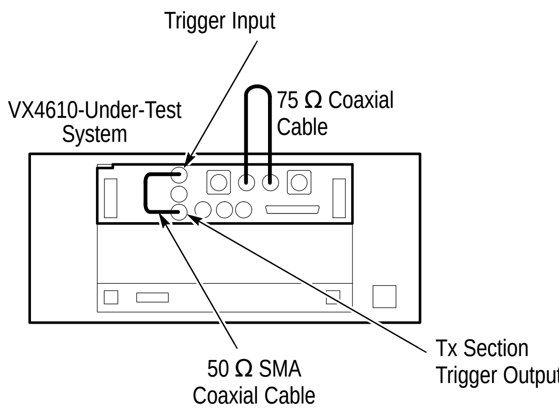


Figure I–14: Trigger input setup

2. To set up the VX4610, click the **RECALL** icon, click the **From Disk** command button, select the file named **pltest22.set**, and then click

3. Perform the following steps to verify that VX4610-under-test is armed to accept the trigger input:

   a. In the menu bar, select **Tools** → **Command Builder...**.

   b. Select **Command Group** → **:TRIGger:** → **:STATus?**

   c. Click the **Send** command button.

d. Verify that Run is returned in the Response text box indicating that the VX4610 is armed and waiting for a trigger.

4. To send the command to generate one RS/Section B1 error and produce one Tx SECTION trigger output pulse, perform the following steps:

a. In the Command Builder, select **Command Group** → **:SOURce:** → **:DATA :TELecom:** → **:ERRor:**.

b. In the Command List text box, select **:IMMediate**.

c. Click the **Send** command button.

5. Perform the following steps to verify that VX4610-under-test has accepted the trigger input:

a. In the Command Builder, select **Command Group** → **:TRIGger:** → **:STATus?**

b. Click the **Send** command button.

c. Verify that Stop is returned in the Response text box indicating that the VX4610 has accepted the trigger input.

***NOTE**. If you have performed all previous functional and physical-layer tests that are applicable to your VX4610, you have now completed the performance verification.*

DS1 Transmit Signal Level (Options 22 and 58 only)

This test verifies the signal level from the VX4610 DS1 output. If you are checking a VX4610 with Option 36, proceed to *2 Mb/s Balanced Transmit Pulse Mask,* beginning on page I–83. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	Communications signal analyzer (item 5) 50 Ω SMA coaxial cable (item 22) SMA male-to-BNC female adapter (item 24) 100 Ω Bantam-to-Bantam cable (item 30) 2X Attenuator (item 39), two required Tributary Signal Converter/Attenuator (item 33)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the communications signal analyzer and VX4610 as shown in Figure I–15.

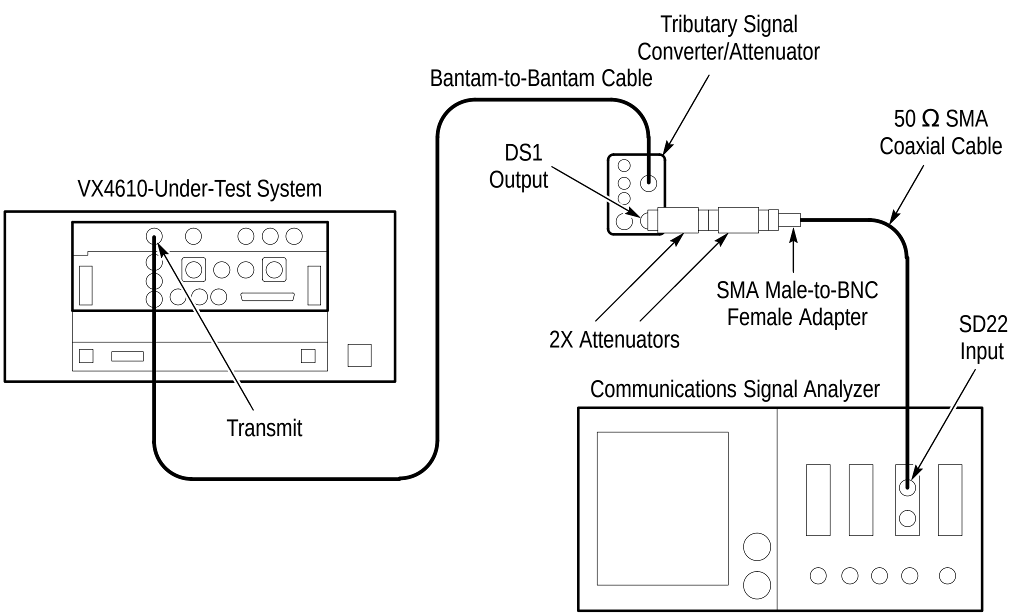


Figure I–15: DS1 signal level setup (Option 22 shown)

2. Set up the VX4610 with the following sequence:

   a. From the **Setup** pull down menu, select **Reset to Defaults**.

   b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

   c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

   d. Select **DS1** in the Tx Rate drop-down list.

   e. Select **AMI** in the Line Code drop-down list. Click **Close**.

   f. Select **UnFramed** in the Framing drop-down list.

   g. Select **1 in 8** in the Test Pattern drop-down list.

3. Perform the initial setup of the communications signal analyzer with the following steps:

   a. To initialize the communications signal analyzer, select the **UTILITY** menu, the **Initialize** pop-up menu, and then select **Initialize** in the pop-up menu.

   b. Press the **SELECT CHANNEL** button next to the input connector on the sampling head channel you are using.

   c. Select the **Sampling Head Fnc's** pop-up menu.

   d. Set the **Ex Channel Attenuation** to 4 $\times$ the calibration factor of the Tributary Signal Converter/Attenuator ($\approx$ 1.6), which is 6.4.

   e. Select the **TRIGGER** menu. Set the **Source** to **Internal Clock**.

4. Perform the test using the following sequence on the communications signal analyzer:

   a. Press the **AUTOSET** button. The waveform appears untriggered on the communications signal analyzer.

   b. Select the **MEASURE** menu and then the **Measurements** pop-up menu.

   c. Select the **Peak-peak** measurement then select **Exit**.

   d. Select the **Peak-peak** measurement selector to display the Peak-peak pop-up menu.

   e. Verify that the **mean value** measurement in the Peak-peak pop-up menu is 6 V $\pm$ 1 V.

DS1 Transmit Pulse Shape (Options 22 and 58 only)

This test verifies the pulse shape from the VX4610 DS1 output. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	Communications signal analyzer (item 5) 50 Ω power splitter (item 21) 50 Ω SMA coaxial cable (item 22), two required SMA male-to-BNC female adapter (item 24) 100 Ω Bantam-to-Bantam cable (item 30) 75 Ω Coaxial Cable (item 19) 2X Attenuator (item 39), two required Tributary Signal Converter/Attenuator (item 33)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately fifteen minutes

1. Connect the communications signal analyzer and VX4610 as shown in Figure I–16.

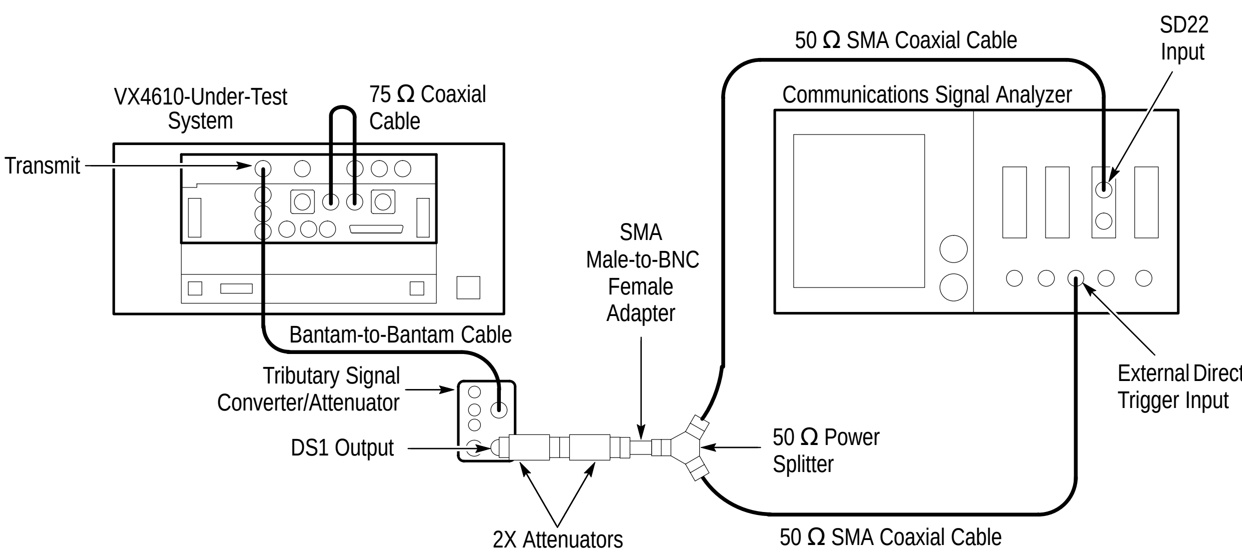


Figure I–16: DS1 pulse shape setup (Option 22 shown)

2. Set up the VX4610 with the following sequence:

   a. From the **Setup** pull down menu, select **Reset to Defaults**.

   b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

   c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

   d. Select **DS1** in the Tx Rate drop-down list.

   e. Select **1 in 8** in the Test Pattern drop-down list.

   f. Select **UnFramed** in the Framing drop-down list.

   g. Select **AMI** in the Line Code drop-down list.

3. Perform the initial setup of the communications signal analyzer with the following steps:

   a. To initialize the communications signal analyzer, select the **UTILITY** menu, the **Initialize** pop-up menu, and then select the **Initialize** menu item in the pop-up menu.

   b. Press the **SELECT CHANNEL** button next to the input connector on the sampling head channel you are using. Press the **AUTOSET** button.

   c. Select the **TRIGGER** menu, set the **Slope** to **+**, and adjust for a stable trigger, if necessary.

   d. Select the **WAVEFORM** menu, select the **Acquire Desc** pop-up menu, and set Average N to **On**.

   e. Select **Set Avg N**, and set **Average N** to **64**. Select **Enter**.

   f. Select the **Sampling Head Fnc's** pop-up menu and set **Smoothing** to **On**.

   g. Select the **DISPLAY MODES** menu.

   h. Select **Mask Testing** pop-up menu and then the **Set N Waveforms** menu item.

   i. Select the **Waveform N** pop-up menu (red boxes located just to the left of the two front panel knobs) then enter the numeric value **100** followed by **Enter**.

   j. Select the **Standard Masks** pop-up menu and then the **DS1 1.544Mb** menu item from the set of built-in ANSI T1.102 Electrical Standards masks.

4. Perform the test with the following sequence on the communications signal analyzer:

   a. Select the **DISPLAY MODES** menu.

   b. Adjust **Vertical Offset** and **Main Position** to locate a positive-going pulse at the center of the mask.

   c. Change the **Vertical Offset**, **Vertical Size**, and **Main Position** controls to **Fine** resolution. To set control resolution, select the appropriate knob label.

   d. Adjust the fine **Vertical Offset**, **Vertical Size**, and **Main Position** controls to best position the pulse within the mask. The signal should not touch the red mask.

   e. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.

   f. Select the **Stop N Waveforms** menu item.

   g. After 100 waveforms have been acquired, the acquisition stops automatically. The test has passed if no more than 200 hits are recorded for 100 waveforms, or the green Passing message is displayed in the Mask Testing pop-up menu.

DS1 Bridged Receive Level (Options 22 and 58 only)

This test verifies the DS1 bridged receive level for the VX4610 DS1 input. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	100 Ω Bantam-to-Bantam Cable (item 30), two required Tributary Signal Converter/Attenuator (item 33), two required 50 Ω terminator (item 40) BNC male to BNC male adapter (item 27)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–17.

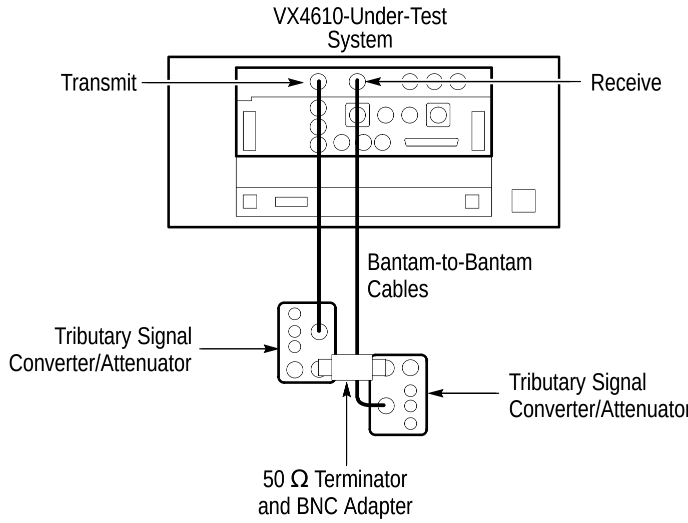


Figure I–17: DS1 data formats setup (Option 22 shown)

2. Set up the VX4610 with the following sequence:

   a. From the **Setup** pull down menu, select **Reset to Defaults**.

   b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

   c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

   d. Select **DS1** in the Tx Rate drop-down list.

   e. Select **B8ZS** in the Line Code drop-down list and then select **PRBS2^23–1** in the Test Pattern drop-down list.

   f. In the menu bar, select **Tools** → **Command Builder...**.

   g. Select **Command Group** → **:INPUT2:TELecom** →**LEVel** →**BRIDge**.

   h. Click the **Send** command button then close the Command Builder dialog box.

3. Click the **START** button.

4. Click the **Main Results...** command button.

5. Click the **Errors** command button, and then click the **Update** button.

6. Verify that there are no errors.

7. Click the **Alarms** command button, and then click the **Update** button.

8. Verify that there are no alarms.

9. Click the **Failures** command button, and then click the **Update** button.

10. Verify that there are no failures.

DS1 Monitor Receive Level (Options 22 and 58 only)

This test verifies the monitor receive level for the VX4610 Option 22 or 58 RECEIVE/ADD input. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	Tributary Signal Converter/Attenuator (item 33), two required 10X Attenuator (item 38) BNC male to BNC male adapter (item 27) 100 Ω Bantam-to-Bantam Cable (item 31), two required
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–18.

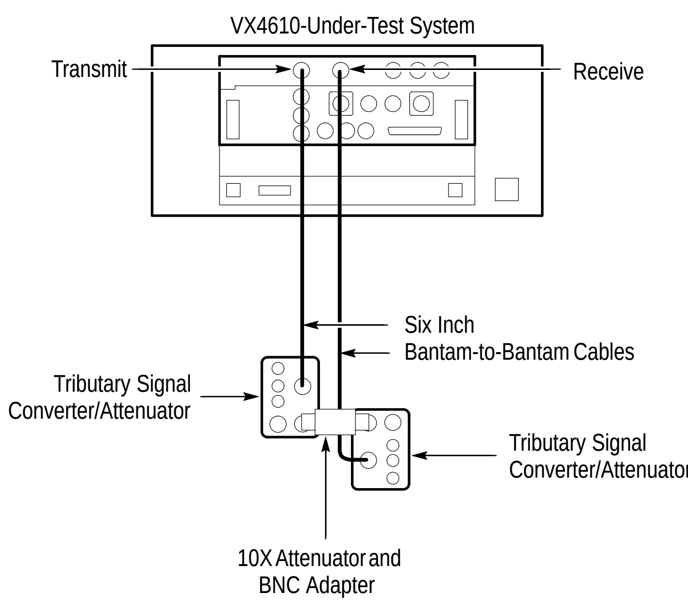


Figure I–18: DS1 monitor receive level setup (Option 22 shown)

2. Set up the VX4610 with the following sequence:

   a. From the **Setup** pull down menu, select **Reset to Defaults**.

   b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

   c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

   d. Select **DS1** in the Tx Rate drop-down list.

   e. Select **PRBS2^23-1** in the Test Pattern drop-down list.

   f. Select **B8ZS** in the Line Coding drop-down list.

   g. Select **Monitor** in the Receive Rx Level drop-down list.

3. Click the **START** button.

4. Click the **Main Results...** command button.

5. Click the **Errors** command button, and then click the **Update** button.

6. Verify that there are no errors.

7. Click the **Alarms** command button, and then click the **Update** button.

8. Verify that there are no alarms.

9. Click the **Failures** command button, and then click the **Update** button.

10. Verify that there are no failures. Click **Close**.

External Clock Input (Options 22 and 58 only)

This test verifies the EXT CLOCK for the VX4610. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	75 Ω BNC coaxial cable (item 19) Frequency Synthesizer (item 2) 100 Ω Bantam-to-Bantam Cable (item 30), two required
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–19.

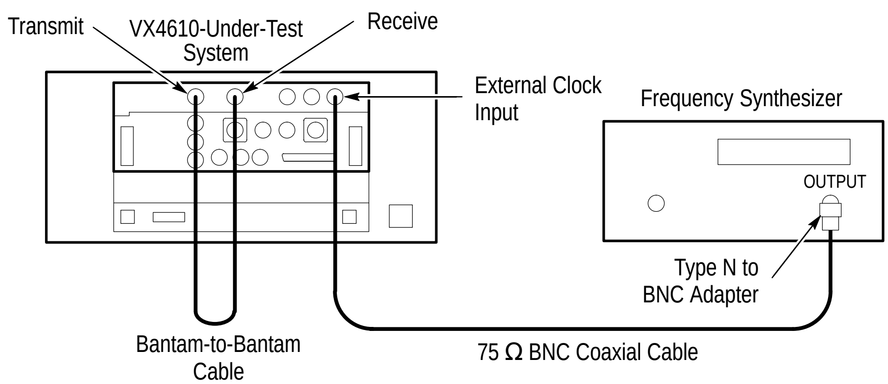


Figure I–19: DS1 external clock setup (Option 22 shown)

2. Set up the VX4610 with the following sequence:

a. From the **Setup** pull down menu, select **Reset to Defaults**.

b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

d. Select **DS1** in the Tx Rate drop-down list.

e. Select **PRBS2^23-1** in the Test Pattern drop-down list.

f. Select **B8ZS** in the Line Coding drop-down list.

   g. Click the **More...** command button.

   h. Select **External DSn** in the Tx Clock drop-down list.

3. Make the following settings on the Frequency Synthesizer:

   a. Set the output frequency to **1.544231 MHz**

   b. Set the output power to **+4 dBm** ($\approx$1 V_{p-p} into 50 Ω).

   c. Set the RF output to **ON**.

4. Click the **START** button.
5. Click the **STOP** button.
6. Click the **Main Results...** command button.
7. Click the **Errors** command button, and then click the **Update** button.
8. Verify that there are no errors.
9. Click the **Alarms** command button, and then click the **Update** button.
10. Verify that there are no alarms.
11. Set the Frequency Synthesizer to **1.543769 MHz**.
12. Click the **START** button.
13. Click the **STOP** button.
14. Click the **Main Results...** command button.
15. Click the **Errors** command button, and then click the **Update** button.
16. Verify that there are no errors.
17. Click the **Alarms** command button, and then click the **Update** button.
18. Verify that there are no alarms. Click **Close**.

***NOTE**. If you have performed all previous functional and physical-layer tests that are applicable to your VX4610, you have now completed the performance verification.*

DS3 Transmit Signal Level (Options 22 and 58 only)

This test verifies the signal level from the VX4610 DS3 output. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	Communications signal analyzer (item 5) 75 Ω to 50 Ω impedance converter (item 18) 50 Ω SMA coaxial cable (item 22) SMA male-to-BNC female adapter (item 24)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the communications signal analyzer and VX4610 as shown in Figure I–20.

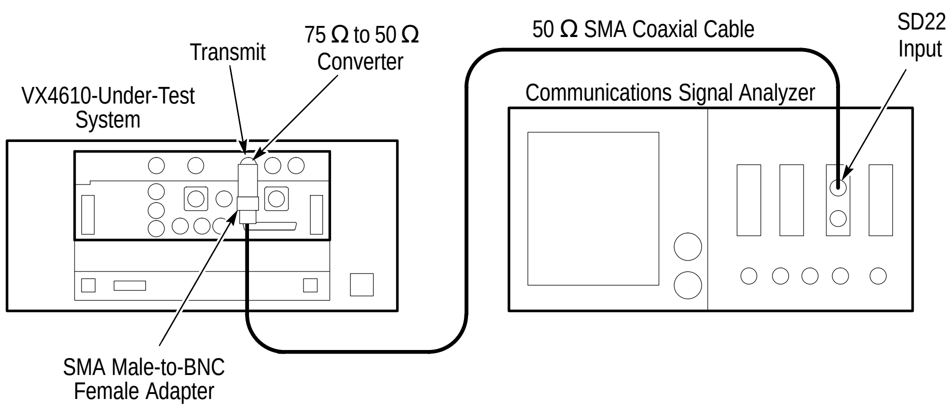


Figure I–20: DS3 signal level setup (Option 22 shown)

2. Perform the initial setup of the communications signal analyzer with the following steps:

   a. To initialize the communications signal analyzer, select the **UTILITY** menu, the **Initialize** pop-up menu, and then select **Initialize** in the pop-up menu.

   b. Press the **SELECT CHANNEL** button next to the input connector on the sampling head channel you are using.

   c. Select the **TRIGGER** menu. Set the **Source** to **Internal Clock**.

3. Set up the VX4610 with the following sequence:

   a. From the **Setup** pull down menu, select **Reset to Defaults**.

   b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

   c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

   d. Select **DS3** in the Tx Rate drop-down list.

   e. Select **PRBS2^23-1** in the Test Pattern drop-down list.

4. Perform the test with the following sequence on the communications signal analyzer:

   a. Press the **AUTOSET** button. The waveform appears untriggered on the communications signal analyzer.

   b. Select the **MEASURE** menu and then the **Measurements** pop-up menu.

   c. Select the **Peak-peak** measurement then select **Exit**.

   d. Select the **Peak-peak** measurement selector to display the Peak-peak pop-up menu.

   e. Verify that the **mean value** of the measurement in the Peak-peak pop-up menu is between 290 mV and 55 mV.

DS3 Pulse Shape (Options 22 and 58 only)

This test verifies the pulse shape from the VX4610 DS3 output. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	Communications signal analyzer (item 5)
	75 Ω to 50 Ω impedance converter (item 18)
	SMA male-to-BNC female adapter (item 24)
	50 Ω power splitter (item 21)
	50 Ω SMA coaxial cable (item 22), two required
Prerequisites	All prerequisites listed on page I–31
	All previous Physical Layer Tests
Time required	Approximately fifteen minutes

1. Connect the communications signal analyzer and VX4610 as shown in Figure I–21 on page I–78.

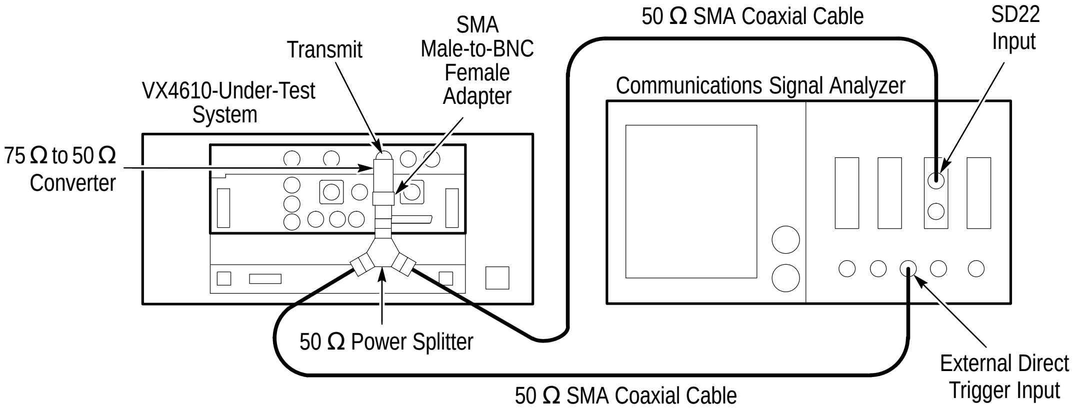


Figure I–21: DS3 pulse shape setup (Option 22 shown)

2. Set up the VX4610 with the following sequence:

   a. From the **Setup** pull down menu, select **Reset to Defaults**.

   b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

   c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

   d. Select **DS3** in the Tx Rate drop-down list.

   e. Select **8 bit Word** in the Test Pattern drop-down list.

   f. Select the **More...** command button in the GENERATOR group.

   g. Set the test pattern to **10101010** (#HAA), and then press **SET**.

3. Perform the initial setup of the communications signal analyzer with the following steps:

   a. To initialize the communications signal analyzer, select the **UTILITY** menu, the **Initialize** pop-up menu, and then select the **Initialize** menu item in the pop-up menu.

   b. Press the **SELECT CHANNEL** button next to the input connector on the sampling head channel you are using.

   c. Select the **TRIGGER** menu, set the **Slope** to **+**, and **Level** to **20 mV**.

d. Select the **WAVEFORM** menu, select the **Acquire Desc** pop-up menu, and set Average N to **On**.

e. Select the **Sampling Head Fnc's** pop-up menu and set **Smoothing** to **On**.

f. Select the **DISPLAY MODES** menu.

g. Select **Mask Testing** pop-up menu and then the **Set N Waveforms** menu item.

h. Select the **Waveform N** pop-up menu (red boxes located just to the left of the two front panel knobs) then enter the numeric value **100** followed by **Enter**.

i. Select the **Standard Masks** pop-up menu and then the **DS3 44.736Mb** menu item from the set of built-in ANSI T1.102 Electrical Standards masks.

4. Perform the test with the following sequence on the communications signal analyzer:

a. Select the **DISPLAY MODES** menu.

b. Adjust **Vertical Offset** and **Main Position** to locate a positive-going pulse at the center of the mask.

c. Change the **Vertical Offset**, **Vertical Size**, and **Main Position** controls to **Fine** resolution.

d. Adjust the fine **Vertical Offset**, **Vertical Size**, and **Main Position** controls to position the pulse optimally within the mask.

e. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.

f. Select the **Stop N Waveforms** menu item.

g. After 100 waveforms have been acquired, the acquisition stops automatically. The test has passed if no more than 200 hits are recorded for 100 waveforms, or the green Passing message is displayed in the Mask Testing pop–up menu.

DS3 Monitor Receive Level (Options 22 and 58 only)

This test verifies the monitor receive level for the VX4610 DS3 input. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	75 Ω BNC coaxial cable (item 19), two required 10X Attenuator (item 36) BNC male to BNC male adapter (item 27)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–22.

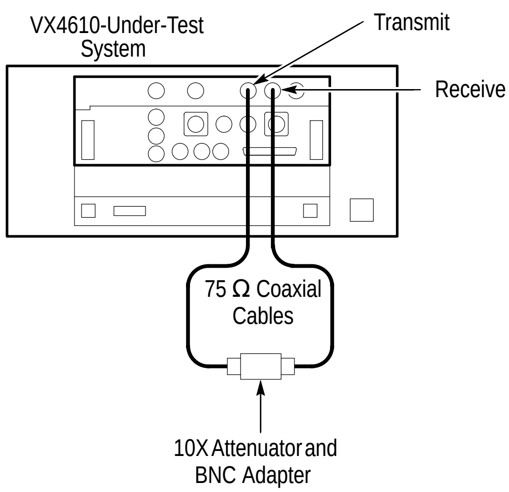


Figure I–22: DS3 monitor receive level setup (Option 22 shown)

2. Set up the VX4610 with the following sequence:

   a. From the **Setup** pull down menu, select **Reset to Defaults**.

   b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

   c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

   d. Select **DS3** in the Tx Rate drop-down list.

   e. Select **PRBS2^23-1** in the Test Pattern drop-down list.

f. Select **Monitor** in the Receive Rx Level drop-down list.

3. Click the **START** button. Click the **Stop** button.
4. Click the **Main Results...** command button.
5. Click the **Errors** command button, and then click the **Update** button.
6. Verify that there are no errors.
7. Click the **Alarms** command button, and then click the **Update** button.
8. Verify that there are no alarms.
9. Click the **Failures** command button, and then click the **Update** button.
10. Verify that there are no failures. Click **Close**.

External Clock Input (Options 22 and 58 only)

This test verifies the EXT CLOCK clock input for the VX4610. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	75 Ω BNC coaxial cable (item 19), two required N-to-BNC adapter (item 28) Frequency Synthesizer (item 2)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–23.

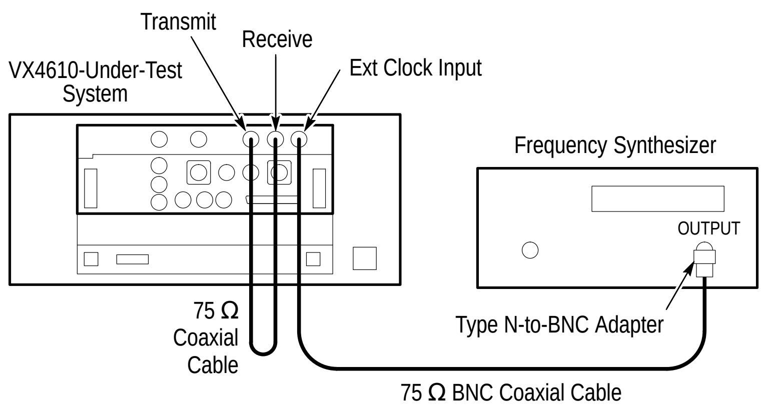


Figure I–23: DS3 external clock setup (Option 22 shown)

2. Set up the VX4610 with the following sequence:

   a. From the **Setup** pull down menu, select **Reset to Defaults**.

   b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

   c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

   d. Select **DS3** in the Tx Rate drop-down list.

   e. Select **PRBS2^23-1** in the Test Pattern drop-down list.

   f. Click the **More...** command button.

   g. Select **External DSn** in the Tx Clock drop-down list.

3. Make the following settings on the Frequency Synthesizer:

   a. Set the output frequency to **44.742710 MHz**

   b. Set the output power to **+4 dBm** ($\approx$1 $V_{p\text{-}p}$ into 50 Ω).

   c. Set the RF output to **ON**.

4. Click the **START** button.

5. Click the **STOP** button.

6. Click the **Main Results...** command button.

7. Click the **Errors** command button, and then click the **Update** button.

8. Verify that there are no errors.

9. Click the **Alarms** command button, and then click the **Update** button.

10. Verify that there are no alarms. Click **Close**.

11. Set the Frequency Synthesizer to **44.729290 MHz**.

12. Click the **START** button.

13. Click the **STOP** button.

14. Click the **Main Results...** command button.

15. Click the **Errors** command button, and then click the **Update** button.

16. Verify that there are no errors.

17. Click the **Alarms** command button, and then click the **Update** button. Click **Close**.

***NOTE**. If you have performed all previous functional and physical-layer tests that are applicable to your VX4610, you have now completed the performance verification.*

2 Mb/s Balanced Transmit Pulse Mask (Options 36 and 58 only)

This test verifies the pulse mask from the VX4610 2 Mb/s output. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	Communications signal analyzer (item 5) 50 Ω power splitter (item 21) 50 Ω SMA coaxial cable (item 22), two required SMA male-to-BNC female adapter (item 24) 2X Attenuator (item 39), two required 120 Ω DIN41628L cable (item 35) Tributary Signal Converter/Attenuator (item 33)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately fifteen minutes

1. Connect the communications signal analyzer and VX4610 as shown in Figure I–24. Connect to the 2 Mb/s or E1 Transmit/Drop connectors.

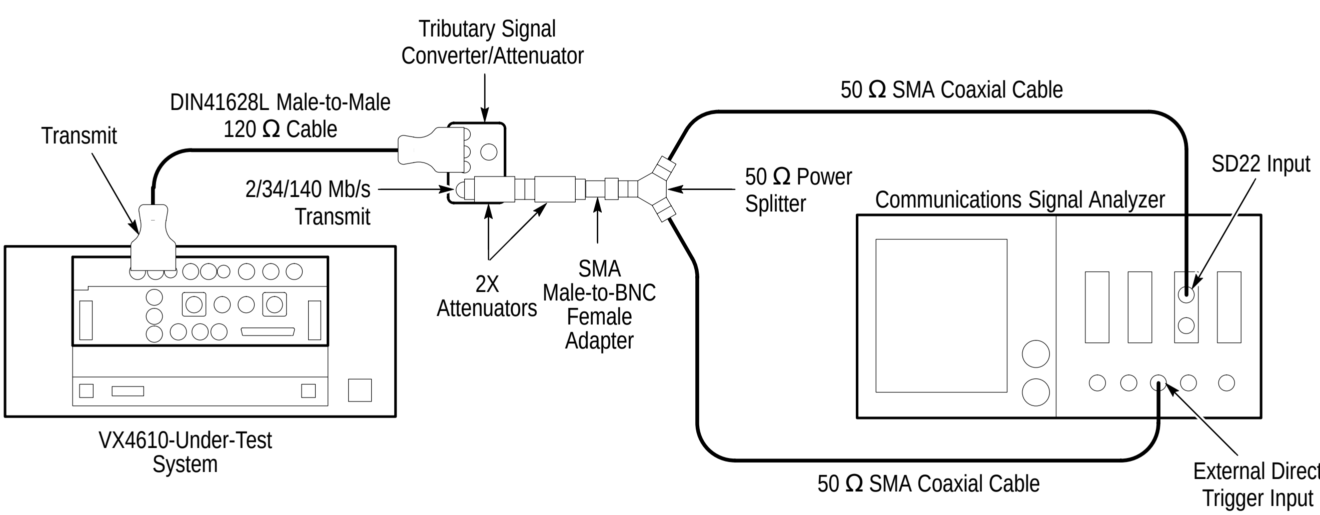


Figure I–24: 2 Mb/s pulse mask setup (Option 36 shown)

2. Set up the VX4610 with the following sequence:

   a. From the **Setup** pull down menu, select **Reset to Defaults**.

   b. From the **Setup** pull down menu, select **SDH Mode**.

   c. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

   d. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

   e. Select **2 Mb Bal Line** in the Tx Rate drop-down list.

   f. Select **All Ones** in the Test Pattern drop-down list.

3. Perform the initial setup of the communications signal analyzer with the following steps:

   a. To initialize the communications signal analyzer, select the **UTILITY** menu, the **Initialize** pop-up menu, and then select the **Initialize** menu item in the pop-up menu.

   b. Press the **SELECT CHANNEL** button next to the input connector on the sampling head channel you are using.

   c. Adjust for 200 ns/DIV, 200 mV/DIV, and a stable trigger.

   d. Select the **WAVEFORM** menu, select the **Acquire Desc** pop-up menu, and set **Average N** to **On**.

   e. Select **Set Avg N**, and set **Average N** to **64**.

   f. Select the **Sampling Head Fnc's** pop-up menu.

   g. Set the **Ex Channel Attenuation** to 8 $\times$ the calibration factor of the Tributary Signal Converter/Attenuator.

   h. Select the **DISPLAY MODES** menu.

   i. Set the **Vertical Size** to **528 mV/DIV** (the default).

   j. Select **Mask Testing** pop-up menu and then the **Set N Waveforms** menu item.

   k. Select the **Waveform N** pop-up menu (red boxes located just to the left of the two front panel knobs) then enter the numeric value **100** followed by **Enter**.

4. Perform the test with the following sequence on the communications signal analyzer:

   a. Select the **DISPLAY MODES** menu.

   b. Select the **Standard Masks** pop-up menu and then the **Sym. Pair 2.048Mb** menu item from the set of built-in ITU-T G.703 Electrical Standards masks.

   c. Press the **AUTOSET** button.

   d. Adjust **Vertical Offset** and **Main Position** to locate a positive-going pulse at the center of the mask using **Fine** knob resolution.

   e. Change the **Vertical Offset** and **Main Position** controls to **Fine** resolution.

   f. Adjust the fine **Vertical Offset** and **Main Position** controls to position the pulse optimally within the mask.

   g. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.

   h. Select the **Stop N Waveforms** menu item.

   i. After 100 waveforms have been acquired, the acquisition stops automatically. The test has passed if no more than 200 hits are recorded for 100 waveforms, or the green Passing message is displayed in the Mask Testing pop-up menu.

   j. Remove the displayed input trace on the communications signal analyzer. Select the trace on screen and then touch the **Remove Trace** selector near the knob labels.

   k. Select **Define Trace**.

   l. Define the trace as **–M1** (this assumes the input signal is connected to M1).

   m. Select the **WAVEFORM** menu, select the **Acquire Desc** pop-up menu, and set **Average N** to **On**.

   n. Verify that the V/DIV display and sampling head Ex Channel Attenuation have not changed.

   o. Select the **DISPLAY MODES** menu.

   p. Select the **Standard Masks** pop-up menu and then the **Sym. Pair 2.048Mb** menu item from the set of built-in ITU-T G.703 Electrical Standards masks.

q. Adjust **Vertical Offset** and **Main Position** to locate a positive-going pulse at the center of the mask.

r. Change the **Vertical Offset** and **Main Position** controls to **Fine** resolution.

s. Adjust the fine **Vertical Offset** and **Main Position** controls to position the pulse optimally within the mask.

t. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.

u. Select the **Stop N Waveforms** menu item.

v. After 100 waveforms have been acquired, the acquisition stops automatically. The test has passed if no more than 200 hits are recorded for 100 waveforms, or the green Passing message is displayed in the Mask Testing pop-up menu.

2 Mb/s Monitor Receive Level (Options 36 and 58 only)

This test verifies the monitor receive level for the VX4610 Option 36 or 58 RECEIVE/ADD input. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	Tributary Signal Converter/Attenuator (item 33), two required 10X Attenuator (item 38) 2X Attenuator (item 39) BNC male to BNC male adapter (item 27) 100 Ω Bantam-to-Bantam Cable (item 31), two required
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–25. Connect to the 2 Mb/s or E1 Transmit/Drop and Receive/Add connectors.

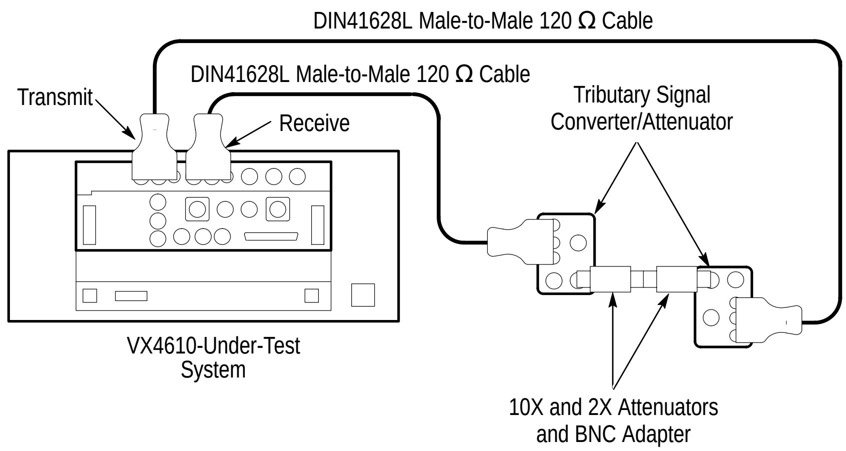


Figure I–25: 2 Mb/s monitor receive level setup (Option 36 shown)

2. Set up the VX4610 with the following sequence:

a. From the **Setup** pull down menu, select **Reset to Defaults**.

b. From the **Setup** pull down menu, select **SDH Mode**.

c. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

d. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

e. Select **2 Mb/s Bal Line** in the Tx Rate drop-down list.

f. Select **PRBS2^23-1** in the Test Pattern drop-down list.

g. Select **Monitor** in the Receive Rx Level drop-down list.

3. Click the **START** button.

4. Click the **Main Results...** command button.

5. Click the **Errors** command button, and then click the **Update** button.

6. Verify that there are no errors.

7. Click the **Alarms** command button, and then click the **Update** button.

8. Verify that there are no alarms.

9. Click the **Failures** command button, and then click the **Update** button.

10. Verify that there are no failures. Click **Close**.

2 Mb/s Balanced Bridged Receive Level (Options 36 and 58 only)

This test verifies the bridged receive level for the VX4610 2 Mb/s input. Connect to the 2 Mb/s or E1 Transmit/Drop and Receive/Add connectors. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	50 Ω terminator (item 40) 50 Ω BNC cable (item 26) 120 Ω DIN41628L cable (item 34)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–26.

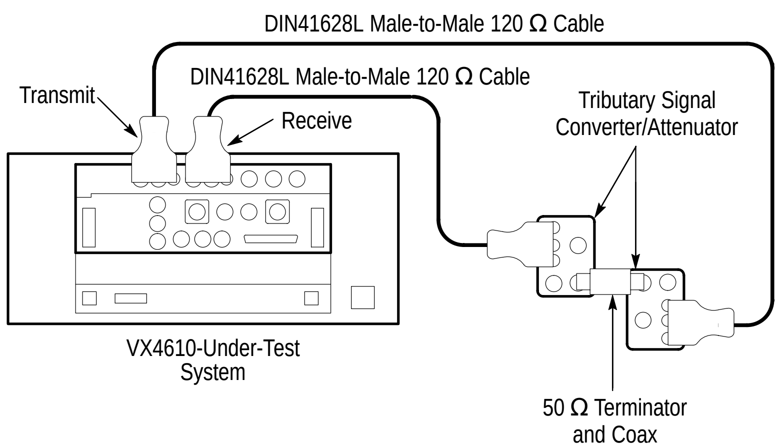


Figure I–26: 2 Mb/s balanced bridged setup (Option 36 shown)

2. Set up the VX4610 with the following sequence:

   a. From the **Setup** pull down menu, select **Reset to Defaults**.

   b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

   c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

   d. Select **2 Mb Bal Line** in the Tx Rate drop-down list.

   e. Select **PRBS2^23–1** in the Test Pattern drop-down list.
   f. Select **Bridge** in the Receive Rx Level drop-down list.

3. Click the **START** button.
4. Click the **Main Results...** command button.
5. Click the **Errors** command button, and then click the **Update** button.
6. Verify that there are no errors.
7. Click the **Alarms** command button, and then click the **Update** button.
8. Verify that there are no alarms.
9. Click the **Failures** command button, and then click the **Update** button.
10. Verify that there are no failures.
11. Click the **START** button. Click **Close**.

2 Mb/s Balanced External Clock Input (Options 36 and 58 only)

This test verifies the external Clock input for the VX4610. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	Frequency Synthesizer (item 2) 75 Ω BNC coaxial cable (item 19) N-to-BNC adapter (item 2) 120 Ω DIN41628L cable (item 34)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–27. Connect to the 2 Mb/s or E1 Transmit/Drop and Receive/Add connectors.

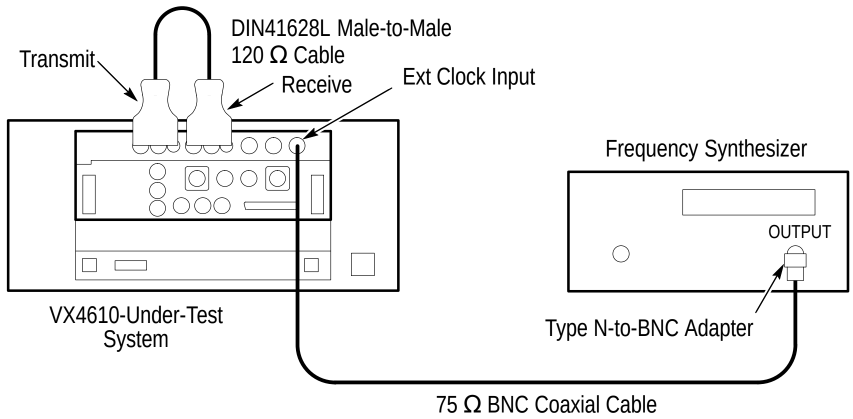


Figure I–27: 2 Mb/s balanced external clock setup (Option 36 shown)

2. Make the following settings on the Frequency Synthesizer:

a. Set the output frequency to **2.048307 MHz**

b. Set the output power to **+4 dBm** ($\approx$1 $V_{p\text{-}p}$ into 50 Ω).

c. Set the RF output to **ON**.

3. Set up the VX4610 with the following sequence:

a. From the **Setup** pull down menu, select **Reset to Defaults**.

b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

d. Select **2 Mb Bal Line** in the Tx Rate drop-down list.

e. Select **PRBS2^23-1** in the Test Pattern drop-down list.

f. Click the **More...** command button.

g. Select **External PDH** in the Tx Clock drop-down list.

4. Click the **START** button.

5. Click the **Main Results...** command button.

6. Click the **Errors** command button, and then click the **Update** button.

7. Verify that there are no errors.

8. Click the **Alarms** command button, and then click the **Update** button.

9. Verify that there are no alarms. Click **Close**.
10. Set the Frequency Synthesizer to **2.047693 MHz**.
11. Click the **START** button.
12. Click the **Main Results...** command button.
13. Click the **Errors** command button, and then click the **Update** button.
14. Verify that there are no errors.
15. Click the **Alarms** command button, and then click the **Update** button. Click **Close**.

2 Mb/s Balanced Cable Equalization (Options 36 and 58 only)

This test verifies the 2 Mb/s cable equalization for the VX4610. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	Communications analyzer (item 17) 120 Ω DIN41628L cable (item 34)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–28. Connect to the 2 Mb/s or E1 Receive/Add connectors.

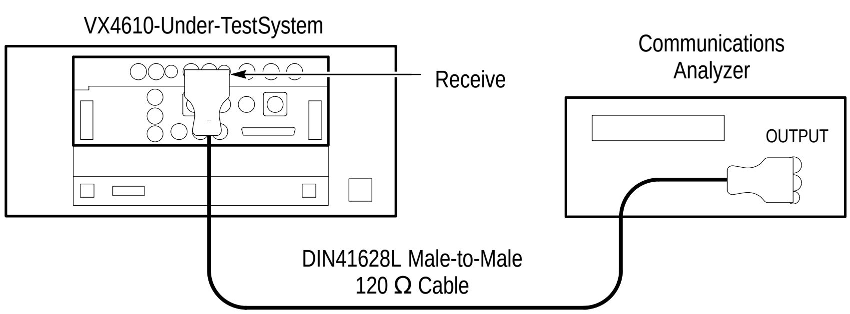


Figure I–28: 2 Mb/s cable equalization setup (Option 36 shown)

2. Perform the initial setup of the communications signal analyzer with the following steps:

   a. Set the communications analyzer to output a 2 Mb/s balanced, PRBS2^23–1 unframed signal.

3. Set up the VX4610 with the following sequence:

   a. From the **Setup** pull down menu, select **Reset to Defaults**.

   b. Select **2 Mb Bal Line** in the Rx Rate drop-down list.

   c. Select **Normal** in the Receive Rx Level drop-down list.

4. Set the communications signal analyzer to output a 0 dB signal.

5. Verify that there are no bit errors or bipolar violations for a measurement period of at least 30 seconds.

6. Set the communications signal analyzer to output a –6 dB signal.

7. Verify that there are no bit errors or bipolar violations for a measurement period of at least 30 seconds.

2 Mb/s Unbalanced Transmit Pulse Mask (Options 36 and 58 only)

This test verifies the 2 Mb/s pulse mask from the VX4610. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	Communications signal analyzer (item 5) 50 Ω power splitter (item 21) 50 Ω SMA coaxial cable (item 22), two required SMA male-to-BNC female adapter (item 24) 50 Ω coaxial cable (item 26) 75 Ω to 50 Ω impedance converter (item 18)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately fifteen minutes

1. Connect the communications signal analyzer and VX4610 as shown in Figure I–29.

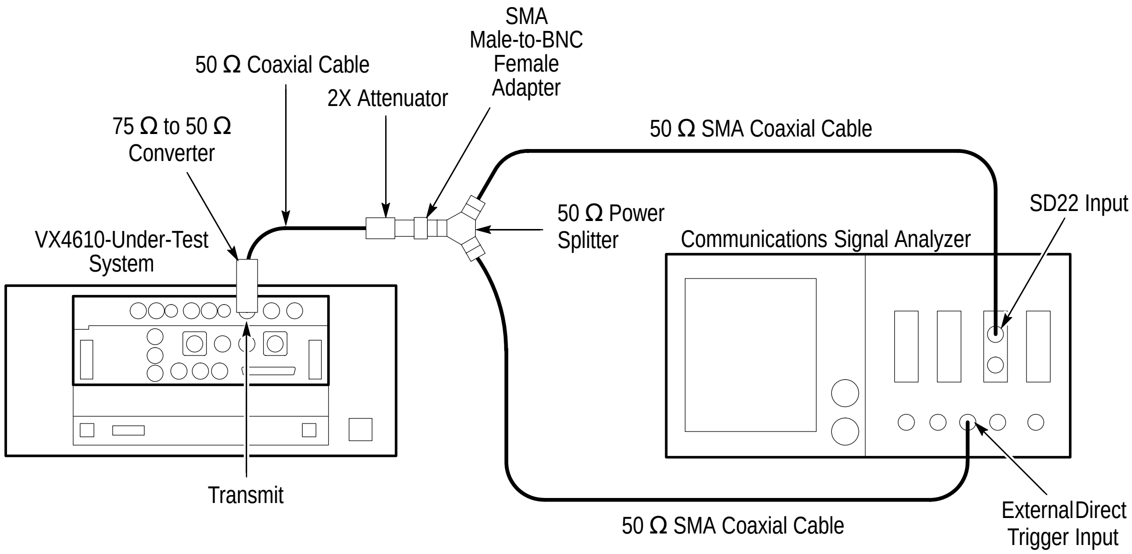


Figure I–29: 2 Mb/s pulse mask setup (Option 36 shown)

2. Set up the VX4610 with the following sequence:

a. From the **Setup** pull down menu, select **Reset to Defaults**.

b. From the **Setup** pull down menu, select **SDH**.

c. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

d. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

e. Select **2 Mb Unbal Line** in the Tx Rate drop-down list.

f. Select **All Ones** in the Test Pattern drop-down list.

3. Perform the initial setup of the communications signal analyzer with the following steps:

a. To initialize the communications signal analyzer, select the **UTILITY** menu, the **Initialize** pop-up menu, and then select the **Initialize** menu item in the pop-up menu.

b. Press the **SELECT CHANNEL** button next to the input connector on the sampling head channel you are using.

c. Adjust the communications signal analyzer for 200 ns/div, 200 mV/div, and a stable trigger.

- **d.** Select the **WAVEFORM** menu, select the **Acquire Desc** pop-up menu, and set **Average N** to **On**.
- **e.** Select **Set Avg N**, and set **Average N** to **64**.
- **f.** Select the **Sampling Head Fnc's** pop-up menu.
- **g.** Set the **Ex Channel Attenuation** to **9.6**.
- **h.** Select the **DISPLAY MODES** menu.
- **i.** Select the **Standard Masks** pop-up menu and then the **CoAx Pair 2.048Mb** menu item from the set of built-in ITU-T G.703 Electrical Standards masks.
- **j.** Set the **Vertical Size** to **414 mV/DIV**.
- **k.** Select **Mask Testing** pop-up menu and then the **Set N Waveforms** menu item.
- **l.** Select the **Waveform N** pop-up menu (red boxes located just to the left of the two front panel knobs) then enter the numeric value **100** followed by **Enter**.

4. Perform the test with the following sequence on the communications signal analyzer:

- **a.** Select the **DISPLAY MODES** menu.
- **b.** Adjust **Vertical Offset** and **Main Position** to locate a positive-going pulse at the center of the mask.
- **c.** Change the **Vertical Offset** and **Main Position** controls to **Fine** resolution.
- **d.** Adjust the fine **Vertical Offset** and **Main Position** controls to position the pulse optimally within the mask.
- **e.** Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.
- **f.** Select the **Stop N Waveforms** menu item.
- **g.** After 100 waveforms have been acquired, the acquisition stops automatically. The test has passed if no more than 200 hits are recorded for 100 waveforms, or the green Passing message is displayed in the Mask Testing pop-up menu.
- **h.** Remove the displayed input trace.
- **i.** Select **Define Trace**.

j. Define the trace as **–M1** (this assumes the input signal is connected to M1).

k. Verify that the V/DIV display and the sampling head Ex Channel Attenuation have not changed.

l. Select the **WAVEFORM** menu, select the **Acquire Desc** pop-up menu, and set **Average N** to **On**.

m. Select the **DISPLAY MODES** menu.

n. Select the **Standard Masks** pop-up menu and then the **CoAx Pair 2.048Mb** menu item from the set of built-in ITU-T G.703 Electrical Standards masks.

o. Adjust **Vertical Offset** and **Main Position** to locate a positive-going pulse at the center of the mask.

p. Change the **Vertical Offset** and **Main Position** controls to **Fine** resolution.

q. Adjust the fine **Vertical Offset** and **Main Position** controls to position the pulse optimally within the mask.

r. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.

s. Select the **Stop N Waveforms** menu item.

t. After 100 waveforms have been acquired, the acquisition stops automatically. The test has passed if no more than 200 hits are recorded for 100 waveforms, or the green Passing message is displayed in the Mask Testing pop-up menu.

2 Mb/s Unbalanced Bridged Receive Level (Options 36 and 58 only)

This test verifies the bridged receive level for the VX4610 2 Mb/s input. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	75 Ω BNC coaxial cable (item 19), two required 75 Ω terminator (item 41)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–30.

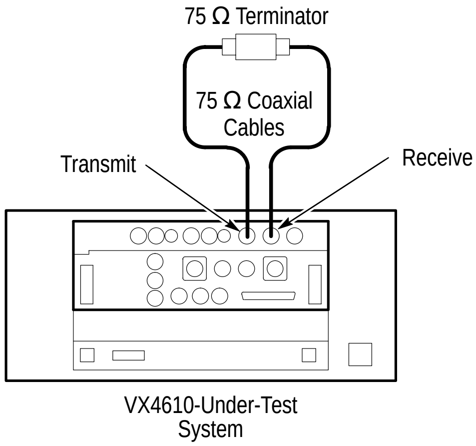


Figure I–30: 2 Mb/s bridged setup (Option 36 shown)

2. Set up the VX4610 with the following sequence:
   a. From the **Setup** pull down menu, select **Reset to Defaults**.
   b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.
   c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.
   d. Select **2 Mb Unbal Line** in the Tx Rate drop-down list.
   e. Select **UnFramed** in the Framing drop-down list.
   f. Select **PRBS2^23–1** in the Test Pattern drop-down list.
   g. Select **Bridge** in the Receive Rx Level drop-down list.
3. Click the **START** button.
4. Click the **Main Results...** command button.
5. Click the **Errors** command button, and then click the **Update** button.
6. Verify that there are no errors.
7. Click the **Alarms** command button, and then click the **Update** button.
8. Verify that there are no alarms.
9. Click the **Failures** command button, and then click the **Update** button.
10. Verify that there are no failures. Click **Close**.

2 Mb/s Unbalanced Monitor Receive Level (Options 36 and 58 only)

This test verifies the 2 Mb/s monitor receive level for the VX4610. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	75 Ω BNC coaxial cable (item 19), two required 10X Attenuator (item 36) 2X Attenuator (item 37)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–31.

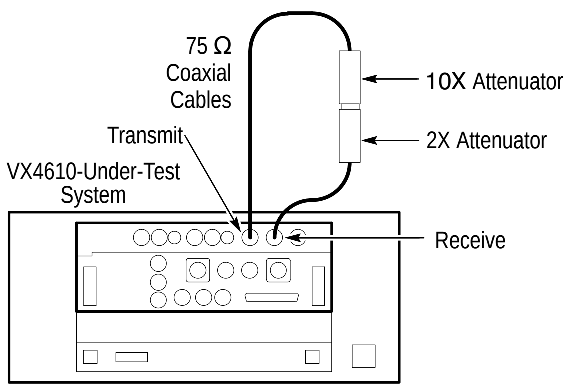


Figure I–31: 2 Mb/s monitor receive level setup (Option 36 shown)

2. Set up the VX4610 with the following sequence:

   a. From the **Setup** pull down menu, select **Reset to Defaults**.

   b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

   c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

   d. Select **2 Mb Unbal Line** in the Tx Rate drop-down list.

   e. Select **UnFramed** in the Framing drop-down list.

   f. Select **PRBS2^23–1** in the Test Pattern drop-down list.

g. Select **Monitor** in the Receive Rx Level drop-down list.

3. Click the **START** button.

4. Verify that there are no bit errors or bipolar violations for a measurement period of at least 30 seconds.

2 Mb/s Unbalanced External Clock input (Options 36 and 58 only)

This test verifies the 2 Mb/s external clock input for the VX4610. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	Frequency Synthesizer (item 2) 75 Ω BNC coaxial cable (item 19), two required N-to-BNC adapter (item 28)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–32.

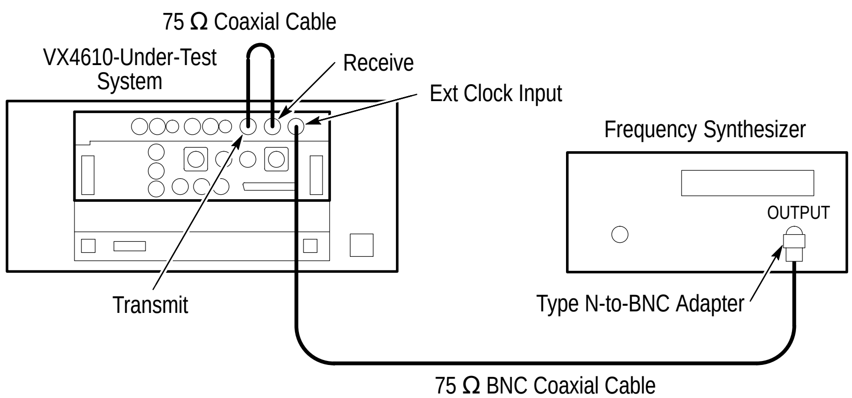


Figure I–32: 2 Mb/s external clock setup (Option 36 shown)

2. Set up the VX4610 with the following sequence:

a. From the **Setup** pull down menu, select **Reset to Defaults**.

b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

d. Select **2 Mb Unbal Line** in the Tx Rate drop-down list.

e. Click the **More...** command button.

f. Select **External** in the Tx Clock drop-down list.

3. Make the following settings on the Frequency Synthesizer:

   a. Set the output frequency to **2.048307 MHz**

   b. Set the output power to **+4 dBm** ($\approx$1 $V_{p\text{-}p}$ into 50 Ω).

   c. Set the RF output to **ON**.

4. Click the **START** button.

5. Click the **Main Results...** command button.

6. Click the **Errors** command button, and then click the **Update** button.

7. Verify that there are no errors.

8. Click the **Alarms** command button, and then click the **Update** button.

9. Verify that there are no alarms.

10. Click **Close** and click the **Stop** button.

11. Set the Frequency Synthesizer to **2.047693 MHz**.

12. Click the **START** button.

13. Click the **Main Results...** command button.

14. Click the **Errors** command button, and then click the **Update** button.

15. Verify that there are no errors.

16. Click the **Alarms** command button, and then click the **Update** button.

17. Click **Close** and click the **Stop** button.

***NOTE**. If you have performed all previous functional and physical-layer tests that are applicable to your VX4610, you have now completed the performance verification.*

34 Mb/s Transmit Pulse Mask (Options 36 and 58 only)

This test verifies the 34 Mb/s pulse mask from the VX4610. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	Communications signal analyzer (item 5) 50 Ω power splitter (item 21) 50 Ω SMA coaxial cable (item 22), two required SMA male-to-BNC female adapter (item 24) 75 Ω to 50 Ω impedance converter (item 18) 50 Ω coaxial cable (item 26)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately fifteen minutes

1. Connect the communications signal analyzer and VX4610 as shown in Figure I–33.

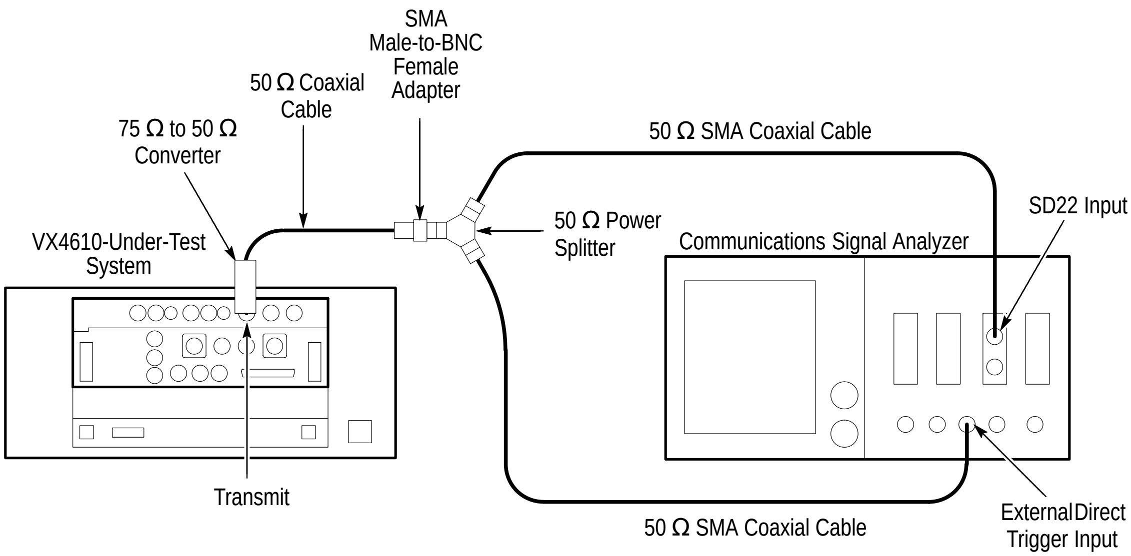


Figure I–33: 34 Mb/s pulse mask setup (Option 36 shown)

2. Set up the VX4610 with the following sequence:

   a. From the **Setup** pull down menu, select **Reset to Defaults**.

   b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

   c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

   d. Select **34 Mb Line** in the Tx Rate drop-down list.

   e. Select **All Ones** in the Test Pattern drop-down list.

3. Perform the initial setup of the communications signal analyzer with the following steps:

   a. To initialize the communications signal analyzer, select the **UTILITY** menu, the **Initialize** pop-up menu, and then select the **Initialize** menu item in the pop-up menu.

   b. Press the **SELECT CHANNEL** button next to the input connector on the sampling head channel you are using.

   c. Adjust the communications signal analyzer for 10 ns/DIV, 50 mV/DIV, and a stable trigger.

   d. Select the **WAVEFORM** menu, select the **Acquire Desc** pop-up menu, and set **Average N** to **On**.

   e. Select **Set Avg N**, and set **Average N** to **64**.

   f. Select the **Sampling Head Fnc's** pop-up menu and set **Smoothing** to **On**.

   g. Set the **Ex Channel Attenuation** to **4.8**.

   h. Select the **DISPLAY MODES** menu.

   i. Select the **Standard Masks** pop-up menu and then the **Pulse 34.368Mb** menu item from the set of built-in ITU-T G.703 Electrical Standards masks.

   j. Set the **Vertical Size** to **175 mV/DIV**.

   k. Select **Mask Testing** pop-up menu and then the **Set N Waveforms** menu item.

   l. Select the **Waveform N** pop-up menu (red boxes located just to the left of the two front panel knobs) then enter the numeric value **20** followed by **Enter**.

4. Perform the test with the following sequence on the communications signal analyzer:

   a. Select the **DISPLAY MODES** menu.

   b. Adjust **Vertical Offset** and **Main Position** to locate a positive-going pulse at the center of the mask.

   c. Change the **Vertical Offset** and **Main Position** controls to **Fine** resolution.

   d. Adjust the fine **Vertical Offset** and **Main Position** controls to position the pulse optimally within the mask.

   e. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.

   f. Select the **Stop N Waveforms** menu item.

   g. After 20 waveforms have been acquired, the acquisition stops automatically. Verify that the test has passed, which is indicated by the green Passing message is displayed in the Mask Testing pop-up menu.

   h. Remove the displayed input trace by selecting the trace and touching the **Remove Trace** label.

   i. Select **Define Trace**.

   j. Define the trace as **–M1** (input signal connected to M1) by touching **–** from the on screen character pad and **M1** channel. Touch **Enter**.

   k. Verify that the V/DIV display and sampling head Ex Channel Attenuation have not changed.

   l. Select the **WAVEFORM** menu, select the **Acquire Desc** pop-up menu, and set **Average N** to **On**.

   m. Select the **DISPLAY MODES** menu.

   n. Select the **Standard Masks** pop-up menu and then the **Pulse 34.368Mb** menu item from the set of built-in ITU-T G.703 Electrical Standards masks.

   o. Adjust **Vertical Offset** and **Main Position** to locate a positive-going pulse at the center of the mask.

   p. Change the **Vertical Offset** and **Main Position** controls to **Fine** resolution.

   q. Adjust the fine **Vertical Offset** and **Main Position** controls to position the pulse optimally within the mask.

r. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.

s. Select the **Stop N Waveforms** menu item.

t. After 20 waveforms have been acquired, the acquisition stops automatically. Verify that the test has passed, which is indicated by the green Passing message is displayed in the Mask Testing pop-up menu.

34 Mb/s Monitor Receive Level (Options 36 and 58 only)

This test verifies the 34 Mb/s monitor receive level for the VX4610. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	10X attenuator (item 360 2X attenuator (item 37) 75 Ω BNC coaxial cable (item 19), two required
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–34.

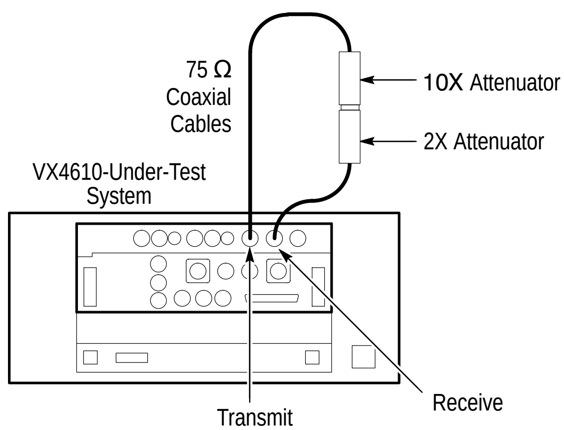


Figure I–34: 34 Mb/s monitor receive level setup (Option 36 shown)

2. Set up the VX4610 with the following sequence:

a. From the **Setup** pull down menu, select **Reset to Defaults**.

b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

d. Select **34 Mb Line** in the Tx Rate drop-down list.

e. Select **PRBS2^23-1** in the Test Pattern drop-down list.

f. Select **UnFramed** in the Framing drop-down list.

g. Select **Monitor** in the Rx Level drop-down list in the RECEIVE group.

3. Verify that there are no bit errors or bipolar violations for a measurement period of at least 30 seconds.

34 Mb/s Cable Equalization (Options 36 and 58 only)

This test verifies the 34 Mb/s Cable Equalization for the VX4610. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	656 foot (200 m) length of 75 Ω Reference Cable (item 16)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–35.

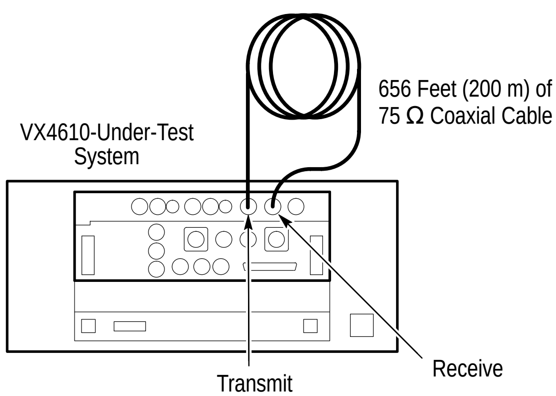


Figure I–35: 34 Mb/s cable equalization setup (Option 36 shown)

2. Set up the VX4610 with the following sequence:

   a. From the **Setup** pull down menu, select **Reset to Defaults**.

   b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

   c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

   d. Select **34 Mb Line** in the Tx Rate drop-down list.

   e. Select **PRBS2^23-1** in the Test Pattern drop-down list.

   f. Select **Normal** in the Level drop-down list in the RECEIVE group.

3. Verify that there are no bit errors or bipolar violations for a measurement period of at least 30 seconds.

34 Mb/s External Clock input (Options 36 and 58 only)

This test verifies the 34 Mb/s external clock input for the VX4610. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	Frequency Synthesizer (item 2) 75 Ω BNC coaxial cable (item 19), two required N-to-BNC adapter (item 28)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–36.

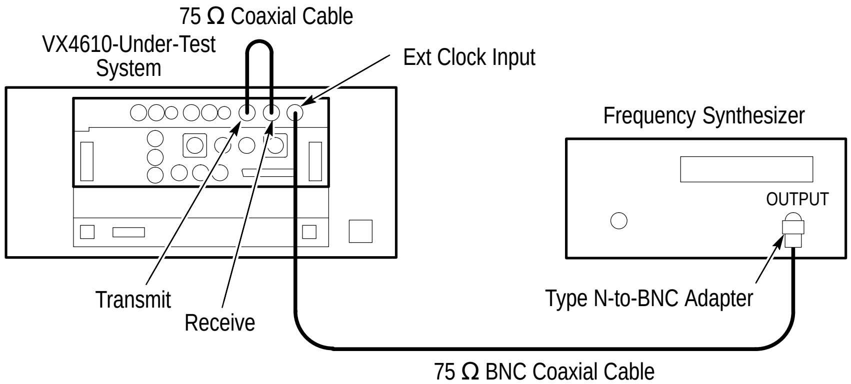


Figure I–36: 34 Mb/s external clock setup (Option 36 shown)

2. Set up the VX4610 with the following sequence:
   - **a.** From the **Setup** pull down menu, select **Reset to Defaults**.
   - **b.** In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.
   - **c.** From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.
   - **d.** Select **34 Mb Line** in the Tx Rate drop-down list.
   - **e.** Select **PRBS2^23-1** in the Test Pattern drop-down list.
   - **f.** Click the **More...** command button.
   - **g.** Select **External PDH** in the Tx Clock drop-down list.
3. Make the following settings on the Frequency Synthesizer:
   - **a.** Set the output frequency to **34.373155 MHz**
   - **b.** Set the output power to **+4 dBm** ($\approx$1 V_{p-p} into 50 Ω).
   - **c.** Set the RF output to **ON**.
4. Click the **START** button.
5. Click the **Main Results...** command button.
6. Click the **Errors** command button, and then click the **Update** button.
7. Verify that there are no errors.
8. Click the **Alarms** command button, and then click the **Update** button.

9. Verify that there are no alarms.
10. Click **Close** and click the **Stop** button.
11. Set the Frequency Synthesizer to **34.362845 MHz**.
12. Click the **START** button.
13. Click the **Main Results...** command button.
14. Click the **Errors** command button, and then click the **Update** button.
15. Verify that there are no errors.
16. Click the **Alarms** command button, and then click the **Update** button.
17. Click **Close** and click the **Stop** button.

***NOTE**. If you have performed all previous functional and physical-layer tests that are applicable to your VX4610, you have now completed the performance verification.*

140 Mb/s Transmit Pulse Mask (Options 36 and 58 only)

This test verifies the 140 Mb/s pulse mask from the VX4610. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	Communications signal analyzer (item 5) 50 Ω power splitter (item 21) 50 Ω SMA coaxial cable (item 22), two required SMA male-to-BNC female adapter (item 24) 75 Ω to 50 Ω impedance converter 50 Ω coaxial cable (item 26)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately fifteen minutes

1. Connect the communications signal analyzer and VX4610 as shown in Figure I–37.

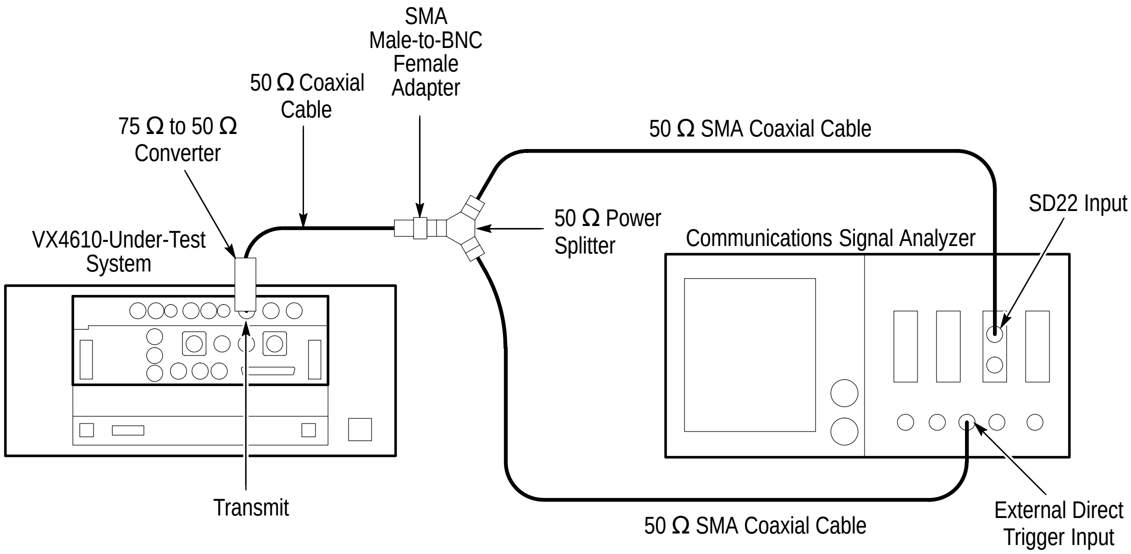


Figure I–37: 140 Mb/s transmit pulse mask setup (Option 36 shown)

2. Set up the VX4610 with the following sequence:

   a. From the **Setup** pull down menu, select **Reset to Defaults**.

   b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

   c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

   d. Select **140 Mb Line** in the Tx Rate drop-down list.

   e. Select **UnFramed** in the Framing drop-down list.

   f. Select **All Ones** in the Test Pattern drop-down list.

3. Perform the initial setup of the communications signal analyzer with the following steps:

   a. To initialize the communications signal analyzer, select the **UTILITY** menu, the **Initialize** pop-up menu, and then select the **Initialize** menu item in the pop-up menu.

   b. Press the **SELECT CHANNEL** button next to the input connector on the sampling head channel you are using.

   c. Adjust the communications signal analyzer for 10 ns, 50 mV, and a stable trigger.

   d. Select the **WAVEFORM** menu, select the **Acquire Desc** pop-up menu, and set **Average N** to **On**.
   e. Select **Set Avg N**, and set **Average N** to **64**.
   f. Select the **Sampling Head Fnc's** pop-up menu.
   g. Set the **Ex Channel Attenuation** to **4.8**.
   h. Select the **DISPLAY MODES** menu.
   i. Select the **Standard Masks** pop-up menu and then the **One Pulse 139.26 Mb** menu item from the set of built-in ITU-T G.703 Electrical Standards masks.
   j. Set the **Vertical Size** to **143 mV/DIV**.
   k. Select **Mask Testing** pop-up menu and then the **Set N Waveforms** menu item.
   l. Select the **Waveform N** pop-up menu (red boxes located just to the left of the two front panel knobs) then enter the numeric value **20** followed by **Exit**.

4. Perform the test with the following sequence on the communications signal analyzer:
   a. Select the **DISPLAY MODES** menu.
   b. Adjust **Vertical Offset** and **Main Position** to locate the waveform at the center of the mask.
   c. Change the **Vertical Offset** and **Main Position** controls to **Fine** resolution.
   d. Adjust the fine **Vertical Offset** and **Main Position** controls to position the pulse optimally within the mask.
   e. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.
   f. Select the **Stop N Waveforms** menu item.
   g. After 20 waveforms have been acquired, the acquisition stops automatically. Verify that the test has passed, which is indicated by the green Passing message is displayed in the Mask Testing pop-up menu.
   h. On the communications signal analyzer, select the **Standard Masks** pop-up menu and then the **Zero Pulse 139.26 Mb** menu item from the set of built-in ITU-T G.703 Electrical Standards masks.

5. Set up the VX4610 with the following sequence:

a. From the **Setup** pull down menu, select **Reset to Defaults**.

b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

d. Select **140 Mb Line** in the Tx Rate drop-down list.

e. Select **All Zeros** in the Test Pattern drop-down list.

6. Perform the test with the following sequence on the communications signal analyzer:

a. Select the **DISPLAY MODES** menu.

b. Adjust **Vertical Offset** and **Main Position** to locate the waveform at the center of the mask.

c. Change the **Vertical Offset** and **Main Position** controls to **Fine** resolution.

d. Adjust the fine **Vertical Offset** and **Main Position** controls to position the pulse optimally within the mask.

e. Select the **Mask Testing** pop-up menu and then the **Pass/Fail Test** menu item.

f. Select the **Stop N Waveforms** menu item.

g. After 20 waveforms have been acquired, the acquisition stops automatically. Verify that the test has passed, which is indicated by the green Passing message is displayed in the Mask Testing pop-up menu.

140 Mb/s Monitor Receive Level (Options 36 and 58 only)

This test verifies the 140 Mb/s monitor receive level for the VX4610. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	10X attenuator (item 36) 2X attenuator (item 37) 75 Ω BNC coaxial cable (item 19), two required
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–38.

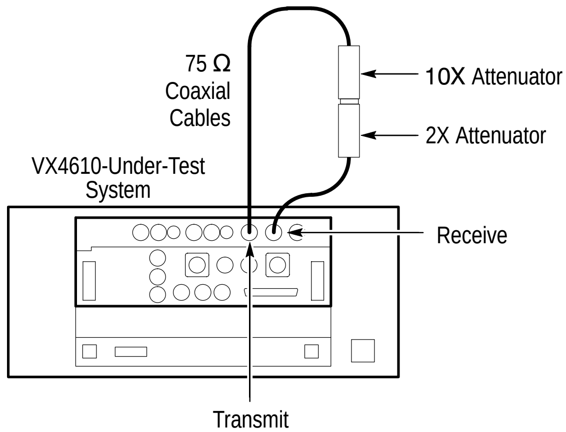


Figure I–38: 140 Mb/s monitor receive level setup (Option 36 shown)

2. Set up the VX4610 with the following sequence:

a. From the **Setup** pull down menu, select **Reset to Defaults**.

b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

d. Select **140 Mb Line** in the Tx Rate drop-down list.

e. Select **PRBS2^23–1** in the Test Pattern drop-down list.

f. Select **UnFramed** in the Framing drop-down list.

g. Select **Monitor** in the Receive Rx Level drop-down list.

3. Verify that there are no bit errors or bipolar violations for a measurement period of at least 30 seconds.

140 Mb/s External Clock input (Options 36 and 58 only)

This test verifies the 140 Mb/s external clock input for the VX4610. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	Frequency Synthesizer (item 2) 75 Ω BNC coaxial cable (item 19), two required N-to-BNC adapter (item 28)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–39.

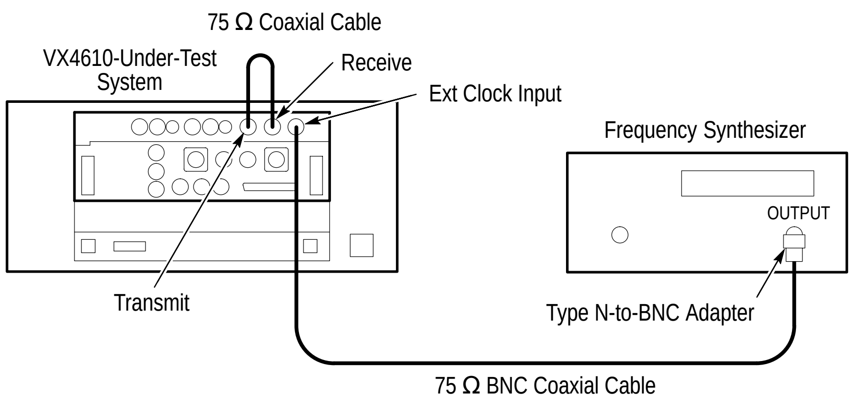


Figure I–39: 140 Mb/s external clock setup (Option 36 shown)

2. Set up the VX4610 with the following sequence:

   a. From the **Setup** pull down menu, select **Reset to Defaults**.

   b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

   c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

   d. Select **140 Mb Line** in the Tx Rate drop-down list.

   e. Select **PRBS2^23-1** in the Test Pattern drop-down list.

   f. Click the **More...** command button.

   g. Select **External PDH** in the Tx Clock drop-down list.

3. Make the following settings on the Frequency Synthesizer:

   a. Set the output frequency to **278.569779 MHz**.

   b. Set the output power to **+4 dBm** ($\approx$1 $V_{p\text{-}p}$ into 50 Ω).

   c. Set the RF output to **ON**.

4. Click the **START** button.
5. Click the **Main Results...** command button.
6. Click the **Errors** command button, and then click the **Update** button.
7. Verify that there are no errors.
8. Click the **Alarms** command button, and then click the **Update** button.
9. Click **Close** and click the **Stop** button.
10. Verify that there are no alarms.
11. Set the Frequency Synthesizer to **278.486221 MHz**.
12. Click the **START** button.
13. Click the **Main Results...** command button.
14. Click the **Errors** command button, and then click the **Update** button.
15. Verify that there are no errors.
16. Click the **Alarms** command button, and then click the **Update** button.
17. Click **Close** and click the **Stop** button.

140 Mb/s Cable Equalization (Options 36 and 58 only)

This test verifies the 140 Mb/s Cable Equalization for the VX4610. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	656 foot (200 m) length of 75 Ω Reference Cable (item 16)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–40.

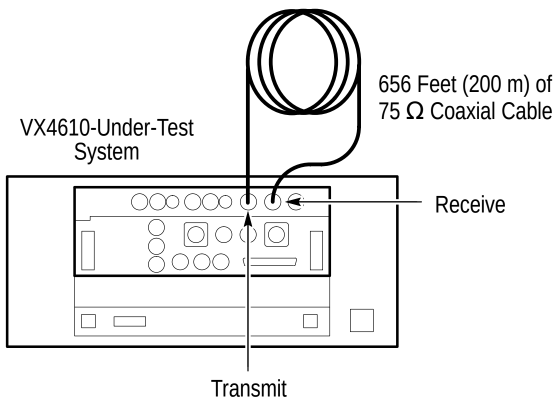


Figure I–40: 140 Mb/s cable equalization setup (Option 36 shown)

2. Set up the VX4610 with the following sequence:
   - **a.** From the **Setup** pull down menu, select **Reset to Defaults**.
   - **b.** In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.
   - **c.** From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.
   - **d.** Select **140 Mb Line** in the Tx Rate drop-down list.
   - **e.** Select **PRBS2^23–1** in the Test Pattern drop-down list.
   - **f.** Select **Normal** in the Receive Rx Level drop-down list.
3. Verify that there are no bit errors or bipolar violations for a measurement period of at least 30 seconds.

Jitter Tolerance (Options 36 and 58 only)

This test verifies the Jitter Tolerance for the VX4610. When using Option 58, refer to Figure 2–3 on page 2–5 for an illustration of the front-panel connectors.

Equipment required	75 Ω BNC coaxial cable (item 19), two required N-to-BNC adapter (item 28) Frequency Synthesizer (item 2) Function Generator (item 3)
Prerequisites	All prerequisites listed on page I–31 All previous Physical Layer Tests
Time required	Approximately ten minutes

1. Connect the VX4610 as shown in Figure I–41.

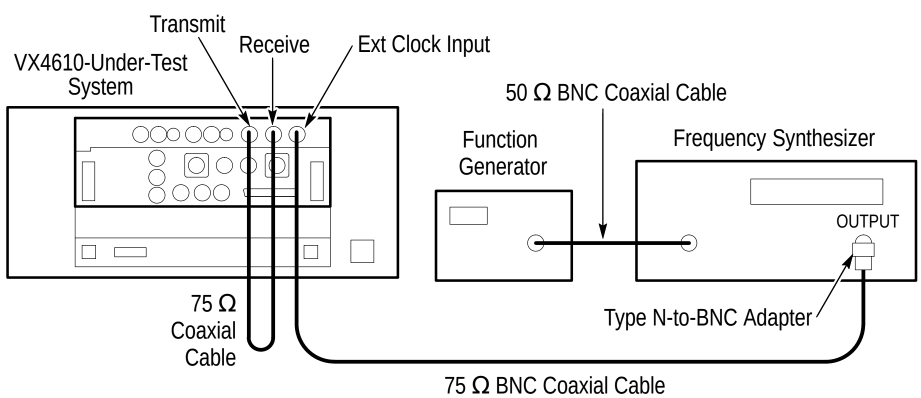


Figure I–41: Jitter tolerance setup (Option 36 shown)

2. Set up the VX4610 with the following sequence:

a. From the **Setup** pull down menu, select **Reset to Defaults**.

b. In the Main window, locate the field showing **Independent**. It overlaps the Generator and Receiver group areas.

c. From the drop-down list, select **Coupled Tx to Rx**. The field will change to **Coupled** indicating that the transmit and receive settings now match.

3. Perform the following substeps for each En Rate and Jitter Test listed in Table I–6.

a. Select the **En Rate** in the Tx Rate drop-down list.

b. Select the **Tx Test Pattern** in the Test Pattern drop-down list.

c. Click the **More...** command button.

d. Select **External PDH** in the Tx Clock drop-down list.

e. Set the Frequency Synthesizer frequency.

f. Set the output power of the Frequency Synthesizer to **+4 dBm** ($\approx$1 V_{p-p} into 50 Ω).

g. Set the Frequency Synthesizer RF output to **ON**.

h. Set the Frequency Synthesizer deviation.

i. Set the Function Generator frequency.

Table I–6: Input jitter tolerance mask

En rate	Tx, Tx test pattern	Synthesizer frequency	Jitter test 1	Jitter test 2	Jitter test 3	Jitter test 4
2 Mb/s Unbalanced	PRBS2^15–1	2.048 MHz	Synthesizer Deviation 100 Hz Function Generator Frequency 20 Hz (1.59 UI_{p-p})	Synthesizer Deviation 11.3 kHz Dev Function Generator Frequency 2.4 kHz (1.59 UI_{p-p})	Synthesizer Deviation 11.3 kHz Function Generator Frequency 18 kHz (0.2 UI_{p-p})	Synthesizer Deviation 62.9 kHz Function Generator Frequency 100 kHz (0.2 UI_{p-p})
34 Mb/s	PRBS2^23–1	34.368 MHz	Synthesizer Deviation 500 Hz Function Generator Frequency 100 Hz (1.59 UI_{p-p})	Synthesizer Deviation 4.8KHz Function Generator Frequency 1 kHz (1.53 UI_{p-p})	Synthesizer Deviation 4.8 kHz Function Generator Frequency 10 kHz (0.153 UI_{p-p})	Synthesizer Deviation 377 kHz Function Generator Frequency 800 kHz (0.15 UI_{p-p})
140 Mb/s	PRBS2^23–1	278.528 MHz	Synthesizer Deviation 1 kHz Function Generator Frequency 200 Hz (1.59 UI_{p-p})	Synthesizer Deviation 2.5 kHz Function Generator Frequency 500 Hz (1.59 UI_{p-p})	Synthesizer Deviation 2.5 kHz Function Generator Frequency 10 kHz (0.079 UI_{p-p})	Synthesizer Deviation 825 kHz Function Generator Frequency 3500 kHz (0.079 UI_{p-p})

- **j.** Click the **START** button.
- **k.** Click the **Main Results...** command button.
- **l.** Click the **Errors** command button, and then click the **Update** button.
- **m.** Verify that there are no errors.
- **n.** Click the **Alarms** command button, and then click the **Update** button.
- **o.** Verify that there are no alarms.

4. Repeat step 3 for each En Rate and Jitter Test in Table I–6.

***NOTE**. If you have performed all previous functional and physical-layer tests that are applicable to your VX4610, you have now completed the performance verification.*

DS1 NRZ Positive Data Polarity (Option 58 only)

This test verifies the DS1 positive outputs and inputs.

Equipment required	50 Ω SMB coaxial cable (item 23), two required Optical fiber cable (item 14) Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level) 75 Ω BNC coaxial cable (item 19)
Prerequisites	The VX4610 has warmed up for at least 20 minutes plus other prerequisites listed on page I–31
Time required	Approximately five minutes

1. Connect the VX4610 as shown in Figure I–42. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.

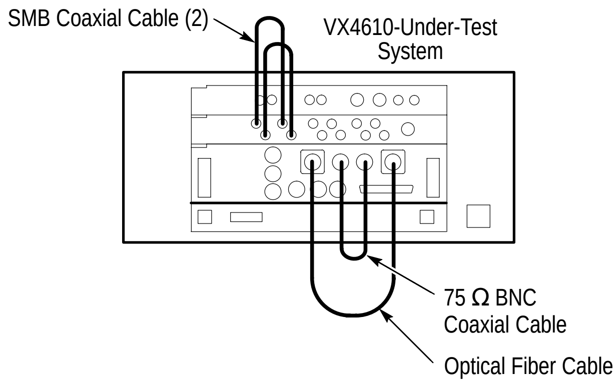


Figure I–42: NRZ tests initial setup

2. Click the **RECALL** icon, click the **From Disk** command button, select **pvsetups**, **nrz**, and the file named **ds1nrz1.set**, and then click **OK.**
3. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.
4. Click the **Start** button and wait thirty seconds for the test to complete.
5. Click the **Error Analysis...** command button. Select **Pattern Bit** or **Payload** from the Analysis for drop-down list, and verify that no Payload Bit errors are reported in the Error Analysis window.

DS1 NRZ Negative Data Polarity (Option 58 only)

This test verifies the DS1 negative outputs and inputs.

Equipment required	50 Ω SMB coaxial cable (item 23), two required Optical fiber cable (item 14) Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level) 75 Ω BNC coaxial cable (item 19)
Prerequisites	The VX4610 has warmed up for at least 20 minutes plus other prerequisites listed on page I–31
Time required	Approximately five minutes

1. Connect the VX4610 as shown in Figure I–42 on page I–118. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.
2. Click the **RECALL** icon, click the **From Disk** command button, select **Pvsetups**, **NRZ**, the file named **ds1nrz2.set**, and then click **OK.**
3. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.
4. Click the **Start** button and wait thirty seconds for the test to complete. Click **Stop**.
5. Click the **Error Analysis...** command button. Select **Pattern Bit** or **Payload** from the Analysis for drop-down list, and verify that no Payload Bit errors are reported in the Error Analysis window.

DS3 NRZ Positive Data Polarity (Option 58 only)

This test verifies the DS3 positive outputs and inputs.

Equipment required	50 Ω SMB coaxial cable (item 23), two required Optical fiber cable (item 14) Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level) 75 Ω BNC coaxial cable (item 19)
Prerequisites	The VX4610 has warmed up for at least 20 minutes plus other prerequisites listed on page I–31
Time required	Approximately five minutes

1. Connect the VX4610 as shown in Figure I–42 on page I–118. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.

2. Click the **RECALL** icon, click the **From Disk** command button, select the file named **ds3nrz1.set**, and then click **OK.**
3. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.
4. Click the **Start** button and wait thirty seconds for the test to complete. Click **Stop**.
5. Click the **Error Analysis...** command button. Select **Pattern Bit** or **Payload** from the Analysis for drop-down list, and verify that no Payload Bit errors are reported in the Error Analysis window. Click **Close**.

DS3 NRZ Negative Data Polarity (Option 58 only)

This test verifies the DS3 negative outputs and inputs.

Equipment required	50 Ω SMB coaxial cable (item 23), two required Optical fiber cable (item 14) 75 Ω BNC coaxial cable (item 19)
Prerequisites	The VX4610 has warmed up for at least 20 minutes plus other prerequisites listed on page I–31
Time required	Approximately five minutes

1. Connect the VX4610 as shown in Figure I–42 on page I–118.
2. Click the **RECALL** icon, click the **From Disk** command button, select the file named **ds3nrz2.set**, and then click **OK.**
3. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.
4. Click the **Start** button and wait thirty seconds for the test to complete. Click **Stop**.
5. Click the **Error Analysis...** command button. Select **Pattern Bit** or **Payload** from the Analysis for drop-down list, and verify that no Payload Bit errors are reported in the Error Analysis window. Click **Close**.

E1 NRZ Positive Data Polarity (Option 58 only)

This test verifies the E1 positive outputs and inputs.

Equipment required	50 Ω SMB coaxial cable (item 23), two required Optical fiber cable (item 14) Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level) 75 Ω BNC coaxial cable (item 19)
Prerequisites	The VX4610 has warmed up for at least 20 minutes plus other prerequisites listed on page I–31
Time required	Approximately five minutes

1. Connect the VX4610 as shown in Figure I–42 on page I–118. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.
2. Click the **RECALL** icon, click the **From Disk** command button, select the file named **e1nrz1.set**, and then click **OK.**
3. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.
4. Click the **Start** button and wait thirty seconds for the test to complete. Click **Stop**.
5. Click the **Error Analysis...** command button. Select **Pattern Bit** or **Payload** from the Analysis for drop-down list, and verify that no Payload Bit errors are reported in the Error Analysis window. Click **Close**.

E1 NRZ Negative Data Polarity (Option 58 only)

This test verifies the E1 negative outputs and inputs.

Equipment required	50 Ω SMB coaxial cable (item 23), two required Optical fiber cable (item 14) Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level) 75 Ω BNC coaxial cable (item 19)
Prerequisites	The VX4610 has warmed up for at least 20 minutes plus other prerequisites listed on page I–31
Time required	Approximately five minutes

1. Connect the VX4610 as shown in Figure I–42 on page I–118. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.

2. Click the **RECALL** icon, click the **From Disk** command button, select the file named **e1nrz2.set**, and then click **OK.**

3. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.

4. Click the **Start** button and wait thirty seconds for the test to complete. Click **Stop**.

5. Click the **Error Analysis...** command button. Select **Pattern Bit** or **Payload** from the Analysis for drop-down list, and verify that no Payload Bit errors are reported in the Error Analysis window. Click **Close**.

E3 NRZ Positive Data Polarity (Option 58 only)

This test verifies the E3 positive outputs and inputs.

Equipment required	50 Ω SMB coaxial cable (item 23), two required Optical fiber cable (item 14) Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level) 75 Ω BNC coaxial cable (item 19)
Prerequisites	The VX4610 has warmed up for at least 20 minutes plus other prerequisites listed on page I–31
Time required	Approximately five minutes

1. Connect the VX4610 as shown in Figure I–42 on page I–118. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.

2. Click the **RECALL** icon, click the **From Disk** command button, select the file named **e3nrz1.set**, and then click **OK.**

3. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.

4. Click the **Start** button and wait thirty seconds for the test to complete. Click **Stop**.

5. Click the **Error Analysis...** command button. Select **Pattern Bit** or **Payload** from the Analysis for drop-down list, and verify that no Payload Bit errors are reported in the Error Analysis window. Click **Close**.

E3 NRZ Negative Data Polarity (Option 58 only)

This test verifies the E3 negative outputs and inputs.

Equipment required	50 Ω SMB coaxial cable (item 23), two required Optical fiber cable (item 14) Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level) 75 Ω BNC coaxial cable (item 19)
Prerequisites	The VX4610 has warmed up for at least 20 minutes plus other prerequisites listed on page I–31
Time required	Approximately five minutes

1. Connect the VX4610 as shown in Figure I–42 on page I–118. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.
2. Click the **RECALL** icon, click the **From Disk** command button, select the file named **e3nrz2.set**, and then click **OK.**
3. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.
4. Click the **Start** button and wait thirty seconds for the test to complete. Click **Stop**.
5. Click the **Error Analysis...** command button. Select **Pattern Bit** or **Payload** from the Analysis for drop-down list, and verify that no Payload Bit errors are reported in the Error Analysis window. Click **Close**.

E4 NRZ Single-Ended ECL (Option 58 only)

This test verifies the E4 NRZ ECL data interface running in the single-ended ECL mode.

Equipment required	50 Ω SMB coaxial cable (item 23), four required Optical fiber cable (item 14) Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level) 75 Ω BNC coaxial cable (item 19)
Prerequisites	The VX4610 has warmed up for at least 20 minutes plus other prerequisites listed on page I–31
Time required	Approximately five minutes

1. Connect the VX4610 as shown in Figure I–43. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.

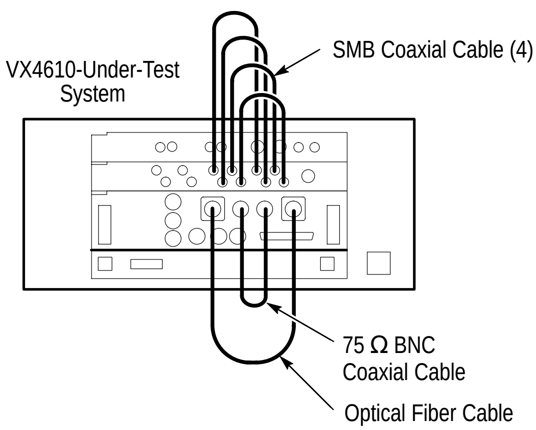


Figure I–43: E4 NRZ tests setup

2. Click the **RECALL** icon, click the **From Disk** command button, select the file named **e4nrz1.set**, and then click **OK.**
3. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.
4. Click the **Start** button and wait thirty seconds for the test to complete. Click **Stop**.
5. Click the **Error Analysis...** command button. Select **Pattern Bit** or **Payload** from the Analysis for drop-down list, and verify that no Payload Bit errors are reported in the Error Analysis window. Click **Close**.

E4 NRZ Differential ECL (Option 58 only)

This test verifies the E4 NRZ ECL data interface running in the differential ECL mode.

Equipment required	50 Ω SMB coaxial cable (item 23), four required Optical fiber cable (item 14) Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level) 75 Ω BNC coaxial cable (item 19)
Prerequisites	The VX4610 has warmed up for at least 20 minutes plus other prerequisites listed on page I–31
Time required	Approximately five minutes

1. Connect the VX4610 as shown in Figure I–43 on page I–124. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.
2. Click the **RECALL** icon, click the **From Disk** command button, select the file named **e4nrz2.set**, and then click **OK.**
3. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.
4. Click the **Start** button and wait thirty seconds for the test to complete. Click **Stop**.
5. Click the **Error Analysis...** command button. Select **Pattern Bit** or **Payload** from the Analysis for drop-down list, and verify that no Payload Bit errors are reported in the Error Analysis window. Click **Close**.

E4 NRZ Single-Ended PECL (Option 58 only)

This test verifies the E4 NRZ ECL data interface running in the single-ended PECL mode.

Equipment required	50 Ω SMB coaxial cable (item 23), four required Optical fiber cable (item 14) Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level) 75 Ω BNC coaxial cable (item 19)
Prerequisites	The VX4610 has warmed up for at least 20 minutes plus other prerequisites listed on page I–31
Time required	Approximately five minutes

1. Connect the VX4610 as shown in Figure I–43 on page I–124. When the Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.
2. Click the **RECALL** icon, click the **From Disk** command button, select the file named **e4nrz3.set**, and then click **OK.**
3. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.
4. Click the **Start** button and wait thirty seconds for the test to complete. Click **Stop**.
5. Click the **Error Analysis...** command button. Select **Pattern Bit** or **Payload** from the Analysis for drop-down list, and verify that no Payload Bit errors are reported in the Error Analysis window. Click **Close**.

E4 NRZ Differential PECL (Option 58 only)

This test verifies the E4 NRZ ECL data interface running in the differential PECL mode.

Equipment required	50 Ω SMB coaxial cable (item 23), four required Optical fiber cable (item 14) Optical attenuator (item 9) set to10 dB if an Option 05 or 10 Optical Plug-in Interface Module is installed (0 dB output level) 75 Ω BNC coaxial cable (item 19)
Prerequisites	The VX4610 has warmed up for at least 20 minutes plus other prerequisites listed on page I–31
Time required	Approximately five minutes

1. Connect the VX4610 as shown in Figure I–43 on page I–124. When Option 05 or 10 optical module is installed, use the optical attenuator set to 10 dB to protect the receiver inputs.
2. Click the **RECALL** icon, click the **From Disk** command button, select the file named **e4nrz4.set**, and then click **OK.**
3. Click the **Auto Update** check box in the **RESULTS** group if it is not already checked.
4. Click the **Start** button and wait thirty seconds for the test to complete.
5. Click the **Error Analysis...** command button. Select **Pattern Bit** or **Payload** from the Analysis for drop-down list, and verify that no Payload Bit errors are reported in the Error Analysis window.

Option 02 ECL Interface Module Diagnostics

These tests run the built-in diagnostics using loop-back connections from the outputs to the inputs of the ECL Interface module.

Equipment required	50 Ω SMA Coaxial Cable (item 22) for electrical loop-back, four required
Prerequisites	VX4610 warmed up for at least twenty minutes
Time required	Approximately ten minutes

CAUTION. *To prevent damage to the cables and module connectors, the cable connections should only be finger tightened.*

Figure I–44 shows the location of the status lights and termination configuration switches.

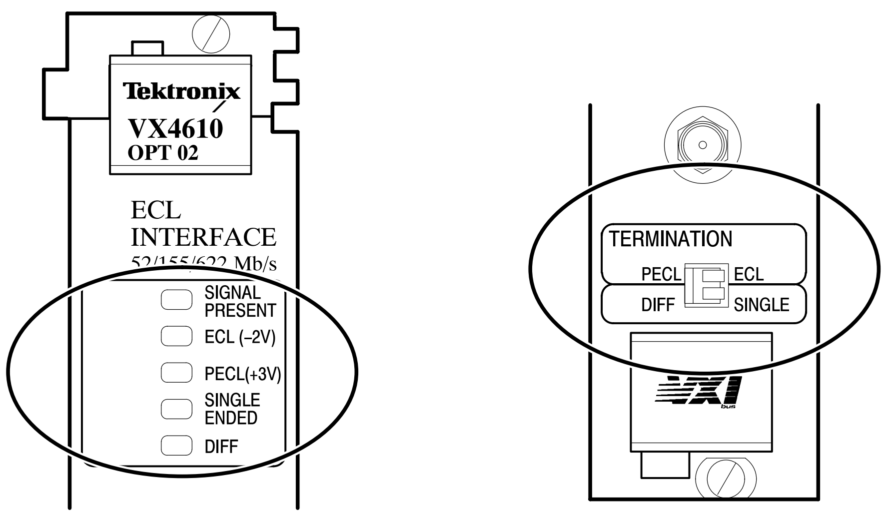


Figure I–44: ECL interface status lights and termination configuration switches

Single-Ended Operation Loopback. This procedure tests the single-ended operation of the module.

1. Set the termination configuration switches to the **ECL** and **SINGLE** positions.
2. Check that the **ECL** and **SINGLE ENDED** status lights turn on to confirm the switch positions.

3. Attach loop-back connections on the ECL Interface module using the SMA cables. See Figure I–45.

   a. Connect **OUTPUT DATA** to **INPUT DATA**.

   b. Connect **OUTPUT CLOCK** to **INPUT CLOCK**.

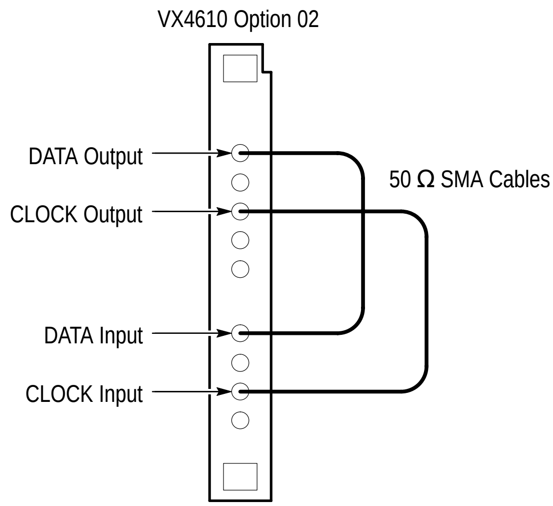


Figure I–45: Single-ended loopback test setup

4. Select **52 Mb**, **155 Mb**, or **622 Mb ECL** in the TX Rate drop-down list.

5. Check that the **SIGNAL PRESENT** status light comes on to confirm complete cable connection.

6. In the UI4610 Software menu bar, select **Tools** → **Command Builder...**.

7. Select **Command Group** → **:DIAGnostic:** → **:BUFFer** → **:CLEAr**, and then click the **SEND** command button.

8. Select **Command Group** → **:DIAGnostic:** → **:SELect** → **ECL**, and then click the **SEND** command button.

9. Select **Command Group** → **:DIAGnostic:** → **:EXECute**, and then click the **SEND** command button.

10. Select **Command Group** → **:DIAGnostic:** → **:RESults?**, and then click the **SEND** command button.

11. Check the Response box of the Command Builder window to confirm that the module has passed the diagnostic test.

12. Select **Command Group** → **COMMON COMMANDS** → ***RST**, and then click the **SEND** command button.

13. Select **52 Mb**, **155 Mb**, or **622 Mb ECL** in the TX Rate drop-down list.
14. To test the signal presence detector, disconnect the **DATA** input to the module.
15. Check that the **SIGNAL PRESENT** status light turns off to indicate a loss of signal.
16. Reconnect the **DATA** input.
17. Repeat step 14 by disconnecting the **CLOCK** input to the module.
18. Reconnect the **CLOCK** input.
19. Select **Command Group** → **Exit** to exit the Command Builder.

Differential Operation Loopback. This procedure tests the differential operation of the module.

1. Set the termination configuration switches to the **PECL** and **DIFF** positions.
2. Check that the **PECL** and **DIFF** status lights will turn on to confirm the switch positions.
3. Attach loop-back connection on the ECL Interface module using the SMA cables. See Figure I–46.
   a. Connect **OUTPUT DATA** to **INPUT DATA**.
   b. Connect **OUTPUT** $\overline{\textbf{DATA}}$ to **INPUT** $\overline{\textbf{DATA}}$.
   c. Connect **OUTPUT CLOCK** to **INPUT CLOCK**.
   d. Connect **OUTPUT** $\overline{\textbf{CLOCK}}$ to **INPUT** $\overline{\textbf{CLOCK}}$.

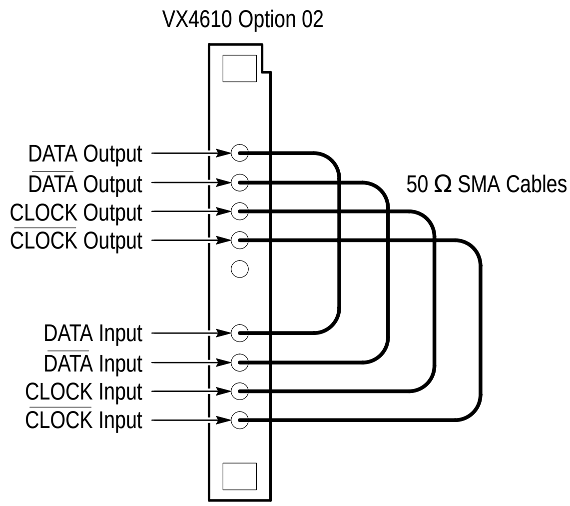


Figure I–46: Differential loopback test setup

4. Check that the **SIGNAL PRESENT** status light comes on when two data inputs and one clock input are present.
5. In the UI4610 Software menu bar, select **Tools** → **Command Builder...**.
6. Select **Command Group** → **:DIAGnostic:** → **:BUFFer** → **:CLEAr**, and then click the **SEND** command button.
7. Select **Command Group** → **:DIAGnostic:** → **:SELect** → **ECL**, and then click the **SEND** command button.
8. Select **Command Group** → **:DIAGnostic:** → **:EXECute**, and then click the **SEND** command button.
9. Select **Command Group** → **:DIAGnostic:** → **:RESults?**, and then click the **SEND** command button.
10. Check the Response box of the Command Builder window to view the status of the diagnostic test.
11. Select **52 Mb**, **155 Mb**, or **622 Mb ECL** in the TX Rate drop-down list.
12. To test the signal presence detector, disconnect the **DATA** input to the module.
13. Check that the **SIGNAL PRESENT** status light turns off when the input is removed.
14. Reconnect the **DATA** input.
15. Check that the **SIGNAL PRESENT** status light comes on when the input is replaced.

16. Repeat steps 12 and 14 by disconnecting the $\overline{\textbf{DATA}}$ input to the module.
17. Reconnect the $\overline{\textbf{DATA}}$ input.
18. To test the clock input circuit, disconnect both the **CLOCK** and $\overline{\textbf{CLOCK}}$ inputs.
19. Check that the **SIGNAL PRESENT** status light turns off only when both clock inputs are removed.
20. Reconnect the clock inputs.
21. Select **Command Group** → **Exit** to exit the Command Builder.

Option 02 ECL Interface Module Frame Pulse to Clock Timing

This test checks the timing difference between the frame and clock pulses.

Equipment required	50 Ω BNC Coaxial Cable (item 26) for electrical loop-back, two required 500 MHz Oscilloscope (item 4) Adapter, SMA Male to BNC Female (item 24), two required
Prerequisites	VX4610 warmed up for at least twenty minutes
Time required	Approximately two minutes

1. Connect the **CLOCK** and **FRAME PULSE** outputs of the ECL Module to the **CH1** and **CH2** inputs of the oscilloscope. Use the SMA male to BNC female adapters with the BNC coaxial cables. See Figure I–47.

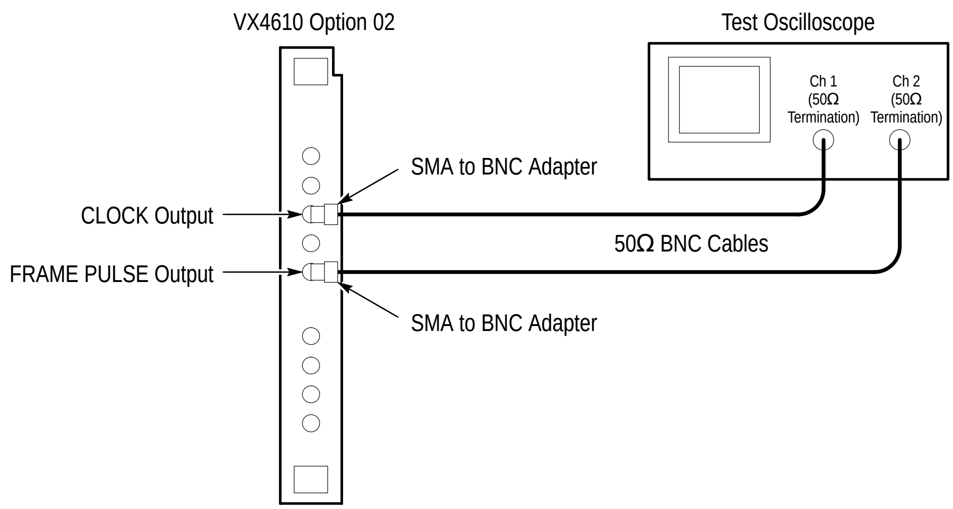


Figure I–47: Frame pulse to clock timing test setup

2. Set the **CH1** and **CH2** input terminations to 50 Ω with **DC** coupling.
3. Set the oscilloscope to trigger on the Frame Pulse signal.
4. Set the oscilloscope to trigger on the rising edge.
5. Set the trigger level to **–80 mV**.
6. Set the vertical display to **1.0 V/div**.
7. Set the horizontal display to **2 nS/div**.
8. In the UI4610 Software GENERATOR group, click on the **Tx Rate** drop-down list and select **52ECL**.

9. Adjust the oscilloscope sweep to display the rising edge of both signals.

10. Check that the leading edge of the frame pulse is 8 ns to 10 ns after the leading edge of the clock pulse. See Figure I–48.

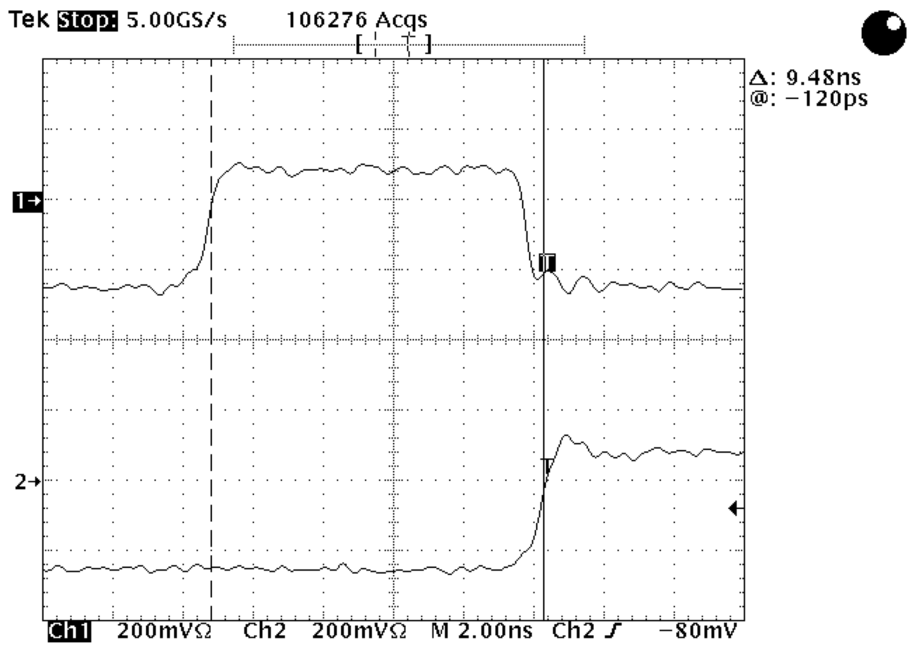


Figure I–48: Typical frame pulse to clock timing

Glossary and Index

Glossary

AIS

An acronym for Alarm Indication Signal. An AIS is used to alert downstream equipment that an upstream failure has been detected.

APS

An acronym for Automatic Protection Switching.

ASCII

An acronym for American Standard Code for Information Interchange.

AU

An acronym for Administrative Unit.

AU-4

Virtual Container (VC) plus the Transport Overhead pointers.

BBE

An acronym for Background Block Error. A Background Block Error is an errored block that occurs outside of a Severely Errored Second.

BER

An acronym for Bit Error Ratio (or Rate). The principal measure of quality of a digital transmission system. BER is defined as:

$$BER = \frac{Number\ of\ Errors}{Total\ Number\ of\ Bits}$$

BER is usually expressed as a negative exponent. For example, a BER of 10^{-7} means that 1 bit out of 10^{7} bits is in error.

BIP

An acronym for Bit Interleaved Parity. A method used to monitor errors in the transmitted signal.

Bit Error

An incorrect bit. Also known as a coding violation.

BITS

An acronym for Building Integrated Timing Supply.

Class 2

A term for ECL-level signals on the VXI Local Bus.

Coding Violation (CV)

An error detected by Bit Interleaved Parity (BIP) checks.

COFA
An acronym for Change of Frame Alignment.

CV
An acronym for Coding Violation.

dB
The symbol for decibels.

dBm
The symbol for power level in decibels relative to 1 mW.

DM
An acronym for Degraded Minute. A minute with a BER greater than 10^{-6}.

DSn
An acronym for Digital Signal-n (DS1, DS2, DS3, and DS4). DS1 is the basic multiplex rate in North America; additional rates are DS2, DS3, and DS4. The following table lists the DSn rates and their multiple of DS1:

Digital signal transmission rates

Level	Rate	Multiple of DS1
DS1	1.544 Mb/s	1
DS1c	3.152 Mb/s	2
DS2	6.312 Mb/s	4
DS3	44.736 Mb/s	24

EB
An acronym for Errored Block. An Errored Block is a block with one or more bit errors, usually applied to a single SDH frame.

ECL
An acronym for Emitter Coupled Logic.

EFS
An acronym for Error Free Seconds.

ES
An acronym for Errored Second. A second with at least one error.

E1, E2, E3, E4
The preferred names for the ITU 2 Mb/s, 8 Mb/s, 32 Mb/s, and 140 Mb/s tributary signals.

FEBE
An acronym for Far End Block Error. An indication returned to the transmitting LTE that an errored block has been detected at the receiving LTE. See REI.

FERF
An acronym for Far End Receive Failure. A FERF indicates to the transmitting LTE that the receiving LTE has detected an incoming line failure or is receiving a Line AIS. See RDI.

Gapped Clock
A discontinuous clock signal that appears in bursts separated by gaps.

ITU
An acronym for the International Telecommunication Union.

Line
The portion of a transmission line between two multiplexers.

Line Alarm Indication Signal (AIS)
A Line AIS is generated by Section Terminating Equipment upon Loss of Signal or Loss of Frame.

Line Coding Violation (CV)
The sum of the BIP errors detected at the Line layer. Line CVs are collected using the BIP codes in the B2 bytes of the Line Overhead.

Line Errored Second (ES)
A second during which at least one Line CV occurred, or a second during which the line was in the Line AIS state.

Line Far End Receive Failure (FERF)
An indication returned to a transmitting LTE from the receiving LTE that a Line AIS or incoming line failure has been detected.

Line Overhead (LOH)
Controls the payload information using the section layer and provides alarm indications, error monitoring, and message signalling between two LTEs.

Line Severely Errored Second (SES)
A second with N or more Line CVs, or a second during which the line was in the Line AIS state. The value of N varies with the transmit rate, but corresponds to a 2×10^{-7} BER.

LOF
An acronym for Loss of Frame.

Logical address
A specific, unique address setting for modules in a VXIbus system.

LOP
An acronym for Loss of Pointer.

LOS
An acronym for Loss of Signal.

LTE
An acronym for Line Terminating Equipment.

Mapping
The process of placing a tributary signal into a SONET SPE or an SDH AU.

Mb/s
Megabits per second.

MS
An acronym for Multiplexer Section.

MS–RDI
An SDH acronym for Line Remote Defect Indication. A signal returned to the transmitting Terminating Equipment upon detecting a Loss of Signal defect. Previously known as MS-FERF.

NE
An acronym for Network Element.

OC
An acronym for Optical Carrier.

OOF
An acronym for Out of Frame.

Optical Carrier Level N (OC-N)
An optical version of an STS-N signal.

Path
The portion of a transmission network between two terminal multiplexers.

Path Overhead (POH)
A set of bytes allocated within the information payload to carry status and maintenance information between two network elements.

POH
An acronym for Path Overhead.

PTE
An acronym for Path Terminating Equipment. Network elements, such as fiber-optic terminating systems, which can access, generate, and process Path Overhead.

RAI
An acronym for Remote Alarm Indication. A code sent upstream in a DSn

network as a notification that a failure condition has been declared downstream. Previously known as Yellow signals.

RDI

An acronym for Remote Defect Indication. A signal returned to the transmitting Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect. Previously known as Far End Receive Failure (FERF).

RDI–L

A SONET acronym for Line Remote Defect Indication. A signal returned to the transmitting Line Terminating Equipment (LTE) upon detecting a Loss of Signal, Loss of Frame, or AIS–L defect. Previously known as Line FERF or LFERF.

RDI–P

A SONET acronym for STS Path Remote Defect Indication. A signal returned to the transmitting STS Path Terminating Equipment (PTE) upon detecting certain defects on the incoming path. Previously known as Path FERF or PFERF.

RDI–V

A SONET acronym for Virtual Tributary or VT Path Remote Defect Indication. A signal returned to the transmitting VT PTE upon detecting certain defects on the incoming path. Previously known as Path VTFERF.

REI

An acronym for Remote Error Indication. An indication returned to a transmitting node (source) that an errored block has been detected at the receiving node (sink). Previously known as Far End Block Error (FEBE).

REI–L

An acronym for Line Remote Error Indication. An indication returned to a transmitting node (source) that an errored block has been detected at the receiving node (sink). Previously known as Line FEBE.

REI–P

An acronym for STS Path Remote Error Indication. An indication returned to a transmitting node (source) that an errored block has been detected at the receiving node (sink). Previously known as Path FEBE.

REI–V

An acronym for VT or Virtual Tributary Remote Error Indication. An indication returned to a transmitting node (source) that an errored block has been detected at the receiving node (sink). Previously known as VTFEBE.

RS

An acronym for Regenerator Section.

Rx
An abbreviation for Receive.

Scrambling
Scrambling is a form of data manipulation to improve clock recovery from a signal.

SDH
An acronym for Synchronous Digital Hierarchy.

Section
The portion of a transmission line between a Network Element (NE) and a Line Terminating Equipment (LTE) or two LTEs.

Section Coding Violation (CV)
A BIP error that is detected at the Section layer. CVs for the Section layer are collected using the BIP-8 in the B1 byte located in the Section overhead of STS-1 number 1.

Section Errored Second (ES)
A second during which at least one Section CV or OOF/COFA event occurred, or a second during which the NE was (at any point during the second) in the LOS state.

Section Overhead (SOH)
A set of bytes allocated within each frame to carry framing and error monitoring information between an NE and LTE or between two LTEs. Part of the transport overhead.

SES
An acronym for Severely Errored Seconds.

Severely Errored Seconds (SES)
A second with more than N CVs. N varies with the transmit rate but corresponds to a BER of 2×10^{-7}.

Slot 0
The location in a VXIbus mainframe for a controller or resource manager module.

SOH
An acronym for Section Overhead.

SONET
An acronym for Synchronous Optical NETwork.

SPE
An acronym for Synchronous Payload Envelope.

STE
An acronym for Section Terminating Equipment.

STM

An acronym for Synchronous Transport Module.

STM-N

An acronym for Synchronous Transport Module-N (STM-1, -4, -16). The different STM-N rates for the SDH Signal Hierarchy are listed in the following table:

SDH signal hierarchy

Electrical signal	Optical signal	Data rate (Mb/s)
STM0E	STM-0	51.84
STM1E	STM-1	155.52
	STM-4	622.08
	STM-8	1244.16
	STM-16	2488.32

STS

An acronym for Synchronous Transport Signal.

STS-N

An acronym for Synchronous Transport Signal level-N (STS-1, -3, -9, -12, -18, -24, -36, -48). The different STS-N rates (and their optical equivalents) for the SONET Signal Hierarchy are listed in the following table:

SONET signal hierarchy

Electrical signal	Optical signal	Data rate (Mb/s)
STS-1	OC-1	51.84
STS-3	OC-3	155.52
STS-9	OC-9	466.56
STS-12	OC-12	622.08
STS-18	OC-18	933.12
STS-24	OC-24	1244.16
STS-36	OC-36	1866.24
STS-48	OC-48	2488.32

TE

An acronym for Terminal Equipment.

Through Mode
The ability to retransmit the incoming signal and manipulate its contents.

TOH
An acronym for Transport Overhead.

Transport Overhead (TOH)
A set of bytes allocated within each frame to carry operation, administration, and maintenance information from one end of the system to the other.

Tributary
A lower-rate signal that is input to a multiplexer for combination (multiplexing) with other low rate signals to form a higher-rate signal.

TTLTRG*
The TTL-level trigger bus on the VXIbus backplane.

TU
An acronym for Tributary Unit. A structure (not a signal) designed for transport and switching of sub-AU-4 payloads. The TU sizes currently in use are TU-11, TU-12, and TU-3.

TUG
An acronym for Tributary Unit Group.

Tx
An abbreviation for Transmit.

VC
An acronym for Virtual Container.

VT
An acronym for Virtual Tributary. A structure (not a signal) designed for transport and switching of sub-STS payloads. The sizes of VT currently in use are VT1.5, VT2, VT3, and VT6.

VXIbus
A standardized backplane and system specification for modular instrumentation.

VXI Local Bus
Lines in the VXIbus backplane for direct communication between adjacent modules.

Yellow Signal
A code sent upstream to indicate that a failure condition has been declared downstream. See RAI.

Index

S

T

U

V

W