EPX User's Guide

Edition 2.1

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REVISION HISTORY

Revision and Date	Description
2.1 06/2002	Updated for Checkpoint/Resume, enhanced SONET/SDH switching, performance monitoring, and STM-4/1, STM-16, and STM-64 modules.
2.0.5 03/2002	Updated for new STM-1 CMI Transmitter and Receiver, for Summary View in EPXam, and for new OC-192 features (overhead insertion, service disruption, new mappings, and stuff columns).
2.0.3 01/2002	Updated for new OC-48 Transmitter and OC-48 Receiver module features: backplane input/output, STS-1 payload stuff column settings, and B1 BIP regeneration settings.
2.0.2 11/2001	Updated for OC-192 document bugs, new OC-48 Tcvr clock source, and clock module and chassis specifications.
2.0.1 11/2001	Updated for EPXam 2.0.1 release of OC-48 Rx and Tx module enhancements.
2.0 9/2001	Updated for EPXam 2.0, STS-1, OC-192, Splitter, and Optical Switch modules
1.2 6/2001	Added EPXOS 1.2.0 updates
1.1 4/2001	Added EPXOS 1.1.5c updates
1.0 11/2000	Initial release

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Part 1 EPX Test System User's Guide

The chapters in this section describe how to use the features of the EPX Test System:

1

USING EPXAM

The EPXam main window controls the graphical user interface (GUI) for the EPX Test System.

The topics in this section provide an overview of the main features of EPXam and how to access them:

EPXam Main Window

The EPXam main window is displayed when you log into the test system and are using the GUI. The default view displays a full logical view of the test system, along with module and group status indicators. This enables you to quickly see what types of test modules are assigned to each slot in the system and view their status.

The default view shows the logical layout of the test system, with all slots and indicators showing. See "Changing the EPXam Main Window View" on page 5 for information about other view options.

The following figure describes the main features of the EPXam main window, using the default display options.

A **EPXam main menu**—Provides menus options for exiting EPXam, setting main window view options, running EPX system tools for logging, system setup, managing groups, running, tests, and so on.

B **EPXam toolbar**—Shortcuts for quick access to Save/Restore, Logging, Group Manager, SCPI Commander, and Test Controls. See “Running EPX Test System Tools” on page 10.

C **Change view**—Shortcuts for switching between logical and physical system views in the EPXam main window. See “Changing the EPXam Main Window View” on page 5.

D **Connection status**—When this indicator is Green, it means that commands can be sent to the EPX and subscription data can be received from the EPX. If either the command or subscription channel are not active, this indicator is Red. You must exit EPXam and re-login to the EPX Test System to reconnect. See “Viewing System Status” on page 10.

E **EPX module window access**—Click on the name of a module to open a window in which you can set up, run, or monitor tests for that module. See “EPX Test System Module Window Reference” on page 155.

F **Module status indicators**—Summary view of clock, test, and defect status for each module (see “Interpreting EPXam Main Window Module Indicators” on page 7).

G **Group status indicators**—Indicates which modules belong to groups and whether the groups are reserved for group use. Modules that are reserved are outlined in Red. See “Groups” on page 49.

H **Number of Connections**—Indicates the number of connections to this EPX chassis and the maximum number of connections allowed. EPXam, SCPI Commander, and Script Runner each open a separate connection to the EPX Test System.

Changing the EPXam Main Window View

The default EPXam main window view is a logical view showing all slots, module indicators, and group assignment status. Use the options in the **View** menu to change the layout of the EPXam main window.

Perform the following steps to change the default view:

1. Open the **View** menu in the EPXam main window.
2. Select either **Logical View** or **Physical View**.

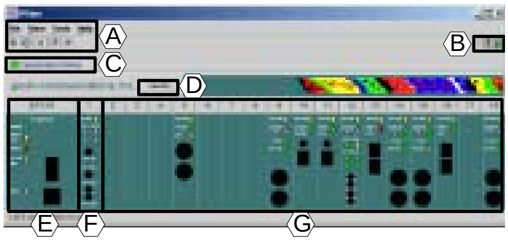
Logical View	Vertical display of slots in logical order, from 1 to 18 (EPX16 chassis) or 1 to 9 (EPX8 or TransPort chassis). This view takes up less space, provides additional information, and includes options for hiding empty slots, selecting specific modules, expanded Summary view, module indicators, and group status.
Physical View	Horizontal display of slots that represents the physical layout of the test system front panel from left to right. The layout of the front panel LEDs and ports shown in the physical view match those on the physical module and behave similarly. This view is similar to the layout in earlier versions of the test system GUI.

3. In **Logical View**, use the following options to choose which modules are shown:
   - **Select Modules...**—This option enables you to choose exactly which modules to display in the logical view. Enter one or more slot numbers and/or slot ranges separated by commas. For example, enter 2,4,10-15 to show only the modules in slots 2, 4, 10, 11, 12, 13, 14, and 15 in the main view.
   - **Hide Empty**— Check this option to hide empty slots in the logical view.
4. In **Logical View**, check one of the following options to choose the amount of detail to display for each module:
   - **Compact**—Hide module indicators and group status information in the logical view.
   - **Normal**— Show slots, modules, clock and module status indicators, and group status areas. This is the default setting.
   - **Expanded**— Show the expanded module status summary in the main window. See “Expanded Module Status Summary” on page 6.

Physical View

The following figure illustrates the main features of the EPXam main window physical view for an EPX16 Test System.

EPX module LEDs, I/O, and ports shown in the physical view match those on the front panel of the actual modules.



A Menus and shortcut icons for accessing EPX Test System tools and features, exiting the system, and viewing online help

B Switch between logical and physical view

C Connection status—When this indicator is Green, it means that commands can be sent to the EPX and subscription data can be received from the EPX.

D Identify button—When pressed, the ACTIVE LINK front panel LED on the CPU module flashes to identify this EPX chassis.

E CPU module

F Clock module

G Front panel physical view showing each slot

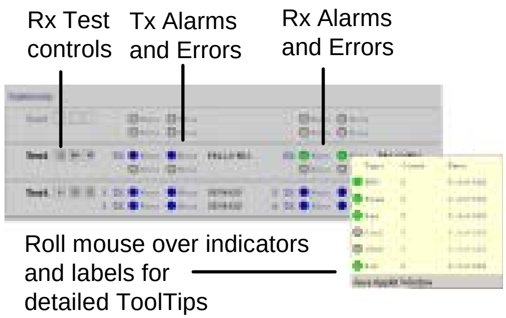
Tip Click the number of a slot with an installed module to open that slot's module window.

Expanded Module Status Summary

Selecting the Expanded view adds a Summary panel with test controls and detailed status indicators for each module. The Summary panel includes test controls and status indicators.

A similar module Summary panel is also displayed at the top of each module's detail window.

Roll the mouse over indicators or text labels in the Summary panel to display ToolTips with more detailed information. See "Expanded Logical View Indicators" on page 8 for information about each indicator.

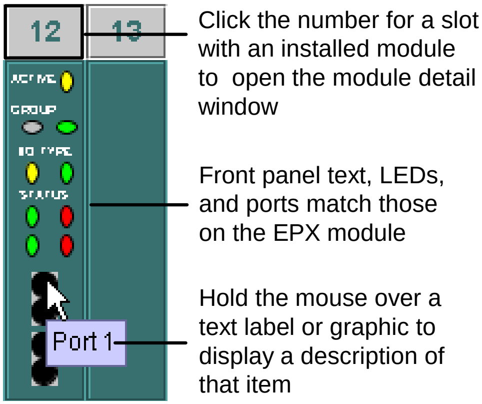


Interpreting EPXam Main Window Module Indicators

EPXam provides module indicators in the physical and logical views of the EPXam main window. The number and layout of the module indicators vary according to the EPXam view option that is selected (logical or physical).

Physical View Indicators

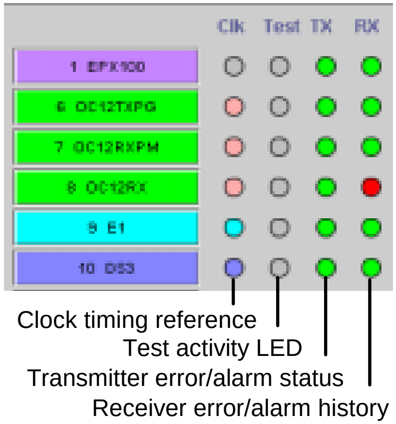
The LEDs, inputs and outputs, and other ports shown in the physical view match those on the front panel of actual EPX modules. The following figure shows an example of an EPX module front panel in the physical view.



Tip Hold the mouse over a text label or graphic in the physical view to display more information about that item.

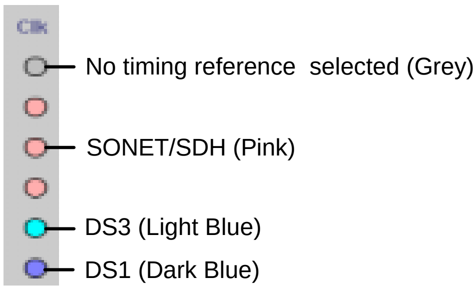
Normal Logical View Indicators

The following figure shows the layout of the module indicators in the logical view.



The EPXam main window module indicators are interpreted as follows:

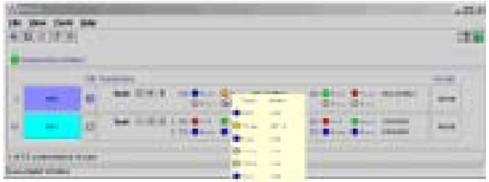
- **Clk**—Indicates the current timing reference signal configured for this slot. This indicator is only available in the logical system view. The **Clk** indicator colors are interpreted as follows:



- **Test**—Test activity LED (only applies to receiver and transceiver modules):
  - **Green**—Module is currently running a test.
  - **Grey**—No test is being run.
- **RX**—Receiver alarm/error history:
  - **Green**—No alarms or errors are currently being received.
  - **Yellow**—Errors or alarms are not currently being received. Errors or alarms were received earlier in the current test session.
  - **Red**—Errors or alarms are currently being received. If the receiver is a multiport receiver, the indicator is Red if errors are being received on any port.
  - **Grey**—The indicator does not apply to this module.
- **TX**—Transmitter error/alarm history:
  - **Green**—No errors or alarms are being inserted or transmitted.
  - **Red**—Errors or alarms are being inserted or transmitted. If the transmitter is a multiport transmitter, this indicator is Red if errors are being transmitted on any port.
  - **Grey**—The indicator does not apply to this module.

Expanded Logical View Indicators

This section describes the controls and indicators in the expanded Summary View. A separate set of indicators is displayed for each Tx or Rx port, as shown in the following figure.



Rx Alarm and Error Indicator Colors

- Green. None received.
- Red. At least 1 alarm/error is active.
- Yellow. At least 1 alarm/error was active.
- Grey. Does not apply.

Tx Alarm and Error Indicator Colors

- Blue. No errors or alarms inserted.
- Orange. Alarms/errors are being inserted.
- Grey. Does not apply.

Summary view indicators and labels are explained in more detail in the following table.

Indicator	Description
Test Controls	Start, stop, pause, and resume tests. These controls are inactive for transmitters modules or Tx ports.
Tx Alarm and Error Status	Tx **Alarm** and **Error** status indicator colors and labels: **Blue**—No alarms or errors are being inserted by the transmitter. The label displays None. **Orange**—Alarms or errors are being inserted by the transmitter. The label next to the indicator displays the type of alarm or error being inserted. **Grey**—Does not apply. **`Label/Label`**—These text labels display module information such as currently selected payload pattern, framing mode, and payload mapping. Use ToolTips to see more information. **ToolTips**—Roll the mouse over alarm and error indicators or text labels to view ToolTips with more detailed information. This detail includes status indicators for all alarms that can be inserted, current error insertion ratio for each error type, payload data pattern, and other module details.

Indicator	Description
Rx Alarm and Error Status	Rx **Alarm** and **Error** status indicator colors and labels: **Green**—No alarms or errors have been received, or the test has not be started yet. The label displayes None. **Red**—At least one alarm or error is active. The label displays the name of the highest enabled, active alarm or error being received. Use ToolTips to determine if more than one alarm is active. **Yellow**—No alarms or errors are currently active, but at least one alarm or error was active during the current test. The label next to the indicator displays the name of the highest alarm or error in the hierarchy that applies. Use ToolTips to see more information. **Grey**—Does not apply. **`Label/Label`**—These text labels display module information such as currently selected payload pattern, framing mode, and payload mapping. Use ToolTips to see more information. **ToolTips**—Roll the mouse over alarm and error indicators or text labels to display ToolTips with more detailed information. This detail includes status indicators for all alarms that can be monitored, current error counts and ratios for each error type, payload data pattern, and other module information.

Viewing System Status

To view EPX Test System status, select **Tools > EPX Status**. The following information is displayed in the EPX Status window:

- EPX Test System date and time
- **Command channel** status indicator
  - **Green**—A connection to the EPX is established, and commands can be sent to the channel.
  - **Red**—This indicates a loss of connection to the EPX Test System or a problem with EPX Test System.
- **Subscription channel** status indicator:
  - **Green**—A connection is established and subscription data can be received.
  - **Red**—This indicates a loss of connection to the EPX Test System or a problem with the EPX Test System.

See “Setting Time and Date” on page 35 for instructions on how to set the time and date and other system-wide settings.

Running EPX Test System Tools

To access EPX Test System tools:

- Select the tool you want to run from the **Tools** menu in the EPXam main window.
- Click on an icon in the EPXam main window toolbar.

The available system tools are described in the following table:

Tool	Description
Save/Restore	Save or restore custom test configurations for modules and restore factory settings. See “Saving and Restoring Test Configurations” on page 107 for more information.
Test Controls	Control test execution for any combination of modules and groups in an EPX chassis from a central location. See “Controlling Tests” on page 115 for more information.
Checkpoint/ Resume	View date and time of last test system power-down and power-up. At regular intervals, the test system saves test state and data for modules that support Checkpoint/ Resume. Tests in progress are resumed if they are interrupted by a power outage. If you are using EPXam Pro, the checkpoint interval is configurable. See “Checkpoint/Resume” for more information.
Logging	Log error and alarm data to files and view data from saved log files. See “Logging” on page 63 for more information.

Tool	Description
Group Manager	Create and manage groups to ensure that modules in test are protected from simultaneous use by other users See“Groups” on page 49 for more information.
SCPI Commander	Open a separate connection with a command and subscription channel to issue commands and subscribe to events on the EPX Test System. See “SCPI Commander” on page 89 for more information.
SCPI Monitor	View commands sent to the EPX by the GUI and data from events subscribed to by the GUI. See “SCPI Monitor” on page 92 for more information.
Script Runner	Create and run SCPI scripts. See “Script Runner” on page 99 for more information.
SONET/SDH Switcher	Reconfigure SONET modules as SDH modules or reconfigure SDH modules as SONET modules. See “Using the SONET/SDH Switcher” on page 121. You do not need to restart the test system or EPXam after swtching between SONET and SDH protocols.
EPX Setup	View or set system date and time, RS-232 connection parameters (EPXam Pro only), or network IP address settings. This window also displays the MAC address of the EPX CPU module. If you are using EPXam Pro, you can also set the maximum number of client connections (up to 10) and configure the Checkpoint/Resume interval. You must log into the EPX Test System as root to access and modify settings using this tool. See “Modifying EPX Network and System Settings” on page 33.
EPX Status	View test system date/time and connection status. See “Viewing System Status” on page 10.
License Manager	View EPXam Pro software licensing status. “EPXam Pro Licensing” on page 149.

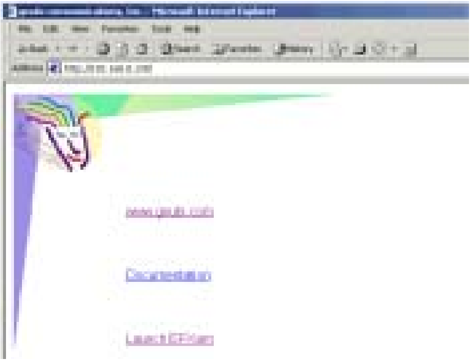
Viewing Online Help

To view EPX Test System online help within EPXam Pro:

- Select **Help > Help Topics** from EPXam main window menu.
- Click **Help** on any EPX module or tool window.

To view EPX Test System online help from EPXam, click the **Documentation** link on the EPXam home page.

The EPXam home page is the page that displays in your web browser when you first connect to the EPXam Test System, as shown in the following figure.



To display EPXam version and copyright information, select **Help > About EPX**. See "Checking Versions" on page 131 for instructions on how to display more detailed version information.

Exiting the EPXam Main Window

To exit the EPXam main window:

- Select **File > Exit** from the EPXam main window menu.
- Click the Close icon on the EPXam main window.

Note Clicking the Close icon on the DOS shell window from which you ran the EPXam GUI closes all windows and closes the connection to the EPX Test System.

Closing EPXam does not stop test execution.

2

BERT Example

This section describes the general procedure for setting up EPX modules for Bit Error Rate Testing (BERT) using a DS1 Quad Transceiver.

The goal of the example test is to inject errors from the DS1 transmitter, send the signal to a Unit Under Test (UUT), and check that the signal is received with the expected errors.

Because a DS1 module has four ports that can be configured as transmitters or receivers, only one DS1 module is required.

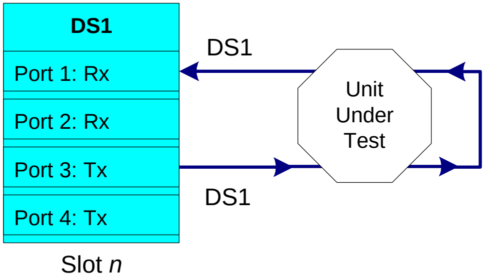
Note The procedures and examples in this section assume that the EPXam graphical user interface is used.

The procedures for setting up, running, and monitoring the DS1 BERT example using EPXam are explained step-by-step in the following sections:

- “Step 1: Connect the DS1 Module to the Unit Under Test” on page 13
- “Step 2: Configure the EPX Clock Module” on page 14
- “Step 3: Configure DS1 Module Setup Options” on page 16
- “Step 4: Configure TX Signal Generation Options” on page 18
- “Step 5: Configure RX Signal Monitoring Options” on page 19
- “Step 6: Start the Test” on page 20
- “Step 7: Monitor Test Data” on page 20
- “Saving and Restoring the BERT Test Configuration” on page 21
- “Changing the Test” on page 22

Step 1: Connect the DS1 Module to the Unit Under Test

The following figure illustrates how the DS1 ports are connected to the UUT to perform the test for this example.



Perform the following steps to connect the DS1 module to the UUT.

1. Before you begin, make sure that the EPX Test System hardware and software are set up and installed as described in the "Initial Setup" and "Software Setup" sections of the *EPX Test System Getting Started* guide, available online at www.gnubi.com.

   In this example, ports 1 and 2 on the DS1 module are configured as receivers, and ports 3 and 4 are configured as transmitters.

2. Connect an outgoing cable to port 3, on the DS1 module.
3. Connect the other end of the cable to the UUT.
4. Connect an incoming cable to port 1, on the DS1 module.
5. Connect the other end of the cable to the UUT.

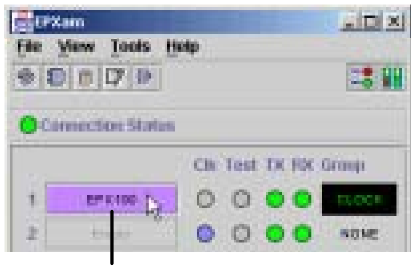
To continue with the BERT example setup, go to the next section, "Step 2: Configure the EPX Clock Module" on page 14.

Step 2: Configure the EPX Clock Module

Before running tests, verify that the EPX Clock Module in slot 1 provide the correct timing reference to each slot in the EPX chassis that has an installed module.

Perform the following steps to make sure that the EPX Clock Module provides a DS1-rate clock to the slot in which the DS1 module is installed.

1. Open the module window for the EPX Clock Module in slot 1.



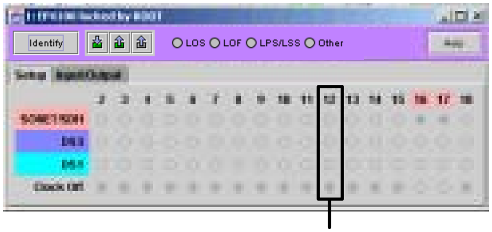
Click here to open the EPX Clock Module window.

The EPX Clock Module is always installed in Slot 1.

When EPX Clock Module window initially opens, the **Setup** tab is selected.

The Clock Module window **Setup** tab shows the available signal rates and indicates what signal rate the clock module currently provides to each slot in the EPX chassis.

The signal/slot selection area is view-only if you are not logged in as root.



In this example, Clock Off is currently selected for slot 12; the EPX Clock Module is not providing any timing reference to slot 12.

2 Determine whether you need to change the Clock Module configuration for the BERT example test.

- If the EPX Clock module already provides a DS1-rate signal to the slot in which the DS1 module is installed, continue with the procedure in "Step 3: Configure DS1 Module Setup Options" on page 16.
- If the EPX Clock module is not sending a DS1-rate signal to the slot in which the DS1 module is installed, continue with the following steps to modify the EPX Clock Module configuration settings so that it does.

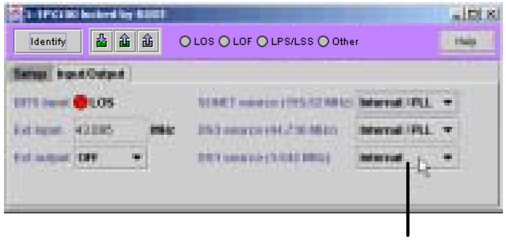
3 Select **File** > **Exit** to close EPXam.

4 Login as root to the EPX Test System.

Note You must be logged in as root to modify configuration settings for the EPX Clock Module.

5 Open the EPX Clock Module window and select the **Input/Output** tab.

6 On the **Input/Output** tab, set the source of the DS1 timing reference to be **Internal** for this example.



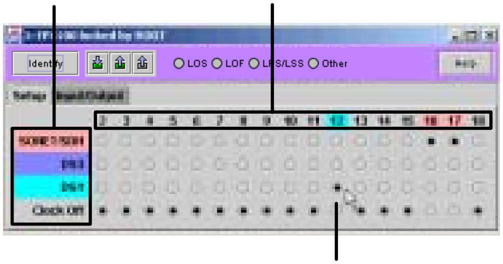
Set the DS1 source to **Internal** for this example.

This specifies that the EPX Clock Module provides the timing reference for the DS1 signal, rather than a BITS or external clock source.

7 Select the **Setup** tab in the EPX Clock Module window. The signal/slot selection area should now be active, because you are logged in as root.

8 Click DS1 for the slot in which the DS1 module is installed, as illustrated in the following figure.

In this example, the DS1 is installed in slot 12.



Configure the EPX Clock Module to provide a DS1 timing reference to the DS1 module in slot 12.

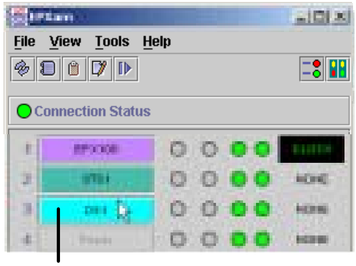
See “Configuring the Clock Module” in the *EPX User’s Guide* for more information (also available at www.gnubi.com).

To continue with the BERT example setup, go to the next section, “Step 3: Configure DS1 Module Setup Options” on page 16.

Step 3: Configure DS1 Module Setup Options

The following steps describe how to configure ports, test type and duration and other setup options for the BERT example.

1 Open the module window for the DS1 module.



Click on the DS1 module to open its module window in logical view

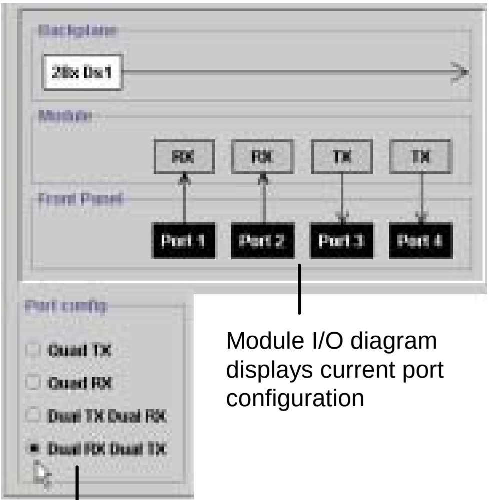
2 Select the **Setup** tab in the DS1 module window.

Select the **Setup** tab

3 Configure which DS1 ports transmit and which receive.

In this example, ports 1 and 2 are configured as receivers, and ports 3 and 4 are configured as transmitters.

To do this, select **Dual RX / Dual TX** in the **Port Config** area of the **Setup** tab.



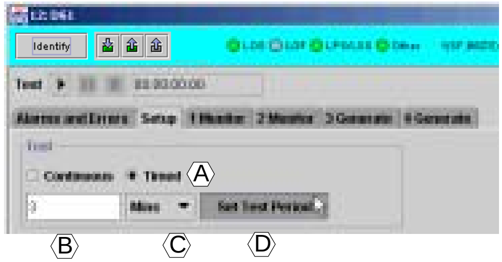
Module I/O diagram displays current port configuration

Select **Dual RX Dual TX** to configure Ports 1 and 2 as receivers and Ports 3 and 4 as transmitters

The DS1 module window updates to display a separate **Generate** tab for each configured TX port, and a separate **Monitor** tab for each configured RX port.

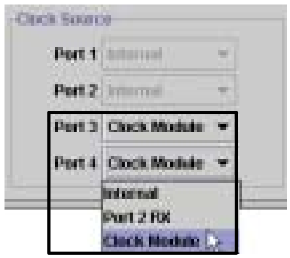
4 In the **Test** section of the **Setup** tab, set the test type and duration.

For this example, specify a three-minute timed test, as illustrated in the following figure.



A. Select **Timed** as the test type.
B. Enter **3** for the duration.
C. Select **Mins** for the unit.
D. Click **Set Test Period**.

5 In the **Clock Source** section of the **Setup** tab, select **Clock Module** as the source of the DS1-rate clock supplied to the transmitter ports (port 3 and port 4) for this test.



Set the clock source for TX port 3 and port 4 to Clock Module

6 Verify that the other options on the **Setup** tab are set to their default values, as listed below:

- **Backplane Output**—Bypass
- **Monitor Source**—Receive
- **Payload**—Unchannelized (all ports)

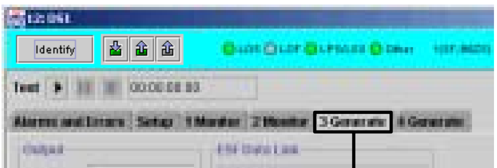
To continue with the BERT example setup, go to the next section, “Step 4: Configure TX Signal Generation Options” on page 18.

Step 4: Configure TX Signal Generation Options

For the procedure in this section, assume that port 1 is monitoring the signal from the UUT and port 3 is transmitting the signal (with injected errors and alarms) to the UUT.

Perform the following steps to define the payload data pattern and type of errors to insert into the generated signal that is transmitted on port 3.

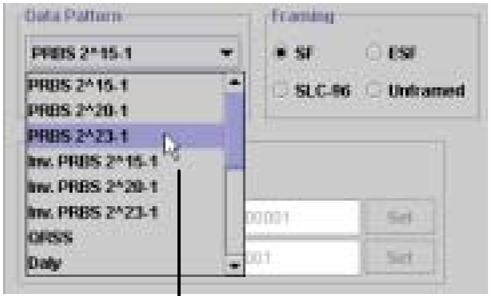
1 Select the port 3 **Generate** tab in the DS1 module window.



Select the port 3 **Generate** tab

In the **Data Pattern** section of the **Generate** tab, select a PRBS pattern from the menu.

For this example, select PRBS 2^{23}-1.

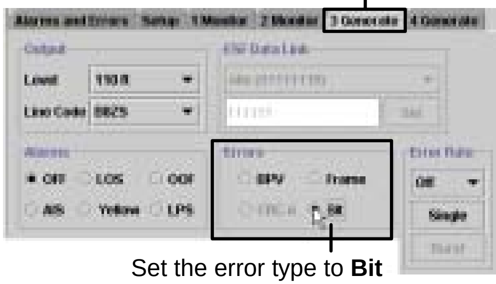


Select PRBS 2^23-1 as the payload data pattern for the generated signal

2 In the **Errors** section of the port 3 **Generate** tab, select the type of error to insert into the generated signal.

For this example, select **Bit** as the error type.

Make sure that the **Generate** tab for port 3 is selected



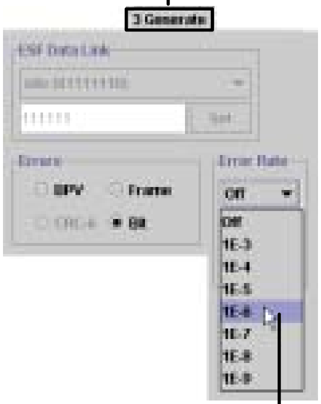
Set the error type to **Bit**

Each time a new error type is selected, error insertion is reset to Off. To enable error insertion, you must select an error rate.

3 In the **Error Rate** section of the **Generate** tab, select the error insertion rate.

For this example, select IE-6, which inserts errors at a rate of 1×10^{-6}.

Select the port 3 **Generate** tab



Set the error insertion rate to IE-6

Selecting an error insertion rate also enables error insertion, which is disabled by default.

4 Verify that the other **Generate** settings are set to their default values, as listed below:

- **Alarms**—Off
- **Output Level**—DSX
- **Output Line Code**—B8ZS
- **Framing**—SF (Superframe)
- **Inband Loopback, ESF Data Link**—These two areas should be greyed out when SF framing is selected.

To continue with the BERT example setup, go to the next section, “Step 5: Configure RX Signal Monitoring Options” on page 19.

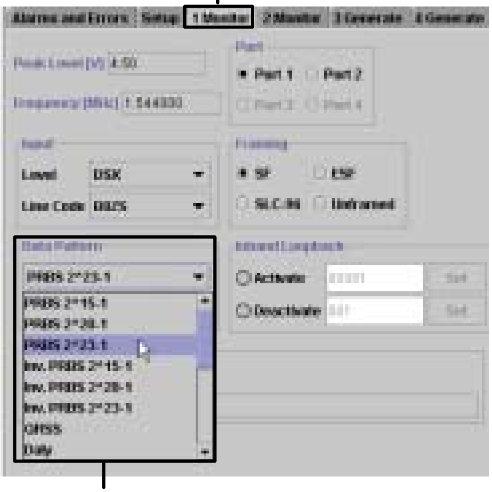
Step 5: Configure RX Signal Monitoring Options

For the procedures in this section, assume that port 1 is monitoring the signal from the UUT and that port 3 is transmitting the signal (with injected errors and alarms) to the UUT. The remainder of the port 2 and port 4 settings will use the default setting.

Perform the following steps to define the payload data pattern to monitor in the signal that is received on port 1.

1 Select the port 1 **Monitor** tab in the DS1 module window.

2 In the **Payload** section, select a PRBS pattern, such as 2^{23}-1.



3 Verify that the other **Monitor** settings are set to their default values, as listed below:

- **Port—**Port 1
- **Level**—DSX
- **Line Code**—B8ZS
- **Framing**—SF (Superframe)
- **Inband Loopback, ESF Data Link**—Inband Loopback monitoring and ESF Data Link messages are not applicable when SF framing is selected.

To continue with the BERT example, go to the next section, "Step 6: Start the Test" on page 20.

Step 6: Start the Test

Perform the following steps to start the test:

1 Open the DS1 module window.

2 Click the start arrow icon in the **Test** area at the top of the DS1 module window to begin testing.

To continue with the BERT example, go to the next section, "Step 7: Monitor Test Data" on page 20.

Step 7: Monitor Test Data

Perform the following steps to monitor the test data for the example test. You do not have to wait until the test completes to view error count and ratio information.

1 Select the **Alarms and Errors** tab to view the error count and ratio data.

You can view the current performance data in this tab at any time during the test; the data displayed in this window is updated continuously as the test runs.

2 Examine the bit error counts and ratio for Port 1 to verify that bit errors were received at the expected rate.

Alarms and Errors tab displays performance data for each port.

Other error/alarm indicator is Red, which shows that bit errors are being received.

Bit error count and ratio for Port 1 shows 73 errors injected at IE-6 at 46 seconds into the test .

To save the test configuration you created for the DS1 BERT example, go to the next section, “Saving and Restoring the BERT Test Configuration” on page 21.

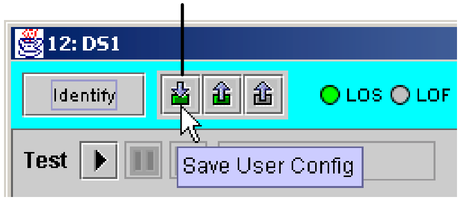
Saving and Restoring the BERT Test Configuration

After configuring modules for running tests, you can save these settings for later use.

To save the test settings for the DS1 module you configured in the BERT example:

Click the **Save User Config** icon in the DS1 module window to save the configuration.

Click the **Save User Config** icon in the module window to save your test settings



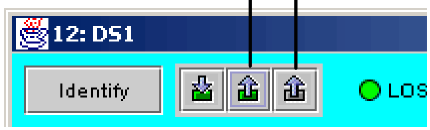
The EPX Test System displays a confirmation dialog.

To restore module/slot configurations:

- Click the **Restore User Config** icon in the DS1 module window, or
- Click the **Restore Factory Config** icon in the DS1 module window.

Restore Factory Defaults

Restore User Config



To continue with the BERT example, go to the next section, “Changing the Test” on page 22.

Changing the Test

While a test is running, you can modify the generated signal.

For example, you may want to insert an alarm while the test is running and then disable the alarm insertion to clear the condition.

1 Restart the test.

2 While the test is running, select the Port 3 **Generate** tab.

Restart the test

Select the port 3 Generate tab

3 In the **Alarms** area, select **OOF** to insert an Out-of-Frame alarm.

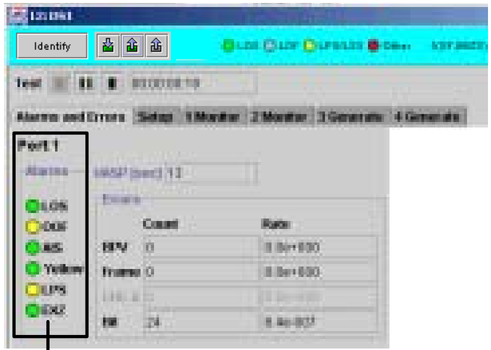
4 After a few seconds, disable OOF alarm generation by selecting **Off**.

Insert an OOF alarm

Wait a few seconds...

Turn off the OOF alarm

5 Select the **Alarms and Errors** tab and look at the OOF alarm status indicator in the error and alarm data for port 1.



Alarm status indicators for Port 1 show that the OOF was detected and then cleared.

The LPS condition was triggered by the OOF.

The OOF indicator for Port 1 should be yellow, which indicates that an OOF alarm was detected during that test but is not currently active.

The LPS alarm indicator is also yellow because an LPS alarm was also triggered as a result of inserting the OOF.

While the OOF condition is active, bit errors are not monitored.

Red indicates a currently active alarm.

You can also change the error type and error insertion rate.

Note When an error rate is changed during a test, the error ratio on the **Alarms and Errors** tab does not immediately match the selected ratio. This mismatch is because the sampled data includes the previous error ratio.

Changing the Test

3

CONFIGURING THE EPX100 CLOCK MODULE

The EPX100 Clock module in slot 1 provides signal timing references for EPX modules.

You must configure the EPX Clock Module to specify the following items:

1 The source of the timing reference for each type of signal, such as SONET/SDH, DS1, DS3, and so on.

   Depending on your test environment or application, that source can be a timing reference generated by the EPX Clock module, a BITS input, or an external clock source.

2 The type of signal timing reference that the Clock Module sends to each slot in the EPX chassis.

   The signal timing reference you select for a slot depends on the type of module installed in that slot.

You must configure the EPX Clock module the first time you log in to the EPX, each time you change a clock source, after installing or upgrading EPXOS, and when you add or move a module to a different slot.

Note You must be logged in as root to configure the EPX Clock module.

Note If you use a BITS or external clock source for one type of timing reference, only modules that can use that timing reference can use the BITS or external clock. Only one BITS and one external clock source can be connected to the EPX Clock module.

This section covers the following topics:

- "Setting the Clock Source" on page 26—Describes how to specify the clock source for each type of signal and select the appropriate signal timing reference for each slot.

- “Configuring Clock Module Outputs” on page 28—Explains how to configure external clock and BITS outputs for EPX modules.
- “Clock Source Frequencies and Settings by Module” on page 29—Lists signal rates and external clock frequency requirements for EPX modules.
- “Other Clock Source Options Listed by Module” on page 30—Lists additional clock source options for each type of module, such an internal oscillator, backplane signal, or recovered clock from a receive port.

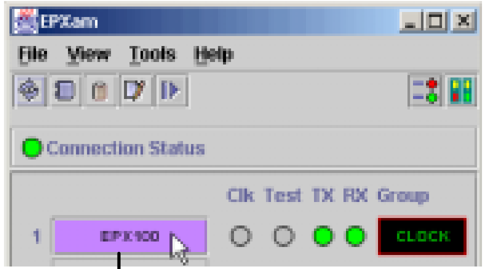
The procedures in this section explain how to configure the clock module using EPXam.

See “Clock Module” on page 587 of the “SCPI Reference” for syntax and parameters configuring the EPX clock module using SCPI.

Setting the Clock Source

Perform the following steps to specify the clock source for each type of signal reference and to select the timing signal reference for each slot:

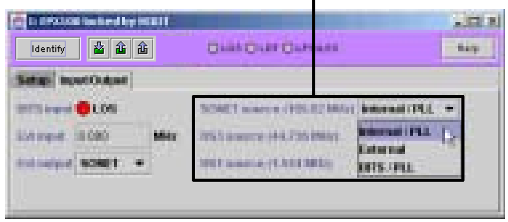
1. Log in as root to the EPX Test System.
2. Click the EPX100 module in slot 1 in the EPXam main window to open the Clock module window.



Log in as root and click on the icon for the EPX100 in slot 1 to access clock configuration options

3. Select the **Input/Output** tab and choose the clock source for each type of signal from the menu.

Select the clock source (clock module, external clock, or BITS source, if available) for each type of signal



Note You cannot select an External or BITS source if there is no external clock or BITS input.

The following clock sources are available:

Internal/PLL—Selects the clock module's internal oscillator as reference to the PLL (phase locked loop) that generates the DS3 or SONET/SDH timing reference.

Internal—DS1 only. Selects the clock module's internal 1.544 MHz oscillator as the DS1 clock source. The input bypasses the PLL and is sent directly to slots via the backplane.

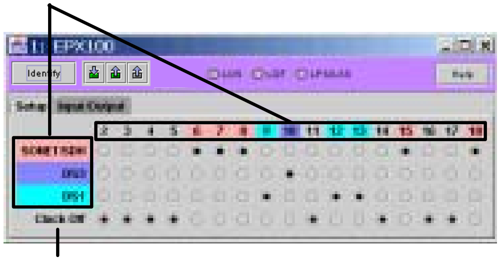
BITS/PLL—The SONET/SDH or DS3 clock source is derived from the BITS input source (the BITS input is used as the reference to the PLL that generates the SONET/SDH or DS3 signal). This option cannot be selected if a BITS clock source is not connected.

BITS—DS1 only. Selects BITS input as the clock source for the DS1 timing reference. The BITS input bypasses the PLL and goes directly to slots via the backplane. This option cannot be selected if a BITS clock source is not connected.

External—Selects an external clock source as the DS1, DS3, or SONET/SDH timing reference. The external clock bypasses the PLL and is sent directly to slots via the backplane. This option cannot be selected if an external clock source is not connected.

4 Select the **Setup** tab and choose the timing references for each slot.

Select the appropriate timing reference option for the module installed in each slot

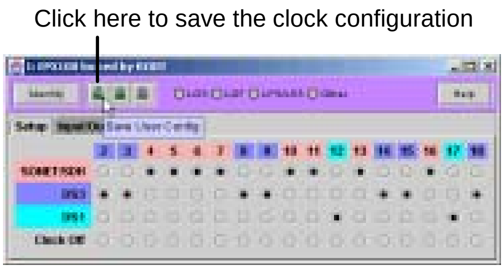


Select Clock Off for empty slots

Select the timing reference for each module as listed below:

Module	Timing Reference
All OC-*nn* and STM-*n* modules	SONET/SDH
STS-1	SONET/SDH
DS1	DS1
DS3	DS3
E1	Clock Off (E1 modules have their own oscillator)
Empty slot	Clock Off

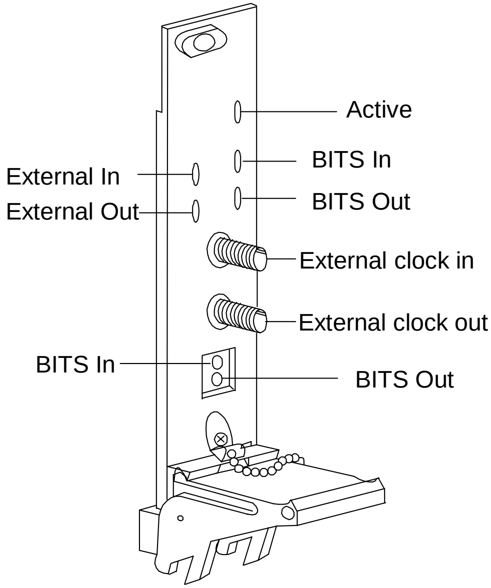
5 When you are done making changes, click the **Save User Config** icon in the Clock Module window to save the clock module configuration.



Configuring Clock Module Outputs

The EPX100 clock module has two output ports:

- External Clock Output
- BITS Output



The BITS output is available only if the EPX100 has a BITS input source. The BITS output port can not be configured through the EPXam or SCPI.

Configuring External Clock Output

The External Clock output can be defined using EPXam or SCPI. The external clock output port can use either of the following:

- INT—The EPX100 clock module's oscillator.
- EXT—The clock source on the External clock input port.

Which source you use, EXT or INT, is determined by how the timing reference is defined in “Setting the Clock Source” on page 26.

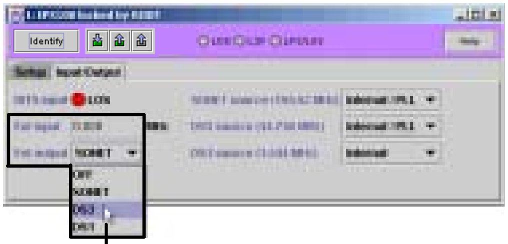
1 Log in as root.

2 Define the sources for the desired timing frequencies. See “Setting the Clock Source” on page 26.

 Example: The SONET/SDH clock source is specified as EXT, which means that an external clock source is connected to the external clock input port and provides the timing reference for SONET/SDH modules in the chassis.

3 In the External Output field on the Input/Output tab, click on the desired timing reference (SONET/SDH, DS3, DS1 or OFF).

 This selection defines the timing reference sent to the clock output port.



Select the timing reference signal to send to the external clock output port

4 If desired, save the clock module configuration.

 To do this, click **Save/Restore...** to open the Save/Restore window, select Slot 1, and click **Save User Config**.

Clock Source Frequencies and Settings by Module

Use the following table to determine what clock source frequencies, options, and setting are used for each module type.

An external clock source must be equal to or within the specified frequency range.

Module	Freq (MHz)	Signal Reference Setting	Ext Clock Frequency Range Required (Hz)
DS1	1.544	DS1	1543000 – 1545000
DS3	44.736	DS3	44732645 – 44739355
OC3 Tx	155.52	SONET/SDH	155508336 – 155531664
OC12 Tx	622.08	SONET/SDH	155508336 – 155531664
OC3 Rx	155.52	SONET/SDH	155508336 – 155531664
OC12 Rx	622.08	SONET/SDH	155508336 – 155531664
OC48 Tx	2.488	SONET/SDH	155508336 – 155531664
OC48 Rx	2.488	SONET/SDH	155508336 – 155531664
STS1	622.08	SONET/SDH	155508336 – 155531664

Module	Freq (MHz)	Signal Reference Setting	Ext Clock Frequency Range Required (Hz)
E1	2.048	Clock Off—Has its own oscillator	Has its own oscillator
STM1 Tx	155.52	SONET/ SDH	155508336 – 155531664
STM4 Tx	622.08	SONET/ SDH	155508336 – 155531664
STM1 Rx	155.52	SONET/ SDH	155508336 – 155531664
STM4 Rx	622.08	SONET/ SDH	155508336 – 155531664
STM16 Tx	155.52 622.08	SONET/ SDH	155508336 – 155531664
STM16 Rx	155.52 622.08	SONET/ SDH	155508336 – 155531664

Other Clock Source Options Listed by Module

Some EPX modules have additional clock source options, such an internal oscillator on the module itself, a backplane signal, or recovered signal from a receiver.

The following table lists available clock sources by module, applicable notes, and references that to where the options are configured in EPXam.

Module Type	Clock Source Options
E1 Quad Transceiver	**Internal**—The E1 onboard oscillator (1.544 MHz +/-50 ppm) provides the timing reference. **Note** The E1 module does not use the clock module in slot 1. **Port n RX**—The receive port *n* on the E1 module provides the timing reference. See “E1 Setup Options” on page 163.
DS1 Transceiver DS3 Transceiver	**Clock module**—The EPX Test System Clock module in slot 1 provides the DS1 or DS3 timing reference. **Internal**—The onboard oscillator (1.544 MHz +/-50 ppm) provides the timing reference. **Port n RX**—”As received.” A recovered clock from a receive port on the DS1 or DS3 module provides the timing reference. See “DS1 Setup Options” on page 178 and “DS3 Setup Options” on page 199.

Module Type	Clock Source Options
OC-12/3 TXPG OC-48 TX OC-48 TCVR STM-4/1 TXPG STM-16 TX	**Clock Module**—The EPX Test System Clock module in slot 1 provides the SONET/SDH timing reference. **Backplane**—The module gets its timing reference from the signal passed along the backplane from the module in the slot to the left.
OC-192	**Internal—**Selects the internal clock source residing on the OC-192 transmitter module. **Backplane**—Selects the clock from the SONET bus backplane. This clock is the clock provided by the module in the slot to the left) in the EPX Test System chassis. The clock frequency must be 622.08 MHz. This module configuration and parameter selection allows a transmitter to generate a test signal synchronized with the recovered clock provided by the receiver when a valid OC-192 input signal exists.

Module Type	Clock Source Options
STS-1 Transceiver	**Internal**—The module gets its timing reference from the onboard oscillator on the STS-1 module (+/- 4.6 ppm). **Clock module**—The EPX Test System Clock module in slot 1 is selected as the clock source. **As Received**—The module gets its timing reference from receiver port n of the STS1 module. **Backplane**—The module gets its timing reference from the signal passed along the backplane from the module in the slot to the left.

Using the OC-48 Tx Clock Output Port

The OC-48 Transmitter has a clock output port (CLK OUT connector on the front panel). This port allows you to transmit a timing reference for triggering.

Note Use this port for maintenance only. The signal transmitted from this port will have noise. The clock is 155 Mhz, 1/16 slower than the OC-48 frequency.

By default, OC-48 transmitters have the clock output turned off.

Note The @ symbol is not used in the following commands as with SCPI. Enter the slot number only.

Enable the clock output with the `SLOT(2:18):WRITE 0XE 0X1` command.

Disable the clock output with the `SLOT(2:18):WRITE 0XE 0X0` command.

4

MODIFYING EPX NETWORK AND SYSTEM SETTINGS

EPX system settings control the test system date and time, maximum number of client connections, Ethernet network settings, and RS-232 serial port connection parameters.

Note You must be logged in as root to modify EPX network or system setting. Changes to system settings other than the system date and time require a restart of the EPX.

Note If you are setting up the EPX Test System for the first time, refer to the “Initial Setup” chapter of the *EPX Test System Getting Started* manual for instructions. The procedures in this section describe how to modify the initial settings.

You can change the EPX system settings using the EPXam Setup tool or by issuing SCPI from a command channel.

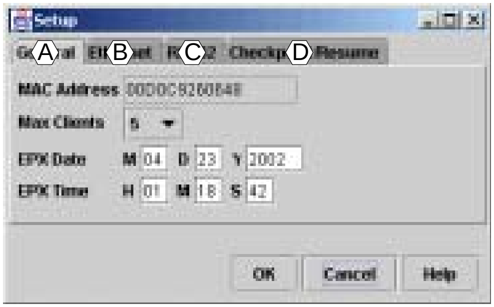
This section covers the following topics:

Using the EPX Setup Tool

To run the EPX Setup tool from the EPXam main window:

1. Log in as root to the EPX Test System.
2. Select **Tools > EPX Setup** from the EPXam main window menu.

The following figure shows the features of the EPXam Setup tool.



A View the MAC address of the EPX CPU module, set the number of client connections, and set the system date and time as described in the following sections:

- View "MAC Address of EPX CPU" on page 34
- "Setting Time and Date" on page 35
- "Setting Maximum Connections" on page 35

B Define and enable network settings as described in "Defining Ethernet (Network) Settings" on page 36.

C Configure the RS-232 port on the test system as described in "Defining RS232 (Serial) Settings" on page 37.

D Set up and enable Checkpoint/Resume as described in "Setting Checkpoint/Resume" on page 38.

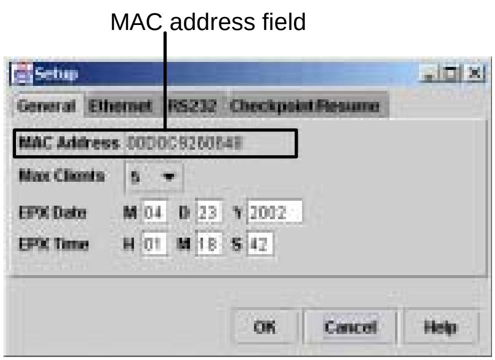
MAC Address of EPX CPU

When contacting gnubi to obtain licensed software products, you must provide the MAC address of the EPX Test System CPU on which the software will be run. See"EPXam Pro Licensing" on page 149.

A MAC (media access control) address is a 48-bit number which is the physical address of a hardware device connected to a network. It is represented as a hexadecimal number, for example, c03c4e00108f.

You can determine the MAC address of the EPX Test System CPU module in two ways:

- Login as root and select **Tools** > **Setup** from the EPXam main window to open the Setup window and check the MAC address field.



- Execute the following command (you do not have to be logged in as root):

```
SYST:HOST:MAC ?
OK. MAC address: 10D24XV891045
```

Setting Time and Date

The following sections explain how to set the system time and date using either EPXam or SCPI.

Using the GUI

To set the EPX system time and date using EPXam:

1. Log in as root to the EPX Test System.
2. Select **Tools > EPX Setup** from the EPXam main window menu to open the Setup window.
3. In the **General** tab enter the desired values for the date and time.
   - .Use mm/dd/yyyy format for the month, day and year.
   - Use 24-hour military time format (hh/mm/ss) for the time. Specify a value from 0 to 23 in the H (hours) field.
4. Click **OK** to apply the changes.

USING SCPI

To set the EPX system date and time using SCPI:

1. Open the SCPI Commander or telnet to the EPX Test System and log in as root:

   SYST:SEC:LOG root *<passwd>*

2. Set the date using a mm/dd/yyyy format. You can use slashes (/) or spaces to delimit the date values. For example:

   SYST:HOST:UTIL:DATE 05 18 2001

3. Set the time using a 24-hour format. Use spaces to delimit hours, minutes, and seconds. For example:

   SYST:HOST:UTIL:TIME 22 30 00

Setting Maximum Connections

EPXam Pro Only

This feature is only available in EPXam Pro. See "EPXam Pro Licensing" on page 149.

Perform the following steps to set the maximum number of simultaneous client connections to the EPX Test System.

Note You must be logged in as root to modify the maximum number of connections, and you must restart the EPX Test System to apply this setting. There is no SCPI equivalent for setting the maximum number of connections.

1. Log into the EPX Test System as root.
2. Select **Tools > EPX Setup** from the EPXam main window menu.
3. In the **General** tab, select the maximum number of client connections to allow from the **Max Clients** menu.

Up to 10 simultaneous connections are allowed. The default is 5.

4 Click **OK**.

5 Restart the EPX Test System.

Defining Ethernet (Network) Settings

The following sections describe how to modify the network settings using either EPXam or SCPI.

Note You must be logged in as root to define network settings. You must restart the EPX Test System for any changes to the Ethernet settings to take effect.

Using the GUI

1 Log in to the EPX Test System as root.

2 Select **Tools > EPX Setup** from the EPXam main window menu.

3 In the **Ethernet** tab, modify the network settings as desired, according to the following guidelines:

Ethernet Settings	
EPX IP Address	Specify the TCP/IP address for the EPX Test System using standard notation. **Example**: 192.168.0.187
Subnet IP Address	Specify the subnet address (subnet mask) for the EPX Test system using standard notation. Supernetting is not supported in this version of the EPX Test System OS. The IP address and subnet address must be the same class. **Example**: 255.255.255.0
Gateway IP Address	Select **Enable**, then specify the IP address of the gateway that the EPX Test System TCP/IP protocol stack will use to route IP traffic back to the client. **Example**: 192.168.1.1
DNS IP Address	Select **Enable**, then specify the IP address of the Domain Name Server on the network that the EPX Test System will use.

4 Click **OK**.

5 Restart the EPX Test System to apply the changes.

Using SCPI

This section provides examples for setting the EXP Test System IP address, subnet IP address, gateway address, and DNS IP address using SCPI.

Note You must be logged in as root to execute these commands. Restart the EPX Test System for the changes to take effect.

The command SYST:HOST:IPAD <###.###.###.###> sets the TCP/IP address for the EPX Test System.

In this example, the address is set to 192.168.0.54.

SYST:HOST:IPAD 192.168.0.54

The command SYSTEM:HOST:SUBNET <###.###.###.###> sets the subnet mask for the EPX Test System.

In this example, the address is set to 255.255.255.0 (the factory default):

SYST:HOST:SUBN 255.255.255.0

```
Ok system subnet mask 255.255.255.0 :
restart epx system
```

The command SYSTEM:HOST:DNS <###.###.###.###> sets the Domain Name Server (DNS) for the EPX Test System.

In this example, the IP address of the DNS is set to 192.167.0.1:

SYSTEM:HOST:DNS 192.167.0.1

```
Ok system DNS 192.167.0.1 : restart epx
system
```

To disable DNS, enter 0.0.0.0 as the IP address:

SYSTEM:HOST:DNS 0.0.0.0

```
ok system dns server: 0.0.0.0 :restart epx
system
```

When you query the DNS setting after using the above command, the system displays a text message indicating that it is disabled:

syst:host:dns ?

```
ok system DNS address: DNS Disabled
```

The command SYST:HOST:GAT <###.###.###.###> configures the EPX System TCP/IP protocol stack to use the gateway to route IP traffic back to the client. In this example, the gateway IP address is set to 192.167.1.28.

SYST:HOST:GAT 192.167.1.28

```
ok system gateway: 0.0.0.0 :restart epx
system
```

To disable the gateway IP address setting, enter 0.0.0.0 as the gateway IP address:

SYSTEM:HOST:GAT 0.0.0.0

```
ok system gateway: 0.0.0.0 :restart epx
system
```

Defining RS232 (Serial) Settings

EPXam Pro Only

This feature is only available in EPXam Pro. See “EPXam Pro Licensing” on page 149.

The RS232 (Serial) port connection to the EPX Test System provides a command-line interface for issuing SCPI. The RS-232 port is used to configure network settings during initial set-up of the EPX Test System or as an alternative to using the Ethernet port connection.

Note Do not connect simultaneously to the EPX Test System’s RS-232 and 10BaseT (Ethernet ports).

Configure these settings to match the settings in the communications software you are using to access your computer’s serial port. See the sections “Setting up NetTerm” and Setting up

HyperTerminal" in the E*PX Test System Getting Started* guide for examples and detailed procedures.

Note The RS-232 Serial Port settings listed below cannot be configured using SCPI.

Note You must restart the EPX Test System to for the changes to take effect.

The following table lists RS-232 connection settings and their default values.

RS232 Serial Port Settings	
Baud Rate	Select 1200, 2600, 9600, 14400, 19200, 28800, 38400, 57600, or 115200. The default is 9600.
Data Bits	Select 5, 6, 7, or 8. The default is 8. Data bit settings 5 or 6 are rarely used.
Parity	Select one of the following: N—None. This is the default. E—Even O—Odd M—Mark. Rarely used. S —Space. Rarely used.
Stop Bits	Select 1 or 2. The default is 1.
Local Echo	Select On or Off. The default is Off.
Line Terminator	LF, CR, or CR/LF. The default is CR/LF.

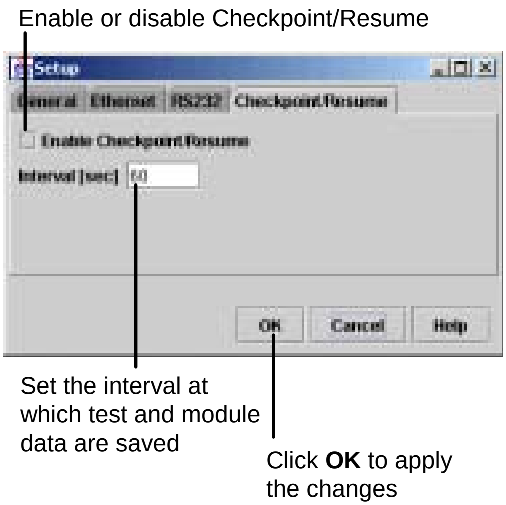
Setting Checkpoint/Resume

EPXam Pro Only

This feature is only available in EPXam Pro. See "EPXam Pro Licensing" on page 149.

Checkpoint/Resume allows a test to resume when a test system is restarted after a power interruption. For more information, see "Checkpoint/Resume" on page 137.

Use the following steps to set up Checkpoint/Resume.



1 Log in to the EPX Test System as root.

2 Select **Tools > EPX Setup** from the EPXam main window menu.

3 In the **Checkpoint/Resume** tab, click the Enable Checkpoint/Resume box.

4 In the Interval field, define how often (in seconds) test data and module configurations are saved.

The Interval must be in the range of 30 to 10000.

5 Click **OK**.

6 Restart the test system and any currently running EPXam or EPXam Pro clients.

5

USING THE BACKPLANE

The EPX Test System has a backplane to pass telecom signal data, timing references, and CPU data among modules installed in an EPX chassis. All modules, including the CPU and clock modules, connect to the backplane.

The purpose of this chapter is to give an overview of the backplane and not to explain how each module can be configured specifically to use the backplane.

This section contains the following topics:

How the CPU, Clock, and Modules Use the Backplane

The EPX backplane is used in the following ways:

- The clock module in slot 1 uses the backplane to pass timing references to slots with installed modules.

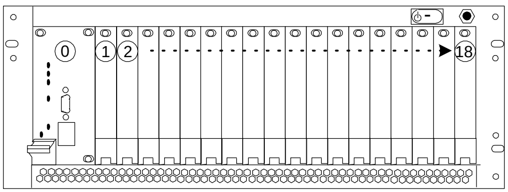
  Each slot has its own connection to the clock module; this use of the backplane does not require modules to be installed in adjacent slots.

- The CPU module uses the backplane for all communication, configuration, and monitoring functions. Subscription messages and commands and their responses use the backplane.

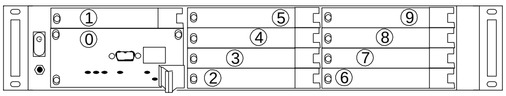
- EPX modules use the backplane to send or receive telecom signal data. The signal data is passed from slot to slot in the direction of the next higher-numbered slot.

  The following figure shows how the slots are numbered in the EPX16 and EPX8 chassis.

EPX16 Slot Numbering



EPX8 Slot Numbering

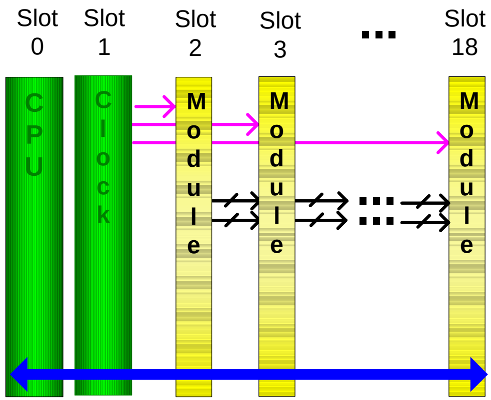


- Modules can be configured to insert telecom signal data onto the backplane that can be passed to the module installed in the adjacent, higher-numbered (downstream) slot.
- Other modules can be configured to monitor or retransmit telecom signal data that is passed along the backplane from a module in the adjacent, lower-numbered (upstream) slot.

Note Some modules can be configured to get their timing reference (clock source) from signal data passed along the backplane instead of from the EPX clock module or an internal oscillator. Backplane clock source options are not covered in detail in this chapter.

To pass telecom signal data between modules via the backplane, the modules must support backplane input/output configuration, have compatible signal interfaces, and be installed in adjacent slots. See “Guidelines for Using the Backplane” on page 44.

The following figure summarizes how the clock module, CPU, and slots use the backplane to pass data.



If configured as the clock source for a slot, the clock module uses the backplane to pass the timing reference.

Some modules can be configured to transmit or monitor telecom signal data that is passed from slot to slot across the backplane.

A bidirectional CPU bus on the backplane carries commands, module status, and subscription data.

Configuring Signal Interaction with the Backplane

You configure the module's signal interaction with the backplane in two ways:

- Configure the output to the backplane:

  Does a signal continue unmodified on the backplane for a module installed in the adjacent, higher-numbered (downstream) slot to use or is a new or modified signal put on the backplane?

- Configure the input to the module:

  Does the module use data from the backplane, from an external source coming into the front panel LIU, or from an internal payload generator?

For modules that support signal interaction with the backplane, you can use EPXam or SCPI to configure how telecom signal data is retrieved from and sent to the backplane.

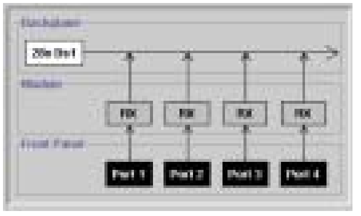
Backplane Output Configuration

Backplane output is configured on each module window's **Setup** tab in EPXam using the following options:

- **Bypass**—This is the default backplane mode. When Bypass is selected, it means that the telecom data signal on the backplane continues unmodified to the next adjacent slot.
- **Insert**—When Insert is selected, the module inserts a new or modified signal onto the backplane; the signal on the backplane is modified. The signal data is passed to the module in the next adjacent slot for use, assuming the next module has a compatible signal interface.

A diagram of the current backplane input and output configuration is displayed on each module's **Setup** tab, as shown in the following figure.

Sample diagram showing backplane output configuration for a DS1 Tcvr



Each RX port is configured to insert a DS1 signal onto the backplane.

Some modules have additional Backplane Output options. See the documentation for individual modules for more information.

Module Input Configuration

Module input is configured on each module window's **Setup** tab in EPXam.

- Transmitters use the Transmit Source option to configure module input.
- Receivers use the Monitor Source option to configure module input.

Transmit Source and Monitor Source settings are described in more detail below.

Transmit Source—For transmitters, the Transmit Source setting controls the source of the transmitted signal.

- **Generate**—The Generate option selects the module's internal payload generator as the source of the transmitted signal. For OC-12/3 modules with a payload generator module (PMOD) installed, this option selects the PMOD as the source of the signal.
- **Backplane**—The Backplane option selects the signal passed on the backplane from the adjacent slot on the left as the source of the transmitted signal.
- **Receive**—For some transceiver modules, such as the DS3, the Receive option selects a signal from an RX port on the front panel as the source of the transmitted signal.

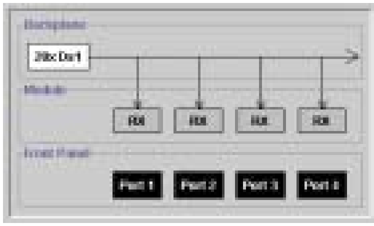
Monitor source—For receiver modules, this setting defines the source of the signal that is monitored:

- If **Receiver** mode is selected, the signal coming through the front panel connection is monitored. This signal is on the Line Interface Unit (LIU) of the receiver module.
- If **Backplane** mode is selected, the signal on the backplane is monitored.

Some modules have additional module input options. See the documentation for individual modules for more information.

A diagram of the current module input configuration is displayed on each module's **Setup** tab, as shown in the following figure.

Sample diagram showing module input configuration for a DS1 Tcvr



Each RX port is configured to receive a DS1 signal from the backplane.

Guidelines for Using the Backplane

You can configure signal output and input for transmitters with either the GUI or with SCPI.

- Modules must be installed in adjacent slots in order to transmit and receive signals along the backplane.
- Backplane signal data is passed from slot to slot and from lower-numbered slot to higher-numbered slot.
- You can only pass data between modules that have compatible signal interfaces.

  The following table shows which modules are compatible with each other for passing signal data on the backplane:

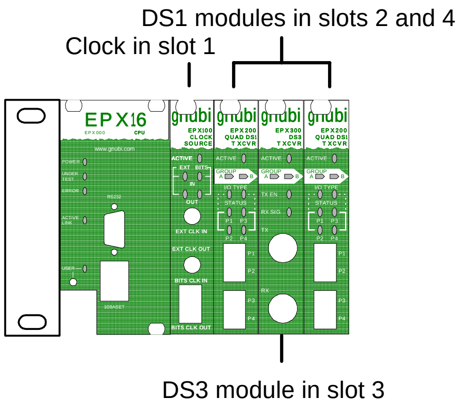
Module	Modules with compatible interfaces
E1 Quad Tcvr	E1 Quad Tcvr DS1 Quad Tcvr DS3 Tcvr
DS1 Quad Tcvr	E1 Quad Tcvr DS1 Quad Tcvr DS3 Tcvr
DS3 Tcvr	E1Quad Tcvr DS1 Quad Tcvr DS3 Tcvr
STS1 Tcvr	STS-1 Tcvr OC-12/3 Rx/RxPm OC-12/3 Tx, TxPg
OC-12/3 Rx/RxPm, OC-12/3 Tx/TxPg	OC-12/3 Rx/RxPm, OC-12/3 Tx/TxPg STS-1 Tcvr
STM-4/1 RxPm, STM-4/1TxPg	STM-4/1 Rx/RxPm, STM-4/1 Tx, TxPg
OC-48 Tx/Rx	OC-48 Tx/Rx

Backplane Input/Output Example

The purpose of the example in this section is to show how modules can insert signal data onto the backplane that is passed along the backplane for use by compatible modules installed in adjacent slots.

Setting up the Modules in the Chassis

This example uses two DS1 Quad Transceiver modules and one DS3 Transceiver module. The modules are installed in adjacent slots in an EPX16 chassis as shown below:

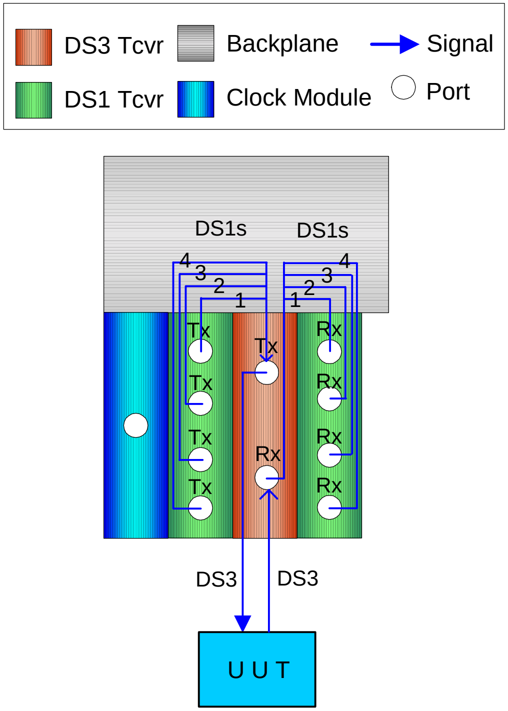


Overview of Example Configuration

Module input and output is configured as follows:

- The DS1 Quad Transceiver in the slot to the left of the DS3 module is configured with four TX ports. Each of the four TX ports inserts one DS1 signal onto the backplane.
- The DS3 module is configured to multiplex the DS1 signals passed along the backplane from the slot on the left into a DS3 signal that it transmits to a unit under test (UUT).
- A UUT monitors the DS3 signal received from the DS3 TX port and sends it back out to the DS3 RX port.
- The DS3 module demultiplexes the DS3 signal received from its RX port and inserts 28 DS1signals onto the backplane. Signals 1 through 4 of those inserted onto the backplane from the DS3 contain the four signals inserted onto the backplane from the DS1 TX ports.
- The DS1 Quad Transceiver in the slot to the right of the DS3 module is configured with four RX ports. Each of the four RX ports monitors one DS1 signal from 28 signals on the backplane from the DS3.

The following figure illustrates this example configuration.



Setting up the Modules Using EPXam

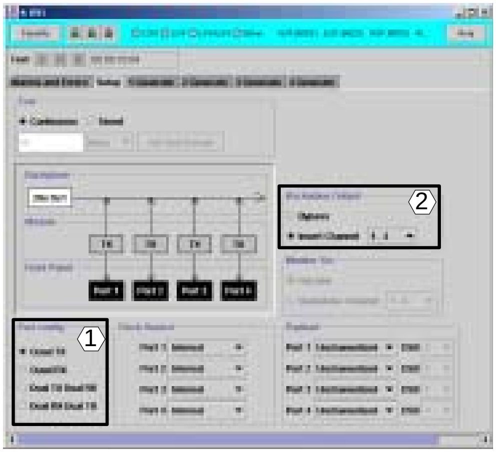
This section describes how to set up each module's input and output for the example using EPXam.

DS1 Transmit Port Setup

In this step, the DS1 Quad Transceiver in the slot to the left of the DS3 Transceiver is configured with four TX ports, each of which inserts a DS1 signal onto the backplane.

All other options are left at their default setting, which should generate a clean signal, with no errors or alarms being inserted.

These settings are configured on the DS1 module window **Setup** tab, as shown in the following figure:



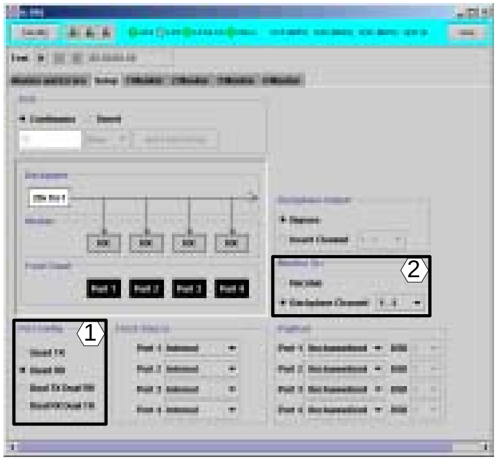
1. Set Port Config to Quad TX.
2. Set Backplane Output to Insert Channel, and select 1 - 4 from the menu.

The Backplane Output Insert Channel 1-4 setting maps the DS1 signals as follows: port 1 inserts a DS1 signal into backplane channel 1, port 2 inserts its signal into channel 2, port 3 inserts its signal into channel 3, and port 4 inserts its signal into channel 4.

DS1 Receive Port Setup

In this step, the DS1 Quad Transceiver in the slot to the right of the DS3 Transceiver is configured with four RX ports, each of which monitors a DS1 signal from the backplane.

These settings are configured on the DS1 module window **Setup** tab, as shown in the following figure.



1. Set Port Config to Quad RX.
2. Set Monitor Source to Insert Channel, and select 1 - 4 from the menu.

All other options are left at their default settings.

At this point in the test setup, you can check to see that the DS1 signals are being inserted onto the backplane and can be monitored from the backplane.

To do this:

1 Start the test on the DS1 module in the slot to the right of the DS3.

2 Open the module window for the DS1 module in the slot to the left of the DS3 module.

 - Click the **Generate** tab for port 1, choose Bit as the error type and click Single to insert a single bit error on port 1.
 - Repeat this step on ports 2, 3, and 4.

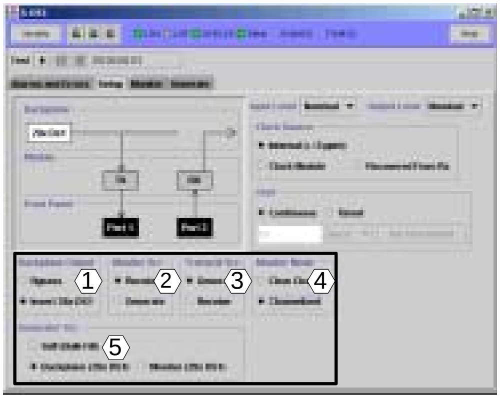
3 Click the **Alarms and Errors** tab on the DS1 module receiving the DS1 signals. The bit error count should show that a bit error was received on each port.

DS3 Transceiver Setup

In this step, the DS3 Transceiver ports are set up as follows:

- The DS3 module is configured to multiplex the DS1 signals from the backplane into a DS3 signal that sends through the TX port to a unit under test (UUT).
- A UUT monitors the DS3 signal received from the DS3 TX port and sends it back out to the DS3 RX port.
- The DS3 module demultiplexes the DS3 signal from its RX port and inserts 28 DS1signals onto the backplane. Signals 1 through 4 of those inserted onto the backplane from the DS3 contain the four signals inserted onto the backplane from the DS1 TX ports. The other DS1s are created by the DS3 module and contain either an all ones or all zeroes pattern.

These settings are configured on the DS3 module window **Setup** tab, as shown in the following figure.



1 Set Backplane Output to Insert 28xDS1.

2 Set Monitor Source to Receive (this is the default setting).

3 Set Transmit Source to Generate.

4 Set Monitor Mode to Channelized.

5 Set Generator Src to Backplane (28x DS1).

Once the modules are set up in this configuration, if you run tests on the DS3 transceiver and the DS1 transceiver receiving the signal, the alarm and error data that is monitored should show that the signals are transmitted and monitored from the backplane as described.

6

GROUPS

A group can have 1-18 modules (only from one chassis, not from multiple chassis). Groups on the EPX Test System are visible to all users, but when a group is activated, other users cannot change or use the modules in the activated group.

Use groups to reserve modules:

- Create multiple groups for different tests and applications
- Easily reuse test configurations
- Ensure that modules in test are protected from simultaneous use by other users

Group information is stored on the EPX Test System in a file (with a `gdf` extension) in the `/groups` directory. The files are numbered and are not named after the group.

This section describes the following topics:

Group Manager Window

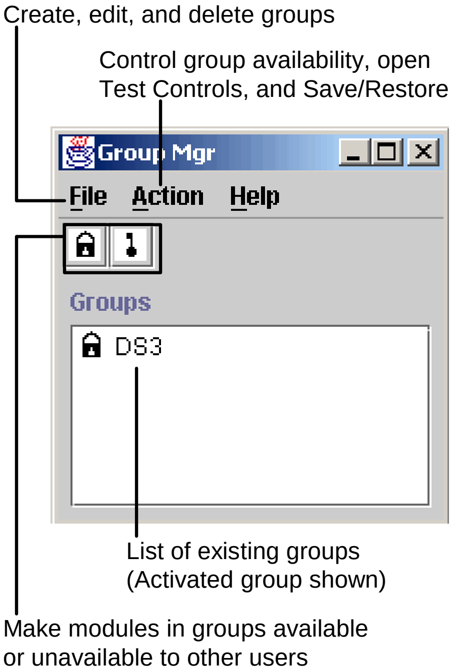
Use the Group Manager window to set up and control groups of modules:

See "Groups" on page 49 for an overview of groups.

Groups can be controlled in other windows:

- "Controlling Tests" on page 116

- "Using the EPXam Save/Restore Window" on page 108
- "Logging Window" on page 65

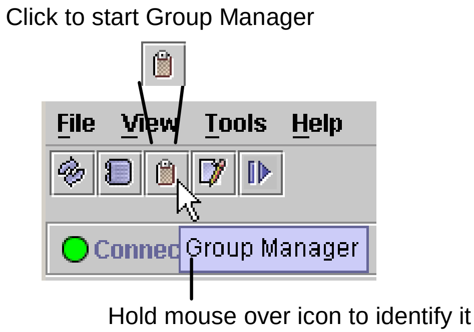


Opening Group Manager Window

You can open the Group Manager window in two ways:

- Click on the Group Manager icon in the EPX Test System GUI toolbar.
- Select **Tools > Group Manager** from the menu.

Tip If you hold the mouse cursor over a toolbar button, the name of the button appears.



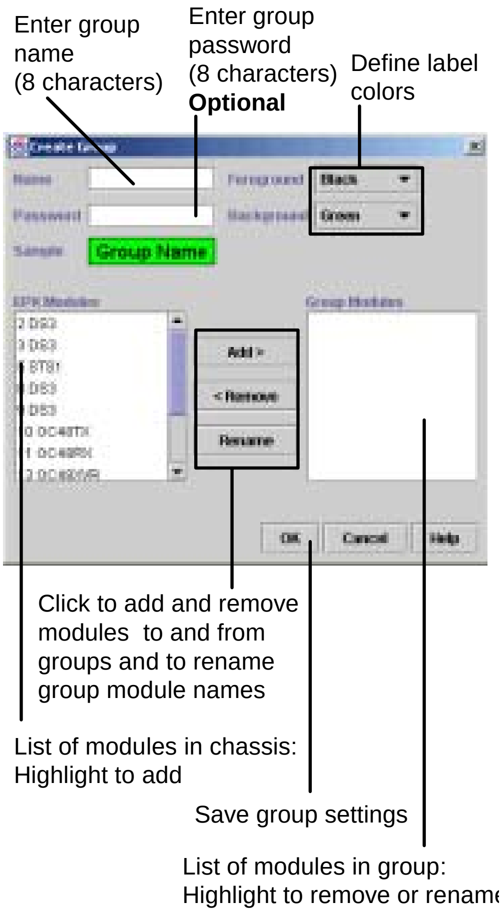
Creating Groups

You can create groups with any modules in a chassis, even if they are in use or in another group.

If you use the Save/Restore window to save configurations for groups, the settings are saved to the DLL.CFG file for each slot. The settings are not saved to the group file.

To prevent other users from overwriting settings for your group's modules, use SCPI to save the settings to a uniquely named configuration file. See "Managing Configurations Using SCPI" on page 110.

Use the following figure and steps to create groups.



1 Open the Group Manager.

2 Select **Group > New Group**. The New Group dialog appears.

3 Type a name in the **Name** field.

Note Use 1-8 alphanumeric characters. Do not use spaces. Names are not case sensitive.

4 If desired, type a password to control editing and activating groups.

Note Use 1-8 alphanumeric characters. Do not use spaces. Passwords are not case sensitive.

5 Select modules in the EPX Modules area.

Tip You can use Shift-click or CTRL-click keyboard shortcuts to select multiple modules or groups in either list.

---

6 Click **Add**>. The module is added to the group and is listed in the Group Modules area.

Note Changes to the group are not saved until you click **OK**.

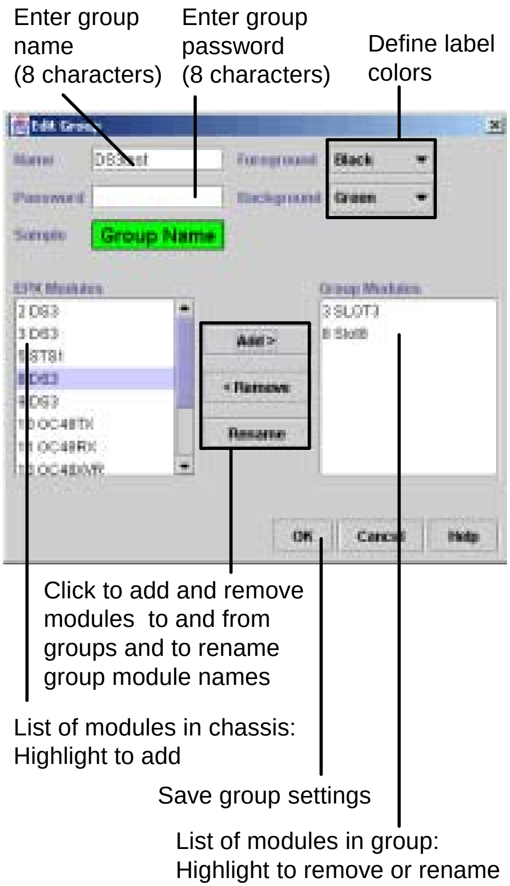
7 Click **OK**.

Editing Groups

Use the Edit Group dialog to change existing groups.

1. Open the Group Manager.
2. Select a group in the Group Manager.
3. Make sure that the group is deactivated. Activated groups are indicated by an Activate icon in the Group Manager window.
4. Select **Group > Edit Group**. The Edit Group dialog appears.
5. Change the group attributes as summarized in the following figure, including adding and deleting modules.

Note Changes to the group are not saved until you click **OK**.



6. Click **OK**.

Deleting Groups

Groups can be deleted from the EPX Test System. Once deleted, they cannot be recovered. Activated groups cannot be deleted.

1. Open the Group Manager.
2. Select a group in the Group Manager.
3. Make sure that the group is deactivated. Activated groups are indicated by an Activate icon in the Group Manager window.
4. Select **Group > Delete Group**. The Confirm dialog appears.
5. Click **Yes** to delete the group. The group is deleted and is not listed in the Group Manager window.

Activating Groups

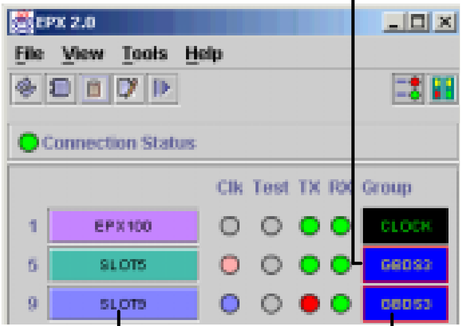
When groups are activated, other users cannot set up modules in the activated group. Groups cannot be edited or deleted when activated. Modules in activated groups cannot be switched between SONET and SDH by other users. See “Switching SONET/SDH Modules” on page 122.

1. Open the Group Manager.
2. Select a group in the Group Manager window.
3. Click the Activate icon, as shown in the following figure. The Input dialog appears requesting the password.

4. Enter the password or leave blank (if there is no password), and click **OK**.

   An Activate icon appears next to the group name in the Group Manager window. In the EPXam main window, the group label appears, and the group names for activated modules appear, as shown in the following figure.

Red border indicates you activated group



Group name for module

Group label

When other users open a module window, they can view but cannot modify the module, as shown in the following figure.

Message that module is activated by a user

Features unavailable when module is activated

Saving and Restore Group Configurations

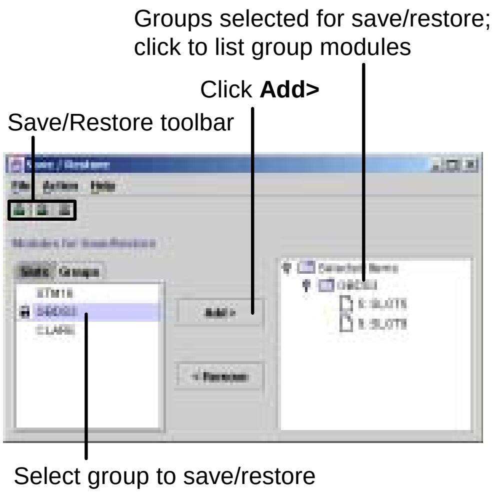
You can save and restore configurations for group modules from the Group Manager window.

CAUTION: The Save/Restore window saves only one custom configuration per module. It is possible to overwrite another custom configuration file. To avoid overwritten custom configurations, use SCPI to save and restore configuration files with unique names. See "Managing Configurations Using SCPI" on page 110 for details.

Activating groups for save and restore is recommended because it prevents other users from changing modules that are in use. However, when groups are deactivated, the custom configuration files for those modules can be overwritten.

1. Create a group as described in "Creating Groups" on page 50.
2. Activate the group to restrict access to the modules to be tested, as described in "Activating Groups" on page 53.
3. For saving configurations, open the module window for each module in the group, and set up the module as desired.
4. In the Group Manager menu, select **Action > Save/Restore Controls**.

   The Save/Restore window appears, displaying the **Groups** tab.



See "EPX Test System Module Window Reference" on page 155 for more details about specific modules.

5 Click the desired save or restore icon from the Save / Restore toolbar.

For details about the Save / Restore window, see "Using the EPXam Save / Restore Window" on page 108.

Testing with Groups

After creating a group, you can control tests for group modules from the Group Manager window.

Using groups for tests is recommended because it prevents other users from interrupting tests or changing modules that are involved in tests.

1 Create a group as described in "Creating Groups" on page 50.

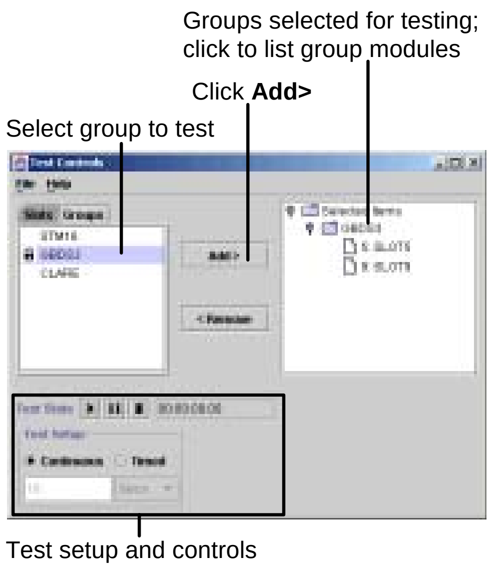
2 Activate the group to restrict access to the modules to be tested, as described in "Activating Groups" on page 53.

3 In the Group Manager menu, select **Action > Test Controls**.

The Test Controls window appears, displaying the **Groups** tab.

4 Highlight the desired groups.

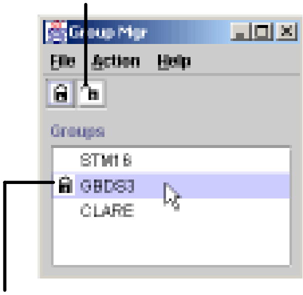
5 Click **Add>**. The group is added to the Selected Items list, as shown in the following figure.



6 Set up and control tests for selected items, as described in "Using the EPXam Test Controls Window" on page 116.

Deactivating Groups

1. Open the Group Manager.
2. Select a group with the Activate icon in the Group Manager window, as shown in the following figure.



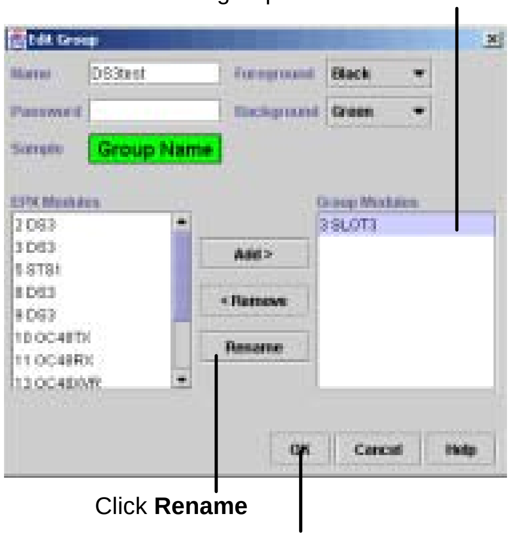
3. Click the Deactivate icon. The Input dialog appears requesting the password.
4. Enter the password or leave blank (if there is no password), and click **OK**.

   The Activate icon is removed from the group name in the Group Manager window, and the group label is removed in the EPXam main window.

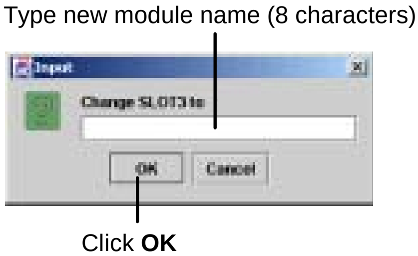
Renaming Group Modules

When groups are activated, a group module name is applied to the module in the EPXam main view. By default, modules added to groups are named slot*Number*, such as slot1, slot2, and slot3. You can assign names to group modules. For example, the name can identify the module's function in the test.

1. Open the Group Manager.
2. Select a group in the Group Manager.
3. Select **Group > Edit Group**. The Edit Group window appears.



4. Select a Group Module.
5. Click **Rename**. The Input dialog appears.



6 Enter the new name of the group module.

Note Use 1-8 alphanumeric characters. Do not use spaces. Names are not case sensitive.

7 Click **OK**. The module name is changed in the Edit Group window.

8 In the Edit Group window, click **OK** to save the changes.

Managing Groups Using SCPI

This section describes how to use SCPI to set up and control groups.

The Group Manager window simplifies the SCPI used to control groups, especially allocation and locking tasks. For more information, see “Locking and Activating” on page 58.

This section describes the steps for using SCPI for the following tasks:

- “Locking and Activating” on page 58
- “Creating Groups” on page 58
- “Renaming Groups” on page 59
- “Changing Passwords” on page 59
- “Renaming Modules” on page 59
- “Testing Groups” on page 60
- “Saving Module Configurations” on page 60
- “Restoring Module Configurations” on page 61
- “Deleting Groups” on page 61
- “Deleting Modules from Groups” on page 61

Locking and Activating

The Group Manager uses the concepts of locking and activating to control group access.

Locking controls access to a group's configuration, to avoid two users simultaneously editing a group's attributes. Locking is controlled by the the `GMAN:LOCK` and `GMAN:GRP:UNL` commands.

Activating reserves the physical modules to a group to prevent simultaneously use of a module or changes in its configuration. Activating is controlled by the `GMAN:GRP:ACT` and `GMAN:GRP:DEAC` commands.

Creating Groups

This section describes how to create a new group and how to add modules to the group.

1 Create a group with the `GMAN:ADD` *group_name* "*password*" command. The new group is automatically locked and selected.

Note Use 1-8 alphanumeric characters. Do not use spaces. Names are not case sensitive.

Note You must include the quotes for the password; you can leave the password blank (no space).

```
GMAN:ADD Test1 ""
```

2 Add modules to the group with the `GMAN:GRP:ADD` *module_name slot_number* command.

The *module_name* parameter assigns a unique name to the module when it is part of the group. *slot_number* selects the module to add to the group.

Note Use 1-8 alphanumeric characters. Do not use spaces. Each module must be given a unique name in the group.

```
GMAN:GRP:ADD oc12tx1 2
GMAN:GRP:ADD STS1_1 3
GMAN:GRP:ADD STS1_2 4
GMAN:GRP:ADD oc12tx2 5
```

3 Activate the modules in your group with the `GMAN:GRP:ACT` command. This prevents other users from changing these modules.

```
GMAN:GRP:ACT
```

4 Configure the modules that you added to your group.

Note You must configure the modules from the same login that you used to reserve the modules.

5 Save the current settings for all the modules in your group with the `GMAN:GRP:SAVE` command.

```
GMAN:GRP:SAVE
```

See "Saving Module Configurations" on page 60 and "Restoring Module Configurations" on page 61 for more information.

6 If desired, run tests with the group, as described in "Testing Groups" on page 60.

7 Allow others to use the group modules with the `GMAN:GRP:DEAC` command.

8 Unlock the group with the `GMAN:GRP:UNL` command.

Renaming Groups

1 Select a group with the `GMAN:SEL` *group_name* command.

2 Lock the group with the `GMAN:LOCK` *group_name* "*password*" command.

Note You must include the quotes for the password; you can leave the password blank (no space).

3 Deactivate the group modules (if they are not already) with the `GMAN:GRP:DEAC` *group_name* command.

4 Changed the group name with the `GMAN:GRP:REN` *group_name* command.

Note Use 1-8 alphanumeric characters. Do not use spaces. Names are not case sensitive.

5 Unlock the group with the `GMAN:GRP:UNL` *group_name* command.

Changing Passwords

To protect group configurations, you can create a password for each group. When someone attempts to lock a group (locking is required to modify a group), they must enter the password. Passwords are not case sensitive.

1 Select a group with the `GMAN:SEL` *group_name* command.

2 Lock the group with the `GMAN:LOCK` *group_name* "*password*" command.

Note You must include the quotes for the password; you can leave the password blank (no space).

3 Deactivate the group modules (if they are not already) with the `GMAN:GRP:DEAC` *group_name* command.

4 Change the selected group's password with the `GMAN:GRP:PASS` *password* command.

Note Use 1-8 alphanumeric characters. Do not use spaces.

5 Unlock the group with the `GMAN:GRP:UNL` *group_name* command.

Renaming Modules

1 Select a group with the `GMAN:SEL` *group_name* command.

2 Lock the group with the `GMAN:LOCK` *group_name* "*password*" command.

Note You must include the quotes for the password; you can leave the password blank (no space).

3 Deactivate the group modules (if they are not already) with the `GMAN:GRP:DEAC` *group_name* command.

4 List the group's modules with the `GMAN:GRP:LIST?` command.

5 Select a module with the `GMAN:GRP:SEL` *module_name* command.

6 Change the module name with the `GMAN:GRP:BOAR:REN` *module_name* command.

Note Use 1-8 alphanumeric characters. Do not use spaces. Names are not case sensitive.

7 Unlock the group with the `GMAN:GRP:UNL` *group_name* command.

Testing Groups

After configuring the group and its modules, you can test the group.

1 Select a group with the `GMAN:SEL` *group_name* command.

2 Lock the group with the `GMAN:LOCK` *group_name* "*password*" command.

Note You must include the quotes for the password; you can leave the password blank (no space).

3 Activate the group modules with the `GMAN:GRP:ACT` command.

4 If desired, configure logging using either the EPXam Logging Window or SCPI. See "Logging" on page 63.

5 Define the test as a continuous or a timed test.

Depending on your selections, this involves the following commands:

- `GMAN:GRP:TEST:TYPE` *type*
- `GMAN:GRP:TEST:UNIT` *unit*
- `GMAN:GRP:TEST:PER` *period*
- `GMAN:GRP:TEST:MODE` *mode*

Saving Module Configurations

You can save module configurations as attributes of the group. These settings are saved to the group file (`*.gdf`) in the `/groups` directory on the EPX Test System.

Note Saving module settings in this way is not available in the EPXam Group Manager window.

1 Select a group with the `GMAN:SEL` *group_name* command.

2 Lock the group with the `GMAN:LOCK` *group_name* "*password*" command.

Note You must include the quotes for the password; you can leave the password blank (no space).

3 Activate the group modules with the `GMAN:GRP:ACT` *group_name* command.

4 Configure the modules that you added to your group.

Note You must configure the modules from the login that you used to reserve the modules.

5 Save the modified group configurations for the modules with the `GMAN:GRP:SAVE` command.

```
GMAN:GRP:SAVE
```

Restoring Module Configurations

If you have modified the settings for modules in a group and have not saved these settings, you can restore the previously saved module configurations.

Note Restoring module settings in this way is not available in the EPXam Group Manager window.

1. Select a group with the GMAN:SEL *group_name* command.
2. Lock the group with the GMAN:LOCK *group_name* "*password*" command.

Note You must include the quotes for the password; you can leave the password blank (no space).

3. Activate the group modules with the GMAN:GRP:ACT *group_name* command.
4. Restore the saved group configurations for the modules with the GMAN:GRP:REST command.

Deleting Groups

1. Select a group with the GMAN:SEL *group_name* command.
2. Lock the group with the GMAN:LOCK *group_name* "*password*" command.

Note You must include the quotes for the password; you can leave the password blank (no space).

3. Deactivate the group modules (if they are not already) with the GMAN:GRP:DEAC *group_name* command.
4. Delete the selected group with the GMAN:GRP:DEL command.

Deleting Modules from Groups

1. Select a group with the GMAN:SEL *group_name* command.
2. Lock the group with the GMAN:LOCK *group_name* "*password*" command.

Note You must include the quotes for the password; you can leave the password blank (no space).

3. Deactivate the group modules (if they are not already) with the GMAN:GRP:DEAC command.
4. Select a module to delete with the GMAN:GRP:SEL *module_name* command.
5. Delete modules from a group with the GMAN:GRP:BOAR:DEL *module_name* command.

   The module is deleted.

7

LOGGING

This section describes how to record test data from the EPX Test System:

Overview

The EPX Test System can record test data to log files that are stored on the EPX Test System or on your computer. By default, logging is turned off.

Logging can only be turned on for transceiver and receiver modules. Logging records test start and stop times and defect information, including the following:

- Alarm type
- Seconds that
- Error type
- Number of bit error
- Ratio of bit errors to total bits
- Date and time of defect
- Slot number
- Performance monitoring statistics for modules supporting the functionality; see module chapters for details
  - Errored seconds for section, line (near end and far end), and path (near and far end)
  - Severely errored seconds for section, line (near end and far end), and path (near and far end)
  - Unavailable Seconds for section, line (near end and far end), and path (near and far end)

A new log file is created in the following ways:

- If logging is turned on, every time you start a new test.
- If you are running a test and logging is off, you turn on logging.

Logging and Subscription Channel

You can use logging and the subscription channel simultaneously. Subscription SCPI does not affect logging. Users cannot define what data is logged, only what slots to collect data for.

	Subscription	Logging
What data is collected?	User defined	Predefined
How is data presented?	Cumulative	By logging intervals
Can SCPI define data collection?	Yes	No
Is data saved?	No	Yes

You can subscribe to events, alarms, and errors with SCPI, viewing the results in a subscription channel window. See “Subscribing for Events” on page 93 for more information.

Logging Intervals

Logging data is collected in intervals.

For log files saved to the client, or local, computer, log files are updated only when an alarm or error occurs or when the signal changes, such as pointer moves. The interval is 1 second and cannot be changed. See “Saving Data to Local Computer” on page 69 for more information.

For log files saved to the EPX Test System, the logging file is updated by default every 600 seconds (10 minutes). The log file for each module can be updated more frequently with a command or from EPXam. To use EPXam, see “Saving Data to EPX Test System” on page 72.

The log data is not cumulative. For cumulative counts, use subscription commands or the monitoring tab for the receivers in EPXam.

Also, the logging file cannot tell you exactly when the defects started and ended. You can define shorter logging intervals to better isolate when defects occurred.

CAUTION: Do not fill the hard drive on the EPX CPU module with log files. If you do, the EPX Test System performance degrades and may lock up.

To set logging intervals, see “Setting Up Logging” on page 66 and “Setting Logging Intervals” on page 85.

Logging Window

Use the Logging window to set up logging, to view log data (either from a current test or saved log files), and to manage log files.

For an overview of logging, see "Overview" on page 63.

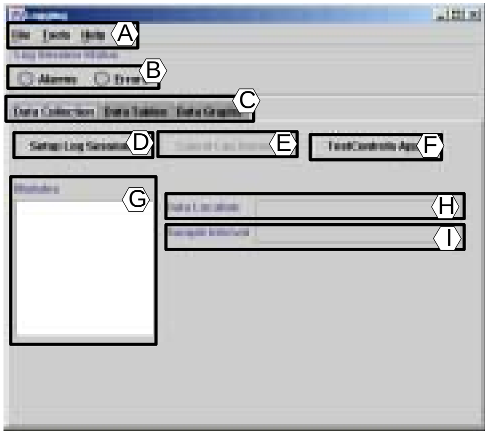
A *log session* is created with the **Start Logging Wizard** in EPXam. The log session defines the storage location for selected modules or groups.

Note You cannot have more than one log session for each EPXam instance. However, you can create one log session for multiple tests. Use the Test Controls window to start and stop testing for modules or groups in the log session.

CAUTION: Other users can cancel your log session if all the following conditions are true: Logging data is saved to the EPX Test System, and individual modules or deactivated groups are included in the log session.

Tip Use activated groups to ensure that other users do not stop logging and testing for your tests. For more about groups, see "Groups" on page 49.

The following figure describes the main feature of the Logging window. These features are described in detail in the following sections.



A Use the **File**, **Tools**, and **Help** menus to close the Logging window, to manage log files, and to read about the Logging window.

B Check alarm and error status for tests that are logged as described in "Viewing Alarm and Error Status" on page 74.

C View logging data as described in "Viewing Data Tables" on page 75 and "Viewing Data Graphs" on page 76.

D Set up and start logging with **Start Logging Wizard** as described in "Setting Up Logging" on page 66.

E Stop, or cancel, logging without stopping the test as described in "Cancelling Log Sessions" on page 73.

F Open Test Controls to start, stop, pause, and resume tests as described in "Controlling Tests in Log Sessions" on page 74.

G View the list of modules that currently have been enabled for logging.

H View where the log files are stored. See “Saving Data to Local Computer” on page 69 and “Saving Data to Local Computer” on page 69 for file storage options.

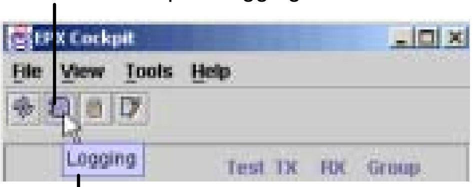
I View the currently defined sample interval for modules that have logging turned on. See “Logging Intervals” on page 64 for more on logging intervals.

Opening the Logging Window

To start the Logging window, click on the Logging icon in the EPXam toolbar or select **Tools > Logging** from the menu.

Tip If you hold the mouse cursor over a toolbar button and wait, the name of the button appears.

Click icon to open Logging window

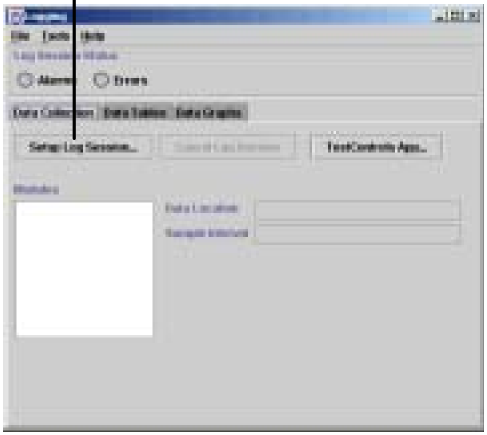


Hold mouse over icon to identify it

Setting Up Logging

Before starting logging, define which modules log data, where the log files are stored, and at what intervals log data is collected. Use the **Start Logging Wizard** to set up logging.

Note Logging must be Off to define logging settings.



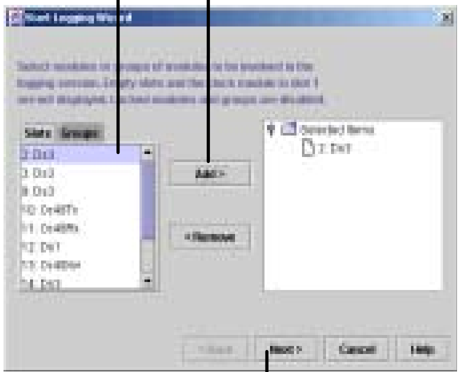
1 Open the Logging window.

See “Opening the Logging Window” on page 66.

2 In the **Data Collection** tab, click **Setup Log Session...** to start the **Start Logging Wizard**.

3 In the first screen of the **Start Logging Wizard**, select the slots for which to collect logging data, as shown in the following figure.

By default, no slots are selected.



To select a slot or group, select the **Slots** or **Groups** tab and highlight the name of the group or module.

Tip Use Shift-click or CTRL-click to select multiple modules or groups.

Tip Use activated groups to ensure that other users do not stop logging and testing for your tests. For more about groups, see “Groups” on page 49.

4 Click **Add>** to add the highlighted modules or groups to the **Selected Items** list.

To remove items from the **Selected Items** list, highlight the items in the **Selected Items** list, and click **<Remove**.

5 After selecting modules, click **Next**.

6 Select **Local** or **EPX** for the location of the log files, as shown in the following figure.

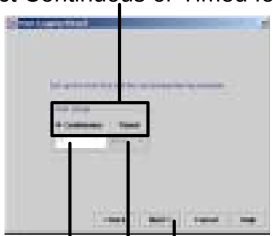
For more information on these options, see “Saving Data to Local Computer” on page 69 and “Saving Data to EPX Test System” on page 72.

Select to store log files on your computer or on EPX Test System

7 After choosing a location, click **Next**.

8 Define the duration of the test for the selected modules.

Select Continuous or Timed for test type



Select **Next** to start test

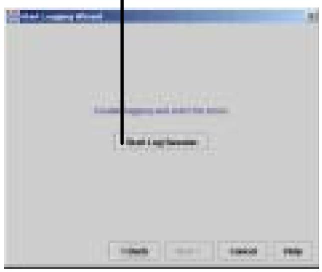
Select a unit of time

Enter duration of test

9 After defining the test duration, click **Next**.

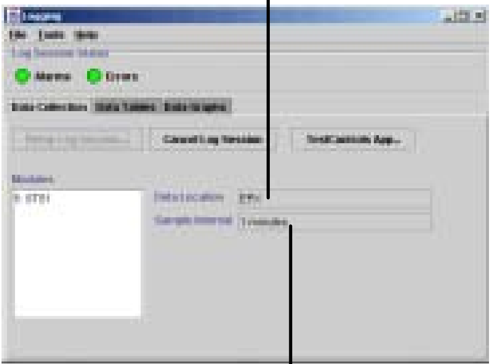
10 Click **Start Log Session** to start testing and logging test data on the selected modules.

Click **Start Log Session** to start testing and collecting data



The **Start Logging Wizard** closes. The Data Collection tab show information about the current log session, as shown in the following figure.

Where logging data is stored (local or EPX)



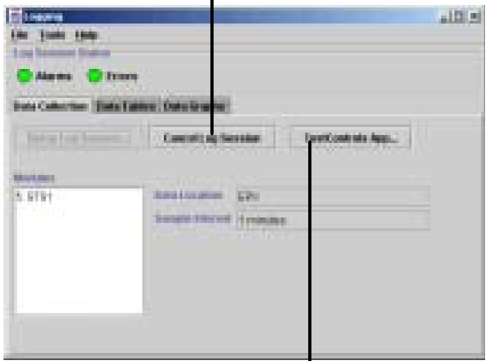
How often logging data is capture

To view data, see “Viewing Data Tables” on page 75 and “Viewing Data Graphs” on page 76.

11 If desired, control tests and logging for selected modules from the Logging window, as shown in the following figure.

For details, see “Controlling Tests in Log Sessions” on page 74.

Click **Cancel Log Session** to stop logging (testing continues)



Click **Test Controls App** to stop, start, and pause testing (logging is not changed)

Saving Data to Local Computer

You can save log files to a local computer. The local computer may be the computer on which EPXam Pro is running or a network computer that you have access to. Because a local computer can have more storage space than the EPX Test System, logging can collect data for shorter data collection intervals and for longer tests.

EPXam Pro Only

This feature is only available with EPXam Pro. For more information, see “EPXam Pro Licensing” on page 149.

This section describes the following topics:

- “Reading Local Log Files” on page 70

- “Recovering from Interruptions” on page 70
- “Selecting Local Data Location” on page 70

Reading Local Log Files

When log files are saved to a local computer, the format of the log file is changed from the format of the log files on the EPX Test System. On the EPX Test System, log files store data in intervals (linear format), which users can define. Local log files store data on change.

See “Log File Formats” on page 83.

See “Converting to Linear Format” on page 82

Recovering from Interruptions

If the client computer or EPXam crashes or is restarted or if connectivity is interrupted between the client and the EPX Test System, log files exist for the test but have no data. If you reconnect to the EPX Test System, the test is still running, but test logging does not resume. Also, real time data of currently running tests is not displayed in the logging window. If you restart logging, a new log file is created.

For more on real time data, see “Viewing Data Tables” on page 75 and “Viewing Data Graphs” on page 76.

If the test system crashes, has a power interruption, or is restarted, log files exist for the test but are partially complete. If you reconnect to the EPX Test System, the test is no longer running, and test logging does not resume.

For more on recovering from power outages, see “Checkpoint/Resume” on page 137.

Selecting Local Data Location

You can only select local data storage from the **Start Logging Wizard**. The location of saved files for the current log session is displayed in the **Data Collection** tab of the Logging window.

CAUTION: Other users can cancel your log session if all the following conditions are true: Logging data is saved to the EPX Test System, and individual modules or deactivated groups are included in the log session.

Tip Use activated groups to ensure that other users do not stop logging and testing for your tests. For more about groups, see “Groups” on page 49.

Use the following steps to save log files to a local computer.

1. Open the **Start Logging Wizard** as described in “Setting Up Logging” on page 66.
2. In the second screen of the **Start Logging Wizard**, click **Store data on local computer**.

Select local storage of logging files

Click **Choose...** to select a directory

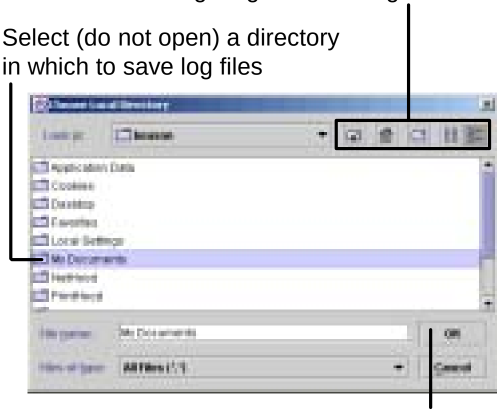
Note Defining the sample interval is not available when storing log files on a local computer. The interval is automatically set to 1 second.

3 To save log files to a different directory than the default, click **Choose...** to open the Choose Local Directory dialog.

By default, log files are saved in the directory where EPXam is installed.

Toolbar for navigating and creating folders

Select (do not open) a directory in which to save log files



Click **OK**

4 Select the folder to save the files to.

Do not double-click, or open, the desired folder.

Tip If you create a new folder from the Choose Local Directory dialog, the new folder is not highlighted. Scroll down the folder list to find a folder named New Folder.

Tip To rename a folder, click once on the highlighted folder, and then highlight the name.

---

5 In the Choose Local Directory dialog, click **OK**.

The selected directory appears in the Data Location field in the **Data Collection** tab.

6 Complete the logging setup as described in “Setting Up Logging” on page 66.

Saving Data to EPX Test System

You can save log files to an EPX Test System. The log files are available on the EPX Test System to all users. However, the storage space is limited.

The real time displays in the Logging window and the log file saved on the EPX Test System can differ slightly because each uses different data sources. When saving log files to the EPX Test System, EPXam uses module firmware to log data. However, the Logging window uses subscription data in a temporary folder to update the **Data Graphs** and **Data Tables** real time displays.

Recovering from Interruptions

If EPXam crashes or is restarted, log files exist for the test but contain data only until the crash or restart. If you reconnect to the EPX Test System, the test is still running, but test logging is not active. Also, real time data is not displayed in the logging window. If you restart logging, a new log file is created.

If the test system crashes, has a power interruption, or is restarted and Checkpoint/Resume is not enabled, log files exist for the test but are partially complete. If you reconnect to the Test System, the test is no longer running, and test logging does not resume.

If Checkpoint/Resume is enabled, tests running at the time of the interrruption are restarted from a saved checkpoint. Logging data is appended to the log files on the test system.

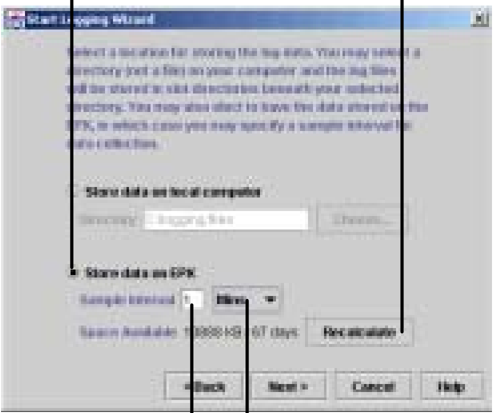
For more on recovering from power outages, see “Checkpoint/Resume” on page 137 and “Viewing Log Files after Resume” on page 140.

Selecting EPX Data Location

You can select EPX data storage only from the **Start Logging Wizard**. The location of saved file for the current log session is displayed in the **Data Collection** tab of the Logging window.

1 Open the **Start Logging Wizard** as described in “Setting Up Logging” on page 66.

2 In the second screen of the **Start Logging Wizard**, click **Store data on EPX**.



3 In the **Sample Interval** field, define the interval at which data is logged. See “Logging Intervals” on page 64.

- Select the unit of time (seconds, minutes, hours, days).
- Enter an integer for the number of seconds, minutes, hours, or days.

4 Check the available space on the EPX Test System by clicking **Recalculate**.

Note The available space is dependent on the Sample Interval that you have defined. Click **Recalculate** anytime you change the Sample Interval.

CAUTION: Do not fill the hard drive on the EPX CPU module with log files. If you do, the EPX Test System performance degrades and may lock up.

5 Complete the logging setup as described in “Setting Up Logging” on page 66.

Cancelling Log Sessions

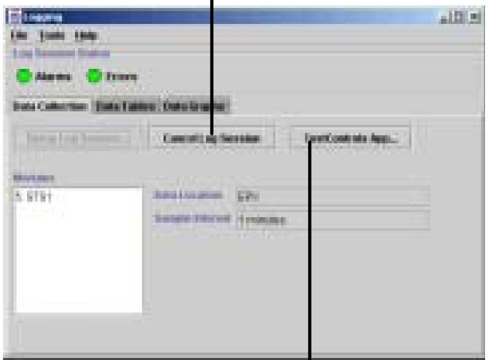
Stop logging by clicking **Cancel Log Session** in the **Data Collection** tab of the Logging window. Cancelling a log session only stops saving data to log files. Also, the graph and table displays of real time data are no longer updated. Testing on the modules or groups in the log session is not stopped.

To restart logging, set up another log session with the **Start Logging Wizard**, as described in “Setting Up Logging” on page 66.

After you cancel logging, the data tables and graphs are updated with all of the saved log data.

If you have long running tests (more than two days) with many errors or alarms, the update of the **Data Tables** and **Data Graphs** displays can take several minutes. See “Viewing Data Tables” on page 75 or “Viewing Data Graphs” on page 76 for more information about possible problems.

Click **Cancel Log Session** to stop logging (testing continues)



Click **Test Controls App** to stop, start, and pause testing (logging is not changed)

Controlling Tests in Log Sessions

Start, stop, and pause tests on modules or groups defined in a logging session. Stopping testing does not cancel the current log session: data is still written to log files. However, when tests are stopped and restarted, new log files are created.

When tests are stopped and logging is still on, the graphs continue to update in the **Data Graphs** tab of the Logging window even though there is no data saved to log files.

For details about controlling tests, see “Controlling Tests” on page 116.

1. In the **Data Collection** tab of the Logging window, click **Test Controls App**.
2. Select modules or groups, and click **Add>** to add them to the **Selected Items** list.
3. Define the test duration.
4. Click **Set Test Period** in the Test Controls window.
5. Use the **Test State** controls to start, pause, and stop tests on the selected modules or groups.

Viewing Log Sessions

You can always view data for a current log session that you created if you do not exit EPXam. If you close the logging window, testing and logging continues. You can open the Logging window and see real time data.

You cannot see other log sessions that are saved to other computers. If log files are saved to the EPX Test System, you can see and cancel other user’s log sessions if the sessions include individual modules or deactivated groups.

Viewing Alarm and Error Status

In the Logging window, indicators display the history of alarms and errors for modules or groups in the current log session.

- **Green**—No alarms or errors are detected or have been detected in the current test.
- **Red**—Errors or alarms are either currently detected or were detected earlier in the current test.
- **Grey**—The indicator does not apply to this module. If you have not set up a logging session, these indicators are grey.

Viewing Data Tables

The Logging window allows you to view the data in either saved log files or in currently running tests.

The **Data Tables** tab has two views:

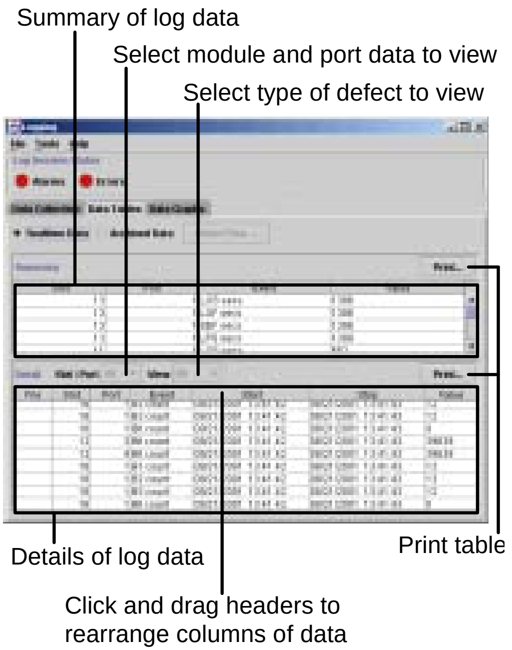
- **Summary**—Displays four types of data: the slot number, the port number (for transceivers), event, and value.
- **Detail**—Displays five types of data: the slot number, the port number (for transceivers), event, start time of event, stop time of event, and value.

EPXam Pro Only

This feature is only available with EPXam Pro. For more information, see “EPXam Pro Licensing” on page 149.

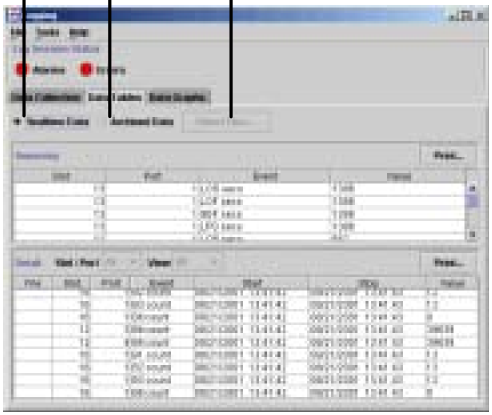
Real time data is reset when logging is turned off and on or when the test is restarted. Also, when logging is on for real time data, the Detail view does not have a scroll bar. When logging is turned off, a scroll bar is available.

Use the following figure and steps to view data tables.



1. When test is complete, turn logging off in the Logging window.
2. In the Logging window, click the **Data Tables** tab.
3. Select the type of data to view:
   - Real time data (for currently running tests)
   - Archived data (only for data saved to your local machine)

   See “Viewing Archived Data” on page 78.



4 In the Detail view, select a slot and port number for **Slot/Port**.

Viewing data by slot and port is only available when logging is turned off.

5 For **View**, select a type of defect to display: All or specific error or alarm type, such as B3, LOS, and Bit.

Viewing data by defect is only available when logging is turned off.

The types of defects available depend on the module type and the actual defects monitored.

6 Click and drag the headers of data columns to rearrange the order of the columns.

Viewing Data Graphs

The Logging window allows you to view the data graphs in either saved log files or in currently running tests.

The **Data Graphs** tab has two views:

- **Summary**—Displays presence of alarms and errors for each slot and port. Error and alarm types are not specified.
- **Detail**—Displays presence of errors, error count, or alarms by specific types.

EPXam Pro Only

This feature is only available with EPXam Pro. For more information, see “EPXam Pro Licensing” on page 149.

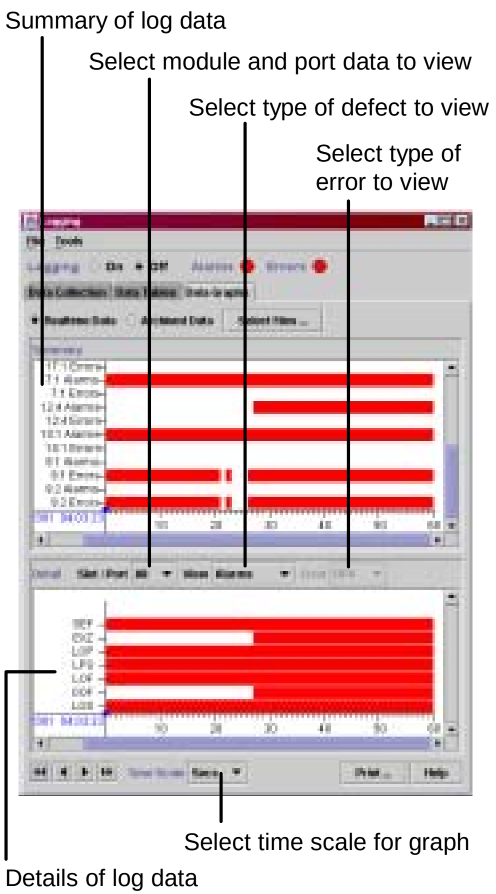
After you cancel logging while the Logging window open, the Logging window reads all the data for the log modules selected for logging and updates the **Data Tables** and **Data Graphs** tabs displays.

After more than 48 hours of logging multiple tests with a high number of errors, the following problems can occur:

- After turning off logging, graphing the data can take as long as an hour and most of the CPU cycles. Data is being read from a cache line by line.
- Gaps can appear in the graph while logging is still enabled.

If the logging window is closed while a test is running, real time data is deleted. If the logging window is opened again while tests are running, real-time data starts from the opening of the new logging window.

Use the following figure and steps to view data graphs.



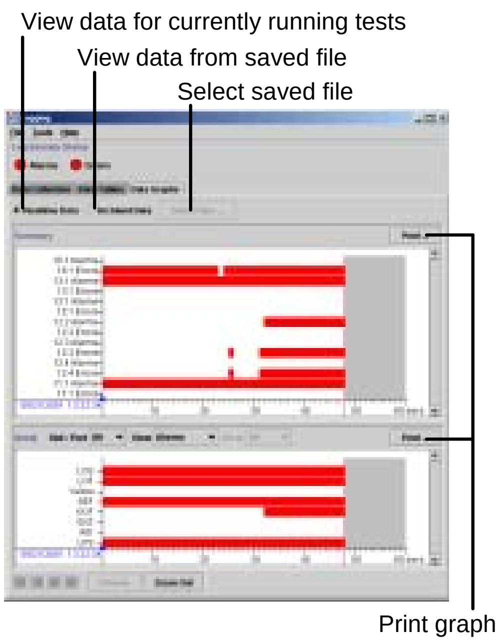
1 When a test is complete, turn logging off in the Logging window.

2 In the Logging window, click the **Data Graphs** tab.

3 Select the type of data to view:

- Real time data (for currently running tests)
- Archived data (only for data saved to your local computer)

See “Viewing Archived Data” on page 78.



4 In the Detail view, select a slot and port number for **Slot/Port**.

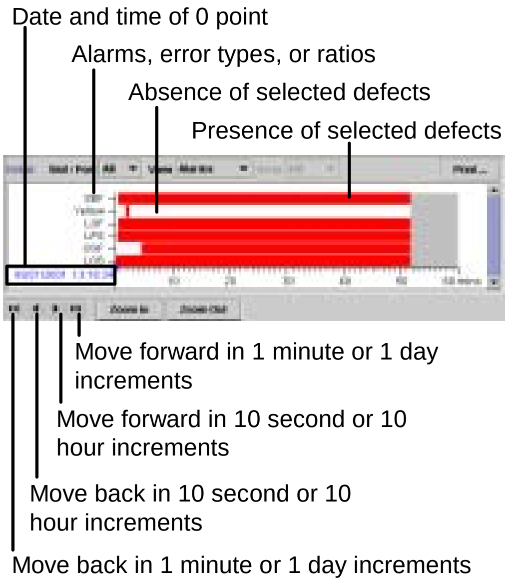
5 For **View**, select a type of defect to display: Alarms, errors, or error count.

6 If Error Count is selected, choose a type of error.

7 Select the time scale to use for the X axis: Seconds, minutes, or hours.

8 Use the controls in the lower left corner to scroll through the graph. See the following figure for control details.

As graph is scrolled, the 0, or origin, point is redefined, as indicated by the blue date and time label.



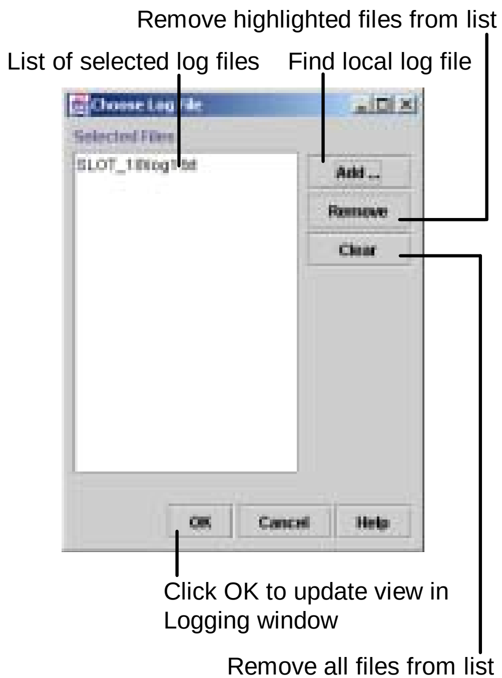
Viewing Archived Data

If you select to view Archived data in the **Data Tables** or **Data Graphs** tab, you can create a list of log files whose data can be displayed.

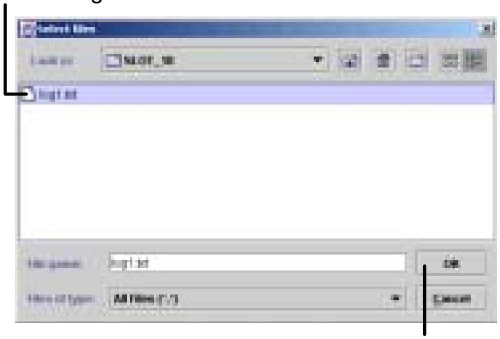
The Logging window can only load log files that have been saved to a local computer. It cannot load files directly from the EPX Test System. You can copy log files from the EPX Test System to your computer. See “Copying Log Files” on page 80 for more information.

1 In the **Data Tables** or **Data Graphs** tab, click **Archived Data**.

2 Click **Select Files...** to choose the log files. The Choose Log File dialog appears.



3 Click **Add...** to locate log files on your computer. The Select Files dialog appears.



4 Navigate to and click the desired log files.

5 In the Select File dialog, click **OK**. The log file is added to the list in the Choose Log File dialog.

6 Add other log files if desired.

7 To remove a file, highlight the file and click **Remove**.

Tip To select files that are not adjacent, hold down CTRL and click. To select adjacent files, hold down SHIFT, click on the first file, and click on the last file.

---

8 To remove all files, click **Clear**.

9 In the Choose Log File dialog, click **OK**. The **Data Tables** or **Data Graphs** tab is updated with logging data.

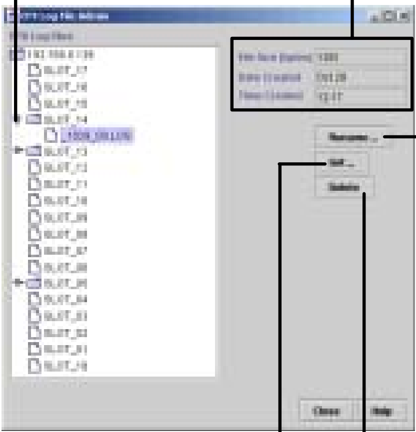
Managing Log Files

Use the Log File Admin window to manage logging files on the EPX Test System.

The Log File Admin window is not updated in real time. Close the window to update directory contents.

- Copy log files from the EPX Test System to your computer, as described in “Copying Log Files” on page 80
- Delete log files from the EPX Test System, as described in “Deleting Log Files” on page 81
- Rename log files on the EPX Test System, as described in “Renaming Log Files” on page 81
- View size and creation date and time of log files

  You can view information for only one selected log file.



COPYING LOG FILES

Log files copied from the EPX Test System to a local computer are converted to a different format. This conversion allows the Logging window to display the data as graphs and tables.

EPXam Pro Only

This feature is only available with EPXam Pro. For more information, see "EPXam Pro Licensing" on page 149.

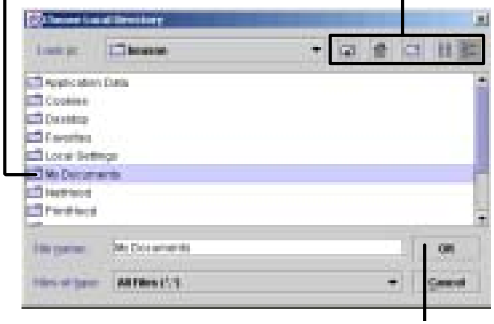
See "Log File Formats" on page 83 for details about log file formats.

1. In the Logging window, select **Tools > EPX file admin**. The EPX Log File Admin window appears.
2. Double-click folders to view their contents.
3. Select the desired log files.

Tip To select files that are not adjacent, hold down CTRL and click. To select adjacent files, hold down SHIFT, click on the first file, and click on the last file.

---

4. Click **Get...**. The Choose Local Directory dialog appears.



5. Select the folder to save the files to.

   Do not double-click, or open, the desired folder. Otherwise, clicking **OK** does not work.

6. In the Choose Local Directory dialog, click **OK**.

The log files are converted and copied.

Deleting Log Files

Use this feature to delete log files from the EPX Test System. You should delete files to keep disk space available so that the EPX Test System works properly.

1 In the Logging window, select **Tools > EPX file admin**. The EPX Log File Admin window appears.

2 Double-click folders to view their contents.

3 Select the desired log files.

Tip To select files that are not adjacent, hold down CTRL and click. To select adjacent files, hold down SHIFT, click on the first file, and click on the last file.

---

4 Click **Delete**. The selected files are deleted.

Renaming Log Files

Use this feature to rename log files on the EPX Test System.

Note File names must be 1-8 alphanumeric characters for the prefix and 3 alphanumeric characters for the suffix.

1 In the EPXam Log Administrator window, double-click folders to view their contents.

2 Select the desired log file.

3 Click **Rename**.

The Input dialog appears.

4 Enter the new file name, and click **OK**.

The file name is changed.

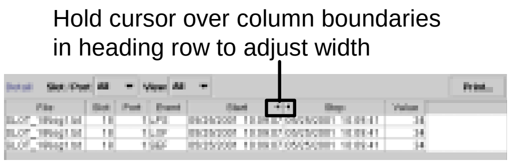
Printing Log Data

Logging data can be printed from the Logging window in two ways:

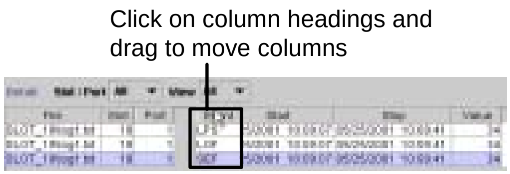
- From the **Data Tables** tab (prints the table)
- From the **Data Graphs** tab (prints the graph)

While printing, the Logging window is not functional.

To get the table data to fit on the printed page, adjust the column widths as shown in the following figure.



You can rearrange columns. Click and hold the column heading, as shown in the following figure. Drag the column to desired location and release.



Converting to Linear Format

Log files saved to the client can be converted to a linear format in which every log interval is written, even intervals during which no events occurred. Linear format is needed to import data files into other programs, such as a spreadsheet program.

Client log files only record events as they occur (on-change format); they do not have data for every interval. Converting to linear format fills in the missing intervals.

See “Log File Formats” on page 83 for details about log file formats.

Only defect data that has been logged is converted. For example, if only alarm events are recorded, then only those alarms have data in the output file, and error data would not be present.

Note Log files saved to the EPX Test System are already in a linear format. However, when log files are copied (using the Log File Admin) from the EPX Test System to the client computer, the log files are converted to the on-change format.

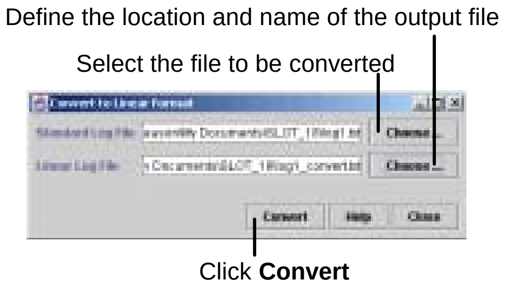
The conversion reads the start and stop time and any defect events in the input file, as shown below.

```
slot 18
start 05/25/2001  10:09:06
1, 05/25/2001  10:09:07, 05/25/2001
10:09:41, Alarm, LPS, Alarm Secs, 34.0
. . .
stop 05/25/2001  10:09:41
```

The data is then converted so that at one second intervals between the start and stop time, data is recorded, as shown below.

```
Date Time Slot Port LOF LPS SEF
05/25/2001  10:09:06 18 1 0 0 0
05/25/2001  10:09:07 18 1 0 0 0
05/25/2001  10:09:08 18 1 1 1 1
. . .
```

1 In the Logging window, select **Tools > Convert log file**. The Convert to Linear Format window appears.



2 Enter the location and name of the input file to be converted.

The input file should have a `.txt` extension. If the extension is `.log`, this is a file that has been copied from the EPX system.

3 Enter the location and name of the output file.

4 Click **Convert**.

5 Open or import the output file in a spreadsheet or other program.

Log File Formats

This section describes:

- Log file format (what information is captured)
- Log file naming conventions

Log files are saved in two formats:

- "Client Format" for logs saved to the local, or client, computer
- "EPX System Format" for logs saved to the EPX Test System

EPX Log File	Client Log File
Intervals for data collection can be set by users.	Intervals for data collection cannot be modified from the default (1 second).
Data varies among modules.	Data is consistent among modules.
Data is derived from module firmware.	Data is derived from subscription channel (but is not changed with SCPI).
Data is stored at intervals.	Data is stored on change.
All data values are recorded, even 0.	Only positive values are entered; values of 0 are not recorded.

Client Format

Log files saved to a client computer or copied from the EPX Test System using the EPX File Admin window have the following format:

- Slot number
- Start date and time of logging
- Event data that includes the following
  - Port number
  - Start date and time of event
  - Stop date and time of event
  - Event type
  - Event name
  - Measurement of event (such as seconds or count)
  - Event duration (such as alarms seconds or error counts)
- Stop date and time of logging

The following example is from a log file for an OC-48 Receiver.

```
slot 11
start 08/21/2001  13:18:34
1, 08/21/2001  13:18:34, 08/21/2001
13:18:35, Alarm, LPS, Alarm Secs, 1.0
1, 08/21/2001  13:18:35, 08/21/2001
13:28:16, Alarm, LOS, Alarm Secs, 581.0
1, 08/21/2001  14:09:06, 08/21/2001
14:09:25, Alarm, LOF, Alarm Secs, 19.0
1, 08/21/2001  14:09:06, 08/21/2001
14:09:25, Alarm, SEF, Alarm Secs, 19.0
1, 08/21/2001  14:09:06, 08/21/2001
14:09:25, Alarm, LPS, Alarm Secs, 19.0
1, 08/21/2001  14:09:24, 08/21/2001
14:09:25, Error, B1, Error Count, 8.0
1, 08/21/2001  14:09:24, 08/21/2001
14:09:25, Error, B2, Error Count, 379961.0
```

```
stop 08/21/2001  14:10:18
```

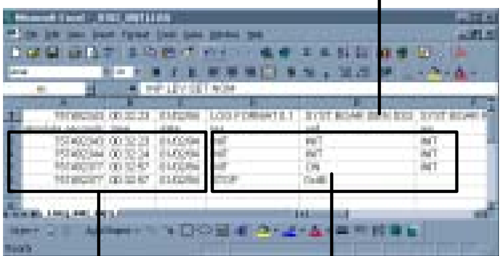
EPX System Format

Logging data is captured via software on the module hardware. You cannot use SCPI to modify what data is logged.

Note The logging data may vary among modules. If you import the log file into a spreadsheet, the data is easier to read, and a row of headers describes each column of data.

Note Hex numbers appear at the end of each line. These are used for checksum and are not a part of the test data.

The following figure shows a log that is imported in Microsoft Excel. The parts of the log file are described below.



- **Module information**—SCPI queries the module for its type, revision, manufacturing date, and build date.
- **Module setup commands**—SCPI is used to set up the receiver module (even from EPXam). These setup commands are recorded, allowing you to check the module in case of unexpected defects.
- **Test data**—This data is captured once testing is started. (STOP indicates that the testing has either been manually stopped or quit automatically as defined by the user.)

  A line above the test data includes brief heading descriptions for each column of data.

  Also, the test data area includes absolute time in seconds and the EPX System clock time for each logging entry. See “Logging Intervals” on page 64 for more information about the timing and log intervals.

The test data includes the following types of information.

- **Errors and alarms—**The status of alarms and errors are noted. The information displayed depends on the type of data collection, such as the duration of alarms in second, error counts, and error ratios.
- **Time—**This column displays the local time (according to the EPX OS clock) of events during the testing.
- **Absolute Seconds—**This column displays time on the EPX Test System in seconds.
- **Date**—This column displays the date of the testing events.

The time and absolute seconds reflect the logging interval set with the `SENS(@2:18):TEST:LOG:SEC` command or with the **Start Logging Wizard**. See “Setting Up Logging” on page 66 and “Setting Logging Intervals” on page 85.

The time and absolute seconds fields indicate when the logging interval began and ended. The error and alarm data for each row indicate the count or ratio in that logging interval.

The logging file saved on the EPX Test System cannot tell you exactly when the defects started and ended. You can define shorter logging intervals to better define when they occurred.

The data is not cumulative for the entire test. For cumulative counts, use subscription commands or the module window for the receivers in EPXam.

A log file is created for each test run on a module. The name of the files follow this pattern:

_0102_*iteration*.LOG

The first four numbers (0102 in the example) indicate the date that the log file was created. In the above example, the log file was created on January 2. The date is based on the EPX Test System date.

Iteration is the test that has been run on that slot. The first iteration of a test is 00; the second is 01; etc.

Controlling Logging with SCPI

This section describes how to use SCPI to set up, start, stop, and read data from logging files. You can use SCPI from several places:

- SCPI Commander in EPXam, as described in “SCPI Commander” on page 89
- Script Runner in EPXam, as described in “Script Runner” on page 99
- A telnet session (using a program such as NetTerm)
- A script written in a programming language, such as Java or C++
- An automated test environment

Note You cannot use SCPI to save log files to a local computer. When you use SCPI, logs can only be saved to the EPX Test System.

Logging can only be turned on for transceiver and receiver modules.

Setting Logging Intervals

By default, log files on the EPX Test System are updated every 600 seconds (10 minutes).

Log files can be updated more frequently by using the `SENS:TEST:LOG:SEC` *seconds* command.

```
SENS(@9:18):TEST:LOG:SEC 60
```

In this example, the log file is updated every 60 seconds.

CAUTION: Do not fill the EPX Test System hard drive with detailed logging, depending on the number of modules and the length of testing. The EPX Test System does not function when the disk is full. See “Logging Window” on page 65.

Enabling Logging

Logging can only be turned on for transceiver and receiver modules. Once enabled, logging remains enabled until either logging is turned off, or the EPX Test System is restarted.

When logging is enabled and testing is started, the log file records when logging started and what slot is being logged.

1. Configure the test modules as desired.
2. Turn on logging with the `SENS:TEST:LOG:MODE ON|OFF` command.

   `SENS(@9:18):TEST:LOG:MODE ON`
3. Set up testing.

   For details on setting up tests, see “Setting Test Type and Duration Using SCPI” on page 119.

   `SENS(@9:18):TEST:TYPE TIM`

   `SENS(@9:18):TEST:UNIT MIN`

   `SENS(@9:18):TEST:PER 10`
4. Start testing with the `SENS:TEST:MODE STAR|STOP|PAUSE|RESUME` command.

   For details on controlling tests, see “Starting and Stopping Tests Using SCPI” on page 119.

   `SENS(@9:18):TEST:MODE STAR`

When the test stops, you can get the log files from the EPX Test System and read them, as described in “Reading and Saving Log Files” on page 87.

Disabling Logging

Turn off logging with the `SENS:TEST:LOG:MODE ON|OFF` command.

`SENS(@9:18):TEST:LOG:MODE OFF`

The log file is updated for the final time, and all further updates stop. The log file also records when logging stopped.

Stopping logging does not turn off any current module tests. For information about stopping tests, see “Starting and Stopping Tests Using SCPI” on page 119.

Accessing Log Files

You cannot read log files from the EPX Test System. You must copy files from the EPX Test System to a local computer in one of two ways:

- Using the EPX File Admin window, as described in “Copying Log Files” on page 80

  Using the EPX File Admin converts the log file from its original format to the on-change format. For more on file formats, see “Log File Formats” on page 83.
- Using an FTP program

Using an FTP Program

You can use any FTP program to connect to the EPX Test System, such as a GUI-based program or FTP from the command line in DOS or UNIX. The following steps use FTP in a DOS window as examples.

1 Logging on as root, connect to the desired EPX Tester using the IP address.

```
% ftp 186.63.214.24
User (186.63.214.24): root
User name okay, need password.
Password: kingpin
User logged in, proceed.
ftp>
```

2 Change to the HTML/LOG/ directory on the EPX Tester.

```
ftp> cd HTML/LOG
```

3 Change to the directory of the desired slot, such as slot_02.

```
ftp> cd slot_02
```

4 View the contents of the slot directory, using a command such as `dir`.

```
ftp> dir
-rw-rw-rw 1 ftproot ftp 1557 Jan 14 5:04
_0114_00.log
-rw-rw-rw 1 ftproot ftp 1557 Jan 15 4:30
_0115_00.log
-rw-rw-rw 1 ftproot ftp 1557 Jan 16 3:22
_0116_00.log
```

5 Close the FTP program.

```
ftp> quit
```

Reading and Saving Log Files

You can read log files as plain text files or, to make reading easier, as spreadsheet files. The following procedures explain how to import the log files into Microsoft Excel and use FTP in a DOS window as examples.

See “Log File Formats” on page 83 for information captured in testing log files.

1 Using an FTP program, connect to the EPX Test System, as described in “Accessing Log Files” on page 86.

2 Change to the HTML/LOG/ directory on the EPX Tester.

```
ftp> cd HTML/LOG
```

3 Change to the directory of the slot that has the log file you want to read.

```
ftp> cd slot_06
```

4 Check the file names in the slot directory.

```
ftp> dir
-rw-rw-rw 1 ftproot ftp 1557 Jan 14 5:04
_0114_00.log
-rw-rw-rw 1 ftproot ftp 1557 Jan 15 4:30
_0115_00.log
-rw-rw-rw 1 ftproot ftp 1557 Jan 16 3:22
_0116_00.log
```

5 Copy the file from the EPX Test System to your local computer.

```
ftp> get _0116_00.log
```

6 Close the FTP program.

```
ftp> quit
```

7 Open a spreadsheet program, such as Microsoft Excel.

8 In Excel, open the saved log file.

Tip If you are using FTP in a DOS or UNIX window, the log file is copied to the directory in which you executed the FTP command.

9 Format the file as delimited with commas.

The file is displayed with data columns.

Deleting Log Files

You should periodically delete log files to make finding files easier and to clear space on the EPX Tester.

You must copy files from the EPX Test System to a local computer in one of two ways:

- Using the EPX File Admin window, as described in "Deleting Log Files" on page 81
- Using an FTP program

Note Only the EPX Test System administrator with root access can delete log files. You must log in as root from the FTP window.

Using an FTP Program

You can use any FTP program to connect to the EPX Test System, such as a GUI-based program or FTP from the command line in DOS or UNIX. The following steps use FTP in a DOS window as examples.

1 Using an FTP program, connect to the EPX Test System, as described in "Accessing Log Files" on page 86.

2 Change to the HTML/LOG/ directory on the EPX Test System.

```
ftp> cd HTML/LOG
```

3 Change to the directory of the desired slot, such as slot_02.

```
ftp> cd slot_02
```

4 Delete the desired log file.

```
ftp> dir
-rw-rw-rw 1 ftproot ftp 1557 Jan 14 5:04
_0114_00.log
-rw-rw-rw 1 ftproot ftp 1557 Jan 15 4:30
_0115_00.log
-rw-rw-rw 1 ftproot ftp 1557 Jan 16 3:22
_0116_00.log
ftp> delete _0116_00.log
ftp> Request file action taken, completed.
```

5 Close the FTP program.

```
ftp> quit
```

8

USING THE SCPI INTERFACE

The EPX Test System is controlled with Standard Commands for Programmable Interfaces (SCPI). You can use SCPI from a telnet session or from the SCPI Commander window in EPXam.

This section covers the following topics:

- “SCPI Commander” on page 89—Describes how to use SCPI Commander to issue commands, view command responses, and subscribe to events.
- “SCPI Monitor” on page 92—Describes how to view SCPI used by EPXam.
- “Subscribing for Events” on page 93—Describes how the subscription channel works and how to subscribe to events using SCPI.
- “Using Tags to Identify Messages” on page 96—Explains how to use the SCPI tag mode command to prefix a string to command input and output for identification.

The following topics provide related information about using SCPI:

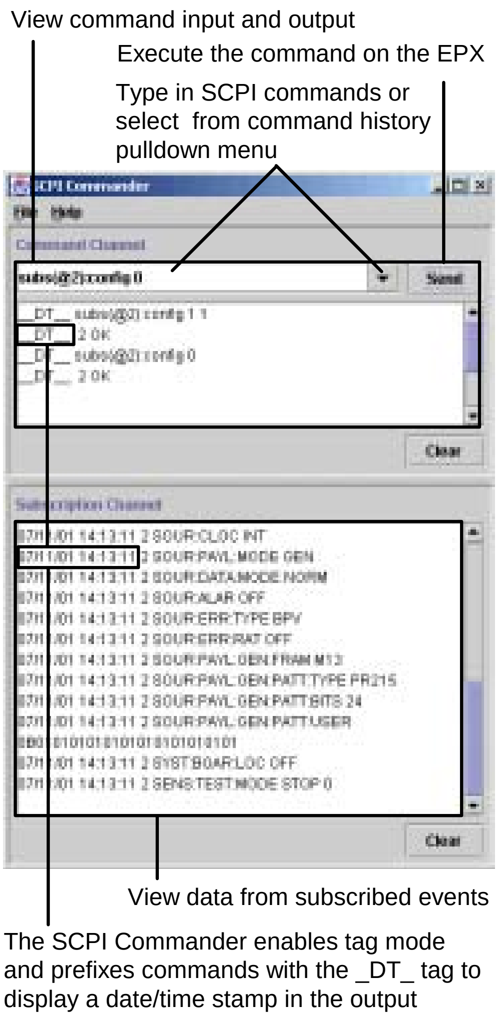
- See “Script Runner” on page 99 for information about using the Script Runner application to build SCPI scripts.
- See the *“SCPI Reference”* section of the EPX Test System online help for complete SCPI syntax and parameters for each module.

SCPI Commander

The SCPI Commander, which is accessed through the EPXam main window, enables you to do the following:

- Issue SCPI commands directly to the EPX Test System using a separate command and subscription channel
- Subscribe to and view selected events and data
- View input and output for SCPI commands issued

The following illustration shows the main features of the SCPI Commander window.



When you run the SCPI Commander, you are opening a separate client connection to the EPX system with its own command channel and subscription channel. You can open more than one SCPI Commander, but each instance creates a separate client connection. The default number of client connections allowed is five. Refer to “Setting Maximum Connections” on page 35 for more information.

EPXam windows are updated to reflect the commands issued with SCPI Commander.

By default, the SCPI Commander does not subscribe to any events when it is first opened. You must enter at least one subscription command in the command channel for there to be any data displayed in the subscription channel view.

Use the SCPI Commander when you need to do the following:

- Execute commands or use parameters that are not available via EPXam (for example, issuing SCPI to a range of slots)
- Test commands and verify output when developing SCPI scripts
- Subscribe to a specific set of events on the EPX Test System or to system events

Command channel input and output and subscription data displayed in the SCPI Commander are not saved or logged to files. You can use logging and the subscription channel simultaneously. Refer to “Logging” on page 63, for information about available EPX Test System logging features.

The rest of this section covers the following topics:

- “Opening the SCPI Commander Window” on page 91
- “Issuing Commands” on page 91
- “Cutting and Pasting Text” on page 91

Opening the SCPI Commander Window

To open the SCPI Commander window, click on the SCPI Commander toolbar icon or select **Tools > SCPI Commander** in the EPXam main window.

Tip If you hold the mouse cursor over a toolbar button and wait, the name of the button appears.

Click icon to start SCPI Commander

Hold mouse over icon to identify it

When you first open the SCPI Commander, no data is displayed because no commands have been issued and no events have been subscribed.

Issuing Commands

To issue commands to the EPX test system:

1. Type the command in the Command Channel field

   You can also select and edit a previously executed command from the command history pulldown menu.

2. Click **Send**.

   The command and its response are displayed in the Command Channel view.

If the command entered is a subscription command, the subscribed events and data are displayed in the Subscription Channel view.

The SCPI Commander uses the `_DT_` tag to automatically prefix subscription channel output with the EPX system date and time.

CAUTION: Do not disable or change the tag mode from the SCPI Commander.

See “Subscribing for Events” on page 93 for detailed information about using the subscription channel and commands.

See the *“SCPI Reference”* section of the online help to view detailed syntax for commands that can be executed on each type of EPX module.

Cutting and Pasting Text

On Windows systems, you can use **CTRL-c** and **CTRL-v** to cut and paste the SCPI Commander window output into other applications, such as Notepad.

Do not cut and paste subscription channel output into the Command Channel field in the SCPI Commander to execute as a command. Doing this results in syntax errors, because the subscription data is formatted differently.

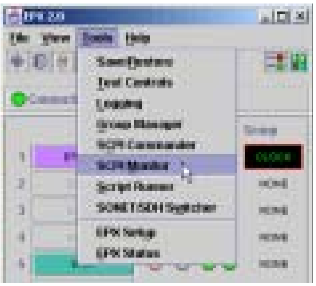
SCPI Monitor

The SCPI Monitor displays the following information:

- SCPI sent to the EPX Test System by the GUI
- Notifications and data from subscribed events that are sent from the EPX Test System to the GUI

Opening the SCPI Monitor Window

To open the SCPI Monitor window, select **Tools > SCPI Monitor** from the EPXam main window.



Using SCPI Monitor

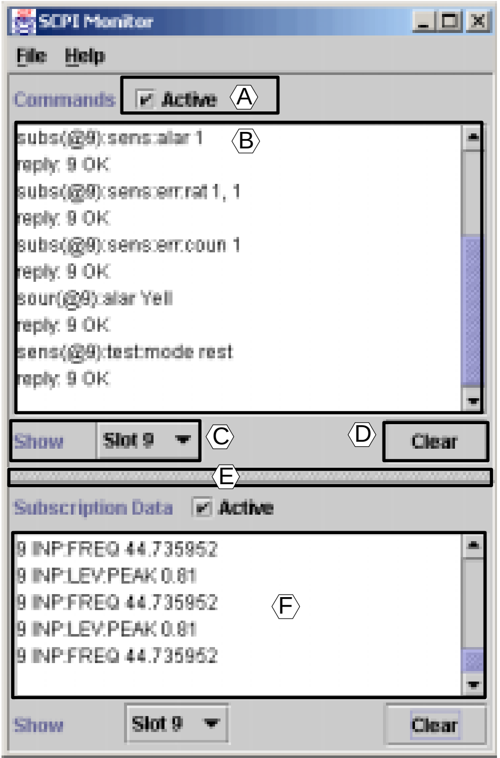
The information in the SCPI Monitor window is view-only and cannot by modified. By default, command and subscription channel output are displayed for all slots, but can be filtered per slot. The output is not available for logging to a file.

The SCPI Monitor enables you to do the following:

- View the exact sequence and syntax of commands issued to the EPX by the GUI. This can be helpful when writing SCPI scripts.
- View GUI command and subscription channel output and monitored data when troubleshooting

The SCPI Monitor window uses the EPXam subscription channel and client connection.

The following illustration shows the main features of the SCPI Monitor window.



A **Active**—Enable or disable display of GUI command or subscription channel data for the selected slots.

B **Commands**—Displays the underlying SCPI input and output for every action performed through the GUI.

C **Show**—Display command channel or subscription channel data for all slots or filter the data per slot.

D **Clear**—Clear the command or subscription data area of the window.

E **Resize control**—Click and drag to resize Commands and Subscription Data display areas.

F **Subscription Data**—Displays all events and data subscribed to by the GUI.

Under Microsoft Windows, you can use the **CTRL-c** and **CTRL-v** to cut and paste text from the SCPI Monitor into other applications, such as Notepad.

Do not cut and paste subscription channel output into the Command Channel field in the SCPI Commander to execute as a command. Doing this results in syntax errors, because the subscription channel output is formatted differently.

Subscribing for Events

In addition to logging and query commands, the subscription channel provides information about EPX tests and data.

- System and module configuration events
- Data from monitored tests

Note Subscription channel data is not captured to a file except by features of the telnet application or by a user-created script.

You cannot run SCPI from the subscription channel: it only displays messages. Use a command channel to subscribe for what events to display. As the subscribed events occur, update messages are displayed in the subscription channel.

Opening a Subscription Channel

You can open a subscription channel in one of two ways:

- From a telnet session (using any telnet application)
- From a new client of the SCPI Commander (See “SCPI Commander” on page 89)

USING TELNET

For details on connecting via telnet and setting up telnet applications, see *EPX Test System Getting Started* manual.

Netterm is used for examples.

Note Some programs, such as the Windows telnet program, have problems displaying subscription channel messages correctly.

1. Start a telnet application.
2. Set the telnet application settings for connecting to the EPX command channel.

   Use the EPX IP address and port 10179.
3. Determine the Subscription channel port by issuing a `SYSTEM:CLIENT:PORT` command.

Note You have 1 minute from the time that you issued the `SYSTEM:CLIENT:PORT` command to the time to complete Steps 5 and 6.

   The command returns the telnet port that you can use for a subscription channel. This value is between 10180 and 10184.

   ```
   SYSTEM:CLIENT:PORT
   OK 10181
   ```
4. Launch a second telnet connection.
5. Set the port number to the value returned by the `SYSTEM:CLIENT:PORT` command issued above.
6. If the telnet application does not successfully connect after 1 minute, re-issue the `SYSTEM:CLIENT:PORT` command and try connecting again.

   The port number may have changed, and you may need to change the settings in your telnet application.

Once you have established both a Command Channel and Subscription Channel, you can issue SCPI on the Command Channel.

Subscribing for System Events

You can be notified of the following events for all boards:

- When tests are enabled
- When alarms are enabled or pending
- When errors are enabled or pending
- When the backplane modes change for each module

See the System SCPI Reference at http://www.gnubi.com or from the EPX GUI online help.

For example, if you wanted to know that alarms are enabled, you would use the following command:

```
syst:subs:stat:alar:enab 1
OK Subscribed for alarms enabled status events
```

The subscription channel displays information similar to the following:

```
SYST:SUBS:STAT:ALAR:ENAB
3,3,3,1,2,3,2,3,1,2,1,3,3,1,3,3,3,3
```

Each of the numbers indicates the status for all 18 slots:

1 = Alarm insertion is not enabled, or active.

2 = Alarm insertion is enabled, or active.

3 = Alarm insertion is not available. This condition may exist for one of two reasons:

- The installed module, such as CPU or clock, does not support alarm insertion.
- A module is not installed in that slot.

The value for these numbers depends on the SCPI subscription command. See the SCPI Reference for details.

Subscribing for Group Manager Events

You can subscribe for all Group Manager events, including:

- When groups are added, deleted, renamed, or locked
- When modules are added to groups, deleted from groups, assigned types or positions, or renamed
- When group tests units, periods, types, and modes are set

You can subscribe to all Group Manager events or to particular events.

To subscribe to all events, you would use the following command:

```
gman:subs:all 1
OK Subscribed for all GMAN events
```

You can also unsubscribe from all events:

```
gman:subs:all 0
OK Unsubscribed for all GMAN events
```

See the Group Manager SCPI Reference page at http://www.gnubi.com or from the EPX GUI online help for more details.

Subscribing for Module Events

You can subscribe for events that occur for individual slots:

- Module configuration change
- Input peak voltage/ power (updated at specified intervals)
- Input frequency (updated at specified intervals)
- Status of alarm counts, seconds, and ratio
- Status of error counts and ratio
- Error-free and error seconds
- Path error types

- Overhead status
- Section (J0) and path (J1) trace messages
- Changes to section and path overhead bytes

Also, Payload Monitor and Payload Generator have their own subscriptions:

- Section (J0) and path (J1) trace messages
- Changes to section, path, and line overhead bytes
- APS information
- Pointer value and pointer-related counter changes

For example, if you want to know configuration status, use the following command:

```
SUBScribe(@2):CONFig  1
OK
```

The subscription channel displays information similar to the following:

```
2 SENS:TEST:MODE STOP 0
2 SENS:TEST:TYPE CONT
2 SENS:TEST:PER 10
2 SENS:TEST:UNIT SEC
2 SENS:TEST:LOG:MODE OFF
2 SYST:BOAR:BACK:MODE PASS
2 INP:RATE STS12
2 SENS:TEST:MODE STOP 0
```

The first number is the slot number followed by a simplified version of the configuration SCPI and their settings. For example, the first line shows that the module in slot 2 is not in use for a test.

If you want to know the APS information for an OC12/3 Transmitter with a Payload Generator, use the following command:

```
SUBScribe(@4):PMODule:SOURce:APS 1
OK
```

The subscription channel displays information similar to the following:

```
4 PMOD:SOUR:APS:K1K2 0xf1 0x14
4 PMOD:SOUR:APS:K1EN:REQ LOPS
4 PMOD:SOUR:APS:K1EN:CHAN 1
4 PMOD:SOUR:APS:K2EN:ARCH A1_1
4 PMOD:SOUR:APS:K2EN:OPER UNID
4 PMOD:SOUR:APS:K2EN:CHAN 1
4 PMOD:SOUR:APS:UPD
```

The first number is the slot number followed by a simplified version of the configuration SCPI and their settings.

See the *SCPI Reference* for individual modules http://www.gnubi.com or from the EPX GUI online help.

Using Tags to Identify Messages

The EXP Test System has a tag mode that allows users to prefix commands with a string.

The tag is returned with responses in the command and subscription channels.

CAUTION: Do not disable or modify tag mode from the SCPI Commander.

1. Open a telnet connection to an EPX Test System.
2. Enable tag mode with the `SYST:CLI:TAGM 1` command.
3. Prefix all commands with desired tag.

   Example: `gg outp(@4):rate stm4`

   The EPX Test System returns the following:

Example: `gg 4 OK`

4 Disable tag mode with a command similar to the following:

Example: `gg SYST:CLI:TAGM 0`

As shown in the above example, when tag mode is enabled, the command to disable tag mode must be prefixed with the current tag.

Tip The maximum length of a tag is 32 characters. Use the *_ _DT_ _* reserved tag to prefix subscription data with the date and time.

9

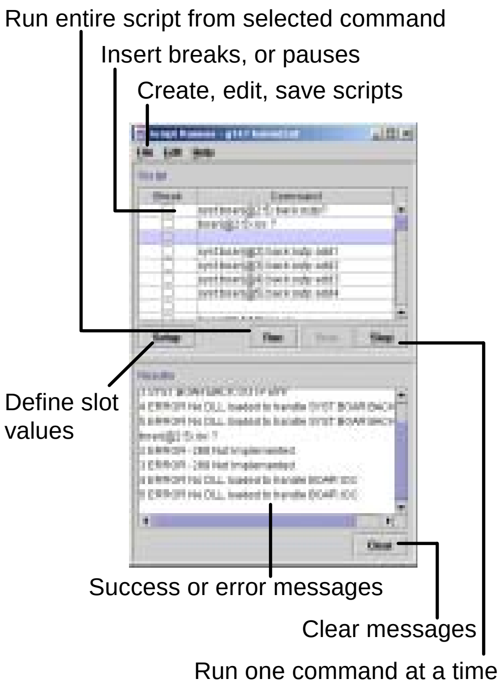
SCRIPT RUNNER

Script Runner allows you to run plain text scripts from EPXam. Scripts are useful if you want to use the same setup and testing repeatedly. Create scripts or edit existing ones from Script Runner.

Creating, saving, and opening scripts from Script Runner is only available from EPXam Pro. The EPXam applet window does not support these functions. For more information on EPXam Pro and the EPXam applet, see “EPXam and EPXam Pro Feature Comparison” on page 149 and “EPXam Pro Licensing” on page 149.

The following topics are described in this section.

Note Each instance of Script Runner uses its own connection, which is not shared with the EPXam connection or other windows.



Starting Script Runner

Start Script Runner from the EPXam main window by selecting **Tools > Save/Restore** from the EPXam menu.

Script Commands

Create scripts with the following commands.

- **SCPI (module commands)**—Enter a SCPI as described in the SCPI reference for each module.

  Example: `sour(@5):err:type sect`

  Use a variable for the slot number. See “Using Slot Variables” on page 102.

Note Do not leave the slot specification blank, such as (@). Script Runner interprets the blank for a slot name and treats it as a slot variable which may be confusing in the Setup dialog.

- **Repeat command**—Repeat a section of the script for any number of times.

  Use `Repeat` *numberOfTimes* before the first command in the repeated section. Enter an integer for *numberOfTimes* to define the number of times to repeat the section.

  Use `End Repeat` after the last command in the repeated section.

  In the following example, a section of the script changing the type of alarm insertion is repeated three times.

  Example:

  ```
  repeat 3
  sour(@5):alar LOS
  sour(@5):alar OFF
  sour(@5):alar LOF
  end repeat
  ```

- **Wait command**—Create a delay in the script with the `wait` *milliseconds* command. Enter an integer for *milliseconds* to define the number of milliseconds to delay execution of the next command.

Unlike the Break feature, `wait` does not require manually resuming the test. Instead, the script waits for the defined number of milliseconds and then executes the next command.

Example:

```
sour(@5):alar LOS
wait 1000
sour(@5):alar OFF
wait 2000
sour(@5):alar LOF
wait 3000
```

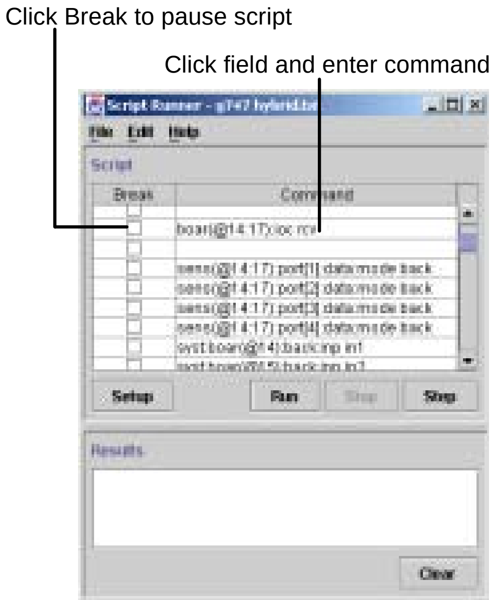
Creating Scripts in Script Runner

Use the following steps to create a script in Script Runner.

1 Select **Script > New** from the Script Runner menu.

2 In a **Command** field, enter one of the command types.

See “Script Commands” on page 100 for more information.



3 To pause the script, click the **Break** box at the desired point in the script. The script pauses before executing the command with the checked **Break** box.

See “Pausing Scripts” on page 104 for more information.

4 Save the script by selecting **Script > Save As**.

EPXam Pro Only

The **Save** feature is only available with EPXam Pro. For more information, see “EPXam Pro Licensing” on page 149.

Creating Scripts in Text Editor

Use a text editor to create scripts to load into Script Runner.

Note You cannot insert Breaks when using a text editor. Breaks can only be defined in Script Runner.

Note Though you can create slot variables, you can define slot variables only in Script Runner. See “Using Slot Variables” on page 102.

1 Start a text editor, such as Notepad or Emacs.

2 Enter each command on a separate line.

See “Script Commands” on page 100 for more information.

Example:

```
pmod(@5):sour:cloc:sour clkb
sour(@5):err:type sect
outp(@5)rate sts3c
pmod(@5):sour:data:sect:tren on
pmod(@5):sour:payl:patt:type user
pmod(@5):sour:payl:patt:user 0b00001111
syst:boar(@5):back:mode pmod
sour(@5):err:rat 1e-9
```

3 Save the file.

4 Select **Script** > **Open** in Script Runner to load the file and run it.

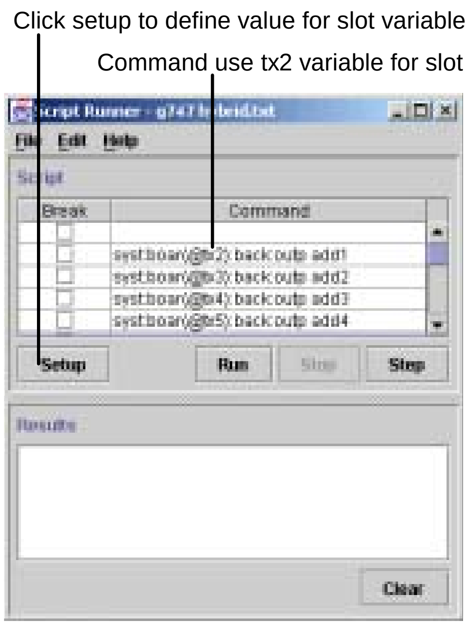
Using Slot Variables

Use variables in scripts instead of specific slot numbers. Variables allow you to customize scripts to whatever EPX System setup you have access to.

Create as many variables in a script as needed. For example, you might create separate variables for OC12/3 Receivers, OC12/3 Transmitters, and DS1 Transceivers.

Create a variable using the following steps.

1 Create variables for slots where needed, such as tx1 and tx2.



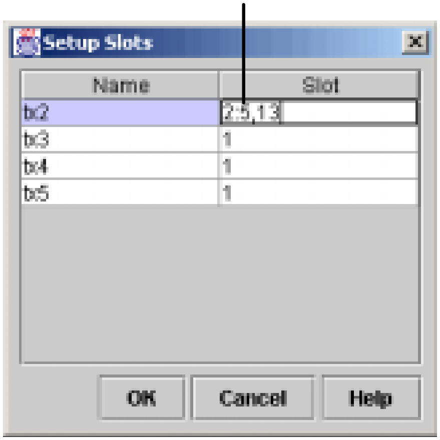
2 After creating variables, click on an empty command line. Otherwise, that slot variable is not listed in the Setup Slots dialog.

3 Click **Setup** to define the variables. The Setup Slots dialog appears.

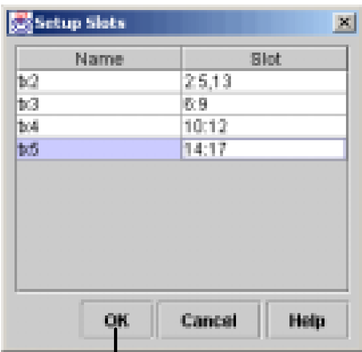
4 For each slot name (variable), click on the adjacent **Slot** field and enter a slot number.

Use colons for ranges of slots (such as 6:10) or commas for non-consecutive slots (such as 6,9,12).

Enter slot numbers using colons for range or comma-separated list



5 After defining all the variables, click **OK** to assign the values.



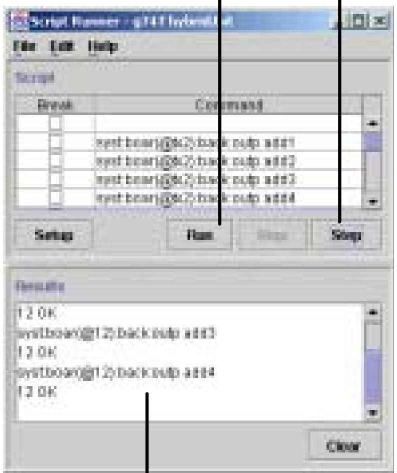
Click **Okay** to assign value

6 Run the script. The command responses show that the defined slot numbers were used.

See “Running Scripts” on page 105 for more information about running scripts.

Click **Step** to execute one script command

Click **Run** to execute script



Command responses show slot used for variable

Pausing Scripts

Pause a script by checking the **Break** box in Script Runner. Scripts using Break must be manually restarted, unlike the `wait` command which automatically restarts the script as described in “Script Commands” on page 100.

Note You can only insert Breaks with Script Runner. You cannot insert them with a text editor.

The script is executed up to but not including the command with the Break checked. The script is then paused until **Run** or **Step** is clicked.

Monitoring Command Responses

You can monitor the success and error messages for commands run from a script in Script Runner. These messages are displayed in the **Results** area of the window. Use the scroll bars to review the list of messages.

Click **Clear** to delete all the command responses.

Note These messages are only for the commands issued from Script Runner. You cannot monitor messages for commands issued from other EPXam windows.

Saving Scripts

Save scripts from Script Runner to a plain text file.

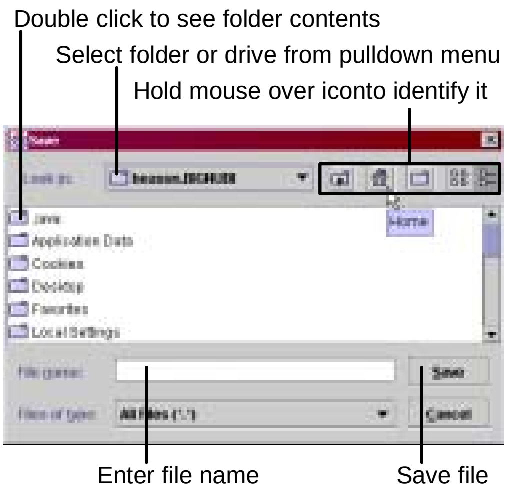
EPXam Pro Only

This feature is only available with EPXam Pro. For more information, see “EPXam Pro Licensing” on page 149.

---

1 From the **File** menu in Script Runner, select one of the following.

- **Save**—Use to save to an existing file.
- **Save As**—Use to a save a file to a new name.



2 Navigate to the desired location to save the script.

3 Enter a file name for script.

4 Click **Save**.

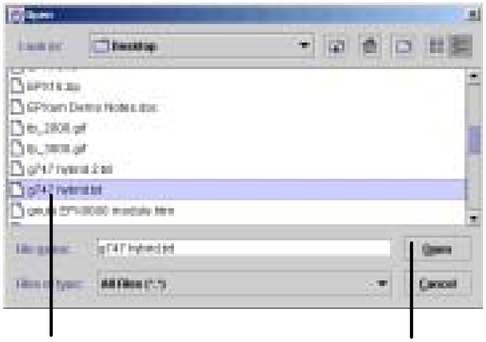
Opening Scripts

Use the following steps to open plain-text scripts in Script Runner.

EPXam Pro Only

This feature is only available with EPXam Pro. For more information, see "EPXam Pro Licensing" on page 149.

1 In the Script Runner menu, select **File > Open**.



Select saved script Click **Open**

2 Navigate to the directory where a script is saved.

3 Select the script, and click **Open**. The script is loaded in the Script Runner window.

4 If desired, edit the script, as described in "Creating Scripts in Script Runner" on page 101.

5 Run the script, as described in "Running Scripts" on page 105.

Running Scripts

Use the following steps to run a script that is open in Script Runner.

1 Select the line of script at which to start.

Note Script Runner does not start executing commands from the first command in the script. Instead, it starts from the highlighted command.

2 Click either **Run** or **Step**.

- **Run**—Executes script starting with the selected command to the end of the script or a Break.
- **Step**—Executes one line of script starting with the selected command and continuing to the next command.

10

SAVING AND RESTORING TEST CONFIGURATIONS

Each type of EPX module has a factory default configuration, which defines settings such as the payload data pattern, error and alarm insertion, error count and ratio monitoring. Once you have modified the default settings for a module, you can use the Save/Restore feature to save your custom settings for later use.

Configuration settings are always saved or restored for a particular slot. See “Understanding EPX Configuration Files” on page 111 for more information about EPX configuration files and how they are named and stored on the test system.

Tip If more than one user is connected to the same EPX Test System, it is possible that they can overwrite each other’s saved configuration. To avoid this problem, reserve the modules using the Group Manager as described in “Creating Groups” on page 50.

You can save and restore module/slot configurations on the EPX Test System using any of the following methods:

- **EPX module window save/restore controls**—Use the save/restore controls on the module window when you want to save or restore the configuration for a single module.

  See “Using Module Window Save and Restore Controls” on page 108.

- **EPXam Save and Restore window**—Use the Save and Restore window when you want to manage slot configurations for all the modules in a group or several modules from a central location.

  See “Using the EPXam Save/Restore Window” on page 108.

- **SCPI**—Use the SCPI interface to manage slot configurations from the command line or in SCPI scripts. Using SCPI to save and restore slot configurations has one advantage over using the GUI: you can specify a unique file name when saving and restoring configurations instead of the default filename DLL.CFG.

  See "Managing Configurations Using SCPI" on page 110.

Using Module Window Save and Restore Controls

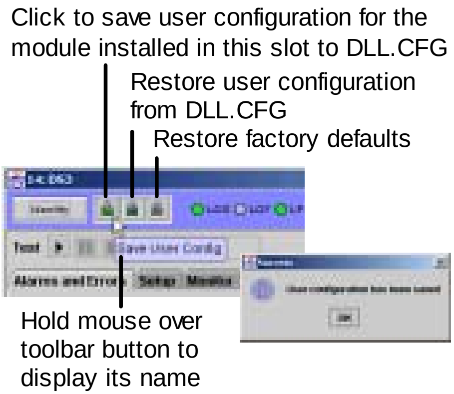
Perform the following steps to use the save and restore controls in a module window to save or restore the configuration for a single module:

1. Configure the module's settings as desired.
2. In the module window, click the toolbar icon that corresponds to the action you wish to perform.

Tip Hold the mouse over a toolbar icon to display its name.

- **Save User Config—**The configuration settings are saved to a file named DLL.CFG for the module installed in the selected slot.
- **Restore User Config—**The configuration settings from the DLL.CFG file for the selected slot are restored.
- **Restore Factory Config**—The configuration settings from the FACTORY.CFG file for the selected slot are restored.

A confirmation dialog displays, as illustrated in the following figure.



See "Understanding EPX Configuration Files" on page 111 for more information EPX configuration files and how they are named and stored on the EPX Test System.

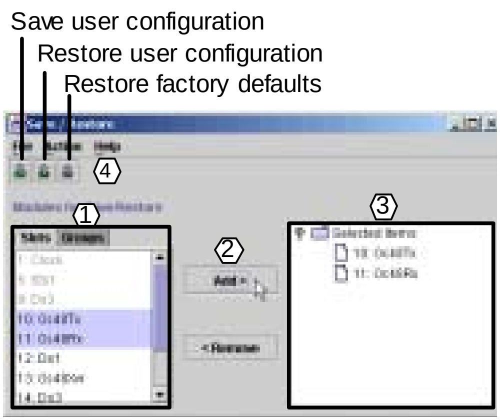
Using the EPXam Save/Restore Window

This section describe how to use the EPXam Save/Restore window to manage module/slot configuration settings. You can save configurations any combination of slots or groups using the Save/Restore window.

When you save or restore configurations for multiple slots through the Save/Restore window, the settings are saved to a file named DLL.CFG for each slot. If a DLL.CFG file for a slot exists, it is overwritten. This means that only one configuration can be saved or restored at a time using the GUI. If you want to save multiple configurations for a slot and name the configuration files uniquely, you must use SCPI. See “Managing Configurations Using SCPI” on page 110 and “Saving and Restoring Test Configurations” on page 107 for more information.

To open the EPX Save/Restore window, log in to the EPX Test System with EPXam and select **Tools > Save/Restore** from the EPXam main window menu or click the Save/Restore icon on the main window toolbar.

The procedures described in this section refer to the following figure.



Perform the following steps in the Save/Restore window to save or restore configuration settings for any combination of EPX modules and groups:

1. From the list on the left, select the groups and slots for which you want to save or restore settings.

   The names of modules and groups that are reserved by other users are greyed out and preceded by a Lock icon and cannot be selected. The EPX Clock module in slot 1 is locked unless you are logged in as root.

   To select a slot or group, select the **Slots** or **Groups** tab and highlight the name of the group or module.

Tip You can use Shift-click or CTRL-click keyboard shortcuts to select multiple modules or groups in either list.

2. Click **Add>** to move the highlighted slots or groups to the **Selected Items** list.

   To remove items from the **Selected Items** list, highlight the items in the list, then click **<Remove**.

3. Continue adding slots and groups as needed until the desired modules and slots are displayed in the **Selected Items** list.

4. Select the action you wish to perform on the selected slots using either the toolbar buttons or the Action menu:

- **Save User Config—**The configuration settings are saved to a file named DLL.CFG for each selected slot. This includes modules that are part of groups.
- **Restore User Config—**The configuration settings from the DLL.CFG file for each selected slot are restored.
- **Restore Factory Config**—The configuration settings from the FACTORY.CFG file for each selected slot are restored.

5 Select **File > Exit** to exit the Save/Restore window.

See “Understanding EPX Configuration Files” on page 111 for more information EPX configuration files and how they are named and stored on the EPX Test System.

Managing Configurations Using SCPI

See the following topics in this section for procedures and example for saving and restoring module/slot configurations using SCPI:

- “Saving Custom Configurations Using SCPI” on page 110
- “Restoring Custom Configuration Settings Using SCPI” on page 111
- “Restoring Factory Defaults Using SCPI” on page 111

Note There are specific Group Manager commands for saving and restoring configuration for groups. See “Saving Module Configurations” on page 60 and “Restoring Module Configurations” on page 61 in the section “Managing Groups Using SCPI” for syntax and examples.

Saving Custom Configurations Using SCPI

1 Open the SCPI Commander or open a command channel using a telnet application to connect to the EPX Test system, such as NetTerm.

2 Enter the `CONF(@1:18):SAVE` *filename*`.cfg` command.

CAUTION: Configuration filenames must not contain spaces. See “Configuration Filename Restrictions” on page 112.

The following example saves a configuration for a single slot.

Example: `CONF(@10):SAVE oc12rx.cfg`.

The following example saves the configuration for slots 3-8 and 10.

Example: `CONF(@3-8,10):SAVE oc12rx.cfg`

This command creates a configuration file named oc12rx.cfg for each of the specified slots and stores it in the appropriate SLOT_*nn*/ directory on the EPX Test System.

Restoring Custom Configuration Settings Using SCPI

You can use SCPI to restore configurations for multiple slots if the configuration settings were saved to the same file name for each slot.

Perform the following steps to restore configuration files using SCPI:

1. Open the SCPI Commander or open a command channel using a telnet application to connect to the EPX Test system, such as NetTerm.
2. Enter the `CONF(@1:18):REST` *filename*`.cfg` command.

   The following example restores a configuration file for a single slot.

   Example: `CONF(@10):REST oc12rx.cfg`

   The following example restores the configuration saved in the file `oc12rx.cfg` for slots 10, 12, and 14:

   Example: `CONF(@10,12,14):REST oc12rx.cfg`

Restoring Factory Defaults Using SCPI

You can use SCPI to restore factory default configuration settings for a single slot or multiple slots:

1. Open the SCPI Commander or open a channel using a telnet application to connect to the EPX Test system, such as NetTerm.
2. Enter the `CONF(@1:18):REST Factory.cfg` command.

   The following example restores the configuration for a single slot:

   Example: `CONF(@10):REST Factory.cfg`.

   The following example restores the default configuration for slots 10, 12, and 14.

   Example: `CONF(@10,12,14):REST Factory.cfg`

Understanding EPX Configuration Files

Each type of EPX module has a default configuration. A configuration varies according to the module type and whether it is a receiver or transmitter. A configuration defines settings such as the payload data pattern, error and alarm insertion, error count and ratio monitoring—anything that can be set with a command.

When you save the configuration for a module, the settings are saved to a .cfg file in a directory on the EPX Test System for the slot in which the module is installed. For example, the configuration file for the clock module is saved to the SLOT_01 directory, the configuration file for the module installed in slot 2 is saved to a file in the SLOT_02 directory, and so on.

In other words, you save the settings *for a particular slot*. You cannot move a module to a different slot, and restore the configuration because the configuration file is not in the slot directory that corresponds to the new slot.

See "Groups" on page 49 for an explanation of how configuration files are managed for groups.

Configuration Filename Restrictions

The following requirements apply to user-defined EPX Test System configuration file names:

- They may not contain spaces.
- They must conform to the 8.3 filename specification (a maximum of 8 letters and/or numbers followed by a period and a three-letter extension).
- They must have a .cfg extension.
- The following filenames are reserved for use by the EPX Test System and should not be used for user-defined configuration files: FACTORY.CFG, DLL.CFG, OCDLL.CFG, STMDLL.CFG.

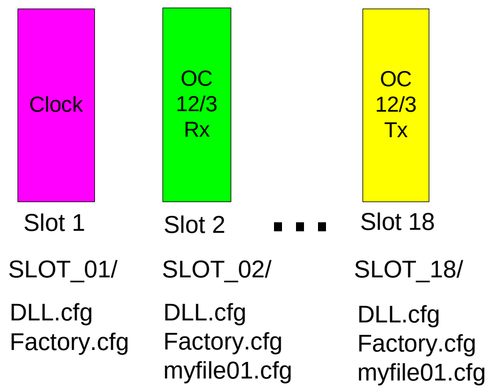
How the EPX Test System Uses Configuration Files

The following table describes how configuration files are used by the test system.

Configuration File	Description
FACTORY.CFG	This is the name of the factory default configuration file for the type of module installed in a particular slot. When you restore the default factory configuration, the settings in this file are applied.

Configuration File	Description
DLL.CFG	DLL.CFG is the file name used by EPXam when saving or restoring the configuration for a particular slot. The DLL.CFG configuration file for a slot is created the first time you save a configuration for that slot using the GUI. For modules that can be switched between SONET and SDH protocol, separate DLL.CFG files are saved and restored for SONET and SDH. When the test system is started, the configuration settings from the file named DLL.CFG are applied.
<*user_defined*>.CFG	If you use SCPI to save the configuration for a module, you can save it to a unique file name. You must use SCPI to create, save, or restore a uniquely named configuration file.

The following figure shows an example of how these configuration files are stored on the EPX Test System.



Note You must be logged in as root to save or restore the clock module (slot 1) configuration. Because the default factory configuration for the clock module is "Clock Off" for all modules, you must modify and save the configuration for the clock module before running tests. See "Configuring the EPX100 Clock Module" on page 25.

You can save configurations for one slot or for multiple slots using either the EPX Test System GUI Save/Restore feature or SCPI. If you save configurations for multiple slots, the same file name must be used for all slots.

- When saving or restoring configurations for multiple slots from the Save/Restore window in the EPX Test System GUI, the filed named DLL.CFG is saved or restored for each slot.

- When saving or restoring configurations for multiple slots using SCPI, the name of the .cfg configuration file specified in the command is saved or restored for each slot.

Tip Using SCPI to save and restore slot configurations has one advantage over using the GUI: you can specify a unique file name when saving and restoring user-defined configurations instead of the default filename DLL.CFG. This allows you to create multiple configuration files for a slot for use in different test scenarios or scripts.

When the EPX Test System is started, the default configuration file for each slot, DLL.CFG, is always applied. You must restore the custom configuration as described in “Using the EPXam Save/Restore Window” on page 108 or “Restoring Custom Configuration Settings Using SCPI” on page 111.

11

CONTROLLING TESTS

This section explains how to set up, start, stop, and pause tests on EPX receiver and transceiver modules installed in the EPX Test System.

Tip If more than one user is connected to the same EPX Test System, it is possible that they can stop or restart each other's tests if they are using the same modules. To avoid this problem, create groups and activate them using the Group Manager as described in "Groups" on page 49.

You can control tests on the EPX Test System using the following interfaces:

- **EPXam Test Controls window**—Use the Test Controls window when you want to control tests on a module group or several modules simultaneously.

  See "Using the EPXam Test Controls Window" on page 116.

- **Test controls on individual module windows for EPX receiver and transceiver modules**—Use the controls on the module window when you want to control tests for a single receiver or transceiver module.

  See "Using Module Window Test Controls" on page 118.

- **SCPI**—Use the SCPI interface to control tests on groups or individual modules from the command line or in SCPI scripts.

  See "Using SCPI to Control Tests" on page 118

Interrupting Tests

In addition to using the stop and restart controls, tests can be interrupted by other means:

- Switching between SONET and SDH

  Before completing a switch, you are prompted to cancel, or interrupt, any currently running tests on the modules that will be switched. If you select to continue with the switch, the module is reset to its default configuration, and any running tests are stopped.

  See “Using the SONET/SDH Switcher” on page 121 for more information on switching.

- Interrupting the power supply (such as restarting the test system)

  If Checkpoint/Resume is not enabled, power interruptions stop any current tests. If Checkpoint/Resume is enabled, then interrupted tests are resumed from a saved checkpoint.

  See “Checkpoint/Resume” on page 137 for more information on Checkpoint/Resume and testing.

Using the EPXam Test Controls Window

The EPXam Test Controls window provides a set of controls for setting up and controlling tests on any combination of modules or groups in an EPX chassis. From this window you can run tests on several modules simultaneously.

CAUTION: Always set up and run tests from either the Test Controls window or an individual module detail window. Do not set up or start a test using the Test Controls window and then switch to controlling the test from a module detail window. The Test Controls window is not updated with changes in test state and setup that are made using test controls on individual module detail windows.

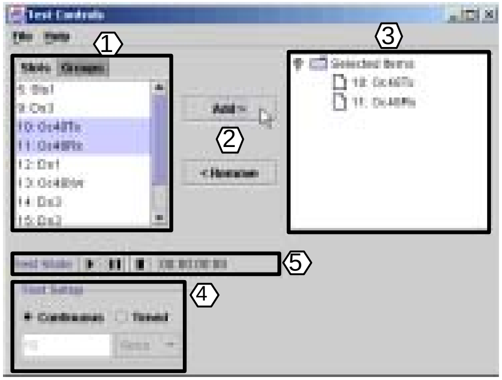
Opening the Test Controls Window

To open the EPX Test Controls window:

1. Log in to the EPX Test System using either the standalone or application version of EPXam.
2. Select **Tools > Test Controls** from the EPXam main window menu.

Controlling Tests

The procedures in this section refer to the following figure.



Tip Before you begin, make sure that the modules you wish to include in your test are configured as needed for the tests you want to run. If you are using groups, activate the groups to reserve them for your use.

Perform the following steps to select groups and modules for testing, set up the type of test to run, and run the test:

1 From the list on the left, select the groups and modules to include in the test.

To select a slot or group, select the **Slots** or **Groups** tab and highlight the name of the group or module.

You can use Shift-click or CTRL-click keyboard shortcuts to select multiple modules or groups in either list.

The names of modules and groups that are reserved by other users are greyed out and preceded by a Lock icon, and cannot be selected.

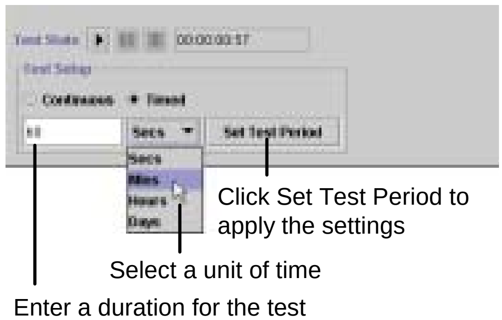
2 Click **Add>** to move the highlighted slots or groups to the **Selected Items** list.

To remove items from the **Selected Items** list, highlight the items in the list, then click **< Remove**.

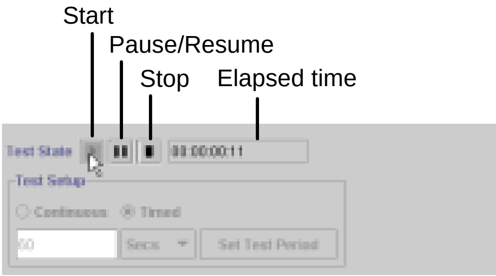
3 Continue adding slots and groups as needed until the desired modules and slots are displayed in the **Selected Items** list.

4 Select the type of test, either **Continuous** or **Timed**.

For **Timed** tests, enter a number for the duration, select unit in seconds, minutes, hours, or days, then click **Set Test Period** to apply the setting.



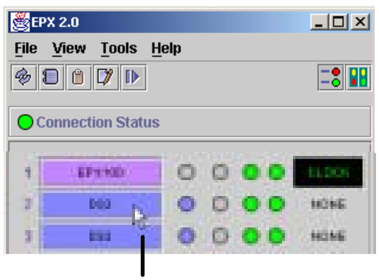
5 Use the Test State controls to start, pause, resume, or stop testing on the selected modules.



Using Module Window Test Controls

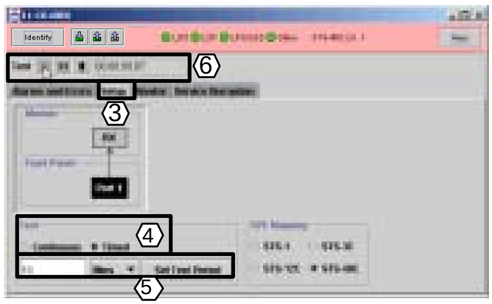
Perform the following steps to control tests for an individual RX or transceiver module from its window in EPXam:

1. Log in to the EPX Test System using either the standalone or application version of EPXam.
2. Click on the name of a module in the main window to open its module window.



Click to open the associated module detail window in logical view

The rest of the steps in this procedure refer to the following figure.



3. Select the **Setup** tab in the module detail window.
4. In the Test Setup area, select the type of test to run: **Continuous** or **Timed**.
5. If **Timed** is selected as the test type:
   - Enter the duration of the test.
   - Select a unit of time: seconds, minutes, hours, or days.
   - Click **Set Test Period** to apply the settings.
6. Start the test using the controls at the top of the module window.

Using SCPI to Control Tests

There are two ways to control testing on modules using SCPI:

- Issuing SCPI test control commands to one or more modules.

See “Setting Test Type and Duration Using SCPI” on page 119 and “Starting and Stopping Tests Using SCPI” on page 119.

- Issuing SCPI Group Manager commands for for running tests on modules that are allocated to groups.

  See “Testing Groups” on page 60 in the section “Managing Groups Using SCPI”.

Setting Test Type and Duration Using SCPI

To set up a continuous test using SCPI:

SENS(@3):TEST:TYPE CONT

To set up a timed test using SCPI:

SENS(@3):TEST:TYPE TIM

SENS(@3):TEST:UNIT MIN

SENS(@3):TEST:PER 10

The commands in the above example specify a timed test lasting 10 minutes.

Available unit intervals are seconds (SEC), minutes (MIN), hours (HOUR), and days (DAYS). Valid numeric values for the test period range from 1 to 1000.

See the section on Test commands for each module in the *“SCPI Reference”* for more information.

Starting and Stopping Tests Using SCPI

To start a test on a module using SCPI:

SENS(@3):TEST:MODE STAR

To stop a test on a module using SCPI:

SENS(@3):TEST:MODE STOP

To restart a test on a module using SCPI:

SENS(@3):TEST:MODE REST

To pause a test on a module using SCPI:

SENS(@3):TEST:MODE PAUSE

To resume a test on a module using SCPI:

SENS(@3):TEST:MODE RESUME

See the section on Test commands for each module in the *“SCPI Reference”* for more information.

12

USING THE SONET/SDH SWITCHER

The SONET/SDH Switcher is a software tool that allows you to switch one or more modules in the test system between SONET and SDH protocols. Switching between SONET and SDH protocol does *not* require a restart of the test system or EPXam.

The following modules can be switched:

- OC-12/3 STM-4/1 Transmitter and Receiver, with or without a personality module
- OC-48/STM-16 Transmitter, Receiver, and Transceiver
- OC-192/STM-64 Transmitter and Receiver

Note The STM-1 CMI Transceiver can not be switched between SONET and SDH.

The following restrictions apply to switching SONET/SDH modules:

- Modules that are locked via the Group Manager can not be switched by other users.
- Active test and logging sessions associated with a module at the time of a switch are cancelled.

This chapter covers the following topics:

Tip To switch a single module between SONET and SDH protocols, change the Protocol setting on the Setup tab in that module's detail window. The protocol switching process is the same.

Switching SONET/SDH Modules

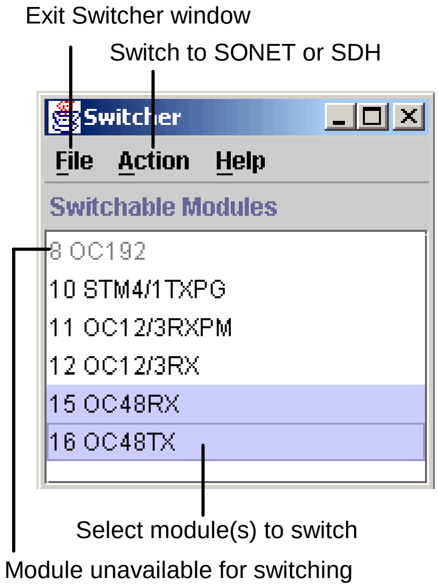
This section explains how to switch modules between SONET and SDH using the EPX Switcher in EPXam.

1. Log in to the EPX test system using EPXam.
2. Select **SONET/SDH Switcher** from the **Tools** menu in the EPXam main window.

   The SONET/SDH Switcher window appears. Only switchable modules are listed.
3. Select one or more modules of one type to be switched.

Note You cannot switch SONET and SDH modules simultaneously. Select only one type of module per switch operation.

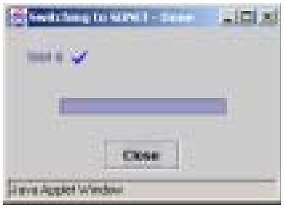
Note Greyed-out modules are unavailable for switching. These modules are locked and activated as part of a group.



4. In the Switcher window, select **Convert to SONET** (for STM-*n* modules) or **Convert to SDH** (for OC-*n* modules) from the **Action** menu or the Switch window toolbar.

   If tests or logging sessions are in progress on any of the modules being switched, a warning dialog is displayed. Choose Cancel to cancel the switch or Continue to complete the switch. If you choose Continue, running tests and logging sessions are cancelled.

   Otherwise, a dialog opens that displays the switching progress.



5 Close the switching progress dialog.

6 Repeats steps 3 and 4 to switch additional modules.

7 Close the Switcher window.

If this is the first time you have switched the module to SONET or SDH, the factory default configuration for the module and protocol is loaded.

See “SONET/SDH Switching and Custom Configuration Files” on page 123 for more information about SONET/SDH switching and configuration files.

SONET/SDH Switching and Custom Configuration Files

This section describes how the EPX SONET/SDH Switcher utility interacts with factory and user-defined configuration files.

The test system maintains separate factory (FACTORY.CFG) and user-defined (DLL.CFG) onfiguration files for SONET and SDH protocol modes.

- If you have not previously saved a custom configuration for the module and protocol using the EPXam Save/Restore feature, the FACTORY.CFG configuration file for that module and protocol is loaded when the module is switched.
- If you have previously saved a custom configuration for the module and protocol using the EPXam Save/Restore feature, it is restored when the module is switched.

However, if you saved custom configuration files to different file names using SCPI, the test system can not identify whether the file specifies a SONET or SDH configuration. This means that you must track which of these files contain SONET configurations and which contain SDH configurations, and save and restore them appropriately using SCPI.

See “Saving and Restoring Test Configurations” on page 107 for more information.

Switching Modules Using SCPI

This section describes SCPI for switching modules between SONET and SDH.

To switch a single module between SONET and SDH, use commnds similar to the following:

```
SYST:BOAR(@3):PROT:MODE SON
SYST:BOAR(@3):PROT:MODE SDH
```

To query the status of a requested protocol switch, use a command similar to the following:

```
SYST:BOAR(@3):PROT:STAT?
```

The status query command returns one of the following:

- `STAR`—The requested protocol switch is in progress.
- `DONE`—The requested protocol switch is complete.
- `NA`—Protocol switching does not apply to this module.

13

MAINTENANCE

Customers can perform the following maintenance procedures.

- “Changing Modules” on page 126
  - “Module Recommendations and Cautions” on page 126
  - “Removing Modules” on page 127
  - “Installing Modules” on page 128
- “Cleaning” on page 129
- “Killing Connections” on page 130
- “Checking Versions” on page 131
- “Disabling Lasers” on page 134

All other EPX Test System maintenance must be done by gnubi.

Replacing Parts

The following items can be replaced by any part that meets the original specifications. All other replacement parts must be purchased through gnubi and replaced by trained gnubi personnel.

- Shielded, grounded power cable
- Shielded, twisted pair Ethernet cable
- Null modem cable
- EPX8 and TransPort fuses , as described in “Replacing Power Fuses” on page 134

Changing Modules

Use these procedures when adding or replacing modules in your system.

Tip If you add a module to chassis, you may need to flash the module with the software that is on the EPX Test System. This ensures that the software on the module matches the EPXOS on the CPU module. See the gnubi web site (http:\\www.gnub.com)for EPXOS download and installation directions.

Module Recommendations and Cautions

Some versions of the OC-192 Transmitter and Receiver (part numbers G0029 and G0030) have the following recommendations to avoid installation issues and special procedures. These recommendations are due to the width of the OC-192 Transmitter and to the temperature of the optical components.

- Do not install any module in an adjacent slot that is to the right in the EPX16 or above in the EPX8 (downstream) of the OC-192 Transmitter.

CAUTION: Permanent damage could occur to the modules if the adjacent modules come into contact with each other. Using configurations other than what is recommended may void the EPX Test System warranty.

- Do not install more than 2 transmitters in an EPX8 chassis. OC-192 Transmitters must be installed in slots 4/5 and 8/9.

  The following EPX8 configurations of OC-192 modules are acceptable. The downstream slot adjacent to the transmitter is empty.

  - 2 transmitters (no receivers)
  - 2 transmitters and 1-2 receivers (in adjacent slots with the receiver in the bottom slots and the transmitter in the top slots)

- Do not install more than 6 transmitters in an EPX16 chassis.

  The following EPX16 configurations of OC-192 modules are acceptable. The adjacent slot to the right of or above the transmitter is empty.

  - 3 transmitter and receiver pairs (in adjacent slots with the receiver first and then the transmitter)
  - 6 transmitters (no receivers)
  - 5 transmitters and 1 receiver
  - 4 transmitters and 1-2 receivers
  - 3 transmitters and 1-4 receivers
  - 2 transmitters and 1-5 receivers
  - 1 transmitters and 1-7 receivers

Removing Modules

If you are not replacing a removed module, you should use a faceplate blank in the slot from where the module is removed. This ensures proper airflow and cooling.

CAUTION: Do not remove or install boards without turning off the EPX Test System. The EPX Test System does not support hot swapping.

1 Turn the power switch to standby on the front of the chassis.

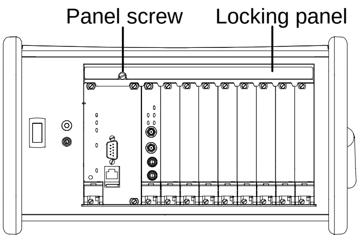
2 Use ESD precautions. You can use the ESD ground connector on the front of the test system if AC power is connected to the chassis.

3 For TransPort chassis, loosen but do not completely remove the locking panel screw as shown in the following figure.

Note You may need to use a #6 spanner bit to loosen the screw, if the TransPort uses the optional spanner screw.

Loosening the screw automatically shuts off power.

TransPort Front View

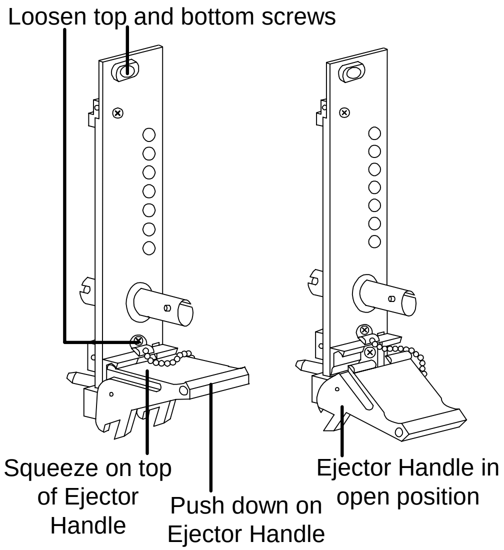


4 On the TransPort, lift the locking panel.

5 Loosen the screw at the top of the module faceplate.

6 Loosen the screw at the bottom of the module faceplate (under the ejector handle).

Module board and chassis are not shown to simplify illustration



7 Move the chain out of the way.

8 Squeeze the ejector handle near the top to begin to release from the catch.

9 Push down on the module ejector handle. The handle is fully released from the catch, and the module is released from the the backplane.

10 If you do not replace the removed module, install a blank faceplate to ensure proper airflow and cooling.

Installing Modules

CAUTION: Do not remove or install modules without turning off the EPX Test System. The EPX Test System does not support hot swapping.

1 Turn the power switch to standby on the front of the chassis.

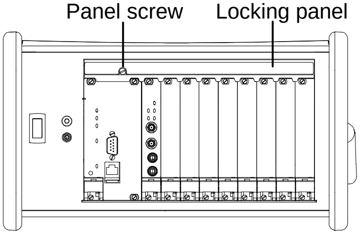
2 Use ESD precautions. You can use the ESD ground connector on the front of the test system if AC power is connected to the chassis.

3 For TransPort chassis, loosen but do not completely remove the locking panel screw as shown in the following figure.

Note You may need to use a #6 spanner bit to loosen the screw, if the TransPort uses the optional spanner screw.

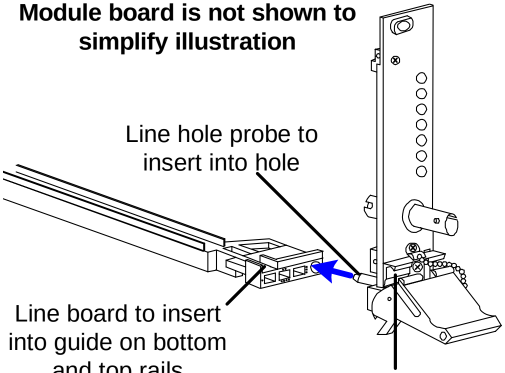
Loosening the screw automatically shuts off power.

TransPort Front View



4 On the TransPort, lift the locking panel.

5 Make sure that the ejector handle is in the open position (down).



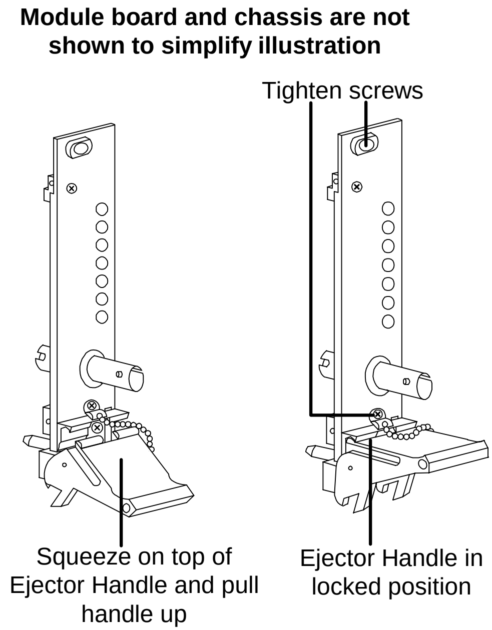
6 Line up the module board with the guides on the top and bottom rails.

7 Make sure that the hole probe is aligned to go into the hole on the bottom rail.

8 Slide the module into the chassis until it stops. The rear feet on the ejector handle should be over holes on the chassis.

9 Move the chain out of the way.

10 Squeeze the ejector handle near the top so it can snap under the catch.



11 Pull up on the ejector handle. The handle snaps under the catch, and the module connects firmly to the backplane.

12 Tighten the screw at the top of the module faceplate.

Cleaning

Clean the product as needed following these procedures.

Cleaning Chassis

CAUTION: Do not use cleaning fluids as they may damage the labelling or may enter the chassis and damage boards. Use only cloth dampened with water.

1 Turn the power switch to standby ( ) on the front of the chassis.

2 Disconnect the AC or DC power supply, depending your unit's configuration.

3 Wipe the chassis with a dampened cloth.

4 With a dry cloth, wipe the chassis to remove excess moisture.

CAUTION: Do not allow water to enter the product.

5 Connect the AC power supply and turn on the DC power.

Cleaning Optic Cables

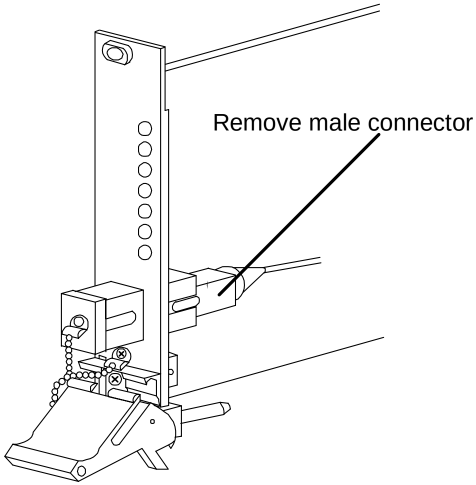
CAUTION: Do not remove or install boards without turning off the EPX Test System. The EPX Test System does not support hot swapping.

1 Turn the power switch to standby ( ) on the front of the chassis.

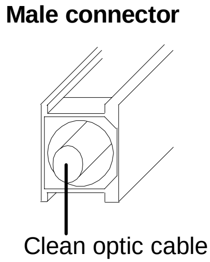
2 Disconnect the AC or DC power supply, depending your unit's configuration.

3 Partially remove the card from the chassis to access the optic cable.

4 Remove the male optic connector from the female connector.



5 Clean the optic cable.



6 Reconnect the optic connector.

7 Push the handle ejector lever down.

8 Push the module back into the chassis.

9 Pull up the handle ejector to secure the module to the backplane.

Cleaning the TransPort Filter

It is recommended that the optional filter on the bottom of the TransPort be cleaned once every six months. The EPX8 and EPX16 do not have optional air filters.

- Remove the filter from the TransPort chassis.
- Clean with low-pressure air or with warm water.

CAUTION: Do not use detergents or chemicals to clean the filter.

- Dry the filter completely before installing it in the chassis.

Killing Connections

You can cancel, or kill, connections to the EPX Test System remotely. This feature is useful if a telnet, script, or EPXam connection does not properly disconnect for some reason.

Using the SYST:CLI:KILL command cancels the command channel and, if applicable, the subscription channel associated with a connection.

When you use the SYST:CLI:KILL? command to list available connection, the query response uses the following format.

loginName (*IPaddress_of_login* : *port_number*)

Note If you a cancel a connection used by the SCPI Commander or Script Runner tools from EPXam, the tool window does not exit. However, commands issued from that window do not work.

1 Use a telnet application to connect to the EPX Test System.

```
syst:kill:cli?
```

Note You cannot cancel connections from the SCPI Commander window in EPXam. The SCPI Commander is an anonymous connection, not root.

2 Log in as root with the `SYST:SEC:LOG` command.

```
syst:sec:log root kingpin
OK ROOT logged in
```

3 Query the EPX Test System for all current connections with the `SYST:KILL:CLI?` command.

```
syst:kill:cli?
ANON(192.192.0.19:264)
G(192.192.0.18:64775)
```

All connections are listed, except for the root connection from which the command is issued.

4 Cancel the desired connection with the `SYST:KILL:CLI` *portNumber* `kingpin` command.

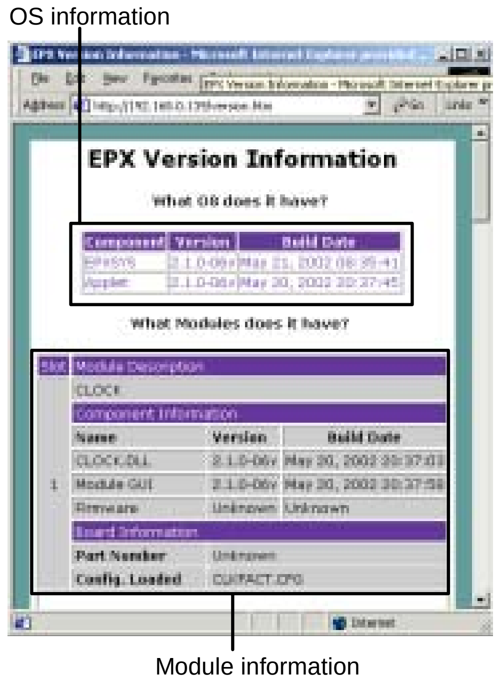
```
syst:cli:kill 264 kingpin
Client ANON at 192.192.0.19:264 killed
```

Checking Versions

You may need to check the versions:

- When adding new types of modules to the EPX Test System
- When determining the version or serial number of modules
- When troubleshooting missing functionality, EPXam display problems, or error messages

In a web browser, enter the URL *EPX_IP_address*/version.htm. A web page appears that describes the OS and each module components.



OS Version Data

A summary of the operating system is provided in the “What OS does it have?” table, as described in the following table. This information is updated when a new version of EPXOS is installed.

Component	Description
EPXSYS	The epxsys.exe file is run to start the OS on the test system.
Applet	The EPXam web applet files are stored on the test system.

Module Version Data

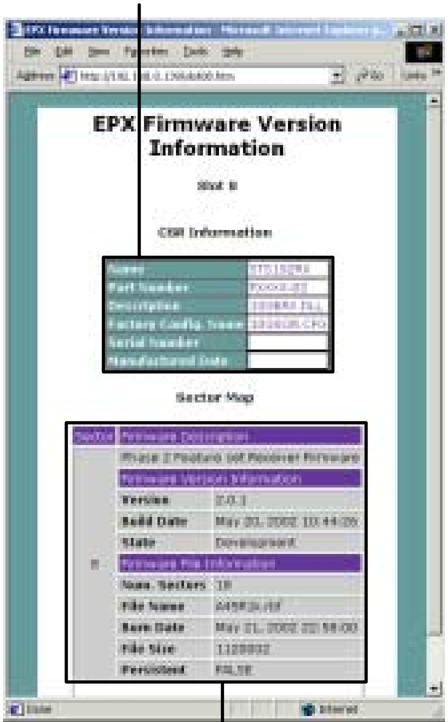
Each module that is installed has its own information. This information can be updated when a new version of EPXOS is installed.

Component	Description
Slot	The slot number in which the module is detected.
Description	Each module has a name that matches the part number.
name.DLL	Each module has a DLL file that defines its available functionality.
Module GUI	In EPXam, each module window has a JAR which controls what is displayed and what behaviors are available.

Component	Description
Firmware	The firmware is installed, or flashed, on the module hardware itself. If available, this links to more information about the firmware, as described in “Firmware Version Data” on page 132
Part Number	This is the manufacturing part number of the module or board. This can be used to determine the version of the module hardware.
Config. Loaded	The name of the configuration file that was used to set up the module when the test system was started. This is not necessarily the currently loaded configuration; it is not updated when a configuration is applied or restored.

Firmware Version Data

More detailed firmware information is available, as shown in the following figure.



A summary of the module firmware is provided in the CSR Information table, as described in the following table.

Component	Description
Name	The name of the module for which the firmware is described.
Part Number	This is the manufacturing part number of the module or board. This can be used to determine the version of the module hardware.
Description	
Factory Config. Name	Each module has at least one or, for SONET/SDH modules, two factory configuration files that set up the module when the test system is started.
Serial Number	This shows the module's serial number.
Manufactured Date	This shows the date that module was manufactured.

Firmware is flashed onto sectors on the module. A summary of the firmware version and file information in each sector is provided in the Sector Map table, as described in the following table. This information may be updated when using EPX Loader to flash the modules.

Component	Description
Sector	The first sector number in which the firmware is detected.
Description	This is a brief description of the firmware.
Version	The version of the firmware.
Build Date	The date that the firmware was built as part of the EPXOS.

Component	Description
State	This is the state (development, production) of the firmware.
Num. Sectors	Firmware can be installed in multiple sectors. This shows the total number of sectors installed with this firmware.
File Name	Firmware is installed from a file.
Burn Date	This is the date on which the firmware was installed on the module.
File Size	This is the size (in bytes) of the firmware file.
Persistent	

Disabling Lasers

Optical transmitter modules always generate a laser output unless the laser is disabled via software. Depending on the type of transmitter, you can disable lasers.

- Use the `SOUR(@1:18):ALAR LOS` command.

Modules achieve LOS by turning off the laser.

Replacing Power Fuses

In case of power overload, you may need to replace the EPX8 and TransPort power fuses. The EPX8 and TransPort each has two fuses.

Note The EPX16 does not have field replaceable fuses.

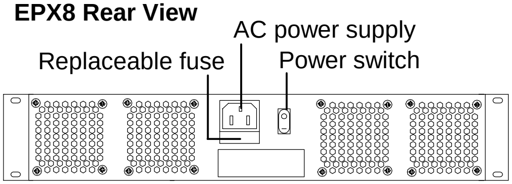
Chassis	Fuse Specifications
EPX8	100-120 4A—T, 250V 200-240 2A—T, 250V 5 mm x 20 mm
TransPort	100-120V 6A—T, 250V 200-240V 3A—T, 250V 5 mm x 20 mm

To replace fuses:

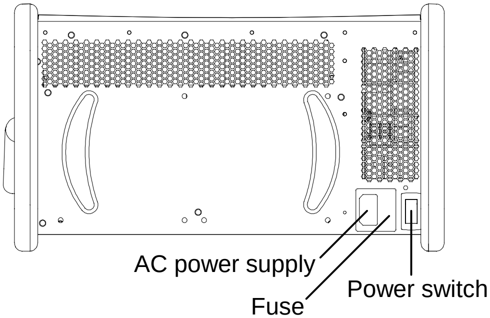
1 Turn the DC power switch on the chassis front to Standby.

2 Turn the AC power switch on the chassis rear to Off.

EPX8 Rear View



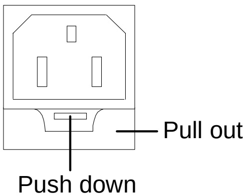
TransPort Rear View



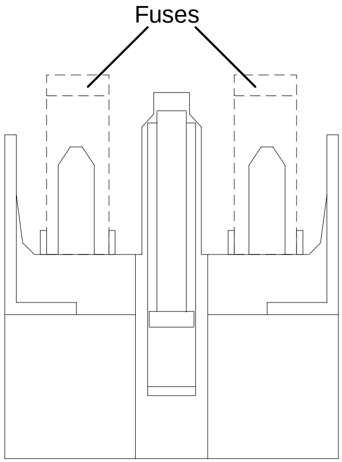
3 Disconnect the power supply.

4 Locate the fuse underneath (EPX8) or to the right of (TransPort) the AC power supply connector.

5 Push down the catch lever, and pull the fuse casing from the chassis.



6 Insert a new fuse into the fuse case.



7 Push down the catch lever, and push the fuse casing into the chassis.

8 Connect the AC power supply.

9 Turn the AC power switch on the chassis rear to On.

10 Turn the DC power switch on the chassis front to On.

14

CHECKPOINT / RESUME

Checkpoint / Resume is a feature that minimizes the effects of power interruptions on testing. At user-defined checkpoints, the test system saves the state of modules and testing data. If the test system loses power (either because of a user power down or a power outage), the test system restores the state of the checkpoint prior to the interruption.

Overview

Checkpoint / Resume can only be configured with EPXam Pro, not with SCPI.

The following table shows the states of different components when testing is resumed from a checkpoint after a power interruption.

Component	What happens after Resume
Tests	Tests resume from the checkpoint immediately prior to the power interruption, including elapsed time, counts, and ratios.
EPXam **EPXam Pro**	All clients are disconnected and must be restarted.
Log data saved on user’s computer	Logging is not resumed although testing is resumed. The logging file is empty.
Log data saved on test system	Logging is resumed as previously configured, and data is appended to the log file with a note of interruption.

Supported Modules

Checkpoint/Resume is available only for the following modules:

- OC-192/STM-64 Transmitter and Receiver
- OC-48/STM-16 Transceiver, Transmitter, and Receiver
- OC-12/3 STM-4/1 Transmitter and Receiver

How Checkpoint/Resume Works

This section describes what happens during Checkpoint/Resume.

CHECKPOINTS

When Checkpoint/Resume is enabled, the test system saves data for modules that support Checkpoint/Resume (as listed in "Supported Modules" on page 138). The module data is saved to a file on the test system and not to the user's local computer. Each module has two Checkpoint/Resume files. The Checkpoint saves alternate between these two files, thus providing a backup checkpoint. A separate file tracks the history of all checkpoints. These files are different than the files used for the default and custom configurations, as described in "Understanding EPX Configuration Files" on page 111.

RESUMES

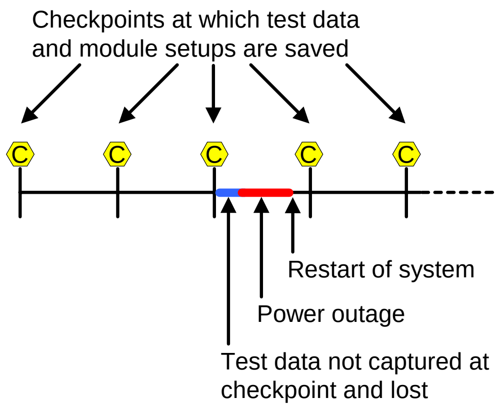
When the test system is restarted after a power interruption, modules are checked to see if they support Checkpoint/Resume. If not, the module is restored from the dll.cfg file, if present, or from the factory.cfg file.

If the module does support Checkpoint/Resume, checkpoint files are checked to make sure that a valid configuration was saved. The most recent, valid checkpoint is then used to restore the module and any ongoing testing. Logging is resumed only if the log files are saved to the test system, as described in "Viewing Log Files after Resume" on page 140. If log files are saved to the client, or local computer, logging is not resumed and log files for tests running at the time of the power outage contain no data.

Tip Avoid moving modules during a power outage. If the checkpoint files for a slot and a module installed in that slot do not match, the checkpoint files are deleted.

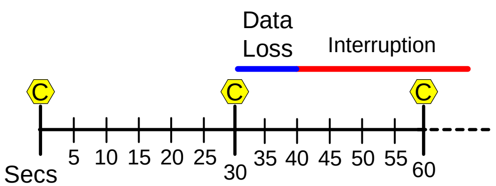
Minimizing Data Loss

The loss of test data is minimized but not elminated with Checkpoint/Resume. The interval between saved checkpoints can be shortened to further minimize the data loss. The following figure shows how data can be lost.



The only lost data is that which occurs after the checkpoint and before the power interruption.

For example, as shown in the following figure, the checkpoint interval is set to every 30 seconds. A power interruption occurs at 40 seconds into the test. When the system is restarted, the test resumes from the last saved checkpoint, which was at thirty seconds into the test. Data loss occurs only in the time between the checkpoint and the interruption. In this case, 10 seconds of data is lost.



Enabling Checkpoint/Resume

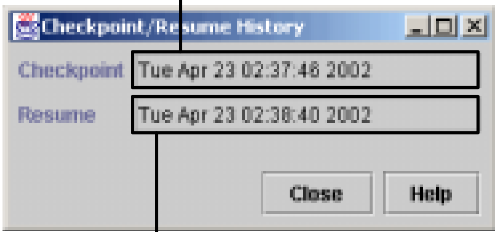
To enable or disable Checkpoint/Resume, you must log in as root with EPXam Pro. Set Checkpoint/Resume in the EPX Setup tool, as described in “Setting Checkpoint/Resume” on page 38.

You must restart the test system after enabling Checkpoint/Resume.

Viewing Checkpoint/Resume History

When the test system is restarted after a power interruption, you can view the date and time of the most recent Checkpoint and Resume.

As shown in the following figure, the Checkpoint displayed is the most recent used to resume testing after a power outage. The Checkpoint is not the most recently saved but the most recently used.



SCPI is available to query Checkpoint/Resume history. Use the SYST:HOST:CHEC? query to display the most Checkpoint.

```
SYST:HOST:CHEC?
OK Tue May 28 03:00:48 2002
```

Use the SYST:HOST:REST? query to display the most Resume.

```
SYST:HOST:REST?
OK Tue May 28 03:00:48 2002
```

Viewing Log Files after Resume

Logging is resumed only for log files saved on the test system. The start and end time of the power outage is noted in the log file:

```
outage 04/24/2002  04:20:16, 04/24/2002
04:21:10
```

Data prior to the outage is saved, and data after the outage is appended to the log file after the line that states the outage start and stop time.

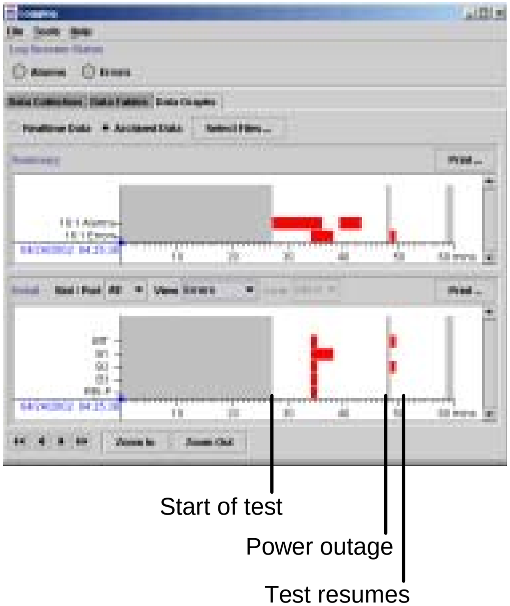
1 When the resumed test has completed, copy the file from the test system to your local computer using the Log File Admin tool in EPXam Pro, as described in “Copying Log Files” on page 80.

2 Display the log file graphically or in a table in the Logging window, as shown in the following figure. See “Viewing Archived Data” on page 78 for details how to display saved log files.

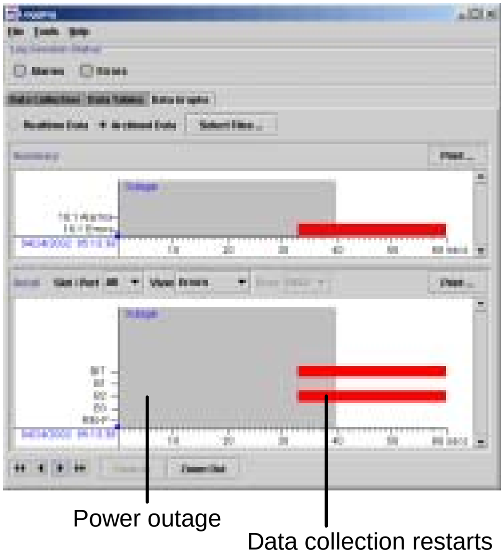
3 You may need to click **Zoom Out** to view the start and stop time of the test.

Also, use the scroll tools to find and position the start of the test data. For details about viewing graphs, see “Viewing Data Graphs” on page 76.

When displayed as a graph, the power outage is indicated as a grey area, as shown in the following figure. In the figure, errors were recorded prior to the power outage. When the test resumed after the power outage, more B1 and Bit errors are detected in this example.



If you click **Zoom In**, as shown in the following figure, you can see that the period of power outage is labelled.



15

CHASSIS THERMAL MANAGEMENT SYSTEM

The Chassis Thermal Management System (CTMS) is a feature that monitors the chassis temperature and thermal components. When temperatures approach or are over or below the operating temperatures, or when a component fails, CTMS issues warnings and shuts down the test system when necessary.

Overview

CTMS is designed to protect the test system by keeping it within operating temperature (0 to 40 degrees Celsius) or by shutting it down.

Especially when the test system is used in different environments, this prevents further damage to the test system.

Note CTMS is currently only available on the TransPort, not on the EPX16 or EPX8 test systems.

Both software and hardware enables CTMS:

- A thermal board that is built into the TransPort chassis
- Pairs of sensors located through the TransPort chassis
- Variable speed fans to control the temperature
- CTMS software that monitors the CTMS components and controls warnings and shutdowns

Chassis Thermal Management Window

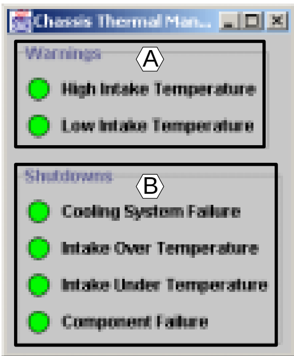
This section describes the Chassis Thermal Management window available in EPXam and EPXam Pro.

Opening Window

You can open the Chassis Thermal Management System window by selecting **Tools > Thermal Board Status** from the EPXam menu.

Checking System Status

The following figure shows the features of the Chassis Thermal Management window.

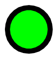
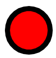
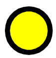


A **Warning**—View the status and history of warrings, as described in "Warnings Status" on page 144.

B **Shutdowns**—View the status and history of shutdowns, as described in "Warnings Status" on page 144.

WARNINGS STATUS

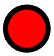
The Warnings area displays the status of any warning because the ambient temperature is within the operating temperature minimum and maximum (0 to 5 and 36 to 40 degrees Celsius).

Setting	Description
High Intake Temperature	Indicates if the intake air is within the maximum operational temperature (36-40 degrees Celsius).
Low Intake Temperature	Indicates if the intake air is within the minimum operational temperature (0-5 degrees Celsius).
Green 	Indicates that no warnings have been issued since the chassis was powered up.
Red 	Indicates that a warning has been issued and is active.
Yellow 	Indicates that a warning had been issued since the chassis was powered up but is no longer active.

SCPI Examples:
`CTMS:WARN:UND?`
`CTMS:WARN:OVER?`
Related Topics
"Warnings" on page 147	

Shutdown Status

The Shutdowns area displays the status of any warning because the ambient temperature is not within operating temperature (0 to 40 degrees Celsius).

Setting	Description
Cooling System	Indicates any cooling system failures since the chassis was powered up.
Intake Over Temperature	Indicates if the intake air is over the maximum operational temperature (41 or more degrees Celsius).
Intake Under Temperature	Indicates if the intake air is under the minimum operational temperature (-1 or more degrees Celsius).
Component Failure	Indicates any CTMS component (such as sensors) failures since the chassis was powered up.
Green 	Indicates that no failures have been issued since the chassis was powered up.
Red 	Indicates that a failure is active.
Yellow 	Indicates that a failure had been issued since the chassis was powered up but is no longer active.

Setting	Description

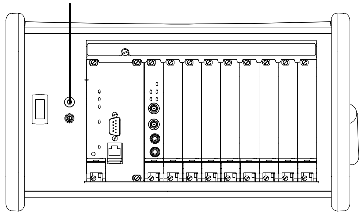
SCPI Examples:
`CTMS:FAIL:COOL?`
`CTMS:FAIL:UND?`
`CTMS:FAIL:OVER?`
Related Topics
“Shutdowns” on page 148	

Troubleshooting the CTMS LED

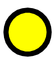
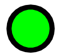
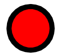
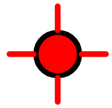
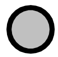
The TransPort has an LED that indicates the chassis status. This LED is controlled by the Chassis Thermal Management System (CTMS). For more information on CTMS, see the *EPX User's Guide* or EPXam Pro online help.

The following figure shows the location of the LED.

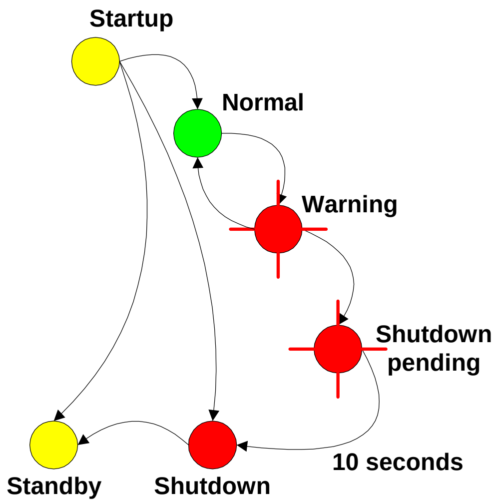
TransPort Front View



The following table describes the CTMS LED states.

LED Status	Description
Yellow 	Chassis is in standby power mode and cannot accept commands. One of the following conditions exists: The TransPort has not completed power-up mode. AC power is supplied, CTMS and fans are active, DC power is not enabled, and the CPU module is not active.
Green 	Chassis is in normal power mode and can accept commands. TransPort has no failures or warnings.
Red 	Chassis has been shut down by CTMS. See "Shutdowns" on page 148.
Flashing Red 	Chassis is in a warning state or is shutting down (10 seconds). In a warning state, the TransPort can accept commands. See "Warnings" on page 147.
Off 	Chassis has main AC power feed off.

The following figure shows how the CTMS LED can progress through the different states.



Standby

The TransPort enters Standby mode for the following conditions.

Condition	Recommendation
The TransPort has not completed system startup.	Wait for the system startup to complete.
DC power is not turned on.	Turn the front power switch to the On position. Make sure that the front panel is down and that the panel screw is tightened.
The CTMS shut down the TransPort automatically, and the condition that caused the shutdown no longer exits.	Toggle the AC power switch.

Warnings

The TransPort issues a warning for the following conditions. When the warning condition is removed, the CTMS LED returns to a normal state.

Condition	Recommendation
The exhaust temperature is 46-50 degrees Celsius.	See the ambient temperature recommendations.
The ambient temperature is 0-5 or 36-40 degrees Celsius.	Make sure all slots have either modules or blank faceplates to ensure proper airflow. Adjust the room temperature. Move the TransPort from other equipment. Remove the filter if installed. If the filter is too dirty, it can block airflow and cause the chassis to overheat. Toggle the DC power switch to see if warning clears.
One or more pair of sensors at any of the six chassis locations differ by more than 5 degrees.	Toggle the AC power switch on the TransPort rear.

Shutdowns

The TransPort shuts down automatically for the following conditions. When the shutdown condition is removed (indicated by a yellow CTMS LED), you must toggle the AC power switch to recover from a shutdown.

Tip Leave the AC power connected and on in the case of an over-temperature shutdown. This allows the fans to continue to cool the system.

Condition	Recommendation
The room temperature is less than 0 or higher than 40 degrees Celsius.	Make sure all slots have either modules or blank faceplates to ensure proper airflow. Adjust the room temperature. Move the TransPort from other equipment. Remove the filter if installed. If the filter is too dirty, it can block airflow and cause the chassis to overheat. Toggle the AC power switch when the ambient temperature is within range.
A thermal sensor has failed.	Contact gnubi product support. See “Service” on page 17.
The exhaust temperature is 51 or higher degrees Celsius.	Toggle the AC power switch on the TransPort rear.

16

EPXam Pro Licensing

This section provides the following information about EPXam Pro licensing:

About EPXam Pro Licenses

EPXam Pro is a licensed software product. You must obtain a license key from gnubi.

Each license key is associated with a specific EPX CPU module (one license per chassis). A license key obtained for one EPX CPU module does not work on any other EPX CPU module.

EPXam Pro, which runs as a client on your computer, provides additional features that are not available in EPXam. EPXam runs as a Java applet that is launched through a web browser.

EPXam and EPXam Pro Feature Comparison

Differences in features between EPXam Pro and and EPXam are summarized in the following table.

Features and Requirements	EPXam Pro	EPXam
Access	Installs and runs locally on user's computer; requires network access to EPX.	Comes pre-installed on EPX and is accessed through a web browser running on user's computer; requires network access to EPX.
Maximum number of client connections	Configurable, up to ten (10) connections per chassis.	Five (5) connections per chassis; not configurable.
Log file location	Log test data to files on the EPX or to files on the user's computer.	Logs test data to files on the EPX only.
Log file data display options	Display data in tables and graphs. Displays data from currently running tests or archived log data.	Must import log files from the EPX into other applications to view data.
Log file administration	Get and convert log files from EPX to user's computer for display in graphs and tables.	Rename log file option only.
Script Runner	Create, run, and save SCPI scripts to client computer; open and run previously saved scripts.	Create and run SCPI scripts only; cannot save or open scripts.
RS-232 serial connection parameter configuration	Update RS-232 serial connection parameters from EPXam Setup window.	Cannot update RS-232 serial connection parameters from the applet.
Online help	GUI access to expanded online help for all features, including SCPI reference.	SCPI reference and EPXam overview available from EPXam applet home page.

Operating System and Web Browser Requirements

This section lists operating system and web browser requirements for using EPXam Pro and EPXam on Windows, HP, and Sun platforms.

Note EPXOS V2.0 or later must be installed before you can use either EPXam or EPXam Pro.

EPXAM PRO

EPXam Pro	Operating System Requirements
Windows Platforms	**Operating System:** Windows 95 Windows 98, First or Second Edition Windows Me Windows NT 4.0, Service Pack 5 Windows 2000 Professional, Server, or Advanced Server A web browser is not required.
Sun Microsystems Platforms	**Operating System**: Sun Solaris 2.6, 7, or 8 A web browser is not required.
Hewlett-Packard Platform	**Operating System**: HP-UX 11.0 or 11i A web browser is not required.

EPXAM

EPXam	Operating System and Web Browser Requirements
Windows Platforms	**Operating System:** Windows 95 Windows 98, First or Second Edition Windows Me Windows NT 4.0, Service Pack 5 Windows 2000 Professional, Server, or Advanced Server **Browsers**: Netscape Navigator 4.7 or 6 Internet Explorer 5.5
Sun Microsystems Platforms	**Operating System**: Sun Solaris 2.6, 7, or 8 **Browser**: Netscape Navigator 4.7 or 6
Hewlett-Packard Platform	**Operating System**: HP-UX 11.0 or 11i **Browser**: Netscape Navigator 4.7 or 6

Evaluation Period and Licenses

The first time you run EPXam Pro, a dialog displays that prompts you to add a license or start a 7-day evaluation period.

- The 7-day evaluation period starts automatically when you select Start 7-Day Evaluation Period.
- Licenses are provided by gnubi when the EPXam Pro software is purchased.

The evaluation period is valid for seven (7) days of use. The evaluation period timer increments if the EPX is running or if users are logged in.

Note The evaluation license timer also increments one (1) day each time the EPX system date is changed (moved either forward or back).

How to Obtain a License

To obtain a license, go to www.gnubi.com/gui and follow the instructions on the web site for purchasing EPXam Pro.

You must provide gnubi with the MAC address of the EPX Test System CPU module to associate with the license.

A MAC (media access control) address is a 48-bit number which is the physical address of a hardware device connected to a network. It is represented as a hexadecimal number, for example, `c03C4e00108f`.

If you are running EPXOS V2.0 or later, you can determine the MAC address of the EPX Test System CPU in two ways:

- Log in to the EPX Test System as root and select **Tools** > **Setup** from the EPXam main window to open the Setup window and check the MAC address field.

Note You must be logged in as root to access EPX Setup information.

- Execute the following command. You do not need to be logged in as root.

```
SYST:HOST:MAC ?
OK MAC address: 00D0C9141088
```

Adding a License

Perform the following steps to add an EPXam Pro license.

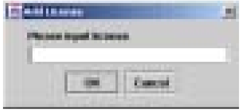
1 Run EPXam Pro.

A dialog displays that prompts you to add a license or start a 7-day evaluation period.

2 Click **Add License**.

3 Enter the license key.

See “How to Obtain a License” on page 152 for more information.



Once you have entered a license key, you can select **Tools** > **License Manager** from the EPXam main window menu to view licensing information. See “Viewing EPXam License Status (License Manager)” on page 153.

Viewing EPXam License Status (License Manager)

Use the EPX License Manager to view the status of your current license or add a license.

Perform the following steps to view licensing status or add licenses.

1. Log in to the EPX Test System using EPXam.
2. Select **Tools** > **License Manager** to open the License Manager window.

The following information is displayed:

- Product name (in this case, EPXam)
- License type
- License key
- For evaluation license, the number of days remaining in the evaluation period

3. Click **Add** if you want to add a license.
4. Enter a valid license key in the Add License dialog. See “How to Obtain a License” on page 152.
5. Click **OK.**

   The **License Manager** window updates to display information about the new license.
6. Click **Close**.

Viewing EPXam License Status (License Manager)

Part 2

EPX Test System Module Window Reference

The chapters in this section describe the features and fields in the module detail window for each type of module that can be installed in an EPX Test System:

17

EPX 100 CLOCK MODULE WINDOW

The topics in this section explain how to configure Setup and Input/Output options for the EPX100 clock module in slot 1 using EPXam:

Note You must configure the clock module the first time you log into the EPX Test System, after installing or upgrading EPXOS, when you change a clock source, and when you add or move a module to a different slot.

Note You must be logged in as root on the EPX Test System to configure the clock module. If you are not logged in as root, the settings are view only.

See "Configuring the EPX100 Clock Module" on page 25 for general information about configuring clock sources and clock output ports.

See "Clock Module" on page 587 of the *SCPI Reference* for information about SCPI for configuring the EPX clock module.

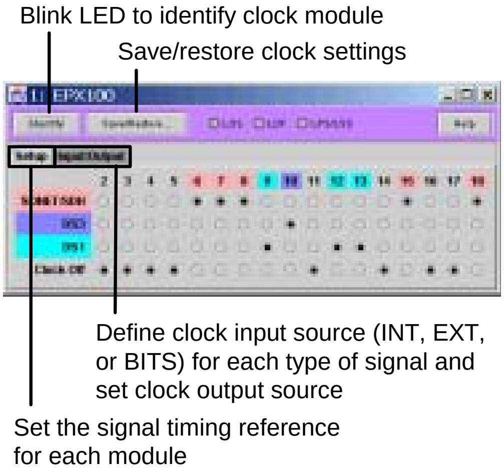
Clock Module Main View

The main view of the EPX clock module window contains the following controls and options:

- Tabs for setting up clock signal timing references for each slot and defining clock input and output sources
- Generic controls for module identification, saving and restoring module/slot configurations, and accessing online help

The following figure shows the main features of the clock module window.

Clock Setup Options



See the following topics for specific information about configuring the clock module:

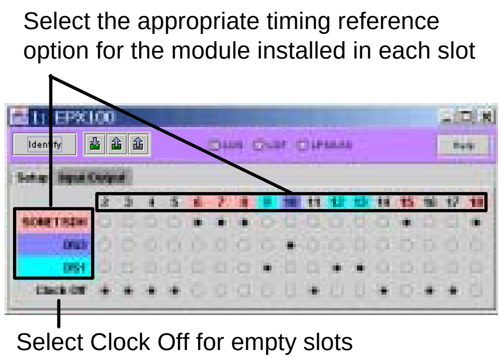
- “Clock Setup Options” on page 158
- “Clock Input/Output Options” on page 159
- “Configuring the EPX100 Clock Module” on page 25

See “Clock Module” on page 587 in the *SCPI Reference* for commands to set the timing reference for a slot using SCPI.

Use the Clock Module **Setup** Options tab to set the signal timing reference for each slot. The type of module installed in the slot determines the type of timing reference to select.

Use the following guidelines to select the timing signal reference.

Module	Timing Reference
All OC-*nn* and STM-*n* modules	SONET/SDH
STS-1	SONET/SDH
DS1	DS1
DS3	DS3
E1	Clock Off (E1 modules have their own oscillator)
Empty slot	Clock Off

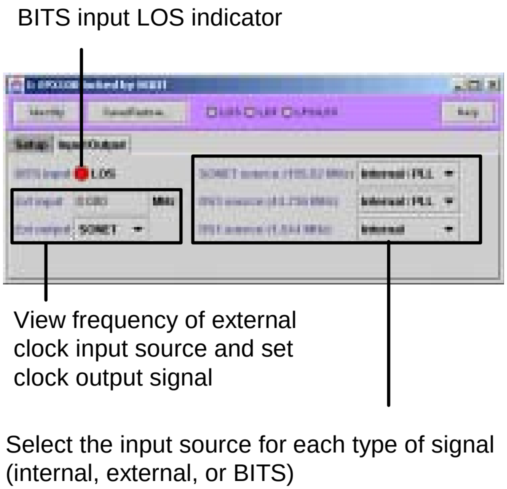


The signal timing reference for the slot is updated as soon as you make a selection.

Clock Input/Output Options

The options on the clock module Input/Output tab enable you to do the following:

- View BITS input signal status and monitor external clock input signal frequency
- Set the signal sent to the external clock output port
- Choose whether the clock source for each type of signal is supplied by the clock module, an external clock, or a BITS clock



See "Configuring Clock Module Outputs" on page 28 for more information about setting up BITS and external clock sources.

The fields in the Input/Output tab are described in the following table. The changes take effect when you make the selection.

Field	Description
BITS Input LOS Indicator	BITS input signal indicator: • Green indicates that a BITS source is connected and the signal is being received. • Red indicates either a loss of signal or that no BITS input source is connected.
Ext Input	Displays the measured frequency of the external clock input port.
Ext Output	Set the clock source for the external clock output port: • OFF—Disable clock to external clock output port. • SONET—Select the SONET/SDH (155.52 MHz) clock source • DS1—Select the DS1 (1.544 MHz) clock source. • DS3—Select the DS3 (44.736 MHz) clock source. See "Clock Source Frequencies and Settings by Module" on page 29 for what frequency range is required for each signal.

Field	Description
SONET/SDH Source **DS1 Source** **DS3 Source**	Select the clock that provides the timing reference for the indicated signal source (DS1, DS3, or SONET/SDH): • **Internal/PLL**—Select the clock module's internal oscillator as reference to the PLL (phase locked loop) that generates the DS3 or SONET/SDH signal. • **Internal**—DS1 only. Select the clock module's internal 1.544 MHz oscillator as the clock source. The input bypasses the PLL and is sent directly to slots via the backplane. • **BITS/PLL**—The SONET/SDH or DS3 clock source is derived from the BITS input source (this option selects the BITS input as reference to the PLL that generates the SONET/SDH or DS3 signal. This option cannot be selected if a BITS clock source is not connected. • **BITS**—DS1 only. Select BITS input as the timing reference. The BITS input bypasses the PLL and goes directly to slots via the backplane. • **External**—Select the external clock. The external clock bypasses the PLL and goes directly to slots via the backplane. This option cannot be selected if an external clock source is not connected.

Field	Description
SCPI Examples:	
See "Clock Module" on page 587 of the *SCPI Reference* for information about SCPI syntax and parameters for EPX Clock Module configuration.	

18

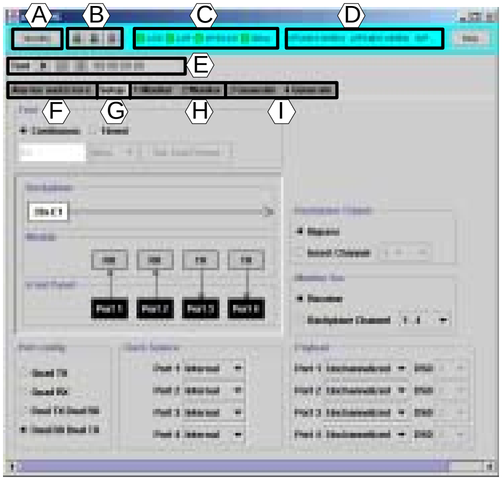
E1 Quad Transceiver Module Window

The topics in this section explain how to configure the E1 Quad Transceiver module Setup, Generate, and Monitor options using the EPX Test System GUI, along with SCPI equivalents.

Tip Configure the E1 ports to transmit or receive using the Port Config options on the **Setup** tab before configuring other settings. Changing the port configuration disables all error and alarm generation on transmit ports and can result in changes to other settings such as the transmit clock source.

E1 Main View

The following figure illustrates the main features of the E1 Quad Transceiver module window, with the **Setup** tab selected.



A Identify—When pressed, it flashes the active LED on the front panel of the module associated with this window.

B Save and restore module/slot configuration or restore factory defaults (see "Using Module Window Save and Restore Controls" on page 108)

C Defect status summary indicators. Defect status indicators are greyed out and do not apply to TX ports. These indicators do not turn red when injecting alarms or errors.

D Displays currently selected framing mode and line coding format for each port

E **Test**—Start, pause, resume, and stop testing for this module (see "Using Module Window Test Controls" on page 118)

F **Alarms and Errors**—Displays alarm status indicators, error counts, and error ratios for the current test.

G **Setup**—Configure ports to transmit or receive, test type and duration, backplane output, TX clock source, RX input source and other options.

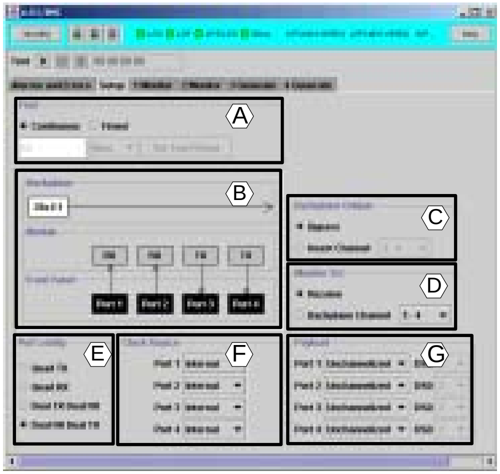
H **Monitor**—Configure payload data pattern, framing mode, line coding, and other options for the monitored signal. One **Monitor** tab is displayed for each configured RX port.

I **Generate**—Configure payload data pattern, alarm and error insertion, line coding, framing mode, and other options for the transmitted signal. One **Generate** tab is displayed for each configured TX port.

These features are covered in more detail in the following sections.

E1 Setup Options

The following figure illustrates the main features of the E1 transceiver module **Setup** tab.



A Select test type and duration, as described in “Test” on page 163.

B View current port and module I/O configuration

C Configure backplane output

D Select the input source for the monitored signal

E Configure ports to either transmit or receive

F Set the clock source for each transmit port

G Payload type (only Unchannelized payloads are supported)

The following sections describe these setup options in more detail.

Test

The Test area defines the type and duration of the test that the receiver runs. To start and stop tests, use the controls in the module window or, to start tests for multiple modules, use the Test Controls window. See “Controlling Tests” on page 115.

Note Selecting a new test type automatically stops the current test.

Test Setting	Description
Continuous	Selects a continuous test that must be manually stopped and started. This is the default setting in the factory configuration.
Timed	Selects a timed test. When Timed is selected: **1** Specify a number and select a unit (seconds, minutes, hours, and days) for the test duration. **2** Click **Set** to apply the settings. **3** Use the controls at the top of the window to start the test. **Note** If you enable logging and are saving the log file to the EPX Test System, gnubi advises you to limit the test period to a maximum of 72 hours (3 days).

Test Setting	Description

SCPI Examples:
`sens(@3):test:type cont`
`sens(@3):test:type tim`
`sens(@3):test:unit min`
`sens(@3):test:per 10`
To control tests use the following commands:
`sens(@3):test:mode star`
`sens(@3):test:mode stop`
`sens(@3):test:mode rest`
`sens(@3):test:mode pause`
Related Topics:
"Logging" on page 63
"Controlling Tests" on page 115	

Backplane Output

The E1 Quad Transceiver module can transmit 28 E1 signals to the module on the right. Possible sources for these 28 E1 signals include the 28 backplane input E1 signals from either the module to the left or the 4 ports of the E1 module.

The graphic display of the current backplane setting, backplane signal, and signal path are updated in the Backplane/Module/ IO view when you change these settings.

Note Using Bypass mode, you can only pass data to and from DS1, DS3, or E1 modules, not optical modules.

Note Modules must be installed in adjacent slots to transmit and receive signals along the backplane.

Backplane Setting	Description
Bypass	Bypass mode. The 28 backplane input signals from the backplane are passed to the next slot unchanged.

Backplane Setting	Description
Insert Channel	Insert E1 signals from each of the 4 ports of the E1 module onto the backplane. **Insert Channel** is only supported for Quad TX and Quad RX port configurations. **Note** The TX port does not generate LOS or AIS alarms to the backplane or inject BPV errors onto the backplane. The following mappings are available: **1 - 4**. Inserts E1 signals numbered 1 - 4 from E1 module ports 1 - 4, respectively. E1 signals 5 through 28 are passed unchanged to the next slot. **5 - 8**. Inserts E1 signals numbered 5 - 8 from E1 module ports 1 - 4, respectively. E1 signals 1 -4 and 9 - 28 are passed unchanged to the next slot. **9 - 12**. Inserts the E1 signals numbered 9 - 12 from E1 module ports 1 - 4, respectively. E1 signals 1 -8 and 13 - 28 are passed unchanged to the next slot. **13 - 16**. Inserts the E1 signals numbered 13 - 16 from E1 module ports 1 - 4, respectively. E1 signals 1 -12 and 17 - 28 are passed unchanged to the next slot. **17 - 20**. Inserts the E1 signals numbered 17 - 20 from E1 module ports 1 - 4, respectively. E1 signals 1 -16 and 21 - 28 are passed unchanged to the next slot.

Backplane Setting	Description
Insert Channel (con't)	**21 - 24.** Inserts the E1 signals numbered 21 - 24 from E1 module ports 1 - 4, respectively. E1 signals 1 -20 and 24 - 28 are passed unchanged to the next slot. **24 - 28**. Inserts the E1 signals numbered 24 - 28 from E1 module ports 1 - 4, respectively. E1 signals 1 - 23 are passed unchanged to the next slot.

SCPI Examples:

```
SYST:BOAR(@8):BACK:OUTP  ADD1
...
SYST:BOAR(@8):BACK:OUTP  ADD7
SYST:BOAR(@8):BACK:OUTP  BYP
```

Related Topics:

“Using the Backplane” on page 41

Monitor Src

The **Monitor Src** setting determines whether the receive ports monitor the E1 signal from the front panel LIU (default) or a backplane input channel. If a backplane input channel is monitored, the channel selection determines which backplane channels are monitored.

Monitor Src	Description
Receive	Configures the receive ports to monitor the E1 signal from the front panel LIU. This is the default setting.

Monitor Src	Description
Backplane Channel	Set the port receive mode to monitor the E1 signal from the backplane and select which set of four backplane signals to monitor. This option is only available when E1 Port Config is set to Quad RX mode. **Note** BPV errors and LOS alarms cannot be monitored in this mode.
Backplane Channel mappings	The following mappings are available: **1 - 4**. RX ports 1 - 4 monitor E1 backplane channel signals numbered 1 - 4, respectively. **5 - 8**. RX ports 1 - 4 monitor E1 backplane channel signals numbered 5 - 8, respectively. **9 - 12**. RX ports 1 - 4 monitor E1 backplane channel signals numbered 9 - 12, respectively. **13 - 16**. RX ports 1 - 4 monitor E1 backplane channel signals numbered 13 - 16, respectively. **17 - 20**. RX ports 1 - 4 monitor E1 backplane channel signals numbered 17 - 20, respectively. **21 - 24**. RX ports 1 - 4 monitor E1 backplane channel signals numbered 21 - 24, respectively. **24 - 28**. RX ports 1 - 4 monitor E1 backplane channel signals numbered 24 - 28, respectively.

Monitor Src	Description

SCPI Examples:
 	
To set all 4 ports to monitor the signal from the LIU:
 	
`SENS(@9):PORT[1]:DATA:MODE NORM`
`SENS(@9):PORT[2]:DATA:MODE NORM`
`SENS(@9):PORT[3]:DATA:MODE NORM`
`SENS(@9):PORT[4]:DATA:MODE NORM`
 	
To monitor from the backplane, first, set all 4 RX ports to monitor the backplane:
 	
`SENS(@9):PORT[1]:DATA:MODE BACK`
`SENS(@9):PORT[2]:DATA:MODE BACK`
`SENS(@9):PORT[3]:DATA:MODE BACK`
`SENS(@9):PORT[4]:DATA:MODE BACK`
 	
Then, select the set of 4 backplane channels to monitor. For example, the following command selects backplane channels 1 through 4, which are monitored by ports 1 through 4, respectively:
 	
`SYST:BOAR(@8):BACK:INP  IN1`
 	
See the Monitor Data Source command under “Data Queries” and the Backplane Input command under “System” in the section “E1” on page 590 of the *SCPI Reference* for more information.	

Port Config

The Port Config settings configure the four E1 ports as either transmitters or receivers. The unit powers up with a default configuration of Dual RX/TX.

Note Changing the port configuration turns off all error and alarm generation on transmit ports and can result in the change of other parameters such as the transmit clock source.

For example, assume the E1 module is in the Dual RX/Dual TX configuration, and the port 4 transmit clock source is set to loop on the port 2 receiver. If the port configuration is then changed to Quad TX, the transmit clock source is set to Internal (the default), because no receive clock source exists for port 2 in this configuration.

Port Config	Description
Quad TX	Configures all four E1 ports as transmitters.
Quad RX	Configures all four E1 ports as receivers
Dual RX/Dual TX	Configures ports 1 and 2 as receivers and ports 3 and 4 as transmitters. This is the default setting.
Dual TX/Dual RX	Configures ports 1 and 2 as transmitters and ports 3 and 4 as receivers.

SCPI Examples:
`BOAR(@3):IOC XMIT`
`BOAR(@3):IOC RCV`
`BOAR(@3):IOC RXTX`
`BOAR(@3):IOC TXRX`	

Clock Source (TX)

The Clock Source option specifies the clock source for each transmit port. If no transmit ports are configured, the Clock Source options are not available. The Clock Module does not generate a timing reference for the E1 module.

Clock Src	Description
Internal	Configures the selected transmit port to use the internal (onboard) E1 clock (2.048 MHz +/- 20 ppm).
Port *n* RX	Configures the selected transmit port to use the recovered clock from the E1 receive interface (also called loop mode). In loop mode: • The port 4 transmitter gets its timing references from the port 2 receiver. • The port 3 transmitter gets its timing reference from the port 1 receiver. • The port 1 transmitter gets its timing reference from the port 4 receiver • The port 2 transmitter gets its timing reference from the port 3 receiver.

SCPI Examples:
`SOUR(@3):PORT[1]:CLOCK INT`
`SOUR(@3):PORT[1]:CLOCK LOOP`	

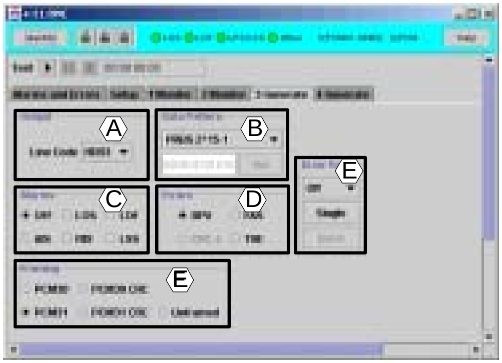
Payload

Currently, the only supported payload type is Unchannelized.

E1 Generate (TX) Settings

The following figure shows the E1 signal generation options for transmit ports available on the **Generate** tab.

A separate **Generate** tab is displayed for each transmit port. For example, if the Port Config option is set to Quad TX, four **Generate** tabs are displayed. This tab is not displayed when the port configuration is set to Quad RX.



A Select the line coding type

B Select the payload data pattern

C Select the type of alarm to insert

D Select the type of error to insert

E Specify the error insertion rate

F Set the framing mode

These signal generation options are described in more detail in the following sections.

Output (TX)

The Output option specifies the line encoding for the transmitted E1 signal.

Setting	Description
Line Code	Controls the output line coding type for the E1 signal transmitted on this port. Select either **AMI** (alternate mark inversion) or **HDB3** (high-density bipolar 3). The default is HDB3.
SCPI Examples:	
`OUTP(@9):PORT[1]:CODE AMI` `OUTP(@9):PORT[1]:CODE HDB3`	

Data Pattern (TX)

Use the Data Pattern setting to select the type of pattern to place into the generated payload for each TX port.

The E1 module payload format is unchannelized, which selects a clear channel E1 payload format. All payload bits are monitored for pattern matching.

Setting	Description
PRBS 2^15-1 (menu of payload patterns types)	This menu lists available payload pattern types that can be inserted into the generated payload, including pseudo-random bit sequences (PRBS 2^n-1), inverted PRBS, QRSS (PRBS 2^20-1 with zeros suppressed.), Daly (55 Octet), user-defined bit patterns, and so on. The default is PRBS 2^15-1. Select **User** from this menu to insert a user-defined custom payload pattern.
Set	This field is only active if a **User** payload pattern type is selected. Enter bit pattern (from 1 to 24 bits can be specified), and click **Set** to apply the custom payload data pattern you specified.

SCPI Examples:

To set the payload data pattern using SCPI, use the

For example, to change the payload pattern type:

```
SOUR(@7):PORT[3]:PAYL:GEN:PATT:TYPE DALY
```

For example, to define and insert an 8-bit custom-payload pattern using SCPI for TX port 3:

```
SOUR(@7):PORT[3]:PAYL:GEN:PATT:TYPE USER
SOUR(@7):PORT[3]:PAYL:GEN:PATT:BITS 8
SOUR(@7):PORT[3]:PAYL:GEN:PATT:USER
0b10010011
```

See the Source commands for Pattern Type, User Pattern, and Pattern Bits in the section “E1” on page 590 of the *“SCPI Reference”* for more information.

Alarms (TX)

Use the Alarms option to select the type of alarm that is inserted into the transmit stream for each TX port.

Note When the framing mode is set to unframed, you cannot insert or monitor LOF, AIS, or RDI alarms.

Setting	Description
Off	Disables alarm insertion.
LOS	Inserts a Loss of Signal alarm. LOS alarms cannot be inserted when the backplane output mode is set to Insert Channel.
LOF	Inserts a Loss of Frame alarm. This alarm is not available in Unframed mode.
AIS	Inserts an Alert Indicator Signal alarm. This alarm is not available in Unframed mode. AIS alarms cannot be inserted when the backplane output mode is set to Insert Channel.
RDI	Inserts an Remote Defect Indicator alarm. This alarm is not available in Unframed mode.
LSS	Generates a Loss of Sequence Sync alarm (equivalent to Loss of Pattern Sync, or LPS alarm).

Setting	Description
SCPI Examples: SOUR(@9):PORT[1]:ALAR LOS SOUR(@9):PORT[1]:ALAR LOF SOUR(@9):PORT[1]:ALAR AIS SOUR(@9):PORT[1]:ALAR RDI SOUR(@9):PORT[1]:ALAR LSS SOUR(@9):PORT[1]:ALAR OFF	

Errors (TX)

The Errors setting controls the type of error that is inserted into the transmit stream for each TX port.

Note The Error Rate setting is always reset to OFF whenever the Error Type is changed.

Note FAS and CRC-4 errors cannot be inserted or monitored when the Framing mode is set to Unframed. CRC-4 errors can only be inserted if the Framing mode is set to PCM30 CRC or PCM31 CRC.

Setting	Description
BPV	Bipolar violation error. Only single BPV errors can be inserted. Burst errors and error rates are not supported for BPV error injection. BPV errors cannot be inserted when the backplane output mode is set to Insert Channel.
FAS	Frame alignment signal error. FAS errors are not available when the Framing mode is set to Unframed.
CRC-4	Cyclic redundancy check error. Error rates for CRC-4 are calculated as the number of CRC-4 errors per payload data bits. CRC-4 errors cannot be inserted when the Framing mode is set to PCM30, PCM31, or Unframed. The R1E-3 error rate is not supported when the Error Type is CRC. This rate is higher then the maximum possible CRC-4 error rate.
TSE	Test sequence (bit pattern) errors.
SCPI Examples: SOUR(@9):PORT[1]:ERR:TYPE BPV SOUR(@9):PORT[1]:ERR:TYPE FRAM SOUR(@9):PORT[1]:ERR:TYPE CRC SOUR(@9):PORT[1]:ERR:TYPE TSE See “Framing (TX)” on page 171.	

Error Rate (TX)

The Error Rate setting enables and disables error insertion and controls the rate at which errors are inserted into the stream.

Error Rate Setting	Description
Off	Disables error insertion.
IE-3 through IE-9	Set the error ratio to 10 x 10^-3, 10 x 10^-4, and so on. IE-3 does not apply to CRC-4 errors.

Error Rate Setting	Description
Single	Error Rate must be set to Off to enable single error insertion. When this option is available, click this button to insert a single error into the transmit stream.
Burst	Inserts a burst of 15 errors and sets error rate to OFF
SCPI Examples: SOUR(@3):ERR:RAT OFF SOUR(@3):ERR:RAT RIE-4 SOUR(@3):ERR:RAT SING SOUR(@3):ERR:RAT BURS	

Framing (TX)

Use the Framing options to select the framing format for the transmitted signal.

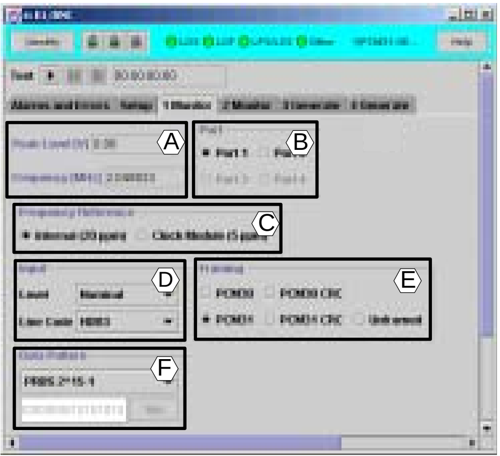
Note Changing the Framing mode turns off alarm and error insertion.

Note CRC-4 errors are not available when the Framing mode is set to PCM30, PCM31, or Unframed. FAS and CRC-4 errors are not available when the Framing mode is set to Unframed.

Frame Mode	Description
PCM30	The E1 transmitter generates a framed format with Channel 16 signaling and without CRC-4. Each frame contains 30 64-kHz channels with byte 16 used for CAS signaling.
PCM30 CRC	The E1 transmitter generates a multiframed CRC-4 format with channel 16 signaling. Each frame contains 31 64-kHz channels with byte 16 used for CAS signaling.
PCM31	The E1 transmitter generates a framed format without CRC-4. Each frame contains thirty 64-kHz channels.
PCM31 CRC	The E1 transmitter generates a multiframed CRC-4 format Each frame contains thirty-one 64-kHz channels.
Unframed	The E1 transmitter generates an unframed pattern (no framing or any overhead bits).
SCPI Examples: SOUR(@9):PORT[1]:GEN:PAYL:FRAM PCM30 SOUR(@9):PORT[1]:GEN:PAYL:FRAM PCM31 SOUR(@9):PORT[1]:GEN:PAYL:FRAM P31CRC SOUR(@9:PORT[1]:GEN:PAYL:FRAM P30CRC SOUR(@9:PORT[1]:GEN:PAYL:FRAM UNFR	

E1 Monitor (RX) Settings

The following figure illustrates the main features of the E1 **Monitor** tab.



A View input peak voltage level, and frequency values for the monitored signal for the selected RX port

B Select the RX port to monitor for input peak voltage and frequency level

C Select the clock source to use as the E1 frequency counter reference

D Select the input level and line coding for the monitored signal

E Select the framing mode for the monitored signal

F Set the payload pattern to monitor

These settings are described in more detail in the following sections.

Port, Peak Level, and Frequency Reference

Setting	Description
Peak Level [V]	Displays the instantaneous peak voltage level received on the monitored E1 signal (accurate to 2 significant digits). The peak level circuitry is sampled once every 500 ms (1/2 second).
Port	Click to select the RX port whose input peak voltage is displayed in the Peak Level (V) field. If there are no RX ports configured, this field is greyed out.
Frequency [mHz]	Displays the frequency in megahertz with an accuracy within 6 ppm.
Frequency Reference	Selects the source of the reference clock for the E1 frequency counter: • **Internal (20 ppm)**—Selects the E1 module onboard reference oscillator as the clock source for the 2.048 megahertz E1 frequency counter (accurate to within approximately 20 ppm).

SCPI Examples:

Select the receive port to be measured for peak voltage level received on the E1 signal and query the peak voltage level:

```
INP(@9):PEAK:SEL 1
INP(@9):LEV:PEAK ?
```

Display frequency for a receive port:

```
INP(@8):PORT[1]:FREQ ?
```

Select the clock source for the E1 frequency counter:

```
INP(@9):FREF INT
```

Input (RX)

Use the input settings to configure the input level and line coding of the monitored signal.

Setting	Description
Level	Controls the input level for the monitored E1 signal. • **Nominal** (default setting) • **Bridged**. The Bridged setting requires a bridged level input. It will not work with the EPX output level settings without attenuation.
Line Code	Controls the line coding for the receive signal. Choose either **HDB3** (high-density bipolar 3, the default) or **AMI** (alternate mark inversion).

SCPI Examples:

```
INP(@9):PORT[1]:LEV:SET  NOM
INP(@9):PORT[1]:LEV:SET  BRID
INP(@9):PORT[1]:CODE HDB3
INP(@9):PORT[1]:CODE AMI
```

Framing (RX)

Use the Framing options to select the framing mode for the monitored signal.

Note CRC-4 errors are not monitored when the framing mode is set to PCM30, PCM31, or Unframed. FAS and CRC-4 errors are not monitored when the Framing mode is set to Unframed.

Setting	Description
PCM30	The E1 receiver monitors a framed format with Channel 16 signaling and without CRC-4.
PCM30 CRC	The E1 receiver monitors a multiframed CRC-4 format with channel 16 signaling.
PCM31	The E1 receiver monitors a framed format without CRC-4.
PCM31 CRC	The E1 receiver monitors a multiframed CRC-4 format.
Unframed	The E1 receiver monitors an unframed pattern (no framing or any overhead bits).

SCPI Examples:

```
SENS(@9):PORT[1]:MON:PAYL:FRAM PCM30
SENS(@9):PORT[1]:MON:PAYL:FRAM PCM31
SENS(@9):PORT[1]:MON:PAYL:FRAM P31CRC
SENS(@9):PORT[1]:MON:PAYL:FRAM P30CRC
SENS(@9):PORT[1]:MON:PAYL:FRAM UNFR
```

Data Pattern (RX)

Use the Data Pattern setting to specify that type of payload pattern that is monitored.

Setting	Description
PRBS 2^15-1 **...** **User**	This menu lists available payload pattern types, including pseudo-random bit sequences (PRBS 2^n-1), inverted PRBS, QRSS (PRBS 2^20-1 with zeros suppressed.), Daly (55 Octet), user-defined bit patterns, and so on. The default is PRBS 2^15-1. Select **User** from this menu to monitor a user-defined payload pattern.
Set	This field is only active if a **User** payload pattern type is selected. Enter the bit pattern (from 1 to 24 bits can be specified) and click **Set** to apply your changes to the custom user payload data pattern.

SCPI Examples:

For example, to change the payload pattern type that is monitored on RX port 1:

```
SENS(@1):PORT[3]:PAYL:MON:PATT:TYPE DALY
```

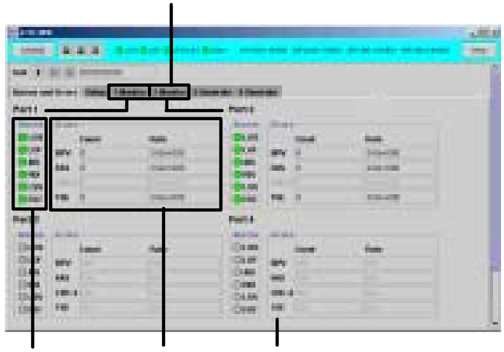
For example, to define an 8-bit custom- payload pattern to monitor using SCPI for RX port 1:

```
SENS(@7):PORT[1]:PAYL:MON:PATT:TYPE USER
SENS(@7):PORT[1]:PAYL:MON:PATT:BITS 8
SENS(@7):PORT[1]:PAYL:MON:PATT:USER
0b10010011
```

See the Data Queries commands for Pattern Type, User Pattern, and Pattern Bits in the section “E1” on page 590 of the *“SCPI Reference”* for more information.

E1 Alarms and Errors

The following figure illustrates the main features of the E1 **Alarms and Errors** tab.



Monitored E1 alarm and error data is described in more detail in the following sections.

Alarms (RX)

The Alarms section on the **Alarms and Errors** tab displays alarm status indicators for the current test.

Alarm indicator colors are defined in the following table. When an alarm indicator is greyed out, it means that the alarm type does not apply to the current test setup.

Green	Yellow	Red
No alarms are detected: signal is clear or monitoring is not started.	Alarm history: an alarm was detected but is not active in the current test.	An alarm is active and currently detected on the monitored signal.

The following types of alarms are monitored:

Note LOF, AIS, and RDI alarms are not monitored when the Framing mode of the monitored signal is set to Unframed.

Alarm Indicator	Description
LOS	Displays the status of the Loss of Signal alarm. LOS alarms are not available when monitoring the signal from a backplane channel (that is, when Monitor Source is set to Backplane Channel).
LOF	Displays the status of the Loss of Frame alarm. LOF alarms are not monitored when the Framing mode is set to Unframed.
AIS	Displays the status of the Alarm Indicator Signal alarm. AIS alarms are not monitored when the Framing mode is set to Unframed.
RDI	Displays the status of the Remote Defect Indicator alarm. RDI alarms are not monitored when the Framing mode is set to Unframed.
LSS	Displays the status of the Loss of Sequence Sync (Loss of Pattern Sync) alarm. LSS alarms are not available when monitoring the signal from a backplane channel or when monitoring live data traffic.
EXZ	Displays the status of the Excessive zeroes alarm. EXZ alarms are not available when monitoring the signal from a backplane channel.

SCPI Examples:

```
SENS(@9):PORT[1]:ALAR:LOS ?
SENS(@9):PORT[1]:ALAR:LOF ?
SENS(@9):PORT[1]:ALAR:AIS ?
SENS(@9):PORT[1]:ALAR:RDI ?
SENS(@9):PORT[1]:ALAR:LSS ?
SENS(@9):PORT[1]:ALAR:EXZ ?
SENS(@9):Port[1]:ALAR:ALL ?
```

Errors (RX)

The Errors section of the E1 **Alarms and Errors** tab displays error counts and ratios for the current test.

See “Errors (TX)” on page 170 for a description of these error types.

Error Type or Setting	Description
BPV	BPV (bipolar path violation error). BPV errors are not available when monitoring the signal from the backplane (that is when Monitor Src is set to Backplane Channel).
CRC-4	CRC-4 (cyclic redundancy check errors). CRC errors are only available for monitoring when the framing mode is set to PCM30 CRC or PCM31 CRC.
Frame	Frame (frame alignment signal error). Frame errors are not monitored in Unframed mode.
TSE	TSE (test sequence, or bit pattern, errors).
Count	Number of times the error was detected during the current test period. Counters are reset at the beginning of each test period.
Ratio	Displays the computed ratio for the selected error type.

SCPI Examples:

```
SENS(@9):PORT[1]:ERR:COUN BPV
SENS(@9):PORT[1]:ERR:RAT BPV
SENS(@9):PORT[1]:ERR:COUN CRC
SENS(@9):PORT[1]:ERR:RAT CRC
SENS(@9):PORT[1]:ERR:COUN FRAM
SENS(@9):PORT[1]:ERR:RAT FRAM
SENS(@9):PORT[1]:ERR:COUN TSE
SENS(@9):PORT[1]:ERR:RAT TSE
```

19

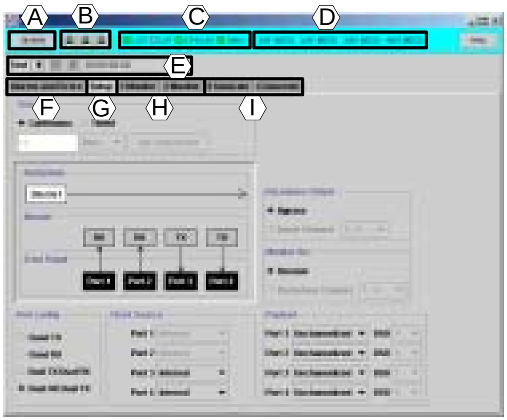
DS1 Quad Transceiver Module Window

The topics in this section explain the DS1 Quad Transceiver module setup, signal generation, and signal monitoring options using the EPX Test System GUI, along with SCPI equivalents:

Tip Configure the DS1 ports to transmit or receive using the Port Config options on the **Setup** tab before configuring other settings. Changing the port configuration disables all error and alarm generation on transmit ports and can result in changes to other settings such as the transmit clock source.

DS1 Main View

The following figure illustrates the main features of the DS1 Quad Transceiver module window.



A **Identify button**—When pressed, flashes the Active LED on the module associated with this window

B Save and restore user-defined module/slot configuration or restore factory defaults (see “Using Module Window Save and Restore Controls” on page 108)

C Defect status indicators. Defect status indicators are greyed out and do not apply to TX ports. These indicators do not turn red when injecting alarms or errors.

D Displays frame format and line code for each port

E Start, stop, pause, or resume test; view elapsed time (see “Using Module Window Test Controls” on page 118)

F **Alarms and Errors**—Displays alarm status, error counts, and error ratios for current test

G **Setup**—Configure ports to transmit or receive, signal source, clock source backplane output, and payload type

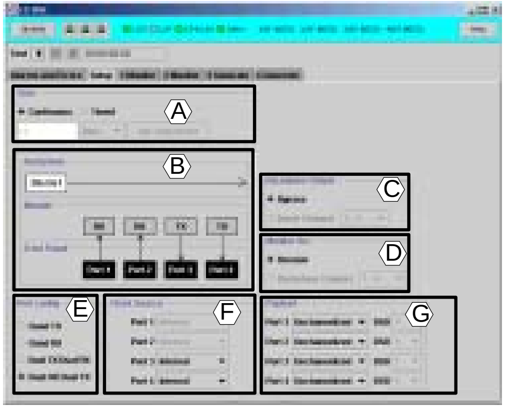
H **Monitor**—Monitor input frequency level and configure monitoring options for RX ports, such as the payload data pattern, framing, ESF data link message, inband loopback activate and deactivate (one **Monitor** tab per configured RX port)

I **Generate**—Configure signal generation options for TX ports, such as the output line code and level, error and alarm insertion, payload data pattern, framing, ESF data link message, and inband loopback activate and deactivate (one **Generate** tab per configured TX port)

These features are described in more detail in the following sections:

DS1 Setup Options

The following figure illustrates the main features of the **Setup** tab in the DS1 Quad Transceiver module window.



A Control test type and duration, as described in “Test” on page 179.

B View current module input source and backplane output settings.

C Specify whether the DS1 signals coming in from the backplane are sent back onto the backplane unchanged to the next slot or DS1 signals from the module's ports are inserted onto the backplane. See "Backplane Output" on page 179.

D Specify whether the receive ports monitor the DS1 signal from the front panel LIU (default) or an input channel from the backplane. See "Monitor Source" on page 181.

E Configure ports to transmit or receive, as described in "Port Config" on page 182.

F Set the clock source for each transmit port, as described in "Clock Source" on page 182.

G Select the payload pattern type that is mapped into the transmit stream (for transmit ports) or demapped into the receive stream (for receive ports). See "Payload Types" on page 183.

Test

The Test area defines the type and duration of the test that the receiver runs. To start and stop tests, use the controls in the module window or, to start tests for multiple modules, use the Test Controls window. See "Controlling Tests" on page 115.

Note Selecting a new test type automatically stops the current test.

Test Setting	Description
Continuous	Selects a continuous test that must be manually stopped and started. This is the default setting in the factory configuration.
Timed	Selects a timed test. When Timed is selected: **1** Specify a number and select a unit (seconds, minutes, hours, and days) for the test duration. **2** Click **Set** to apply the settings. **3** Use the controls at the top of the window to start the test. **Note** If you enable logging and are saving the log file to the EPX Test System, gnubi advises you to limit the test period to a maximum of 72 hours (3 days).

SCPI Examples:
`sens(@3):test:type cont`
`sens(@3):test:type tim`
`sens(@3):test:unit min`
`sens(@3):test:per 10`
To control tests use the following commands:
`sens(@3):test:mode star`
`sens(@3):test:mode stop`
`sens(@3):test:mode rest`
`sens(@3):test:mode pause`
Related Topics:
"Logging" on page 63
"Controlling Tests" on page 115	

Backplane Output

The Backplane Output option determines whether the DS1 module transmits all 28 DS1 signals from the backplane unchanged to the module to the right. (Bypass mode) or whether

DS1 signals from each of the module's four ports are inserted onto the backplane and transmitted to the next module (Insert mode).

Backplane Output	Description
Bypass (Default)	Sets the backplane to bypass the carrier board. All 28 DS1 signals on the backplane are sent onto the backplane unchanged to the next slot. **Note** Bypass mode only passes data to and from DS3, DS1, or E1 modules, not optical modules.
Insert Channel	The **Insert Channel** option can only be selected when the ports on the DS1 module are configured for Quad TX or Quad RX. **1 - 4**. Puts DS1 signals 1 - 4 from ports 1 - 4 onto the backplane. DS1 signals numbered 5 through 28 are passed unchanged to the next slot. **5 - 8**. Puts DS1 signals 5 - 8 from ports 1 - 4 onto the backplane. DS1 signals numbered 1 - 4 and 9 - 28 are passed unchanged to the next slot. **9 - 12**. Puts DS1 signals 9 - 12 from ports 1 - 4 onto the backplane. DS1 signals numbered 1 - 8 and 13 - 28 are passed unchanged to the next slot. **13 - 16**. Puts DS1 signals 13 - 16 from ports 1 - 4 onto the backplane. DS1 signals numbered 1 - 12 and 17 - 28 are passed unchanged to the next slot. **17 - 20**. Puts DS1 signals 17 - 20 from ports 1 - 4 onto the backplane. DS1 signals numbered 1 - 16 and 21 - 28 are passed unchanged to the next slot. **21 - 24**. Puts DS1 signals 21 - 24 from ports 1 - 4 onto the backplane. DS1 signals numbered 1 - 20 and 25 - 28 are passed unchanged to the next slot. **24 - 28**. Puts DS1 signals 25 - 28 from ports 1 - 4 onto the backplane. DS1 signals numbered 1 - 23 are passed unchanged to the next slot.

Backplane Output	Description
SCPI Examples: To set the DS1 backplane output to the default bypass mode: `SYST:BOAR(@9):BACK:OUTP BYP` See the Backplane Output command under System commands in “DS1” on page 587 of the “SCPI Reference” for information about configuring backplane output to insert channel mode using SCPI.	

Monitor Source

The **Monitor Src** setting determines whether the receive ports monitor the DS1 signal from the front panel LIU (default) or a backplane input channel. If a backplane input channel is monitored, the channel selection determines which backplane channels are monitored.

Note

Monitor Src	Description
Receive (Default)	Configures the receive ports to monitor the DS1 signal from the front panel LIU. This is the default setting.
Backplane Channel	Sets the port receive mode to monitor the DS1 signal from the backplane and selects a set of four backplane signals to monitor. The Backplane Channel option is only available when the Port Config setting is configured for Quad RX mode. **Note** BPV errors and LOS alarms cannot be monitored in this mode. The following backplane channel mappings are available: **1 - 4**. Ports 1 - 4 monitor DS1 signals 1 - 4 from the backplane, respectively. **5 - 8**. Ports 1 - 4 monitor DS1 signals 5 - 8 from the backplane, respectively. **9 - 12**. Ports 1 - 4 monitor DS1 signals 9 - 12 from the backplane, respectively. **13 - 16**. Ports 1 - 4 monitor DS1 signals 13 - 16 from the backplane, respectively. **17 - 20**. Ports 1 - 4 monitor DS1 signals 17 - 20 from the backplane, respectively. **21- 24**. Ports 1 - 4 monitor DS1 signals 21 - 24 from the backplane, respectively. **25 - 28**. Ports 1 - 4 monitor DS1 signals 25 - 28 from the backplane, respectively.

Monitor Src	Description

SCPI Examples:
To set all 4 ports to monitor the signal from the LIU:
`SENS(@9):PORT[1]:DATA:MODE NORM`
`SENS(@9):PORT[2]:DATA:MODE NORM`
`SENS(@9):PORT[3]:DATA:MODE NORM`
`SENS(@9):PORT[4]:DATA:MODE NORM`
To monitor from the backplane, first, set all 4 RX ports to monitor the backplane:
`SENS(@9):PORT[1]:DATA:MODE BACK`
`SENS(@9):PORT[2]:DATA:MODE BACK`
`SENS(@9):PORT[3]:DATA:MODE BACK`
`SENS(@9):PORT[4]:DATA:MODE BACK`
Then, select the set of 4 backplane channels to monitor. For example, the following command selects backplane channels 1 through 4, which are monitored by ports 1 through 4, respectively:
`SYST:BOAR(@8):BACK:INP  IN1`
See the Monitor Data Source command under “Sense Data” and the Backplane Input command under “System” in the section “DS1” on page 587 of the *“SCPI Reference”* for more information.	

Port Config

Use the **Port Config** options to configure each of the four DS1 ports to transmit or receive. The default setting is dual RX/dual TX (ports 1 and 2 receive and ports 3 and 4 transmit).

Changing the port configuration turns off all error and alarm generation on transmit ports and can result in changes to other settings such as the transmit clock source. For example, assume the DS1 board is in the Dual RX/TX configuration, and the port 4 transmit clock source is set to loop on the port 2 receiver. If the port configuration is changed to Quad TX, the transmit clock source is set to Internal (the default) because no receive clock exists for port 2 in this configuration.

Port Config	Description
Quad TX	Configures all four DS1 ports as transmitters.
Quad RX	Configures all four DS1 ports as receivers.
Dual TX/Dual RX	Configures ports 1 and 2 as transmitters and ports 3 and 4 as receivers.
Dual RX/Dual TX (Default)	Configures ports 1 and 2 as receivers and ports 3 and 4 as transmitters.

SCPI Examples:
`BOAR(@3):IOC  XMIT`
`BOAR(@3):IOC  RCV`
`BOAR(@3):IOC  RXTX`
`BOAR(@3):IOC  TXRX`	

Clock Source

The **Clock Src** setting specifies the clock source that provides the signal timing reference for each transmit port. If no transmit ports are configured, the **Clock Src** options are not available.

Clock Src	Description
Internal (Default)	Configures the selected transmit port to use the internal DS1 clock. The default is Internal.
Clock Module	Configures the selected transmit port to use the EPX clock module. **Note** The EPX clock module in slot 1 must be correctly configured to provide a DS1 rate clock to the slot in which the DS1 module is installed.
Port *n* RX	Configures the selected TX port to use a recovered clock from a DS1 RX port (loop mode). In loop mode: • TX port 4 uses the port 2 receive clock. • TX port 3 uses the port 1 receive clock. • TX port 1 uses the port 4 receive clock. • TX port 2 uses the port 3 receive clock.

SCPI Examples:
`SOUR(@3):PORT[1]:CLOCK INT`
`SOUR(@3):PORT[1]:CLOCK LOOP`
`SOUR(@3):PORT[1]:CLOCK CLKB`	

Payload Types

Use the payload options to select the type of payload that is mapped into the transmit stream (for transmit ports) or demapped into the receive stream (for receive ports).

Payload	Description
Unchannelized (Default)	Selects clear channel DS1 payload format. This is the default setting.
Channelized	Selects channelized DS1 payload format. Patterns for selected DS0 time slots are generated.
Robbed-Bit	Selects channelized DS1with robbed-bit signaling payload format. A selected DS0 time slot pattern is generated, excluding the bits used for robbed-bit signaling. Every six frames, signaling is sent in the least significant bit of a channel, and the most significant 7 bits contain valid signal. During the other 5 frames, 8 bits per channel are used for data.
56 kHz	Selects channelized DS1 with robbed-bit signaling payload format. Patterns for selected DS0 time slots are generated., excluding bits used for robbed-bit signaling. This allows pattern matching with other vendor's test equipment which refer to this mode as 56 x 1.
DS0	When any of the channelized options are selected, this option selects which of the 24 DS0 channels to transmit or monitor.

Payload	Description

SCPI Examples:

SCPI for selecting payload mode and channels vary, according to whether a port is configured to transmit or receive. For example:

Select unchannelized payload mode for a TX port:

```
SOUR(@12):PORT[1]:PAYL:GEN:MODE UNCH
```

Select unchannelized payload mode for an RX port:

```
SENS(@12):PORT[1]:PAYL:MON:MODE UNCH
```

Select channelized payload mode for a TX port:

```
SOUR(@12):PORT[1]:PAYL:GEN:MODE CH
```

Select robbed-bit channelized payload mode for an RX port:

```
SENS(@12):PORT[1]:PAYL:MON:MODE ROB2
```

Select 56-kHz channelized payload mode for a TX port:

```
SOUR(@12):PORT[1]:PAYL:GEN:MODE ROB
```

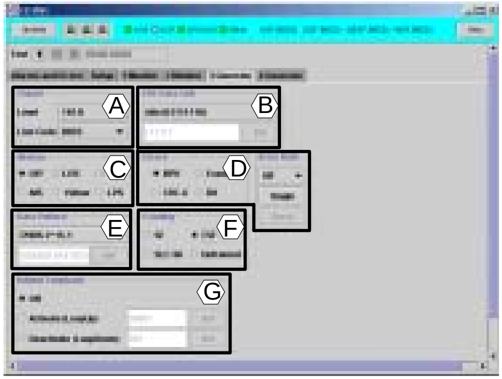
Select a time slot for a channelized payload for an RX port:

```
SENS(@12):PORT[1]:PAYL:MON:CHAN 2
```

DS1 Generate (TX) Settings

The following sections describe the available options on the **Generate** tab for configuring DS1 transmit signal and payload generation. One **Generate** tab is displayed for each configured DS1 TX port.

The following figure shows the main areas of the DS1 **Generate** tab.



A Set output line level and line coding type for the transmitted signal

B Specify an ESF Data Link message

C Select the type of alarm to insert

D Select the type of error to insert and the rate of error insertion

E Set the payload data pattern

F Select the framing format

G Enable Inband Loopback transmission and specify an Activate (LoopUp) code or Deactivate (LoopDown) code.

Each of these settings is described in more detail in the following sections.

Output (TX)

DS1 transmit signal output settings are described in the following table.

Clock Src	Description
Level	Sets one of the following as the output level for the DS1 transmit signal: 110 ft (the default), 220 ft, 330 ft, 440 ft, 550ft, or 660 ft, depending on the length of the cable driving the signal.
Line Code	Sets the output line code for the DS1 transmit signal. **AMI**. Alternate Mark Inversion. **B8ZS**. Binary 8 Zero Substitution (the default).
SCPI Examples:	

```
OUTP(@3):PORT[1]:LEV:SET  110
OUTP(@3):PORT[1]:CODE  AMI
OUTP(@3):PORT[1]:CODE  B8ZS
```

ESF Data Link (TX)

The ESF Data Link options enable you to select and transmit an ESF data link message bit code. The available message types and codes listed in the menu are as defined by T1.403-1999. You can also define a custom 6-bit ESF data link code.

Note This option is only active when the port framing format is set to ESF.

Setting	Description
Idle (01111110), and so on	Select the ESF data link bit-oriented message type. The default selection is Idle (01111110).
User defined pattern	To send a custom ESF data link bit pattern, select User-defined pattern from the ESF Data Link menu, specify a 6-bit pattern, and click **Set** to insert the message.
Set	Transmits the specified user-defined ESF data link bit pattern. The pattern must be 6 bits.

SCPI Examples:

Refer to the documentation for “ESF Data Link Type” and “ESF Data Link Pattern” commands in “DS1” on page 587 of the *“SCPI Reference”* for detailed command syntax and parameters.

Alarms (TX)

The Alarms option for each TX port specifies the type of alarm that is inserted into the transmitted signal. See ANSI T1.403 - 1999.

Note OOF, AIS, and Yellow alarms are not available when the Framing format is set to Unframed.

Setting	Description
Off	Disable Alarm insertion in the transmit signal.
LOS	Insert Loss of Signal alarm. The transmit signal is disconnected from the line.

Setting	Description
OOF	Insert Out-of-Frame alarm. An OOF condition occurs when one or more OOF events are detected during a 40-ms interval. An OOF event is defined as 2 or more out of 4 consecutive frame bit errors. The DS1 transmitter generates an OOF condition by transmitting an unframed data pattern.
AIS	Insert Alarm Indication Signal. A valid AIS signal is declared during a 60-ms interval if the OOF condition has persisted for the entire interval, and the received PCM data stream is not logic 0 for 126 or fewer times.
Yellow (RAI)	Insert a Yellow alarm (also called a Remote Alarm Indicator, or RAI). For SF formats, the Yellow alarm condition is caused when bit 2 of each channel is not logic 0 for 16 or fewer times during a 40-ms interval. For ESF formats, the Yellow alarm condition is caused when the 16-bit Yellow bit-oriented code is received error-free 8 or more times during the interval with a 4 kHz data link.
LPS	Insert Loss of Pattern Sync alarm.

SCPI Examples:

```
SOUR(@12):PORT[1]:ALAR OFF
SOUR(@12):PORT[1]:ALAR LOS
SOUR(@12):PORT[1]:ALAR OOF
SOUR(@12):PORT[1]:ALAR AIS
SOUR(@12):PORT[1]:ALAR YELL
SOUR(@12):PORT[1]:ALAR LPS
```

Errors (TX)

Use the Error settings to specify the type of error to insert into the transmit signal stream.

Note Whenever you change the error type setting, the error rate is set to Off, which disables error insertion. After you select the error type, you must select an error rate to enable error insertion. Changing the port configuration or port framing format also disables error insertion.

Setting	Description
BPV	Sets the error type to bipolar violation. A BPV is the occurrence of a pulse of the same polarity as the previous pulse without being part of the zero substitution code. Only single BPV errors can be injected.
Frame	Frame error. Frame errors can be generated as a single occurrence or as a burst error. **Note** Frame errors are not available when the frame format is set to Unframed.
CRC-6	Sets the error type to CRC-6 **Note** CRC-6 errors are only available if ESF frame format is selected.
Bit	Sets the error type to Bit.

SCPI Examples:

```
SOUR(@12):PORT[1]:ERR:TYPE BPV
SOUR(@12):PORT[1]:ERR:TYPE FRAM
SOUR(@12):PORT[1]:ERR:TYPE CRC
SOUR(@12):PORT[1]:ERR:TYPE BIT
```

Error Rate (TX)

The Error Rate options control the rate at which the selected Error Type is inserted into the transmit stream. Whenever the Error Type setting is changed, the Error Rate is automatically set to **Off** (error insertion disabled).

Setting	Description
Off	Disables error generation.
IE-3 through IE-9	Sets the error insertion rate to 1.0 x 10^-3, 1.0 x 10^-4, and so on. The IE-3 error rate is not supported when the Error Type is CRC-6. This rate is higher then the maximum possible CRC-6 error rate.
Single	Sends a single error, then sets the error rate to Off (disabled).
Burst	Sends a burst of errors, then sets the error rate to Off (disabled).

SCPI Examples:

```
SOUR(@12):PORT[1]:ERR:RAT OFF
SOUR(@12):PORT[1]:ERR:RAT R1E-3
SOUR(@12):PORT[1]:ERR:RAT SING
SOUR(@12):PORT[1]:ERR:RAT BURS
```

Data Pattern (TX)

The Data Pattern options specify the pattern to place into the generated payload for TX ports.

Setting	Description
PRBS 2^15-1 (Menu of payload patterns types)	This menu lists available payload pattern types, including pseudo-random bit sequences (PRBS), inverted PRBS, QRSS, Daly, and so on. Select **User** from this menu to define a custom payload pattern.
Set	This field is only active if a **User** payload pattern type is selected. Enter the bit pattern (up to 24 bits can be defined) and click **Set** to apply the change and insert it into the generated payload.

SCPI Examples:

To change the payload pattern type for TX port 1:

```
SOUR(@12):PORT[1]:PAYL:GEN:PAT:TYPE
pr215
```

To generate a custom payload pattern for TX port 1 using SCPI, set the pattern type to USER, specify the number of bits to be sent in the pattern (up to 24), then define the bit pattern. For example:

```
SOUR(@12):PORT[1]:PAYL:GEN:PATT:TYPE
USER
SOUR(@12):PORT[1]:PAYL:GEN:PATT:BITS  8
SOUR(@12):PORT[1]:PAYL:GEN:PATT:USER
0b00110011
```

See the Source commands for Pattern Type, User Pattern, and Pattern Bits in the section “DS1” on page 587 of the *“SCPI Reference”* for more information.

Framing (TX)

The Framing setting controls the frame format for a DS1 transmit port.

Note Changing the port frame format disables all error and alarm generation on transmit ports.

Setting	Description
SF (Default)	The DS1 port transmits a super frame format.
ESF	The DS1 port transmits extended super frame format.
SLC-96	The DS1 port transmits an SLC-96 frame format.
Unframed	The DS1 port transmits an unframed format (no framing or any overhead bits). **Note** When the frame format is set to Unframed, AIS, OOF, and Yellow alarms, Frame errors, and CRC-6 errors are not selectable.

SCPI Examples:

```
SOUR(@12):PORT[1]:PAYL:GEN:FRAM  SF
SOUR(@12):PORT[1]:PAYL:GEN:FRAM  ESF
SOUR(@12):PORT[1]:PAYL:GEN:FRAM  SLC
SOUR(@12):PORT[1]:PAYL:GEN:FRAM  UNFR
```

Inband Loopback (TX)

Use the Inband Loopback options to enable or disable DS1 loopback control and specify the bit pattern that is transmitted as the inband loopback activate or deactivate code.

Setting	Description
Off	Disables all inband loopback commands. This is the default setting.
Activate (LoopUp)	Specifies the 3 to 8-bit pattern to be sent as the transmit inband activate (LoopUp) command.
Set	Click **Set** to transmit the specified bit pattern (from 3 to 8 bits) as the inband loopback activate code
Deactivate (LoopDown)	Specifies the 3 to 8-bit pattern to be sent as the transmit inband deactivate (LoopDown) command.
Set	Click **Set** to transmit the specified bit pattern (from 3 to 8 bits) as the inband loopback deactivate code.

Setting	Description

SCPI Examples:

To disable inband loopback control:

```
SOUR(@3):PORT[4]:LOOP:COMM  OFF
```

To transmit a an inband loopback activate command, set the bit pattern length, specify a 3 to 8 bit code, and send the LoopUp command:

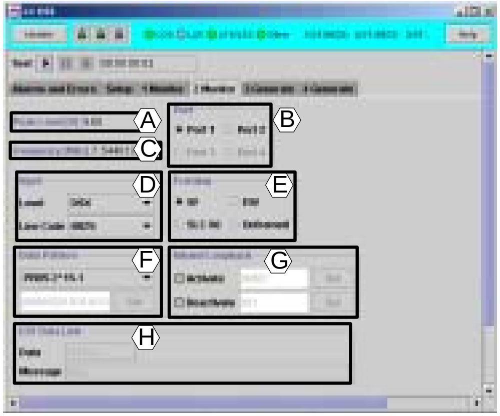
```
SOUR(@3):PORT[4]:LOOP:ACT:PAT:BIT  5
SOUR(@3):PORT[4]:LOOP:ACT:PAT:USER  0b10
000
SOUR(@3):PORT[4]:LOOP:COMM  LUP
```

To send a transmit inband deactivate (LoopDown) command, set the pattern length, specify a deactivate code, and send the LoopDown command:

```
SOUR(@3):PORT[4]:LOOP:DEAC:PAT:BITS  3
SOUR(@3):PORT[4]:LOOP:DEAC:PAT:USER  0b1
00
SOUR(@3):PORT[4]:LOOP:COMM: LDOWN
```

DS1 Monitor Settings

The following figure illustrates the main options available on the DS1 **Monitor** tab. One **Monitor** tab is displayed for each configured RX port.



A Monitor the instantaneous peak voltage level on the selected RX port

B Select the RX port to monitor for input voltage level

C Monitor the clock frequency level for the selected RX port

D Configure the input level and line code for the monitored signal

E Select the frame format for the monitored signal

F Select the type of payload pattern to monitor or specify a custom payload pattern

G Monitor inband loopback status and specify bit patterns to monitor for inband loopback Activate and Deactivate commands (only active when ESF framing is selected)

H Monitor ESF data link bit codes and messages (only active when ESF framing is selected)

The following sections describe the above options for configuring DS1 signal and payload monitoring in more detail.

Peak Level, Port, and Clock Frequency

The Peak Level field display the peak input voltage for the selected RX port. The Clock Frequency field displays the clock frequency for the RX port.

Setting	Description
Peak Level (V)	Displays the instantaneous peak voltage level received on the DS1 signal for the selected RX port. The peak level circuitry is sampled once every 500 ms (1/2 second), and the voltage level returned is accurate within 2 significant digits.
Frequency (mHz)	Displays the frequency in MHz with an accuracy within 6 ppm for the selected port.
Port	Select the RX to monitor for the input peak voltage level.

SCPI Examples:
`INP(@12):PEAK:SEL 4 ?`
`INP(@12):PORT[1]:FREQ ?`	

Input

Clock Src	Description
Level	Controls the input level for the DS1 signal. Select one of the following options: **DSX (Default)**. Selects the DSX (nominal) setting on the input interface. **Bridged**. Requires a bridged level input. It does not work with the EPX Test System output level settings without attenuation.
Line Code	Sets the input line code for the DS1 receive signal. Select one of the following: **AMI**. Alternate Mark Inversion. **B8ZS**. Binary 8 Zero Substitution.

SCPI Examples:
`INP(@14):PORT[1]:LEV:SET DSX`
`INP(@14):PORT[1]:LEV:SET BRID`
`INP(@14):PORT[1]:CODE AMI`
`INP(@14):PORT[1]:CODE B8ZS`	

Data Pattern (RX)

The Data Pattern options select the type of pattern to monitor in the payload for an RX port.

Setting	Description
PRBS 2^15-1 (Menu of payload patterns types)	This menu lists available payload pattern types, including pseudo-random bit sequences (PRBS), inverted PRBS, QRSS, Daly, Live pattern, and so on. LPS alarms are not monitored when a Live RX payload data pattern is monitored.
User	Select **User** from Data Pattern menu to define a custom payload pattern.
Set	This field is only active if a **User** payload pattern type is selected. Enter the bit pattern (up to 24 bits can be defined) and click **Set** to apply the change to the custom payload pattern that is monitored.

Setting	Description

SCPI Examples:
To specify a pattern type to monitor for RX port 1:
`SENS(@12):PORT[1]:PAYL:MON:PAT:TYPE pr215`
To monitor a custom payload pattern for RX port 1 using SCPI, set the pattern type to USER, specify the number of bits tin the pattern (up to 24), then define the bit pattern. For example:
`SENS(@12):PORT[1]:PAYL:MON:PATT:TYPE USER`
`SENS(@12):PORT[1]:PAYL:MON:PATT:BITS 8`
`SENS(@12):PORT[1]:PAYL:MON:PATT:USER 0b00110011`
See the Sense Data commands for Pattern Type, User Pattern, and Pattern Bits in the section “DS1” on page 587 of the *“SCPI Reference”* for more information.	

Framing (RX)

The Framing options select the type of frame format monitored by a DS1 receive port.

Setting	Description
SF	The DS1 receiver monitors a super frame format.
ESF	The DS1 receiver monitors an extended super frame format.
SLC-96	The DS1 receiver monitors an SLC-96 frame format.
Unframed	The DS1 receiver monitors an unframed format (no framing or any overhead bits).

Setting	Description
SCPI Examples:	
`SENS(@14):PORT[1]:PAYL:MON:FRAM SF`	
`SENS(@14):PORT[1]:PAYL:MON:FRAM ESF`	
`SENS(@14):PORT[1]:PAYL:MON:FRAM SLC`	
`SENS(@14):PORT[1]:PAYL:MON:FRAM UNFR`	

Inband Loopback (RX)

The Inband Loopback area of the monitor tab contains status indicators for inband loopback monitoring and configuration options for selecting bit patterns to monitor for Activate and Deactivate codes.

Field/ Indicator	Description
Activate	This indicator is Green if the inband activate (LoopUp) status is currently active. It is Yellow if the inband activate status is not currently active, but has been active during the current test session.
Set	Click **Set** to monitor the specified bit pattern (from 1 to 8 bits) as the inband activate (LoopUp) code.
Deactivate	This indicator is Green if the inband deactivate (LoopDown) status is currently active. It is Yellow if the inband deactivate status is not currently active, but has been active during the current test session.
Set	Click **Set** to monitor the specified bit pattern (from 1 to 8 bits) as the inband deactivate (LoopDown) code.
SCPI Examples:	
`SENS(@14):PORT[1]:LOOP:ACT:PATT:BITS 5`	
`SENS(@14):PORT[1]:LOOP:ACT:PATT:USER 0b00001000`	
`SENS(@14):PORT[1]:LOOP:DEAC:PATT:BITS 3`	
`SENS(@14):PORT[1]:LOOP:DEAC:PATT:USER 0b00100000`	

ESF Data Link (RX)

The ESF Data Link area displays ESF Data Link bit codes and corresponding messages received as defined by T1.403-1999.

Note The ESF Data Link fields are only active when the frame format is set to ESF.

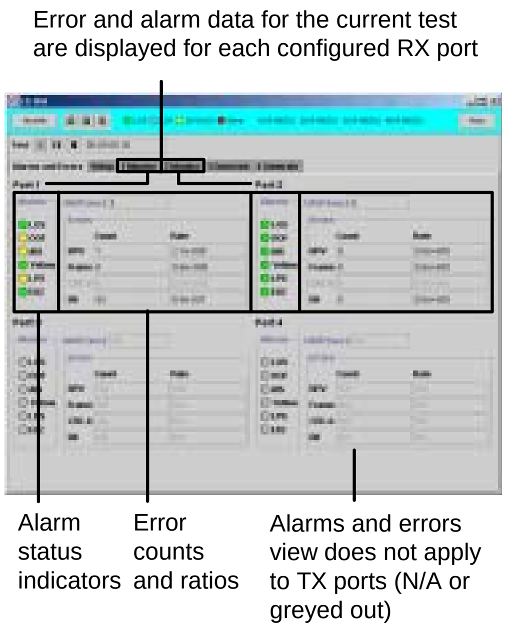
Setting	Description
Data	Displays the ESF Data Link bit code received.
Message	Displays a text message that corresponds to the received bit code displayed in the Data field.

Setting	Description
SCPI Examples:	
Display the full 16-bit pattern of the ESF Data Link message. Data link messages are of the format 0xxxxxx 011111111, with the rightmost bit transmitted first:	
`SENS(@14):PORT[1]:DLNK:PATT ?`	
Display the decoded ESF Data Link message in text form:	
`SENS(@14):PORT[1]:DLNK:DEC ?`	

DS1 Alarms and Errors

The DS1 **Alarms and Errors** tab displays performance data for each RX port for the current test.

The following figure illustrates the main features of the DS1 **Alarms and Errors** tab.



Monitored DS1 alarm and error data is described in more detail in the following sections.

Alarms (RX)

The Alarms area of the Performance Monitor tab displays alarm status indicators for the current test.

Alarm indicator colors are defined in the following table. When an alarm indicator is greyed out, it means that the alarm type does not apply to the current test setup.

Green	Yellow	Red
No alarms are detected: signal is clear or monitoring is not started.	Alarm history: an alarm was detected but is not active in the current test.	An alarm is active and currently detected on the monitored signal.

The following types of alarms are monitored. See “Alarms (TX)” on page 185 for descriptions of these alarms.

Alarm Indicator	Description
LOS	Displays status of Loss of Signal alum.
OOF	Displays status of Out-of-Frame alarm. OOF alarms are not monitored when the frame format is set to Unframed.
AIS	Displays status of Alarm Indicator Signal alarms. AIS alarms are not monitored when the frame format is set to Unframed.
Yellow	Displays status of Yellow alarms. Yellow alarms are not monitored when the frame format is set to Unframed.
LPS	Displays status of Loss of Pattern Sync alarms. LPS alarms are only monitored when mapping an internally generated payload such as a PRBS pattern, user pattern, and so on. LPS alarms are not available for monitoring when inserting DS1 signals or when monitoring live traffic.
EXZ	Monitor Excessive Zeroes alarms. The EXZ alarm detects occurrences of 8 consecutive zeros when the input line coding is set to B8ZS or 15 consecutive zeros when the input line coding is set to AMI.

SCPI Examples:

```
SENS(@14):PORT[1]:ALAR:LOS ?
SENS(@14):PORT[1]:ALAR:OOF ?
SENS(@14):PORT[1]:ALAR:AIS ?
SENS(@14):PORT[1]:ALAR:YELL ?
SENS(@14):PORT[1]:ALAR:LPS ?
SENS(@14):PORT[1]:ALAR:ALL ?
```

UASP

The UASP field for each port displays the count of path unavailable seconds for the current test.

To display the count of path unavailable seconds using SCPI for a given port, use a command similar to the following:

```
SENS(@14):PORT[1]:PERF:ERR:PATH: UASP ?
```

Errors (RX)

Setting	Description
BPV	Bipolar violation error.
Frame	Frame error.
CRC-6	Monitor CRC-6 errors. This setting is only available when framing is set to ESF.
Bit	Bit errors.
Count	Displays the error count for each monitored error. The counters are reset at the start of each test period.
Rate	Displays the error ratio for each type of monitored error.

SCPI Examples:

Display the error count for the specified error type:

```
SENS(@14):PORT[1]:ERR:COUN:BPV ?
SENS(@14):PORT[1]:ERR:COUN:FRAM ?
SENS(@14):PORT[1]:ERR:COUN:BIT ?
SENS(@14):PORT[1]:ERR:COUN:CRC ?
```

Display the error ratio for the specified error type:

```
SENS(@14):PORT[1]:ERR:RAT:BPV ?
SENS(@14):PORT[1]:ERR:RAT:FRAM ?
SENS(@14):PORT[1]:ERR:RAT:BIT ?
SENS(@14):PORT[1]:ERR:RAT:CRC ?
```

20

DS3 Transceiver Module Window

The topics in this section explain how to configure the DS3 Transceiver module Setup, Generate, and Monitor options using the EPX Test System GUI, along with SCPI equivalents.

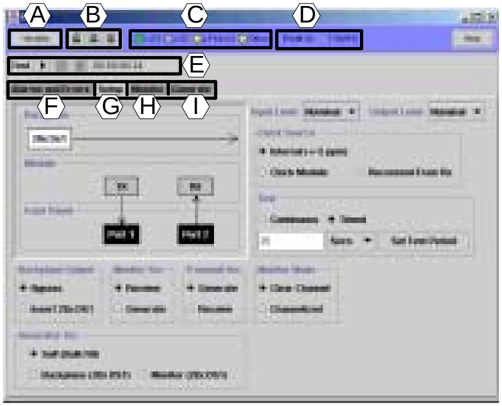
- "DS3 Main View" on page 198
- "DS3 Setup Options" on page 199
- "DS3 Generate Settings" on page 204
- "DS3 Monitor" on page 208
- "DS3 Alarms and Errors" on page 210

Some DS3 functionality is not available in EPXam or EPXam Pro but is available with SCPI.

- DS2 Alarm Status
- DS2 Alarm Insertion
- DS2 Hybrid Source
- DS2 Receive Mapping Mode
- DS2 Source Mapping Mode
- DS2 Source Signal
- DS1 Insert
- DS1 Destination
- Backplane Output Source
    - SELECTED, E1DMUX, and HYBRID parameters
- Destination for Hybrid or Selected Output
- Source for Hybrid or Selected Output
- Payload Type
    - E1MUX and HYBRID parameters

DS3 Main View

The following figure shows the main features of the DS3 Transceiver module window.



A Identify button—When pressed, it flashes the ACTIVE front-panel LED on the module associated with this window

B Save or restore user-defined module/slot configuration or restore factory default configuration (see “Using Module Window Save and Restore Controls” on page 108)

C Defect status indicators. Defect status indicators are greyed out and do not apply to TX ports. These indicators do not turn red when injecting alarms or errors.

D View current RX and TX frame format selection

E Start, stop, pause, or resume test; view elapsed time (see “Using Module Window Test Controls” on page 118)

F **Alarms and Errors**—View alarm status, error counts, and error ratios for the current test

G **Setup**—Configure options for test type and duration, backplane output, transmit and receive signal sources, clock source, input and output levels, and generate and pattern monitor sources

H **Monitor**—Select the framing mode for the RX signal, type of payload pattern to monitor, and view current input frequency and power levels

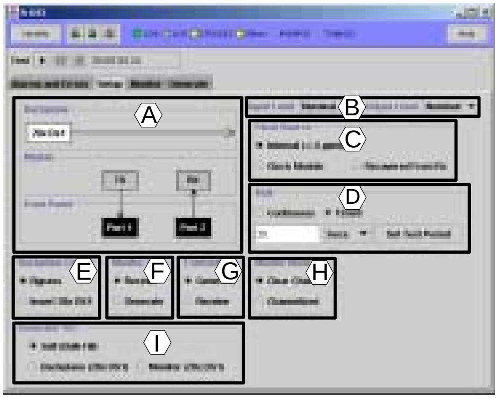
I **Generate**—Select the type of error and alarm to insert

These features are discussed in more detail in the following sections:

- “DS3 Setup Options” on page 199
- “DS3 Generate Settings” on page 204
- “DS3 Monitor” on page 208
- “DS3 Alarms and Errors” on page 210

DS3 Setup Options

The following figure illustrates the main options on the **Setup** tab in the DS3 module window.



A View graphic display of currently selected transmit, receive, and generate signal sources and backplane output settings

B Select input and output signal levels for DS3 signals

C **Clock Source**—Select whether the module uses the DS3 module's internal clock, the EPX clock module, or a recovered clock from the DS3 receiver

D **Test**—Select continuous test or timed test and duration, and apply settings, as described in "Test" on page 201.

E **Backplane Output**—Select whether signals from this DS3 module are inserted onto the backplane outputs or signals from the backplane inputs are passed to the next slot unchanged

F **Monitor Source**—Select whether the DS3 module's RX port monitors the signal from the front panel LIU or a looped-back signal from the DS3 transmitter

G **Transmit Source**—Select whether the transmitted signal is generated by the DS3 module (for normal operation) or the signal from the receiver is retransmitted (for a monitor-only test).

H **Monitor Mode**—Select clear channel or channelized (DS3/DS1 mapped) payload monitoring.

I **Generator Src**—Select the source for the transmitted payload. The default is a bulk-filled payload with a clear channel pattern inserted. You can also select a channelized payload with all 28 DS1 signals sourced from either the backplane input or the receiver input.

These options are described in more detail in the following sections.

Input Level

The **Input Level** setting controls the voltage of the input signal. The default setting of Nominal is recommended for most applications.

Setting	Description
Nominal (Default)	Enables the receiver equalizer. This is the recommended default setting.
Monitor	Use this setting when the input signal is coming from an external monitor port with a lower (attenuated) signal. The signal is amplified before it is sent to the receiver.
High	Bypasses the receive equalizer. This setting can be used for signals that are not run through long cables.

SCPI Examples: `INP(@3):LEV:SET NOM`
`INP(@9):LEV:SET MON`
`INP(@3):LEV:SET HIGH`	

Output Level

The output level setting controls the voltage of the output signal. The default setting of Nominal is recommend for most applications.

Setting	Description
Low	Selects the 0.19 volt setting on the output interface. This setting can be used when driving an input that is expecting a signal from a monitor port with a lower (attenuated) signal.
Nominal (Default)	Selects the 0.39 volt setting on the output interface. This is the recommended default setting for cables shorter than 225 ft.
High	This setting can be used when the driving the signal across a cable that is longer than 225 ft.

SCPI Examples: `OUTP(@3):LEV:SET LOW`
`OUTP(@9):LEV:SET NOM`
`OUTP(@3):LEV:SET HIGH`	

Clock Source

The clock source setting selects the clock source for the transmitter.

Setting	Description
Internal (+/- 50 ppm)	Selects the DS3 onboard crystal (44.736 MHz +/-50 ppm) as the clock source.
Clock Module	Select the EPX Test System clock module in slot 1 as the clock source. Verify that the clock module is configured to output a DS3 rate signal to slots with DS3 modules.
Recovered from RX	The clock source is recovered from the DS3 module's receiver (loop mode).

SCPI Examples:

```
SOUR(@3):CLOC  INT
SOUR(@3):CLOC  CLKB
SOUR(@3):CLOC  LOOP
```

Test

The Test area defines the type and duration of the test that the receiver runs. To start and stop tests, use the controls in the module window or, to start tests for multiple modules, use the Test Controls window. See "Controlling Tests" on page 115.

Note Selecting a new test type automatically stops the current test.

Test Setting	Description
Continuous	Selects a continuous test that must be manually stopped and started. This is the default setting in the factory configuration.
Timed	Selects a timed test. When Timed is selected: **1** Specify a number and select a unit (seconds, minutes, hours, and days) for the test duration. **2** Click **Set** to apply the settings. **3** Use the controls at the top of the window to start the test. **Note** If you enable logging and are saving the log file to the EPX Test System, gnubi advises you to limit the test period to a maximum of 72 hours (3 days).

SCPI Examples:

```
sens(@3):test:type cont
sens(@3):test:type tim
sens(@3):test:unit min
sens(@3):test:per 10
```

To control tests use the following commands:

```
sens(@3):test:mode star
sens(@3):test:mode stop
sens(@3):test:mode rest
sens(@3):test:mode pause
```

Related Topics:

"Logging" on page 63

"Controlling Tests" on page 115

Backplane Output

The Backplane Output setting determines whether the DS3 module inserts signals onto the backplane.

Setting	Description
Bypass	Sets the backplane to bypass the DS3 module. Data coming in from the backplane is sent back onto the backplane unmodified.
Insert 28xDS1	The DS3 module de-maps 28 DS1 signals from the DS3 signal and inserts them all onto the backplane.
SCPI Examples: `SYST:BOAR(@3):BACK:OUTP BYP` `SYST:BOAR(@3):BACK:OUTP PASS`	

Monitor Source

The Monitor Source option determines whether module monitors the signal from the front panel LIU or a looped back signal from the module's transmitter.

Setting	Description
Receive	Normal mode (default). Monitor the DS3 signal from the front panel LIU.
Generate	Loopback mode. Monitor the looped back transmit DS3 source. The Monitor Src: Generate and the Transmit Src: Monitor options cannot be set simultaneously.
SCPI Examples: `SENS(@3):DATA:MODE NORM` `SENS(@3):DATA:MODE LOOP`	

Transmit Source

The Transmit Source option sets the source of the transmitted signal.

Setting	Description
Generate	Select the standard (default) transmit mode. This mode can map data from the internal pattern generator or data from a DS1 board into M13 or C-bit structures.
Monitor	Select the transmitter to retransmit data that is coming in on the receiver. This mode is also called local loopback mode. The Monitor Src: Generate and the Transmit Src: Monitor options cannot be set simultaneously.
SCPI Examples: `SOUR(@3):DATA:MODE LLO` `SOUR(@3):DATA:MODE NORM`	

Generator Source

The Generator Source setting determines the source of the transmitted payload.

Setting	Description
Self (Bulk Fill)	The transmitted payload is generated by the internal pattern generator. This is also called the Clear Channel Payload. All non-overhead data is filled with the generated pattern.
Backplane (28x DS1)	The transmitted payload consists of 28 DS1 signals (typically generated from one or more DS1 boards) inserted from the backplane into the DS3 transmit stream. **Note** A single EPX DS1Quad Transceiver module can generate (or monitor) four (4) DS1 signals. Thus, seven (7) DS1 boards can generate or monitor all 28 DS1 signals in a DS3 payload.
Monitor (28x DS1)	Payload loopback mode. The 28 DS1 channels de-multiplexed from the received DS3 signal are multiplexed into the transmitted DS3 signal. The DS1 source is the DS3 receiver rather than the backplane.

SCPI Examples:
`SOUR(@3):PAYL:MODE INS`
`SOUR(@3):PAYL:MODE GEN`
`SOUR(@3):PAYL:MODE PLO`	

Payload Monitor Mode

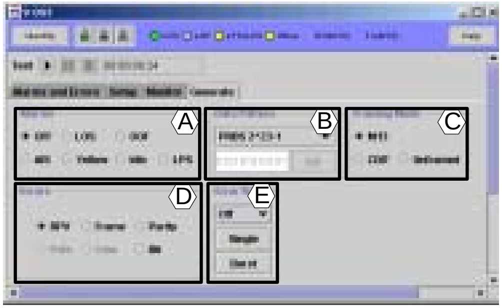
The Payload Monitor mode determines whether the payload monitor expects a clear channel or a channelized (DS3/DS1 mapped) payload.

Setting	Description
Clear Channel	Selects the internal payload pattern monitor (default). This is also called the clear channel payload. Enable this setting for DS3 bit error rate testing (BERT).
Channelized	Drop payload mode. Selects all 28 DS1 signals to be dropped from the DS3 receive stream to the EPX Test System backplane. Enable this setting for DS3 add/drop multiplex test applications. **Note** When in drop payload mode, the LPS alarm is not monitored and bit errors are not counted. **Note** For DS1 signals to be available on the backplane, you must set the Backplane Output Setting to I**nsert 28xDS1.**

SCPI Examples:
`SENS(@3):PAYL:MODE DROP`
`SENS(@3):PAYL:MODE MON`	

DS3 Generate Settings

The following figure illustrates the main features of the DS3 **Generate** tab.



A Select the type of alarm to insert or disable alarm insertion

B Select the type of data pattern to generate for clear channel DS3 payloads

C Select the frame format for the transmitted signal

D Select the type of error to insert

E Enable or disable error insertion and select the error insertion rate

These settings are explained in more detail in the following sections.

Alarms (TX)

The DS3 module generates the following alarms based on ANSI T1.107a.

Note The OOF, AIS, Yellow, and Idle alarms are not available in unframed mode. Also, error and alarm insertion are disabled when the frame format is changed.

Setting	Description
OFF	Disables alarm generation.
LOS	Loss of Signal alarm. **Implementation**: The DS3 transmitter generates an LOS alarm by disabling the DS3 transmitter.
OOF	Out-of-Frame alarm. **Implementation**: The DS3 transmitter causes an OOF alarm by inverting 3 of 16 consecutive F-bits in a single DS3 frame. When enabled, the OOF condition persists until it is disabled.
AIS	Alarm Indicator Signal. **Implementation**: The DS3 transmitter generates an AIS alarm by forcing all C-bits to zero, all X-bits to one, and the information bits to a 1010 pattern. When enabled, the AIS condition persists until it is disabled.

Setting	Description
Yellow	Yellow alarm (RDI). **Implementation**: The DS3 transmitter generates a Yellow alarm by setting both X-bits to zero. When enabled, the Yellow alarm condition persists until it is disabled.
Idle	Idle signal. **Implementation**: The DS3 transmitter generates an Idle signal by forcing all C-bits in subframe 3 to zero, all X-bits to 1, and the payload information bits to a 1100 pattern. When enabled, transmission of the Idle signal persists until it is disabled.
LPS	Loss of Pattern Sync. **Implementation**: The DS3 transmitter generates an LPS alarm by causing payload bit errors at a rate that exceeds the maximum acceptable for achieving a pattern match. If the payload pattern is a PRBS pattern, an all ones pattern, or an all zeroes pattern, the pattern is inverted. If the pattern is unframed or is not an all 1s ones or all zeroes pattern, the pattern is set to all zeroes. All other patterns are set to all ones. LPS alarm insertion only applies when transmitting internally generated payloads. Therefore, LPS alarm insertion is not available when the Transmit Source is set to Receive or when the Generator Source is set to Backplane 28x DS1 or Monitor 28x DS1. When enabled, the LPS condition persists until it is disabled.
SCPI Examples:	

	`SOUR(@3):ALAR OFF`
	`SOUR(@3):ALAR LOS`
	`SOUR(@3):ALAR OOF`
	`SOUR(@3):ALAR YELL`
	`SOUR(@3):ALAR IDLE`
	`SOUR(@3):ALAR AIS`
	`SOUR(@3):ALAR LPS`

Errors (TX)

The Errors option selects the type of error that is inserted into the transmit stream. The DS3 module generates the following error conditions based on the ANSI T1.107a.

Note Whenever a new error type is selected, the Error Rate option is set to Off, which disables error insertion. Error insertion is also reset to Off when the frame format is changed.

Setting	Description
BPV	Bipolar violation. **Implementation**: The DS3 generates a BPV error by transmitting a logic 1 with the same polarity AMI pulse as the previously transmitted logic 1.
Frame	Frame (F-bit) error. Frame errors can not be inserted when the frame format is set to Unframed. **Implementation**: The DS3 generates a Frame error by inverting the F bit.

Setting	Description
Parity	Parity (P-bit) error. Parity errors can not be inserted when the frame format is set to Unframed. **Implementation**: The DS3 generates a Parity error by inverting the P bits.
Path	Path parity (CP-bit) error. This error type is only available in C-bit frame format. The three C-bits in subframe 3 are the CP bits, which carry path parity. The CP bits are set to the same value as the P-bits at the point of origination. **Implementation**: Two of the three CP-bits are inverted for error insertion.
FEBE	Far-end block error. This error type is only available in C-Bit frame format. **Implementation**: The FEBE error is transmitted by setting three C-bits in subframe 4 to a pattern other than all ones. All possible error-indicating FEBE bit patterns (0-6H) are generated. For non-error conditions, the FEBE is set to all ones.
Bit	Pattern bit error. **Implementation**: The DS3 inserts pattern bit errors by selectively inverting bits in the payload data of internally generated patterns. Correct parity is retained (only the pattern bits errors are found at the receiver).

SCPI Examples:
`SOUR(@3):ERR:TYPE BPV`
`SOUR(@3):ERR:TYPE PAR`
`SOUR(@3):ERR:TYPE FEBE`
`SOUR(@3):ERR:TYPE PATH`
`SOUR(@3):ERR:TYPE BIT`	

Error Rate (TX)

The Error Rate setting controls the rate at which errors are inserted.

Note The Error Rate is reset to Off whenever the Error Type or frame format is changed.

Setting	Description
Off (Default)	Disables error generation. This is the default setting.
IE-3 through IE-9	Sets the error insertion rate to 1.0 x 10^-3, 1.0 x 10^-4, and so on.
Single	Inserts a single error of the currently selected error type and resets the Error Rate to Off.
Burst	Inserts a burst of 15 errors of the currently selected error type and resets the Error Rate to Off.

SCPI Examples:
`SOUR(@12):ERR:RAT OFF`
`SOUR(@12):ERR:RAT R1E-3`
`SOUR(@12):ERR:RAT SING`
`SOUR(@12)ERR:RAT BURS`	

Data Pattern (TX)

This command selects the type of pattern to place into the generated payload.

Note The payload pattern selection is hardware-coupled to the signal generation side. Changing the Data Pattern on the **Generate** tab also changes the data pattern selection on the **Monitor** tab.

Setting	Description
PRBS 15^-1 **PRBS 20^-1** **PRBS 23^1** **1010** **1100** **1111** **USER**	This menu lists available payload pattern types, including pseudo-random bit sequences (PRBS), and other bit patterns. Select **User** from this menu to generate a custom payload pattern. When you make a selection in this field, the Monitor tab Data Pattern is automatically updated to match the selection.
Set	This field is only active if a **User** payload pattern type is selected. Enter the bit pattern (up to 24 bits can be defined). You must click **Set** to apply your changes to the user-defined payload pattern for the generated payload.

Setting	Description

SCPI Examples:
For example, to change the payload data pattern type:
`SOUR(@3):PAYL:GEN:PAT:TYPE pr215`
To generate a custom payload pattern using SCPI, set the pattern type to USER, specify the number of bits to be sent in the pattern (up to 24), then define the bit pattern. For example:
`SOUR(@3):PAYL:GEN:PATT:TYPE  USER`
`SOUR(@3):PAYL:GEN:PATT:BITS  8`
`SOUR(@3):PAYL:GEN:PATT:USER  0b00110011`
See the Source commands for Pattern Type, User Pattern, and Pattern Bits in the section “DS3” on page 589 of the *“SCPI Reference”* for more information.	

Framing Mode (TX)

The Framing Mode setting specifies the frame format for the generated DS3 signal.

Note Alarm and error insertion is turned off whenever the Framing Mode setting is changed.

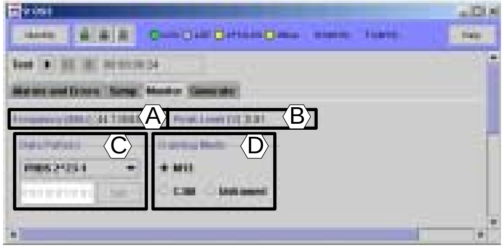
Setting	Description
M13	Generates a DS3 signal with the M13 asynchronous framing format per ANSI T1.107a. **Note** FEBE and PATH errors are not available in M13 framing mode.
C-Bit	Generates a DS3 signal with C-Bit framing per ANSI T1.107a.

Setting	Description
Unframed	Generates an unframed DS3 signal with no framing (F-bits), multi-framing (M-bits), or any overhead bits (X-bits, P-bits, or C-bits). **Note** OOF, AIS, Yellow, and Idle alarms and Frame, FEBE, Parity, and Path errors are not available in Unframed mode.

SCPI Examples:
`SOUR(@3):PAYL:GEN:FRAM M13`
`SOUR(@3):PAYL:GEN:FRAM CBIT`
`SOUR(@3):PAYL:GEN:FRAM UNFR`	

DS3 Monitor

The following figure shows the features of the DS3 **Monitor** tab.



A View the frequency level of the monitored signal

B View the instantaneous peak voltage level of the monitored DS3 signal

C Select the type of payload data pattern to monitor for clear-channel payloads (this selection automatically updates the payload data pattern on the **Generate** tab)

D Select the frame format for the monitored signal: M13, C-bit, or Unframed

These features are described in more detail in the following sections.

Frequency and Power

Setting	Description
Frequency (mHz)	Displays the frequency of the monitored signal in megahertz with accuracy within 5ppm. This setting requires that EPX Test System Clock Module in slot 1 is driving the DS3 reference clock with the internal reference to the DS3 module slot.
Power (V)	Monitors the instantaneous peak voltage level received on the DS3 signal. The peak level circuitry is sampled once every 500 ms (1/2 second). The signal level is measured in volts and is accurate to 2 significant digits.

SCPI Examples:
`INP(@3):LEVEL:PEAK ?`
`INP(@3):LEVEL:FREQ ?`	

Data Pattern (RX)

The Data Pattern option selects the type of payload data pattern that is monitored.

Note The payload pattern selection is hardware-coupled to the payload generation side. Changing the Data Pattern on the **Generate** tab also changes the data pattern selection on the **Monitor** tab.

Setting	Description
PRBS 15^-1 **PRBS 20^-1** **PRBS 23^1** **1010** **1100** **1111** **LIVE** **USER**	This menu lists available payload pattern types, including pseudo-random bit sequences (PRBS), and other bit patterns. Select **USER** from this menu to monitor a custom payload pattern. When you make a selection in this field, the **Generate** tab Data Pattern is automatically updated to match the selection (except for the **Live** pattern). Select **Live** when monitoring live data traffic. LPS alarms are not available when monitoring a live signal.
Set	This field is only active if a **User** payload pattern type is selected. Enter the bit pattern (up to 24 bits can be defined). You must click **Set** to apply your changes to the user-defined payload data pattern.

Setting	Description
SCPI Examples:	

To change the payload pattern type:

```
SENS(@3):PAYL:MON:PAT:TYPE pr215
```

To monitor a custom payload pattern using SCPI, set the pattern type to USER, specify the number of bits to be sent in the pattern (up to 24), then define the bit pattern. For example:

```
SENS(@3):PAYL:MON:PATT:TYPE  USER
SENS(@3):PAYL:MON:PATT:BITS  8
SENS(@3):PAYL:MON:PATT:USER  0b00110011
```

See the Sense commands for Pattern Type, User Pattern, and Pattern Bits in the section “DS3” on page 589 of the *“SCPI Reference”* for more information.

Framing Mode (RX)

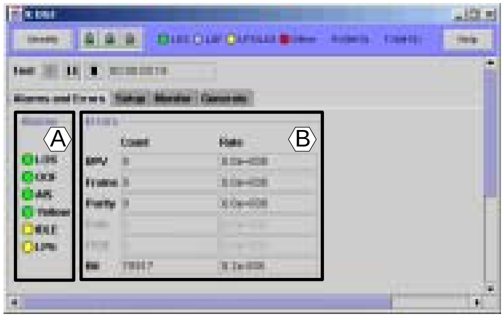
The Framing Mode option selects the frame format for the monitored signal.

Setting	Description
M13	Generates a DS3 signal with the M13 asynchronous framing format per ANSI T1.107a. FEBE and PATH errors are not available in M13 framing mode.
C-Bit	Generates a DS3 signal with C-Bit framing format per ANSI T1.107a.

Setting	Description
Unframed	Generates an unframed DS3 signal with no framing (F-bits), multi-framing (M-bits), or any overhead bits (X-bits, P-bits, or C-bits). **Note** OOF, AIS, Yellow, and Idle alarms and Frame, FEBE, Parity, and Path errors are not available in Unframed mode.

SCPI Examples:
`SENS(@9):PAYL:MON:FRAM M13`
`SENS(@9):PAYL:MON:FRAM CBIT`
`SENS(@9):PAYL:MON:FRAM UNFR`	

DS3 Alarms and Errors



A Alarm status indicators for the current test

B Monitor error counts and ratios for the current test

Alarms (RX)

The Alarms area of the Alarms and Errors tab displays alarm status indicators for the current test.

The DS3 module monitors DS3 alarms based on the ANSI T1.107a specification.

Note The OOF, AIS, Yellow, and Idle alarms are not monitored in Unframed mode.

Alarm status indicator colors are defined in the following table. When an alarm indicator is greyed out, it means that the alarm type does not apply to the current test setup.

Green	Yellow	Red
No alarms are detected: signal is clear or monitoring is not started.	Alarm history: an alarm was detected but is not active in the current test.	An alarm is active and currently detected on the monitored signal.

The following types of alarms are monitored:

Alarm Indicator	Description
LOS	Displays the status of the Loss of signal alarm.
AIS	Displays the status of the Alarm indicator signal alarm (not monitored in Unframed mode).
OOF	Displays the status of the Out-of-frame alarm (not monitored in Unframed mode).
Yellow	Displays the status of the Yellow (remote defect indicator or RDI) alarm (not monitored in Unframed mode).
IDLE	Displays the status of the Idle alarm (not monitored in Unframed mode).
LPS	Displays the status of the Loss of pattern sync alarm. LPS alarms are not available when monitoring Live data.

SCPI Examples:
`SENS(@3):ALAR:LOS ?`
`SENS(@3):ALAR:AIS ?`
`SENS(@3):ALAR:OOF ?`
`SENS(@3):ALAR:YELL ?`
`SENS(@3):ALAR:IDLE ?`
`SENS(@3):ALAR:LPS ?`
`SENS(@3):ALAR:ALL ?`	

Errors (RX)

The Errors section of the **Alarms and Errors** tab displays error counts and ratios for the current test. The following types of errors are monitored.

Error Type/ Setting	Description
FEBE	Far end block errors. FEBE error monitoring is only available when C-Bit framing is enabled.
Bit	Bit errors.
BPV	Bipolar violation errors.
Frame	Frame (F-bit) errors (F-bit). Frame error monitoring is not available when the framing mode is set to Unframed.
Parity	Parity (P-bit) errors. Parity errors are not available for monitoring in Unframed mode.

Error Type/ Setting	Description
Path	Path parity (CP-Bit) errors. Path error monitoring is only available when C-Bit framing mode is selected.
Count	Error count for the type of error in the current test.
Ratio	Error ratio for the type of error in the current test.

SCPI Examples:

```
SENS(@3):ERR:COUN:FEBE ?
SENS(@3):ERR:RAT:FEBE ?
SENS(@3):ERR:COUN:BIT ?
SENS(@3):ERR:RAT:BIT ?
SENS(@3):ERR:COUN:BPV ?
SENS(@3):ERR:RAT:BPV ?
SENS(@3):ERR:COUN:FRAM ?
SENS(@3):ERR:RAT:FRAM ?
SENS(@3):ERR:COUN:PAR ?
SENS(@3):ERR:RAT:PAR ?
SENS(@3):ERR:COUN:PATH ?
SENS(@3):ERR:RAT:PATH ?
```

21

STM-1 CMI RXPM WINDOW

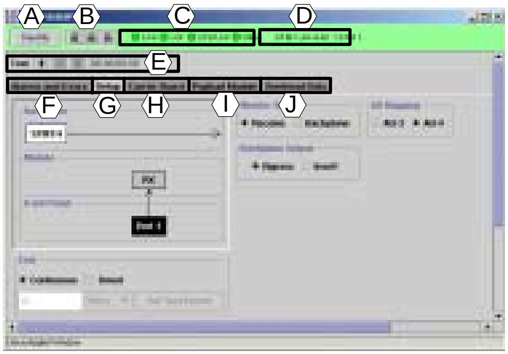
The topics in this section explain setup and monitoring options for the STM-1 CMI Receiver, module, which includes a Payload Monitor (PM).

- “STM-1 CMI RXPM Main View” on page 213
- “STM-1 CMI RXPM Setup” on page 214
- “STM-1 CMI RXPM Alarms and Errors” on page 217
- “STM-1 CMI RXPM Carrier Board Monitor” on page 220
- “STM-1 CMI RXPM Payload Module” on page 221
- “STM-1 CMI RXPM Overhead Data” on page 225

Instructions are provided for using EPXam to configure the module, along with SCPI equivalents.

STM-1 CMI RXPM Main View

The following figure shows the main features of the STM-1 CMI RXPM module window.



A Identify button—When pressed, it flashes the Active LED on the front panel of the module associated with this window

B Save or restore module/slot configuration or factory defaults. See “Using Module Window Save and Restore Controls” on page 108.

C Error and alarm defect status indicators

D View currently selected RX signal rate, payload mapping, and channel

E Start, stop, pause or resume test; view elapsed time. See “Using Module Window Test Controls” on page 118.

F **Alarms and Errors tab**—Monitor alarm status, errors counts, and error ratios for the current test. See “STM-1 CMI RXPM Alarms and Errors” on page 217.

G **Setup tab**—Set signal rate and source, backplane output, test type and duration, and payload mapping. See “STM-1 CMI RXPM Setup” on page 214.

H **Carrier Board tab**—Monitor input frequency and view SS overhead byte values.

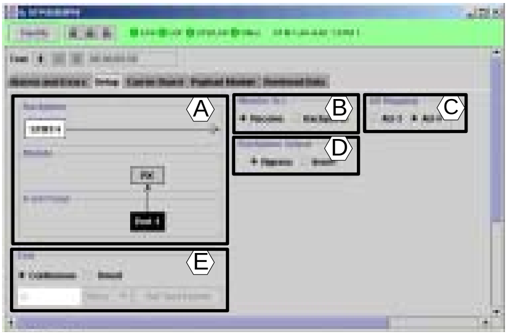
I **Payload Module**—Monitor K1/K2 byte values, pointer values and event counts, APS channel messages, and J1/J0 trace messages. See “STM-1 CMI RXPM Payload Module” on page 221.

J **Overhead Data**—Monitor individual transport and path overhead byte values for a selected AU. See “STM-1 CMI RXPM Overhead Data” on page 225.

The fields and data displayed for each tab on the STM-1 CMI RXPM module window are explained in more detail in the following sections.

STM-1 CMI RXPM Setup

The following figure illustrates the main features of the **Setup** tab on the STM-1 CMI RXPM module window.



A View graphic display of current signal source and backplane output settings.

B **Monitor source**—Set the signal source for the payload monitor module, either from the front panel or the backplane.

C **AU Mapping**—Set the SDH administrative unit mapping.

D **Backplane Output**—Select whether the signal from the front panel LIU is inserted onto the backplane or the backplane signal is unchanged (bypass).

E **Test**—Set the test type and duration

The options on the **Setup** tab are described in more detail in the following sections.

Monitor Src

The **Monitor Src** setting determines whether the Payload Monitor module monitors the SDH signal coming from the front panel line interface unit (LIU) or an adjacent STM-1 CMI or STM-4/1 module via the backplane.

The graphic display of the current backplane setting, backplane signal, and signal path are updated in the Backplane/Module/IO view when you change these settings.

Note Modules must be installed in adjacent slots to transmit or receive signals along the backplane and must have compatible signal interfaces. See "Using the Backplane" on page 41.

Setting	Description
Receiver	The module monitors the SDH signal from the front panel LIU.
Backplane	The module monitors the SDH signal from an STM-1 CMI or STM-4/1 module installed in the adjacent slot to the left, via the EPX Test System backplane.

SCPI Examples:

```
PMOD:SENS(@8):DATA:SOUR  NORM
PMOD:SENS(@8):DATA:SOUR  BACK
```

Related Topics:

"Using the Backplane" on page 41

Backplane Output

The Backplane Output setting selects whether the backplane outputs the signal from the LIU or the backplane input signal.

The graphic display of the current backplane setting, backplane signal, and signal path are updated in the Backplane/Module/IO view when you change these settings.

Note Modules must be installed in adjacent slots to transmit or receive signals along the backplane and must have compatible signal interfaces. See "Using the Backplane" on page 41.

Setting	Description
Bypass	Bypass mode. The backplane input signal is unchanged and is passed to the next higher-numbered slot in the EPX chassis (in an EPX16 chassis, this is the adjacent slot to the right).
Insert	Passthrough mode. The incoming data from the front panel LIU is inserted onto the backplane for use by an STM-1 CMI or STM-4/1 module installed in the adjacent, higher-numbered slot. This option is not available when the Monitor Src is set to Backplane.

SCPI Examples:

```
SYST:BOAR(@8):BACK:MODE  PASS
SYST:BOAR(@8):BACK:MODE  BYP
```

Related Topics:

"Using the Backplane" on page 41

AU Mapping

The AU Mapping option sets the size of the SDH administrative unit (AU). At the STM-1 signal rate (155.52 Mbits/sec), the AU mapping can be set to AU-3 or AU-4.

SPE Mapping	Description
AU-3	Selects an AU-3-sized payload.
AU-4	Selects an AU-4-sized payload.

SCPI Examples:
`PMOD(@7):SENS:DATA:SIZE AU3`
`PMOD(@7):SENS:DATA:SIZE AU4`	

Test

The Test area defines the type and duration of the test that the receiver runs. To start and stop tests, use the controls in the module window or, to start tests for multiple modules, use the Test Controls window. See “Controlling Tests” on page 115.

Note Selecting a new test type automatically stops the current test.

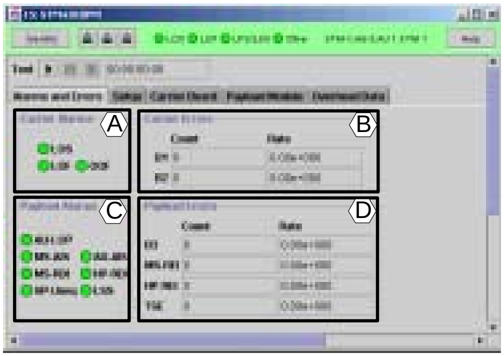
Test Setting	Description
Continuous	Selects a continuous test that must be manually stopped and started.
Timed	Selects a timed test. When Timed is selected: **1** Specify a number and select a unit (seconds, minutes, hours, and days) for the test duration. **2** Click **Set** to apply the settings. **3** Use the controls at the top of the window to start the test. **Note** If you enable logging and are saving the log file to the EPX Test System, gnubi advises you to limit the test period to a maximum of 72 hours (3 days).

SCPI Examples:
`SENS(@6):TEST:TYPE CONT`
`SENS(@6):TEST:TYPE TIM`
`SENS(@6):TEST:PER 3`
`SENS(@6):TEST:UNIT MIN`
To control tests use the following commands:
`sens(@3):test:mode star`
`sens(@3):test:mode stop`
`sens(@3):test:mode rest`
`sens(@3):test:mode pause`
Related Topics:
“Logging” on page 63
“Controlling Tests” on page 115	

STM-1 CMI RXPM Alarms and Errors

The **Alarms and Errors** tab displays alarm status indicators, error counts, and error ratios for the current test.

The following figure shows the main areas of the STM-1 CMI RXPM **Alarms and Errors** tab.



A View carrier board alarm status indicators

B Monitor carrier board error counts and ratios

C View payload module alarm status indicators

D View payload module error counts and ratios

The alarm and error data displayed on this tab is described in more detail in the following sections.

Alarm indicator colors are defined in the following table.

Green	Yellow	Red
No alarms are detected: alarm is inactive or monitoring has not started.	Alarm history: an alarm was detected but is not currently active.	An alarm is active and currently detected on the monitored signal.

Carrier Alarms

Alarm types that can be monitored by the STM1CMI RXPM carrier board are described in the following table.

Alarm	Description
LOS	Loss of Signal. The LOS state is cleared when two consecutive framing patterns are received and no new LOS condition is detected.
LOF	Loss of Frame. The STMI-CMI Receiver declares LOF when the OOF state exists for 3 ms. LOF is cleared when an in-frame condition exists continuously for 3 ms.

Alarm	Description
OOF	Out-of-Frame. The STM-1 CMI Receiver declares OOF when 4 consecutive SDH frames are received with invalid (errored) framing patterns (A1 and A2 bytes). The maximum time to detect OOF is 625 microseconds. OOF is cleared when two consecutive SDH frames are received with valid framing patterns.

SCPI Examples:
`SENS(@3):ALAR LOS`
`SENS(@3):ALAR LOF`
`SENS(@3):ALAR OOF`	

Carrier Errors

Errors that can be monitored by the STM-1 CMI RXPM carrier board are described in the following table.

Error Data	Description
Type	The following error types are monitored: • Section (B1) errors • Line (B2) errors
Count	Current error count for each type of error. The counters are reset to zero at the start of each test period.
Rate	Computed ratio for each type of error. It is the ratio of errored bits to total errors in the stream since the last test restart. The error ratio is reset to zero at the start of each test period.

SCPI Examples:
`SENS(@8):ERR:COUN:B1ER ?`
`SENS(@8):ERR:COUN:B2ER ?`
`SENS(@8):ERR:RAT:B1ER ?`
`SENS(@8):ERR:RAT:B2ER ?`	

Payload Alarms

The Payload Alarms section in the Alarms and Errors tab displays information about the alarms monitored by the Payload Monitor module.

Alarm indicator colors are defined below.

Green	Yellow	Red
No alarms are detected: signal is clear or monitoring is not started.	Alarm history: an alarm was detected but is not active in the current test.	An alarm is active and currently detected on the monitored signal.

Alarm	Description
AU-LOP	Administrative Unit Loss of Pointer. The STM-1 CMI Receiver detects LOP when 10 consecutive invalid pointers are received. LOP state is cleared when three equal valid pointers or three consecutive AIS indications are received. **Note** The pointer interpreter on the STM-1 CMI Receiver module checks the SS bits as required by G.783, Annex C. The STM-1 CMI Receiver detects an LOP condition if the SS bits are incorrect.
MS-AIS	Multiplex Section Alarm Indication Signal. The STM-1 CMI Receiver declares MS-AIS when the STM-1, excluding the Regenerator Section Overhead (RSOH), is all ones. MS-AIS is cleared when the above condition is not met.
AU-AIS	Administrative Unit - Alarm Indication Signal. The STM-1 CMI Receiver declares AU-AIS when the AU, including the AU pointer, is all ones. AU-AIS is cleared when the above condition is not met.

Alarm	Description
MS-RDI	Multiplex Section - Remote Defect Indicator. The STM-1 CMI Receiver detects MS-RDI when bits 6, 7, and 8 of the K2 byte (before scrambling) are set to 110b. MS-RDI is cleared when bits 6,7,and 8 of the K2 byte are not set to 110b.
HP-RDI	Higher order - Path Remote Defect Indicator. The STM-1 CMI Receiver detects HP-RDI when bit 5 of the G1 path overhead byte is set to 1 for 5 consecutive frames. HP-RDI is cleared when the STM-1 CMI Receiver detects HP-RDI when bit 5 of the G1 path overhead byte is set to 0.
HP-UNEQ	Higher order - Path Unequipped. The STM-1 CMI Receiver detects HP-UNEQ when the C2 byte is set to zero for 5 consecutive frames. HP-UNEQ is cleared when the C2 byte is non-zero.
LSS	Loss of Sequence Synchronization. The STM-1 CMI Receiver detects LSS when the PRBS pattern does not match for 4 clock cycles. LSS is cleared when pattern matching occurs for 7 consecutive clock cycles.

Alarm	Description

SCPI Examples:
`PMOD:SENS(@3):ALAR MSA`
`PMOD:SENS(@3):ALAR AUL`
`PMOD:SENS(@3):ALAR AUA`
`PMOD:SENS(@3):ALAR MSRD`
`PMOD:SENS(@3):ALAR HPRD`
`PMOD:SENS(@3):ALAR UNEQ`
`PMOD:SENS(@3):ALAR LPS`	

Payload Errors

The Payload Errors section of the Alarms and Errors tab displays counts and ratios for the alarms that are monitored by the Payload Monitor module.

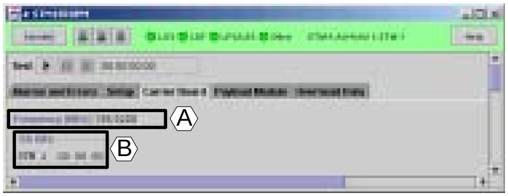
Settings	Description
Path (B3)	Path BIP-8 errors.
PFEBE	Path (G1) Far End Block Errors.
LFEBE	Line (M1) Far End Block Errors.
TSE	Pattern bit errors.
Count	Current error count for the corresponding error type since the last test restart. Error counters are reset at the start of each test period.
Rate	Computed error ratios since the last test restart for the given error type.

Settings	Description

SCPI Examples:
`PMOD(@6):SENS:ERR:COUN PFEB`
`PMOD(@6):SENS:ERR:RAT PFEB`
`PMOD(@6):SENS:ERR:COUN PATH`
`PMOD(@6):SENS:ERR:RAT PATH`
`PMOD(@6):SENS:ERR:COUN TSE`
`PMOD(@6):SENS:ERR:RAT TSE`	

STM-1 CMI RXPM Carrier Board Monitor

The following figure illustrates the main features of the **Carrier Board** tab of the STM-1 CMI RXPM module window.



A Monitor signal input frequency

B Monitor individual SS bit values from the H1 overhead byte

The fields and indicators in the **Carrier Board** tab in more detail in the following sections.

Frequency

Data	Description
Frequency	Monitors the frequency of incoming signal in MHz, with accuracy within 5 ppm. **Note** The clock source must be configured to provide a 155.52 MHz signal to the slot in which the STM-1 CMI RXPM module is installed.
SCPI Examples: `INP(@3):FREQ ?`	

SS Bits

This area of the **Carrier Board** tab displays the current data for the SS bits (bits 5 and 6 in the H1 overhead byte). The SS bits indicate whether the signal is carrying SONET traffic (value of 00) or SDH traffic (value of 10).

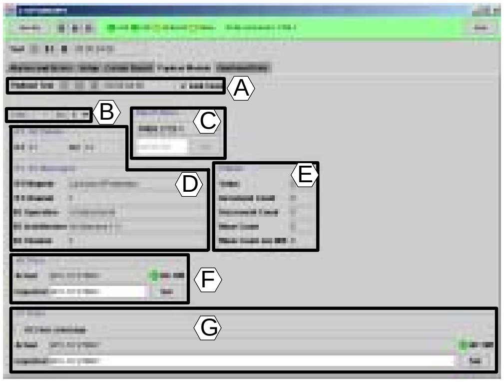
For the STM-1 signal rate, 3 pairs of SS bits are displayed.

To display SS overhead bit values using SCPI, use a command similar to the following:

```
SENS(@8):OVER:SSB ?
```

STM-1 CMI RXPM Payload Module

The following figure shows the main features of the STM-1 CMI RXPM **Payload Module** tab.



A Control test linking between carrier board and payload monitor module and run payload monitor tests (when unlinked).

B Select the payload channel to monitor.

C Select a payload pattern or specify a user-defined payload pattern to monitor.

D Monitor Automated Protection Switching (APS) K1/K2 byte values and messages.

E Monitor AU pointer values and pointer actions.

F Monitor actual and expected J0 section trace messages and RS-TIM (Regenerator Section Trace Identifier Mismatch) alarm status.

G Monitor actual and expected J1 path trace messages and HP-TIM (High-Order Path Trace Identifier Mismatch) alarm status.

The following sections describe these fields and settings in more detail.

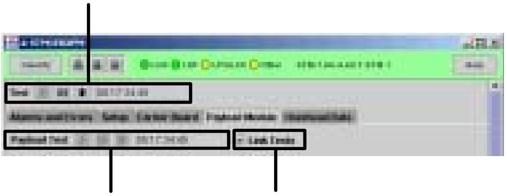
STM and AU Channel (Time Slot)

Settings	Description
STM	STM-1 is always selected.
AU	Selects the AU (administrative unit) time slot to be monitored. • If the monitored AU is an AU-3, 1 of 3 AU time slots can be selected. • If the monitored AU is an AU-4, there is only AU time slot.

SCPI Examples:
`PMOD(@7):SENS:DATA:AUN 2`
`PMOD(@7):SENS:DATA:STM 1`	

Payload Monitor Tests and Test Linking

You can run separate tests on the payload monitor and the receiver carrier board when the **Link Tests** option is disabled (unchecked).



Settings	Description
Payload Test	Start, pause, or pause a separate payload monitor test. These controls are not available when Link Tests is enabled (checked).
Link Test	Enable/disable separate payload monitor tests: • Uncheck this option to enable separate tests to be run on the payload monitor and the carrier board. • Check this box to link the payload monitor and carrier board so that only one test can be run. When Link Tests is enabled, **Payload Test** controls are unavailable and the module functions as any other receiver.

SCPI Examples:
See the PMOD Test section for the STM-1 CMI Receiver in the "*SCPI Reference*" for commands to control payload monitor tests.
To link and unlink tests:
`PMOD(@6):SENS:TEST:LINK ON`
`PMOD(@6):SENS:TEST:LINK OFF`	

K1/K2 (APS) Values and Messages

The K1/K2 line overhead byte values are used to monitor automated protection switching (APS) channel messages.

Field	Description
K1/K2 Values	Monitors hexadecimal values for K1/K2 line overhead bytes in monitored signal.
K1/K2 Messages	Monitors APS messages that correspond to the values in the K1/K2 bytes. See “J0 Trace Message” on page 470 for a description of these messages and the corresponding K1/K2 bit values.

SCPI Examples:

```
PMOD(@3)SENS:APS:K1K2  ?
PMOD(@3):SENS:APS:K1D:REQ ?
PMOD(@3):SENS:APS:K1D:CHAN ?
PMOD(@3):SENS:APS:K2D:ARCH ?
PMOD(@3):SENS:APS:K2D:OPER ?
PMOD(@3):SENS:APS:K2D:CHAN ?
```

Pointer

The Pointer area of the **Payload Module** tab displays AU pointer values and event counts.

AU pointer event counters are reset at the start of each test period.

Pointer Field	Description
Value	Displays the current value in hexadecimal of the administrative unit (AU) pointer. This value is what the hardware pointer processor interprets as the current pointer.

Pointer Field	Description
Increment Count	Number of AU pointer increment events since the last restart.
Decrement Count	Number of AU pointer decrement events since the last restart.
Move Count	Number of times the pointer generator moved to a new pointer value using the New Data Flag (bits 1 to 4 of the H1 pointer byte).
Move w/o NDF Count	Number of times the pointer generator moved to a new pointer value without the New Data Flag (missing NDF).

SCPI Examples:

```
PMOD(@6):SENS:POIN:VAL  ?
PMOD(@6):SENS:POIN:COUN  INCR
PMOD(@6):SENS:POIN:COUN  DECR
PMOD(@6):SENS:POIN:COUN  NDF
PMOD(@6):SENS:POIN:COUN  MNDF
```

J0 Trace Message

The J0 Trace Message area displays the received J0 trace message, RS-TIM alarm status, and enables you to define and enable monitoring of the expected trace message.

Field/ Indicator	Description
Actual	Displays the received 15-byte J0 trace message.

Field/ Indicator	Description
Expected	Enter a 15-byte character string to be used as the expected trace message for the RS-TIM (Regenerator Section-Trace Identifier Mismatch) alarm.
Set	Click **Set** to enable monitoring of the expected J0 trace message.
RS-TIM Alarm Indicator	Displays the status of the Regenerator Section-Trace Identifier Mismatch (RS-TIM) alarm. The indicator is Green if the actual message matche the expected message, Red if the a mismatch is active, and Yellow if a mismatch was detected during the current test, but is not active.

SCPI Examples:
Display the received (actual) J0 trace message:
`PMOD(@3):SENS:DATA:SECT:TRAC ?`
Set the expected J0 trace message:
`PMOD(@3):SENS:DATA:SECT:EXP “15-byte msg”`
Display RS-TIM alarm status:
`PMOD(@3):SENS:DATA:SECT:TIM ?`	

J1 Trace Message

The J1 Trace Message area displays the received J1 trace message, HP-TIM alarm status, and enables you to define and enable monitoring of the expected J1 trace message.

Field/ Indicator	Description
64-byte Message	When checked, this selection enables 64-byte J1 trace message length. The default is disabled, which selects a 15-byte J1 trace message.
Actual	Displays the received 15or 62-byte J1 trace message.
Expected	Enter a 15- or 62-byte character string to be used as the expected J1 trace message for the HP-TIM (High order Path Trace Identifier Mismatch) alarm. For a 64-byte message, two bytes are used for the newline and string terminator; for a 16-byte message, one byte is used for a CRC.
Set	Click **Set** to enable monitoring of the expected J1 trace message.
HP-TIM Alarm Indicator	Displays the status of the High order Path - Trace Identifier Mismatch (HP-TIM) alarm. The indicator is Green if the actual message matche the expected message, Red if a mismatch is active, and Yellow if a mismatch was detected during the current test, but is not active.

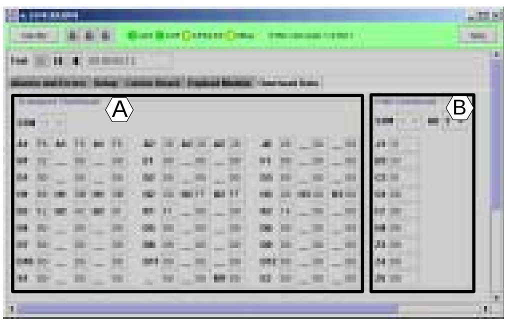
Field/ Indicator	Description

SCPI Examples:
Set the J1 trace message length:
`PMOD(@3):SENS:DATA:PATH:TRL 64`
Set the expected J1 trace message:
`PMOD(@3):SENS:DATA:PATH:EXP “J1 trace msg”`
Display the received J1 trace message:
`PMOD(@3)DATA:PATH:TRAC  ?`
Display HP-TIM alarm status:
`PMOD(@3):SENS:DATA:PATH:TIM ?`	

STM-1 CMI RXPM Overhead Data

The STM-1 CMI RXPM **Overhead Data** tab displays the current values of the STM transport and path overhead bytes for the selected AU within the STM-1.

The following figure shows the features of the STM-1 CMI RXPM **Overhead Data** tab.



A View transport overhead data for all three AUs within the STM-1.

B Select the administrative unit (AU) within the STM-1 for which path overhead data is displayed. The number of AUs depends on the currently selected AU mapping.

Selection	Description
STM (Transport Overhead)	STM-1 is the only valid value for this field.
STM (Path Overhead)	STM-1 is the only valid value for this field.
AU (Path Overhead)	Selects the administrative unit (AU) for which the path overhead data is displayed. Select 1 of 3 available AUs if the AU mapping is set to AU-3. If the AU mapping is set to AU-4, there is only 1 AU.

SCPI Examples:
Use the following command to query the values for bytes A1;A2;J0;B1;E1;F1;D1;D2;D3.
`SENS(@6):DATA:SECT:OVER:BYT?`
Use the following command to set the values for bytes H1;H2;H3;B2;K1;K2;D4;D5;D6;D7;D8;D9;D10;D11;D12;S1;M1;E2.
`SENS(@6):DATA:LINE:OVER:BYT?`	

22

STM-1 CMI TXPG MODULE WINDOW

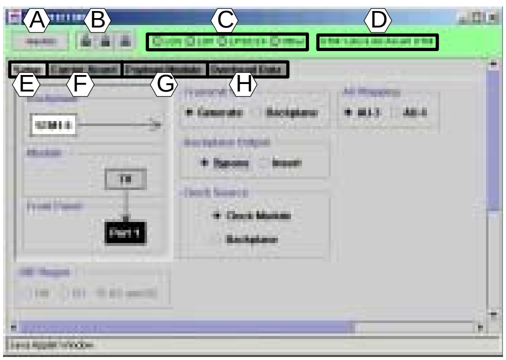
The topics in this section explain how to configure set-up options, alarm and error insertion, payload generation, and overhead data values for the STM-1CMI Transmitter, which includes a Payload Generator (PG).

- “STM-1 CMI TXPG Main View” on page 227
- “STM-1 CMI TXPG Setup” on page 228
- “STM-1 CMI TXPG Carrier Board Settings” on page 231
- “STM-1 CMI TXPG Payload Module Settings” on page 233
- “STM-1 CMI TXPG Overhead” on page 241

Instructions are provided for using EPXam to configure the module, along with SCPI equivalents.

STM-1 CMI TXPG Main View

The following figure shows the main features of the STM-1 TXPG module window.



A Identify button—When pressed, flashes the Active LED on the front panel of the module associated with this window.

B Save or restore module/slot configuration; restore factory default setting (see “Using Module Window Save and Restore Controls” on page 108).

C View defect status indicators.

D View signal rate, AU mapping, and AU channel (time slot) information.

E **Setup**—Configure clock source, backplane input and output, and other STM-1 CMI TXPG module setup options (see “STM-1 CMI TXPG Setup” on page 228).

F **Carrier Board**—Configure carrier board alarm and error insertion (see “STM-1 CMI TXPG Carrier Board Settings” on page 231).

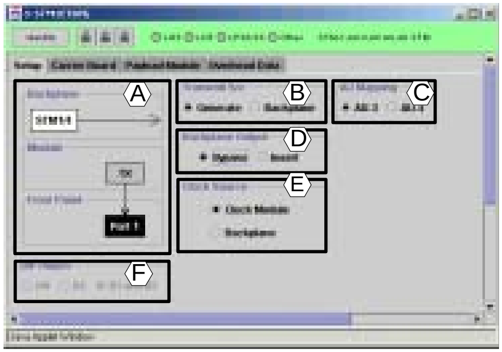
G **Payload Module**—Configure payload generator alarm and error insertion (see “STM-1 CMI TXPG Payload Module Settings” on page 233).

H **Overhead Data**—View or modify SDH transport and path overhead bytes (see “STM-1 CMI TXPG Overhead” on page 241).

STM-1 CMI TXPG Setup

The **Setup** tab contains options for configuring Administrative Unit (AU) mapping (payload envelope size), configuring module input and output, setting the clock source, and enabling BIP regenerators.

The following figure shows the main features of the STM-1 CMI TXPG **Setup** tab.



A View graphic display of currently selected module input and output options.

B **Transmit Source**—Select whether the output signal is generated by the onboard Payload Generator or comes from an STM-1 CMI or STM-4/1 module in the adjacent slot to the left via the test system backplane.

C **AU Mapping**—Set the Administrative Unit (AU) data size.

D **Backplane Output**—Specify whether the generated signal is inserted back onto the backplane or bypasses the backplane (signal on the backplane is not modified).

E **Clock Source**—Set the clock source for payload generation.

F **BIP Regen**—Enable/disable BIP B1 and B2 regenerators. This setting controls whether B1 and B2 errors can be inserted when the Transmit Src is set to Backplane.

These settings are explained in more detail in the following sections.

Transmit Source

The Transmit Source setting determines whether the signal source for the transmitter is generated by its Payload Generator or is a signal input from the backplane.

Note Modules must be installed in adjacent slots to transmit or receive signals using the backplane and must have compatible signal interfaces. See "Using the Backplane" on page 41.

When the Transmit Src is set to Backplane:

- The clock source is automatically set to Backplane.
- The BIP Regen setting become active. BIP Regen must be enabled for B1 and /or B2 to allow B1 and/or B2 error insertion in this mode.
- Alarm insertion is limited to LOS, LOF, and OOF.
- Error insertion is limited to physical (random) errors, B1 errors, and B2 errors (assuming BIP Regen is set appropriately).
- Overhead byte insertion, trace message insertion, K1/K2 byte manipulation, SPE pointer manipulation, and payload pattern selection are not available in this mode.

Transmit Source	Description
Generate	The transmitter outputs the signal from its payload generator.
Backplane	The transmitter outputs the signal received from an STM-1 CMI or STM-4/1 module installed in the adjacent (lower-numbered) slot via the test system backplane. In an EPX16 chassis, this is the adjacent slot to the left.

SCPI Examples:

```
SOUR(@6):DATA:SOUR  PMOD
SOUR(@6):DATA:SOUR  BACK
```

Related Topics

"Using the Backplane" on page 41

AU Mapping

The AU Mapping option controls the mapping (size) of the administrative unit (AU) for the generated payload.

SPE Mapping	Description
AU-3	Selects an AU-3-sized payload for the SPE.
AU-4	Selects an AU-4-sized payload for the SPE.

SCPI Examples:

```
PMOD(@7):SOUR:DATA:SIZE AU3
PMOD(@7):SOUR:DATA:SIZE AU4
```

Backplane Output

The Backplane Output setting determines whether the STM-1 CMI TXPG module inserts the signal from its Payload Generator onto the backplane or the signal on the backplane is passed through unchanged to the next adjacent slot.

Note Modules must be installed in adjacent slots to transmit or receive signals using the backplane and must have compatible signal interfaces. See “Using the Backplane” on page 41.

Backplane Output Setting	Description
Bypass	When Bypass mode is selected for a transmitter, the input data from the backplane is output to the backplane without modification.
Insert	When Insert mode is selected for a transmitter, the signal data from the module’s payload generator is output to the backplane. This option is not available when the Transmit Src is set to Backplane.

SCPI Examples:

```
SYST:BOAR(@6):BACK:MODE  PMOD
SYST:BOAR(@6):BACK:MODE  BYP
```

Related Topics

“Using the Backplane” on page 41

Clock Source

The Clock Source setting selects the timing reference that the payload generator uses to generate the payload.

Note Modules must be installed in adjacent slots to transmit or receive signals using the backplane and must have compatible signal interfaces. See “Using the Backplane” on page 41.

Clock Source Setting	Description
Clock Module	The Payload Generator gets its timing reference from the test system’s clock module in slot 1. The clock module must be properly configured to provide a SONET/SDH timing reference to the slot in which the STM-1 CMI module is installed. This option is not available when the Transmit Src is set to Backplane.
Backplane	The payload generator gets its timing reference from the STM-1 CMI or STM-4/1 module installed in the adjacent, lower-numbered slot via the test system backplane.

SCPI Examples:

```
PMOD(@7):SOUR:CLOC:SOUR  CLKB
PMOD(@7):SOUR:CLOC:SOUR  BACK
```

Related Topics

“Configuring the EPX100 Clock Module” on page 25

BIP Regen

The BIP Regen setting controls B1 and B2 byte regeneration when the Transmit Source is set to Backplane.

Note This setting is only available when the Transmit Src is set to Backplane. You must enable BIP Regen settings to insert B1 and/or B2 errors in this mode.

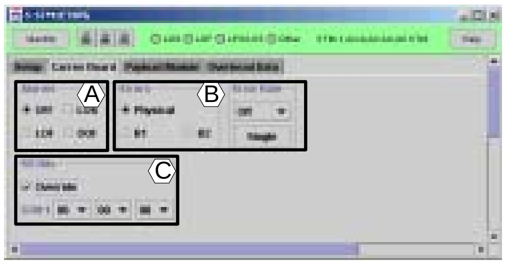
Setting	Description
Off	Disable B1 and B2 BIP regenerators. Only physical layer errors can be inserted when the Transmit Source is set to Backplane. If the error type is currently set to B1 or B2 and this setting is chosen, the error type is forced to physical.
B1	Enable the B1 BIP regenerator. Only physical layer and B1 errors can be inserted when the Transmit Source is set to Backplane. If the error type is currently set to B2 and this setting is chosen, the error type is forced to physical.
B1 and B2	Enable the B1 and B2 BIP regenerators. B1, B2, and physical layer errors can be inserted when the Transmit Source is set to Backplane. This is the default setting.
SCPI Examples:	

```
SOUR(@3):OVER:BIPR  B1
SOUR(@3):OVER:BIPR  B1_B2
SOUR(@3):OVER:BIPR  OFF
```

STM-1 CMI TXPG Carrier Board Settings

Errors and alarms that can be inserted by EPX STM-1 TXPG modules into the SDH transmit error stream are configured in the **Carrier Board** tab.

The following figure illustrates the main areas of the STM-1 CMI TXPG **Carrier Board** tab.



A Select the type of carrier alarm to insert

B Select the type of carrier error to insert and set the error insertion rate

C Override SS (SONET/SDH) bit values

Alarms, error types, and messages that can be inserted are described in more detail in the following sections.

Carrier Alarms

The Alarm setting determines the type of SDH alarm that can be inserted into the transmit stream by the STM-1 CMI TX carrier board.

Alarm setting	Description
Off	Alarm insertion is disabled.
LOS	Loss of signal. **Implementation**: LOS is forced by continuously disabling the transmit drivers. When LOS insertion is turned off, the transmit drivers are re-enabled.
LOF	Loss of Frame. **Implementation**: LOF is forced by continuously inverting the A1 and A2 framing bytes. When LOF insertion is turned off, the A1 and A2 framing bytes are generated with the correct values.
OOF	Out of Frame. **Implementation**: OOF is forced by inverting the A1 and A2 framing bytes for 4 frames, followed by 40 frames with a normal framing pattern. This is repeated until OOF insertion is turned off.

SCPI Examples:

```
SOUR(@3):ALAR  OFF
SOUR(@3):ALAR  OOF
SOUR(@3):ALAR  LOF
SOUR(@3):ALAR  LOS
```

Carrier Errors

The Errors and Error Rate settings control the type of error and the rate at which it is inserted into the transmit stream.

Note Whenever the Error Type setting is modified, the Error Rate setting is always reset to Off.

Note When the Transmit Src is set to Backplane, B1 and B2 error insertion depends on the BIP Regen setting. Conflicts can occur if you attempt to set the error type to B1 or B2 and the BIP Regen option is not set correctly. See “BIP Regen” on page 231 for more information.

Choose one of the following error types.

Error Type	Description
Physical	Insert physical layer (or random) errors into the stream. The BIP Regen setting does not affect physical error insertion.
B1 (Line)	Insert B1 errors into the stream. If the Transmit Source is set to Backplane, the BIP Regen setting must be either B1 or B1 and B2.
B2 (Section)	Insert B2 errors into the stream. If the Transmit Source is set to Backplane, the BIP Regen setting must be set to B1 and B2.

SCPI Examples:

```
SOUR(@3):ERR:TYPE  SECT
SOUR(@3):ERR:TYPE  LINE
SOUR(@3):ERR:TYPE  PHYS
```

Error Rate

The Error Rate setting enables and disables error insertion and controls the rate at which errors are inserted into the stream.

Note The Error Rate setting is always reset to OFF whenever the Error Type is changed.

Error Rate Setting	Description
Off	Disables error insertion.
All	Errors all bits in the B1 or B2's BIP-8. This setting does not apply to physical errors. Set the Error Type Section (B1) or Line (B2), and set BIP Regen to B1 or B1 and B2.
IE-3 through IE-9	Set the error ratio to 10 x 10^-3, 10 x 10^-4, and so on. IE-3 does not apply to Section (B1) errors, because this error rate cannot be achieved. Set the Error Type to Line (B2) and BIP Regen to B1 and B2 to use IE-3.
Single	Error Rate must be set to Off to enable single error insertion. When this option is available, click this button to insert a single error into the transmit stream.

SCPI Examples:
`SOUR(@3):ERR:RAT OFF`
`SOUR(@3):ERR:RAT ALL`
`SOUR(@3):ERR:RAT RIE-4`
`SOUR(@3):ERR:RAT SING`	

SS Bits

Use the SS Bits Override setting to modify the SS overhead bits that are inserted into the H1 overhead byte in the STM-1 stream. By default, these bits are not modified.

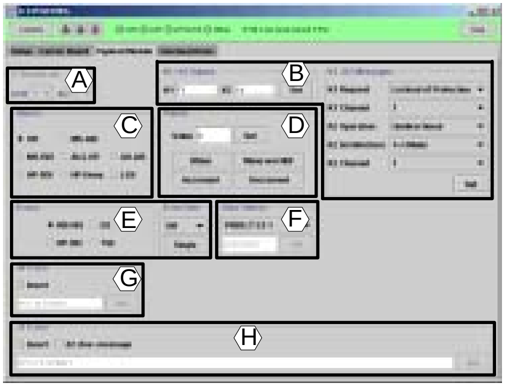
The SS bits are bits 5 and 6 of the H1 overhead byte. They indicate whether the signal is carrying SONET traffic (value of 00) or SDH traffic (value of 10).

SS Bits Settings	Description
Override	If checked, the binary values specified override the default SS bit values (00 for SONET, 10 for SDH).
1 through 3 (STM-1)	Specify a binary value (00, 01, 10, or 11) for each of the three bit pairs. The default binary values are 10, 00, 00.

SCPI Examples:
`SOUR(@3):OVER:SS 11;11;11`
`SOUR(@3):OVER:SS OFF`	

STM-1 CMI TXPG Payload Module Settings

The following figure illustrates the options available on the STM-1 CMI TXPG **Payload Module** tab.



A Select the AU to map the payload into or broadcast to all AUs (the STM selection is not available, because there is only one STM).

B Set K1/K2 byte values directly or select and insert a K1/K2 APS bit-oriented message.

C Select the type of alarm to insert or disable alarm insertion.

D Set payload pointer values or perform actions on current payload pointer.

E Select the type of error to insert and set the error insertion rate.

F Specify the data pattern to place into the generated payload.

G Define and insert a J0 trace message.

H Define and insert a J1 trace message.

These settings are described in more detail in the sections the following sections.

STM and AU Payload Mapping

The STM and AU selections control how the internally generated payload is mapped into the STM and AU time slots.

Note STM and AU selection are not available when the Transmit Src is set to Backplane.

Settings	Description
Broadcast	Maps the internally generated payload into all all channels.
STM	This selection is not available on the STM-1 CMI TXPG module, as there is only 1 STM.
AU	Maps the internally generated payload into the selected administrative unit (AU) time slot. If the generated AU is an AU-3, select 1 of 3 time slots. If the generated AU is an AU-4, there is only one AU. This selection is not available when Broadcast mode is selected.

SCPI Examples:

To map the internally generated payload to all AU time slots (broadcast):

```
PMOD(@6):SOUR:DATA:MODE  BRO
```

To map the payload to a selected AU and STM-1:

```
PMOD(@6):SOUR:DATA:MODE  SEL
PMOD(@6):SOUR:DATA:AUN   1
PMOD(@6):SOUR:DATA:STM  1
```

Payload Module Alarms

The following alarms can be inserted by the Payload Generator.

Note Payload module alarm insertion is not available when the Transmit Src is set to Backplane.

STM Line/ Path Alarms	Description
OFF	Disable all alarms.
MS-AIS	Multiplex Section Alarm Indication Signal. **Implementation**: The STM-1 CMI TXPG module generates MS-AIS by continuously inserting all ones into the STM payload, excluding the Regenerator Section Overhead (RSOH). When MS-AIS insertion is turned off, the STM payload is generated normally.
MS-RDI	Multiplex Section Remote Defect Indicator. **Implementation**: The STM-1 CMI TXPG module generates MS-RDI by continuously injecting a value of 110b into bits 6, 7, and 8 of the K2 byte, respectively. When MS-RDI insertion is turned off, a value of 100 is inserted into bits 6, 7, and 8 of the K2 byte, respectively.
AU-LOP	Administrative Unit Loss of Pointer. **Implementation**: The STM-1 CMI TXPG module generates AU-LOP by continuously setting the H1 and H2 pointer bytes to 6B and 0F, respectively. When AU-LOP insertion is turned off, the H1 and H2 pointer bytes are returned to the previous pointer values.
HP-AIS	High order Path Alarm Indication Signal. **Implementation**: The STM-1 CMI TXPG module generates HP-AIS by continuously inserting all ones into the H1, H2, and H3 bytes, path overhead, and all of the SPE. When HP-AIS insertion is turned off, the original overhead values are restored, along with the data patterns.
HP-RDI	High-Order Path Remote Defect Indicator. **Implementation**: The STM-1 CMI TXPG module generates HP-RDI by setting bit 5 of the G1 byte to 1. When HP-RDI insertion is turned off, bit 5 of the G1 byte is set to 0.

STM Line/ Path Alarms	Description
HP-UNEQ	High-Order Path Unequipped. **Implementation**: The STM-1 CMI TXPG module generates HP-UNEQ by setting the C2 byte to zero (0). When HP-UNEQ insertion is turned off, the previous C2 byte value is restored.
LSS	Loss of Sequence Sync. **Implementation**: The STM-1 CMI TXPG module generates LSS by continuously sending a pattern that differs from the expected pattern. If the expected pattern is PRBS 2^20, a PRBS 2^23 pattern is transmitted. For all other patterns, a PRBS 2^20 pattern is transmitted. When LSS insertion is turned off, the expected pattern is transmitted.

SCPI Examples:
`PMOD(@6):SOUR:ALAR OFF`
`PMOD(@6):SOUR:ALAR MSA`
`PMOD(@6):SOUR:ALAR MSRC`
`PMOD(@6):SOUR:ALAR AUL`
`PMOD(@6):SOUR:ALAR AUA`
`PMOD(@6):SOUR:ALAR HPUN`
`PMOD(@6):SOUR:ALAR LSS`	

Payload Module Errors

The following types of alarms can be inserted by the Payload Generator module:

Note Payload Generator alarms can not be inserted when the Transmit Src is set to Backplane.

Settings	Description
MS-REI	Inserts MS-REI errors (M1 errors).
B3	Inserts Path (B3) errors.
HP-REI	Inserts High order Path Remote Error Indicator (HP-REI) errors (G bits 1 - 4).
TSE	Inserts test sequence errors (bit errors).

SCPI Examples:
`PMOD(@6):SOUR:ERR:TYPE MSR`
`PMOD(@6):SOUR:ERR:TYPE B3`
`PMOD(@6):SOUR:ERR:TYPE HPR`
`PMOD(@6):SOUR:ERR:TYPE TSE`	

Error Rate

The Error Rate setting enables and disables error insertion and controls the rate at which errors are inserted into the stream.

Tip The Error Rate setting is always reset to OFF whenever the Error Type is changed.

Error Rate Setting	Description
Off	Disables error insertion.
All	When **All** is selected, all bits in the B3 BIP-8, MS-REI or HP-REI are errored. This mode does not apply to TSE errors.
IE-3 through IE-9	Set the error ratio to 10 x 10^-3, 10 x 10^-4, and so on. The IE-3 setting does not apply to B3 or HP-REI errors when the payload mapping is AU-4; the IE-3 setting does apply to these error types when the payload mapping is AU-3.
Single	Error Rate must be set to Off to enable single error insertion. When this option is available, click this button to insert a single error of the currently selected error type.

SCPI Examples:
`SOUR(@3):ERR:RAT OFF`
`SOUR(@3):ERR:RAT ALL`
`SOUR(@3):ERR:RAT RIE-4`
`SOUR(@3):ERR:RAT SING`	

K1/K2 Values

Use the K1/K2 Values settings to directly set values in the automated protection switching (APS) channel K1and K2 bytes. As you modify K1/K2 values, the K1/K2 Message setting fields are updated appropriately. This feature is not available if the Transmit Src is set to Backplane.

K1/K2 Value Settings	Description
K1	The default value is 0xF1. Bits 1 through 4 control the request message, and bits 5 through 8 control the channel message code.
K2	The default value is 14. Bits 1 through 4 of the K2 byte control the channel number, bit 5 controls the architecture, and bits 6 thorough 8 indicate the mode of operation.
Set	You must click **Set** to update and transmit new K1/K2 values entered here.
SCPI Examples: `PMOD(@6):SOUR:APS:K1K2 0xF2,0x14` **Related Topics:** “K1/K2 Messages” on page 237	

K1/K2 Messages

Use the fields in the K1/K2 message panel to set K1 and K2 bits for APS channel message encoding. As you set K1/K2 message fields, the hexadecimal values displayed in the **K1/K2 Values** field update accordingly.

Note This feature is not available when the Transmit Src is set to Backplane.

K1/K2 Message Settings	Description
K1 Request	Sets bits 1 through 4 of K1 with one of the following request messages. **Lockout of Protection**. Sets bits 1 through 4 to 1111. **Forced Switch**. Sets bits 1 through 4 to 1110. **SF - High Priority**. Sets bits 1 through 4 to 1101. **SF - Low Priority**. Sets bits 1 through 4 to 1100. **SD - High Priority**. Sets bits 1 through 4 to 1011. **SD - Low Priority**. Sets bits 1 through 4 to 1010. **Manual Switch**. Sets bits 1 through 4 to 1000. **Wait-to-Restore**. Sets bits 1 through 4 to 0110. **Exercise**. Sets bits 1 through 4 to 0100. **Revert Request**. Sets bits 1 through 4 to 0100 **Do Not Revert**. Sets bits 1 through 4 to 0001 **No Request**. Sets bits 1 through 4 to 0000.

K1/K2 Message Settings	Description
K1 Channel	Selects the channel to apply the requesting message (sets bits 5 through 8 of K1 with the channel message code): • 0 selects the Null channel. • 1 through 14 selects Channel 1 through 14. • 15 selects the extra traffic channel.
K2 Operation	Sets the operational mode of the APS. Bits 6 through 8 of the K2 byte carries this information. **Unidirectional**. Sets bits 6 to 8 to 100. **Bidirectional**. Sets bits 6 to 8 to 101.
K2 Architecture	Sets the architecture mode for the APS. Bit 5 of K2 carries this information. **Architecture 1+1**. Sets bit 5 to 0. **Architecture 1:n**. Sets bit 5 to 1.
K2 Channel	Selects the channel to apply the requesting message (sets bits 1through 4 of K1 with the channel message code): **0**. Null channel. **1** to **14**. Channel 1 to 14. **15**. Extra traffic channel.
Set	You must click **Set** to update and apply the K1/K2 Message settings.

K1/K2 Message Settings	Description
SCPI Examples:	

```
sour(@4):aps:k1en:req lops
sour(@4):aps:k1en:chan 1
sour(@4):aps:k2en:oper bid
sour(@4):aps:k2en:arch a1_n
sour(@4):aps:k2en:chan 1
sour(@4):aps:upd
```

J0 Trace Message

To create and insert a 15-character user-defined J0 trace message:

1 Click **Insert** to enable J0 trace message insertion.

2 Enter a 15-character trace message.

3 Click **Set** to apply the changes. If you do not click **Set**, the modified message is not inserted (the default trace message is sent).

J0 trace message insertion is not available if the Transmit Src is set to Backplane.

To enable J0 trace and insert a trace message using SCPI, use the following pair of commands:

```
PMOD:(@6):SOUR:DATA:SECT:TREN ON
PMOD:(@6):SOUR:DATA:SECT:TRAC “My J0 trace
msg”
```

J1 Trace Message

To create and insert a user-defined J1 trace message:

1 Click **Insert** to enable J1 trace message insertion.

2 If desired, select 62-byte length (by default, a 15-character message can be inserted).

When 62-byte message length is selected, two bytes are added for carriage return and line field, for a total of 64 bytes.

When the default 16-byte message length is selected, one byte is used for CRC, leaving a total of 15 bytes for the message content.

3 Enter the trace message.

4 Click **Set** to apply the changes. If you do not click **Set**, the modified message is not inserted (the default J1 trace message is sent).

Note J1 trace message insertion is not available if the Transmit Src is set to Backplane.

To set the J1 message length to 64 bytes, enable J1 trace and insert a trace message using SCPI, use commands similar to the following:

```
PMOD:(@6):SOUR:DATA:PATH:TRL 64
PMOD:(@6):SOUR:DATA:PATH:TREN ON
PMOD:(@6):SOUR:DATA:PATH:TRAC “J1 trace
msg”
```

Pointer

Use the Pointer settings to increment, decrement, move, or set the value of the AU pointer.

Note SPE pointer manipulation is not available if the Transmit Src is set to Backplane.

Pointer Settings	Description
Value	Manually set the AU pointer. Enter an integer value from 0 to 782. The value entered is displayed as a hexadecimal number. This performs a pointer move with NDF to the specified value.
Set	You must click **Set** to apply the change to the AU pointer value entered in the **Value** field.
Move	Move pointer with the New Data Flag (bits 1 to 4 of the H1 overhead byte). This causes a large change to the pointer value, and the NDF flag in the H1 overhead byte is updated appropriately.
Move w/o NDF	Move pointer without the New Data Flag. This causes a large change in the pointer value without the appropriate NDF indication in the H1 overhead byte.
Increment Decrement	Increment or decrement the AU pointer value by 1.

SCPI Examples:

```
PMOD(@6):SOUR:POIN:VAL  574
PMOD(@6):SOUR:POIN:ACT  INCR
PMOD(@6):SOUR:POIN:ACT  DECR
PMOD(@6):SOUR:POIN:ACT  NDF
PMOD(@6):SOUR:POIN:ACT  MNDF
```

Data Pattern

The Data Pattern selects the type of pattern to place into the generated payload. Data pattern selection is not available if the Transmit Src is set to Backplane.

Settings	Description
PRBS 2^15-1 **PRBS 2^20-1** **PRBS 2^23-1** **Inverted PRBS 2^15-1** **Inverted PRBS 2^20-1** **Inverted PRBS 2^23-1**	True and inverted pseudo random bit (PRBS) patterns.
1111	All ones.
0000	All zeroes.
0101	Alternating zero-one (0b01010101) pattern.
1010	Alternating one-zero (0b10101010) pattern.
User	8-bit binary user-defined payload pattern.

SCPI Examples:

```
PMOD(@6):SOUR:PAYL:PATT:TYPE <parameter>
```

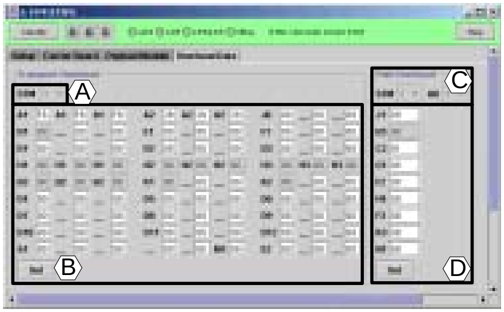
where <*parameter*> can be `PR215`, `PR223`, `PR220`, `ZER`, `ONES`, `ALT01`, `ALT10`, or `USER 0bxxxxxxxx`.

STM-1 CMI TXPG Overhead

The **Overhead Data** tab provides options for modifying individual path and transport overhead byte values for a given AU.

Note Overhead insertion is not available if the Transmit Src is set to Backplane.

The following figure shows the main features of the **Overhead Data** tab.



A Select an STM for viewing or modifying transport overhead bytes. This setting is greyed out because there is only one STM.

B Modify transport overhead byte values for the selected AU and click **Set** to apply changes.

C Select the AU time slot to view or modify its path overhead bytes. STM selection is disabled because there is only one STM. AU selection is disabled in Broadcast mode, because the generated payload is mapped into all AUs.

D Modify path overhead byte values for the selected AU time slot and click **Set** to apply changes.

Transport Overhead Data

To modify specific transport overhead bytes, select an AU channel, enter hexadecimal values and click **Set**.

The following notes apply to modifying STM transport overhead bytes:

- The notation "XX" indicates that the corresponding overhead byte cannot be modified through this interface.
- Modifying A1 and A2 bytes causes receivers to lose framing.
- The B1 and B2 bytes can only be modified through the B1 and B2 error insertion setting on the **Carrier Board** tab.
- Modifying J0 in STM-1, AU 1 only takes effect if J0 section trace insertion is disabled.
- Modifying the K1 and K2 bytes is possible through this interface, but to ensure proper K1 and K2 updates, use the K1/K2 interface on the **Payload Module** tab.
- Enabling alarms (MS-RDI, AU-AIS) overrides changes to K2.
- Modifying M1 of STM-1 does not override enabled error injection of MS-REI.

STM transport overhead bytes and settings are described in the following table.

Settings	Description
Transport Overhead STM	This setting is disabled because there is only 1 STM.
Transport Overhead Bytes	
A1, A2	Framing alignment bytes. Modifying A1 and A2 bytes causes receivers to lose framing.
B1	BIP-8 parity check byte. This byte cannot be modified through this interface. The B1 byte can only be modified through the error insertion setting on the **Carrier Board** tab.
C1 (J0)	Formerly C1 (STM-1 ID), now redefined as the J0 trace byte. Modifying J0 in STM-1, AU 1 only takes effect if J0 trace insertion is disabled.
E1	Orderwire section byte located in first STM-1 of an STM-N.
F1	Section user channel byte located in first STM-1 of an STM-N.
D1, D2, D3	Section data communication channel bytes located in first STM-1 of an STM-N.

Settings	Description
K1, K2	APS channel bytes. Modifying the K1 and K2 bytes is possible through this interface, but to ensure proper K1 and K2 updates, use the K1/K2 interface on the **Payload Module** tab. Enabling alarms (MS-RDI, AU-AIS) override changes to K2.
H1, H2	AU payload pointer bytes.
H3	AU pointer action byte.
D4 through D12	Line data communications channel bytes.
S1/Z1	Synchronization status/growth bytes.
Z2/M1	Z2—Growth M1—Line Remote Error Indicator (Line REI) byte. Modifying M1 does not override enabled error injection of MS-REI.
E2	Express orderwire byte.
Set	You must click **Set** to apply any changes to the transport overhead byte values.
SCPI Examples: For detailed information about commands for setting transport overhead values, refer to the "Overhead Access" commands in the "STM-1 CMI Transmitter" section of the *"SCPI Reference"*.	

STM Path Overhead Data

To modify path overhead bytes:

1. Select an AU.

   AU selection is disabled in Broadcast mode, because the payload is mapped into all AUs. AU selection is also disabled if there is only one AU.

2. Enter a hexadecimal value.
3. Click **Set** to apply the changes to the STM path overhead bytes.

The following notes apply to modifying STM path overhead bytes:

- The notation "XX" indicates that the corresponding overhead byte cannot be modified.
- Modifying J1 only takes effect if J1 trace message insertion is disabled.
- The B3 byte cannot be modified through this interface. Use the B3 error injection setting on the **Carrier Board** tab.
- Modifying G1 does not override an enabled alarm (HP-RDI) or enabled error injection on HP-REI.

The following table describes STM path overhead bytes and settings.

Settings	Description
Path Overhead STM and AU	Select the AU time slot for which you want to modify path overhead bytes. STM selection is disabled because there is only 1 STM. AU selection is disabled in Broadcast mode, because the generated payload is mapped into all AUs.
Path Overhead Bytes	
J1	Path trace byte. Modifying J1 only takes effect if J1 trace message insertion is disabled.
C2	VC signal label.
B3	Parity check byte. The B3 byte cannot be modified through this interface. Use the B3 error injection setting on the **Carrier Board** tab.
G1	Path terminating status byte. Modifying G1 does not override an enabled alarm (HP-RDI) or enabled error injection on HP-REI.
F2	Path user channel byte.
H4	Multiframe indicator byte.
Z3, Z4	Allocated for future growth.
Z5	Tandem connection byte.
Set	You must click **Set** to apply any changes to the transport overhead byte values.

Settings	Description
SCPI Examples: For detailed information about commands for setting transport overhead values, refer to the section on “Overhead Access” commands in the section “STM-1 CMI Transmitter” on page 594 of the *“SCPI Reference”*.	

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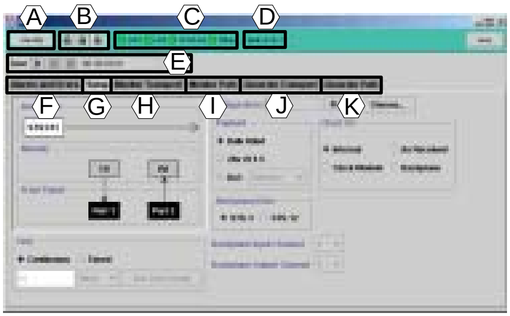
STS-1 TRANSCEIVER

The topics in this section explain how to configure the STS-1 Transceiver Setup, Generate, and Monitor options using EPXam, along with SCPI equivalents.

Main View

The following figure shows the main features of the STS-1 Transceiver module window.



A **Identify button**—Flashes the Active LED on the module associated with this window

B Save or restore custom module/slot configurations or restore factory defaults, as described in "Using Module Window Save and Restore Controls" on page 108

C View defect status summary indicators for current test

D View currently selected TX and RX payload mapping

E Start, stop, or pause test; view elapsed time as described in “Using Module Window Test Controls” on page 118

F **Alarms and Errors**—Monitor alarm status, error counts, and error ratios for current test, as described in “Alarms and Errors” on page 250

G **Setup**—Configure clock source, test type and duration, backplane rate, backplane input and output, transmit and monitor source, and synchronous payload envelope mapping (SPE) for transmit and receive, as described in “STS-1 Setup” on page 246

H **Monitor Transport**—Monitor the incoming signal and the J0 trace message, as described in “Monitor Transport” on page 273

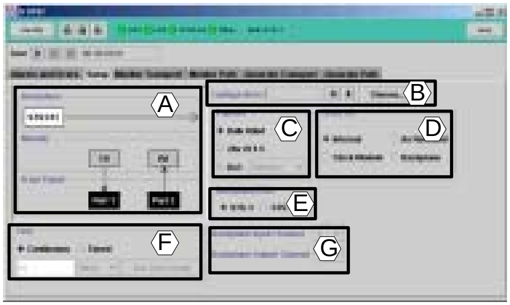
I **Monitor Path**—Monitor pointer moves and the J1 trace message, and select the channel, PRBS pattern, and framing mode of the monitored signal, as described in “Monitor Path” on page 273

J **Generate Transport**—Configure section and line alarm and error generation, and J0 trace message insertion, as described in “Generate Transport” on page 260

K **Generate Path**—Configure path alarm and error generation, J1 trace message insertion, framing modes, data patterns, and pointer moves, as described in “Generate Path” on page 262

STS-1 Setup

Use the **Setup** tab to define the basic properties of the STS-1 Transceiver and its generated and monitored signals, as described below. These settings are explained in more detail in the following sections.



A View current input and output from the backplane and front panel. This is view is changed by using the Configuration control.

B Configure the source and output for generated and monitored signals, as described in “Configurations” on page 280.

C Define the STS-1 payload, as described in “STS-1 Payload” on page 247.

D Select the clock source for the transmitted STS-1 signal, as described in “Clock Source” on page 247.

E Select the rate of the backplane signal that the STS-1 transceiver will monitor, add to, or drop from, as described in “Backplane Rate” on page 248.

F Set up and control test monitoring, as described in “Test” on page 249.

G Select the STS-1 signal to use for input to and output from the EPX chassis backplane, as described in “Backplane Channels” on page 249.

STS-1 Payload

The **Payload** area defines the payload generated and monitored by the STS-1 transceiver. The STS-1 payload may be bulk filled or mapped with DS3 or DS1 data (either as part of DS3 or VT1.5 structures). Bit Error Rate Testing (BERT) can be performed at the STS-1, DS3, VT1.5, or DS1 levels. After selecting

The STS-1 transmitter fills the entire payload with data patterns, including the fixed stuffed columns (columns 30 and 59).

Payload Setting	Description
Bulk filled	The STS-1 payload is filled with the selected STS-1 payload pattern. This is a clear channel pattern for the STS-1 payload. The pattern may be user defined or a PRBS pattern. See “Data Pattern” on page 264.
28 VT1.5	The STS-1 payload is mapped with 28 VT1.5/DS1 payloads (using asychronous byte mapping).
DS3	The STS-1 payload is mapped with a DS3 payload (using asychronous byte mapping). The DS3 can have one of the payloads: • **Bulk filled**—The DS3 payload is filled with the selected DS3 payload pattern. This is a clear channel pattern for the DS3 payload. • **28 DS1**—The DS3 payload is mapped with 28 DS1 payload patterns.
SCPI Examples:	

```
SENS(@7)PAYL:MODE BULK
SENS(@7)PAYL:MODE VT15
SENS(@7)PAYL:MODE DS3
SENS(@7)PAYL:DS3:MODE CHAN
```

Clock Source

The Clock Source setting selects the clock source, or timing reference, that the payload generator uses to generate the SONET payload. You can specify whether timing reference is provided by the EPX Clock module in slot 1, by the STS-1 module oscillator, or from a different source.

Clock Source Setting	Description
Internal	The generator gets its timing reference from the oscillator (+/-4.6 ppm) on the STS1 module.
As Received	The generator gets its timing reference from the signal that is received on the STS-1 receiver port.
Clock Module	The generator gets its timing reference from the EPX Test System's EPX100 Clock Module in slot 1. The clock module must be configured to transmit the appropriate timing reference.
Backplane	The module gets its timing reference from the backplane. This is a signal put on the backplane by an upstream module. Modules must have no open slots among them for signals to pass along the backplane.

SCPI Examples:

```
SOUR(@7):CLOC  INT
SOUR(@7):CLOC  LOOP
SOUR(@7):CLOC  CLKB
SOUR(@7):CLOC  BACK
```

Related Topics

"Configuring the EPX100 Clock Module" on page 25

Backplane Rate

The Backplane Rate area selects an STS-3 or STS-12 signal rate. This rate is used whenever monitoring a signal from the backplane or transmitting a signal to the backplane. The STS-1 can only add or drop STS-1 signals from an STS-3 or STS-12 signal on the backplane.

Note Only path information is monitored or transmitted when using the backplane with the STS-1 transceiver.

Backplane Rate	Description
STS-3	The signal on the EPX backplane is an STS-3 signal.
STS-12	The signal on the EPX backplane is an STS-12 signal.

SCPI Examples:

```
SYST:BOAR(@7):BACK:STS:RATE  STS3
SYST:BOAR(@7):BACK:STS:RATE  STS12
```

Related Topics

"Backplane Channels" on page 249

Test

The Test area defines the type and duration of the test that the receiver runs. To start and stop tests, use the controls in the module window or, to start tests for multiple modules, use the Test Controls window. See "Controlling Tests" on page 115.

Note Selecting a new test type automatically stops the current test.

Test Setting	Description
Continuous	Selects a continuous test that must be manually stopped and started. This is the default setting in the factory configuration.
Timed	Selects a timed test. When Timed is selected: **1** Specify a number and select a unit (seconds, minutes, hours, and days) for the test duration. **2** Click **Set** to apply the settings. **3** Use the controls at the top of the window to start the test. **Note** If you enable logging and are saving the log file to the EPX Test System, gnubi advises you to limit the test period to a maximum of 72 hours (3 days).

Test Setting	Description

SCPI Examples:
`sens(@3):test:type cont`
`sens(@3):test:type tim`
`sens(@3):test:unit min`
`sens(@3):test:per 10`
To control tests use the following commands:
`sens(@3):test:mode star`
`sens(@3):test:mode stop`
`sens(@3):test:mode rest`
`sens(@3):test:mode pause`
Related Topics:
"Logging" on page 63
"Controlling Tests" on page 115	

Backplane Channels

The Backplane Input and Output Channels area selects which STS-1 channel from the backplane signal is dropped or added. These features are only available when the STS-1 Transceiver is transmitting to or monitoring from the EPX backplane, as described in "Configurations" on page 280.

Input/Output Backplane Channel	Description
ALL	All channels are selected for output to the EPX backplane.

Input/Output Backplane Channel	Description
1-3	A channel between 1 and 3 is selected for input from or output to the EPX backplane. This range is only available if the rate of the backplane signal is selected as STS-3.
1-12	A channel between 1 and 12 is selected for input from or output to the EPX backplane. This range is only available if the rate of the backplane signal is selected as STS-12.

SCPI Examples:

```
SYST:BOAR(@7):BACK:STS:INP:CHAN  2
SYST:BOAR(@7):BACK:STS:OUTP:CHAN  4
```

Related Topics

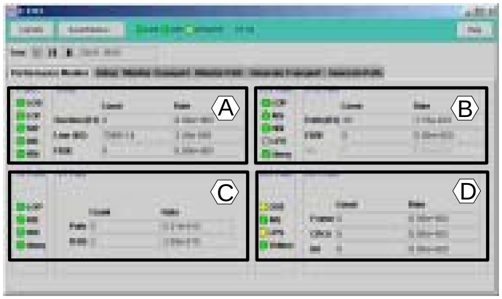
“Backplane Rate” on page 248

“Configurations” on page 280

Alarms and Errors

The **Alarms and Errors** tab displays alarm status indicators, error counts, and error ratios for the current test.

The following figure shows the main features of the STS-1 module **Alarms and Errors** tab.



A View alarm status and error counts and ratios for the STS-1 transport. See “STS-1 Transport Alarms” on page 250 and “STS-1 Transport Errors” on page 252.

B View alarm status and error counts and ratios for the STS-1 path. See “STS-1 Path Alarms” on page 252 and “DS3 Path Errors” on page 255.

C View alarm status and error counts and ratios for the DS3 or VT1.5. See “DS3 Path Alarms” on page 254 and “VT1.5 Path Errors” on page 257.

D View alarm status and error counts and ratios for the DS1. See “DS1 Path Alarms” on page 258 and “DS1 Path Errors” on page 259.

STS-1 Transport Alarms

The **Trans.** area displays status for the current test. This is status only for alarms in the transport overhead of the STS-1 signal.

Alarm indicator colors are defined in the following table. Once a test is restarted, the alarm history is cleared.

Note If an alarm is greyed out in this view, it means that alarm does not apply to the current test configuration.

Green	Yellow	Red
No alarms are detected: signal is clear, or monitoring is not started.	Alarm history: an alarm was detected but is not active in the current test.	An alarm is active and currently detected on the monitored signal.

The following alarms can be monitored.

Alarm Indicator	Description
LOS	Monitors status of Loss of Signal (LOS) alarm. LOS is declared when voltage is insufficient or has not had any data transitions for 2.4 mircroseconds or more.
LOF	Monitors status of Loss of Frame (LOF) alarm. LOF is declared when SEF is present for 3 or more microseconds.
SEF	Monitors status of Severely Errored Frame (SEF) alarm. SEF is declared when framing pattern errors persist for 4-32 frames.
AIS	Monitor status of AIS-L (Line Alarm Indication Signal) alarm. AIS-L is declared when bits 6, 7, and 8 of the K2 byte contain a 111 pattern for at least five consecutive frames. AIS-L is cleared when bits 6, 7, and 8 have a pattern other than 111 for five consecutive frames. AIS-L triggers the following alarms: OOF (DS3 and DS1), AIS (DS1), and LPS (DS1).
RDI	Monitor status of RDI-L (Line Remote Defect Indication) alarm. RDI-L is declared when bits 6, 7, and 8 of the K2 byte contain a 110 pattern for at least five consecutive frames. RDI-L is cleared when bits 6, 7, and 8 have a pattern other than 110 for five consecutive frames. RDI-L triggers no alarms in the DS3, VT1.5, and DS1 channels.

SCPI Examples:
`SENS(@8):TRAN:ALAR:LINE?`
`SENS(@8):TRAN:ALAR:LPS?`	

STS-1 Transport Errors

The **Trans.** area displays error counts and ratios for the current test. This is status only for errors in the transport overhead of the STS-1 signal.

The error data is cumulative. To get data for intervals, see “Logging” on page 63. Once a test is restarted, the error history is cleared.

Error Type or Setting	Description
Section	An error in the B1 byte of the section overhead This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B1 section parity byte.
Line	An error in the B2 byte of the line overhead This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B2 line parity byte.
FEBE	An error in the 5-8 bits of the M0 byte of the line overhead

SCPI Examples:

```
SENS(@1:18):TRANS:ERR:COUN:SECT?
SENS(@1:18):TRANS:ERR:COUN:LINE?
SENS(@1:18):TRANS:ERR:RAT:SECT?
SENS(@1:18):TRANS:ERR:RAT:LINE?
```

STS-1 Path Alarms

The **STS Path** area displays status for the current test. This is status only for alarms in the path overhead of the STS-1 signal.

Alarm indicator colors are defined in the following table. Once a test is restarted, the alarm history is cleared.

Note If an alarm is greyed out in this view, it means that alarm does not apply to the current test configuration.

Green	Yellow	Red
No alarms are detected: signal is clear, or monitoring is not started.	Alarm history: an alarm was detected but is not active in the current test.	An alarm is active and currently detected on the monitored signal.

The following alarms can be monitored.

Alarm Indicator	Description
LOP	An LOP (Loss of Pointer) alarm status is monitored. LOP is declared when an invalid pointer or asserted NDF signal persists for 10 or more consecutive frames. LOP clears when a valid pointer with a normal NDF signal persists for 3 consecutive frames.

Alarm Indicator	Description
AIS	An AIS-P (Path Alarm Indication Signal) alarm status is monitored. AIS-P is declared when an all-ones pattern is received in the H1 and H2 bytes for three consecutive frames. AIS-P clears when the H1 and H2 bytes have a valid STS pointer with NDF set to 1001 or have a valid identical STS pointer with normal NDF for three consecutive frames.
RDI	An RDI-P (Path Remote Defect Indication) alarm status is monitored. RDI-P is declared when bits 5, 6, and 7 of the G1 byte are set to non-zero values for 5-10 consecutive frames. RDI-P clears when bits 5, 6, and 7 have 0 for 5-10 conecutive frames.
LPS	An LPS (Loss of Pattern Synchronization) alarm status is monitored. LPS is only available when the STS-1 payload is bulk filled. LPS is declared when the received error rate is too high , indicating that a selected pattern cannot be matched for the received payload. LPS is cleared when four consecutive bytes match the expected receive data pattern.
Uneq	An UNEQ (Unequipped) alarm status is monitored. UNEQ is declared when C2 labels that indicate an unequipped payload type have been received for five consecutive frames. UNEQ is cleared when non-unequipped C2 signal labels are received for five consecutive frames.

SCPI Examples:

```
SENS(@2):PAYL:STS:ALAR:AIS?
SENS(@2):PAYL:STS:ALAR:LPS?
```

STS-1 Path Errors

The **STS Path** area displays error counts and ratios for the current test. This is status only for errors in the path overhead of the STS-1 signal.

The error data is cumulative. To get data for intervals, see “Logging” on page 63. Once a test is restarted, the error history is cleared.

Error Type or Setting	Description
Path	An error in the B3 byte of the path overhead This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B3 path parity byte.

Error Type or Setting	Description
FEBE	An error in bits 1-4 of the G1 byte for the STS-1 SPE
Bit	An error in a bit of the payload so that the received payload does not match the expected pattern This error is not counted when LPS is active. Payload bit errors are only available when the payload is an STS-1 bulk filled payload.

SCPI Examples:
`SENS(@2):PAYL:STS:ERR:COUN:PATH?`
`SENS(@2):PAYL:STS:ERR:COUN:FEBE?`
`SENS(@2):PAYL:STS:ERR:RAT:PATH?`
`SENS(@2):PAYL:STS:ERR:RAT:FEBE?`
Related Topics
"STS-1 Payload" on page 247	

DS3 Path Alarms

The **DS3 Path** area displays status for the current test. This is status only for alarms in the path overhead of the DS3 signal. This area is only available when the payload is set to DS3, as described in "STS-1 Payload" on page 247.

Alarm indicator colors are defined in the following table. Once a test is restarted, the alarm history is cleared.

Note If an alarm is greyed out in this view, it means that alarm does not apply to the current test configuration.

Green	Yellow	Red
No alarms are detected: signal is clear, or monitoring is not started.	Alarm history: an alarm was detected but is not active in the current test.	An alarm is active and currently detected on the monitored signal.

The following alarms can be monitored.

Alarm Indicator	Description
OOF	The status of the OOF (Out of Frame) alarm is monitored. LPS is declared when 3 of 16 consecutive F bits or 3 of 4 M bits are in error.
AIS	The status of the AIS (Alarm Indication Signal) alarm is monitored. AIS is declared when all the C bits in a DS3 frame are set to 0, both X bits are set to 1, and the payload pattern is 1010 for more than 2.2 microseconds. AIS is cleared when any of the three conditions are not present.

Alarm Indicator	Description
Yellow	The status of the Yellow (RDI) alarm is monitored. Yellow is declared when both X bits are set to 0 for more than 2.2 microseconds. Yellow is cleared immediately when the condition is not present.
IDLE	The status of the IDLE alarm is monitored. IDLE is declared when the C and M bits for subframe three are set to 0, X bits are set to 1, and the payload pattern is a repeating 1100 synchronized to the framing bits for more than 2.2 microseconds. IDLE is cleared immediately when any of the conditions is not present.
LPS	The status of the LPS (Loss of Pattern Synchronization) alarm is monitored. LPS is declared when the received error rate is too high , indicating that a selected pattern cannot be matched for the received payload.

SCPI Examples:

```
SOUR(@2):PAYL:DS3:ALAR OFF
SOUR(@2):PAYL:DS3:ALAR LPS?
```

Related Topics

“STS-1 Payload” on page 247

DS3 Path Errors

The **DS3 Path** area displays error counts and ratios for the current test. This is status only for errors in the path overhead of the DS3 signal. This area is only available when the payload is set to DS3, as described in “STS-1 Payload” on page 247.

The error data is cumulative. To get data for intervals, see “Logging” on page 63. Once a test is restarted, the error history is cleared.

Error Type	Description
Frame	An error when the expected frame bit does not match the received frame bit.
FEBE	An error (in the M bit, F bit, or CP bit) indicated when the three C bits of subframe four are set to a non-111 pattern. The three C bits are designated for Far-End Block Error.
PBit	An error when the recovered parity bit does not match the calculated parity of the previous DS3 frame.
CPBit	An error when the recovered CP-bits (majority voting among the three bits) do not match the calculated path parity of the previous DS3 frame. This error is only available when the DS3 framing mode is CBIT.

Error Type	Description
Bit	An error in a bit of the payload so that the received payload does not match the expected pattern This error is not counted when LPS is active. This error is only available when the STS-1 payload is set to a bulk-filled DS3.

SCPI Examples:

```
SENS(@2):PAYL:DS3:ERR:COUN:BIT?
SENS(@2):PAYL:DS3:ERR:COUN:FEBE?
SENS(@2):PAYL:DS3:ERR:RAT:BIT?
SENS(@2):PAYL:DS3:ERR:RAT:FEBE?
```

Related Topics

“STS-1 Payload” on page 247

VT1.5 Path Alarms

The **VT Path** area displays status for the current test. This is status only for alarms in the path overhead of the VT1.5 signal. This area is only available when the payload is set to VT1.5, as described in “STS-1 Payload” on page 247.

Alarm indicator colors are defined in the following table. Once a test is restarted, the alarm history is cleared.

Note If an alarm is greyed out in this view, it means that alarm does not apply to the current test configuration.

Green	Yellow	Red
No alarms are detected: signal is clear, or monitoring is not started.	Alarm history: an alarm was detected but is not active in the current test.	An alarm is active and currently detected on the monitored signal.

The following alarms can be monitored.

Alarm	Description
LOP	The status of LOP-V (Loss of Pointer) alarm is monitored. LOP-V is declared when an invalid pointer (V1 and V2 bytes) or asserted NDF signal persists for 10 consecutive VT frames. LOP-V is cleared when a valid pointer with a normal NDF signal persists for three consecutive VT frames.

Alarm	Description
AIS	The status of VT1.5 AIS-V (Alarm Indication Signal) alarm is monitored. AIS-V is declared when an all-ones pattern is received in the V1 and V2 bytes in three consecutive VT super-frames. AIS-V is cleared when the V1 and V2 bytes have a valid VT pointer with NDF set to 1001 or have valid identical VT pointers with normal NDF for three consecutive VT super-frames.
RDI	The RDI-V (VT1.5 Remote Defection Indication) alarm status is monitored. RDI-V is declared when the same signal (in bit 8 of the V5 byte) is received for 5-10 consecutive super-frames. RDI-V is cleared when bit 8 of the V5 byte has a zero in 5-10 consecutive VT super-frames.
UNEQ	The status of the UNEQ-V (VT1.5 Unequipped) alarm is monitored. UNEQ-V is declared when five consecutive super-frames with VT signal labels that indicate an unequipped payload type are received. UNEQ-V is cleared when five consecutive frames with non-unequipped VT signal labels are received.

SCPI Examples:

```
SENS(@2):PAYL:VT15:ALAR:OOF?
SENS(@2):PAYL:VT15:ALAR:LPS?
SENS(@2):PAYL:VT15:ALAR:AIS?
```

Related Topics

“STS-1 Payload” on page 247

VT1.5 Path Errors

The **VT Path** area displays error counts and ratios for the current test. This is status only for errors in the path overhead of the VT1.5 signal. This area is only available when the payload is set to VT1.5, as described in “STS-1 Payload” on page 247.

The error data is cumulative. To get data for intervals, see “Logging” on page 63. Once a test is restarted, the error history is cleared.

Error Type	Description
Path	An error in bits 1 and 2 of the V5 byte of the selected VT1.5.
FEBE	An error in bit 3 of the V5 byte of the selected VT1.5.

SCPI Examples:

```
SENS(@2):PAYL:VT15:ERR:COUN:PATH?
SENS(@2):PAYL:VT15:ERR:COUN:FEBE?
SENS(@2):PAYL:VT15:ERR:RAT:PATH?
SENS(@2):PAYL:VT15:ERR:RAT:FEBE?
```

Related Topics

“STS-1 Payload” on page 247

DS1 Path Alarms

The **DS1 Path** area displays status for the current test. This is status only for alarms in the path overhead of the DS1 signal. This area is only available when the payload is set to channelized (28 DS1) DS3 or to VT1.5, as described in “STS-1 Payload” on page 247.

Alarm indicator colors are defined in the following table. Once a test is restarted, the alarm history is cleared.

Note If an alarm is greyed out in this view, it means that alarm does not apply to the current test configuration.

Green	Yellow	Red
No alarms are detected: signal is clear, or monitoring is not started.	Alarm history: an alarm was detected but is not active in the current test.	An alarm is active and currently detected on the monitored signal.

The following alarms can be monitored.

Alarm	Description
OOF	The status of the DS1 OOF (Out of Frame) alarm is monitored. OOF is declared when two or more of four consecutive frames have bit errors during a 40 microsecond interval. OOF is cleared when the condition is not present. This alarm is not available when the DS1 framing mode is set to Unframed.
AIS	The status of the DS1 AIS (Alarm Indication Signal) alarm status is monitored. AIS is declared when an out of frame condition persists for 60 microseconds and the received PCM data stream is not logic 0 for 126 or fewer times. AIS is cleared when the condition is not present.
LPS	The status of the DS1 LPS (Loss of Pattern Synchronization) alarm is monitored. LPS is declared when the received error rate is too high , indicating that a selected pattern cannot be matched for the received payload. LPS is cleared when the receiver matches six consecutive expected bit patterns.

Alarm	Description
Yellow	The status of the DS1 Yellow (RDI) alarm is monitored. Yellow is declared for SF mode when bit 2 of each channel is not logic 0 for 16 or fewer times in an 40 microsecond interval. Yellow is declared for ESF mode when the 16-bit yellow bit-oriented code is received error-free eight or fewer times during an interval. Yellow is cleared when the condition is not present. This alarm is not available when the DS1 framing mode is set to Unframed.

SCPI Examples:

```
SENS(@2):PAYL:DS1:ALAR:OOF?
SENS(@2):PAYL:DS1:ALAR:LPS?
SENS(@2):PAYL:DS1:ALAR:AIS?
```

Related Topics

"STS-1 Payload" on page 247

DS1 Path Errors

The **DS1 Path** area displays error counts and ratios for the current test. This is status only for errors in the path overhead of the DS1 signal. This area is only available when the payload is set to channelized (28 DS1) DS3 or to VT1.5, as described in "STS-1 Payload" on page 247.

The error data is cumulative. To get data for intervals, see "Logging" on page 63. Once a test is restarted, the error history is cleared.

Error Type	Description
Frame	An error when the expected frame bit does not match the received frame bit. This error is not available when the DS1 framing mode is set to Unframed.
CRC6	An error that results when the calculated CRC-6 value (a 4-bit value calculated over four frames) does not match the received CRC-6 value. This error is only available when the DS1 framing mode is set to ESF.
Bit	An error in a bit of the DS1 payload so that the received payload does not match the expected pattern This error is not counted when LPS is active.

SCPI Examples:

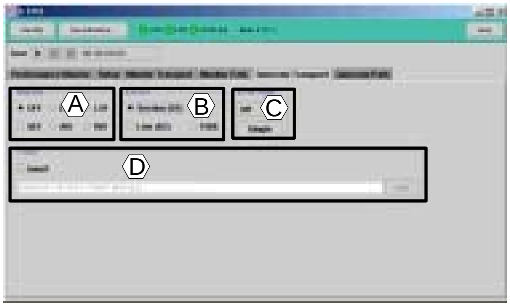
```
SENS(@2):PAYL:DS1:ERR:COUN:FRAM?
SENS(@2):PAYL:DS1:ERR:COUN:CRC6?
SENS(@2):PAYL:DS1:ERR:COUN:BIT?
SENS(@2):PAYL:DS1:ERR:RAT:FRAM?
SENS(@2):PAYL:DS1:ERR:RAT:CRC6?
SENS(@2):PAYL:DS1:ERR:RAT:BIT?
```

Related Topics

"STS-1 Payload" on page 247

Generate Transport

The **Generate Transport** tab defines the transport overhead of the transmitted STS-1 signal, as described below. The **Generate Transport** options are always available and are described in the following sections.



A Insert alarms into the transmitted transport overhead, as described in “Alarms” on page 260.

B Select the type of error to insert, as described in “Errors” on page 261.

C Insert errors into the transmitted transport overhead at a rate or as a single error, as described in “Error Rate” on page 261.

D Insert and define a section (J0) trace message, as described in “Trace” on page 261.

Alarms

The **Alarms** area defines the type of alarm that is inserted into the section and line overhead of the transmitted STS-1 signal.

To insert alarms into the path, see “Alarms” on page 263.

Alarm Setting	Description
OFF	Transport alarm insertion is disabled.
LOS	Insert an LOS (Loss of Signal) alarm by sending data output to all zeroes.
LOF	Insert an LOF (Loss of Frame) alarm by asserting an SEF alarm for at least three microseconds.
SEF	Insert an SEF (Severely Errored Frame) alarm by asserting an invalid A1 or A2 bytes for 4-32 consecutive frames.
AIS	Insert a Line AIS (Alarm Indicator Signal) alarm by sending a valid sectin overhead and an all-ones pattern in the remainder of the SONET frame.
RDI	Insert a Line RDI alarm setting bits 6-8 of the K2 byte to 110 for at least five consecutive frames.

SCPI Examples:

```
SOUR(@1:18):TRAN:ALAR LOS
SOUR(@1:18):TRAN:ALAR SEF
SOUR(@1:18):TRAN:ALAR AIS
SOUR(@1:18):TRAN:ALAR RDI
SOUR(@1:18):TRAN:ALAR OFF
```

Errors

The **Errors** area defines the type of error that is inserted into the section and line overhead of the generated signal. Errors are inserted by invertings bits in the specified byte. To select path errors, see “Errors” on page 263.

Selecting an error type does not insert the error, as with the alarm feature. To insert errors, see “Error Rate” on page 261.

Error Type	Description
Section	An error in the B1 byte of the section overhead injected by inverting bits in the B1 parity byte.
Line	An error in the B2 byte of the line overhead injected by inverting bits in the B2 parity byte.
FEBE	An error in the 5-8 bits of the M0 byte of the line overhead

SCPI Examples:

```
SOUR(@1:18):TRANS:ERR:TYPE SECT
SOUR(@1:18):TRANS:ERR:TYPE LINE
```

Related Topics

“Error Rate” on page 261

Error Rate

The **Error Rate** area inserts errors of the defined type into the section and line overhead of the generated signal. Select an error ratio, or click **Single** to inject a single error.

Tip Select **Single** after you have started the test monitoring on the receiver.

Error Enable Setting	Description
OFF	No errors are inserted into the signal.
ALL	All eight bits within the specified parity byte are inverted to create errors in all bits.
1E-3 to 1E-9	Errors of a defined type are inserted at the selected rate.
Single	A single error of the selected type is inserted.

SCPI Examples:

```
SOUR(@1:18):TRANS:ERR:RAT OFF
SOUR(@1:18):TRANS:ERR:RAT ALL
SOUR(@1:18):TRANS:ERR:RAT R1E-5
SOUR(@1:18):TRANS:ERR:RAT SING
```

Related Topics

“Errors” on page 261

Trace

The **Trace** area defines a section trace message (in the J0 byte) and inserts the message into the generated signal.

Define a trace message up to 62 bytes long.

Note Two bytes are used for carriage return and line feed.

1 Check the **Insert** box.

2 Enter the message in the **Trace** field.

3 Click **Set**.

Note The trace message is defined but not inserted.

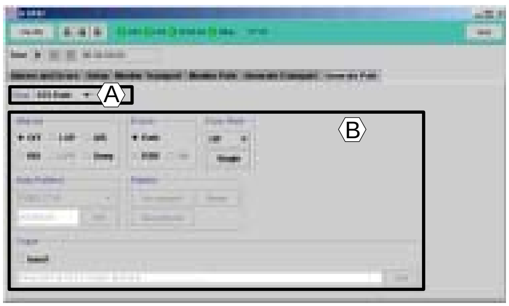
To enable J0 trace and insert a trace message using SCPI, use a pair of commands similar to the following:

```
SOUR:(@6):TRAN:TREN ON
SOUR:(@6):TRAN:TRAC “sts1 in slot 6”
```

Note When using SCPI, you must enclose the message in quotation marks. Otherwise, only the characters before the first space are used as the trace message.

Generate Path

The **Generate Path** tab defines the path overhead of the transmitted STS-1 signal, as described below. The contents of this tab depend on the type of STS-1 payload, as defined in “STS-1 Payload” on page 247.



A Select the path to define. The available rates depend on the defined STS-1 payload, as described in “STS-1 Payload” on page 247.

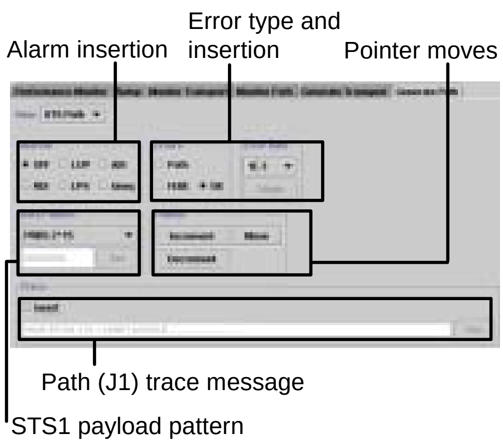
B Define the path of the selected rate.

- STS-1 path—See “STS Path” on page 262.
- DS3 path—“DS3 Path” on page 265
- VT1.5—“VT1.5 Path” on page 271
- DS1 path—“DS1 Path” on page 268

STS Path

The **STS Path** view defines the generated STS-1 payload and path overhead, including defect insertion.

The STS-1 view is always available and is described in the following sections. However, some features are available depending on how the payload is defined.



ALARMS

The **Alarms** area defines the type of alarm to insert into the path overhead of the transmitted STS-1 signal.

To insert alarms into the transport, see "Alarms" on page 260.

Alarm Setting	Description
OFF	Path alarm insertion is disabled.
LOP	An LOP-P (Path Loss of Pointer) alarm is inserted by generating continuously an illegal NDF bit setting.
AIS	An AIS-P (Path Alarm Indication Signal) alarm is inserted by setting the H1, H2, and H3 bytes and the entire STS-1 SPE to all ones.
RDI	An RDI-P (Path Remote Detection Indication) alarm is inserted by setting bit 5 of the G1 byte to 1.
LPS	An LPS (Loss of Pattern Synchronization) alarm is inserted by inserting bit errors above the acceptable maximum to match patterns (approximately 50%). This alarm is only available when the STS-1 payload is set to bulk filled.
UNEQ	An UNEQ (Unequipped) alarm is inserted by setting the C2 byte and the entire SPE (before scrambling) to 0 with a valid path overhead.

Alarm Setting	Description

SCPI Examples:
`SOUR(@2):PAYL:STS:ALAR OFF`
`SOUR(@2):PAYL:STS:ALAR LPS`	

ERRORS

The **Errors** area defines the type of error to insert into the path overhead of the generated signal. Errors are inserted by invertings bits in the specified byte.

To select transport errors, see "Errors" on page 261.

Selecting an error type does not insert the error, as with the alarm feature. To insert errors, see "Error Rate" on page 264.

Error Type	Description
Path	An error in the B3 byte of the path overhead injected by inverting bits in the B3 parity byte.
FEBE	An error in bits 1-4 of the G1 byte of the path overhead
Bit	An error in a bit of the payload Payload bit errors are only available when the payload is an STS-1 bulk filled payload.

Error Type	Description

SCPI Examples:
`SOUR(@2):PAYL:STS:ERR:TYPE PATH`
`SOUR(@2):PAYL:STS:ERR:TYPE FEBE`
`SOUR(@2):PAYL:STS:ERR:TYPE BIT`
Related Topics
“Error Rate” on page 264	

ERROR RATE

The **Error Rate** area inserts errors of the defined type into the section and line overhead of the generated signal. Select an error ratio, or click **Single** to inject a single error.

Tip Select **Single** after you have started the test monitoring on the receiver.

Error Enable Setting	Description
OFF	No errors are inserted into the signal.
ALL	All eight bits within the specified byte are inverted to create errors in all bits.
1E-3 to 1E-9	Errors of a defined type are inserted at the selected rate.

SCPI Examples:
`SOUR(@2):PAYL:STS:ERR:RAT OFF`
`SOUR(@2):PAYL:STS:ERR:RAT ALL`
`SOUR(@2):PAYL:STS:ERR:RAT R1E-5`
`SOUR(@2):PAYL:STS:ERR:RAT SING`
Related Topics
“Errors” on page 263	

DATA PATTERN

The **Data Pattern** area defines the payload, or data, pattern for the transmitted STS-1 signal. This area is only available when the STS-1 payload is bulk filled, as described in “STS-1 Payload” on page 247.

To specify a custom user-defined pattern, select **User**, specify an 8-bit binary pattern, and click **Set**.

The STS-1 payload pattern for transmit and receive can be set separately.

Payload Setting	Description
PRBS 2^{15}-1, 2^{20}-1, 2^{23}-1	A pseudo random bit sequence is defined for the STS-1 payload.
Inverted PRBS 2^{15}-1, 2^{20}-1, 2^{23}-1	An inverted pseudo random bit sequence is defined for the STS-1 payload.
11111111	A pattern of all ones is defined for the STS-1 payload.
00000000	A pattern of all zeroes is defined for the STS-1 payload.
10101010	A pattern of alternating 10 is defined for the STS-1 payload.
USER	A user pattern is defined for the STS-1 payload. A different command is used to define the pattern.
Set	If a custom user-defined payload pattern is defined, click **Set** to apply the changed user payload pattern.

Payload Setting	Description

SCPI Examples:
`SOUR(@2):PAYL:STS:PATT PR223`
`SOUR(@2):PAYL:STS:PATT IPR215`
`SOUR(@2):PAYL:STS:PATT USER`
`SOUR(@2):PAYL:STS:USER 0b01110111`
Related Topics
"STS-1 Payload" on page 247	

Moving Pointers

Use this area to move the pointer (in the H1 and H2 bytes) and the payload in the generated STS-1 signal. This feature is only available when the STS-1 payload is set to bulk filled, as defined in "STS-1 Payload" on page 247.

The default value of the generated pointer varies.

Note The STS-1 generator does not support missing NDF (MNDF) moves.

Pointer Action	Description
Increment	The pointer value is increased by one integer.
Decrement	The pointer value is decreased by one integer.
Move	The pointer value is moved with a new data flag (NDF). Moves with NDF alternate between increments and decrements.

Pointer Action	Description

SCPI Examples:
`SOUR(@2):PAYL:STS:POIN:ACT INCR`
`SOUR(@2):PAYL:STS:POIN:ACT NDF`
`SOUR(@2):PAYL:STS:POIN:ACT OFF`	

Trace

The **Trace** area defines a path trace message (in the J1 byte) and inserts the message into the generated signal.

Define a trace message up to 62 bytes long.

Note Two bytes are used for carriage return and line feed.

1 Check the **Insert** box.

2 Enter the message in the **Trace** field.

3 Click **Set**.

Note The trace message is defined but not inserted.

To enable J0 trace and insert a trace message using SCPI, use a pair of commands similar to the following:

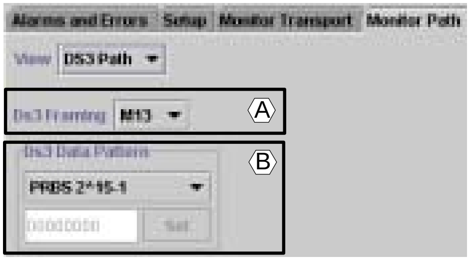
```
SOUR:(@6):PAYL:STS:TREN ON
SOUR:(@6):PAYL:STS:TRAC "sts1 in slot 6"
```

Note When using SCPI, you must enclose the message in quotation marks. Otherwise, only the characters before the first space are used as the trace message.

DS3 Path

The **DS3 Path** view defines the generated DS3 payload, including defect insertion.

The **DS3 Path** options are available when the STS-1 payload is a DS3 signal (bulk filled or mapped with DS1 signals), as defined in “STS-1 Payload” on page 247.



DS3 Framing

The **DS3 Framing** area sets the framing mode of the DS3 signal mapped into the generated STS-1 signal.

The DS3 frame has seven subframes called M subframes 1-7. The seven subframes are not the DS2 signals, which are bit interleaved.

Framing Setting	Description
M13	A DS3 payload is asynchronously mapped as defined in ANSI TI.107a.
CBIT	A DS3 payload is mapped asynchronously as defined in ANSI TI.107a.

SCPI Examples:

```
SOUR(@2):PAYL:DS3:FRAM M13
SOUR(@2):PAYL:DS3:FRAM CBIT
```

DS3 Alarms

The **DS3 Alarms** area defines the type of alarm inserted into the DS3 signal of the generated STS-1 signal.

Alarm Setting	Description
OFF	DS3 alarm insertion is disabled.
OOF	An OOF (Out of Frame) alarm is inserted by inverting at least 3 of 16 F bits in a DS3 frame continuously.
Yellow	A Yellow (RDI) alarm is inserted by setting both X bits to 0.
IDLE	An IDLE alarm is inserted by setting all C bits in subframe 3 to 0, all X bits to 1, and the payload bits to a 1100 pattern.
AIS	An AIS (Alarm Indication Signal) alarm is inserted by setting all C bits to 0, all X bits to 1, and the payload bits to a 1010 pattern.
LPS	An LPS (Loss of Pattern Synchronization) alarm is inserted by inserting bit errors above the acceptable maximum to match patterns (approximately 50%).

SCPI Examples:

```
SOUR(@2):PAYL:DS3:ALAR OFF
SOUR(@2):PAYL:DS3:ALAR LPS
```

DS3 Errors

The **DS3 Errors** area defines the type of error inserted into the DS3 signal of the generated STS-1 signal. Errors are inserted by inverting bits in the specified byte.

Selecting an error type does not insert the error, as with the alarm feature. To insert errors, see “DS3 Rate” on page 267.

Error Type	Description
PBit	An error injected by inverting both P bit of the DS3 signal (first bits in subframes 3 and 4)
CPBit	An error injected by inverting both CP bits of the DS3 subframe 3 This error type is only available when DS3 framing is set to CBIT.
Bit	An error injected by inverting payload bits Payload bit errors are only available when the DS3 payload is bulk filled.

SCPI Examples:

```
SOUR(@2):PAYL:DS3:ERR:TYPE PBIT
SOUR(@2):PAYL:DS3:ERR:TYPE CPB
SOUR(@2):PAYL:DS3:ERR:TYPE BIT
```

DS3 Rate

The **DS3 Errors** area inserts errors of the defined type into the section and line overhead of the generated signal. Select an error ratio, or click **Single** to inject a single error.

Tip Select **Single** after you have started the test monitoring on the receiver.

Error Enable Setting	Description
OFF	No errors are inserted into the signal.
1E-3 to 1E-6	Errors of a defined type are inserted at the selected rate. These options are only available for Bit errors.

SCPI Examples:

```
SOUR(@2):PAYL:DS3:ERR:RAT OFF
SOUR(@2):PAYL:DS3:ERR:RAT R1E-5
SOUR(@2):PAYL:DS3:ERR:RAT SING
```

Related Topics

“DS3 Rate” on page 267

DS3 Data Pattern

The **DS3 Data Pattern** area defines the DS3 data, or payload, pattern.

DS3 data patterns are only available when the DS3 is bulk filled, as defined in “STS-1 Payload” on page 247.

To specify a custom user-defined pattern, select **User**, specify an 8-bit binary pattern, and click **Set**.

The DS3 payload pattern for transmit and receive cannot be set separately. For example, if an all-ones pattern is selected for the DS3 transmit pattern, the DS3 receive pattern is automatically changed to all ones as well.

Payload Setting	Description
PRBS 2^{15}-1, 2^{20}-1, 2^{23}-1	A pseudo random bit sequence is defined for the DS3 payload.
Inverted PRBS 2^{15}-1, 2^{20}-1, 2^{23}-1	An inverted pseudo random bit sequence is defined for the DS3 payload.
00000000	An all zeroes pattern is inserted.
11111111	An all ones pattern is inserted.
10101010	An alternating 10 pattern is inserted.
USER	A user pattern is defined for the STS-1 payload. A different command is used to define the pattern.
Set	If a custom user-defined payload pattern is defined, click **Set** to apply the changed user payload pattern.

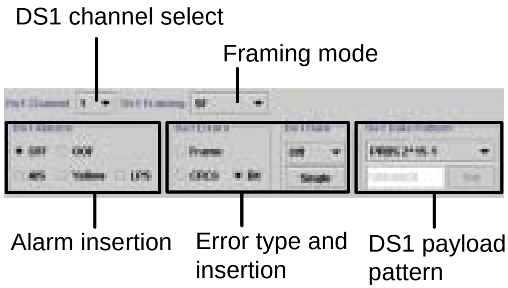
SCPI Examples:

```
SOUR(@2):PAYL:DS3:PATT:TYPE PR223
SOUR(@2):PAYL:DS3:PATT:TYPE ONES
SOUR(@2):PAYL:DS3:PATT:TYPE USER
SOUR(@2):PAYL:DS3:PATT:USER 0b01110111
```

DS1 Path

The **DS1 Path** area defines the generated DS1 payload, including defect insertion.

These options are available when the STS-1 payload is either mapped with 28 VT1.5 channels or a channelized DS3, as defined in "STS-1 Payload" on page 247.



DS1 Channel

The **DS1 Channel** area defines how the DS3 payload is mapped with DS1 channels.

DS1 channel options are only available when the DS3 is channelized, or mapped with 28 DS1 channels, as defined in "STS-1 Payload" on page 247.

Channel Setting	Description
1-28	The DS1 (defined in "DS1 Path" on page 268) is inserted into one of 28 channels.
All	The DS1 (defined in "DS1 Path" on page 268) is inserted into all 28 channels of the DS3 signal.

Channel Setting	Description

SCPI Examples:
`SOUR(@2):PAYL:DS3:MODE UNCH`
`SOUR(@2):PAYL:DS3:MODE BRO`
`SOUR(@2):PAYL:DS3:MODE CHAN`
`SOUR(@2):PAYL:DS3:CHAN 3`
Related Topics
“STS-1 Payload” on page 247	

DS1 Framing

The **DS1 Framing** area defines how the DS1 signal is framed. The framing mode determines what types of alarms and errors are available.

Payload Setting	Description
SF	The DS1 signal uses superframing. The DS1 signal is composed of 12 frames, each with a framing bit.
ESF	The DS1 signal uses extended superframing. The DS1 signal is composed of 24 frames, each with a framing bit used for framing, data link statistics, and CRC.
Unframed	The DS1 signal uses no framing. Only AIS and LPS alarms and bit errors are available.

SCPI Examples:
`SOUR(@2):PAYL:DS1:FRAM SF`
`SOUR(@2):PAYL:DS1:FRAM ESF`
`SOUR(@2):PAYL:DS1:FRAM UNFR`	

DS1 Alarms

The **DS1 Alarms** area defines the type of alarm to insert into the generated DS1 payload, including defect insertion.

Alarm Setting	Description
OFF	Path alarm insertion is disabled.
OOF	An OOF (Out of Frame) alarm is inserted by injecting 2 or more of 4 consecutive frame bit errors during a 40 microsecond interval. This alarm is not available in unframed DS1 mode.
Yellow	A Yellow (RDI) alarm is inserted in two ways for SF and ESF modes. For SF mode, bit 2 of each channel is not logic 0 for 16 or fewer times during a 40 microsecond interval. Bit 1 is the first transmitted (MSB). Bit 2 is the second MSB. For ESF mode, the 16-bit yellow-bit-oriented code is received error free eight or more times during the interval with the 4 kHz data link. This alarm is not available in unframed DS1 mode.
AIS	An AIS (Alarm Indication Signal) alarm is inserted by setting all DS1 bits to 1.
LPS	An LPS (Loss of Pattern Synchronization) alarm is inserted by transmitting a different pattern than the set pattern.

Alarm Setting	Description

SCPI Examples:
`SOUR(@2):PAYL:DS1:ALAR OFF`
`SOUR(@2):PAYL:DS1:ALAR LPS`	

DS1 Errors

The **DS1 Errors** area defines the type of error to insert into the path overhead of the generated signal. Errors are inserted by invertings bits in the specified byte.

Selecting an error type does not insert the error, as with the alarm feature. To insert errors, see “DS1 Rate” on page 270.

Error Type	Description
Frame	An error in the framing bit. This alarm is not available in unframed DS1 mode.
CRC6	An error in one of the six bits that are used for payload block error detection (cyclic redundancy check). This alarm is only available in DS1 ESF framing mode.
Bit	An error injected by inverting DS1 payload bits

SCPI Examples:
`SOUR(@2):PAYL:DS1:ERR:TYPE FRAM`
`SOUR(@2):PAYL:DS1:ERR:TYPE CRC6`
`SOUR(@2):PAYL:DS1:ERR:TYPE BIT`	

DS1 Rate

The **DS1 Rate** area inserts errors of the defined type into the generated DS1 channel. Select an error ratio, or click **Single** to inject a single error.

Tip Select **Single** after you have started the test monitoring on the receiver.

Error Enable Setting	Description
OFF	No errors are inserted into the signal.
1E-3 to 1E-9	Errors of a defined type are inserted at the selected rate.

SCPI Examples:
`SOUR(@2):PAYL:DS1:ERR:RAT OFF`
`SOUR(@2):PAYL:DS1:ERR:RAT R1E-5`
`SOUR(@2):PAYL:DS1:ERR:RAT SING`	

DS1 Data Pattern

The **DS1 Data Pattern** area defines the type of pattern inserted as fill data for the DS1 payload.

The DS1 payload pattern for transmit and receive can be set separately.

Payload Setting	Description
PRBS 2^{15}-1, 2^{20}-1, 2^{23}-1	A pseudo random bit sequence is defined for the DS1 payload.

Payload Setting	Description
Inverted PRBS 2^{15}-1, 2^{20}-1, 2^{23}-1	An inverted pseudo random bit sequence is defined for the DS1 payload.
00000000	An all zeroes pattern is inserted.
11111111	An all ones pattern is inserted.
10101010	An alternating 10 pattern is inserted.
11001100	An alternating 1100 pattern is inserted.
QRSS	The quasi random sequence signal is a 1,048,575 bit sequence with a 2^{20}-1 pattern. On average, the QRSS pattern is 50% ones.
DALY	Also known as 55 Octet, this pattern changes between low and high density octets and uses rapid 1010 transitions.
1of8	This pattern uses seven consecutive zeroes.
2of8	In this pattern, two of the eight bits are ones, and the other six bits are zeroes.
1of16	In this pattern, the first bit is 1 and the remaining 15 bits are 0.
3of24	This pattern uses a minimum of ones and a maximum of 15 consecutive zeroes.
USER	A user pattern is defined for the DS1 payload. A different command is used to define the pattern.

Payload Setting	Description
Set	If a custom user-defined payload pattern is defined, click **Set** to apply the changed user payload pattern.

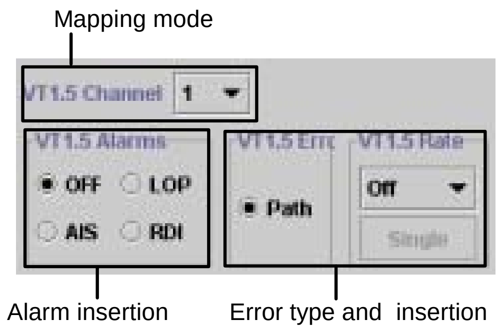
SCPI Examples:

```
SOUR(@2):PAYL:DS1:PATT:TYPE PR223
SOUR(@2):PAYL:DS1:PATT:TYPE 3of24
SOUR(@2):PAYL:DS1:PATT:TYPE USER
SOUR(@2):PAYL:DS1:PATT:USER 0b01110111
```

VT1.5 Path

The **VT1.5 Path** area defines the generated VT1.5 payload, including defect insertion.

The VT1.5 options are available when the payload is mapped with 28 VT1.5 channels, as defined in “STS-1 Payload” on page 247.



VT1.5 Channel

The **VT1.5 Channel** area defines how the generated VT1.5 channel is mapped into the STS-1 signal.

- **Selected**—Insert the VT1.5 signal that you configure into a selected channel of the STS-1 signal.
- **Broadcast**—Insert the VT1.5 signal that you configure into all 28 channels of the STS-1 signal.
- **Channel**—Select one of 28 channels into which to insert the VT1.5 signal. This option is not available when broadcast is selected.

  SCPI Examples:

```
SOUR(@2):PAYL:VT15:MODE SEL
SOUR(@2):PAYL:VT15:CHAN 22
```

INSERTING VT1.5 ALARMS

The **VT1.5 Alarms** area defines the type of alarm to insert into the path overhead of the transmitted signal. To insert alarms into the transport, see “Alarms” on page 260.

Alarm Setting	Description
OFF	VT1.5 payload alarm insertion is disabled.
LOP	An LOP-V (VT1.5 Loss of Pointer) alarm is inserted generating an out-of-range pointer in the V1 and V2 bytes.
AIS	An AIS-V (VT1.5 Alarm Indication Signal) alarm is inserted generating an all-ones pattern in the V1, V2, V3, and V4 bytes and in the entire VT1.5 SPE.
RDI	An RDI-V (VT1.5 Remote Detection Indication) alarm is inserted by setting bit 8 of the V5 byte to 1 and bits 5-7 of the Z7 byte of the selected VT1.5 location.
UNEQ	An UNEQ-V (VT1.5 Unequipped) alarm is inserted.
SCPI Examples: SOUR(@2):PAYL:VT15:ALAR OFF SOUR(@2):PAYL:VT15:ALAR LPS	

SETTING VT1.5 ERRORS

The **VT1.5 Errors** area defines the type of error to insert into the path overhead of the generated signal. Errors are inserted by invertings bits in the specified byte. To select transport errors, see “Errors” on page 261.

Selecting an error type does not insert the error, as with the alarm feature. To insert errors, see “Error Rate” on page 264.

Error Type	Description
Path	An error caused by inverting bits 1 and 2 the V5 byte of the selected channel.
FEBE	An error injected by setting bit 3 of the V5 byte of the selected channel to 1.

Error Type	Description
SCPI Examples: SOUR(@2):PAYL:VT15:ERR:TYPE PATH SOUR(@2):PAYL:VT15:ERR:TYPE FEBE	

VT1.5 Rate

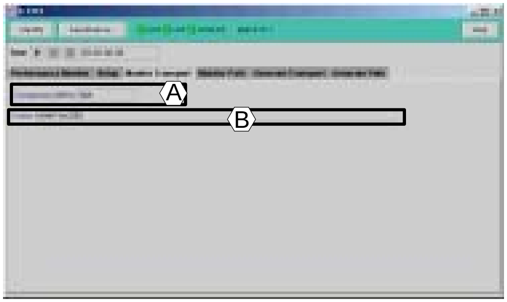
The **VT1.5 Path** area inserts errors of the defined type into the section and line overhead of the generated signal. Select an error ratio, or click **Single** to inject a single error.

Tip Select **Single** after you have started the test monitoring on the receiver.

Error Enable Setting	Description
OFF	No errors are inserted into the signal.
ALL	All selected bits within the V5 byte are inverted to create errors.
SCPI Examples: SOUR(@2):PAYL:VT15:ERR:RAT OFF SOUR(@2):PAYL:VT15:ERR:RAT ALL	

Monitor Transport

The **Monitor Transport** tab displays the transport properties of the received STS-1 signal., as described below. The STS-1 Transceiver can monitor only the transport of signals received on the front panel receiver port.



A Monitor the frequency (in Megahertz) of the incoming signal on the front panel.

SCPI Example:

```
INP(@8):FREQ?
```

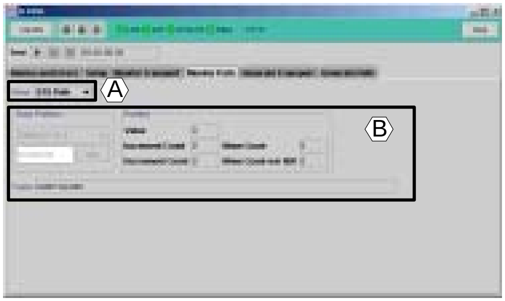
B Monitor the trace message in the STS-1 section overhead (J0 byte).

SCPI Example:

```
SENS(@8):TRAN:TRAC?
```

Monitor Path

The following figure illustrates the main areas on the STS-1 Transceiver **Monitor Path** tab.



A Select the type of signal to monitor. The available signals depend on the type of STS-1 payload that is defined in "STS-1 Payload" on page 247.

- Monitor STS-1 path data. This data is always available, regardless of payload as defined in "STS-1 Payload" on page 247. See "Monitoring STS-1 Path" on page 274.
- Monitor DS3 or VT1.5 data. The DS3 data is available when the payload is a DS3 signal (bulk filled or mapped with DS1 signals). The VT1.5 data is available when the payload is mapped with 28 VT1.5 channels.

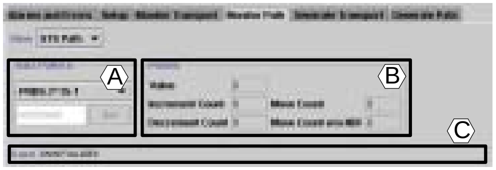
  See "Monitor DS3 Path" on page 275 and "Monitor VT1.5 Path" on page 277.
- Monitor DS1 data. This data is available when the payload is either mapped with 28 VT1.5 channels or a DS3 mapped with 28 DS1 signals.

  See "Monitor DS1 Path" on page 278.

B View path data for the selected signal.

Monitoring STS-1 Path

The following figure illustrates the areas on the STS-1 Transceiver **Monitor Path** tab for the STS-1 path.



A Select a data pattern for the monitored STS-1 payload, as described in "Monitored STS-1 Payload Pattern" on page 274.

B Monitor pointer actions in the STS-1 path, as described in "Monitored STS-1 Pointer Actions" on page 275.

C Monitor the trace message in the STS-1 path (J1 byte).

SCPI Example:

```
SENS(@8):PAYL:STS:TRAC?
```

Monitored STS-1 Payload Pattern

This option is only available when the STS-1 payload is bulk filled, as defined in "STS-1 Payload" on page 247.

The STS-1 payload pattern for transmit and receive can be set separately.

Payload Setting	Description
PRBS 2^{15}-1, 2^{20}-1, 2^{23}-1	A pseudo random bit sequence is defined for the STS-1 payload.
Inverted PRBS 2^{15}-1, 2^{20}-1, 2^{23}-1	An inverted pseudo random bit sequence is defined for the STS-1 payload.
11111111	A pattern of all ones is defined for the STS-1 payload.
00000000	A pattern of all zeroes is defined for the STS-1 payload.
10101010	A pattern of alternating 10 is defined for the STS-1 payload.
LIVE	A live signal is monitored. LPS alarm and Bit error counting are disabled while in this mode.
USER	A user pattern is defined for the STS-1 payload. A different command is used to define the pattern.
Set	If a custom user-defined payload pattern is defined, click **Set** to apply the changed user payload pattern.
SCPI Examples: SENS(@2):PAYL:STS:PATT PR223 SENS(@2):PAYL:STS:PATT IPR215 SENS(@2):PAYL:STS:PATT USER SENS(@2):PAYL:STS:USER 0b01110111	

Monitored STS-1 Pointer Actions

The pointer data is cumulative for the current test period. Once a test is restarted, the history of pointer actions is cleared.

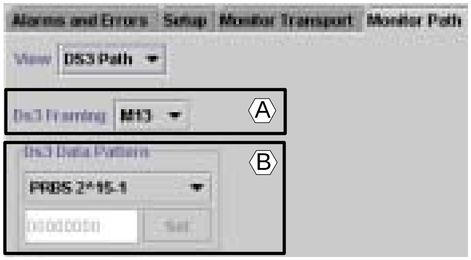
Action	Description
Value	The current location of the start of the STS-1 payload.
Increment Count	The number of pointer increments.
Decrement Count	The number of pointer decrements.
Move Count	The number of moves (increments or decrements) with a new data flag.
Move w/o NDF	The number of moves (increments or decrements) without a new data flag.
SCPI Examples: SENS(@2):PAYL:STS:POIN:VAL? SENS(@2):PAYL:STS:POIN:COUN:NDF? SENS(@2):PAYL:STS:POIN:COUN:MNDF?	

Monitor DS3 Path

The following figure illustrates the areas on the STS-1 Transceiver **Monitor Path** tab for the DS3 path.

The DS3 data is available when the payload is a DS3 signal (bulk filled or mapped with DS1 signals).

To view DS3 error and alarm status, use the Alarms and Errors tab, as described in “Alarms and Errors” on page 250.



A Select the DS3 framing, as described in “DS3 Framing” on page 276.

B Define the expected payload pattern of the monitored DS3, as described in “DS3 Payload Pattern” on page 276.

DS3 Framing

The DS3 Framing area sets the framing mode of the DS3 signal mapped into the generated STS-1 signal. If the DS3 is mapped with DS1 signals, then select the DS1 channel to monitor, as described in “Monitor DS1 Path” on page 278.

The DS3 frame has seven subframes called M subframes 1-7. The seven subframes are not the DS2 signals, which are bit interleaved.

Framing Setting	Description
M13	A DS3 payload is asynchronously mapped as defined in ANSI TI.107a.
CBIT	A DS3 payload is mapped asynchronously as defined in ANSI TI.107a.

SCPI Examples:

```
SOUR(@2):PAYL:DS3:FRAM M13
SOUR(@2):PAYL:DS3:FRAM CBIT
```

DS3 Payload Pattern

This option is only available when the DS3 payload is bulk filled, as defined in “STS-1 Payload” on page 247.

The DS3 payload pattern for transmit and receive cannot be set separately. For example, if an all-ones pattern is selected for the DS3 transmit pattern, the DS3 receive pattern is automatically changed to all ones as well.

Payload Setting	Description
PRBS 2^{15}-1, 2^{20}-1, 2^{23}-1	A pseudo random bit sequence is defined for the DS3 payload.
Inverted PRBS 2^{15}-1, 2^{20}-1, 2^{23}-1	An inverted pseudo random bit sequence is defined for the DS3 payload.
00000000	An all zeroes pattern is inserted.
11111111	An all ones pattern is inserted.
10101010	An alternating 10 pattern is inserted.

Payload Setting	Description
LIVE	A live signal is monitored. LPS alarm and Bit error counting are disabled while in this mode.
USER	A user pattern is defined for the STS-1 payload. A different command is used to define the pattern.
Set	If a custom user-defined payload pattern is defined, click **Set** to apply the changed user payload pattern.

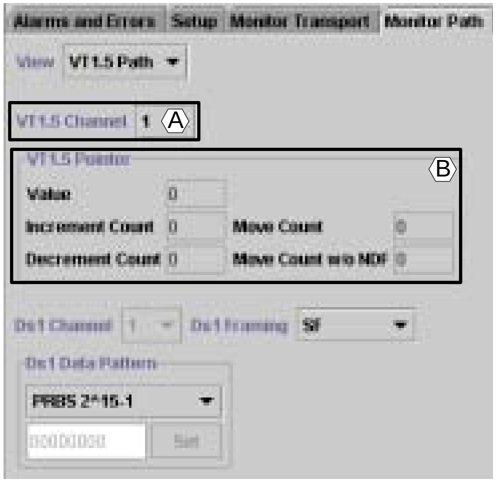
SCPI Examples:
`SOUR(@2):PAYL:DS3:PATT:TYPE PR223`
`SOUR(@2):PAYL:DS3:PATT:TYPE ONES`
`SOUR(@2):PAYL:DS3:PATT:TYPE USER`
`SOUR(@2):PAYL:DS3:PATT:USER 0b01110111`	

Monitor VT1.5 Path

The following figure illustrates the areas on the STS-1 Transceiver **Monitor Path** tab for the VT1.5 path.

The VT1.5 data is available when the payload is mapped with 28 VT1.2 signals.

To view VT1.5 error and alarm status, use the Alarms and Errors tab, as described in “VT1.5 Path Alarms” on page 256 and “VT1.5 Path Errors” on page 257.



A Select the VT1.5 channel to monitor, as described in “VT1.5 Channel Selection” on page 277.

B Monitor pointer actions in the VT1.5 channel, as described in “VT1.5 Pointer Actions” on page 277.

VT1.5 Channel Selection

Select one of the 28 VT1.5 channels to monitor.

The selected channels for VT1.5 generation and monitor can be set independently.

SCPI Example:

```
SENS(@10):PAYL:VT15:CHAN 2
```

VT1.5 Pointer Actions

The pointer data is cumulative for the current test period. Once a test is restarted, the history of pointer actions is cleared.

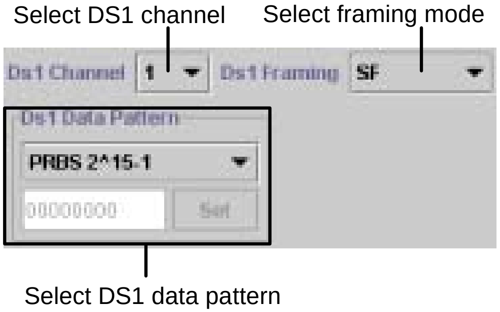
Action	Description
Value	The current location of the start of the VT payload.
Increment Count	The number of pointer increments.
Decrement Count	The number of pointer decrements.
Move Count	The number of moves (increments or decrements) with a new data flag.
Move Count w/o NDF	The number of moves (increments or decrements) without a new data flag.
SCPI Examples: SENS(@2):PAYL:VT15:POIN:VAL? SENS(@2):PAYL:VT15:POIN:COUN:NDF? SENS(@2):PAYL:VT15:POIN:COUN:MNDF?	

Monitor DS1 Path

The following figure illustrates the areas on the STS-1 Transceiver **Monitor Path** tab for the DS1 path.

The DS1 data is available when the payload is mapped with 28 VT1.2 signals or with a channelized DS3 signal.

To view DS1 error and alarm status, use the Alarms and Errors tab, as described in “DS1 Path Alarms” on page 258 and “DS1 Path Errors” on page 259.



A Select the DS1 channel to monitor, as described in “DS1 Channel” on page 278

B Select the DS1 framing, as described in “DS1 Framing” on page 279

C Define the expected payload pattern of the monitored DS1, , as described in “DS1 Data Pattern” on page 279

DS1 Channel

This option is only available when the STS-1 payload is mapped with a DS3 that is channelized with 28 DS1 signals.

Select one of the 28 DS1 channels to monitor.

The selected channels for DS1 generation and monitor can be set independently.

SCPI Example:

```
SENS(@10):PAYL:DS3:CHAN 2
```

DS1 Framing

The **DS1 Framing** area defines how the monitored DS1 signal is framed. The framing mode determines what types of alarms and errors are available.

Framing Setting	Description
SF	The DS1 signal uses superframing. The DS1 signal is composed of 12 frames, each with a framing bit. All alarm and error types are available.
ESF	The DS1 signal uses extended superframing. The DS1 signal is composed of 24 frames, each with a framing bit used for framing, data link statistics, and CRC. All alarms are available; frame and bit errors are available.
Unframed	The DS1 signal uses no framing. Only LPS and bit errors are available.

SCPI Examples:
`SENS(@2):PAYL:DS1:FRAM SF`
`SENS(@2):PAYL:DS1:FRAM ESF`
`SENS(@2):PAYL:DS1:FRAM UNFR`	

DS1 Data Pattern

The **DS1 Data Pattern** area defines the type of pattern monitored as fill data for the DS1 payload.

The DS1 payload pattern for transmit and receive can be set separately.

Payload Setting	Description
PRBS 2^{15}-1, 2^{20}-1, 2^{23}-1	A pseudo random bit sequence is defined for the DS1 payload.
Inverted PRBS 2^{15}-1, 2^{20}-1, 2^{23}-1	An inverted pseudo random bit sequence is defined for the DS1 payload.
00000000	An all zeroes pattern is inserted.
11111111	An all ones pattern is inserted.
10101010	An alternating 10 pattern is inserted.
11001100	An alternating 1100 pattern is inserted.
QRSS	The quasi random sequence signal is a 1,048,575 bit sequence with a 2^{20}-1 pattern. On average, the QRSS pattern is 50% ones.
DALY	Also known as 55 Octet, this pattern changes between low and high density octets and uses rapid 1010 transitions.
1of8	This pattern uses seven consecutive zeroes.
2of8	In this pattern, two of the eight bits are ones, and the other six bits are zeroes.
1of16	In this pattern, the first bit is 1 and the remaining 15 bits are 0.
3of24	This pattern uses a minimum of ones and a maximum of 15 consecutive zeroes.

Payload Setting	Description
USER	A user pattern is defined for the DS1 payload. A different command is used to define the pattern.
Set	If a custom user-defined payload pattern is defined, click **Set** to apply the changed user payload pattern.

SCPI Examples:

```
SENS(@2):PAYL:DS1:PATT:TYPE PR223
SENS(@2):PAYL:DS1:PATT:TYPE 3of24
SENS(@2):PAYL:DS1:PATT:TYPE USER
SENS(@2):PAYL:DS1:PATT:USER 0b01110111
```

Configurations

This section describes what signals are being monitored, transmitted, added, and dropped in the configurations that can be selected from the **Setup** tab, as described in “STS-1 Setup” on page 246.

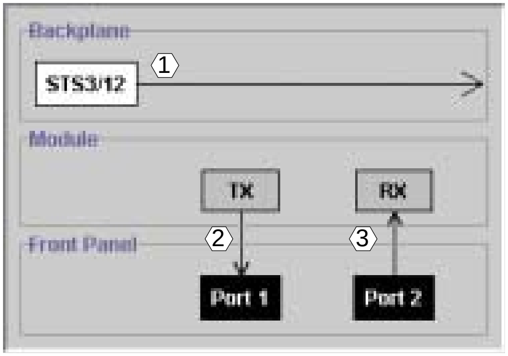
Backplane Guidelines

The following are restrictions for the STS-1 interaction with the backplane.

- The STS-1 Transceiver cannot add an STS-1 signal to the backplane unless an STS-3 or STS-12 signal is already on the backplane. To put an STS-3 or STS-12 signal on the backplane, an OC-12/3 Transmitter or Receiver must be installed in the adjacent slot to the left.
- The STS-1 Transceiver can only generate, transmit, or receive STS-1 signals.
- With backplane signals, the STS-1 Transceiver can only monitor or transmit the path of the STS-1 signal.

Configuration 1

To select this configuration with SCPI, use the `SYST:BOAR(@2:18):MODE 1` command.



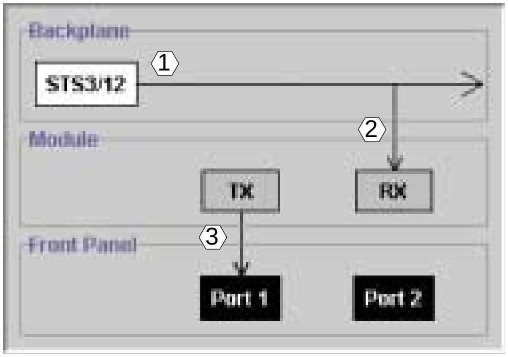
1 An STS-12/3 signal is on the backplane if inserted by a module to the immediate left of the STS-1 Transceiver. In this configuration, the backplane signal is not used.

2 The STS-1 module generates an STS-1 signal with path information. The generated signal is sent to the STS-1 transport generator. After adding transport information, the generated STS-1 signal is sent out the STS-1 transmit port.

3 An STS-1 signal is received from the STS-1 receiver port. The received STS-1 signal is monitored for path and transport information.

Configuration 2

To select this configuration with SCPI, use the `SYST:BOAR(@2:18):MODE 2` command.



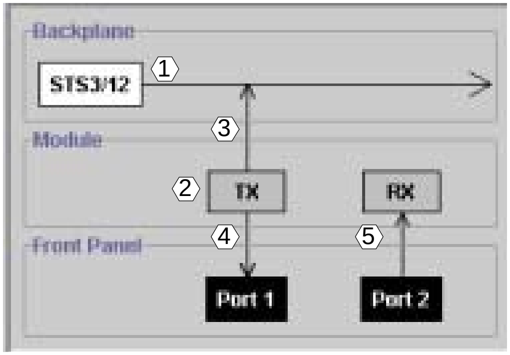
1 An STS-12/3 signal is on the backplane if inserted by a module to the immediate left of the STS-1 Transceiver.

2 The selected STS-1 signal is dropped from the backplane signal. The dropped signal is monitored for path information.

3 The STS-1 module generates an STS-1 signal with path information. The generated signal is sent to the STS-1 transport generator. After adding transport information, the generated STS-1 signal is sent out the STS-1 transmit port.

Configuration 3

To select this configuration with SCPI, use the SYST:BOAR(@2:18):MODE 3 command.



1 An STS-12/3 signal is on the backplane if inserted by a module to the immediate left of the STS-1 Transceiver.

2 The STS-1 module generates an STS-1 signal with path information.

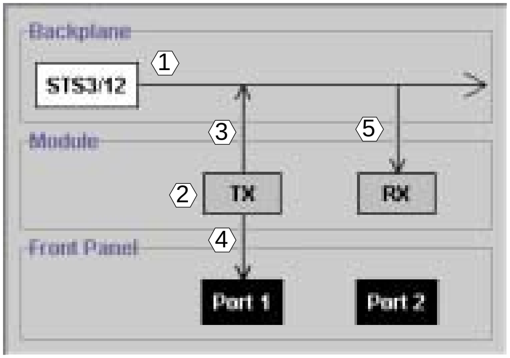
3 The generated signal with path information is added to the backplane STS-12/3 signal.

4 The generated signal with path information is sent to the STS-1 transport generator.After adding transport information, the generated STS-1 signal is sent out the STS-1 transmit port.

5 An STS-1 signal is received from the STS-1 receiver port. The received STS-1 signal is monitored for path and transport information.

Configuration 4

To select this configuration with SCPI, use the SYST:BOAR(@2:18):MODE 4 command.



1 An STS-12/3 signal is on the backplane if inserted by a module to the immediate left of the STS-1 Transceiver.

2 The STS-1 module generates an STS-1 signal with path information.

3 The generated signal with path information is added to the backplane STS-12/3 signal.

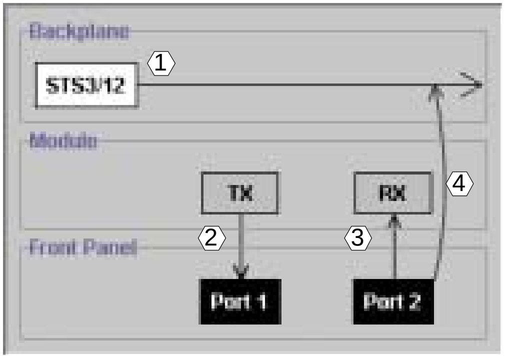
Note This signal is added to the backplane after any signal is dropped.

4 The generated signal with path information is sent to the STS-1 transport generator. After adding transport information, the generated STS-1 signal is sent out the STS-1 transmit port.

5 The selected STS-1 signal is dropped from the backplane signal. The signal is monitored for path information.

Configuration 5

To select this configuration with SCPI, use the SYST:BOAR(@2:18):MODE 5 command.



1 An STS-12/3 signal is on the backplane if inserted by a module to the immediate left of the STS-1 Transceiver.

2 The STS-1 module generates an STS-1 signal with path information. The generated signal is sent to the STS-1 transport generator. After adding transport information, the generated STS-1 signal is sent out the STS-1 transmit port.

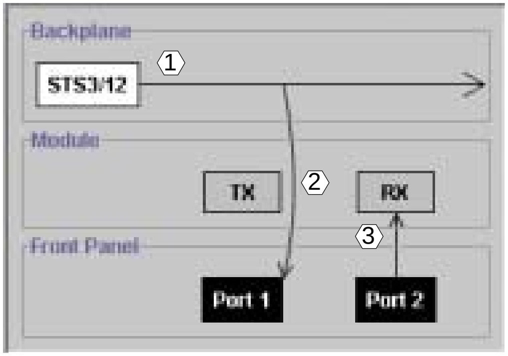
3 An STS-1 signal is received from the STS-1 receiver port. The received STS-1 signal is monitored for path and transport information.

4 The received STS-1 signal is added to the backplane signal.

Note Only the path information is sent to the backplane. The transport data is not sent.

Configuration 6

To select this configuration with SCPI, use the SYST:BOAR(@2:18):MODE 6 command.



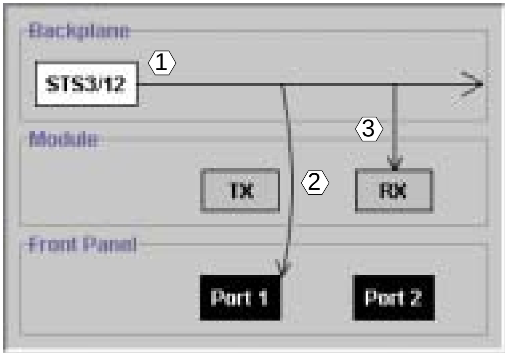
1 An STS-12/3 signal is on the backplane if inserted by a module to the immediate left of the STS-1 Transceiver.

2 A selected STS-1 signal is dropped from the backplane signal. The STS-1 module can only change transport-level settings. The dropped STS-1 backplane signal is sent out the STS-1 transmit port.

3 An STS-1 signal is received from the STS-1 receiver port. The received STS-1 signal is monitored for path and transport information.

Configuration 7

To select this configuration with SCPI, use the SYST:BOAR(@2:18):MODE 7 command.



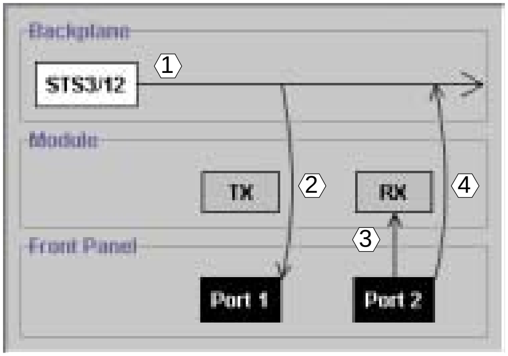
1 An STS-12/3 signal is on the backplane if inserted by a module to the immediate left of the STS-1 Transceiver.

2 A selected STS-1 signal is dropped from the backplane signal. The STS-1 module can only change transport-level settings. The dropped STS-1 backplane signal is sent out the STS-1 transmit port.

3 A selected STS-1 signal is dropped from the backplane signal. The dropped signal is monitored for path information.

Configuration 8

To select this configuration with SCPI, use the SYST:BOAR(@2:18):MODE 8 command.



1 An STS-12/3 signal is on the backplane if inserted by a module to the immediate left of the STS-1 Transceiver.

2 A selected STS-1 signal is dropped from the backplane signal. The STS-1 module can only change transport-level settings. The dropped STS-1 backplane signal is sent out the STS-1 transmit port.

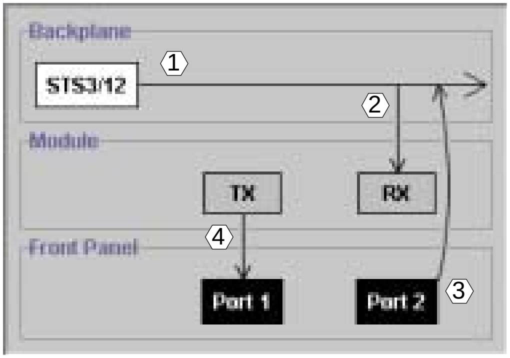
3 An STS-1 signal is received from the STS-1 receiver port. The received STS-1 signal is monitored for path and transport information.

4 The received STS-1 signal is added to the backplane signal.

Note Only the path information is sent to the backplane. The transport data is not sent.

Configuration 9

To select this configuration with SCPI, use the SYST:BOAR(@2:18):MODE 9 command.



1 An STS-12/3 signal is on the backplane if inserted by a module to the immediate left of the STS-1 Transceiver.

2 A selected STS-1 signal is dropped from the backplane signal. The dropped signal is monitored for path information.

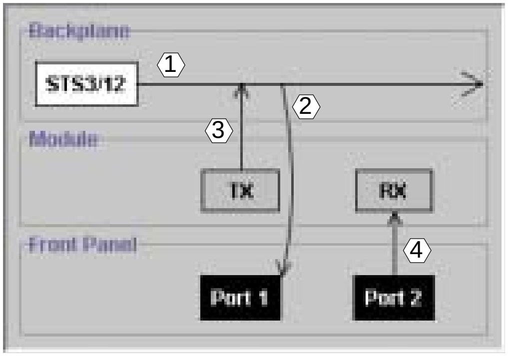
3 An STS-1 signal is received from the STS-1 receiver port. The received STS-1 signal is added to the backplane signal.

Note Only the path information is sent to the backplane. The transport data is not sent.

4 The STS-1 module generates an STS-1 signal with path information. The generated signal is sent to the STS-1 transport generator. After adding transport information, the generated STS-1 signal is sent out the STS-1 transmit port.

Configuration 10

To select this configuration with SCPI, use the SYST:BOAR(@2:18):MODE 10 command.



1 An STS-12/3 signal is on the backplane if inserted by a module to the immediate left of the STS-1 Transceiver.

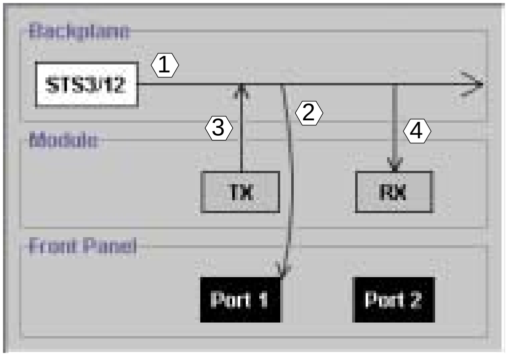
2 A selected STS-1 signal is dropped from the backplane signal. The STS-1 module can only change transport-level settings. The dropped STS-1 backplane signal is sent out the STS-1 transmit port.

3 The STS-1 module generates an STS-1 signal with path information. The generated signal with path information is added to the backplane STS-12/3 signal.

4 An STS-1 signal is received from the STS-1 receiver port. The received STS-1 signal is monitored for path and transport information.

Configuration 11

To select this configuration with SCPI, use the `SYST:BOAR(@2:18):MODE 11` command.



1 An STS-12/3 signal is on the backplane if inserted by a module to the immediate left of the STS-1 Transceiver.

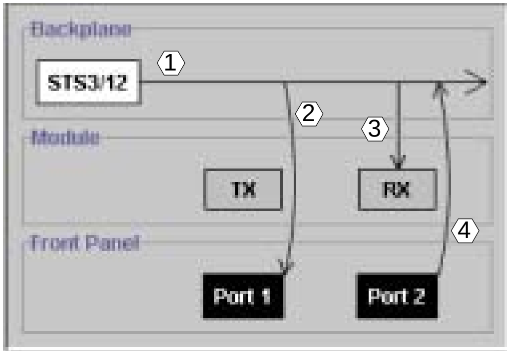
2 A selected STS-1 signal is dropped from the backplane signal. The STS-1 module can only change transport-level settings. The dropped STS-1 backplane signal is sent out the STS-1 transmit port.

3 The STS-1 module generates an STS-1 signal with path information. The generated signal with path information is added to the backplane STS-12/3 signal.

4 A selected STS-1 signal is dropped from the backplane signal. The dropped signal is monitored for path information.

Configuration 12

To select this configuration with SCPI, use the `SYST:BOAR(@2:18):MODE 12` command.



1 An STS-12/3 signal is on the backplane if inserted by a module to the immediate left of the STS-1 Transceiver.

2 A selected STS-1 signal is dropped from the backplane signal. The STS-1 module can only change transport-level settings. The dropped STS-1 backplane signal is sent out the STS-1 transmit port.

3 A selected STS-1 signal is dropped from the backplane signal. The dropped signal is monitored for path information.

4 An STS-1 signal is received from the STS-1 receiver port. The received STS-1 signal is added to the backplane signal.

Note Only the path information is sent to the backplane. The transport data is not sent.

Backplane Examples

This section explains how to configure the STS-1 Transceiver to add and drop signal to and from the backplane.

The following are restrictions for the STS-1 interaction with the backplane.

- The STS-1 Transceiver cannot add an STS-1 signal to the backplane unless an STS-3 or STS-12 signal is already on the backplane. To put an STS-3 or STS-12 signal on the backplane, an OC-12/3 Transmitter or Receiver must be installed in the adjacent slot to the left.
- The STS-1 Transceiver can only generate, transmit, or receive STS-1 signals.
- With backplane signals, the STS-1 Transceiver can only monitor or transmit the path of the STS-1 signal.

Dropping from STS-12/3 Signals

The STS-1 module can drop STS-1 signals from an STS-12 or STS-3 signal on the backplane of the EPX Test System. Because the front panel connectors are STS-1 only, you must use the EPX backplane to drop from STS-3 or STS-12 signals.

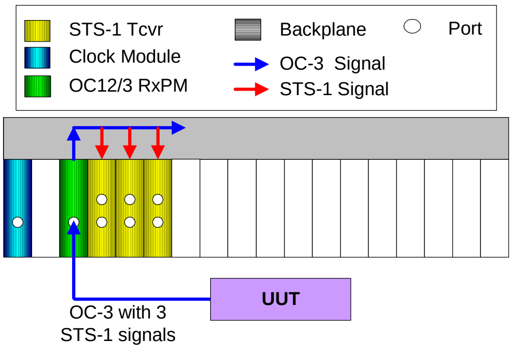
Note STS-1 transceivers can monitor only the path of backplane signals.

This procedure requires setting up OC-12/3 and STS-1 modules.

In the following figure, an OC-12/3 Receiver puts the OC-3 input from a unit under test (UUT) on the backplane. The received signal is generated by a source other than the EPX Test System.

Note The received signal must be channelized with STS-1 signals.

Three STS-1 transcievers each drop and monitor an STS-1 channel from the STS-3 signal on the backplane.



Setting Up the OC-12/3 Receiver

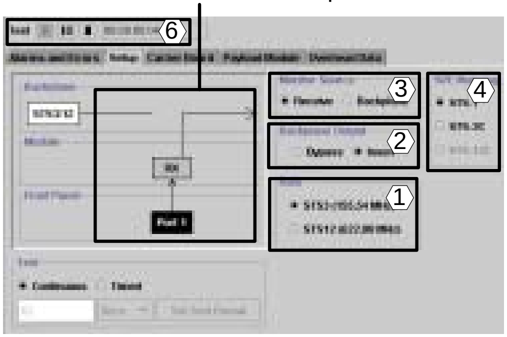
This section describes how to set up the OC-12/3 Receiver. In the example, the OC-12/3 Receiver has a Payload Monitor (PM).

For specifics about the transmitter, see “OC-12/3 RX and RXPM Receiver Windows” on page 293.

For an overview of the EPX backplane, see “Using the Backplane” on page 41.

The following figure shows the **Setup** tab of the OC-12/3 Receiver. The numbered options match the following steps.

OC-12/3 Rx receives signal on its port and inserts it onto the backplane



1 In the **Setup** tab of the detail window, set **Rate** to monitor an OC-12 or OC-3 signal.

   In this example, the rate is OC-3.

2 Set **Backplane Output** to **Insert**.

   The receiver inserts the received signal onto the backplane.

3 Set the **Monitor Src** to **Receive**.

   The receiver monitors the signal received on the front panel connector of the OC-12/3 Receiver.

4 Set **SPE Mapping** to **STS-1**.

5 Define the other settings to match that of the received signal, such as the PRBS pattern.

6 In the **Test** area, click the start button.

   Data is passed to the back plane regardless if the OC-12/3 test is started or stopped.

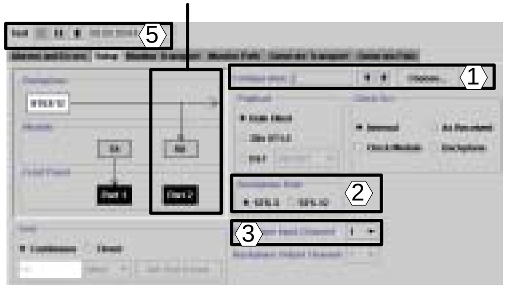
Setting Up the STS-1

This section describes how to set up the STS-1 Transceivers so that they each drop an STS-1 signal from the STS-12 or STS-3 signal on the backplane.

When the STS-1 module drops a signal from the backplane signal, the existing signal is not replaced but continues to the next slot.

The following figure shows the **Setup** tab of the STS-1 Transceiver. The numbered options match the following steps.

Uses the STS-3 or STS-12 signal on the backplane for the monitor source



1 In the **Setup** tab of the detail window, set **Configuration** so that the backplane signal is used for the monitor source.

   For definitions of the configurations, see “Configurations” on page 280.

2 Set **Backplane Rate** to the same rate that is set for the first OC-12/3 Transmitter.

   For details on the backplane rate options, see “Backplane Rate” on page 248.

3 Set **Backplane Input Channel** to the channel to be dropped from the backplane signal.

For details on the backplane input, see “Backplane Channels” on page 249.

4 In the **Monitor Path** tab, set **Data Pattern** to a PRBS pattern that matches the pattern for the OC-12/3 Receiver and UUT.

For details on the data patterns, see “Monitored STS-1 Payload Pattern” on page 274.

5 In the **Test** area, click the start button.

Adding to STS-12/3 Signals

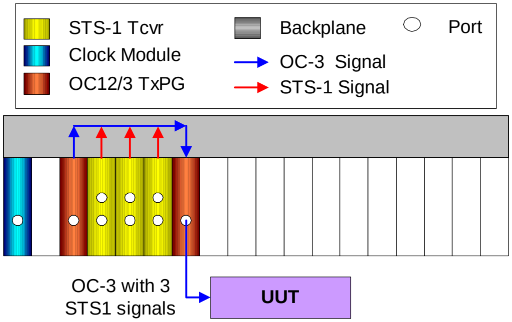
The STS-1 module can add STS-1 signals to an STS-12 or STS-3 signal on the backplane of the EPX Test System.

This procedure requires setting up OC-12/3 and STS-1 modules.

The following figure shows three STS-1 transcievers, each adding an STS-1 to an STS-3 signal. The first OC-12/3 transmitter generates an OC-3 output to the backplane. Each STS-1 transceiver adds an STS-1 signal, inserting errors or alarms as desired.

The second OC-12/3 transmitter sends the OC-3 signal from the backplane to a unit under test (UUT).

Note The first OC-12/3 transmitter could be replaced by an OC-12/3 receiver taking input from another source.



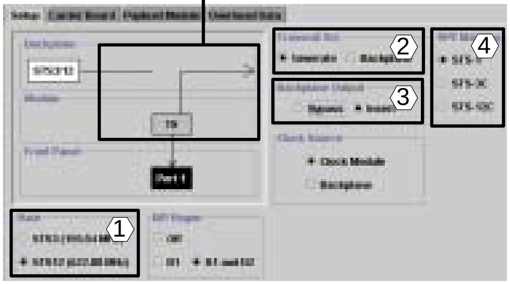
Setting Up the First OC-12/3 Transmitter

This section describes how to set up the OC-12/3 Transmitter. In the example, the OC-12/3 Transmitter has a Payload Generator (PG).

For specifics about the transmitter, see “OC-12/3 TX and TXPG Transmitter Windows” on page 315.

For an overview of the EPX backplane, see “Using the Backplane” on page 41.

The following figure shows the **Setup** tab of the OC-12/3 Transmitter. The numbered options match the following steps.



1 In the **Setup** tab of the detail window, set **Rate** to generate an OC-12 or OC-3 signal.

2 Set the **Transmit Src** to **Generate**. The transmitter uses the signal generated by the OC-12/3 Payload Generator.

3 Set **Backplane Output** to **Insert**. The transmitter inserts the generated signal onto the backplane.

4 Set **SPE Mapping** to **STS-1**.

5 In the **Payload Module** tab, set **Channel** to **All** or to a specific channel.

- **All**—The same signal is broadcast to all STS-1 channels of the generated signal. This is useful if you are using only one OC-12/3 Transmitter.
- **1-12**—The signal that is configured in the transmitter detail window is sent only to the selected STS-1 signal. This is useful if you are using multiple OC-12/3 Transmitters or if you only want to modify only one channel.

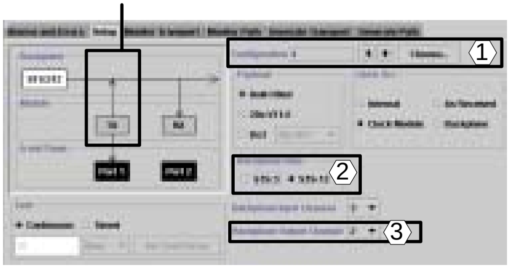
6 Leave all other settings at their defaults to transmit a clean signal.

Setting Up the STS-1

This section describes how to set up the STS-1 Transceivers so that they each add an STS-1 signal to the STS-12 or STS-3 signal on the backplane.

When the STS-1 module adds a signal to the backplane signal, the existing signal in that channel is replaced.

The following figure shows the **Setup** tab of the STS-1 Transceiver. The numbered options match the following steps.



1 In the **Setup** tab of the detail window, set **Configuration** so that a signal from the transmitter or receiver is inserted onto the backplane.

For definitions of the configurations, see “Configurations” on page 280.

2 Set **Backplane Rate** to the same rate that is set for the first OC-12/3 Transmitter.

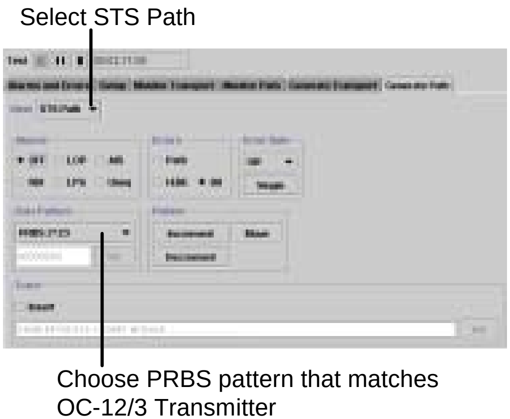
For details on the backplane rate options, see "Backplane Rate" on page 248.

3 Set **Backplane Output Channel** to the channel to be added to the backplane signal.

For details on the backplane input, see "Backplane Channels" on page 249.

4 In the **Generate Path** tab, set **Data Pattern** to a PRBS pattern that matches the pattern for the OC-12/3 Transmitter.

For details on the data patterns, see "Data Pattern" on page 264.



5 Leave all other settings at their defaults to transmit a clean signal.

Setting Up the Second OC-12/3 Transmitter

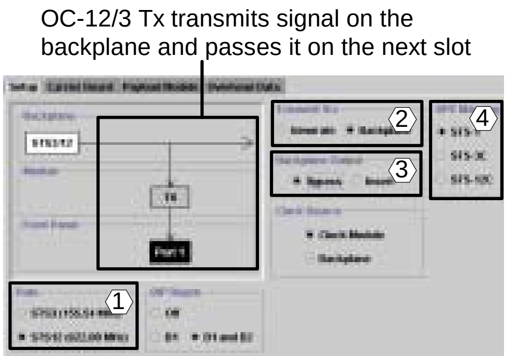
This section describes how to set up the second OC-12/3 Transmitter which sends the OC-12 or OC-3 signal with the added STS-1 channels to the unit under test (UUT). In the example, the OC-12/3 Transmitter has a Payload Generator (PG).

The difference between this transmitter and the first one is that the second transmitter uses the backplane signal rather its generated signal. This signal is sent out the front panel connecto the UUT.

For specifics about the transmitter, see "OC-12/3 TX and TXPG Transmitter Windows" on page 315.

For an overview of the EPX backplane, see "Using the Backplane" on page 41.

The following figure shows the **Setup** tab of the OC-12/3 Transmitter. The numbered options match the following steps.



1. In the **Setup** tab of the detail window, set **Rate** to generate an OC-12 or OC-3 signal.
2. Set the **Transmit Src** to **Backplane**. The transmitter uses the signal on the backplane.
3. To regenerate the signal for other OC-12/3 transmitters to create multiple tests, set **Backplane Output** to **Bypass**. The backplane signal continues to the next slot.
4. Set **SPE Mapping** to **STS-1**.
5. In the **Payload Module** tab, set **Channel** to **All** or to a specific channel.
   - **All**—The same signal is broadcast to all STS-1 channels of the generated signal. This is useful if you are using only one OC-12/3 Transmitter.
   - **1-12**—The signal that is configured in the transmitter detail window is sent only to the selected STS-1 signal. This is useful if you are using multiple OC-12/3 Transmitters or if you only want to modify only one channel.
6. Leave all other settings at their defaults to transmit a clean signal.

24

OC-12/3 RX AND RXPM RECEIVER WINDOWS

The topics in this section explain setup and monitoring options for the OC-12/3 receiver (RX) and OC-12/3 receiver with a payload monitor (RXPM) installed.

Instructions are provided for using EPXam to configure the module, along with SCPI equivalents.

Tip OC-12/3 modules can be switched between SONET and SDH functionality. See “Protocol” on page 297 and “Using the SONET/SDH Switcher” on page 121.

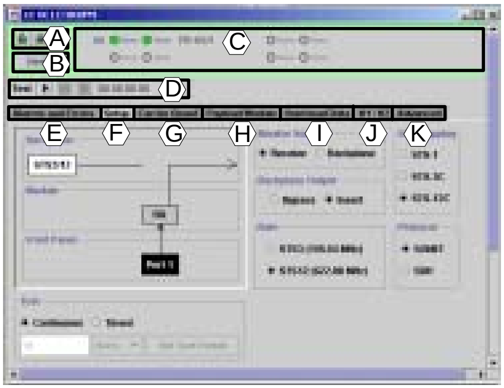
See “STM-4/1 RX and RXPM Receiver Windows” on page 441 for information about the configuration settings and features for these modules in SDH protocol mode.

For more information about EPXam, see “Using EPXam” on page 3.

Main View

The following figure shows the main features of the OC-12/3 RXPM module window.

If a Payload Monitor module is installed, the module window has additional tabs for payload , K1/K2, and overhead data monitoring.



A Save or restore module/slot configuration or factory defaults. See “Using Module Window Save and Restore Controls” on page 108.

B **Identify**—When pressed, it flashes the ACTIVE front panel LED on the module associated with this window.

C View summary defect status, alarm indicators, and other module information. See “Expanded Logical View Indicators” on page 8.

D **Test**—Start, stop, or pause test; view elapsed time. See “Using Module Window Test Controls” on page 118.

E **Alarms and Errors**—View alarm indicators, error counts, error ratios, service disruption data, and performance statistics for the current test. See “Alarms and Errors” on page 298.

F **Setup**—Set signal rate and source, backplane output, test type and duration, and payload mapping; switch module between SONET and SDH protocol. See “Setup” on page 295.

G **Carrier Board**—Monitor input frequency and voltage. See “Carrier Board” on page 305.

H **Payload Module**—(RXPM only) Set the payload data pattern, monitor J1/J0 trace messages (RXPM only). See “Payload Module (RXPM)” on page 306.

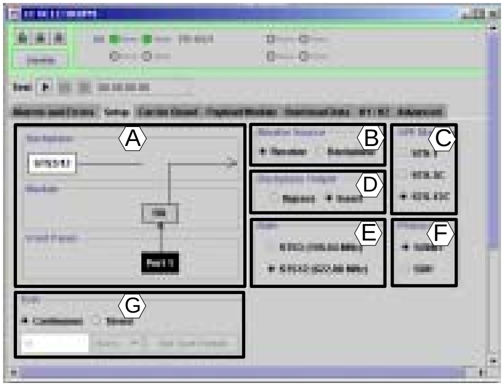
I **Overhead Data**—(RXPM only) Monitor individual transport and path overhead byte values for a selected channel. See “Overhead Data (RXPM)” on page 308.

J **K1/K2**—(RXPM only) Monitor K1 and K2 byte values and decoded APS channel messages. See “K1/K2 Monitor (RXPM)” on page 310.

K **Advanced**—(RXPM only) Specify STS-1 stuff column fill type and view SS overhead bit values. See “Advanced Settings (RXPM only)” on page 312.

Setup

The following figure illustrates the main features of the **Setup** tab on the OC12RX and RXPM module windows.



A View graphic display of current signal source and backplane output settings.

B **Monitor Source**—(RXPM only) Set the signal source for the installed payload monitor module. See "Monitor Source (RXPM)" on page 295.

C **SPE Mapping**—(RXPM only) Set the expected STS size and mapping of the monitored SPE. See "SPE Mapping (RXPM)" on page 296.

D **Backplane Output**—Specify whether the incoming signal on the OC-12/3 Receiver front panel is passed through to the backplane or the backplane signal is unchanged (bypass). See "Backplane Output" on page 296.

E **Rate**—Set the receive signal rate to either STS-3 or STS-12. See "Rate" on page 297.

F **Protocol—**Switch the module between SONET and SDH. See "Protocol" on page 297.

G **Test**—Set the test type and duration. See "Test" on page 298.

Monitor Source (RXPM)

The **Monitor Source** setting determines the source of the monitored signal. The signal must match the currently selected rate (OC-12 or OC-3).

Backplane Setting	Description
Receiver	The module monitors the SONET signal from the LIU of the carrier board (from the front panel).
Backplane	The module monitors the SONET signal from the backplane that is passed from a compatible module in the adjacent, lower-numbered slot.

SCPI Examples:

```
PMOD:SENS(@8):DATA:SOUR  NORM
PMOD:SENS(@8):DATA:SOUR  BACK
```

Related Topics:

"Using the Backplane" on page 41

"Rate" on page 297

SPE Mapping (RXPM)

The Synchronous Payload Envelope (SPE) Mapping option sets the size of the channels to be monitored by the payload monitor module.

The available mappings depend on the signal rate setting.

SPE Mapping	Description
STS-1	Selects an STS-1 sized payload for the SPE. This is a 783-byte payload
STS-3C	Selects an STS-3C sized payload for the SPE. This is a 2349-byte payload.
STS-12C	Selects an STS-12C sized payload for the SPE. This is a 9396-byte payload. This mapping is not available for the STS3 rate.

SCPI Examples:

```
PMOD(@7):SENS:DATA:SIZE STS1
PMOD(@7):SENS:DATA:SIZE STS3C
PMOD(@7):SENS:DATA:SIZE STS12C
```

Related Topics:

"Rate" on page 297

Backplane Output

The Backplane Output setting determines whether the data from the front panel connector is sent to the backplane or the backplane signal is unchanged.

The graphic display of the current backplane setting, backplane signal, and signal path are updated when you change these settings.

Note Modules must be installed contiguously to transmit and receive signals along with backplane.

Backplane Setting	Description
Bypass	Bypass mode. The backplane signal is not modified and is passed to the next slot to the right.
Insert	Passthrough mode. The incoming optical signal is inserted onto the backplane for the next slot to the right.

SCPI Examples:

```
SYST:BOAR(@8):BACK:MODE  PASS
SYST:BOAR(@8):BACK:MODE  BYP
```

Related Topics:

"Using the Backplane" on page 41

Rate

The OC-12/3 RX and RXPM modules can receive at either STS-3 or STS-12 signal rates.

Note When you modify the receive signal rate, check that the settings (such as SPE mapping and data pattern) match the expected signal.

Rate Setting	Description
STS3 (155.54 MHz)	OC/STS-3 signal rate
STS12 (622.08 MHz)	OC/STS-12 signal rate
SCPI Examples: INP(@3):RATE sts3 INP(@3):RATE sts12	

Protocol

The Protocol setting switches the module between SONET and SDH. When the switch is complete, EPXam displays the appropriate protocol configuration options and field labels for the module and updates all references to the module to use the correct protocol.

Note Switching between SONET and SDH protocol does *not* require a restart of the test system or EPXam.

Restrictions:

- Modules that are locked via the Group Manager cannot be switched by other users.
- Active test and logging sessions associated with a module at the time of a switch are cancelled.

  If tests or logging sessions are in progress on any of the modules being switched, a warning dialog is displayed. Click **Cancel** to abort the switch or **Continue** to complete the switch. If you choose **Continue**, running tests and logging sessions are cancelled. Otherwise, a dialog opens that displays the switching progress.

Setting	Description
SONET	Switches the module to SONET without restarting the test system or EPXam. This is the default setting in the factory configuration.
SDH	Switches the module to SDH without restarting the test system or EPXam.
SCPI Examples: SYST:BOAR(@7):PROT:TYPE SON SYST:BOAR(@7):PROT:TYPE SDH SYST:BOAR(@7):PROT:STAT?	

See “STM-4/1 RX and RXPM Receiver Windows” on page 441 for a description of this module’s SDH features and configuration.

See the following topics for more information about SONET/SDH switching:

- “Using the SONET/SDH Switcher” on page 121
- “SONET/SDH Switching and Custom Configuration Files” on page 123
- “Switching Modules Using SCPI” on page 123

Test

The Test area defines the type and duration of the test that the receiver runs. To start and stop tests, use the controls in the module window or, to start tests for multiple modules, use the Test Controls window. See “Controlling Tests” on page 115.

Note Selecting a new test type automatically stops the current test.

Test Setting	Description
Continuous	Selects a continuous test that must be manually stopped and started.
Timed	Selects a timed test. When Timed is selected: **1** Specify a number and select a unit (seconds, minutes, hours, and days) for the test duration. **2** Click **Set** to apply the settings. **3** Use the controls at the top of the window to start the test.

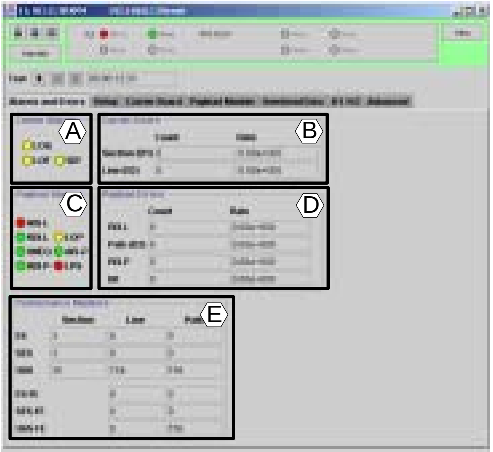
Test Setting	Description

SCPI Examples:
`sens(@3):test:type cont`
`sens(@3):test:type tim`
`sens(@3):test:unit min`
`sens(@3):test:per 10`
To control tests use the following commands:
`sens(@3):test:mode star`
`sens(@3):test:mode stop`
`sens(@3):test:mode rest`
`sens(@3):test:mode pause`
Related Topics:
“Logging” on page 63
“Controlling Tests” on page 115	

Alarms and Errors

The **Alarms and Errors** tab displays alarm status indicators, error counts, and error ratios for the current test. If a Payload Monitor module is installed, additional payload alarm and error data is displayed.

The following figure shows the main areas of the STM-4/1 **Alarms and Errors** tab.



- **A** **Carrier Alarms**—View LOS, LOF, and SEF alarm status indicators for current test, as described in “Payload Alarms (RXPM)” on page 302.
- **B** **Carrier Errors**—View B1 and B2 error counts and error ratios for current test, as described in “Payload Alarms (RXPM)” on page 302.
- **C** **Payload Alarms**—(RXPM only) View alarm status indicators for current test, as described in “Payload Alarms (RXPM)” on page 302.
- **D** **Payload Errors**—(RXPM only) View error counts and error ratios for current test, as described in “Payload Alarms (RXPM)” on page 302.
- **E** **Performance Monitors**—(RXPM only) Displays performance monitoring statistics for Section, Near-End Line, Far-End Line, Near-End Path, and Far-End Path layers, as described in “Payload Alarms (RXPM)” on page 302

Alarm Indicators

Alarm indicator colors are defined in the following table.

Note If an alarm is greyed out in this view, it means that alarm does not apply to the current test configuration.

Green	Yellow	Red
No alarms are detected: signal is clear or monitoring is not started.	Alarm history: an alarm was detected but is not active in the current test.	An alarm is active and currently detected on the monitored signal.

Carrier Alarms

The following table lists and describes alarms that can be monitored by the EPX OC-12/3 TX carrier board. For a description of indicator colors, see “Alarm Indicators” on page 299.

Alarm	Description
LOS	Loss of Signal An LOS alarm condition is declared either when a received signal with an all-zeroes pattern has insufficient data bit transitions or when the as received clock cannot be recovered from the received signal because the optical power is insufficient. LOS ends when a received signal has a minimum optical power and data bit transitions so that the as received clocked can be recovered, and two consecutive valid frame alignment patterns occur without LOS defects.
LOF	Loss of Frame LOF occurs when an Severely Errored Frame (SEF) condition occurs and does not clear for more than 3 milliseconds, as decribed in Bellcore GR-253-CORE, section 6.2.1.1.2. LOF ends 3 milliseconds after SEF ends.
SEF	Severely Errored Frame SEF occurs when 4 consecutive frames do not contain a valid frame word, as described in Bellcore GR-253-CORE, section 5.5. SEF ends when two successive error-free framing patterns are detected.

SCPI Examples:
`SENS(@3):ALAR LOS`
`SENS(@3):ALAR LOF`
`SENS(@3):ALAR SEF`	

Carrier Errors

The Errors area displays error counts and ratios for the current test.

The error data is cumulative. To get data for intervals, see “Logging” on page 63. Once a test is restarted, the error history is cleared.

Error Type or Setting	Description
Section (B1)	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B1 section parity byte.
Line (B2)	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B2 line parity byte.
Count	Number of errors of the specified type detected in the current test.
Rate	Computed error ratio for the specified error type for the current test.

SCPI Examples:
`SENS(@8):ERR:COUN:LINE ?`
`SENS(@8):ERR:RAT:LINE ?`
`SENS(@8):ERR:COUN:SECT ?`
`SENS(@8):ERR:RAT:SECT ?`	

Error Data	Description
Error Type	The Carrier Board monitor tab displays performance data for Section (B1) and Line (B2) errors.
Count	Current error count for each type of error type: Section (B1), Line (B2) errors. The counters are reset to zero at the start of each test period.
Rate	Computed ratio for each type of error: Section (B1) and Line (B2) errors. Computes the ratio of errored bits to total errors in the stream since the last test restart. The error ratio is reset to zero at the start of each test period.

SCPI Examples:
`SENS(@8):ERR:COUN:LINE ?`
`SENS(@8):ERR:RAT:LINE ?`
`SENS(@8):ERR:COUN:SECT ?`
`SENS(@8):ERR:RAT:SECT ?`	

Payload Errors (RXPM)

The Errors area displays error counts and ratios for the current test.

The error data is cumulative. To get data for intervals, see “Logging” on page 63. Once a test is restarted, the error history is cleared.

Error Type or Setting	Description
REI-L	The Line Remote Error Indicator (also known as Line FEBE) error is declared when the M1 byte has a non-zero value. A maximum of 255 errors are reported per frame.
Path (B3)	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B3 path parity byte.
REI-P	The Path Remote Error Indicator (also known as Path FEBE) error is declared when bits 1-4 of the G1 byte have a non-zero value. A maximum of eight errors are reported per frame.
Bit (Payload)	This error is declared when the payload pattern of the received signal does not match the pattern selected.
Count	Number of errors of the specified type detected in the current test.
Rate	Computed error ratio for the specified error type for the current test.

SCPI Examples:
`PMOD(@6):SENS:ERR:COUN PFEB`
`PMOD(@6):SENS:ERR:RAT PFEB`
`PMOD(@6):SENS:ERR:COUN PATH`
`PMOD(@6):SENS:ERR:RAT PATH`
`PMOD(@6):SENS:ERR:COUN BIT`
`PMOD(@6):SENS:ERR:RAT BIT`	

Payload Alarms (RXPM)

The Alarms section in the Payload Module tab displays alarm indicators for the current test. For a description of indicator colors, see “Alarm Indicators” on page 299.

Alarm	Description
LOP	Loss of Pointer LOP indicates that the H1/H2 bytes do not contain a valid pointer, and the condition has persisted for 8 frames. A valid pointer must be in range (0-783) and the NDF (New Data Flag) must be a 6 (normal pointer) or 9 (new pointer value or concatenation indicator if the pointer value is 0x3FF). LOP is cleared when 3 consecutive frames of valid pointer data are detected.
AIS-P	Path Alarm Indication Signal AIS-P is detected after 3 consecutive frames of all 1s in the associated pointer bytes (H1, H2). AIS-P is cleared when 3 consecutive frames with valid pointers are detected, and the pointer bytes are not all 1s.
RDI-P	Remote defect indicator RDI-P is declared when bit 5 (this is fourth from LSB) of G1 is 1 for 10 consecutive frames. RDI-P is cleared when bit 5 of G1 is 0 for 10 consecutive frames.

Alarm	Description
AIS-L	Line Alarm Indicator Signal AIS-L is a static, all 1s data pattern in the line. It is detected in the K2 byte (bits 6,7,8) when all 1s are present for 5 consecutive frames. AIS-L is cleared after five frames with a pattern other than all 1s in K2.
RDI-L	Line Remote Defect Indication RDI-L is detected when K2 (bits 6,7,8) is 110 for 5 consecutive frames. RDI-L is cleared when K2 (bits 6,7,8) is not 110 for 5 consecutive frames.
UNEQ	Path Unequipped alarm The UNEQ-P alarm is indicated by persistent all 0s in the path. UNEQ-P is detected after 5 consecutive frames of all 0s in the C2 byte of the path overhead. UNEQ-P is cleared when 5 consecutive frames containing valid data in the C2 byte are detected (that is, the C2 byte is not 0x00).
LPS	Loss of Pattern Synchronization LPS is detected when the payload data pattern in the monitored signal does not match the expected pattern for 6 consecutive clock cycles (if it is a pre-defined payload pattern) or 2 clock cycles (if it is a user-defined pattern). LPS is not monitored when a Live payload data pattern is selected.

Alarm	Description
SCPI Examples:	
	PMOD:SENS(@3):ALAR LOP PMOD:SENS(@3):ALAR PAIS PMOD:SENS(@3):ALAR PRDI PMOD:SENS(@3):ALAR LAIS PMOD:SENS(@3):ALAR LRDI PMOD:SENS(@3):ALAR UNEQ PMOD:SENS(@3):ALAR LPS

Performance Monitors (RXPM)

The following table describes Section, Near-End Line, Far-End Line, Near-End Path, and Far-End Path layer performance statistics that are displayed on the **Alarms and Errors** tab.

Statistic	Description
ES-S	**Errored Seconds - Section.** Number of seconds during which at least one B1 error was detected or an SEF or LOS defect was present.
SES-S	**Severely Errored Seconds - Section.** Number of seconds during which at least *n* B1 errors were detected or an SEF or LOS defect was present. At 0C-48 rates, *n* is 2,392.
UAS-S	**Unavailable Seconds - Section**. Number of seconds during which the Section was considered unavailable. A Section becomes unavailable at the onset of 10 consecutive seconds that qualify as an SES-S, and continues to be unavailable until the onset of 10 consecutive consecutive seconds that do not qualify as SES-S.
ES - L	**Errored Seconds - Line, Near-end.** Number of seconds during which at least one B2 error was detected or an AIS-L was present.
SES-L	**Severely Errored Seconds - Line, Near-end.** Number of seconds during which at least *n* B2 errors were detected or an AIS-L defect was present. At OC-48 rates, n is 2,459.
UAS-L	**Unavailable Seconds - Line, Near-end**. Number of seconds during which the Line was considered unavailable. A Line becomes unavailable at the onset of 10 consecutive seconds that qualify as an SES-L, and continues to be unavailable until the onset of 10 consecutive consecutive seconds that do not qualify as SES-L.
ES-LFE	**Errored Seconds - Line, Far-end**. Number of seconds during which at least one REI-L error was detected or an RDI-L was present.

Statistic	Description
SES-LFE	**Severely Errored Seconds - Line, Far-end**. Number of seconds during which at least *n* REI-L errors were detected or an RDI-L defect was present. present. At OC-48 rates, *n* is 2,459.
UAS-LFE	**Unavailable Seconds - Line, Far-end**. Number of seconds during which the Line was considered to be unavailable at the far end. A Line becomes unavailable at the far end at the onset of 10 consecutive seconds that qualify as SES-LFE, and continues to be unavailable until the onset of 10 consecutive seconds that do not qualify as SES-LFE.
ES-P	**Errored Seconds - Path, Near-end**. Number of seconds during which at least one B3 error was detected or an AIS-P, LOP, or UNEQ defect was present.
SES-P	**Severely Errored Seconds - Path, Near-end**. Number of seconds during which at least *n* B3 errors were detected or an AIS-P, LOP, or ENEQ defect was present. For OC-48c, *n* is 2,400.
UAS-P	**Unavailable Seconds - Path, Near-end**. Number of seconds during which the Path was considered unavailable. A Path becomes unavailable at the onset of 10 consecutive seconds that qualify as SES-P and continues to be unavailable until the onset of 10 consecutive seconds that do not qualify as SES-P.

Statistic	Description
ES-PFE	**Errored Seconds - Path, Far-end**. Number of seconds during which at least one REI-P error was detected or an RDI-P was present.
SES-PFE	**Severely Errored Seconds - Path, Far-end**. Number of seconds during which at least <n> REI-P errors were detected or an RDI-P defect was present. For OC-48, <n> is 2,400.
UAS-PFE	**Unavailable Seconds - Path, Far-end**. Number of seconds during which the Path was considered to be unavailable at the far end. A Path becomes unavailable at the far end at the onset of 10 consecutive seconds that qualify as SES-PFE, and continues to be unavailable until the onset of 10 consecutive seconds that do not qualify as SES-PFE.

SCPI Examples:

```
SENS(@3):PMON:<perf_monitor> ?
```

<*perf_monitor*> is one of the following:

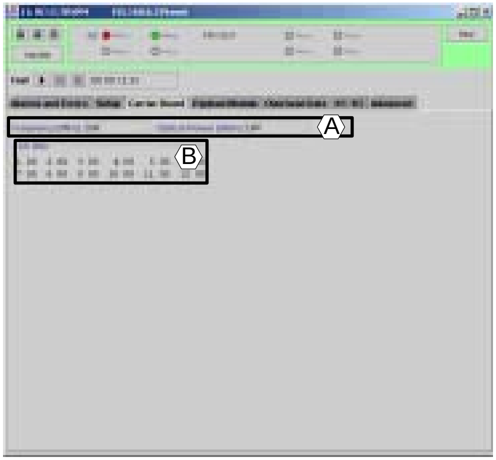
ESS, SSS, USS, ESLN, SSLN, USLN, ESLF, SSLF, USLF, ESPN, SSPN, USPN, ESPF, SSPF, or USPF.

For example:

```
SENS(@3):PMON:SSS ?
```

Carrier Board

The following figure shows the main features of the OC-12/3 **Carrier Board** tab.



A **Input Monitoring**—Displays the frequency and power of the monitored signal, as described in “Input Monitoring” on page 305.

B **SS Bits**—Displays the values of the SS bits, as described in “SS Bits” on page 305.

Input Monitoring

The frequency and optical power cannot be monitored when the Monitor Source is set to Backplane.

Data	Description
Frequency	Frequency of incoming signal in MHz, with accuracy within 5 ppm.
Optical Power	Input optical power (in dBm). Precision is 2 digits. Software averages over 10 samples, with a response time of approximately 5 seconds.
SCPI Examples: `INP(@3):POW ?` `INP(@3):FREQ ?`	

SS Bits

The SS Bits area displays the current data for the SS bits (bits 5 and 6 in the H1 overhead byte). The SS bits indicate whether the signal is carrying SONET traffic (value of 00) or SDH traffic (value of 10).

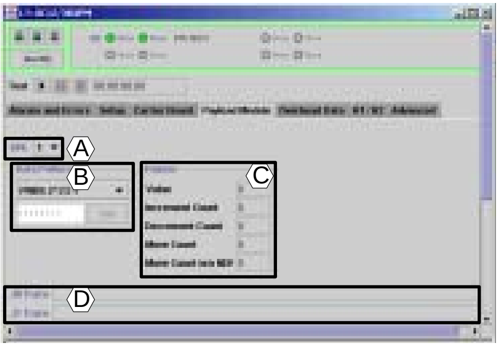
The SS bits cannot be monitored when the Monitor Source is set to Backplane.

To display the current state of the SS overhead bits using SCPI, use the following command.

```
SENS(@8):OVER:SSB?
```

Payload Module (RXPM)

The following figure shows the main features of the OC-12/3 **Payload Module** tab.



A **SPE**—Select the SPE channel to monitor, as described in “SPE” on page 306.

B **Data Pattern**—Select a payload data pattern or specify a custom payload data pattern to monitor in the received payload, as described in “Data Pattern” on page 307.

C **Pointer**—Monitor the SPE pointer value and pointer event counts, as described in “Pointer” on page 307.

D **J0/J1 Trace**—Monitor the J0 section trace and J1 path trace messages in the received signal, as described in “J0 and J1 Trace Messages (RXPM)” on page 308.

SPE

The SPE setting determines which synchronous payload envelope (SPE) time slot is monitored. The number of channels available depends on the currently selected SPE mapping.

Settings	Description
SPE	Selects the SPE channel to monitor in the received payload. This field is linked to the SPE field in the **Overhead** tab. The number of channels depends on the setting for the SPE mapping (SPE size). Channel 1 is the default in the factory configuration. • If the SPE size is STS-1, select 1 of 12 channels (for OC-12) or select 1 of 3 channels (for OC-3). • If the SPE size is STS-3c, there is only 1 channel (for OC-3), or select 1 of 4 channels (for OC-12). • If the SPE size is STS-12c, there is only 1 channel.

SCPI Examples:

```
PMOD(@6):SENS:DATA:SPE 12
```

Related Topics:

“SPE Mapping (RXPM)” on page 296

“Path Overhead” on page 309

Data Pattern

The Data Pattern setting selects the type of pattern to monitor in the received payload.

Settings	Description
PRBS 2^15-1 **PRBS 2^20-1** **PRBS 2^23-1** **Inv. PRBS 2^23-1** **Inv. PRBS 2^20-1** **Inv. PRBS 2^15-1**	Selects a pseudo-random bit pattern or an inverted pseudo-random bit pattern.
1111	Selects an all ones pattern.
0000	Selects an all zeroes pattern.
0101	Selects an alternating zero-ones (0b01010101) pattern.
1010	Selects an alternating one-zeros (0b10101010) pattern.
User	Selects an 8-bit binary user-defined payload pattern.
Set	This selection is only available if User is selected as the payload pattern type. If a custom user-defined payload pattern type is selected, enter a binary number for the pattern, then click **Set** to apply the changes to the user-defined payload pattern.

Settings	Description

SCPI Examples:
`PMOD(@6):SENS:PAYL:PATT:TYPE PR215`
`PMOD(@6):SENS:PAYL:PATT:TYPE PR223`
`PMOD(@6):SENS:PAYL:PATT:TYPE IPR215`
`PMOD(@6):SENS:PAYL:PATT:TYPE IPR223`
`PMOD(@6):SENS:PAYL:PATT:TYPE ALT10`
`PMOD(@6):SENS:PAYL:PATT:TYPE ALT01`
`PMOD(@6):SENS:PAYL:PATT:TYPE USER`
`PMOD(@6):SENS:PAYL:PATT:ISER 0b00010001`	

Pointer

The Pointer area of the **Payload Module** tab displays synchronous payload envelope (SPE) pointer values and event counts. Pointer event counters are reset at the start of each test period.

Pointer Field	Description
Value	Displays the current value in hexadecimal of the synchronous payload envelope (SPE) pointer. This value is what the hardware pointer processor interprets as the current pointer.
Increment Count	Number of SPE pointer increment events since the last restart.
Decrement Count	Number of SPE pointer decrement events since the last restart.
Move Count	Number of times the pointer generator moved to a new pointer value using the New Data Flag (bits 1 to 4 of the H1 pointer byte).

Pointer Field	Description
Move w/o NDF Count	Number of times the pointer generator moved to a new pointer value without the New Data Flag (missing NDF).
SCPI Examples: PMOD(@6):SENS:POIN:VAL ? PMOD(@6):SENS:POIN:COUN:INCR? PMOD(@6):SENS:POIN:COUN:DECR? PMOD(@6):SENS:POIN:COUN:NDF? PMOD(@6):SENS:POIN:COUN:MNDF?	

J0 and J1 Trace Messages (RXPM)

The J0 and J1 fields display the 64-byte J0 section and J1 path trace messages. The maximum message length is 62 characters.

To display the J0 trace message using SCPI, use the following command:

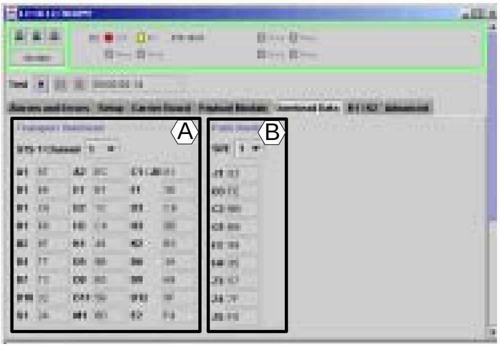
```
SENS(@3)DATA:SECT:TRAC ?
```

To display the J1 trace message using SCPI, use the following command:

```
PMOD(@3):SENS:DATA:PATH:TRAC ?
```

Overhead Data (RXPM)

The following figure shows the features of the OC-12/3 RXPM **Overhead Data** tab.



A **Transport Overhead**—View Transport Overhead byte values for the selected STS-1 channel.

B **Path Overhead**—View path overhead byte values for the selected SPE time slot.

Transport Overhead

The following table describes the STS transport overhead fields and values.

Transport Overhead	Description
STS-1 Channel	Select the STS channel for which you want to view transport overhead bytes
A1, A2	Section overhead framing bytes.

Transport Overhead	Description
J0 (C1)	Formerly C1 (STS-1 ID), now redefined as the J0 section trace byte.
E1	Orderwire section byte located in first STS-1 of an STS-N.
F1	Section user channel byte located in first STS-1 of an STS-N.
D1, D2, D3	Section data communication channel bytes located in first STS-1 of an STS-N.
K1, K2	APS (automatic protection switching) channel bytes.
H1, H2	SPE payload pointer bytes.
H3	SPE pointer action byte.
D4 through D12	Line data communications channel bytes.
S1	Synchronization status byte.
M1	Line Remote Error Indicator (Line REI) byte in STS channel 7, (the 3rd byte in order of appearance).
E2	Express orderwire byte.
Z0, Z1, Z2	Allocated for future growth.
SCPI Examples: For detailed information about commands for monitoring transport overhead values, refer to the section on "Overhead Queries" for the "OC-12/3 STM-4/1 Receiver" module in the "*SCPI Reference*".	

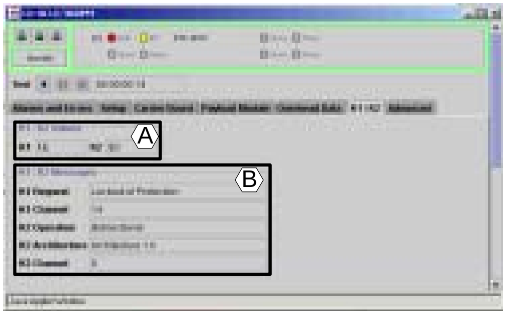
Path Overhead

The following table describes path overhead bytes.

Path Overhead	Description
SPE	Select the number of the SPE time slot within the monitored payload for which you want to view path overhead bytes
J1	STS path trace byte.
C2	STS path signal label indicating the construction of the SPE
G1	Path terminating status byte.
F2	Path user channel byte.
H4	Indicator allocated for use as a mapping-specific indicator byte.
Z3, Z4	Allocated for future growth.
Z5	Tandem connection byte.
SCPI Examples: For detailed information about commands for monitoring path overhead values, refer to the "Overhead Access" commands in the "OC-12/3 STM-4/1 Receiver" section of the "*SCPI Reference*".	

K1/K2 Monitor (RXPM)

The following figure shows the main features of the OC-12/3 RXPM **K1/K2** tab.



A **K1/K2 Values**—Hexadecimal values of the automated protection switching (APS) channel K1 and K2 bytes, as described in “K1/K2 Values” on page 310.

B **K1/K2 Messages**—Displays automated protection switching (APS) channel messages decoded from the K1/K2 bytes, as described in “K1/K2 Messages” on page 310.

K1/K2 Values

The K1/K2 line overhead byte values are used to monitor automated protection switching (APS) channel messages.

Field	Description
K1/K2 Values	Monitors hexadecimal values for K1/K2 line overhead bytes in monitored signal.
SCPI Example: `SENS(@3):TRAN:APS:K1K2 ?`	

K1/K2 Messages

This field displays automated protection switching (APS) channel messages decoded from the K1/K2 bytes.

K1/K2 Messages	Description
K1 Request	Bits 1 through 4 of K1 can contain the following request messages. **Lockout of Protection**. Bits 1 through 4 have a value of 1111. **Forced Switch**. Bits 1 through 4 contain 1110. **SF - High Priority**. Bits 1 through 4 Have a value of 1101. **SF - Low Priority**. Bits 1 through 4 have a value of 1100. **SD - High Priority**. Bits 1 through 4 have a value of 1011.

K1/K2 Messages	Description
	SD - Low Priority. Bits 1 through 4 have a value of 1010. **Manual Switch**. Bits 1 through 4 have a value of 1000. **Wait-to-Restore**. Bits 1 through 4 have a value of 0110. **Exercise**. Bits 1 through 4 have a value of 0100. **Revert Request**. Bits 1 through 4 have a value of 0100
	Do Not Revert. Bits 1 through 4 have a value of 0001
	No Request — Bits 1 through 4 have a value of 0000.
K1 Channel	Channel selection for the requesting message (bits 5 through 8 of K1 carry the channel message code): • 0 — Null channel. • 1 through 14 — Channel 1 through 14. • 15 — Extra traffic channel.
K2 Operation	Operational mode of the APS. Bits 6 through 8 of the K2 byte carry this information. **Unidirectional**. Bits 6 to 8 have a value of 100. **Bidirectional**. Bits 6 to 8 have a value of 101.

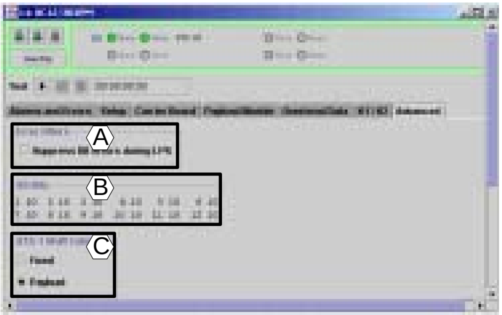
K1/K2 Messages	Description
K2 Architecture	Architecture mode for the APS. Bit 5 of K2 carries this information. **Architecture 1+1**. Bit 5 is 0. **Architecture 1:n**. Bit 5 is 1.
K2 Channel	Channel selection for the requesting message (bits 1 through 4 of K2 carry the channel message code): **0**—Null channel. **1** to **14**—Channel 1 to 14. **15**—Extra traffic channel.

SCPI Examples:

```
pmod(@11):sens:aps:enab 1
pmod(@11):sens:aps:k1d:req?
pmod(@11):sens:aps:k1d:chan?
pmod(@11):sens:aps:k2d:oper?
pmod(@11):sens:aps:k2d:arch?
pmod(@11):sens:aps:k2d:chan?
```

Advanced Settings (RXPM only)

The following figure shows the main features of the **Advanced** tab.



A **STS-1 Stuff Columns**—When the SPE mapping is set to STS-1, select whether the SPE stuff columns are expected to contain a fixed pattern or a PRBS payload data pattern. See “Error Filters” on page 312.

B **Error Filters**—Specify whether bit errors are suppressed (not counted) during an LPS alarm condition. See “STS-1 Stuff Columns” on page 312.

Error Filters

The Error Filters setting specifies whether the bit errors are suppressed when an LPS alarm condition is active.

Field/ Setting	Description
Suppress Bit errors	When this setting is checked, bit errors are not counted when the LPS alarm is active. When unchecked, bit errors are counted when the LPS alarm is active. Disabled is the default setting in the factory configuration.
SCPI Examples:	`SENS(@3):ALAR:IGN LPS ON` `SENS(@3):ALAR:IGN LPS OFF`

STS-1 Stuff Columns

Note This setting is only available if the SPE mapping is set to STS-1 for the OC-12/3 Receiver.

The STS-1 Stuff Columns setting specifies whether the SPE stuff columns are expected to contain a fixed pattern or a PRBS payload data pattern (Payload) for payload pattern matching.

The SPE stuff columns are columns 30 and 59 of the SPE envelope as specified in GR-253-CORE. The default setting is Payload (PRBS pattern).

Setting	Description
Fixed	When Fixed is selected, the bytes in the stuff columns are expected to contain a fixed pattern and are not considered to be part of the payload. The stuff columns are ignored for payload pattern matching.
Payload (Default)	When Payload is selected, the bytes in the stuff columns are considered to be part of the payload, and PRBS pattern data is expected in all 87 columns for payload pattern matching.

SCPI Examples:

```
SENS(@7):PAYL:STUF  PAYL
SENS(@7):PAYL:STUF  FIX
SENS(@7):PAYL:STUF  ?
```

25

OC-12/3 TX AND TXPG TRANSMITTER WINDOWS

The topics in this section explain how to configure set-up options, alarm and error insertion, payload generation, and overhead byte values for the OC-12/3 transmitter (TX) and the OC-12/3 transmitter with a payload generator (TXPG) module installed.

Instructions are provided for using EPXam to configure the module, along with SCPI equivalents.

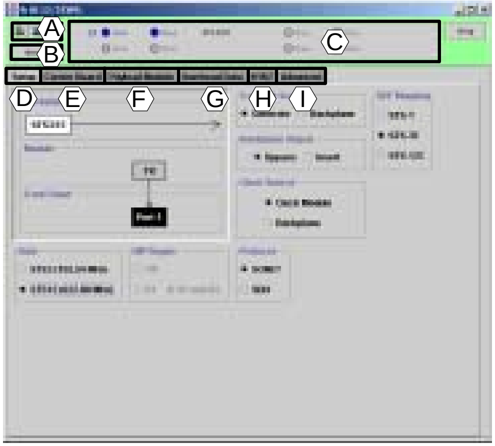
Tip OC-12/3 modules can be switched between SONET and SDH functionality. See "Protocol" on page 320 and "Using the SONET/SDH Switcher" on page 121.

See "STM-4/1 TX and TXPG Transmitter Windows" on page 457 for information about configuration settings and features for these modules in SDH protocol mode.

For more information about EPXam, see "Using EPXam" on page 3.

Main View

The following figure illustrates the features of the OC-12/3 TXPG module window main view.



A Save and restore module/slot configuration; restore factory default settings. See “Saving and Restoring Test Configurations” on page 107.

B **Identify**—When pressed, it flashes the Active LED on the module associated with this window.

C View summary defect status, alarm indicators, and other module information. See “Expanded Logical View Indicators” on page 8.

D **Setup**—Configure transmit source, clock source, backplane output, SPE mapping, signal rate, BIP regen, and SPE mapping or switch the module between SONET and SDH protocol. See “Setup” on page 317.

E **Carrier Board**—Configure OC-12/3 TX carrier board alarm and error insertion settings and view or override SS bit values. See “Carrier Board Settings” on page 321.

F **Payload Module**—Configure OC-12/3 TXPG payload generator alarm and error insertion, enable and specify J1 and J0 trace messages, and manipulate SPE pointer values (TXPG only). See “Payload Module (TXPG only)” on page 324.

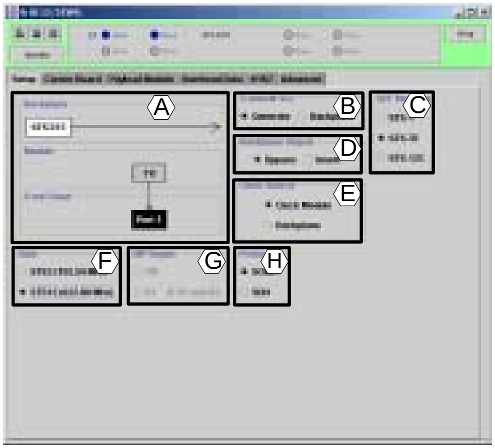
G **Overhead Data**—View or modify transport and path overhead byte values for a selected STS channel in the generated signal. See “Overhead Data (TXPG only)” on page 330.

H **K1/K2**—Modify K1 and K2 byte values and specify APS channel message encoding. See “K1/K2 Settings (TXPG only)” on page 333.

I **Advanced**—Set payload stuff columns for STS-1 mapping, as described in “Advanced (TXPG only)” on page 335.

Setup

The following figure shows the main features of the OC-12/3 TX and TXPG **Setup** tab.



A View graphic display of currently selected module input and output options

B **Transmit Source**—Select whether the data source for the transmitted signal comes from the module's Payload Generator or from an adjacent module via the test system backplane (TXPG only). See "Transmit Source (TXPG)" on page 317.

C **SPE Mapping**—Set the payload size (TXPG only). See "SPE Mapping (TXPG)" on page 318.

D **Backplane Output**—Specify whether the signal generated by the OC-12/3 TXPG is inserted onto the backplane or bypasses the backplane (TXPG only). See "Backplane Output (TXPG)" on page 318.

E **Clock Source**—Specify whether the clock source for the payload generator is provided by the EPX Clock module or from a different source via the backplane (TXPG only). See "Clock Source (TXPG)" on page 319.

F **Rate**—Set the transmit signal rate to OC-3 or OC-12. See "Rate" on page 319.

G **BIP Regen**—Enable or disable B1 and B2 byte regeneration when the Transmit Source is a signal from the backplane. See "BIP Regen" on page 320.

H **Protocol**—Switch between SONET and SDH protocol. See "Protocol" on page 320.

Transmit Source (TXPG)

The **Transmit Source** setting determines whether the data source for the transmitted signal comes from the module's Payload Generator module or from an adjacent, compatible module via the test system backplane.

When Backplane is selected as the Transmit Source, the following limitations apply:

- Error injection is limited to Physical errors, B1, and B2 errors (assuming B1/B2 error injection is enabled via the BIP Regen setting).
- Clock Source setting is set to Backplane.
- Overhead byte insertion, trace message insertion, K1/K2 byte manipulation and APS channel message encoding, SPE pointer manipulation, and payload pattern modification are not available.

Transmit Source Setting	Description
Generate	The OC-12/3 Transmitter with Payload Module generates the signal to be transmitted.
Backplane	The transmit source is a signal on the Test System backplane from the OC-12/3 Receiver installed in the adjacent slot to the left of the transmitter.

SCPI Examples:
`SOUR(@6):DATA:SOUR  PMOD`
`SOUR(@6):DATA:SOUR  BACK`
Related Topics
"Using the Backplane" on page 41	

SPE Mapping (TXPG)

The **SPE Mapping** option sets the size of the SPE (Synchronous Payload Envelope) that is mapped into the generated payload.

This setting affects options for the STS and SPE selections in the **Payload Module** and **Overhead** tabs. Changing the SPE Mapping also returns the SPE selection to the default of Broadcast.

Note This setting does not apply when the Transmit Source is set to Backplane.

SPE Mapping	Description
STS-1	Selects an STS-1 sized payload for the SPE. This is a 783-byte payload.
STS-3C	Selects an STS-3C sized payload for the SPE. This is a 2349-byte payload.
STS-12C	Selects an STS-12C sized payload for the SPE. This is a 9396-byte payload.

SCPI Examples:
`PMOD(@7):SOUR:DATA:SIZE STS1`
`PMOD(@7):SOUR:DATA:SIZE STS3C`
`PMOD(@7):SOUR:DATA:SIZE STS12C`	

Backplane Output (TXPG)

The Backplane Output setting determines whether the transmitter module inserts the signal from the payload generator onto the backplane.

Backplane Output Setting	Description
Bypass	The data currently on the backplane is sent back to the backplane. It is not modified and continues to the adjacent, higher-numbered slot for use.
Insert	The signal from the module's Payload Generator is inserted on the backplane, replacing any existing STS-12/3 backplane signal.

Backplane Output Setting	Description

SCPI Examples:
`SYST:BOAR(@6):BACK:MODE PMOD`
`SYST:BOAR(@6):BACK:MODE BYP`
Related Topics
"Using the Backplane" on page 41	

Clock Source (TXPG)

The Clock Source setting selects the timing reference that the payload generator uses to generate the SONET payload.

When Backplane is selected as the Transmit Source, the Clock Source can only be Backplane.

Clock Source Setting	Description
Clock Module	Selects the timing reference from the EPX Test System's clock module. Verify that the EPX clock module is correctly providing a SONET/SDH timing reference for the slot in which the OC-12/3 Transmitter is installed.
Backplane	Selects a timing reference from another source via the backplane. This option is always selected when the Transmit Source is signal from the test system backplane.

Clock Source Setting	Description

SCPI Examples:
`PMOD(@7):SOUR:CLOC:SOUR CLKB`
`PMOD(@7):SOUR:CLOC:SOUR BACK`
Related Topics
"Configuring the EPX100 Clock Module" on page 25	

Rate

The OC-12/3 TX and TXPG can transmit at STS-3 or STS-12 signal rates.

Note When you modify the transmit signal rate, check that the settings for the receiver of the signal (such as the receive signal rate, channel, payload, SPE mapping, backplane I/O, and so on) are appropriately configured for the new signal rate.

TX Rate Setting	Description
STS3 (155.54 MHz)	OC-3 signal rate
STS12 (622.08 MHz)	OC-12 signal rate

SCPI Examples:
`OUTP(@3):RATE sts3`
`OUTP(@3):RATE sts12`	

BIP Regen

The BIP Regen options control B1 and B2 byte regeneration when the Transmit Source is a signal from the Backplane.

BIP Regen Setting	Description
Off	Disables B1 and B2 BIP regenerators. The signal is retransmitted as it is received from the backplane, and only physical layer errors can be inserted. If the error type is section (B1)or line (B2) and this setting is chosen, the Error Type setting is forced to physical.
B1	Enables B1 BIP regenerator. The B1 byte is recaculated before the signal is retransmitted. Only physical layer and section (B1) errors can be inserted when the transmit source is a signal from the backplane. If the Error Type is set to line (B2) and this setting is chosen, the Error Type setting is forced to physical.
B1 and B2 (Default)	Enable B1 and B2 BIP regenerators. The B2 and B2 bytes are recalculated before the signal is retransmitted. Physical, B1, and B2 errors can be inserted when the transmit source is a signal from the backplane.

BIP Regen Setting	Description

SCPI Examples:
`SOUR(@3):OVER:BIPR B1`
`SOUR(@3):OVER:BIPR B1_B2`
`SOUR(@3):OVER:BIPR OFF`
Related Topics:
“Transmit Source (TXPG)” on page 317	

Protocol

The Protocol setting switches the module between SONET and SDH. When the switch is complete, EPXam displays the appropriate protocol configuration options and field labels for the module and updates all references to the module to use the correct protocol.

Note Switching between SONET and SDH protocol does *not* require a restart of the test system or EPXam.

Restrictions:

- Modules that are locked via the Group Manager cannot be switched by other users.
- Active test and logging sessions associated with a module at the time of a switch are cancelled.

  If tests or logging sessions are in progress on any of the modules being switched, a warning dialog is displayed. Click **Cancel** to abort the switch or **Continue** to complete the switch. If you choose **Continue**, running tests and logging sessions are cancelled. Otherwise, a dialog opens that displays the switching progress.

Setting	Description
SONET	Switches the module to SONET without restarting the test system or EPXam. This is the default setting in the factory configuration.
SDH	Switches the module to SDH without restarting the test system or EPXam.

SCPI Examples:
`SYST:BOAR(@7):PROT:TYPE SON`
`SYST:BOAR(@7):PROT:TYPE SDH`
`SYST:BOAR(@7):PROT:STAT?`	

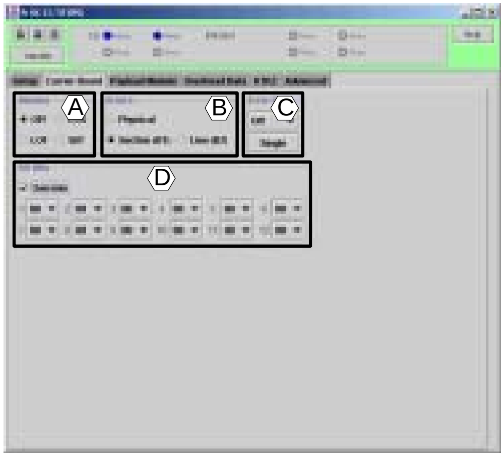
See “STM-4/1 TX and TXPG Transmitter Windows” on page 457 for a description of this module’s SDH features and configuration.

See the following topics for more information about SONET/SDH switching:

- “Using the SONET/SDH Switcher” on page 121
- “SONET/SDH Switching and Custom Configuration Files” on page 123
- “Switching Modules Using SCPI” on page 123

Carrier Board Settings

The following figure illustrates the settings that are configured on the STM-64 transmitter **Carrier Board** tab.



A **Alarms**—Select the type of alarm to insert, as described in “Alarms” on page 322.

B **Errors**—Select the type of error to insert, as described in “Errors” on page 322.

C **Error Rate**—Set the error insertion rate, as described in “Error Rate (Carrier Board)” on page 323.

D **SS Bits**—Override the values for the SS bits, as described in “SS Bits (Carrier Board)” on page 323.

Alarms

The Alarms setting determines the type of alarm that is inserted into the transmit stream.

Alarm setting	Description
Off	Disables alarm insertion.
LOS	Loss of Signal **Implementation**: LOS is generated by disabling the signal output. When LOS insertion is turned off, the transmit drivers are re-enabled.
LOF	Loss of Frame **Implementation**: The OC-12/3 Transmitter generates LOF by inverting the framing bytes (A1, A2) in the SONET overhead. When LOF insertion is turned off, the framing bytes are restored.
SEF	Severely Errored Frame **Implementation**: SEF is inserted by inverting the framing bytes (A1, A2) in the SONET overhead for four consecutive frames and then reverting to the correct values. This sequence is repeated until SEF alarm insertion is turned off.

SCPI Examples:

```
SOUR(@3):ALAR OFF
SOUR(@3):ALAR SEF
SOUR(@3):ALAR LOF
SOUR(@3):ALAR LOS
```

Errors

The Errors setting determines the type of error that is inserted into the transmit stream. Whenever the Error Type setting is modified, the Error Rate setting is always reset to Off.

Note When the Transmit Source is set to Backplane, Section (B1) and Line (B2) error insertion depends on the BIP Regen setting on the **Setup** tab. Conflicts can occur if you attempt to set the error type to Section or Line and the BIP Regen option is not set correctly. See “BIP Regen” on page 320 for more information.

Error Type	Description
Physical	Insert physical layer (or random) errors into the stream. The BIP Regen setting does not affect physical error insertion when the Transmit Source is set to Backplane.
Section (B1)	Insert section (B1 BIP-8) errors into the stream. The BIP Regen setting must be either **B1** or **B1 and B2** to insert B1 errors when the Transmit Source is set to Backplane.
Line (B2)	Insert line (B2 BIP-8) errors into the stream. The BIP Regen setting must be set to **B1 and B2** to insert B2 errors when the Transmit Source is set to Backplane.

Error Type	Description
SCPI Examples: `SOUR(@3):ERR:TYPE SECT` `SOUR(@3):ERR:TYPE LINE` `SOUR(@3):ERR:TYPE PHYS`	

Error Rate (Carrier Board)

The Error Rate setting enables and disables error insertion and controls the rate at which errors are inserted into the stream.

Tip The Error Rate setting is always reset to OFF whenever the Error Type is changed.

Error Rate Setting	Description
Off	Sets the error rate to 0, effectively disabling error insertion.
IE-3 through IE-9	Set the error ratio to 10 x 10^-3, 10 x 10^-4, and so on. IE-3 does not apply to Section (B1) errors. Set the Error Type to Line (B2) and BIP Regen to B1 and B2 to use IE-3.
Single	The Error Rate must be set to Off to enable single error insertion. When this option is available, click this button to insert a single error into the transmit stream.

Error Rate Setting	Description
SCPI Examples: `SOUR(@3):ERR:RAT OFF` `SOUR(@3):ERR:RAT RIE-4` `SOUR(@3):ERR:RAT SING`	

SS Bits (Carrier Board)

Use the SS Bits Override setting to modify the SS overhead bits that are inserted into the H1 overhead byte in the OC-3 or OC-12 stream. By default, these bits are not modified.

The SS bits are bits 5 and 6 of the H1 overhead byte. They indicate whether the signal is carrying SONET traffic (value of 00) or SDH traffic (value of 10).

- When the signal rate is set to STS3, 3 bit pairs can be modified.
- When the signal rate is set to STS12, 12 bit pairs can be modified.

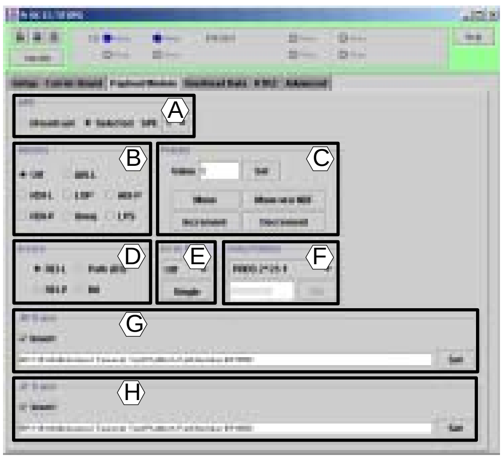
SS Bits Settings	Description
Override	If checked, the binary values specified override the default SS bit values.
1 through 3 (OC-3) or 1 through 12 (OC-12)	Specify a binary value for each bit pair (00, 01, 10, or 11).

SS Bits Settings	Description
SCPI Examples: `SOUR(@3):OVER:SS 11;11;11` `SOUR(@3):OVER:SS OFF`	

Payload Module (TXPG only)

The following figure illustrates the options available on the OC-12/3 TXPG **Payload Module** tab.

Note The settings on the Payload Module tab do not apply when the Transmit Source is set to Backplane.



A **SPE**—Select an SPE time slot to map the generated payload or broadcast to all time slots, as described in “SPE” on page 325.

B **Alarms**—Select the type of payload module alarms to insert, as described in “Payload Module Alarms” on page 326.

C **Pointer**—Set payload pointer values or perform actions on current payload pointer, as described in “Pointer” on page 327.

D **Errors**—Select the type of payload module error to insert, as described in “Errors” on page 327.

E **Error Rate**—Set the error insertion rate, as described in “Error Rate” on page 328.

F **Data Pattern**—Specify the data pattern to place into the generated payload, as described in “Data Pattern” on page 329.

G **J0 Trace**—Define and insert J0 trace messages, as described in “J0 Trace” on page 329.

H **J1 Trace**—Define and insert J0 trace messages, as described in “J0 Trace” on page 329.

SPE

The SPE setting determines whether the generated signal is mapped to a specific SPE time slot or broadcast to all time slots.

The number of available channels depends on the SPE mapping that is selected on the **Setup** tab.

Settings	Description
Broadcast	Map the generated payload to all time slots. When **Broadcast** is selected, channel selection is unavailable. This is the default in the factory configuration.
Selected	Map the generated payload to the time slot specified by the **SPE** setting.
SPE	Select a channel to insert the generated payload. This option is not available in broadcast mode. This field is linked to the SPE field in the **Overhead** tab. The range of channels available depends on the settings specified for the SPE mapping: • If the SPE mapping is STS-1c, select 1 of 12 (for STS-12 rate) or 1 of 3 (for STS-3 rate) channels. • If the SPE mapping is STS-3c, select 1 of 4 channels (for STS-12 rate) or only 1 channel can be selected. • If the SPE mapping is STS12c, only 1 channel can be selected.

Settings	Description

SCPI Examples:
`PMOD(@6):SOUR:DATA:MODE BRO`
`PMOD(@6):SOUR:DATA:MODE SEL`
`PMOD(@6):SOUR:DATA:SPE 1`
Related Topics:
“Rate” on page 319
“SPE Mapping (TXPG)” on page 318
“Path Overhead Data” on page 332	

Payload Module Alarms

The **Alarms** setting determines the type of alarm that is inserted into the transmit stream.

Note If Backplane is selected as the Transmit Source, alarm injection from the payload module is not available.

STS Line/ Path Alarms	Description
OFF	Disables payload alarm insertion.
AIS-L	Line Alarm Indication Signal or AIS-L. **Implementation**: The OC-12/3 Transmitter generates the AIS-L alarm by forcing the entire line to all 1s. When AIS-L alarm insertion is turned off, the normal line data is restored.
RDI-L	Line Remote Defect Indicator (formerly Line FERF or Line Far End Remote Failure). **Implementation**: RDI-L is generated by setting the K2 byte to 6 (0b110). When RDI-L insertion is turned off, the K2 byte is restored.
LOP	Loss of Pointer. **Implementation**: LOP is generated by setting the pointer to an out-of-range value. LOP is cleared by restoring the pointer data.
AIS-P	Path Alarm Indication Signal. **Implementation**: AIS-P (Path Alarm Indicator Signal) is generated by setting the pointer bytes and all path data to all 1s. When AIS-P insertion is turned off, the pointer bytes and path data are restored.
RDI-P	Path Remote Defect Indicator. **Implementation**: RDI-P is generated by setting bit 5 of the G1 byte in the path overhead. When RDI-P insertion is turned off, bit 5 of the G1 byte is cleared.
Uneq	Path Unequipped. **Implementation**: UNEQ-P (Path Unequipped) is generated by forcing the path data to all 0s. When UNEQ-P insertion is turned off, the path data is restored.
LPS	Loss of Pattern Synchronization. This alarm is generated by setting the payload data pattern to one that is different than expected.

SCPI Examples:

```
PMOD(@6):SOUR:ALAR OFF
PMOD(@6):SOUR:ALAR LOP
PMOD(@6):SOUR:ALAR PAIS
PMOD(@6):SOUR:ALAR PRDI
PMOD(@6):SOUR:ALAR UNEQ
PMOD(@6):SOUR:ALAR LPS
```

Pointer

Use the Pointer settings to move or set the value of the payload pointer.

Note The SPE pointer cannot be modified when the Transmit Source is set to Backplane.

Pointer Settings	Description
Value	Manually set the SPE pointer. Enter an integer value from 0 to 782. The value entered is displayed as a hexadecimal number.
Set	You must click **Set** to apply the change to the SPE pointer value entered in the **Value** field.
Move	Move pointer with the New Data Flag (bits 1 to 4 of the H1 overhead byte). This causes a large change to the pointer value, and the NDF flag in the H1 overhead byte is updated appropriately. The moves alternate between increment and decrement.
Move w/o NDF	Move pointer without the New Data Flag. This causes a large change in the pointer value without the appropriate NDF indication in the H1 overhead byte. The moves alternate between increment and decrement.
Increment Decrement	Increment or decrement the SPE pointer value by 1.

Pointer Settings	Description
SCPI Examples: `PMOD(@6):SOUR:POIN:VAL 260` `PMOD(@6):SOUR:POIN:ACT INCR` `PMOD(@6):SOUR:POIN:ACT DECR` `PMOD(@6):SOUR:POIN:ACT NDF` `PMOD(@6):SOUR:POIN:ACT MNDF`	

Errors

The **Error** setting controls the type of error which is inserted into the transmit stream. Whenever the Error setting is modified, the Error Rate setting is always reset to Off.

Note If Backplane is selected as the Transmit Source, error injection on the payload module is not available.

Settings	Description
REI-L	Line Remote Error Indicator Inserts error counts in the M1 byte.
Path (B3)	Inserts Path (B3) errors into the stream.
REI-P	Path Remote Error Indicator Inserts error counts in the G1 byte (bits 1 to 4).
Bit	Inserts errors into the bits of the payload so that the transmitted payload does not match the expected pattern.

Settings	Description

SCPI Examples:
`PMOD(@6):SOUR:ERR:TYPE LREI`
`PMOD(@6):SOUR:ERR:TYPE PREI`
`PMOD(@6):SOUR:ERR:TYPE PATH`
`PMOD(@6):SOUR:ERR:TYPE BIT`	

Error Rate

The Error Rate setting enables and disables error insertion and controls the rate at which errors are inserted into the stream.

The Error Rate setting is always reset to OFF whenever the Error Type is changed.

The IE-3 setting does not apply to Section (B3) errors.

Error Rate Setting	Description
Off	Disables error insertion. This is the default setting in the factory configuration.
IE-3 through IE-9	Sets the error insertion ratio to 10 x 10^-3, 10 x 10^-4, etc. The IE-3 setting does not apply to Path (B3) and REI-P errors.
All	Inserts errors into all bits in the Path (B3), REI-L, and REI-P bytes. This mode does not apply to Bit errors.
Single	Inserts a single error. Error Rate must be set to Off to enable single error insertion.

SCPI Examples:
`PMOD(@6):SOUR:ERR:RAT OFF`
`PMOD(@6):SOUR:ERR:RAT SING`
`PMOD(@6):SOUR:ERR:RAT RIE-4`	

Data Pattern

The Data Pattern setting selects the type of pattern to place into the generated payload. The data pattern cannot be modified when the Transmit Source is set to Backplane.

Settings	Description
PRBS 2^15-1 **PRBS 2^20-1** **PRBS 2^23-1** **Inv. PRBS 2^23-1** **Inv. PRBS 2^20-1** **Inv. PRBS 2^15-1**	Pseudo-random bit sequence (PRBS) patterns and inverted PRBS patterns. The default setting is PRBS 2^23-1
1111	All Ones.
0000	All Zeroes.
0101	Alternating zero-ones (0b01010101) pattern.
1010	Alternating one-zeros (0b10101010) pattern.
User	8-bit binary user-defined payload pattern.
Set	If a custom user-defined payload pattern is defined, click **Set** to apply the changed user payload pattern.

SCPI Examples:
`PMOD(@6):SOUR:PAYL:PATT:TYPE PR215`
`PMOD(@6):SOUR:PAYL:PATT:TYPE PR220`
`PMOD(@6):SOUR:PAYL:PATT:TYPE IPR223`
`PMOD(@6):SOUR:PAYL:PATT:TYPE USER`
`PMOD(@6):SOUR:PAYL:PATT:USER 0b00010001`	

J0 Trace

Create and insert a user-defined section J0 trace message.

Note The J0 trace message cannot be modified when the Transmit Source is set to Backplane. In the factory configuration, the default setting is off.

1 Click **Insert**.

2 Enter the trace message.

Note Messages can be no longer than 62 characters.

3 Click **Set** to apply the changes.

If you do not click **Set**, the modified message is not inserted.

To enable J0 trace and insert a trace message using SCPI, use a pair of commands similar to the following:

```
PMOD(@6):SOUR:DATA:SECT:TREN ON
PMOD(@6):SOUR:DATA:SECT:TRAC “J0 trace
msg”
```

Note When using SCPI, you must enclose the message in quotation marks. Otherwise, only the characters before the first space are used as the trace message.

J1 Trace

Create and insert a user-defined section J0 trace message.

Note The J1 trace message cannot be modified when the Transmit Source is set to Backplane. In the factory configuration, the default setting is off.

1 Click **Insert**.

2 Enter the trace message.

Note Messages can be no longer than 62 characters.

3 Click **Set** to apply the changes.

If you do not click **Set**, the modified message is not inserted.

To enable J0 trace and insert a trace message using SCPI, use a pair of commands similar to the following:

```
PMOD(@6):SOUR:DATA:PATH:TREN ON
PMOD(@6):SOUR:DATA:PATH:TRAC “J1 trace
msg”
```

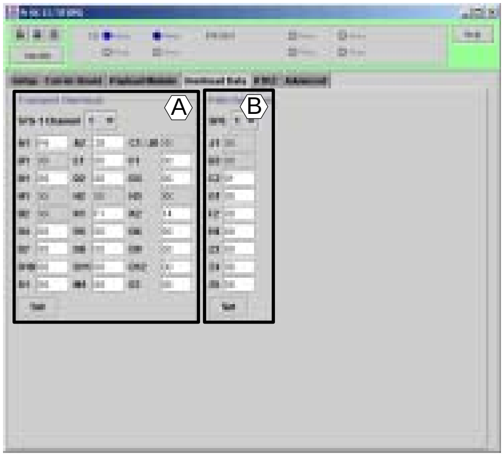
Note When using SCPI, you must enclose the message in quotation marks. Otherwise, only the characters before the first space are used as the trace message.

Overhead Data (TXPG only)

The **Overhead Data** tab provides options for modifying individual path and transport overhead data values for a given time slot.

The following figure shows the main features of the **Overhead Data** tab.

Note Overhead data cannot be modified when the Transmit Source is set to Backplane.



A **Transport Overhead**—Set transport overhead byte values (section and line) for the selected STS-1 channel. See “Transport Overhead Data” on page 330.

B **Path Overhead**—Set path overhead byte values for the selected SPE channel or broadcast to all channels. See “Path Overhead Data” on page 332.

Transport Overhead Data

To modify specific STS transport overhead bytes.

1 Select a channel (time slot).

2 Enter hexadecimal byte values.

3 Click **Set** to apply the changes.

The following notes apply to modifying transport overhead bytes:

- Overhead bytes that cannot be modified are indicated with “XX” greyed out in the user interface.
- The B1 and B2 bytes cannot be modified using this interface. Use the B1 and B2 error insertion setting on the **Carrier Board** tab.

Settings	Description
Channel	Select the number of the time slot in the internally generated SPE for which you want to modify transport overhead bytes The number of available channels is either 3 or 12, depending on whether the currently selected signal rate is OC-3 or OC-12.
A1, A2	Section overhead framing bytes. Modifying A1 and A2 bytes causes receivers to lose framing.
J0 (C1)	Formerly C1 (STS-1 ID), now redefined as the J0 section trace byte. Modifying J0 in STS-1, channel 1 only takes effect if section trace message insertion is disabled, as described in “J0 Trace” on page 329.
E1	Orderwire section byte located in first STS-1 of an STS-N.
F1	Section user channel byte located in first STS-1 of an STS-N.
D1, D2, D3	Section data communication channel bytes located in first STS-1 of an STS-N.

Settings	Description
K1, K2	APS channel bytes. Modifying K1 and K2 is possible through this interface, but to ensure proper K1 and K2 updates, see “K1/K2 Settings (TXPG only)” on page 333. Enabled alarms (RDI-L, AIS-L) override changes to K2.
H1, H2	SPE payload pointer bytes. The H1 and H2 bytes cannot be modified.
H3	SPE pointer action byte. The H3 byte cannot be modified.
D4 through D12	Line data communications channel bytes.
S1	Synchronization status byte.
M1	Line Remote Error Indicator (Line REI) byte. Modifying M1 of STS-1, channel 7 does not override enabled error injection of Line REIs.
E2	Express orderwire byte.
Set	You must click **Set** to apply any changes to the transport overhead byte values.

Settings	Description
SCPI Examples:	
	pmod(@13):sour:data:tran:over[1]:ord 1 1 0x11
	pmod(@13):sour:data:tran:over[1]:ord 1 2 0x28
	pmod(@13):sour:data:tran:over[1]:ord 1 3 0x01
	pmod(@13):sour:data:tran:over[1]:ord 2 2 0x00
	pmod(@13):sour:data:tran:over[1]:ord 2 3 0x00
	pmod(@13):sour:data:tran:over[1]:ord 3 1 0x00
	pmod(@13):sour:data:tran:over[1]:ord 3 2 0x00
	pmod(@13):sour:data:tran:over[1]:ord 3 3 0x00
	pmod(@13):sour:data:tran:over[1]:ord 5 2 0xF1
	pmod(@13):sour:data:tran:over[1]:ord 5 3 0x14
	pmod(@13):sour:data:tran:over[1]:ord 6 1 0x00
	pmod(@13):sour:data:tran:over[1]:ord 6 2 0x00
	pmod(@13):sour:data:tran:over[1]:ord 6 3 0x00
	pmod(@13):sour:data:tran:over[1]:ord 7 1 0x00
	pmod(@13):sour:data:tran:over[1]:ord 7 2 0x00
	pmod(@13):sour:data:tran:over[1]:ord 7 3 0x00
	pmod(@13):sour:data:tran:over[1]:ord 8 1 0x00
	pmod(@13):sour:data:tran:over[1]:ord 8 2 0x00
	pmod(@13):sour:data:tran:over[1]:ord 8 3 0x00
	pmod(@13):sour:data:tran:over[1]:ord 9 1 0x00
	pmod(@13):sour:data:tran:over[1]:ord 9 2 0x00
	pmod(@13):sour:data:tran:over[1]:ord 9 3 0x00

Path Overhead Data

Perform the following steps to modify specific transport overhead bytes for a specific time slot in the internally generated SPE.

Note Channel selection is only available when the signal is framed and the SPE is set to Selected. See “SPE” on page 325.

1. Select an STS-1 channel (time slot).
2. Enter hexadecimal values.
3. Click **Set** to apply the changes.

The following notes apply to modifying transport overhead bytes:

- Overhead bytes that cannot be modified are indicated with “XX” greyed out in the user interface.
- The B3 byte cannot be modified using this interface. Use the B3 error insertion as described in “Errors” on page 327.

Settings	Description
STS-1 Channel	Select the number of the time slot in the internally generated SPE for which you want to modify path overhead bytes The number of slots varies, depending on the currently selected transmit signal rate (OC-3 or OC-12) and the current SPE payload mapping.
J1	STS path trace byte. Modifying J1 only takes effect if J1 path trace message insertion is disabled “J1 Trace” on page 329.

Settings	Description
C2	STS path signal label.
G1	Path terminating status byte.
F2	Path user channel byte.
H4	Indicator allocated for use as a mapping-specific indicator byte.
Z3, Z4	Allocated for future growth.
Z5	Tandem connection byte.
Set	You must click **Set** to apply any changes to the transport overhead byte values.

SCPI Examples:

```
pmod(@13):sour:data:path:over:ord 1 0x00
pmod(@13):sour:data:path:over:ord 3 0x01
pmod(@13):sour:data:path:over:ord 4 0x00
pmod(@13):sour:data:path:over:ord 5 0x00
pmod(@13):sour:data:path:over:ord 6 0x00
pmod(@13):sour:data:path:over:ord 7 0x00
pmod(@13):sour:data:path:over:ord 8 0x00
pmod(@13):sour:data:path:over:ord 9 0x00
```

K1/K2 Settings (TXPG only)

The following figure shows the main features on the OC-12/3 TXPG **K1/K2** tab.

Note K1/K2 byte values and messages cannot be set when the Transmit Source is set to Backplane.

A **K1/K2 Values**—Directoy set K1 and K2 byte values.

B **K1/K2/Messages**—Set K1 and K2 bits to encode APS channel messages.

These settings are described in more detail in the following sections.

Set K1/K2 Values (TXPG)

The K1/K2 Values setting enables you to directly set values in the automated protection switching (APS) channel K1 and K2 bytes. As you modify K1/K2 values, the K1/K2 Message setting fields are updated appropriately.

K1/K2 Value Settings	Description
K1	The default value is 0xF1. Bits 1 through 4 control the request message, and bits 5 through 8 control the channel message code.
K2	The default value is 0x14. Bits 1 through 4 of the K2 byte control the channel number, bit 5 controls the architecture, and bits 6 thorough 8 indicate the mode of operation.
Set	You must click **Set** to update and transmit new K1/K2 values entered here.

SCPI Examples:

```
PMOD(@6):SOUR:APS:K1K2 0xF2,0x14
```

Related Topics:

"Set K1/K2 Messages (TXPG)" on page 334

Set K1/K2 Messages (TXPG)

Use the fields in the K1/K2 message panel to set K1 and K2 bits to generate APS channel messages.

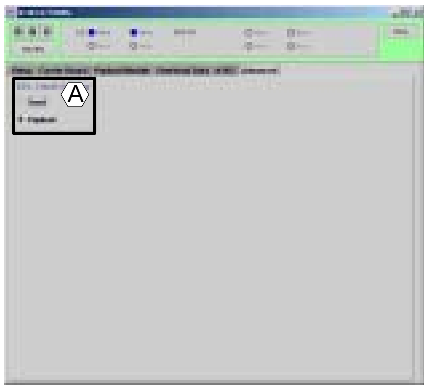
As you set K1/K2 message fields, the hexadecimal values displayed in the **K1/K2 Values** field update accordingly.

K1/K2 Message Settings	Description
K1 Request	Sets bits 1 through 4 of K1 with one of the following request messages.
	Lockout of Protection. Sets bits 1 through 4 to 1111.
	Forced Switch. Sets bits 1 through 4 to 1110.
	SF - High Priority. Sets bits 1 through 4 to 1101.
	SF - Low Priority. Sets bits 1 through 4 to 1100.
	SD - High Priority. Sets bits 1 through 4 to 1011.
	SD - Low Priority. Sets bits 1 through 4 to 1010.
	Manual Switch. Sets bits 1 through 4 to 1000.
	Wait-to-Restore. Sets bits 1 through 4 to 0110.
	Exercise. Sets bits 1 through 4 to 0100.
	Revert Request. Sets bits 1 through 4 to 0100
	Do Not Revert. Sets bits 1 through 4 to 0001
	No Request — Sets bits 1 through 4 to 0000.

K1/K2 Message Settings	Description
K1 Channel	Selects the channel to apply the requesting message (sets bits 5 through 8 of K1 with the channel message code): • 0 selects the Null channel. • 1 through 14 — Channel 1 through 14. • 15 — Extra traffic channel.
K2 Operation	Sets the operational mode of the APS. Bits 6 through 8 of the K2 byte carry this information. **Unidirectional**. Sets bits 6 to 8 to 100. **Bidirectional**. Sets bits 6 to 8 to 101.
K2 Architecture	Sets the architecture mode for the APS. Bit 5 of K2 carries this information. **Architecture 1+1**. Sets bit 5 to 0. **Architecture 1:n**. Sets bit 5 to 1.
K2 Channel	Selects the channel to apply the requesting message (sets bits 1 through 4 of K1 with the channel message code): **0**. Null channel. **1** to **14**. Channel 1 to 14. **15**. Extra traffic channel.
Set	You must click **Set** to update and apply the K1/K2 Message settings.
SCPI Examples: See “APS” in the “OC-12/3 STM-4/1 Transmitter” on page 597 section of the *“SCPI Reference”* for detailed information about setting K1/K2 messages using SCPI.	

Advanced (TXPG only)

The following figure illustrates the settings that are configured on the OC-12/3 Transmitter **Advanced** tab.



A **STS-1 Stuff Columns**—When the SPE mapping is set to STS-1, select whether the SPE stuff columns contain a fixed pattern (all zeroes) or a PRBS payload data pattern. See “STS-1 Stuff Columns” on page 336.

STS-1 Stuff Columns

The **STS-1 Stuff Columns** setting specifies whether the SPE stuff columns are filled with a fixed (all zeroes) pattern or a PRBS payload pattern.

Note This setting is only available when the SPE mapping for the OC-48 Transmitter is set to STS-1.

The stuff columns are columns 30 and 59 of the SPE as specified in GR-253-CORE. The default setting is Payload (PRBS pattern).

Setting	Description
Fixed	Fills the bytes in the SPE stuff columns with a fixed pattern of all zeroes.
Payload	Fills the bytes in the stuff columns with PRBS pattern data. This is the default setting in the factory configuration.

SCPI Examples:
`SOUR(@7):PAYL:STUF PAYL`
`SOUR(@7):PAYL:STUF FIX`
`SOUR(@7):PAYL:STUF ?`	

26

OC-48 Receiver Window

The topics in this section explain setup and monitoring options and monitored performance data for the OC-48 Receiver:

Instructions are provided for using EPXam to configure the module with SCPI equivalents.

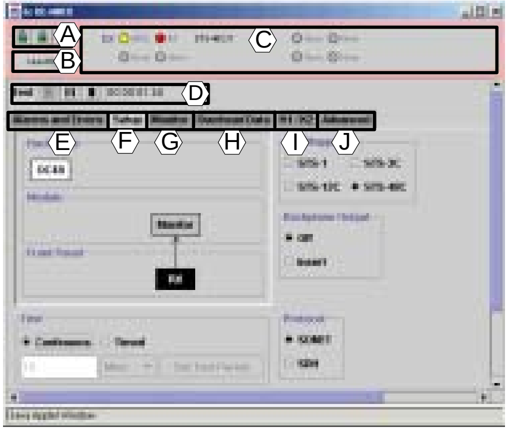
Tip OC-48 Receivers can be switched between SONET and SDH functionality. See "Protocol" on page 341 and "Using the SONET/SDH Switcher" on page 121.

See "STM-16 Receiver Window" on page 479 for a description of the features and user interface for this module in SDH protocol mode.

For more information about EPXam, see "Using EPXam" on page 3.

Main View

The following figure illustrates the main features of the OC-48 Receiver window.



A Save or restore custom module/slot configuration; restore factory defaults. See “Using Module Window Save and Restore Controls” on page 108.

B **Identify**—When pressed, it flashes the Active LED on module associated with this window.

C View summary defect status, alarm indicators, and other module information. See “Expanded Logical View Indicators” on page 8.

D Start, stop, or pause test; view elapsed time. See “Using Module Window Test Controls” on page 118.

E **Alarms and Errors**—View alarm indicators, error counts, error ratios, service disruption data, and performance statistics for the current test. See “Alarms and Errors” on page 342 and “Service Disruption Monitoring” on page 346.

F **Setup**—Configure payload mapping, backplane enable or disable, test type, and duration, and set the protocol (either SONET or SDH). See “Setup” on page 339.

G **Monitor**—Monitor SPE pointer values and pointer event counts, set the type of payload data pattern to monitor, and monitor J0 and J1 trace messages. See “Monitor Settings” on page 350.

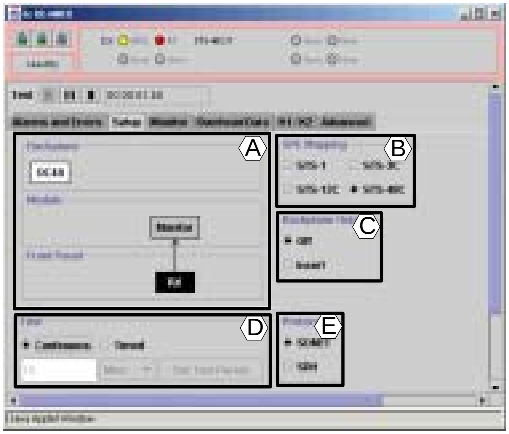
H **Overhead Data**—Monitor individual transport and path overhead byte values for a selected channel. See “Overhead Data” on page 352.

I **K1/K2**—Monitor K1 and K2 byte values and decoded APS channel messages. See “K1/K2 Settings” on page 354.

J **Advanced**—Specify STS-1 stuff column fill type, error filter options, and whether the received K1/K2 values are broadcast to an OC-48 module in the adjacent, higher-numbered slot. See “Advanced Settings” on page 357.

Setup

The following figure shows the settings that are configured on the **Setup** tab.



A View graphic display of current signal source and backplane output settings.

B **SPE Mapping**—Set the expected STS size and mapping of the monitored SPE. See “SPE Mapping” on page 339

C **Backplane Output**—Specify whether the incoming signal on the OC-48 Receiver front panel is passed through to the backplane or the backplane signal is unchanged (bypass). See “Backplane Output” on page 340.

D **Test**—Set the test type and duration. See “Test” on page 340.

E **Protocol**—Switch the module between SONET and SDH. See “Protocol” on page 341.

SPE Mapping

The SPE Mapping option sets the expected STS size and mapping of the monitored SPE. This setting affects the number of channels available for monitoring in the Overhead and Monitor tabs. See “SPE” on page 350 and “Path Overhead” on page 353.

SPE Mapping	Description
STS-1	Selects STS-1 as the monitored payload. This is a 783-byte payload.
STS-3C	Selects STS-3c as the monitored payload. This is a 2349-byte payload.
STS-12C	Selects STS-12c as the monitored payload. This is a 9396-byte payload.
STS-48C	Selects STS-48c as the monitored payload. This is a 37584-byte payload. This is the default setting in the factory configuration.

SCPI Examples:

```
SENS(@7):DATA:SIZE STS1
SENS(@7):DATA:SIZE STS3C
SENS(@7):DATA:SIZE STS12C
SENS(@7):DATA:SIZE STS48C
```

Related Topics:

“SPE” on page 350

“Path Overhead” on page 353

Backplane Output

The Backplane Output setting determines whether the data from the front panel connector is sent to the backplane or the backplane signal is unchanged.

The graphic display of the current backplane setting, backplane signal, and signal path are updated when you change these settings.

Note Modules must be installed contiguously to transmit and receive signals along with backplane.

Setting	Description
Off	The incoming OC-48 signal is not passed through to the backplane, and the signal on the backplane is not modified. This is the default setting in the factory configuration.
Insert	The incoming OC-48 signal is inserted onto the backplane. This enables the OC-48 TX module in the adjacent slot (to the right, or downstream) to use the signal from the backplane as its transmit source.

SCPI Examples:
`SENS(@7):DATA:BACK ENAB 1`
`SENS(@7):DATA:BACK ENAB 0`	

Test

The Test area defines the type and duration of the test that the receiver runs. To start and stop tests, use the controls in the module window or, to start tests for multiple modules, use the Test Controls window. See “Controlling Tests” on page 115.

Note Selecting a new test type automatically stops the current test.

Test Setting	Description
Continuous	Selects a continuous test that must be manually stopped and started. This is the default setting in the factory configuration.
Timed	Selects a timed test. When Timed is selected: **1** Specify a number and select a unit (seconds, minutes, hours, and days) for the test duration. **2** Click **Set** to apply the settings. **3** Use the controls at the top of the window to start the test.

Test Setting	Description

SCPI Examples:
`sens(@3):test:type cont`
`sens(@3):test:type tim`
`sens(@3):test:unit min`
`sens(@3):test:per 10`
To control tests use the following commands:
`sens(@3):test:mode star`
`sens(@3):test:mode stop`
`sens(@3):test:mode rest`
`sens(@3):test:mode pause`
Related Topics:
"Logging" on page 63
"Controlling Tests" on page 115	

Protocol

The Protocol setting switches the module between SONET and SDH. When the switch is complete, EPXam displays the appropriate protocol configuration options and field labels for the module and updates all references to the module to use the correct protocol.

Note Switching between SONET and SDH protocol does *not* require a restart of the test system or EPXam.

Restrictions:

- Modules that are locked via the Group Manager cannot be switched by other users.
- Active test and logging sessions associated with a module at the time of a switch are cancelled.

If tests or logging sessions are in progress on any of the modules being switched, a warning dialog is displayed. Click **Cancel** to abort the switch or **Continue** to complete the switch. If you choose **Continue**, running tests and logging sessions are cancelled. Otherwise, a dialog opens that displays the switching progress.

Setting	Description
SONET	Switches the module to SONET without restarting the test system or EPXam. This is the default setting in the factory configuration.
SDH	Switches the module to SDH without restarting the test system or EPXam.

SCPI Examples:
`SYST:BOAR(@7):PROT:TYPE SON`
`SYST:BOAR(@7):PROT:TYPE SDH`
`SYST:BOAR(@7):PROT:STAT?`	

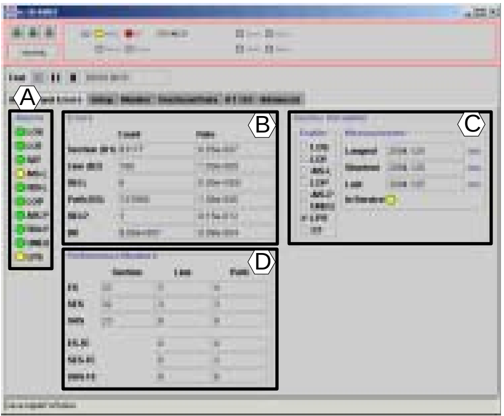
See "STM-16 Receiver Window" on page 479 for a description of this module's SDH features and configuration.

See the following topics for more information about SONET/SDH switching:

- "Using the SONET/SDH Switcher" on page 121
- "SONET/SDH Switching and Custom Configuration Files" on page 123
- "Switching Modules Using SCPI" on page 123

Alarms and Errors

The following figure shows the main features of the **Alarms and Errors** tab.



A **Alarms**—View alarm status indicators for current test. See “Alarms” on page 342.

B **Errors**—View error counts and error ratios for current test. See “Errors” on page 344.

C **Service Disruption**—Enable one or more alarm types for service disruption monitoring and view service disruption in-service status and data for the current test. By default, only LPS alarms are enabled for service disruption monitoring. See “Service Disruption Monitoring” on page 346.

D **Performance Monitors**—Displays performance monitoring statistics for Section, Near-End Line, Far-End Line, Near-End Path, and Far-End Path layers. See “Performance Monitors” on page 348.

Service disruption monitoring, alarm indicators, alarm and error types that can be monitored, and performance statistics are described in more detail in the following sections.

Alarms

The Alarm area displays status indicators for the current test. The alarm indicator colors are defined below.

Note If an alarm is greyed out in this view, it means that alarm does not apply to the current test configuration.

Green	Yellow	Red
No alarms are detected: signal is clear or monitoring is not started.	Alarm history: an alarm was detected but is not currently active.	An alarm is active and currently detected on the monitored signal.

The following alarms are monitored.

Alarm Indicator	Description
LOS	Loss of Signal An LOS alarm condition is declared either when a received signal with an all-zeroes pattern has insufficient data bit transitions or when the as received clock cannot be recovered from the received signal because the optical power is insufficient. LOS ends when a received signal has a minimum optical power and data bit transitions so that the as received clocked can be recovered, and two consecutive valid frame alignment patterns occur without LOS defects.
LOF	Loss of Frame LOF occurs when an Severely Errored Frame (SEF) condition occurs and does not clear for more than 3 milliseconds, as decribed in Bellcore GR-253-CORE, section 6.2.1.1.2. LOF ends 3 milliseconds after SEF ends.
SEF	Severely Errored Frame SEF occurs when 4 consecutive frames do not contain a valid frame word, as described in Bellcore GR-253-CORE, section 5.5. SEF ends when two successive error-free framing patterns are detected.

Alarm Indicator	Description
AIS-L	Line Alarm Indicator Signal AIS-L is a static, all 1s data pattern in the line. It is detected in the K2 byte (bits 6,7,8) when all 1s are present for 5 consecutive frames. AIS-L is cleared after five frames with a pattern other than all 1s in K2.
RDI-L	Line Remote Defect Indication RDI-L is detected when K2 (bits 6,7,8) is 110 for 5 consecutive frames. RDI-L is cleared when K2 (bits 6,7,8) is not 110 for 5 consecutive frames.
LOP	Path Loss of Pointer LOP indicates that the H1/H2 bytes do not contain a valid pointer, and the condition has persisted for 8 frames. A valid pointer must be in range (0-783) and the NDF (New Data Flag) must be a 6 (normal pointer) or 9 (new pointer value or concatenation indicator if the pointer value is 0x3FF). LOP is cleared when 3 consecutive frames of valid pointer data are detected.
AIS-P	Path Alarm Indication Signal AIS-P is detected after 3 consecutive frames of all 1s in the associated pointer bytes (H1, H2). AIS-P is cleared when 3 consecutive frames with valid pointers are detected, and the pointer bytes are not all 1s.

Alarm Indicator	Description
RDI-P	Remote defect indicator RDI-P is declared when bit 5 (this is fourth from LSB) of G1 is 1 for 10 consecutive frames. RDI-P is cleared when bit 5 of G1 is 0 for 10 consecutive frames.
UNEQ	Path Unequipped alarm The UNEQ-P alarm is indicated by persistent all 0s in the path. UNEQ-P is detected after 5 consecutive frames of all 0s in the C2 byte of the path overhead. UNEQ-P is cleared when 5 consecutive frames containing valid data in the C2 byte are detected (that is, the C2 byte is not 0x00).
LPS	Loss of Pattern Synchronization LPS is detected when the payload data pattern in the monitored signal does not match the expected pattern for 6 consecutive clock cycles (if it is a pre-defined payload pattern) or 2 clock cycles (if it is a user-defined pattern). LPS is not monitored when a Live payload data pattern is selected.
SCPI Examples:	

```
SENS(@3):ALAR:LOS  ?
SENS(@3):ALAR:LOF  ?
SENS(@3):ALAR:SEF  ?
Sens(@3):ALAR:LAIS  ?
SENS(@3):ALAR:LOP  ?
SENS(@3):ALAR:PAIS?
SENS(@3):ALAR:UNEQ?
SENS(@3):ALAR:LRDI?
SENS(@3):ALAR:PRDI?
SENS(@3):ALAR:LPS  ?
```

Errors

The Errors area displays error counts and ratios for the current test.

The error data is cumulative. To get data for intervals, see “Logging” on page 63. Once a test is restarted, the error history is cleared.

Error Type or Setting	Description
Section (B1)	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B1 section parity byte. Only in framed mode.
Line (B2)	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B2 line parity byte.

Error Type or Setting	Description
REI-L	The Line Remote Error Indicator (also known as Line FEBE) error is declared when the M1 byte has a non-zero value. A maximum of 255 errors are reported per frame.
Path (B3)	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B3 path parity byte.
REI-P	The Path Remote Error Indicator (also known as Path FEBE) error is declared when bits 1-4 of the G1 byte have a non-zero value. A maximum of eight errors are reported per frame.
Bit (Payload)	This error is declared when the payload pattern of the received signal does not match the pattern selected.
Count	Number of errors of the specified type detected in the current test.
Rate	Computed error ratio for the specified error type for the current test.

SCPI Examples:

```
SENS(@18):ERR:COUN:SECT?
SENS(@18):ERR:RAT:SECT?
SENS(@18):ERR:COUN:LINE?
SENS(@18):ERR:RAT:LINE?
SENS(@18):ERR:COUN:PATH?
SENS(@18):ERR:RAT:PATH?
SENS(@18):ERR:COUN:BIT?
SENS(@18):ERR:RAT:BIT?
SENS(@18):ERR:COUN:LREI?
SENS(@18):ERR:RAT:LREI?
SENS(@18):ERR:COUN:PREI?
SENS(@18):ERR:RAT:PREI?
```

Service Disruption Monitoring

The **Service Disruption** tab displays In-Service status and the time, in milliseconds of the longest, shortest, and most recent service disruptions detected during the current test. This tab also provides controls for selectively enabling alarms for service disruption monitoring.

Service Disruption Detection

A service disruption condition is detected when one or more of the following alarms that are enabled for service disruption monitoring are detected in the monitored signal.

- LOS—Loss of Signal
- LOF—Loss of Frame
- AIS-L—Line Alarm Indicator Signal
- LOP—Path Loss of Pointer
- AIS-P—Path Alarm Indicator Signal
- UNEQ—Path Unequipped
- LPS—Loss of pattern synchronization.
- B3 (Path CV)—Path code violation

  A Path CV alarm condition is detected when there are 4 consecutive frames containing Path CV (B3) errors. The Path CV alarm condition is cleared when there are 4 consecutive frames without Path CV (B3) errors.

See “Alarms” on page 342 for a description of these alarms.

Service disruption alarm states are updated at each SONET frame, or once every 125 microseconds. The service disruption condition is cleared when none of the above conditions are present in the monitored signal.

Service Disruption Limitations

The following limitations apply to service disruption monitoring on the OC-48 Receiver:

- When multiple alarms are enabled, the last and longest service disruption measurements start with the first detected alarm and end with the last detected alarm. The start and end alarms may not be the same type.
- Service disruption tests must start with a clear signal with no alarms or errors.
  - Start a test.
  - Enable service disruption for the desired alarm(s).
  - Inject alarms.
- An LOP (Loss of Pointer) alarm may not cause a service disruption when only LPS (Loss of Pattern Sync) is enabled. LOP must be enabled to guarantee service disruption measurement for LOP-only alarms.

- The service disruption time limit is 15 minutes. Longer disruptions produce event overflow and false measurements.
- Event counter overflow can occur when multiple alarms are enabled for service disruption monitoring and a major alarm, such as LOF, is bouncing. Overflow is indicated when **Last** displays 9,999,999.000 mS. Limit the number of alarms that are enabled to reduce the chance of an overflow.

Controls, Measurements, and Indicators

Service disruption alarm enable controls, measurements, and indicators are described in the following table.

Setting or Field	Description
Enable	When checked for an alarm type, a service disruption event is triggered when that alarm is detected, and service disruption measurement begins. To disable service disruption monitoring, uncheck the boxes for all alarm types. By default, all alarms are enabled.
Measurements	The following service disruption measurement statistics are displayed: • **Longest**—Time, in milliseconds, of the longest service disruption period for the current test. • **Shortest**—Time, in milliseconds, of the shortest disruption period for the current test. • **Last**—Time, in milliseconds, of the most recent service disruption that occurred during the current test.
In-Service	The In-Service indicator colors are interpreted as follows: • **Green**—No service disruptions have occurred since the last test restart. • **Red**—A service disruption condition is present in the current test. • **Yellow**—At least one service disruption was detected since the last test restart, but none is currently detected.

Setting or Field	Description
SCPI Examples:	

	To monitor service disruption data:
	`SENS(@6):DISR:LONG ?`
	`SENS(@6):DISR:SHOR ?`
	`SENS(@6):DISR:LAST ?`
	`SENS(@6):DISR:INS ?`
	To subscribe to service disruption events:
	`SUBS(@6)SENS:DISR:ALL 1`
	To unsubscribe to service disruption events:
	`SUBS(@6)SENS:DISR:ALL 0`
	To disable service disruption monitoring:
	`SENS(@6):DISR ENAB OFF`
	To enable service disruption monitoring and specify which alarms trigger service disruption events, use the `SENS(@1:18):DISR:ENAB` command and specify a list of alarms to enable. Each instance of this command overwrites the previous setting.
	Separate alarms in the list with semi-colons and do not include any spaces in the list. Valid values for the alarm parameter list are `LOF`, `AIS-L`, `LOP`, `AIS-P`, `UNEQ`, `LPS`, and `B3`. For example, the following command specifies that only AIS-P and AIS-L alarms trigger service disruption events.
	`SENS(@6):DISR:ENAB AIS-P;AIS-L`

Performance Monitors

The following table describes Section, Near-End Line, Far-End Line, Near-End Path, and Far-End Path layer performance statistics.

Statistic	Description
ES-S	**Errored Seconds - Section.** Number of seconds during which at least one B1 error was detected or an SEF or LOS defect was present.
ES - L	**Errored Seconds - Line, Near-end.** Number of seconds during which at least one B2 error was detected or an AIS-L was present.
ES-P	**Errored Seconds - Path, Near-end**. Number of seconds during which at least one B3 error was detected or an AIS-P, LOP, or UNEQ defect was present.
SES-S	**Severely Errored Seconds - Section.** Number of seconds during which at least *n* B1 errors were detected or an SEF or LOS defect was present. At 0C-48 rates, *n* is 2,392.
SES-L	**Severely Errored Seconds - Line, Near-end.** Number of seconds during which at least *n* B2 errors were detected or an AIS-L defect was present. At OC-48 rates, n is 2,459.
SES-P	**Severely Errored Seconds - Path, Near-end**. Number of seconds during which at least *n* B3 errors were detected or an AIS-P, LOP, or ENEQ defect was present. For OC-48c, *n* is 2,400.

Statistic	Description
UAS-S	**Unavailable Seconds - Section**. Number of seconds during which the Section was considered unavailable. A Section becomes unavailable at the onset of 10 consecutive seconds that qualify as an SES-S, and continues to be unavailable until the onset of 10 consecutive seconds that do not qualify as SES-S.
UAS-L	**Unavailable Seconds - Line, Near-end**. Number of seconds during which the Line was considered unavailable. A Line becomes unavailable at the onset of 10 consecutive seconds that qualify as an SES-L, and continues to be unavailable until the onset of 10 consecutive seconds that do not qualify as SES-L.
UAS-P	**Unavailable Seconds - Path, Near-end**. Number of seconds during which the Path was considered unavailable. A Path becomes unavailable at the onset of 10 consecutive seconds that qualify as SES-P and continues to be unavailable until the onset of 10 consecutive seconds that do not qualify as SES-P.
ES-LFE	**Errored Seconds - Line, Far-end**. Number of seconds during which at least one REI-L error was detected or an RDI-L was present.
ES-PFE	**Errored Seconds - Path, Far-end**. Number of seconds during which at least one REI-P error was detected or an RDI-P was present.

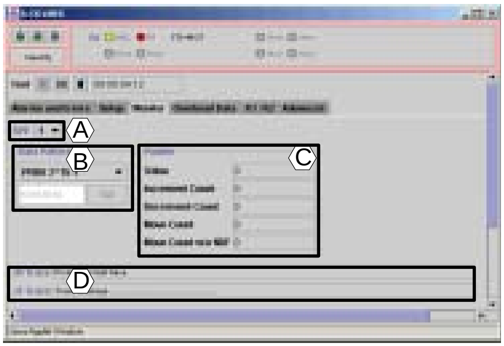
Statistic	Description
SES-LFE	**Severely Errored Seconds - Line, Far-end**. Number of seconds during which at least *n* REI-L errors were detected or an RDI-L defect was present. At OC-48 rates, *n* is 2,459.
SES-PFE	**Severely Errored Seconds - Path, Far-end**. Number of seconds during which at least <n> REI-P errors were detected or an RDI-P defect was present. For OC-48, <n> is 2,400.
UAS-LFE	**Unavailable Seconds - Line, Far-end**. Number of seconds during which the Line was considered to be unavailable at the far end. A Line becomes unavailable at the far end at the onset of 10 consecutive seconds that qualify as SES-LFE, and continues to be unavailable until the onset of 10 consecutive seconds that do not qualify as SES-LFE.
UAS-PFE	**Unavailable Seconds - Path, Far-end**. Number of seconds during which the Path was considered to be unavailable at the far end. A Path becomes unavailable at the far end at the onset of 10 consecutive seconds that qualify as SES-PFE, and continues to be unavailable until the onset of 10 consecutive seconds that do not qualify as SES-PFE.

Statistic	Description

SCPI Examples:
`SENS(@3):PMON:ESS?`
`SENS(@3):PMON:ESLN?`
`SENS(@3):PMON:USS?`
`SENS(@3):PMON:ESPF?`
`SENS(@3):PMON:ESPN?`
`SENS(@3):PMON:USLF?`
`SENS(@3):PMON:USPF?`	

Monitor Settings

The following figure illustrates the main areas on the **Monitor** tab.



A **SPE**—Select the SPE channel to monitor, as described in “SPE” on page 350.

B **Data Pattern**—Select a payload data pattern or specify a custom payload data pattern to monitor in the received payload, as described in “Data Pattern” on page 351.

C **Pointer**—Monitor the SPE pointer value and pointer event counts, as described in “Pointer” on page 351.

D **J0/J1 Trace**—Monitor the J0 section trace and J1 path trace messages in the received signal, as described in “J0 and J1 Trace” on page 352.

SPE

The SPE setting determines which synchronous payload envelope (SPE) time slot is monitored. The number of channels available depends on the currently selected SPE mapping.

Setting	Description
SPE	Selects the SPE channel to monitor in the received payload. This field is linked to the SPE field in the **Overhead** tab. The number of channels depends on the setting for the SPE mapping (SPE size). Channel 1 is the default in the factory configuration. • If the SPE size is STS-1, select 1 of 48 channels. • If the SPE size is STS-3c, select 1 of 16 channels • If the SPE size is STS-12c, select 1 of 4 channels. • If the SPE size is STS-48c, there is only 1 channel.

Setting	Description
SCPI Examples: `SENS(@6):DATA:SPE 4` **Related Topics:** "SPE Mapping" on page 339 "Path Overhead" on page 353	

Data Pattern

The Data Pattern selects the type of pattern to monitor in the generated payload.

Settings	Description
PRBS 2^15-1 **PRBS 2^20-1** **PRBS 2^23-1** **Inv. PRBS 2^23-1** **Inv. PRBS 2^20-1** **Inv. PRBS 2^15-1**	Pseudo-random bit patterns. The default setting is PRBS 2^23-1.
Live	Monitor live payload data pattern.
User	8-bit binary user-defined payload pattern.
Set	This selection is only available if User is selected as the payload pattern type. If a custom user-defined payload pattern type is selected, enter a binary number for the pattern, then click **Set** to apply the changes to the user-defined payload pattern

Settings	Description

SCPI Examples:
`SENS(@6):PAYL:MON:PATT:TYPE PR215`
`SENS(@6):PAYL:MON:PATT:TYPE PR223`
`SENS(@6):PAYL:MON:PATT:TYPE IPR215`
`SENS(@6):PAYL:MON:PATT:TYPE LIVE`
`SENS(@6):PAYL:MON:PATT:TYPE USER`
`SENS(@3):PAYL:MON:PATT:USER 0b00110011`	

Pointer

The Pointer area displays synchronous payload envelope (SPE) pointer values and event counts.

Pointer event counters are reset at the start of each test period.

Pointer Field	Description
Value	Displays the current value in hexadecimal of the synchronous payload envelope (SPE) pointer. This value is what the hardware pointer processor interprets as the current pointer.
Increment Count	Displays the number of SPE pointer increment events since the last restart.
Decrement Count	Displays the number of SPE pointer decrement events since the last restart.
Move Count	Displays the number of times the pointer moved to a new pointer value using the New Data Flag (bits 1 to 4 of the H1 pointer byte).

Pointer Field	Description
Move w/o NDF Count	Displays the number of times the pointer moved to a new pointer value without the New Data Flag (missing NDF).
SCPI Examples: SENS(@6):POIN:VAL? SENS(@6):POIN:COUN:INCR? SENS(@6):POIN:COUN:DECR? SENS(@6):POIN:COUN NDF? SENS(@6):POIN:COUN:MNDF?	

J0 and J1 Trace

The J0 Trace and J1 Trace fields display the current valuse of the J0 section and J1 path trace messages from the monitored signal.

To monitor the J0 trace message using SCPI, use a the following command:

```
SENS(@3):DATA:SECT:TRAC?
```

To monitor the J1 trace message using SCPI, use a the following command:

```
SENS(@3):DATA:PATH:TRAC?
```

Overhead Data

The **Overhead Data** tab displays the current values of the STS section, line, and path overhead bytes for the selected STS channel.

Overhead bytes are labeled according to GR-253 standards. In some cases, an overhead byte is only defined in the first STS-1 of an STS-*n*; in other cases, bytes in the same position in different STS channels have different labels. For example, the J0 byte is defined in the first STS-1 of an STS-n, but the same byte position is labeled Z0 in the remaining STS channels.

The following figure shows the layout of the **Overhead Data** tab.

A View transport overhead (section and line) byte values for the selected STS channel.

B View path overhead byte values for the selected STS-1 or STS-*n*c concatenated channel or broadcast to all channels; *n* is 3, 12, or 48, depending on the currently selected SPE mapping.

Transport Overhead

The following table describes the STS transport overhead fields and values.

Transport Overhead	Description
STS-1 Channel	Select 1 of 48 STS channels for which you want to view transport overhead bytes. Channel 1 is the default in the factory configuration.
A1, A2	Section overhead framing bytes.
J0 (C1)	Formerly C1 (STS-1 ID), now redefined as the J0 section trace byte.
E1	Orderwire section byte located in first STS-1 of an STS-N.
F1	Section user channel byte located in first STS-1 of an STS-N.
D1, D2, D3	Section data communication channel bytes located in first STS-1 of an STS-N.
K1, K2	APS (automatic protection switching) channel bytes.
H1, H2	SPE payload pointer bytes.
H3	SPE pointer action byte.
D4 through D12	Line data communications channel bytes.
S1	Synchronization status byte.
M1	Line Remote Error Indicator (Line REI) byte in STS channel 7, (the 3rd byte in order of appearance).
E2	Express orderwire byte.
Z0, Z1, Z2	Allocated for future growth.

Transport Overhead	Description

SCPI Examples:
Use the following command to query the values for bytes A1;A2;J0;B1;E1;F1;D1;D2;D3.
`SENS(@6):DATA:SECT:OVER:BYT?`
Use the following command to set the values for bytes H1;H2;H3;B2;K1;K2;D4;D5;D6;D7;D8;D9;D10;D11;D12;S1;M1;E2.
`SENS(@6):DATA:LINE:OVER:BYT?`
For detailed information, see“Overhead” on page 602.	

Path Overhead

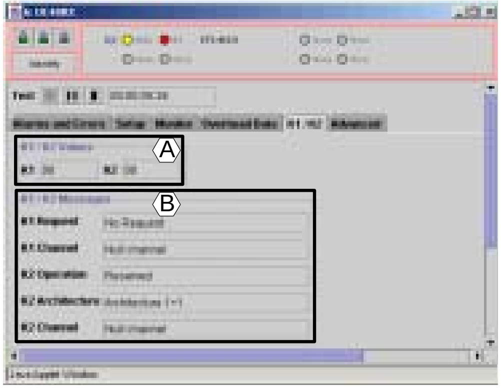
The following table describes path overhead bytes.

Path Overhead	Description
SPE	Select the number of the STS-1 or STS-*n*c concatenated channel in the monitored payload for which you want to view path overhead bytes. SPE 1 is the default in the factory configuration. The available channels depends on the selected SPE mapping. This field is linked to the SPE field in the **Monitor** tab.
J1	STS path trace byte.
C2	STS path signal label indicating the construction of the SPE.
G1	Path terminating status byte.

Path Overhead	Description
F2	Path user channel byte.
H4	Indicator allocated for use as a mapping-specific indicator byte.
Z3, Z4	Allocated for future growth.
Z5	Tandem connection byte.
SCPI Examples: Use the following command to set the values for bytes J1;B3;C2;G1;F2;H4;Z3;Z4;Z5. `SENS(@6):DATA:PATH:OVER:BYT?` For detailed information, see “Overhead” on page 602. **Related Topics:** “SPE Mapping” on page 339 “SPE” on page 350	

K1/K2 Settings

The following figure shows the main features of the **K1/K2** tab.



A **K1/K2 Values**—Displays hexadecimal values of the automated protection switching (APS) channel K1 and K2 bytes, as described in “K1/K2 Values” on page 354.

B **K1/K2 Messages**—Displays automated protection switching (APS) channel messages decoded from the K1/K2 bytes, as described in “K1/K2 Messages” on page 355.

K1/K2 Values

The K1/K2 Values field displays the hexadecimal values of the automated protection switching (APS) channel K1 and K2 bytes for the monitored signal.

Field/ Setting	Description
K1	The default value is 0xF1. Bits 1 through 4 contain the request message, and bits 5 through 8 control the channel message code.
K2	The default value is 0x14. Bits 1 through 4 of the K2 byte contain the channel number, bit 5 specifies the architecture, and bits 6 thorough 8 indicate the mode of operation.
SCPI Examples: `SENS(@3):TRAN:APS:K1K2?`	

K1/K2 Messages

This field displays automated protection switching (APS) channel messages decoded from the K1/K2 bytes.

K1/K2 Messages	Description
K1 Request	Bits 1 through 4 of K1 can contain the following request messages. **Lockout of Protection**. Bits 1 through 4 have a value of 1111. **Forced Switch**. Bits 1 through 4 contain 1110. **SF - High Priority**. Bits 1 through 4 Have a value of 1101. **SF - Low Priority**. Bits 1 through 4 have a value of 1100. **SD - High Priority**. Bits 1 through 4 have a value of 1011. **SD - Low Priority**. Bits 1 through 4 have a value of 1010. **Manual Switch**. Bits 1 through 4 have a value of 1000. **Wait-to-Restore**. Bits 1 through 4 have a value of 0110. **Exercise**. Bits 1 through 4 have a value of 0100. **Revert Request**. Bits 1 through 4 have a value of 0100. **Do Not Revert**. Bits 1 through 4 have a value of 0001. **No Request**. Bits 1 through 4 have a value of 0000. This is the default in the factory configuration.

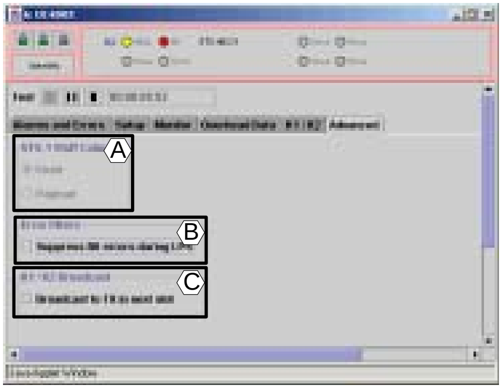
K1/K2 Messages	Description
K1 Channel	Channel selection for the requesting message (bits 5 through 8 of K1 carry the channel message code): **0**. Null channel. **1** to **14**. Channel 1 through 14. **15**. Extra traffic channel.
K2 Operation	Operational mode of the APS. Bits 6 through 8 of the K2 byte carry this information. **Unidirectional**. Bits 6 to 8 have a value of 100. **Bidirectional**. Bits 6 to 8 have a value of 101.
K2 Architecture	Architecture mode for the APS. Bit 5 of K2 carries this information. **Architecture 1+1**. Bit 5 is 0. **Architecture 1:n**. Bit 5 is 1.
K2 Channel	Channel selection for the requesting message (bits 1 through 4 of K2 carry the channel message code): **0**. Null channel. **1** to **14**. Channel 1 to 14. **15**. Extra traffic channel.

SCPI Examples:

```
SENS(@8):APS:ENAB 1
SENS(@8):APS:K1D:REQ?
SENS(@8):APS:K1D:CHAN?
SENS(@8):APS:K2D:OPER?
SENS(@8):APS:K2D:ARCH?
SENS(@8):APS:K2D:CHAN?
```

Advanced Settings

The following figure shows the settings that can be configured on the **Advanced** tab.



A **STS-1 Stuff Columns**—When the SPE mapping is set to STS-1, select whether the SPE stuff columns are expected to contain a fixed pattern or a PRBS payload data pattern. See “STS-1 Stuff Columns” on page 357.

B **Error Filters**—Specify whether bit errors are suppressed (not counted) during an LPS alarm condition. See “Error Filters” on page 358.

C **K1/K2 Broadcast**—Select whether or not the K1/K2 byte values are broadcast to the transmitter in the next slot to the right. See “K1/K2 Broadcast” on page 358.

STS-1 Stuff Columns

The STS-1 Stuff Columns setting specifies whether the SPE stuff columns are expected to contain a fixed pattern or a PRBS payload data pattern (Payload) for payload pattern matching.

Note This setting is only available if the SPE mapping is set to STS-1 for the OC-48 Receiver.

The SPE stuff columns are columns 30 and 59 of the SPE envelope as specified in GR-253-CORE. The default setting is Payload (PRBS pattern).

Setting	Description
Fixed	When Fixed is selected, the bytes in the stuff columns are expected to contain a fixed pattern and are not considered to be part of the payload. The stuff columns are ignored for payload pattern matching.
Payload	When Payload is selected, the bytes in the stuff columns are considered to be part of the payload, and PRBS pattern data is expected in all 87 columns for payload pattern matching. This is the default in the factory configuration.

SCPI Examples:

```
SENS(@7):PAYL:STUF PAYL
SENS(@7):PAYL:STUF FIX
SENS(@7):PAYL:STUF?
```

Error Filters

The Error Filters setting specifies whether the bit errors are suppressed when an LPS alarm condition is active.

Field/ Setting	Description
Suppress Bit errors	When this setting is checked, bit errors are not counted when the LPS alarm is active. When unchecked, bit errors are counted when the LPS alarm is active. Disabled is the default setting in the factory configuration.

SCPI Examples:
`SENS(@3):ALAR:IGN LPS ON`
`SENS(@3):ALAR:IGN LPS OFF`	

K1/K2 Broadcast

The following table describes the K1/K2 setting for the OC-48 Receiver.

Field/ Setting	Description
Broadcast to TX	Enable or disable broadcasting of the received APS K1 and K2 bytes to a transmitter in the adjacent slot to the right of the receiver. The default setting is disabled in the factory configuration.

SCPI Examples:
`SENS(@18):APS:ENAB 1`
`SENS(@18):APS:ENAB 0`	

27

OC-48 Transmitter Window

The topics in this section explain how to configure set-up options, alarm and error insertion, payload generation, and overhead data values for the OC-48 transmitter.

Instructions are provided for using EPXam to configure the module, along with SCPI equivalents.

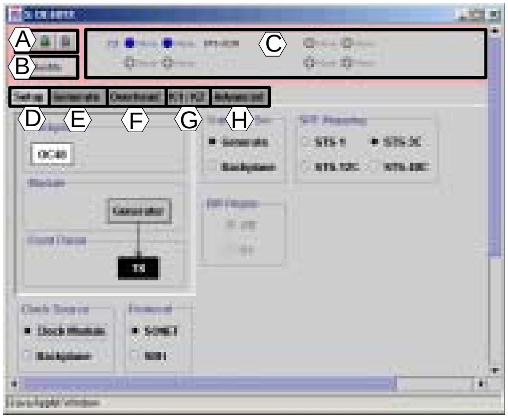
Tip OC-48 Transmitters can be switched between SONET and SDH functionality. See "Protocol" on page 363 and "Using the SONET/SDH Switcher" on page 121.

See "STM-16 Transmitter Window" on page 499 for a description of this module's features and user interface in SDH protocol mode.

For more information about EPXam, see "Using EPXam" on page 3.

Main View

The following figure illustrates the main features and controls of the OC-48 Transmitter module window.



A Save and restore module/slot configuration; restore factory default settings (see “Saving and Restoring Test Configurations” on page 107).

B **Identify**—When pressed, it flashes the Active LED on the module associated with this window.

C View summary defect status, alarm indicators, and other module information. See “Expanded Logical View Indicators” on page 8 for more information.

D **Setup**—Configure TX clock source, transmit source, B1 byte regeneration, SPE mapping or switch the module between SONET and SDH protocol. See “Setup” on page 361.

E **Generate**—Configure alarm and error insertion settings, enable and specify J1 and J0 trace messages, and manipulate SPE pointer values. See “Generate Settings” on page 364.

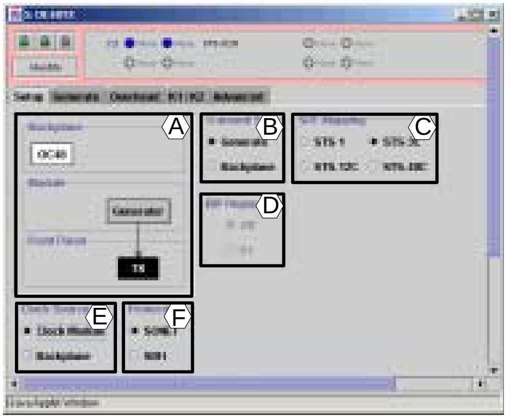
F **Overhead Data**—View or modify STS transport and path overhead byte values in the generated signal. See “Overhead Data” on page 371.

G **K1/K2**—Modify K1 and K2 byte values and specify APS channel message encoding. See “K1/K2 Settings” on page 374.

H **Advanced**—Specify STS-1 stuff column fill type. See “Advanced Settings” on page 376.

Setup

The following figure illustrates the main features of the **Setup** tab.



A View graphic display of current module input/output configuration.

B **Transmit Source**—Select the source for the transmitted signal, either internally generated or input from the backplane. See “Transmit Source” on page 361.

C **SPE Mapping**—Configure the synchronous payload envelope (SPE) mapping for the transmitted signal. See “SPE Mapping” on page 362.

D **BIP Regen**—Controls B1 byte regeneration when the source for the OC-48 Transmitter is a signal received from the backplane. See “BIP Regen” on page 362.

E **Clock Source**—Select the clock source that provides the timing reference that is used to generate the SONET payload. See “Clock Source” on page 363.

F **Protocol**—Switch between SONET and SDH protocol. See “Protocol” on page 363.

Transmit Source

The **Transmit Source** setting determines whether the data source for the transmitted signal comes from the module’s Payload Generator module or from an adjacent, compatible module via the test system backplane.

If Backplane is selected as the Transmit Source, the following conditions exist:

- Alarm injection is limited to LOS only.
- Error injection is limited to Physical errors or B1 errors (assuming B1 error injection is enabled via the BIP Regen setting).
- Overhead byte insertion, trace message insertion, K1/K2 byte manipulation and APS channel message encoding, SPE pointer manipulation, and payload pattern modification are not available.

Setting	Description
Generate	The OC-48 Transmitter generates the signal to be transmitted. This is the default setting in the factory configuration.

Setting	Description
Backplane	The transmit source is a signal on the Test System backplane from the OC-48 Receiver installed in the adjacent slot to the left of the transmitter.
SCPI Examples: SOUR(@7):DATA:SOUR NORM SOUR(@7):DATA:SOUR BACK SOUR(@7):DATA:SOUR ?	

SPE Mapping

The **SPE Mapping** option sets the size of the SPE (Synchronous Payload Envelope) that is mapped into the generated payload.

This setting affects options for the STS and SPE selections in the **Generate** and **Overhead** tabs. Changing the SPE Mapping also returns the SPE selection to the default of Broadcast.

Note This option is not available with the Transmit Source is set to Backplane.

SPE Mapping	Description
STS-1	Selects an STS-1 sized payload for the SPE. This is a 783-byte payload.
STS-3C	Selects an STS-3C sized payload for the SPE. This is a 2349-byte payload.
STS-12C	Selects an STS-12C sized payload for the SPE. This is a 9396-byte payload.
STS-48C	Selects an STS-48c sized payload for the SPE. This is a 37584-byte payload. This is the default setting in the factory configuration.
SCPI Examples: SOUR(@7):DATA:SIZE STS1 SOUR(@7):DATA:SIZE STS3C SOUR(@7):DATA:SIZE STS12C SOUR(@7):DATA:SIZE STS48C **Related Topics:** “SPE” on page 365 “Path Overhead” on page 373	

BIP Regen

The BIP Regen setting controls B1 byte regeneration when the Transmit Source is set to Backplane.

Setting	Description
Off	Disables B1 BIP regenerator. The signal is retransmitted as it is received from the backplane, and only physical layer errors can be inserted.
B1	Enables B1 BIP regenerator. The B1 byte is recaculated before the signal is retransmitted. Only physical layer and section (B1) errors can be inserted.

Setting	Description

SCPI Examples:
`SOUR(@7):OVER:BIPR NORM`
`SOUR(@7):OVER:BIPR BONE`
`SOUR(@7):OVER:BIPR ?`
Related Topics:
"Transmit Source" on page 361	

Clock Source

The Clock Source setting selects the timing reference that is used to generate the SONET payload.

When Backplane is selected as the Transmit Source, the Clock Source can only be Backplane.

Clock Source	Description
Clock Module	Selects the timing reference from the EPX Test System's clock module. Verify that the EPX clock module is correctly providing a SONET/SDH timing reference for the slot in which the OC-48 Transmitter is installed.
Backplane	Selects the timing reference from the signal transmitted via the Test System backplane from the OC-48 Receiver installed in the adjacent slot to the left of the transmitter.

Clock Source	Description

SCPI Examples:
`SOUR(@7):CLOC CLKB`
`SOUR(@7):CLOC BACK`
Related Topics
"Configuring the EPX100 Clock Module" on page 25	

Protocol

The Protocol setting switches the module between SONET and SDH. When the switch is complete, EPXam displays the appropriate protocol configuration options and field labels for the module and updates all references to the module to use the correct protocol.

Note Switching between SONET and SDH protocol does *not* require a restart of the test system or EPXam.

Restrictions:

- Modules that are locked via the Group Manager cannot be switched by other users.
- Active test and logging sessions associated with a module at the time of a switch are cancelled.

  If tests or logging sessions are in progress on any of the modules being switched, a warning dialog is displayed. Click **Cancel** to abort the switch or **Continue** to complete the switch. If you choose **Continue**, running tests and logging sessions are cancelled. Otherwise, a dialog opens that displays the switching progress.

Setting	Description
SONET	Switches the module to SONET without restarting the test system or EPXam. This is the default setting in the factory configuration.
SDH	Switches the module to SDH without restarting the test system or EPXam.

SCPI Examples:
`SYST:BOAR(@7):PROT:TYPE SON`
`SYST:BOAR(@7):PROT:TYPE SDH`
`SYST:BOAR(@7):PROT:STAT?`	

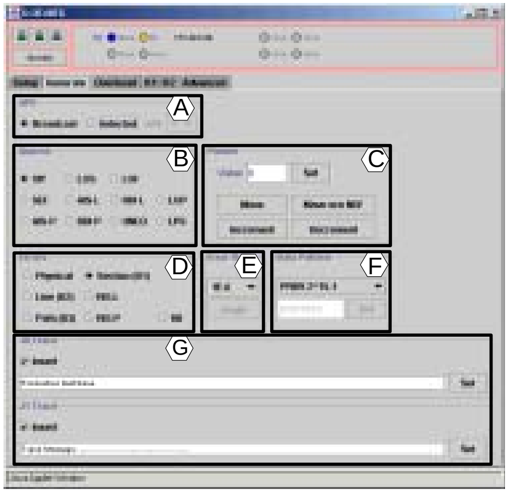
See "STM-16 Transmitter Window" on page 499 for a description of this module's SDH features and configuration.

See the following topics for more information about SONET/SDH switching:

- "Using the SONET/SDH Switcher" on page 121
- "SONET/SDH Switching and Custom Configuration Files" on page 123
- "Switching Modules Using SCPI" on page 123

Generate Settings

The following figure illustrates the settings that are configured on the OC-48 Transmitter **Generate** tab.



A **SPE**—Select a specific channel (SPE time slot) or broadcast the payload to all time slots, as described in "SPE" on page 365.

B **Alarms**—Select the type of alarm to insert, as described in "Alarms" on page 366.

C **Pointer**—Set SPE pointer byte values or perform pointer actions, as described in "Pointer" on page 367.

D **Errors**—Select the type of error to insert, as described in "Errors" on page 368.

E **Error Rate**—Set the error insertion rate, as described in "Error Rate" on page 369.

F **Data Pattern**—Select the payload data pattern to insert into the transmitted signal, as described in “Data Pattern” on page 369.

G **J0 and J1 Trace**—Specify and insert a J0 section or J1 path trace message, as described in “J0 Section Trace Message” on page 370 and “J1 Path Trace Message” on page 370.

These settings are described in more detail in the following sections.

SPE

The SPE setting specifies whether the SPE (synchronous payload envelope) is mapped to a single channel (time slot) or broadcast to all channels.

The number of available channels depends on the SPE mapping that is selected on the **Setup** tab. The SPE setting is reset to broadcast when the SPE Mapping is changed.

Settings	Description
Broadcast	Maps the generated payload to all time slots. When **Broadcast** is selected, channel selection is unavailable. This is the default in the factory configuration.
Selected	Maps the generated payload to the time slot specified by the **SPE** setting.

Settings	Description
SPE	Selects a channel to insert the generated payload. This option is not available in broadcast mode. This field is linked to the SPE field in the **Overhead** tab. The range of channels available depends on the settings specified for the SPE mapping: • If the SPE mapping is STS-1c, select 1 of 48 channels. • If the SPE mapping is STS-3c, select 1 of 16 channels. • If the SPE mapping is STS12c, select 1 of 4 channels. • If the SPE size is STS-48c, only 1 channel can be selected.

SCPI Examples:

```
SOUR(@6):DATA:MODE  BRO
SOUR(@6):DATA:MODE  SEL
SOUR(@6):DATA:SPE   1
```

Related Topics:

“SPE Mapping” on page 362

“Path Overhead” on page 373

Alarms

The Alarm setting determines the type of SONET alarm that is inserted into the transmit stream.

Note If Backplane is selected as the Transmit Source, alarm injection is limited to LOS only.

Alarm setting	Description
Off	Disables alarm insertion. This is the default setting in the factory configuration.
LOS	Loss of Ssignal **Implementation**: LOS is generated by disabling signal output. When LOS insertion is turned off, the signal output is turned back on.
LOF	Loss of Frame **Implementation**: LOF is generated by inverting the framing bytes (A1, A2) in the SONET overhead. When LOF insertion is turned off, the framing bytes are restored.
SEF	Severely Errored Frame **Implementation**: SEF is generated by inverting the framing bytes (A1, A2) in the SONET overhead for four consecutive frames, then reverting to the correct values for the next 252 frames. This sequence is repeated until SEF alarm insertion is turned off.

Alarm setting	Description
AIS-L	Line Alarm Indication Signal **Implementation**: AIS-L is generated by forcing the entire line to all zeroes. When AIS-L alarm insertion is turned off, the normal line data is restored.
RDI-L	Line Remote Defect Indicator **Implementation**: RDI-L is generated by setting the K2 byte to 6 (0b110). When RDI-L insertion is turned off, the K2 byte is restored.
LOP	Loss of Pointer **Implementation**: LOP is generated by forcing the H1 and H2 pointer bytes for all ones. LOP is cleared by restoring the pointer data.
AIS-P	Path Alarm Indication Signal **Implementation**: AIS-P (Path Alarm Indicator Signal) is generated by setting the pointer bytes and all path data to all 1s. When AIS-P insertion is turned off, the pointer bytes and path data are restored.
RDI-P	Path Remote Defect Indicator **Implementation**: RDI-P is generated by setting bit 5 of the G1 byte to 1. When RDI-P insertion is turned off, bit 5 of the G1 byte is cleared.

Alarm setting	Description
UNEQ-P	Path unequipped **Implementation**: UNEQ-P (Path Unequipped) is generated by forcing the path data to all zeroes. When UNEQ-P insertion is turned off, the path data is restored.
LPS	Loss of Pattern Sync **Implementation**: LPS is generated by setting the payload pattern in the generated payload to a value other than what is specified in the Payload Data Pattern setting. When LPS alarm insertion is turned off, the pattern is reset to the expected value.
SCPI Examples:	

```
SOUR(@3):ALAR  OFF
SOUR(@3):ALAR  SEF
SOUR(@3):ALAR  LOF
SOUR(@3):ALAR  LOS
SOUR(@3):ALAR  LPS
SOUR(@3):ALAR PAIS
SOUR(@3):ALAR LAIS
SOUR(@3):ALAR UNEQ
SOUR(@3):ALAR PRDI
SOUR(@3):ALAR LRDI
```

Pointer

Use the Pointer settings to move or set the value of the SPE payload pointer.

Note The SPE pointer cannot be modified when the Transmit Source is set to Backplane.

Pointer Settings	Description
Value	Manually sets the SPE pointer. Enter an integer value from 0 to 782. The value entered is displayed as a hexadecimal number.
Set	You must click **Set** to apply the change to the SPE pointer value entered in the **Value** field.
Move	Moves pointer with the New Data Flag (bits 1 to 4 of the H1 overhead byte). This causes a large change to the pointer value, and the NDF flag in the H1 overhead byte is updated appropriately. The moves alternate between increment and decrement.
Move w/o NDF	Moves pointer without the New Data Flag. This causes a large change in the pointer value without the appropriate NDF indication in the H1 overhead byte. The moves alternate between increment and decrement.
Increment Decrement	Increments or decrements the SPE pointer value by 1.

Pointer Settings	Description

SCPI Examples:
`SOUR(@6):POIN:VAL 260`
`SOUR(@6):POIN:ACT INCR`
`SOUR(@6):POIN:ACT DECR`
`SOUR(@6):POIN:ACT NDF`
`SOUR(@6):POIN:ACT MNDF`
Related Topics:
"Transmit Source" on page 361	

Errors

The Errors setting controls the type of error that it is inserted into the transmit stream. Whenever the Error Type setting is modified, the Error Rate setting is always reset to Off.

Note If Backplane is selected as the Transmit Source, error injection is limited to Physical errors or B1 errors (assuming B1 error injection is enabled via the BIP Regen setting).

Error Type	Description
Physical	Inserts physical layer (or random) errors. This setting is the default in the factory configuration.
Section (B1)	Inserts section (B1 BIP-8) errors into the stream.
Line (B2)	Inserts line (B2 BIP-8) errors into the stream.
Path (B3)	Inserts path (B3 BIP 8) errors into the stream.
Bit	Inserts errors into the bits of the payload so that the transmitted payload does not match the expected pattern.
REI-L	Line Remote Error Indicator Inserts error counts in the M1 byte in the line overhead.
REI-P	Path Remote Error Indicator Inserts error counts in the G1 byte.

SCPI Examples:
`SOUR(@3):ERR:TYPE SECT`
`SOUR(@3):ERR:TYPE LINE`
`SOUR(@3):ERR:TYPE PATH`
`SOUR(@3):ERR:TYPE PHYS`
`SOUR(@3):ERR:TYPE BIT`
`SOUR(@3):ERR:TYPE LREI`
`SOUR(@3):ERR:TYPE PREI`	

Error Rate

The Error Rate setting enables and disables error insertion and controls the rate at which errors are inserted into the stream. The error rate is applied to the currently selected error type.

The Error Rate setting is always reset to OFF whenever the Error Type is changed.

Error Rate Setting	Description
Off	Sets the error rate to 0, effectively disabling error insertion. This setting is the default in the factory configuration.
IE-3 through IE-12	Sets the error ratio to 10 x 10^-3, 10 x 10^-4, and so on.
Single	The Error Rate must be set to Off to enable single error insertion. When this option is available, click this button to insert a single error into the transmit stream.

SCPI Examples:
`SOUR(@3):ERR:RAT OFF`
`SOUR(@3):ERR:RAT RIE-4`
`SOUR(@3):ERR:RAT SING`	

Data Pattern

The Data Pattern setting selects the type of pattern to place into the generated payload. The data pattern cannot be modified when the Transmit Source is set to Backplane.

Settings	Description
PRBS 2^15-1 **PRBS 2^20-1** **PRBS 2^23-1** **Inv. PRBS 2^23-1** **Inv. PRBS 2^20-1** **Inv. PRBS 2^15-1**	Selects a pseudo-random bit sequence (PRBS) pattern or inverted PRBS pattern. The default setting is PRBS 2^23-1
User	Selects an 8-bit binary user-defined payload pattern.
Set	If a custom user-defined payload pattern is defined, click **Set** to apply the changed user payload pattern.

SCPI Examples:
`SOUR(@6)PAYL:GEN:PATT:TYPE PR215`
`SOUR(@6)PAYL:GEN:PATT:TYPE PR223`
`SOUR(@6)PAYL:GEN:PATT:TYPE IPR215`
`SOUR(@3):PAYL:GEN:PATT:TYPE USER`
`SOUR(@3):PAYL:GEN:PATT:USER 0b00110011`	

J0 Section Trace Message

Create and insert a user-defined section J0 trace message.

Note The J0 trace message cannot be modified when the Transmit Source is set to Backplane. In the factory configuration, the default setting is off.

1. Click **Insert**.
2. Enter the trace message.

Note Messages can be no longer than 62 characters.

3. Click **Set** to apply the changes.

   If you do not click **Set**, the modified message is not inserted.

To enable J0 trace and insert a trace message using SCPI, use a pair of commands similar to the following:

```
SOUR(@6):DATA:SECT:TREN ON
SOUR(@6):DATA:SECT:TRAC “oc192TX in slot
6”
```

Note When using SCPI, you must enclose the message in quotation marks. Otherwise, only the characters before the first space are used as the trace message.

J1 Path Trace Message

To create and insert a user-defined STS path J1 trace message:

Note The J1 trace message cannot be modified when the Transmit Source is set to Backplane. In the factory configuration, the default setting is off.

1. Click **Insert**.
2. Enter a trace message of up to 62 bytes. Two bytes are added for carriage return and line feed, for a total of 64 bytes.
3. Click **Set** to apply the changes.

   If you do not click **Set**, the modified message is not inserted.

The J1 path trace message cannot be modified when the Transmit Source is set to Backplane. In the factory configuration, the default setting is off.

To enable J1 trace and insert a trace message using SCPI, use a pair of commands similar to the following:

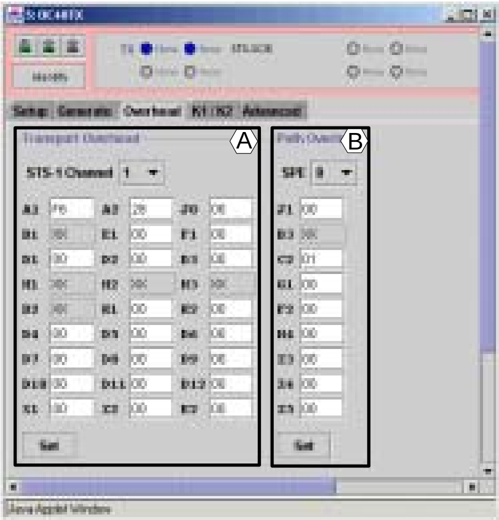
```
SOUR(@6):DATA:PATH:TREN ON
SOUR(@6):DATA:PATH:TRAC “J0 trace msg”
```

Overhead Data

The **Overhead Data** tab provides options for modifying individual path and transport overhead data values for a given time slot.

The following figure shows the main features of the **Overhead Data** tab.

Note Overhead data cannot be modified when the Transmit Source is set to Backplane.



A **Transport Overhead**—Set transport overhead byte values (section and line) for the selected STS-1 channel. See “Transport Overhead” on page 371.

B **Path Overhead**—Set path overhead byte values for the selected SPE channel or broadcast to all channels. See “Path Overhead” on page 373.

Transport Overhead

To modify specific transport overhead bytes.

1. Select an STS-1 channel (time slot).
2. Enter hexadecimal values.
3. Click **Set** to apply the changes.

The following notes apply to modifying transport overhead bytes:

- Overhead bytes that cannot be modified are indicated with “XX” greyed out in the user interface.
- The B1 and B2 bytes cannot be modified using this interface. Use the B1 and B2 error insertion setting on the **Generate** tab.

Settings	Description
STS-1 Channel	Selects the number of the time slot in the internally generated SPE for which you want to modify transport overhead bytes. Channel 1 is the default in the factory configuration.
A1, A2	Section overhead framing bytes. Modifying A1 and A2 bytes causes receivers to lose framing.
J0 (C1)	Formerly C1 (STS-1 ID), now redefined as the J0 section trace byte. Modifying J0 in STS-1, channel 1 only takes effect if section trace message insertion is disabled, as described in “J0 Section Trace Message” on page 370.

Settings	Description
E1	Orderwire section byte located in first STS-1 of an STS-N.
F1	Section user channel byte located in first STS-1 of an STS-N.
D1, D2, D3	Section data communication channel bytes located in first STS-1 of an STS-N.
K1, K2	APS channel bytes. Modifying K1 and K2 is possible through this interface, but to ensure proper K1 and K2 updates, see “K1/K2 Settings” on page 374. Enabled alarms (RDI-L, AIS-L) override changes to K2.
H1, H2, H3	SPE payload pointer bytes. H1, H2, and H3 bytes cannot be modified.
D4 through D12	Line data communications channel bytes.
S1	Synchronization status byte.
M1	Line Remote Error Indicator (Line REI) byte. Modifying M1 of STS-1, channel 7, does not override enabled error injection of Line REI (REI-L).
E2	Express orderwire byte.
Set	You must click **Set** to apply any changes to the transport overhead byte values.

Settings	Description

SCPI Examples:
Use the following command to set the values for bytes A1;A2;J0;B1;E1;F1;D1;D2;D3.
`sour(@7):data:sect:over:byt F6;28;01;XX;00;00;00;00;00`
Use the following command to set the values for bytes H1;H2;H3;B2;K1;K2;D4;D5;D6;D7;D8;D9;D10;D11;D12;S1;M1;E2.
`sour(@7):data:line:over:byt XX;XX;XX;XX;00;00;00;00;00;00;00;00;00;00;00;00;00;00`
For detailed information, see “Overhead Access” on page 601.	

Path Overhead

Perform the following steps to modify specific transport overhead bytes for a specific time slot in the internally generated SPE.

Note Channel selection is only available when the signal is framed and the SPE is set to Selected. See “SPE” on page 365.

1 Select an STS-1 channel (time slot).
2 Enter hexadecimal values.
3 Click **Set** to apply the changes.

The following notes apply to modifying transport overhead bytes:

- Overhead bytes that cannot be modified are indicated with “XX” greyed out in the user interface.
- The B1 and B2 bytes can only be modified through the B1 and B2 error insertion, as described in “Errors” on page 368.

Settings	Description
SPE	Selects the number of the time slot in the internally generated SPE for which you want to modify path overhead bytes. Channel 1 is the default in the factory configuration. The available channels depends on the selected SPE mapping. This field is linked to the SPE field in the **Generate** tab and is only available when the SPE field is set to Selected.
J1	STS path trace byte. Modifying J1 only takes effect if J1 path trace message insertion is disabled.
C2	STS path signal label.
G1	Path terminating status byte. This byte cannot be modified.
F2	Path user channel byte.
H4	Indicator allocated for use as a mapping-specific indicator byte.
Z3, Z4	Allocated for future growth.
Z5	Tandem connection byte.
Set	You must click **Set** to apply any changes to the transport overhead byte values.

SCPI Examples:

Use the following command to set the values for bytes J1;B3;C2;G1;F2;H4;Z3;Z4;Z5.

```
sour(@7):data:path:over:byt
00;XX;01;00;00;00;00;00;00
```

For detailed information, see “Overhead Access” on page 601.

Related Topics:

“SPE Mapping” on page 362

“SPE” on page 365

K1/K2 Settings

The following figure shows the main features of the K1/K2 tab.

A **K1/K2 Values**—Set K1 and K2 byte values, as described in "K1/K2 Values" on page 374.

B **K1/K2/Messages**—Set K1 and K2 bits to encode APS channel messages, as described in "K1/K2 Messages" on page 374..

K1/K2 Values

The K1/K2 Values setting enables you to directly set values in the automated protection switching (APS) channel K1 and K2 bytes. These bytes cannot be modified when the Transmit source is set to Backplane.

K1/K2 Values	Description
K1	Bits 1 through 4 control the request message, and bits 5 through 8 control the channel message code.
K2	Bits 1 through 4 of the K2 byte control the channel number, bit 5 controls the architecture, and bits 6 thorough 8 indicate the mode of operation.
Set	You must click **Set** to update and transmit new K1/K2 values entered here.
SCPI Examples: `SOUR(@6):APS:K1K2 0xF2,0x14`	

K1/K2 Messages

Use the fields in the K1/K2 message panel to set K1 and K2 bits to encode APS channel messages.

As you set K1/K2 message fields, the hexadecimal values displayed in the **K1/K2 Values** field update accordingly.

K1/K2 Message Settings	Description
K1 Request	Sets bits 1 through 4 of K1 with one of the following request messages. **Lockout of Protection**. Sets bits 1 through 4 to 1111. **Forced Switch**. Sets bits 1 through 4 to 1110. **SF - High Priority**. Sets bits 1 through 4 to 1101. **SF - Low Priority**. Sets bits 1 through 4 to 1100. **SD - High Priority**. Sets bits 1 through 4 to 1011. **SD - Low Priority**. Sets bits 1 through 4 to 1010. **Manual Switch**. Sets bits 1 through 4 to 1000. **Wait-to-Restore**. Sets bits 1 through 4 to 0110. **Exercise**. Sets bits 1 through 4 to 0100. **Revert Request**. Sets bits 1 through 4 to 0100. **Do Not Revert**. Sets bits 1 through 4 to 0001. **No Request** — Sets bits 1 through 4 to 0000. This setting is the default in the factory configuration.

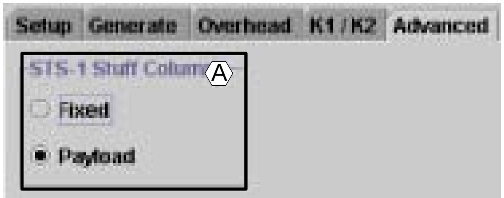
K1/K2 Message Settings	Description
K1 Channel	Selects the channel to apply the requesting message (sets bits 5 through 8 of K1 with the channel message code): **0**. The Null channel. This setting is the default in the factory configuration. **1** to **14**. Channel 1 through 14. **15**. Extra traffic channel.
K2 Operation	Sets the operational mode of the APS. Bits 6 through 8 of the K2 byte carry this information. **Unidirectional**. Sets bits 6 to 8 to 100. This setting is the default in the factory configuration. **Bidirectional**. Sets bits 6 to 8 to 101.
K2 Architecture	Sets the architecture mode for the APS. Bit 5 of K2 carries this information. **Architecture 1+1**. Sets bit 5 to 0. This setting is the default in the factory configuration. **Architecture 1:n**. Sets bit 5 to 1.
K2 Channel	Selects the channel to apply the requesting message (sets bits 1 through 4 of K1 with the channel message code): **0**. Null channel. This setting is the default in the factory configuration. **1** to **14**. Channel 1 to 14. **15**. Extra traffic channel.

K1/K2 Message Settings	Description
Set	You must click **Set** to update and apply the K1/K2 Message settings.
SCPI Examples:	

```
sour(@4):tran:aps:k1k2 0x00 0x00
sour(@4):aps:k1en:req lops
sour(@4):aps:k1en:chan 1
sour(@4):aps:k2en:oper bid
sour(@4):aps:k2en:arch a1_n
sour(@4):aps:k2en:chan 1
sour(@4):aps:upd
```

Advanced Settings

The following figure illustrates the settings that are configured on the OC-48 Transmitter **Advanced** tab.



A **STS-1 Stuff Columns**—When the SPE mapping is set to STS-1, select whether the SPE stuff columns contain a fixed pattern (all zeroes) or a PRBS payload data pattern. See "STS-1 Stuff Columns" on page 376.

STS-1 Stuff Columns

The **STS-1 Stuff Columns** setting specifies whether the SPE stuff columns are filled with a fixed (all zeroes) pattern or a PRBS payload pattern.

Note This setting is only available when the SPE mapping for the OC-48 Transmitter is set to STS-1.

The stuff columns are columns 30 and 59 of the SPE as specified in GR-253-CORE. The default setting is Payload (PRBS pattern).

Setting	Description
Fixed	Fills the bytes in the SPE stuff columns with a fixed pattern of all zeroes.
Payload	Fills the bytes in the stuff columns with PRBS pattern data. This is the default setting in the factory configuration.
SCPI Examples:	

```
SOUR(@7):PAYL:STUF  PAYL
SOUR(@7):PAYL:STUF  FIX
SOUR(@7):PAYL:STUF  ?
```

28

OC-48 TRANSCEIVER WINDOW

The topics in this section explain how to configure set-up options, alarm and error insertion, payload generation, and monitoring options for the OC-48 Transceiver module:

Instructions are provided for using EPXam to configure the module, along with SCPI equivalents.

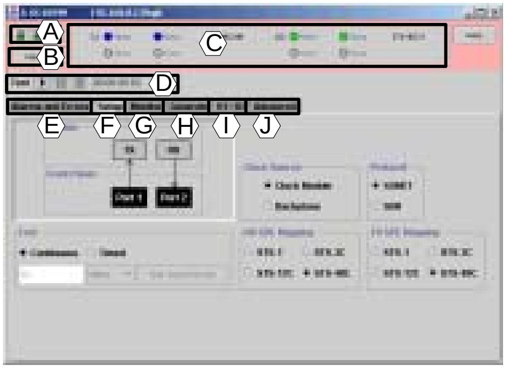
Tip OC-48 Transceivers can be switched between SONET and SDH functionality. See “Protocol” on page 380 and “Using the SONET/SDH Switcher” on page 121.

See “STM-16 Transceiver Window” on page 517 for a description of this module’s features and user interface in SONET protocol mode.

For more information about EPXam, see “Using EPXam” on page 3.

Main View

The following figure shows the main features of the OC-48 Transceiver window.



A Save or restore custom module/slot configurations or restore factory defaults. See “Using Module Window Save and Restore Controls” on page 108.

B **Identify**—When pressed, it flashes the Active LED on the module associated with this window.

C View summary defect status, alarm indicators, and other module information. See “Expanded Logical View Indicators” on page 8 for more information.

D Start, stop, or pause test; view elapsed time. See “Using Module Window Test Controls” on page 118.

E **Alarms and Errors**—Monitor alarm status, error counts, and error ratios for current test. See “Alarms and Errors” on page 387.

F **Setup**—Configure clock source, test type and duration, SPE mapping, or switch the module between SONET and SDH protocol. See “Setup” on page 379.

G **Generate**—Configure alarm and error generation, payload data pattern, and J0 trace message insertion. See “Generate Settings” on page 382.

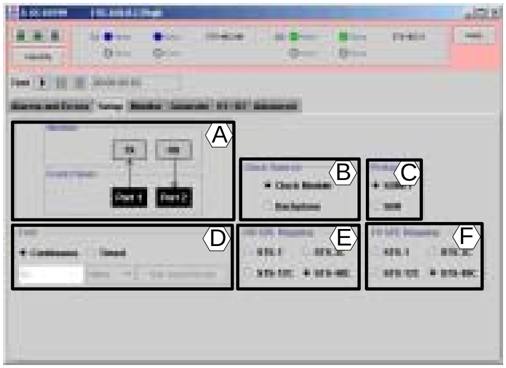
H **Monitor**—Monitor J0 section trace message, select the STS channel to monitor, and set the type of payload data pattern to monitor. See “Monitor Settings” on page 386.

I **K1/K2**—Monitor or generate K1/K2 byte values and APS channel messages. See “K1/K2 Settings” on page 389.

J **Advanced**—Select STS-1 stuff column fill type. See “Advanced Settings” on page 393.

Setup

The following figure illustrates the main features of the OC-48 Transceiver **Setup** tab.



A Graphical view of currently selected OC-48 module input and output.

B **Clock Source**—Select the clock source that provides the timing reference that is used to generate the SONET payload. See “Clock Source” on page 379.

C **Protocol**—Switch between SONET and SDH protocol, as described in “Protocol” on page 380.

D **Test**—Select test type and duration. See “Test” on page 381.

E **Rx SPE Mapping**—Set the expected STS size and mapping of the monitored SPE, as described in “RX SPE Mapping” on page 381.

F **Tx SPE Mapping**—Configure the synchronous payload envelope (SPE) mapping for the transmitted signal, as described in “TX SPE Mapping” on page 382.

These settings are explained in more detail in the following sections.

Clock Source

The Clock Source setting controls whether the OC-48 Transceiver uses the EPX clock module in slot 1, an “as received” clock from a TX port on the transceiver, or the backplane as the clock source for payload generation.

Rate Setting	Description
Clock Module	Selects the timing reference from the EPX Test System’s clock module. Verify that the EPX clock module is correctly providing a SONET/SDH timing reference for the slot in which the OC-48 Transceiver is installed.
Backplane	Selects the timing reference from the signal transmitted via the Test System backplane from the OC-48 Receiver installed in the adjacent slot to the left of the transmitter.
As Received	Selects the “as received” clock from the signal received on the RX port on the OC-48 Transceiver.

Rate Setting	Description

SCPI Examples:
`SOUR(@18):CLOC CLKB`
`SOUR(@18):CLOC BACK`
`SOUR(@10):CLOC ASRX`
Related Topics
“Configuring the EPX100 Clock Module” on page 25	

Protocol

The Protocol setting switches the module between SONET and SDH. When the switch is complete, EPXam displays the appropriate protocol configuration options and field labels for the module and updates all references to the module to use the correct protocol.

Note Switching between SONET and SDH protocol does *not* require a restart of the test system or EPXam.

Restrictions:

- Modules that are locked via the Group Manager cannot be switched by other users.
- Active test and logging sessions associated with a module at the time of a switch are cancelled.

  If tests or logging sessions are in progress on any of the modules being switched, a warning dialog is displayed. Click **Cancel** to abort the switch or **Continue** to complete the switch. If you choose **Continue**, running tests and logging sessions are cancelled. Otherwise, a dialog opens that displays the switching progress.

Setting	Description
SONET	Switches the module to SONET without restarting the test system or EPXam. This is the default setting in the factory configuration.
SDH	Switches the module to SDH without restarting the test system or EPXam.

SCPI Examples:
`SYST:BOAR(@7):PROT:TYPE SON`
`SYST:BOAR(@7):PROT:TYPE SDH`
`SYST:BOAR(@7):PROT:STAT?`	

See “STM-16 Transceiver Window” on page 517 for a description of this module’s SDH features and configuration.

See the following topics for more information about SONET/SDH switching:

- “Using the SONET/SDH Switcher” on page 121
- “SONET/SDH Switching and Custom Configuration Files” on page 123
- “Switching Modules Using SCPI” on page 123

Test

The Test area defines the type and duration of the test that the receiver runs. To start and stop tests, use the controls in the module window or, to start tests for multiple modules, use the Test Controls window. See “Controlling Tests” on page 115.

Note Selecting a new test type automatically stops the current test.

Test Setting	Description
Continuous	Selects a continuous test that must be manually stopped and started. This is the default setting in the factory configuration.
Timed	Selects a timed test. When Timed is selected: **1** Specify a number and select a unit (seconds, minutes, hours, and days) for the test duration. **2** Click **Set** to apply the settings. **3** Use the controls at the top of the window to start the test. **Note** If you enable logging and are saving the log file to the EPX Test System, gnubi advises you to limit the test period to a maximum of 72 hours (3 days).

Test Setting	Description

SCPI Examples:
`sens(@3):test:type cont`
`sens(@3):test:type tim`
`sens(@3):test:unit min`
`sens(@3):test:per 10`
To control tests use the following commands:
`sens(@3):test:mode star`
`sens(@3):test:mode stop`
`sens(@3):test:mode rest`
`sens(@3):test:mode pause`
Related Topics:
“Logging” on page 63
“Controlling Tests” on page 115	

RX SPE Mapping

The RX SPE Mapping option sets the expected STS size and mapping of the monitored SPE.

This setting affects options for the Channel selections in the Monitor tab.

RX SPE Mapping	Description
STS-1	Selects an STS-1 sized payload for the SPE. This is a 783-byte payload.
STS-3	Selects an STS-3c sized payload for the SPE. This is a 2349-byte payload.
STS-12	Selects an STS-12c sized payload for the SPE. This is a 9396-byte payload.
STS-48	Selects an STS-48c sized payload for the SPE. This is a 37584-byte payload.

RX SPE Mapping	Description
SCPI Examples:	

```
SENS(@18):DATA:SIZE  STS1C
SENS(@18):DATA:SIZE  STS3C
SENS(@18):DATA:SIZE  STS12C
SENS(@18):DATA:SIZE  STS48C
```

Related Topics:

"Channel" on page 386.

TX SPE Mapping

The TX SPE Mapping option sets the size of the SPE (Synchronous Payload Envelope) that is mapped into the generated payload.

This setting affects options for the Channel selections in the Generate tab.

TX SPE Mapping	Description
STS-1	Selects an STS-1 sized payload for the SPE. This is a 783 byte payload.
STS-3	Selects an STS-3c sized payload for the SPE. This is a 2349-byte payload.
STS-12	Selects an STS-12c sized payload for the SPE. This is a 9396-byte payload.
STS-48	Selects an STS-48c sized payload for the SPE. This is a 37584-byte payload.

TX SPE Mapping	Description
SCPI Examples:	

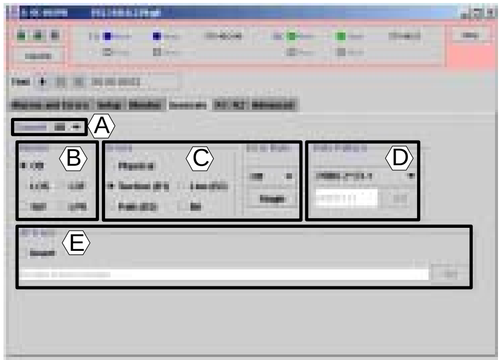
```
SOUR(@18):DATA:SIZE  STS1C
SOUR(@18):DATA:SIZE  STS3C
SOUR(@18):DATA:SIZE  STS12C
SOUR(@18):DATA:SIZE  STS48C
```

Related Topics:

"Channel" on page 383.

Generate Settings

The following figure illustrates the main features of the OC-48 Transceiver **Generate** tab.



A **Channel**—Select a specific channel (SPE time slot) or broadcast the payload to all time slots, as described in "Channel" on page 383.

B **Alarms**—Select the type of alarm to insert, as described in "Alarms" on page 383.

C **Errors**—Select the type of error to insert and the insertin rate, as described in “Errors” on page 384 and “Error Rate” on page 384.

D **Data Pattern**—Select the payload data pattern to insert into the transmitted signal, as described in “Data Pattern” on page 385.

E **J0 Trace**—Specify and insert a J0 section or J1 path trace message, as described in “J0 Trace Message” on page 385.

Channel

The Channel option specifies whether the internally generated payload is mapped to a single SPE time slot or broadcast to all SPE channels.

The number of time slots varies, depending on the currently selected TX SPE mapping.

Channel	Description
All	Broadcast mode. The hardware maps the SPE into all SPE time slots.
1 to 48	This selection range is available if the TX SPE size is set to STS-1.
1 to 16	This selection range is available if the TX SPE size is set to STS-3c.
1 to 4	This selection range is available if the TX SPE size is set to STS-12c.
1	There is only one SPE when the TX SPE size is set to STS-48c.

Channel	Description

SCPI Examples:
`SOUR(@18):DATA:MODE  SEL`
`SOUR(@18):DATA:SPE  1`
`SOUR(@18):DATA:MODE BRO`	

Alarms

The Alarms setting determines the type of SONET alarm that is inserted into the transmit stream.

Alarm setting	Description
Off	Alarm insertion is disabled.
LOS	Loss of Ssignal **Implementation**: LOS is generated by disabling signal output. When LOS insertion is turned off, the signal output is turned back on.
LOF	Loss of Frame **Implementation**: LOF is generated by inverting the framing bytes (A1, A2) in the SONET overhead. When LOF insertion is turned off, the framing bytes are restored.

Alarm setting	Description
SEF	Severely Errored Frame **Implementation**: SEF is generated by inverting the framing bytes (A1, A2) in the SONET overhead for four consecutive frames, then reverting to the correct values for the next 252 frames. This sequence is repeated until SEF alarm insertion is turned off.
LPS	Loss of Pattern Sync **Implementation**: LPS is generated by setting the payload pattern in the generated payload to a value other than what is specified in the Payload Data Pattern setting. When LPS alarm insertion is turned off, the pattern is reset to the expected value.

SCPI Examples:

```
SOUR(@3):ALAR  OFF
SOUR(@3):ALAR  LOS
SOUR(@3):ALAR  LOF
SOUR(@3):ALAR  SEF
SOUR(@3):ALAR  LPS
```

Errors

The Error Type and Error Rate settings control the type of error and the rate at which it is inserted into the transmit stream.

Note Whenever the Error Type setting is modified, the Error Rate setting is always reset to Off.

Choose one of the following error types.

Error Type	Description
Physical	Inserts physical layer (or random) errors. This setting is the default in the factory configuration.
Section (B1)	Inserts section (B1 BIP-8) errors into the stream.
Line (B2)	Inserts line (B2 BIP-8) errors into the stream.
Path (B3)	Inserts path (B3 BIP 8) errors into the stream.
Bit	Inserts errors into the bits of the payload so that the transmitted payload does not match the expected pattern.

SCPI Examples:

```
SOUR(@3):ERR:TYPE  SECT
SOUR(@3):ERR:TYPE  LINE
SOUR(@3):ERR:TYPE  PHYS
SOUR(@3):ERR:TYPE  PATH
SOUR(@3):ERR:TYPE  BIT
```

Error Rate

The Error Rate setting enables and disables error insertion and controls the rate at which errors are inserted into the stream.

Tip The Error Rate setting is always reset to OFF whenever the Error Type is changed.

Error Rate Setting	Description
Off	Sets the error rate to 0, effectively disabling error insertion. This setting is the default in the factory configuration.
IE-3 through IE-9	Sets the error ratio to 10 x 10^-3, 10 x 10^-4, and so on.
Single	The Error Rate must be set to Off to enable single error insertion. When this option is available, click this button to insert a single error into the transmit stream.

SCPI Examples:
`SOUR(@3):ERR:RAT OFF`
`SOUR(@3):ERR:RAT RIE-4`
`SOUR(@3):ERR:RAT SING`	

Data Pattern

The Payload Pattern selects the type of pattern to place into the generated payload.

Settings	Description
PRBS 2^15-1 **PRBS 2^20-1** **PRBS 2^23-1** **Inv. PRBS 2^23-1** **Inv. PRBS 2^20-1** **Inv. PRBS 2^15-1**	Selects a pseudo-random bit sequence (PRBS) pattern or inverted PRBS pattern. The default setting is PRBS 2^23-1
User	Selects an 8-bit binary user-defined payload pattern.
Set	If a custom user-defined payload pattern is defined, click **Set** to apply the changed user payload pattern.

SCPI Examples:
`SOUR(@6):PAYL:GEN:PATT:TYPE PR215`
`SOUR(@6):PAYL:GEN:PATT:TYPE PR223`
`SOUR(@6):PAYL:GEN:PATT:TYPE USER`
`SOUR(@6):PAYL:GEN:PATT:USER 0b00110011`	

J0 Trace Message

Create and insert a user-defined section J0 trace message.

1 Click **Insert**.

2 Enter the trace message.

Note Messages can be no longer than 62 characters.

3 Click **Set** to apply the changes.

If you do not click **Set**, the modified message is not inserted.

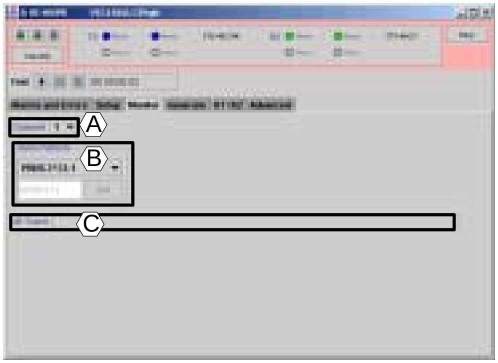
To enable J0 trace and insert a trace message using SCPI, use a pair of commands similar to the following:

```
SOUR(@6):DATA:SECT:TREN ON
SOUR(@6):DATA:SECT:TRAC “oc48tcvr in slot 6”
```

Note When using SCPI, you must enclose the message in quotation marks. Otherwise, only the characters before the first space are used as the trace message.

Monitor Settings

The following figure illustrates the options available on the OC-48 Transceiver **Monitor** tab.



A **Channel**—Select the STS time slot (channel) to monitor, as described in “Channel” on page 386.

B **Data Pattern**—Select the type of payload data pattern to monitor, as described in “Data Pattern” on page 386.

C **J0 Trace**—Monitor J0 trace messages, as described in “J0 Trace Message” on page 387.

Channel

The Channel setting determines which synchronous payload envelope (SPE) time slot is monitored. The number of channels available depends on the currently selected SPE mapping.

Setting	Description
Channel	Selects the SPE time slot (channel) to monitor in the received payload. The number of channels depends on the setting for the SPE mapping (SPE size). • If the SPE size is STS-1, select 1 of 48 channels. • If the SPE size is STS-3c, select 1 of 16 channels • If the SPE size is STS-12c, select 1 of 4 channels. • If the SPE size is STS-48c, there is only 1 channel.

SCPI Examples:

```
SENS(@6):DATA:SPE   4
```

Related Topics:

“RX SPE Mapping” on page 381.

Data Pattern

The Data Pattern setting selects the type of payload pattern to monitor in the received signal.

Settings	Description
PRBS 2^15-1 **PRBS 2^20-1** **PRBS 2^23-1** **Inv. PRBS 2^23-1** **Inv. PRBS 2^20-1** **Inv. PRBS 2^15-1**	Pseudo-random bit patterns. The default setting is PRBS 2^23-1.

Settings	Description
Live	Monitor live payload data pattern.
User	8-bit binary user-defined payload pattern.
Set	This selection is only available if User is selected as the payload pattern type. If a custom user-defined payload pattern type is selected, enter a binary number for the pattern, then click **Set** to apply the changes to the user-defined payload pattern

SCPI Examples:
`SENS(@6):PAYL:MON:PATT:TYPE PR215`
`SENS(@6):PAYL:MON:PATT:TYPE PR223`
`SENS(@6):PAYL:MON:PATT:TYPE IPR215`
`SENS(@3):PAYL:MON:PATT:TYPE  USER`
`SENS(@3):PAYL:MON:PATT:USER  0b00110011`	

J0 Trace Message

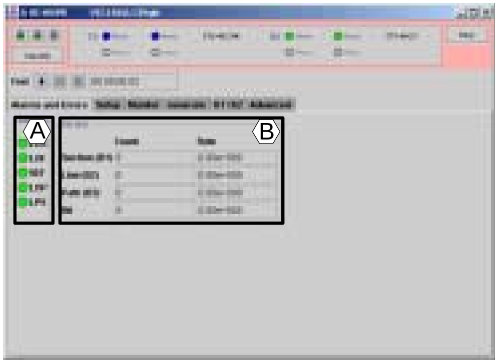
The J0 Trace Message field displays the J0 section trace message.

To query the J0 trace message using SCPI, use a command similar to the following:

```
SENS(@16):DATA:SECT:TRAC ?
```

Alarms and Errors

The following figure illustrates the main areas on the OC-48 Transceiver **Alarms and Errors** tab.



A **Alarms**—View alarm status indicators for the current test. See “Alarms” on page 383.

B **Errors**—View error counts and error ratios for current test. See “Errors” on page 384.

Alarms

The Alarm area displays status indicators for the current test.

The alarm indicator colors are defined below.

Note If the status indicator for an alarm is grey, that type of alarm is not available for monitoring.

Green	Yellow	Red
No alarms are detected: signal is clear or monitoring is not started.	Alarm history: an alarm was detected but is not active in the current test.	An alarm is active and currently detected on the monitored signal.

The following alarms can be monitored.

Alarm Indicator	Description
LOS	Loss of Signal An LOS alarm condition is declared either when a received signal with an all-zeroes pattern has insufficient data bit transitions or when the as received clock cannot be recovered from the received signal because the optical power is insufficient. LOS ends when a received signal has a minimum optical power and data bit transitions so that the as received clocked can be recovered, and two consecutive valid frame alignment patterns occur without LOS defects.
LOF	Loss of Frame LOF occurs when an Severely Errored Frame (SEF) condition occurs and does not clear for more than 3 milliseconds, as decribed in Bellcore GR-253-CORE, section 6.2.1.1.2. LOF ends 3 milliseconds after SEF ends.
SEF	Severely Errored Frame SEF occurs when 4 consecutive frames do not contain a valid frame word, as described in Bellcore GR-253-CORE, section 5.5. SEF ends when two successive error-free framing patterns are detected.
LOP	Path Loss of Pointer LOP indicates that the H1/H2 bytes do not contain a valid pointer, and the condition has persisted for 8 frames. A valid pointer must be in range (0-783) and the NDF (New Data Flag) must be a 6 (normal pointer) or 9 (new pointer value or concatenation indicator if the pointer value is 0x3FF). LOP is cleared when 3 consecutive frames of valid pointer data are detected.
LPS	Loss of Pattern Synchronization LPS is detected when the payload data pattern in the monitored signal does not match the expected pattern for 6 consecutive clock cycles (if it is a pre-defined payload pattern) or 2 clock cycles (if it is a user-defined pattern). LPS is not monitored when a Live payload data pattern is selected.

SCPI Examples:

```
SENS(@3):ALAR:LOS ?
SENS(@3):ALAR:LOF ?
SENS(@3):ALAR:SEF ?
SENS(@3):ALAR:LOP ?
SENS(@3):ALAR:LPS ?
```

Errors (RX)

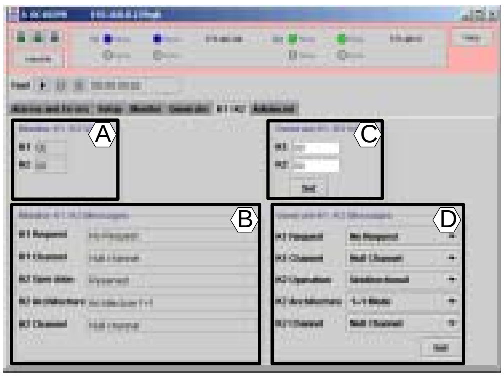
The Errors section displays monitored error counts and ratios for the current test, as described in the following table.

Error Types and Fields	Description
Section (B1)	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B1 section parity byte. Only in framed mode.
Line (B2)	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B2 line parity byte.
Path (B3)	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B3 path parity byte.
Bit (Payload)	This error is declared when the payload pattern of the received signal does not match the pattern selected.
Count	Number of errors of the specified type detected in the current test.
Rate	Computed error ratio for the specified error type for the current test.

SCPI Examples:
`SENS(@3):ERR:COUN:SECT ?`
`SENS(@3):ERR:RAT:SECT ?`
`SENS(@3):ERR:COUN:LINE ?`
`SENS(@3):ERR:RAT:LINE ?`
`SENS(@3):ERR:COUN:PATH ?`
`SENS(@3):ERR:RAT:PATH ?`
`SENS(@3):ERR:COUN:BIT ?`
`SENS(@3):ERR:RAT:BIT ?`	

K1/K2 Settings

The following figure shows the main features of the **K1/K2** tab.



A **Monitor K1/K2 Values**—Displays hexadecimal values of the automated protection switching (APS) channel K1 and K2 bytes, as described in “Monitor K1/K2 Values” on page 392.

B **Monitor K1/K2 Messages**—Displays automated protection switching (APS) channel messages decoded from the K1/K2 bytes, as described in “Monitor K1/K2 Messages” on page 392.

C **Generate K1/K2 Values**—Set K1 and K2 byte values, as described in “Generate K1/K2 Values” on page 390.

D **Generate K1/K2 Messages**—Set K1/K2 bits to encode APS channel messages, as described in “Generate K1/K2 Messages” on page 390.

Generate K1/K2 Values

The K1/K2 Values setting enables you to directly set values in the automated protection switching (APS) channel K1 and K2 bytes.

K1/K2 Value Settings	Description
K1	The default value is 0xF1. Bits 1 through 4 control the request message, and bits 5 through 8 control the channel message code.
K2	The default value is 0x14. Bits 1 through 4 of the K2 byte control the channel number, bit 5 controls the architecture, and bits 6 thorough 8 indicate the mode of operation.
Set	You must click **Set** to update and transmit new K1/K2 values entered here.

K1/K2 Value Settings	Description
SCPI Examples: `SOUR(@3):TRAN:APS:K1K2 0xf1 0x14`	

Generate K1/K2 Messages

Use the fields in the K1/K2 message panel to set K1 and K2 bits to encode APS channel messages.

As you set K1/K2 message fields, the hexadecimal values displayed in the **K1/K2 Values** field update accordingly.

K1/K2 Message Settings	Description
K1 Request	Sets bits 1 through 4 of K1 with one of the following request messages.
	Lockout of Protection. Sets bits 1 through 4 to 1111.
	Forced Switch. Sets bits 1 through 4 to 1110.
	SF - High Priority. Sets bits 1 through 4 to 1101.
	SF - Low Priority. Sets bits 1 through 4 to 1100.
	SD - High Priority. Sets bits 1 through 4 to 1011.
	SD - Low Priority. Sets bits 1 through 4 to 1010.

K1/K2 Message Settings	Description
	Manual Switch. Sets bits 1 through 4 to 1000.
	Wait-to-Restore. Sets bits 1 through 4 to 0110.
	Exercise. Sets bits 1 through 4 to 0100.
	Revert Request. Sets bits 1 through 4 to 0100
	Do Not Revert. Sets bits 1 through 4 to 0001
	No Request — Sets bits 1 through 4 to 0000.
K1 Channel	Selects the channel to apply the requesting message (sets bits 5 through 8 of K1 with the channel message code): • 0 selects the Null channel. • 1 through 14 — Channel 1 through 14. • 15 — Extra traffic channel.
K2 Operation	Sets the operational mode of the APS. Bits 6 through 8 of the K2 byte carry this information. **Unidirectional**. Sets bits 6 to 8 to 100. **Bidirectional**. Sets bits 6 to 8 to 101.
K2 Architecture	Sets the architecture mode for the APS. Bit 5 of K2 carries this information. **Architecture 1+1**. Sets bit 5 to 0. **Architecture 1:n**. Sets bit 5 to 1.
K2 Channel	Selects the channel to apply the requesting message (sets bits 1 through 4 of K1 with the channel message code): **0**. Null channel. **1** to **14**. Channel 1 to 14. **15**. Extra traffic channel.
Set	You must click **Set** to update and apply the K1/K2 Message settings.

SCPI Examples:

```
sour(@4):tran:aps:k1k2 0x00 0x00
sour(@4):aps:k1en:req lops
sour(@4):aps:k1en:chan 1
sour(@4):aps:k2en:oper bid
sour(@4):aps:k2en:arch a1_n
sour(@4):aps:k2en:chan 1
sour(@4):aps:upd
```

Monitor K1/K2 Values

The K1/K2 Values field displays the hexadecimal values of the automated protection switching (APS) channel K1 and K2 bytes for the monitored signal.

K1/K2 Value Settings	Description
K1	The default value is 0xF1. Bits 1 through 4 control the request message, and bits 5 through 8 control the channel message code.
K2	The default value is 0x14. Bits 1 through 4 of the K2 byte control the channel number, bit 5 controls the architecture, and bits 6 thorough 8 indicate the mode of operation.
Broadcast to TX	Enable or disable broadcasting of the received APS K1 and K2 bytes to an OC-48 Transceiver in the adjacent , higher-numbered slot. By default, this setting is disabled.
SCPI Examples: `SENS(@12):TRAN:APS:K1K2?`	

Monitor K1/K2 Messages

This field displays automated protection switching (APS) channel messages decoded from the K1/K2 bytes.

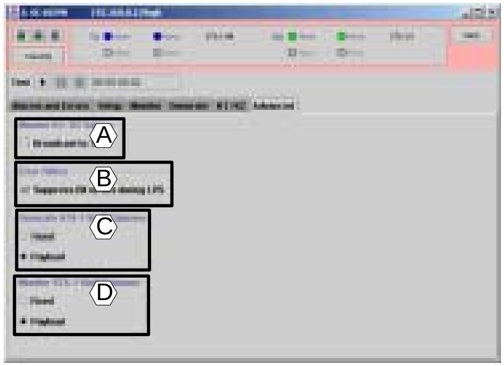
K1/K2 Messages	Description
K1 Request	Bits 1 through 4 of K1 can contain the following request messages. **Lockout of Protection**. Bits 1 through 4 have a value of 1111. **Forced Switch**. Bits 1 through 4 contain 1110. **SF - High Priority**. Bits 1 through 4 Have a value of 1101. **SF - Low Priority**. Bits 1 through 4 have a value of 1100. **SD - High Priority**. Bits 1 through 4 have a value of 1011. **SD - Low Priority**. Bits 1 through 4 have a value of 1010. **Manual Switch**. Bits 1 through 4 have a value of 1000. **Wait-to-Restore**. Bits 1 through 4 have a value of 0110. **Exercise**. Bits 1 through 4 have a value of 0100. **Revert Request**. Bits 1 through 4 have a value of 0100. **Do Not Revert**. Bits 1 through 4 have a value of 0001. **No Request**. Bits 1 through 4 have a value of 0000. This is the default in the factory configuration.

K1/K2 Messages	Description
K1 Channel	Channel selection for the requesting message (bits 5 through 8 of K1 carry the channel message code): **0**. Null channel. **1** to **14**. Channel 1 through 14. **15**. Extra traffic channel.
K2 Operation	Operational mode of the APS. Bits 6 through 8 of the K2 byte carry this information. **Unidirectional**. Bits 6 to 8 have a value of 100. **Bidirectional**. Bits 6 to 8 have a value of 101.
K2 Architecture	Architecture mode for the APS. Bit 5 of K2 carries this information. **Architecture 1+1**. Bit 5 is 0. **Architecture 1:n**. Bit 5 is 1.
K2 Channel	Channel selection for the requesting message (bits 1 through 4 of K2 carry the channel message code): **0**. Null channel. **1** to **14**. Channel 1 to 14. **15**. Extra traffic channel.

SCPI Examples:
`SENS(@8):APS:K1D:REQ?`
`SENS(@8):APS:K1D:CHAN?`
`SENS(@8):APS:K2D:OPER?`
`SENS(@8):APS:K2D:ARCH?`
`SENS(@8):APS:K2D:CHAN?`	

Advanced Settings

The following figure illustrates the settings that are configured on the OC-48 Transceiver **Advanced** tab.



A **Monitor K1/K2 Values**—Select whether or not the K1/K2 byte values are broadcast to the transmitter in the next slot to the right. See “K1/K2 Broadcast” on page 395

B **Error Filters**—Specify whether bit errors are suppressed (not counted) during an LPS alarm condition. See “Error Filters” on page 394.

C **Generate STS-1 Stuff Columns**—When the SPE mapping is set to STS-1, select whether the SPE stuff columns contain a fixed pattern (all zeroes) or a PRBS payload data pattern. See “STS-1 Stuff Columns” on page 394.

- **D** **Monitor STS-1 Stuff Columns**—When the SPE mapping is set to STS-1, select whether the SPE stuff columns contain a fixed pattern (all zeroes) or a PRBS payload data pattern. See “STS-1 Stuff Columns” on page 394.

STS-1 Stuff Columns

The **STS-1 Stuff Columns** setting specifies whether the SPE stuff columns are filled with a fixed (all zeroes) pattern or a PRBS payload pattern.

Note This setting is only available when the SPE mapping for the OC-48 Transceiver is set to STS-1.

The stuff columns are columns 30 and 59 of the SPE as specified in GR-253-CORE. The default setting is Payload (PRBS pattern).

Setting	Description
Fixed	Fills the bytes in the SPE stuff columns with a fixed pattern of all zeroes.
Payload	Fills the bytes in the stuff columns with PRBS pattern data. This is the default setting in the factory configuration.
SCPI Examples:	
	SOUR(@7):PAYL:STUF PAYL SOUR(@7):PAYL:STUF FIX SOUR(@7):PAYL:STUF ? SENS(@7):PAYL:STUF PAYL SENS(@7):PAYL:STUF FIX SENS(@7):PAYL:STUF ?
Related Topics:	
	“RX SPE Mapping” on page 381 “TX SPE Mapping” on page 382

Error Filters

The Error Filters setting specifies whether the bit errors are suppressed when an LPS alarm condition is active.

Field/ Setting	Description
Suppress Bit errors	When this setting is checked, bit errors are not counted when the LPS alarm is active. When unchecked, bit errors are counted when the LPS alarm is active. Disabled is the default setting in the factory configuration.
SCPI Examples:	
	SENS(@3):FILT:BIT ON SENS(@3):FILT:BIT OFF

K1/K2 Broadcast

The following table describes the K1/K2 setting for the OC-48 Transceiver.

Field/ Setting	Description
Broadcast to TX	Enable or disable broadcasting of the received APS K1 and K2 bytes to a transmitter in the adjacent slot to the right of the receiver. The default setting is disabled in the factory configuration.

SCPI Examples:
`SENS(@18):APS:ENAB 1`
`SENS(@18):APS:ENAB 0`	

29

OC-192 RECEIVER WINDOW

The topics in this section explain how to configure received signals and how to monitor data for the OC-192 receiver.

Instructions are provided for using EPXam to configure the module, along with SCPI equivalents.

Tip OC-192 Receivers can be switched between SONET and SDH functionality. See "Protocol" on page 409 and "Using the SONET/SDH Switcher" on page 121.

See "STM-64 Receiver Window" on page 537 for a description of this module's features and user interface in SDH mode.

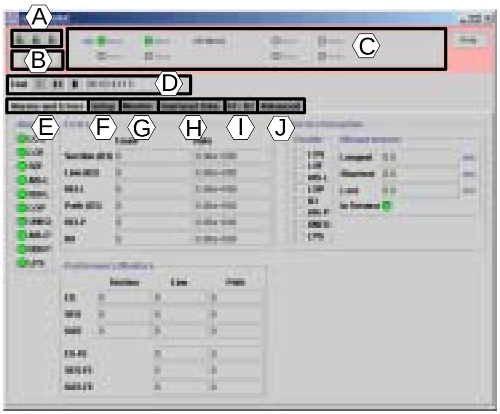
- For more information about EPXam, see "Using EPXam" on page 3.
- For information about changing and installing OC-192 modules, see "Changing Modules" on page 126.

Main View

The OC-192 receiver window has tabs for configuring setup options and monitoring error and alarm data.

The main view of the OC-192 receiver also has standard controls for running tests, saving and restoring configuration, and viewing alarm/error status, current signal rate and channel.

The following figure shows the main features of the OC-192 receiver window.



A Save or restore module/slot configuration or factory defaults, as described in“Saving and Restoring Test Configurations” on page 107.

B **Identify**—When pressed, **Identify** flashes the Active LED on the module associated with this window.

C View summary defect status, alarm indicators, and other module information. See “Expanded Logical View Indicators” on page 8.

D Start, stop, or pause test; view elapsed time.

E **Alarms and Errors**—View alarm indicators, error counts, error ratios, service disruption data, and performance statistics for the current test. , as described in “Alarms and Errors” on page 399.

F **Setup**—Set test type and duration, clock output trigger, and payload mapping; enable service disruption; and view status, as described in “Setup” on page 406.

G **Monitor**—Monitor trace messages and pointer events; select framing mode, channel, and data pattern, as described in “Monitor Settings” on page 410.

H **Overhead Data**—View STS transport and path overhead byte values for the selected SPE time slot, as described in “Overhead Data” on page 412.

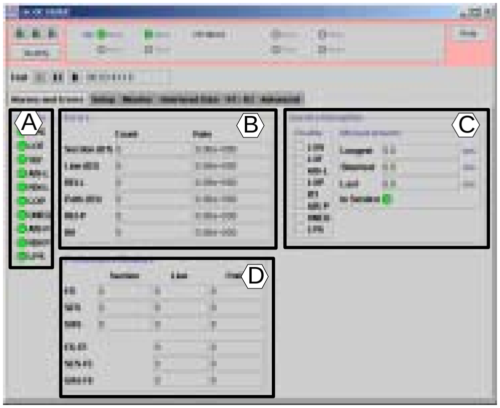
I **K1/K2**— Monitor K1 and K2 values and messages, as described in “K1/K2 Values” on page 415.

J **Advanced**— Set bit filtering and payload stuff columns for STS-1 mapping, as described in “Advanced Settings” on page 417.

Alarms and Errors

The **Alarms and Errors** tab displays alarm status indicators, error counts, and error ratios for the current test.

The following figure shows the main features of the OC-192 receiver **Alarms and Errors** tab.



A **Alarms**—View alarm status indicators for current test, as described in "Alarms" on page 399.

B **Errors**—View error counts and error ratios for current test, as described in "Errors" on page 402.

C **Service Disruption**—Enable one or more alarm types for service disruption monitoring and view service disruption in-service status and data for the current test. By default, only LPS alarms are enabled for service disruption monitoring. See "Service Disruption Monitoring" on page 403.

D **Performance Monitors**—

Alarms

The Alarm area displays status indicators for the current test.

Alarm indicator colors are defined in the following table.

Note If an alarm is greyed out in this view, it means that alarm does not apply to the current test configuration.

Green	Yellow	Red
No alarms are detected: signal is clear, or monitoring is not started.	Alarm history: an alarm was detected but is not active in the current test.	An alarm is active and currently detected on the monitored signal.

The following alarms can be monitored.

Alarm Indicator	Description
LOS	Loss of Signal An LOS alarm condition is declared either when a received signal with an all-zeroes pattern has insufficient data bit transitions or when the as received clock cannot be recovered from the received signal because the optical power is insufficient. LOS ends when a received signal has a minimum optical power and data bit transitions so that the as received clocked can be recovered, and two consecutive valid frame alignment patterns occur without LOS defects.
LOF	Loss of Frame LOF occurs when an Severely Errored Frame (SEF) condition occurs and does not clear for more than 3 milliseconds, as decribed in Bellcore GR-253-CORE, section 6.2.1.1.2. LOF ends 3 milliseconds after SEF ends.
SEF	Severely Errored Frame SEF occurs when 4-31 consecutive frames do not contain a valid frame word, as described in Bellcore GR-253-CORE, section 5.5. SEF ends when two successive error-free framing patterns are detected.

Alarm Indicator	Description
AIS-L	Line Alarm Indicator Signal AIS-L is a static, all ones data pattern in the line. It is detected in the K2 byte (bits 6,7,8) when all ones are present for 5 consecutive frames. AIS-L is cleared after five frames with a pattern other than all ones in K2.
RDI-L	Line Remote Defect Indication RDI-L is detected when K2 (bits 6,7,8) is 110 for 5 consecutive frames. RDI-L is cleared when K2 (bits 6,7,8) is not 110 for 5 consecutive frames.
LOP	Loss of Pointer LOP is declared when a detected pointer-offset value is out of range, is greater than 782, or has an invalid New Data Flag (NDF) value, the four most significant bits of pointer byte H1 do not conform to a majority rule for a normal or NDF.
UNEQ	Path Unequipped UNEQ is declared when all zeroes persist in the path. UNEQ is detected after 5 consecutive frames of all zeroes in the C2 byte of the path overhead. UNEQ-P is cleared when 5 consecutive frames containing valid data in the C2 byte are detected (that is, the C2 byte is not 0x00).

Alarm Indicator	Description
AIS-P	Path Alarm Indication Signal AIS-P is declared when an all ones data pattern persists in the path and its associated pointer (H1, H2) in the line. AIS-P is cleared when 3 consecutive frames with valid pointers are detected, and the pointer bytes are not all ones.
RDI-P	Remote defect indicator RDI-P is declared when bit 5 (this is fourth from LSB) of G1 is 1 for 10 consecutive frames. RDI-P is cleared when bit 5 of G1 is 0 for 10 consecutive frames.
LPS	Loss of Pattern Synchronization LPS is declared when the received bit error rate is too high (at least one in three consecutive 128-bit sequences), indicating that a selected pattern cannot be matched for the received payload. LPS terminates when no errors in three consecutive payload patterns are detected. The LPS alarm does not apply to Live payload data monitoring.

Alarm Indicator	Description
SCPI Examples:	

```
SENS(@3):ALAR:LOS?
SENS(@3):ALAR:LOF?
SENS(@3):ALAR:SEF?
SENS(@3):ALAR:LOP?
SENS(@3):ALAR:LPS?
SENS(@3):ALAR:AISL?
SENS(@3):ALAR:AISP?
SENS(@3):ALAR:UNEQ?
SENS(@3):ALAR:LRDI?
SENS(@3):ALAR:PRDI?
```

Errors

The Errors area displays error counts and ratios for the current test.

The error data is cumulative. To get data for intervals, see “Logging” on page 63. Once a test is restarted, the error history is cleared.

Error Type or Setting	Description
Section (B1)	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B1 section parity byte. Only in framed mode.
Line (B2)	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B2 line parity byte. Only in framed mode.
REI-L	The Line Remote Error Indicator (also known as Line FEBE) error is declared when the M1 byte has a non-zero value. A maximum of 255 errors are reported per frame.
Path (B3)	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B3 path parity byte. Only in framed mode.
REI-P	The Path Remote Error Indicator (also known as Path FEBE) error is declared when bits 1-4 of the G1 byte have a non-zero value. A maximum of eight errors are reported per frame.
Bit (Payload)	This error is declared when the payload pattern of the received signal does not match the pattern selected.
Count	Number of errors of the specified type detected in the current test.
Rate	Computed error ratio for the specified error type for the current test.

SCPI Examples:

```
SENS(@18):ERR:COUN:SECT?
SENS(@18):ERR:RAT:SECT?
SENS(@18):ERR:COUN:LINE?
SENS(@18):ERR:RAT:LINE?
SENS(@18):ERR:COUN:PATH?
SENS(@18):ERR:RAT:PATH?
SENS(@18):ERR:COUN:BIT?
SENS(@18):ERR:RAT:BIT?
```

Service Disruption Monitoring

The **Service Disruption** tab displays In-Service status and the time, in milliseconds of the longest, shortest, and most recent service disruptions detected during the current test. This tab also provides controls for selectively enabling alarms for service disruption monitoring.

- “Service Disruption Detection” on page 403
- “Service Disruption Limitations” on page 403
- “Controls, Measurements, and Indicators” on page 404

Service Disruption Detection

A service disruption condition is detected when one or more of the following alarms that are enabled for service disruption monitoring are detected in the monitored signal.

- LOS—Loss of Signal
- LOF—Loss of Frame
- AIS-L—Line Alarm Indicator Signal
- LOP—Path Loss of Pointer
- AIS-P—Path Alarm Indicator Signal
- UNEQ—Path Unequipped
- LPS—Loss of pattern synchronization.
- B3 (Path CV)—Path code violation

  A Path CV alarm condition is detected when there are 4 consecutive frames containing Path CV (B3) errors. The Path CV alarm condition is cleared when there are 4 consecutive frames without Path CV (B3) errors.

See “Alarms” on page 399 for a description of these alarms.

Service disruption alarm states are updated at each SONET frame, or once every 125 microseconds. The service disruption condition is cleared when none of the above conditions are present in the monitored signal.

Service Disruption Limitations

The following limitations apply to service disruption monitoring on the OC-192 Receiver:

- When multiple alarms are enabled, the last and longest service disruption measurements start with the first detected alarm and end with the last detected alarm. The start and end alarms may not be the same type.
- Service disruption tests must start with a clear signal with no alarms or errors.
  - Start a test.
  - Enable service disruption for the desired alarm(s).
  - Inject alarms.
- An LOP (Loss of Pointer) alarm may not cause a service disruption when only LPS (Loss of Pattern Sync) is enabled. LOP must be enabled to guarantee service disruption measurement for LOP-only alarms.

- The service disruption time limit is 16777215 frames or approximately 35 minutes. Longer disruptions produce false measurements.
- Event counter overflow can occur when multiple alarms are enabled for service disruption monitoring and a major alarm, such as LOF, is bouncing. Overflow is indicated when **Last** displays 9,999,999.000 ms. Limit the number of alarms that are enabled to reduce the chance of an overflow.

CONTROLS, MEASUREMENTS, AND INDICATORS

Service disruption alarm enable controls, measurements, and indicators are described in the following table.

Setting or Field	Description
Enable	When the Enable box for a type of alarm is checked, a service disruption event is triggered when that alarm is detected and service disruption measurement begins. This is how you specify which types of alarms are monitored for service disruption. To disable service disruption monitoring, uncheck the boxes for all alarm types. By default, only LPS alarms are enabled for service disruption monitoring.
Measurement	The following service disruption measurement statistics are displayed: • **Longest**—Time, in milliseconds, of the longest service disruption period for the current test. • **Shortest**—Time, in milliseconds, of the shortest disruption period for the current test. • **Last**—Time, in milliseconds, of the most recent service disruption that occurred during the current test.
In-Service Indicator	The In-Service indicator colors are interpreted as follows: • **Green**—No service disruptions have occurred since the last test restart. • **Red**—A service disruption condition is present in the current test. • **Yellow**—At least one service disruption was detected since the last test restart, but none is currently detected.

Setting or Field	Description

SCPI Examples:
To monitor service disruption data:
`SENS(@6):DISR:LONG ?`
`SENS(@6):DISR:SHOR ?`
`SENS(@6):DISR:LAST ?`
`SENS(@6):DISR:INS ?`
To subscribe to service disruption events:
`SUBS(@6)SENS:DISR:ALL 1`
To unsubscribe to service disruption events:
`SUBS(@6)SENS:DISR:ALL 0`
To disable service disruption monitoring:
`SENS(@6):DISR ENAB OFF`
To enable service disruption monitoring and specify which alarms trigger service disruption events, use the `SENS(@1:18):DISR:ENAB` command and specify a list of alarms to enable. Separate alarms in the list with semi-colons and do not include any spaces in the list. Valid values for the alarm parameter list are `LOF`, `AIS-L`, `LOP`, `AIS-P`, `UNEQ`, `LPS`, and `B3`.
`SENS(@6):DISR:ENAB AIS-P;AIS-L`	

Performance Monitors

The following table describes Section, Near-End Line, Far-End Line, Near-End Path, and Far-End Path layer performance statistics.

Statistic	Description
ES-S	**Errored Seconds - Section.** Number of seconds during which at least one B1 error was detected or an SEF or LOS defect was present.
ES - L	**Errored Seconds - Line, Near-end.** Number of seconds during which at least one B2 error was detected or an AIS-L was present.
ES-P	**Errored Seconds - Path, Near-end**. Number of seconds during which at least one B3 error was detected or an AIS-P, LOP, or UNEQ defect was present.
SES-S	**Severely Errored Seconds - Section.** Number of seconds during which at least *n* B1 errors were detected or an SEF or LOS defect was present. At 0C-48 rates, *n* is 2,392.
SES-L	**Severely Errored Seconds - Line, Near-end.** Number of seconds during which at least *n* B2 errors were detected or an AIS-L defect was present. At OC-48 rates, `n` is 2,459.
SES-P	**Severely Errored Seconds - Path, Near-end**. Number of seconds during which at least *n* B3 errors were detected or an AIS-P, LOP, or ENEQ defect was present.
UAS-S	**Unavailable Seconds - Section**. Number of seconds during which the Section was considered unavailable. A Section becomes unavailable at the onset of 10 consecutive seconds that qualify as an SES-S, and continues to be unavailable until the onset of 10 consecutive consecutive seconds that do not qualify as SES-S.

Statistic	Description
UAS-L	**Unavailable Seconds - Line, Near-end**. Number of seconds during which the Line was considered unavailable. A Line becomes unavailable at the onset of 10 consecutive seconds that qualify as an SES-L, and continues to be unavailable until the onset of 10 consecutive consecutive seconds that do not qualify as SES-L.
UAS-P	**Unavailable Seconds - Path, Near-end**. Number of seconds during which the Path was considered unavailable. A Path becomes unavailable at the onset of 10 consecutive seconds that qualify as SES-P and continues to be unavailable until the onset of 10 consecutive seconds that do not qualify as SES-P.
ES-LFE	**Errored Seconds - Line, Far-end**. Number of seconds during which at least one REI-L error was detected or an RDI-L was present.
ES-PFE	**Errored Seconds - Path, Far-end**. Number of seconds during which at least one REI-P error was detected or an RDI-P was present.
SES-LFE	**Severely Errored Seconds - Line, Far-end**. Number of seconds during which at least *n* REI-L errors were detected or an RDI-L defect was present. present.
SES-PFE	**Severely Errored Seconds - Path, Far-end**. Number of seconds during which at least <n> REI-P errors were detected or an RDI-P defect was present.

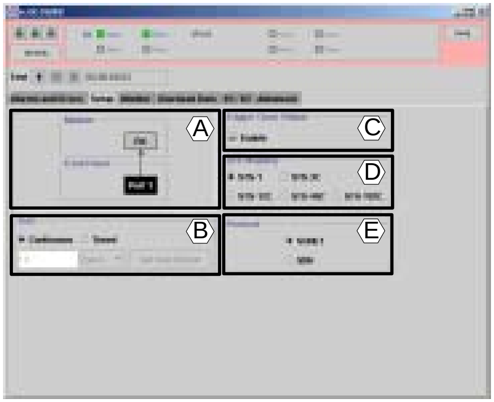
Statistic	Description
UAS-LFE	**Unavailable Seconds - Line, Far-end**. Number of seconds during which the Line was considered to be unavailable at the far end. A Line becomes unavailable at the far end at the onset of 10 consecutive seconds that qualify as SES-LFE, and continues to be unavailable until the onset of 10 consecutive seconds that do not qualify as SES-LFE.
UAS-PFE	**Unavailable Seconds - Path, Far-end**. Number of seconds during which the Path was considered to be unavailable at the far end. A Path becomes unavailable at the far end at the onset of 10 consecutive seconds that qualify as SES-PFE, and continues to be unavailable until the onset of 10 consecutive seconds that do not qualify as SES-PFE.

SCPI Examples:

```
SENS(@3):PMON:ESS ?
SENS(@3):PMON:ESLN ?
SENS(@3):PMON:USS ?
SENS(@3):PMON:ESPF ?
SENS(@3):PMON:ESPN ?
SENS(@3):PMON:USLF ?
SENS(@3):PMON:USPF ?
```

Setup

The following figure illustrates the main features of the **Setup** tab.



A View graphic display of signal source and backplane output settings. This configuration cannot be modified for the OC-192 Receiver.

B **Test**—Set the test type and duration, as described in “Test” on page 407.

C **Trigger Clock Output**—Enable or disable clock trigger output on the OC-192 front panel connector (CLK_OUT), as described in “Trigger Clock Output” on page 408.

D **SPE Mapping**—Set the expected STS size and mapping of the monitored SPE, as described in “SPE Mapping” on page 408.

E **Protocol**—Switch the module between SONET and SDH, as described in “Protocol” on page 409.

Test

The Test area defines the type and duration of the test that the receiver runs. To start and stop tests, use the controls in the module window or, to start tests for multiple modules, use the Test Controls window. See “Controlling Tests” on page 115.

Note Selecting a new test type automatically stops the current test.

Test Setting	Description
Continuous	Selects a continuous test that must be manually stopped and started.
Timed	Selects a timed test. When Timed is selected: **1** Specify a number and select a unit (seconds, minutes, hours, and days) for the test duration. **2** Click **Set** to apply the settings. **3** Use the controls at the top of the window to start the test.

SCPI Examples:

```
sens(@3):test:type cont
sens(@3):test:type tim
sens(@3):test:unit min
sens(@3):test:per 10
```

To control tests use the following commands:

```
sens(@3):test:mode star
sens(@3):test:mode stop
sens(@3):test:mode rest
sens(@3):test:mode pause
```

Related Topics:

“Logging” on page 63

“Controlling Tests” on page 115

Trigger Clock Output

The **Clock Trigger Output** enables a synchronized clock output on the TRIG_CLK SMA connector on the module's front panel.

This clock output is synchronized to the optical signal input. The clock trigger operates at the received clock frequency.

Output Setting	Description
Enable	When checked, the clock trigger is active, and a signal is transmitted out on the CLK_OUT port. When unchecked, the clock trigger is not active, and no signal is transmitted out on the CLK_OUT port.

SCPI Examples:

```
SENS(@7):TRIG:CLOC:ENAB ON
SENS(@7):TRIG:CLOC:ENAB OFF
```

SPE Mapping

The SPE Mapping option sets the expected STS size and mapping of the monitored SPE. This setting affects the number of channels available for monitoring in the Overhead and Monitor tabs.

SPE Mapping	Description
STS-1	Selects an STS-1 sized payload for the SPE. This is a 783-byte payload.
STS-3C	Selects an STS-3C sized payload for the SPE. This is a 2349-byte payload.
STS-12C	Selects an STS-12C sized payload for the SPE. This is a 9396-byte payload.
STS-192C	Selects an STS-48C sized payload for the SPE. This is a 37584-byte payload.
STS-192C	Selects an STS-192C sized payload for the SPE. This is a 150336-byte payload.

SCPI Examples:

```
SENS(@7):DATA:SIZE STS1
SENS(@7):DATA:SIZE STS3C
SENS(@7):DATA:SIZE STS12C
SENS(@7):DATA:SIZE STS48C
SENS(@7):DATA:SIZE STS192C
```

Related Topics:

"SPE" on page 410
"Path Overhead" on page 414

Protocol

The Protocol setting switches the module between SONET and SDH. When the switch is complete, EPXam displays the appropriate protocol configuration options and field labels for the module and updates all references to the module to use the correct protocol.

Note Switching between SONET and SDH protocol does *not* require a restart of the test system or EPXam.

Restrictions:

- Modules that are locked via the Group Manager cannot be switched by other users.
- Active test and logging sessions associated with a module at the time of a switch are cancelled.

  If tests or logging sessions are in progress on any of the modules being switched, a warning dialog is displayed. Click **Cancel** to abort the switch or **Continue** to complete the switch. If you choose **Continue**, running tests and logging sessions are cancelled. Otherwise, a dialog opens that displays the switching progress.

Setting	Description
SONET	Switches the module to SONET without restarting the test system or EPXam. This is the default setting in the factory configuration.
SDH	Switches the module to SDH without restarting the test system or EPXam.

SCPI Examples:

```
SENS(@7):DATA:BACK ENAB 1
SENS(@7):DATA:BACK ENAB 0
```

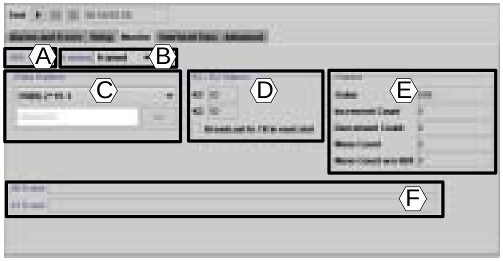
See “STM-64 Receiver Window” on page 537 for a description of this module’s SDH features and configuration.

See the following topics for more information about SONET/SDH switching:

- “Using the SONET/SDH Switcher” on page 121
- “SONET/SDH Switching and Custom Configuration Files” on page 123
- “Switching Modules Using SCPI” on page 123

Monitor Settings

The following figure illustrates the main areas on the **Monitor** tab.



A **SPE**—Select the channel (SPE time slot) to monitor, as described in “SPE” on page 410.

B **Framing**—Select framed or unframed mode, as described in “Framing” on page 411.

C **Data Pattern**—Select a payload data pattern or specify a custom payload data pattern to monitor in the received payload, as described in “Data Pattern” on page 411.

D **Pointer**—Monitor the STS pointer value and pointer event counts, as described in “Pointer” on page 412.

E **Trace**—Monitor J0 section and J1 path trace messages in the received signal, as described in “J0 and J1 Trace Messages” on page 412.

SPE

The Channel setting determines which synchronous payload envelope (SPE) time slot is monitored. The number of channels available depends on the currently selected SPE mapping.

Setting	Description
SPE	Selects the SPE time slot (channel) to monitor in the received payload. The number of channels depends on the setting for the SPE mapping (SPE size). • If the SPE mapping is STS-1c, select 1 of 192 channels. • If the SPE mapping is STS-3c, select 1 of 64 channels. • If the SPE mapping is STS12c, select 1 of 16 channels. • If the SPE size is STS-48c, select 1 of 4 channels. • If the SPE size is STS-192c, only 1 channel can be selected.

SCPI Example:

```
SENS(@6):DATA:SPE 4
```

Related Topics:

“SPE Mapping” on page 408

Framing

The Framing area selects whether the monitored signal is framed or unframed.

Setting	Description
Framed	Sets the monitored signal to framed mode with transport overhead per GR-253-CORE and GR-1377-CORE.
Unframed	Sets the monitored signal to unframed mode with no transport overhead. The following features are not available in unframed mode: • Selectable SPE mappings • Channel select • Only LOS and LPS alarm monitoring • Pointer monitoring • Overhead monitoring • Only Bit error monitoring

SCPI Examples:

```
SENS(@6):DATA:MODE FRAM
SENS(@6):DATA:MODE UNFR
```

Data Pattern

The Payload Pattern selects the type of pattern to monitor in the generated payload.

Settings	Description
PRBS 2^7-1 **PRBS 2^15-1** **PRBS 2^20-1** **PRBS 2^23-1** **PRBS 2^31-1**	Pseudo random bit patterns. The default setting is PRBS 2^15-1. PRBS 2^7-1 is only available in unframed mode.
Inv. PRBS 2^7-1 **Inv. PRBS 2^15-1** **Inv. PRBS 2^20-1** **Inv. PRBS 2^23-1** **Inv. PRBS 2^31-1**	Inverted pseudo random bit patterns. The default setting is PRBS 2^15-1. Inv. PRBS 2^7-1 is only available in unframed mode.
Live	Monitor live payload data pattern. Only in framed mode.
User	Defines an 8-bit or 16-bit binary user-defined payload pattern. Only in framed mode.
Set	If a custom user-defined payload pattern is defined, click **Set** to apply the changed user payload pattern.

SCPI Examples:

```
SENS(@6):PAYL:MON:PATT:TYPE PR215
SENS(@6):PAYL:MON:PATT:TYPE PR223
```

To generate a custom payload pattern using SCPI, set the pattern type to USER and define the bit pattern.

```
SENS(@3):PAYL:MON:PATT:TYPE  USER
SENS(@3):PAYL:MON:PATT:USER  0b00110011
```

Pointer

The **Pointer** area displays synchronous payload envelope (SPE) pointer values and event counts.

SPE pointer event counters are reset at the start of each test period.

Pointer Field	Description
Value	Displays the current value in hexadecimal of the synchronous payload envelope (SPE) pointer. This value is what the hardware pointer processor interprets as the current pointer.
Increment Count	Number of SPE pointer increment events since the last restart.
Decrement Count	Number of SPE pointer decrement events since the last restart.
Move Count	Number of times the pointer moved to a new pointer value using the New Data Flag (bits 1 to 4 of the H1 pointer byte).
Move w/o NDF Count	Number of times the pointer moved to a new pointer value without the New Data Flag (missing NDF).
SCPI Examples: SENS(@6):POIN:VAL ? SENS(@6):POIN:COUN:INCR? SENS(@6):POIN:COUN:DECR? SENS(@6):POIN:COUN:NDF? SENS(@6):POIN:COUN:MNDF?	

J0 and J1 Trace Messages

The J0 Trace and J1 Trace fields display the current valuse of the J0 section and J1 path trace messages from the monitored signal.

To monitor the J0 trace message using SCPI, use a the following command:

```
SENS(@3):DATA:SECT:TRAC ?
```

To monitor the J1 trace message using SCPI, use a the following command:

```
SENS(@3):DATA:PATH:TRAC ?
```

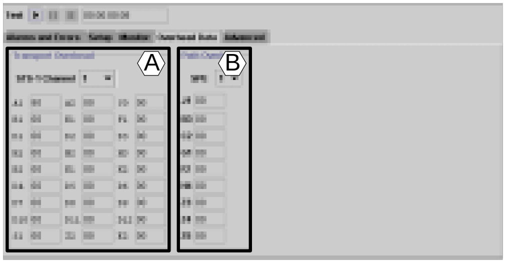
Overhead Data

The OC-192 **Overhead Data** tab displays the current values of the STS section, line, and path overhead bytes for the selected STS channel.

Overhead bytes are labeled according to GR-253 standards. In some cases, an overhead byte is only defined in the first STS-1 of an STS-*n*; in other cases, bytes in the same position in different STS channels have different labels. For example, the J0 byte is defined in the first STS-1 of an STS-n, but the same byte position is labeled Z0 in the remaining STS channels.

Note Dashes (--) are displayed for bytes that are undefined by GRE-253.

The following figure shows the layout of the OC-192 **Overhead Data** tab.



A **Transport Overhead**—View transport overhead (section and line) byte values for the selected STS channel, as described in "TransPort Overhead" on page 413.

B **Path Overhead**—View path overhead byte values for the selected SPE, as described in "TransPort Overhead" on page 413

TransPort Overhead

The following table describes the STS transport overhead fields and values.

Transport Overhead	Description
STS Channel	Select 1 of 192 STS channels for which you want to view transport overhead bytes.
A1, A2	Section overhead framing bytes.
J0 (C1)	Formerly C1 (STS-1 ID), now redefined as the J0 section trace byte.
E1	Orderwire section byte located in first STS-1 of an STS-N.
F1	Section user channel byte located in first STS-1 of an STS-N.
D1, D2, D3	Section data communication channel bytes located in first STS-1 of an STS-N.
K1, K2	APS (automatic protection switching) channel bytes.
H1, H2	SPE payload pointer bytes.
H3	SPE pointer action byte.
D4 through D12	Line data communications channel bytes.
S1	Synchronization status byte.
M1	Line Remote Error Indicator (Line REI) byte in STS channel 7, (the 3rd byte in order of appearance).
E2	Express orderwire byte.
Z0, Z1, Z2	Allocated for future growth.

Transport Overhead	Description

SCPI Examples:
Use the following command to query the values for bytes A1;A2;J0;B1;E1;F1;D1;D2;D3.
`SENS(@6):DATA:SECT:OVER:BYT?`
Use the following command to set the values for bytes H1;H2;H3;B2;K1;K2;D4;D5;D6;D7;D8;D9;D10;D11;D12;S1;M1;E2.
`SENS(@6):DATA:LINE:OVER:BYT?`
For detailed information, see“Overhead Queries” on page 606.	

Path Overhead

The following table describes path overhead bytes.

Path Overhead	Description
SPE	Select the number of the concatenated channel in the monitored payload for which you want to view path overhead bytes. The number of channels depends on the setting for the SPE mapping (SPE size). • If the SPE mapping is STS-1c, select 1 of 192 channels. • If the SPE mapping is STS-3c, select 1 of 64 channels. • If the SPE mapping is STS12c, select 1 of 16 channels. • If the SPE size is STS-48c, select 1 of 4 channels. • If the SPE size is STS-192c, only 1 channel can be selected.
J1	STS path trace byte.
C2	STS path signal label indicating the construction of the SPE (ATM,
G1	Path terminating status byte.
F2	Path user channel byte.
H4	Indicator allocated for use as a mapping-specific indicator byte.

Path Overhead	Description
Z3, Z4	Allocated for future growth.
Z5	Tandem connection byte.

SCPI Examples:

Use the following command to set the values for bytes J1;B3;C2;G1;F2;H4;Z3;Z4;Z5.

```
SENS(@6):DATA:PATH:OVER:BYT?
```

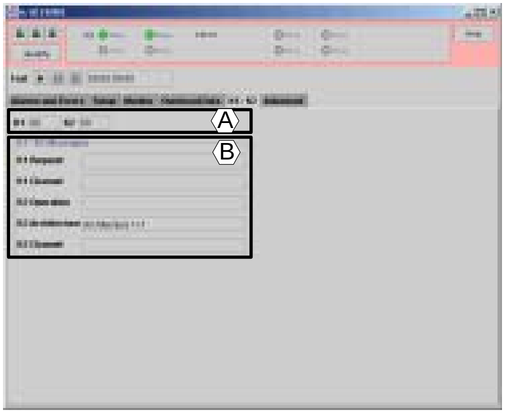
For detailed information, see “Overhead Queries” on page 606.

Related Topics:

“SPE Mapping” on page 408

K1/K2 Settings

The following figure shows the main features of the **K1/K2** tab.



A **K1/K2 Values**—Hexadecimal values of the automated protection switching (APS) channel K1 and K2 bytes, as described in “K1/K2 Values” on page 415.

B **K1/K2 Messages**—Displays automated protection switching (APS) channel messages decoded from the K1/K2 bytes, as described in “K1/K2 Messages” on page 416.

K1/K2 Values

The **K1/K2 Values** field displays the hexadecimal values of the automated protection switching (APS) channel K1 and K2 bytes for the monitored signal.

Field/ Setting	Description
K1	Bits 1 through 4 control the request message, and bits 5 through 8 control the channel message code.
K2	Bits 1 through 4 of the K2 byte control the channel number, bit 5 controls the architecture, and bits 6 thorough 8 indicate the mode of operation.

SCPI Examples:

```
SENS(@18):TRAN:APS:K1K2?
```

K1/K2 Messages

This field displays automated protection switching (APS) channel messages decoded from the K1/K2 bytes.

K1/K2 Messages	Description
K1 Request	Bits 1 through 4 of K1 can contain the following request messages. **Lockout of Protection**. Bits 1 through 4 have a value of 1111. **Forced Switch**. Bits 1 through 4 contain 1110. **SF - High Priority**. Bits 1 through 4 Have a value of 1101. **SF - Low Priority**. Bits 1 through 4 have a value of 1100. **SD - High Priority**. Bits 1 through 4 have a value of 1011. **SD - Low Priority**. Bits 1 through 4 have a value of 1010. **Manual Switch**. Bits 1 through 4 have a value of 1000. **Wait-to-Restore**. Bits 1 through 4 have a value of 0110. **Exercise**. Bits 1 through 4 have a value of 0100. **Revert Request**. Bits 1 through 4 have a value of 0100. **Do Not Revert**. Bits 1 through 4 have a value of 0001. **No Request**. Bits 1 through 4 have a value of 0000. This is the default in the factory configuration.

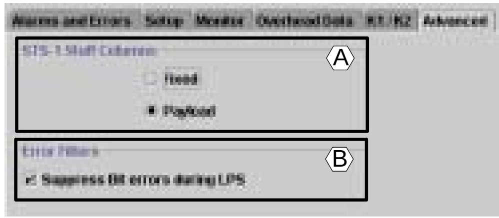
K1/K2 Messages	Description
K1 Channel	Channel selection for the requesting message (bits 5 through 8 of K1 carry the channel message code): **0**. Null channel. **1** to **14**. Channel 1 through 14. **15**. Extra traffic channel.
K2 Operation	Operational mode of the APS. Bits 6 through 8 of the K2 byte carry this information. **Unidirectional**. Bits 6 to 8 have a value of 100. **Bidirectional**. Bits 6 to 8 have a value of 101.
K2 Architecture	Architecture mode for the APS. Bit 5 of K2 carries this information. **Architecture 1+1**. Bit 5 is 0. **Architecture 1:n**. Bit 5 is 1.
K2 Channel	Channel selection for the requesting message (bits 1 through 4 of K2 carry the channel message code): **0**. Null channel. **1** to **14**. Channel 1 to 14. **15**. Extra traffic channel.

SCPI Examples:

```
SENS(@8):APS:ENAB 1
SENS(@8):APS:K1D:REQ?
SENS(@8):APS:K1D:CHAN?
SENS(@8):APS:K2D:OPER?
SENS(@8):APS:K2D:ARCH?
SENS(@8):APS:K2D:CHAN?
```

Advanced Settings

The following figure illustrates the settings that are configured on the OC-192 receiver **Advanced** tab.



A **STS-1 Stuff Columns**—When the SPE mapping is set to STS-1, select whether the SPE stuff columns are expected to contain a fixed pattern (all zeroes) or a PRBS payload data pattern. See "STS-1 Stuff Columns" on page 418.

B **Error Filters**—Option for suppressing bit errors when LPS alarm is detected, as described in "Bit Error Suppression" on page 418.

STS-1 Stuff Columns

The **STS-1 Stuff Columns** setting specifies whether the SPE stuff columns are expected to contain a fixed pattern or a PRBS payload data pattern (Payload) for payload pattern matching.

Note This setting is only available if the SPE mapping is set to STS-1 for the OC-192 receiver.

The SPE stuff columns are columns 30 and 59 of the SPE envelope as specified in GR-253-CORE. The default setting is Payload (PRBS pattern).

Setting	Description
Fixed	When Fixed is selected, the bytes in the stuff columns are expected to contain a fixed pattern and are not considered to be part of the payload. The stuff columns are ignored for payload pattern matching.
Payload	When Payload is selected, the bytes in the stuff columns are considered to be part of the payload, and PRBS pattern data is expected in all 87 columns for payload pattern matching. This is the default in the factory configuration.

SCPI Examples:

```
SENS(@7):PAYL:STUF  PAYL
SENS(@7):PAYL:STUF  FIX
SENS(@7):PAYL:STUF  ?
```

Bit Error Suppression

Because Bit error counts can be high while an LPS alarm occurs, you can suppress, or filter, the bit error count.

Filter Setting	Description
Suppress Bit Errors	When checked, BIT errors are not counted when an LPS alarm is active. When unchecked, BIT errors are counted when an LPS alarm is active

SCPI Examples:

```
SENS(@18):ALAR:IGN LPS OFF
SENS(@18):ALAR:IGN LPS ON
```

30

OC-192 TRANSMITTER WINDOW

The topics in this section explain how to configure setup options, alarm and error insertion, payload generation, and overhead data values for the OC-192 transmitter.

Instructions are provided for using EPXam to configure the module, along with SCPI equivalents.

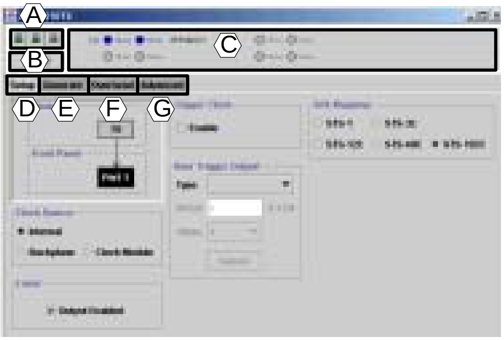
Tip OC-192 Transmitters can be switched between SONET and SDH functionality. See “Protocol” on page 422 and “Using the SONET/SDH Switcher” on page 121.

See “STM-64 Transmitter Window” on page 559 for a description of this module’s features and user interface in SDH mode.

- For more information about EPXam, see “Using EPXam” on page 3.
- For information about changing and installing OC-192 modules, see “Changing Modules” on page 126.

Main View

The following figure illustrates the main features of the OC-192 Transmitter window. The features are described in the following sections.



A Save and restore module configurations or restore factory default settings, as described in "Saving and Restoring Test Configurations" on page 107.

B **Identify**—When pressed, **Identify** flashes the Active LED on the module associated with this window.

C Error and alarm status indicators, as described in "Alarms" on page 427. This includes the currently selected signal rate and channel. For more detail about the summary view, see "Expanded Module Status Summary" on page 6 and "Expanded Logical View Indicators" on page 8.

D **Setup**—Configure transmitter clock source, enable triggers, enable laser output, and define the SPE mapping, as described in "Setup" on page 421.

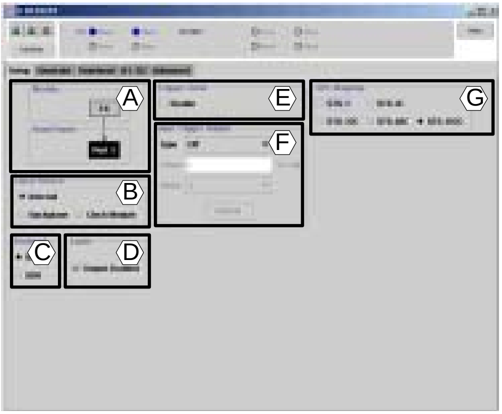
E **Generate**—Configure alarm and error insertion, trace messages, pointer values, K1/K2 bytes, data pattern, channel selection, and framing, as described in "Generate Settings" on page 425.

F **Overhead Data**—Modify bytes for path and transport overhead for selected STS channels, as described in "Overhead Data" on page 433.

G **Advanced**— Set payload stuff columns for STS-1 mapping, as described in "STS-1 Stuff Columns" on page 439.

Setup

The following figure illustrates the main features of the OC-192 TX **Setup** tab. These features are explained in more detail in the following sections.



A View graphic display of signal source and backplane output settings. This configuration cannot be modified for the OC-192 Transmitter.

B **Clock Source**—Select the source for the timing reference that is used to generate the SONET payload, as described in “Clock Source” on page 421.

C **Protocol**—Switch between SONET and SDH protocol, as described in “Protocol” on page 422.

D **Laser**—Enable or disable the laser output to the port on the transmitter’s front panel, as described in “Laser Output Enabled” on page 423.

E **Trigger Clock**—Enable or disable a clock trigger output to the connector on the transmitter’s front panel, as described in “Clock Trigger Output” on page 423.

F **User Trigger Output**—Enable or disable a user trigger output to the connector on the transmitter’s front panel and configure the delay and duration of the trigger, as described in “User Trigger Output” on page 423.

G **SPE Mapping**—Configure the synchronous payload envelope mapping for the transmitted signal, as described in “SPE Mapping” on page 425.

Clock Source

The **Clock Source** setting selects the timing reference that is used to generate the SONET payload.

Clock Source Setting	Description
Internal	Selects the on-board oscillator for the timing reference..
Backplane	Selects the backplane signal for the timing reference. This clock is the clock provided by the adjacent receiver to the left in the chassis. The clock frequency must be 622.08 MHz.

Clock Source Setting	Description
Clock Module	Selects the timing reference from the EPX Test System's clock module. Verify that the EPX clock module is correctly providing a SONET/SDH timing reference for the slot in which the OC-192 Transmitter is installed.

SCPI Examples:

```
SOUR(@7):CLOC INT
SOUR(@7):CLOC CLKB
SOUR(@7):CLOC BACK
```

Related Topics

"Configuring the EPX100 Clock Module" on page 25

Protocol

The Protocol setting switches the module between SONET and SDH. When the switch is complete, EPXam displays the appropriate protocol configuration options and field labels for the module and updates all references to the module to use the correct protocol.

Note Switching between SONET and SDH protocol does *not* require a restart of the test system or EPXam.

Restrictions:

- Modules that are locked via the Group Manager cannot be switched by other users.
- Active test and logging sessions associated with a module at the time of a switch are cancelled.

  If tests or logging sessions are in progress on any of the modules being switched, a warning dialog is displayed. Click **Cancel** to abort the switch or **Continue** to complete the switch. If you choose **Continue**, running tests and logging sessions are cancelled. Otherwise, a dialog opens that displays the switching progress.

Setting	Description
SONET	Switches the module to SONET without restarting the test system or EPXam. This is the default setting in the factory configuration.
SDH	Switches the module to SDH without restarting the test system or EPXam.

SCPI Examples:

```
SYST:BOAR(@7):PROT:TYPE SON
SYST:BOAR(@7):PROT:TYPE SDH
SYST:BOAR(@7):PROT:STAT?
```

See "STM-64 Transmitter Window" on page 559 for a description of this module's SDH features and configuration.

See the following topics for more information about SONET/SDH switching:

- “Using the SONET/SDH Switcher” on page 121
- “SONET/SDH Switching and Custom Configuration Files” on page 123
- “Switching Modules Using SCPI” on page 123

Laser Output Enabled

The **Output Enabled** selection controls whether or not an optical signal is sent to the output connector on the transmitter’s front panel. By default, the signal output is disabled.

When checked, an optical signal is sent to the output connector. When unchecked, no signal is sent.

SCPI Examples:

```
SOUR(@7):SIGN:ENAB ON
SOUR(@7):SIGN:ENAB OFF
```

Clock Trigger Output

The **Clock Trigger Output** enables a synchronized clock output on the TRIG_CLK SMA connector on the module's front panel. This clock output is synchronized to the optical signal output. The clock trigger operates at the frequency of the selected clock source. See “Clock Source” on page 421 for setting the clock source.

Clock Trigger Setting	Description
Enable	When checked, a trigger clock output is sent to the front panel connector. When unchecked, no trigger clock output is sent.
SCPI Examples: SOUR(@7):TRIG:CLOC:ENAB ON SOUR(@7):TRIG:CLOC:ENAB OFF	

User Trigger Output

The **User Trigger Output** enables a trigger pulse output on the USER_TRIG SMA connector on the Transmitter 's front panel.

User Trigger Setting	Description
Type	Describes when the trigger pulse occurs. The following settings are available. **Off**—This setting disables sending any pulse to the USER_TRIG connector. **8KHz Frame Pulse**—Available in framed mode only, this setting enables pattern (or user) triggering that is synchronized to the SONET frame. **Start of PRBS**—This setting enables pattern (or user) triggering that is synchronized to the currently selected PRBS pattern for the payload. This setting is only available when the signal is unframed and when the payload pattern is either 2^7-1 or inverted 2^7-1 PRBS. **Event**—Available in framed mode only, this setting enables event triggering that is synchronized to events as defined in Telcordia GR-253-CORE, section 5.3.3. Inject one of the following defects: • LOS alarm • LOF alarm • AIS-L alarm • Line (B2) BER—Any rate triggers the event. The rate does not have to exceed 10-3.
Offset x 1 Bit	Defines the delay of the trigger pulse in increments of a single bit. This setting is available only when **Type** is set to **Start of PRBS**. This setting is not changed until **Submit** is clicked. This setting uses the `SOUR(@`*slot*`):TRIG:PATT:FINE` command.
Width	Defines the duration of the trigger pulse in clock pulse units. The available values are 0-127. This setting is available only when **Type** is set to **Start of PRBS**. This setting is not changed until **Submit** is clicked. This setting uses the `SOUR(@`*slot*`):TRIG:PATT:LENG` command.
Submit	Sets the Offset and Width parameters to the user-defined values. If **Submit** is not clicked, no changes are applied.

SCPI Examples:

```
SOUR(@7):TRIG:TYPE FRAM
SOUR(@7):TRIG:TYPE EVENT
SOUR(@7):TRIG:TYPE OFF
SOUR(@7):TRIG:PATT:FINE 1
SOUR(@7):TRIG:PATT:LENG 8
```

Related Topics

"Framing" on page 430

"SPE" on page 426

"Data Pattern" on page 432

SPE Mapping

The **SPE Mapping** option sets the size of the SPE (Synchronous Payload Envelope) that is mapped into the generated payload.

This setting affects options for the STS and SPE selections in the **Generate** and **Overhead** tabs. Changing the SPE Mapping also returns the SPE selection to the default of Broadcast.

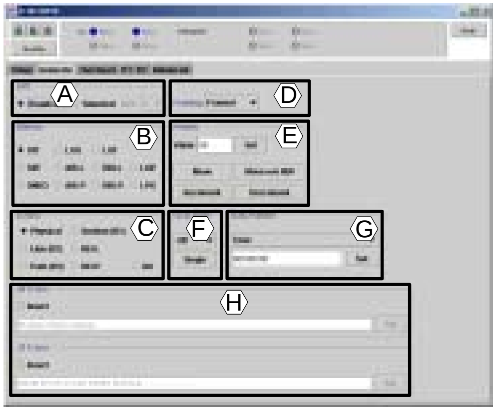
SPE Mapping	Description
STS-1	Selects an STS-1 sized payload for the SPE. This is a 783-byte payload.
STS-3C	Selects an STS-3C sized payload for the SPE. This is a 2349-byte payload.
STS-12C	Selects an STS-12C sized payload for the SPE. This is a 9396-byte payload.
STS-48C	Selects an STS-48c sized payload for the SPE. This is a 37584-byte payload.
STS-192C	Selects an STS-192c sized payload for the SPE. This is a 150336-byte payload.

SCPI Examples:

```
SOUR(@7):DATA:SIZE STS1
SOUR(@7):DATA:SIZE STS3C
SOUR(@7):DATA:SIZE STS12C
SOUR(@7):DATA:SIZE STS48C
SOUR(@7):DATA:SIZE STS192C
```

Generate Settings

The following figure illustrates the settings that are configured on the OC-192 Transmitter **Generate** tab.



A **SPE**—Select a specific channel (SPE time slot) into which to transmit the generated signal or broadcast the payload to all time slots, as described in “SPE” on page 426.

B **Alarms**—Select the type of alarm to insert, as described in “Alarms” on page 427.

C **Errors**—Select the type of error to insert, as described in “Error” on page 429.

D **Framing**—Select to use a framed or unframed signal, as described in “SPE” on page 426.

E **Pointer**—Set SPE pointer byte values or perform pointer actions, as described in “Pointer” on page 431.

F **Error Rate**—Set the error insertion rate, as described in “Error Rate” on page 430.

G **Data Pattern**—Select the payload data pattern to insert into the transmitted signal, as described in “Data Pattern” on page 432.

H **J0 and J1 Trace**—Define and insert a J0 section trace message, as described in “J0 Trace Message” on page 432 and “J1 Trace Message” on page 433.

SPE

The SPE setting specifies whether the SPE (synchronous payload envelope) is mapped to a single channel (time slot) or broadcast to all channels.

The number of available channels depends on the SPE mapping that is selected on the **Setup** tab. The SPE setting is reset to broadcast when the SPE Mapping is changed.

Settings	Description
Broadcast	Maps the generated payload to all time slots. When **Broadcast** is selected, channel selection is unavailable. This is the default in the factory configuration.
Selected	Maps the generated payload to the time slot specified by the **SPE** setting.

Settings	Description
SPE	Selects a channel to insert the generated payload. This option is not available in broadcast mode. This field is linked to the SPE field in the **Overhead** tab. The range of channels available depends on the settings specified for the SPE mapping: • If the SPE mapping is STS-1c, select 1 of 192 channels. • If the SPE mapping is STS-3c, select 1 of 64 channels. • If the SPE mapping is STS12c, select 1 of 16 channels. • If the SPE size is STS-48c, select 1 of 4 channels. • If the SPE size is STS-192c, only 1 channel can be selected.

SCPI Examples:
`SOUR(@6):DATA:MODE  BRO`
`SOUR(@6):DATA:MODE  SEL`
`SOUR(@6):DATA:SPE   1`
Related Topics:
"SPE Mapping" on page 425
"Path Overhead" on page 435	

Alarms

The **Alarms** setting determines the type of alarm that is inserted into the transmit stream. Only LOS and LPS alarms are availabe in Unframed mode.

Alarm setting	Description
Off	Disables alarm insertion.
LOS	Loss of signal alarm LOS is generated by disabling the signal output.
LOF	Loss of Frame LOF is generated by inverting the framing bytes (A1, A2) in the SONET overhead for at least 3 microseconds. LOF is only available in Framed mode.
SEF	Severely Errored Frame SEF is generated by inverting the framing bytes (A1, A2) in the SONET overhead for at least four consecutive frames and then reverting to the correct values to avoid causing LOF. SEF is only available in Framed mode.
AIS-L	Line Alarm Indication Signal AIS-L is generated by forcing the entire line to all ones. When AIS-L alarm insertion is turned off, the normal line data is restored. AIS-L is only available in Framed mode.

Alarm setting	Description
RDI-L	Line Remote Defect Indicator RDI-L is generated by setting the K2 byte to 6 (0b110). When RDI-L insertion is turned off, the K2 byte is restored. RDI-L is only available in Framed mode.
LOP	Loss of Pointer LOP is generated by transmitting an out-of-range pointer value equal to or greater than 783. LOP is only available in Framed mode.
AIS-P	Path Alarm Indication Signal AIS-P (Path Alarm Indicator Signal) is generated by setting the pointer bytes and all path data to all ones. When AIS-P insertion is turned off, the pointer bytes and path data are restored. AIS-P is only available in Framed mode.
RDI-P	Path Remote Defect Indicator RDI-P is generated by setting bit 5 of the G1 byte in the path overhead. When RDI-P insertion is turned off, bit 5 of the G1 byte is cleared. RDI-P is only available in Framed mode.
UNEQ-P	Path unequipped UNEQ-P (Path Unequipped) is generated by forcing the path data to all zeroes. When UNEQ-P insertion is turned off, the path data is restored. UNEQ-P is only available in Framed mode.

Alarm setting	Description
LPS	Loss of Pattern Synchronization LPS is generated by setting the payload pattern in the generated payload to a value other than what is specified in the Payload Data Pattern setting.

SCPI Examples:

```
SOUR(@3):ALAR  OFF
SOUR(@3):ALAR  SEF
SOUR(@3):ALAR  LOF
SOUR(@3):ALAR  LOS
SOUR(@3):ALAR  LRDI
```

Error

The **Error** setting controls the type of error which is inserted into the transmit stream. Whenever the Error setting is modified, the Error Rate setting is always reset to Off.

Only Bit errors are availabe in Unframed mode.

Error Type	Description
Physical	Inserts physical layer (or random) errors into the stream. One bit is inverted, and no bit is inverted twice before all bits in the frame have been inverted.
Section (B1)	Inserts section (B1 BIP-8) errors into the stream by inverting one B1 parity bit.
Line (B2)	Inserts line (B2 BIP-8) errors into the stream by inverting one B2 parity bit.
Path (B3)	Inserts path (B3 BIP 8) errors into the stream by inverting one B3 parity bit.
Bit	Inserts errors into the bits of the payload so that the transmitted payload does not match the expected pattern.
REI-L	Line Remote Error Indicator Inserts error counts in the M1 byte.
REI-P	Path Remote Error Indicator Inserts error counts in the G1 byte.s

Error Type	Description
SCPI Examples:	

```
SOUR(@3):ERR:TYPE  SECT
SOUR(@3):ERR:TYPE  LINE
SOUR(@3):ERR:TYPE  PATH
SOUR(@3):ERR:TYPE  PHYS
SOUR(@3):ERR:TYPE  LREI
SOUR(@3):ERR:TYPE  BIT
```

Error Rate

The **Error Rate** setting enables and disables error insertion and controls the rate at which errors are inserted into the transmitted signal.

The Error Rate setting is always reset to OFF whenever the Error Type is changed.

Error Rate Setting	Description
Off	Sets the error rate to 0, disabling error insertion.
ALL	Inserts errors into all bits in the B2 byte.
IE-3 through IE-14	Sets the error ratio to 1.0 x 10^-3, 1.0 x 10^-4, and so on. Some rates are not supported for all types of errors. For all payload mappings, the maxmum ratio for REI-L errors is 1.0 x 10^5. For B1 errors, the maxmum ratio is 1.0 x 10^6. For STS-192c, the maxmum ratio for REI-P errors is 1.0 x 10^6. For STS-48c, the maxmum ratio for REI-P errors is 1.0 x 10^5. For STS-12c, the maxmum ratio for REI-P errors is 1.0 x 10^4. For STS-3c, the maxmum ratio for REI-P errors is 1.0 x 10^4. For STS-1, the maxmum ratio for REI-P errors is 1.0 x 10^3.
Single	Error Rate must be set to Off to enable single error insertion. When this option is available, click **Single** to insert a single error into the transmit stream.

SCPI Examples:

```
SOUR(@3):ERR:RAT  OFF
SOUR(@3):ERR:RAT  RIE-4
SOUR(@3):ERR:RAT  SING
```

Related Topics:

“SPE Mapping” on page 425

Framing

The **Framing Mode** setting specifies the frame format for the generated OC-192 signal.

Some types of alarm and error insertion are turned off whenever the Framing Mode setting is changed. For details, see “Alarms” on page 427 and “Error” on page 429.

Setting	Description
Framed	Generates a framed OC-192 signal with transport overhead per GR-253-CORE and GR-1377-CORE.

Setting	Description
Unframed	Generates an unframed OC-192 signal with no transport overhead. Only the following features are available in unframed mode: • LOS and LPS alarm insertion • Bit error insertion • Data pattern selection
SCPI Examples:	
	SOUR(@3):DATA:MODE FRAM SOUR(@3):DATA:MODE UNFR

Pointer

Use the **Pointer** settings to move or set the value of the SPE payload pointer.

Pointer Settings	Description
Value	Manually sets the SPE pointer. Enter an integer value from 0 to 782. The value is a hexadecimal number.
Set	You must click **Set** to apply the change to the SPE pointer value entered in the **Value** field.
Move	Moves pointer with the New Data Flag (bits 1 to 4 of the H1 overhead byte). This changes the pointer value, and the NDF flag in the H1 overhead byte is updated appropriately. The moves alternate between increment and decrement.

Pointer Settings	Description
Move w/o NDF	Moves pointer without the New Data Flag. This causes a large change in the pointer value without the appropriate NDF indication in the H1 overhead byte. The moves alternate between increment and decrement.
Increment Decrement	Increments or decrements the SPE pointer value by 1.
SCPI Examples:	
	SOUR(@6):POIN:VAL 260 SOUR(@6):POIN:ACT INCR SOUR(@6):POIN:ACT DECR SOUR(@6):POIN:ACT NDF SOUR(@6):POIN:ACT MNDF

Data Pattern

The **Data Pattern** setting selects the type of pattern to place into the generated payload. The fixed stuffed columns contain all zeroes.

Settings	Description
PRBS 2^7-1 **PRBS 2^15-1** **PRBS 2^20-1** **PRBS 2^23-1** **PRBS 2^31-1**	Selects a pseudo random bit pattern. PRBS 2^7-1 is only available in unframed mode.
Inv. PRBS 2^7-1 **Inv. PRBS 2^15-1** **Inv. PRBS 2^20-1** **Inv. PRBS 2^23-1** **Inv. PRBS 2^31-1**	Selects an inverted pseudo-random bit pattern. PRBS 2^7-1 is only available in unframed mode.
User	Defines an 8-bit or 16-bit binary user-defined pattern.
Set	If a custom user-defined payload pattern is defined, click **Set** to apply the changed user payload pattern.

SCPI Examples:
`SOUR(@6)PAYL:GEN:PATT:TYPE PR215`
`SOUR(@6)PAYL:GEN:PATT:TYPE PR220`
To generate a custom payload pattern, set the pattern type to USER and define the bit pattern.
`SOUR(@3):PAYL:GEN:PATT:TYPE  USER`
`SOUR(@3):PAYL:GEN:PATT:USER  0b00110011`	

J0 Trace Message

Create and insert a user-defined section J0 trace message.

1 Click **Insert**.

2 Enter the trace message.

Note Messages can be no longer than 62 characters.

3 Click **Set** to apply the changes.

If you do not click **Set**, the modified message is not inserted.

To enable J0 trace and insert a trace message using SCPI, use a pair of commands similar to the following:

```
SOUR(@6):DATA:SECT:TREN ON
SOUR(@6):DATA:SECT:TRAC “oc192TX in slot
6”
```

Note When using SCPI, you must enclose the message in quotation marks. Otherwise, only the characters before the first space are used as the trace message.

J1 Trace Message

Create and insert a user-defined path J1 trace message.

Define a trace message up to 62 bytes long.

Note Two bytes of the available 64 bytes are used for carriage return and line feed.

1 Click **Insert**.

2 Enter the trace message.

Note Messages can be no longer than 62 characters.

3 Click **Set** to apply the changes.

If you do not click **Set**, the modified message is not inserted.

To enable J1 trace and insert a trace message using SCPI, use a pair of commands similar to the following:

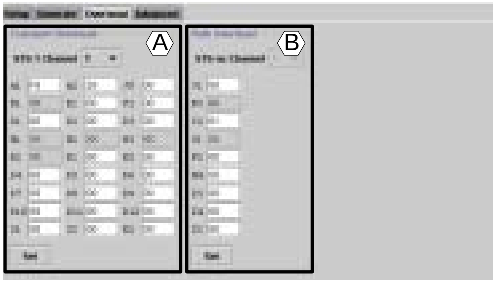
```
SOUR(@6):DATA:PATH:TREN ON
SOUR(@6):DATA:PATH:TRAC “oc192TX in slot 6”
```

Note When using SCPI, you must enclose the message in quotation marks. Otherwise, only the characters before the first space are used as the trace message.

Overhead Data

The **Overhead Data** tab provides options for modifying individual path and transport overhead data values for a given time slot.

The following figure shows the main features of the **Overhead Data** tab.



A **Transport Overhead**—Set transport overhead byte values (section and line) for the selected STS-1 channel, as described in “Transport Overhead” on page 434.

B **Path Overhead**—Set path overhead byte values for the selected channel, as described in “Path Overhead” on page 435.

Transport Overhead

Perform the following steps to modify specific transport overhead bytes for a specific time slot in the internally generated SPE.

Note Channel selection is only available when the signal is framed and the SPE is set to Selected. See “Framing” on page 430 and “SPE” on page 426.

1 Select an STS-1 channel (time slot).
2 Enter hexadecimal values.
3 Click **Set** to apply the changes.

The following notes apply to modifying transport overhead bytes:

- Overhead bytes that cannot be modified are indicated with “XX” greyed out in the user interface.
- The B1 and B2 bytes can only be modified through the B1 and B2 error insertion, as described in “Error” on page 429.

Settings	Description
STS-1 Channel	Selects the number of the time slot in the internally generated SPE for which you want to modify transport overhead bytes. Channel 1 is the default in the factory configuration.
A1, A2	Section overhead framing bytes. Modifying A1 and A2 bytes causes receivers to lose framing.

Settings	Description
J0 (C1)	Formerly C1 (STS-1 ID), now redefined as the J0 section trace byte. Modifying J0 in STS-1, channel 1 only takes effect if section trace message insertion is disabled, as described in “J0 Trace Message” on page 432.
E1	Orderwire section byte located in first STS-1 of an STS-N.
F1	Section user channel byte located in first STS-1 of an STS-N.
D1, D2, D3	Section data communication channel bytes located in first STS-1 of an STS-N.
K1, K2	APS channel bytes. Modifying K1 and K2 is possible through this interface, but to ensure proper K1 and K2 updates, see “K1/K2 Settings” on page 436. Enabled alarms (RDI-L, AIS-L) override changes to K2.
H1, H2, H3	SPE payload pointer bytes. H1, H2, and H3 bytes cannot be modified.
D4 through D12	Line data communications channel bytes.
S1	Synchronization status byte.
M1	Line Remote Error Indicator (Line REI) byte. Modifying M1 of STS-1, channel 7, does not override enabled error injection of Line REI (REI-L).

Settings	Description
E2	Express orderwire byte.
Set	You must click **Set** to apply any changes to the transport overhead byte values.

SCPI Examples:

Use the following command to set the values for bytes A1;A2;J0;B1;E1;F1;D1;D2;D3.

```
sour(@2):data:sect:over:byt
F6;28;01;XX;00;00;00;00;00
```

Use the following command to set the values for bytes H1;H2;H3;B2;K1;K2;D4;D5;D6;D7;D8;D9;D10;D11;D12;S1;M1;E2.

```
sour(@2):data:line:over:byt
XX;XX;XX;XX;00;00;00;00;00;00;00;00;00;0
0;00;00;00;00
```

For detailed information, see “Overhead Access” on page 605.

Path Overhead

Perform the following steps to modify specific STS path overhead bytes for a specific time slot in the internally generated SPE.

1. Select a channel.

Note Channel selection is only available when the signal is Framed and the SPE is set to selected.

2. Enter hexadecimal values for the appropriate fields.
3. Click **Set** to apply the changes to the STS path overhead bytes for the selected time slot.

The following notes apply to modifying STS path overhead bytes:

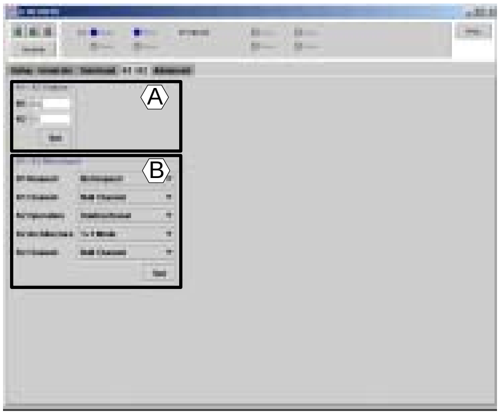
- Overhead bytes that cannot be modified are indicated with “XX” greyed out in the user interface.
- Modifying J1 only takes effect if J1 trace message insertion is disabled, as described in “J1 Trace Message” on page 433.
- The B3 byte cannot be modified using this interface. Use the B3 error insertion as described in “Error” on page 429.

Settings	Description
SPE	Selects the number of the time slot in the internally generated SPE for which you want to modify path overhead bytes. Channel 1 is the default in the factory configuration. The available channels depends on the selected SPE mapping. This field is linked to the SPE field in the **Generate** tab and is only available when the SPE field is set to Selected.
J1	STS path trace byte. Modifying J1 only takes effect if J1 path trace message insertion is disabled.
C2	STS path signal label.
G1	Path terminating status byte. This byte cannot be modified.
F2	Path user channel byte.
H4	Indicator allocated for use as a mapping-specific indicator byte.
Z3, Z4	Allocated for future growth.
Z5	Tandem connection byte.
Set	You must click **Set** to apply any changes to the transport overhead byte values.

Settings	Description
SCPI Examples: Use the following command to set the values for bytes J1;B3;C2;G1;F2;H4;Z3;Z4;Z5. `sour(@2):data:path:over:byt 00;XX;01;00;00;00;00;00;00` For detailed information, see “Overhead Access” on page 605. **Related Topics:** “SPE Mapping” on page 425 “SPE” on page 426	

K1/K2 Settings

The following figure shows the main features of the K1/K2 tab.



A **K1/K2 Values**—Set K1/K2 byte (APS channel) values, as described in “K1/K2 Values” on page 437.

B **K1/K2/Messages**—Set K1 and K2 bits to encode APS channel messages, as described in “K1/K2 Messages” on page 437.

K1/K2 Values

The **K1/K2 Values** setting enables you to directly set values in the automated protection switching (APS) channel K1 and K2 bytes.

K1/K2 Values	Description
K1	Bits 1 through 4 control the request message, and bits 5 through 8 control the channel message code.
K2	Bits 1 through 4 of the K2 byte control the channel number, bit 5 controls the architecture, and bits 6 thorough 8 indicate the mode of operation.
Set	You must click **Set** to update and transmit new K1/K2 values. As you set K1/K2 values, the **K1/K2 Messages** fields update accordingly.
SCPI Examples:	
`SOUR(@6):TRAN:APS:K1K2 0xF2,0x14`	

K1/K2 Messages

Use the fields in the K1/K2 Messages panel to set K1 and K2 bits to encode APS channel messages.

As you set K1/K2 message fields, the hexadecimal values displayed in the **K1/K2 Values** field update accordingly.

K1/K2 Message Settings	Description
K1 Request	Sets bits 1 through 4 of K1 with one of the following request messages. **Lockout of Protection**. Sets bits 1 through 4 to 1111. **Forced Switch**. Sets bits 1 through 4 to 1110. **SF - High Priority**. Sets bits 1 through 4 to 1101. **SF - Low Priority**. Sets bits 1 through 4 to 1100. **SD - High Priority**. Sets bits 1 through 4 to 1011. **SD - Low Priority**. Sets bits 1 through 4 to 1010. **Manual Switch**. Sets bits 1 through 4 to 1000. **Wait-to-Restore**. Sets bits 1 through 4 to 0110. **Exercise**. Sets bits 1 through 4 to 0100. **Revert Request**. Sets bits 1 through 4 to 0100.

K1/K2 Message Settings	Description
	Exercise. Sets bits 1 through 4 to 0100. **Revert Request**. Sets bits 1 through 4 to 0100. **Do Not Revert**. Sets bits 1 through 4 to 0001. **No Request** — Sets bits 1 through 4 to 0000. This setting is the default in the factory configuration.
K1 Channel	Selects the channel to apply the requesting message (sets bits 5 through 8 of K1 with the channel message code): **0**. The Null channel. This setting is the default in the factory configuration. **1** to **14**. Channel 1 through 14. **15**. Extra traffic channel.
K2 Operation	Sets the operational mode of the APS. Bits 6 through 8 of the K2 byte carry this information. **Unidirectional**. Sets bits 6 to 8 to 100. This setting is the default in the factory configuration. **Bidirectional**. Sets bits 6 to 8 to 101.

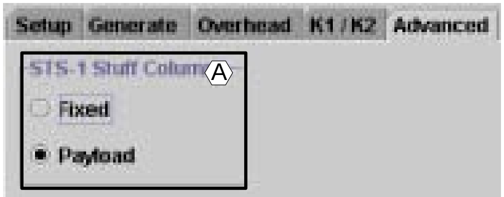
K1/K2 Message Settings	Description
K2 Architecture	Sets the architecture mode for the APS. Bit 5 of K2 carries this information. **Architecture 1+1**. Sets bit 5 to 0. This setting is the default in the factory configuration. **Architecture 1:n**. Sets bit 5 to 1.
K2 Channel	Selects the channel to apply the requesting message (sets bits 1 through 4 of K1 with the channel message code): **0**. Null channel. This setting is the default in the factory configuration. **1** to **14**. Channel 1 to 14. **15**. Extra traffic channel.
Set	You must click **Set** to update and apply the K1/K2 Message settings.

SCPI Examples:

```
sour(@4):tran:aps:k1k2 0x00 0x00
sour(@4):aps:k1en:req lops
sour(@4):aps:k1en:chan 1
sour(@4):aps:k2en:oper bid
sour(@4):aps:k2en:arch a1_n
sour(@4):aps:k2en:chan 1
sour(@4):aps:upd
```

Advanced Settings

The following figure illustrates the settings that are configured on the OC-192 Transmitter **Advanced** tab.



A **STS-1 Stuff Columns**—When the SPE mapping is set to STS-1, select whether the SPE stuff columns contain a fixed pattern (all zeroes) or a PRBS payload data pattern. See "STS-1 Stuff Columns" on page 439.

STS-1 Stuff Columns

The **STS-1 Stuff Columns** setting specifies whether the SPE stuff columns are filled with a fixed (all zeroes) pattern or a PRBS payload pattern.

Note This setting is only available when the SPE mapping for the OC-192 Transmitter is set to STS-1.

The stuff columns are columns 30 and 59 of the SPE as specified in GR-253-CORE. The default setting is Payload (PRBS pattern).

Setting	Description
Fixed	Fills the bytes in the SPE stuff columns with a fixed pattern of all zeroes.
Payload	Fills the bytes in the stuff columns with PRBS pattern data. This is the default setting in the factory configuration.
SCPI Examples:	

	`SOUR(@7):PAYL:STUF PAYL`
	`SOUR(@7):PAYL:STUF FIX`
	`SOUR(@7):PAYL:STUF ?`

31

STM-4/1 RX AND RXPM RECEIVER WINDOWS

The topics in this section explain the setup and monitoring options for the STM-4/1 Receiver (RX) and STM-4/1 Receiver with a Payload Monitor (RXPM) installed.

Instructions are provided for using EPXam to configure the module, along with SCPI equivalents.

Tip STM-4/1 RX and RXPM modules can be switched between SDH and SONET functionality. See “Protocol” on page 445.

See “OC-12/3 RX and RXPM Receiver Windows” on page 293 for a description of this module’s SONET features and configuration.

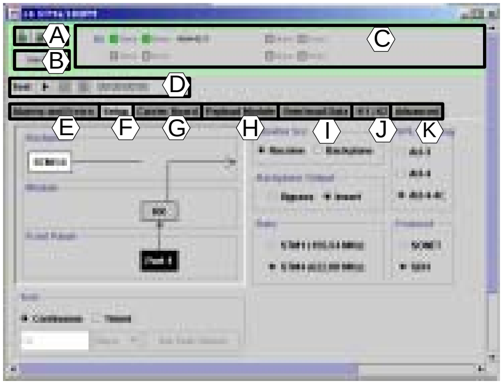
For more information about EPXam, see “Using EPXam” on page 3.

Main View

The STM-4/1 RX and RXPM module windows contain tabs for configuring setup options and monitoring error and alarm data.

If a payload monitor module is installed, the STM 4/1 RXPM module window has additional tabs for payload, K1/K2, and overhead data monitoring.

The following figure shows the main features of the STM-4/1 RXPM module window.



A Save or restore module/slot configuration or factory defaults. See “Using Module Window Save and Restore Controls” on page 108.

B **Identify**—When pressed, it flashes the Active LED on the front panel of the module associated with this window

C View summary defect status, alarm indicators, and other module information. See “Expanded Logical View Indicators” on page 8.

D Start, stop, pause or resume test; view elapsed time. See “Using Module Window Test Controls” on page 118.

E **Alarms and Errors**—Monitor carrier board and payload module alarm status, errors counts, and error ratios for current test. See “Alarms and Errors” on page 447.

F **Setup**—Set signal rate and source, backplane output, test type and duration, and payload mapping. See “Setup” on page 443.

G **Carrier Board**—Monitor input frequency and voltage. See “Carrier Board” on page 450.

H **Payload Module**—Monitor pointer values and J1/J0 trace messages or set the payload data pattern for the monitored signal (RXPM only). See “Payload Module (RXPM)” on page 450.

I **Overhead Data**—Monitor individual overhead byte values for a selected channel (RXPM only). See “Overhead Data (RXPM)” on page 453.

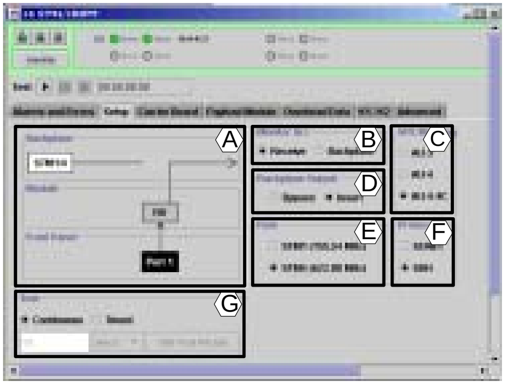
J **K1/K2**—Monitor K1 and K2 byte values and decoded APS channel messages. See “K1/K2 Settings (RXPM)” on page 454.

K **Advanced**—Specify STS-1 stuff column fill type and view SS overhead bit values. See “Advanced Settings (RXPM)” on page 456.

The fields and data displayed for each tab on the STM-4/1 RX and RXPM window are explained in more detail in the following sections.

Setup

The following figure illustrates the main features of the **Setup** tab on the STM-4/1 RX and RXPM module windows.



A View graphic display of current signal source and backplane output settings

B **Monitor source**—Set the signal source for the installed payload monitor module (RXPM only).

C **AU Mapping**—Set the administrative unit (AU) size; options vary, depending on the input signal rate selected (RXPM only).

D **Backplane Output**—Select whether the signal from the front panel LIU is inserted onto the backplane or the backplane signal is unchanged (bypass).

E **Rate**—Set the receiver signal rate to STM-1 or STM-4.

F **Protocol**—Switch the module between SONET and SDH protol.

G **Test**—Set the test type and duration

The options on the **Setup** tab are described in more detail in the following sections.

Monitor Src (RXPM)

The **Monitor Src** setting determines whether the installed payload monitor module monitors the SDH signal coming from the backplane or the signal from the front panel LIU on the carrier board in which the module is installed.

Backplane Setting	Description
Receiver	The module monitors the SDH signal from the LIU of the carrier board (from the front panel).
Backplane	The module monitors the SDH signal from the backplane.

SCPI Examples:

```
PMOD:SENS(@8):DATA:SOUR  NORM
PMOD:SENS(@8):DATA:SOUR  BACK
```

Related Topics:

“Using the Backplane” on page 41

AU Mapping (RXPM)

The AU Mapping option sets the size of the SDH administrative unit (AU). The available mappings depend on the SDH signal rate setting. For example, if the monitored input rate is STM-4 (622.08 Mbits/sec), the SPE size can be set to AU-3, AU-4, or AU-4-4c. If the signal rate is STM-1 (155.52 Mbits/sec), the AU (SPE) size can be set to either AU-3 or AU-4.

SPE Mapping	Description
AU-3	Selects an AU-3-sized payload for the SPE.
AU-4	Selects an AU-4-sized payload for the SPE.
AU-4-4c	Selects an AU-4-4c-sized (AU-4 concatenated) payload for the SPE.

SCPI Examples:
`PMOD(@7):SENS:DATA:SIZE AU3`
`PMOD(@7):SENS:DATA:SIZE AU4`
`PMOD(@7):SENS:DATA:SIZE AU44c`	

Backplane Output

The Backplane Output setting determines whether the data from the front panel connector is sent to the backplane or the backplane signal is unchanged.

The graphic display of the current backplane setting, backplane signal, and signal path are updated in the Backplane/Module/IO view when you change these settings.

Note Modules must be installed contiguously to transmit and receive signals along the backplane.

Backplane Setting	Description
Bypass	Bypass mode. The backplane signal is unchanged and is passed to the next slot.
Insert	Passthrough mode. The incoming data on the optical receiver is inserted onto the backplane for the next slot.

SCPI Examples:
`SYST:BOAR(@8):BACK:MODE PASS`
`SYST:BOAR(@8):BACK:MODE BYP`
Related Topics:
"Using the Backplane" on page 41	

Rate

The STM-4/1 RX and RXPM modules can receive at an STM-1 or STM-4 signal rate.

If you are configuring this module for the first time or if you have moved the module to a different slot, you should verify that the timing references and input/output clock sources are configured correctly for SONET/SDH. See “Configuring the EPX100 Clock Module” on page 25 for more information.

Rate Setting	Description
STM1 (155.54 MHz)	STM-1 signal rate
STM4 (622.08 MHz)	STM-4 signal rate

SCPI Examples:
`INP(@3):RATE STM1`
`INP(@3):RATE STM4`	

Note When you modify the receive signal rate, check that the settings for the transmitter of the signal (such as the transmit signal rate, channel, payload, SPE mapping, backplane I/O, and so on) are configured appropriately for the new signal rate.

Protocol

The Protocol setting switches the module between SONET and SDH. When the switch is complete, EPXam displays the appropriate protocol configuration options and field labels for the module and updates all references to the module to use the correct protocol.

Note Switching between SONET and SDH protocol does *not* require a restart of the test system or EPXam.

Restrictions:

- Modules that are locked via the Group Manager cannot be switched by other users.
- Active test and logging sessions associated with a module at the time of a switch are cancelled.

  If tests or logging sessions are in progress on any of the modules being switched, a warning dialog is displayed. Click **Cancel** to abort the switch or **Continue** to complete the switch. If you choose **Continue**, running tests and logging sessions are cancelled. Otherwise, a dialog opens that displays the switching progress.

Setting	Description
SONET	Switches the module to SONET without restarting the test system or EPXam. This is the default setting in the factory configuration.
SDH	Switches the module to SDH without restarting the test system or EPXam.

SCPI Examples:
`SYST:BOAR(@7):PROT:TYPE SON`
`SYST:BOAR(@7):PROT:TYPE SDH`
`SYST:BOAR(@7):PROT:STAT?`	

See “OC-12/3 RX and RXPM Receiver Windows” on page 293 for a description of this module’s SONET features and configuration.

See the following topics for more information about SONET/SDH switching:

- “Using the SONET/SDH Switcher” on page 121
- “SONET/SDH Switching and Custom Configuration Files” on page 123
- “Switching Modules Using SCPI” on page 123

Test

The Test area defines the type and duration of the test that the receiver runs. To start and stop tests, use the controls in the module window or, to start tests for multiple modules, use the Test Controls window. See “Controlling Tests” on page 115.

Note Selecting a new test type automatically stops the current test.

Test Setting	Description
Continuous	Selects a continuous test that must be manually stopped and started.
Timed	Selects a timed test. When Timed is selected: **1** Specify a number and select a unit (seconds, minutes, hours, and days) for the test duration. **2** Click **Set** to apply the settings. **3** Use the controls at the top of the window to start the test. **Note** If you enable logging and are saving the log file to the EPX Test System, gnubi advises you to limit the test period to a maximum of 72 hours (3 days).

SCPI Examples:

```
sens(@3):test:type cont
sens(@3):test:type tim
sens(@3):test:unit min
sens(@3):test:per 10
```

To control tests use the following commands:

```
sens(@3):test:mode star
sens(@3):test:mode stop
sens(@3):test:mode rest
sens(@3):test:mode pause
```

Related Topics:

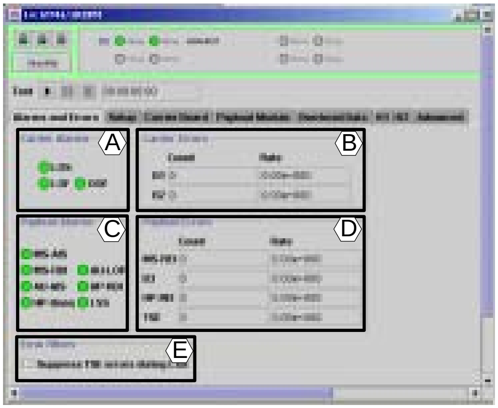
“Logging” on page 63

“Controlling Tests” on page 115

Alarms and Errors

The **Alarms and Errors** tab displays alarm status indicators, error counts, and error ratios for the current test. If a Payload Monitor module is installed, additional payload alarm and error data is displayed.

The following figure shows the main areas of the STM-4/1 **Alarms and Errors** tab.



A Monitor carrier board alarm status

B Monitor carrier board error counts and ratios

C Monitor payload module alarm status

D Monitor payload module error counts and ratios

E Specify whether bit errors are counted during LSS alarms

Alarm indicator colors are defined in the following table.

Green	Yellow	Red
No alarms are detected: signal is clear or monitoring is not started.	Alarm history: an alarm was detected but is not active in the current test.	An alarm is active and currently detected on the monitored signal.

Aarm and error data displayed on this tab is described in more detail in the following sections.

Carrier Alarms

Alarm types that can be monitored by the STM-4/1 RX carrier board are described in the following table.

Alarm	Description
LOS	Loss of Signal. The LOS state is cleared when two consecutive framing patterns are received and no new LOS condition is detected.
LOF	Loss of Frame. The STM-4/1 Receiver declares LOF when the OOF state exists for 3 ms. LOF is cleared when an in-frame condition exists continuously for 3 ms.

Alarm	Description
OOF	Out-of-Frame. The STM-4/1 Receiver declares OOF when 4 consecutive SDH frames are received with invalid (errored) framing patterns (A1 and A2 bytes). The maximum time to detect OOF is 625 microseconds. OOF is cleared when two consecutive SDH frames are received with valid framing patterns.

SCPI Examples:
`SENS(@3):ALAR LOS`
`SENS(@3):ALAR LOF`
`SENS(@3):ALAR OOF`	

Carrier Errors

The Errors area displays error counts and ratios for the current test.

The error data is cumulative. To get data for intervals, see “Logging” on page 63. Once a test is restarted, the error history is cleared.

Error Data	Description
Type	The following error types are monitored: • Section (B1) errors • Line (B2) errors
Count	Current error count for each type of error type: Section (B1), Line (B2) errors. The counters are reset to zero at the start of each test period.

Error Data	Description
Rate	Computed ratio for each type of error: Section (B1) and Line (B2) errors. It is the ratio of errored bits to total errors in the stream since the last test restart. The error ratio is reset to zero at the start of each test period.

SCPI Examples:
`SENS(@8):ERR:COUN:B1ER ?`
`SENS(@8):ERR:COUN:B2ER ?`
`SENS(@8):ERR:RAT:B1ER ?`
`SENS(@8):ERR:RAT:B2ER ?`	

Payload Alarms (RXPM)

The Payload Alarms section in the Payload Module tab displays alarm indicators for the current test.

The alarm indicator colors are defined below.

Green	Yellow	Red
No alarms are detected: signal is clear or monitoring is not started.	Alarm history: an alarm was detected but is not active in the current test.	An alarm is active and currently detected on the monitored signal.

Alarm	Description
AU-LOP	Administrative Unit Loss of Pointer. The STM-4/1 RXPM module detects LOP when 10 consecutive invalid pointers are received. LOP state is cleared when three equal valid pointers or three consecutive AIS indications are received.
MS-AIS	Multiplex Section Alarm Indication Signal. The STM-4/1 RXPM module declares MS-AIS when the STM-1, excluding the Regenerator Section Overhead (RSOH), is all ones. MS-AIS is cleared when the above condition is not met.
AU-AIS	Administrative Unit - Alarm Indication Signal. The STM-4/1 RXPM module declares AU-AIS when the AU, including the AU pointer, is all ones. AU-AIS is cleared when the above condition is not met.
MS-RDI	Multiplex Section - Remote Defect Indicator. The STM-4/1 RXPM module detects MS-RDI when bits 6, 7, and 8 of the K2 byte (before scrambling) are set to 110b. MS-RDI is cleared when bits 6,7,and 8 of the K2 byte are not set to 110b.

Alarm	Description
HP-RDI	Higher order - Path Remote Defect Indicator. The STM-4/1 RXPM module detects HP-RDI when bit 5 of the G1 path overhead byte is set to 1 for 5 consecutive frames. HP-RDI is cleared when bit 5 of the G1 path overhead byte is set to 0.
HP-UNEQ	Higher order - Path Unequipped. The STM-4/1 RXPM module detects HP-UNEQ when the C2 byte is set to zero for 5 consecutive frames. HP-UNEQ is cleared when the C2 byte is non-zero.
LSS	Loss of Sequence Synchronization. The STM-4/1 RXPM module detects LSS when the PRBS pattern does not match for 4 clock cycles. LSS is cleared when pattern matching occurs for 7 consecutive clock cycles.

SCPI Examples:

```
PMOD:SENS(@3):ALAR  MSA
PMOD:SENS(@3):ALAR  AUL
PMOD:SENS(@3):ALAR  AUA
PMOD:SENS(@3):ALAR  MSRD
PMOD:SENS(@3):ALAR  HPRD
PMOD:SENS(@3):ALAR  UNEQ
PMOD:SENS(@3):ALAR  LPS
```

Payload Errors (RXPM)

The Errors area displays error counts and ratios for the current test.

The error data is cumulative. To get data for intervals, see “Logging” on page 63. Once a test is restarted, the error history is cleared.

Settings	Description
B3	Path B3 BIP-8 errors.
MS-REI	Multplex Section - Remote Error Indication errors.
HP-REI	High-order Path - Remote Error Indication errors.
TSE	Test Sequence Errors (bit errors).
Count	Current error count for the corresponding error type since the last test restart. Error counters are reset at the start of each test period.
Rate	Computed error ratios since the last test restart for the given error type.
SCPI Examples: PMOD(@6):SENS:ERR:COUN B3ER PMOD(@6):SENS:ERR:RAT B3ER PMOD(@6):SENS:ERR:COUN MSR PMOD(@6):SENS:ERR:RAT MSR PMOD(@6):SENS:ERR:COUN HPR PMOD(@6):SENS:ERR:RAT HPR PMOD(@6):SENS:ERR:COUN TSE PMOD(@6):SENS:ERR:RAT TSE	

Error Filters (RXPM)

The Error Filters setting specifies whether TSE errors (bit errors) are suppressed when an LSS alarm condition is active. The default is OFF (bit errors are counted when the LSS alarm is active).

When this setting is enabled, bit errors are not counted when the LSS alarm is active.

To enable or disable bit error filtering using SCPI, use commands similar to the following:

```
SENS(@3):FILT:BIT ON
SENS(@3):FILT:BIT OFF
```

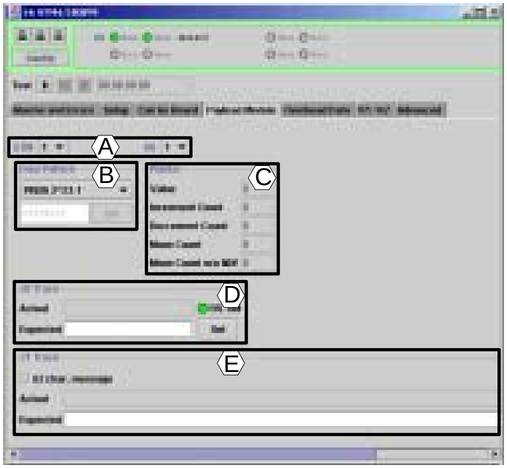
Carrier Board

The **Carrier Board** tab of the STM-4/1RX and RXPM module windows displays the monitored frequence and optical power.

Data	Description
Frequency	Monitors the frequency of incoming signal in MHz, with accuracy within 5 ppm.
Optical Power	Monitors the input optical power (in dBm). Precision is 2 digits. Software averages over 10 samples, with a response time of approximately 5 seconds.
SCPI Examples: INP(@3):POW ? INP(@3):FREQ ?	

Payload Module (RXPM)

The following figure shows the main features of the STM-4/1 RXPM **Payload Module** tab.



A **STM** and **AU**—Select the payload channel to monitor

B **Data Pattern**—Select payload pattern or specify a user-defined payload pattern to monitor

C **Pointer**—Monitor payload pointer values and pointer event counts

D **J0 Trace**—Monitor J0 trace messages, set the expected J0 trace message, and view RS-TIM alarm status.

E **J1 Trace**—Monitor J1 trace messages, set the expected J1 trace message and length, and view HP-TIM alarm status..

The following sections describe these fields and settings in more detail.

STM and AU Channel (Time Slot)

Settings	Description
STM	Select the STM channel (time slot) to monitor. The number of STM channels depends on the settings specified for the Rate and VC (virtual container) Mapping. For example, if the signal rate is STM-4 and the VC Mapping is AU-3 or AU-4, you can select 1 of 4 STM channels to monitor. If the signal rate is STM-4 and the SPE mapping is AU-4-4c, there is only one STM channel to monitor.
AU	Selects the AU (administrative unit) time slot to be monitored. If the monitored AU is an AU-3, 1 of 3 AU time slots can be selected. If the monitored AU is an AU-4 or AU-4-4c, there is only AU time slot.

SCPI Examples:
`PMOD(@7):SENS:DATA:AUN 2`
`PMOD(@7):SENS:DATA:STM 1`	

Pointer

The Pointer area of the **Payload Module** tab displays AU (administrative unit) pointer values and event counts.

Pointer event counters are reset at the start of each test period.

Pointer Field	Description
Value	Displays the current value in hexadecimal of the synchronous payload envelope (SPE) pointer. This value is what the hardware pointer processor interprets as the current pointer.
Increment Count	Number of SPE pointer increment events since the last restart.
Decrement Count	Number of SPE pointer decrement events since the last restart.
Move Count	Number of times the pointer generator moved to a new pointer value using the New Data Flag (bits 1 to 4 of the H1 pointer byte).
Move w/o NDF Count	Number of times the pointer generator moved to a new pointer value without the New Data Flag (missing NDF).

SCPI Examples:
`PMOD(@6):SENS:POIN:VAL ?`
`PMOD(@6):SENS:POIN:COUN:INCR?`
`PMOD(@6):SENS:POIN:COUN:DECR?`
`PMOD(@6):SENS:POIN:COUN:NDF?`
`PMOD(@6):SENS:POIN:COUN:MNDF?`	

J0 Trace (RXPM)

The J0 Section Trace Message display the received section trace message, RS-TIM alarm status, and enable you to define and enable monitoring of the expected trace message.

Field/ Indicator	Description
Actual	Displays the received 15-byte J0 section trace message.
Expected	Enter a 15-byte character string to be used as the expected trace message for the RS-TIM (Regenerator Section-Trace Identifier Mismatch alarm.
Set	Click **Set** to enable monitoring of the expected J0 trace message.
RS-TIM Alarm Indicator	Displays the status of the Regenerator Section-Trace Identifier Mismatch (RS-TIM) alarm.

SCPI Examples:
`PMOD(@3):SENS:DATA:SECT:TRAC ?`
`PMOD(@3):SENS:DATA:SECT:EXP “15-byte msg”`
`PMOD(@3):SENS:DATA:SECT:TIM ?`	

J1 Trace

The J1 Path Trace Message settings control the length of the expected trace message, expected trace message for the HP-TIM (high-order path trace message identifier mismatch) alarm, and the HP-TIM alarm status indicator.

Field/ Indicator	Description
64-byte Message	When checked, this selection enables 64-byte J1 path trace message length. The default is disabled (15-byte J1 trace message).
Actual	Displays the received 15- or 64-byte J1 path trace message.
Expected	Enter a 15- or 62-byte character string to be used as the expected J1 path trace message for the HP-TIM (High order Path Trace Identifier Mismatch) alarm.
Set	Click **Set** to enable monitoring of the expected J1 trace message.
HP-TIM Alarm Indicator	Displays the status of the High order Path - Trace Identifier Mismatch (HP-TIM) alarm.

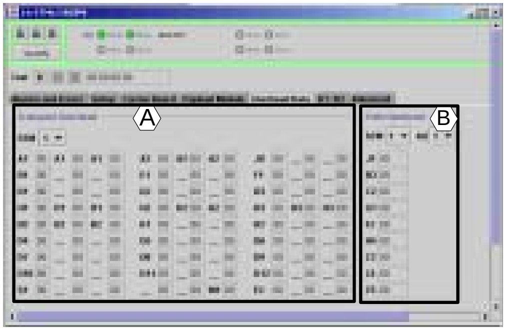
SCPI Examples:

```
PMOD(@3):SENS:DATA:PATH:TRL 64
PMOD(@3):SENS:DATA:PATH:EXP “J1 trace msg”
PMOD(@3)DATA:PATH:TRAC ?
PMOD(@3):SENS:DATA:PATH:TIM ?
```

Overhead Data (RXPM)

The STM-4/1 RXPM **Overhead Data** tab displays the current values of the STM transport and path overhead bytes for the selected STM channel.

The following figure shows the features of the STM-4/1 RXPM **Overhead Data** tab.



A **Transport Overhead**—Select the STM channel (time slot) for which transport overhead data is displayed. The number of channels depends on the input signal rate and the currently selecte VC*n* Mapping.

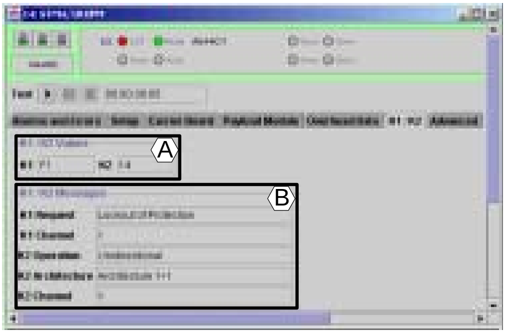
B **Path Overhead**—Select the STM channel and administrative unit (AU) for which path overhead data is displayed. The number of AUs depends on the currently selected VC*n* mapping.

Selection	Description
STM (Transport Overhead)	Selects the STM channel for which the transport overhead bytes are displayed.
STM (Path Overhead)	Select 1 of 4 STM channels if the monitored input signal rate is STM-4 (622.08 Mbits/sec). If the monitored input signal rate is STM-1 (155.52 Mbits/sec), then there is only 1 STM channel.
AU (Path Overhead)	Selects the administrative unit (AU) for which the path overhead data is displayed. Select 1 of 3 available AUs if the VC*n* mapping is set to AU-3. If the VC*n* mapping is set to AU-4 or AU-4-4c, there is only 1 AU.

SCPI Examples:
`pmod(@11):sens:data:rsoh[2]:byt?`
`pmod(@11):sens:data:msoh[2]:byt?`	

K1/K2 Settings (RXPM)

The following figures shows the main areas of the STM-4/1 RXPM module **K1/K2** tab.



A **K1/K2 Values**—View hexadecimal K1/K2 byte values.

B **K1/K2 Messages**—View APS (automated protection switching) messages decoded from K1/K2 bytes.

K1/K2 Values

The K1/K2 line overhead byte values are used to monitor automated protection switching (APS) channel messages.

Field	Description
K1/K2 Values	Monitors hexadecimal values for K1/K2 line overhead bytes in monitored signal.
SCPI Example: `SENS(@3):TRAN:APS:K1K2 ?`	

K1/K2 Messages

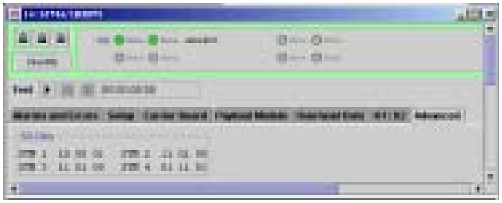
This field displays automated protection switching (APS) channel messages decoded from the K1/K2 bytes.

K1/K2 Messages	Description
K1 Request	Bits 1 through 4 of K1 can contain the following request messages. **Lockout of Protection**. Bits 1 through 4 have a value of 1111. **Forced Switch**. Bits 1 through 4 contain 1110. **SF - High Priority**. Bits 1 through 4 Have a value of 1101. **SF - Low Priority**. Bits 1 through 4 have a value of 1100. **SD - High Priority**. Bits 1 through 4 have a value of 1011. **SD - Low Priority**. Bits 1 through 4 have a value of 1010. **Manual Switch**. Bits 1 through 4 have a value of 1000. **Wait-to-Restore**. Bits 1 through 4 have a value of 0110. **Exercise**. Bits 1 through 4 have a value of 0100. **Revert Request**. Bits 1 through 4 have a value of 0100 **Do Not Revert**. Bits 1 through 4 have a value of 0001 **No Request** — Bits 1 through 4 have a value of 0000.
K1 Channel	Channel selection for the requesting message (bits 5 through 8 of K1 carry the channel message code): • 0 — Null channel. • 1 through 14 — Channel 1 through 14. • 15 — Extra traffic channel.
K2 Operation	Operational mode of the APS. Bits 6 through 8 of the K2 byte carry this information. **Unidirectional**. Bits 6 to 8 have a value of 100. **Bidirectional**. Bits 6 to 8 have a value of 101.
K2 Architecture	Architecture mode for the APS. Bit 5 of K2 carries this information. **Architecture 1+1**. Bit 5 is 0. **Architecture 1:n**. Bit 5 is 1.
K2 Channel	Channel selection for the requesting message (bits 1 through 4 of K2 carry the channel message code): **0**—Null channel. **1** to **14**—Channel 1 to 14. **15**—Extra traffic channel.

K1/K2 Messages	Description
SCPI Examples: PMOD(@3):SENS:APS:K1D:REQ ? PMOD(@3):SENS:APS:K1D:CHAN ? PMOD(@3):SENS:APS:K2D:ARCH ? PMOD(@3):SENS:APS:K2D:OPER ? PMOD(@3):SENS:APS:K2D:CHAN ?	

Advanced Settings (RXPM)

The **Advanced** tab (shown below) displays the current data for the SS bits (bits 5 and 6 in the H1 overhead byte). The SS bits indicate whether the signal is carrying SONET traffic (value of 00) or SDH traffic (value of 10).



If the signal rate is STM-1, 3 pairs of SS bits are displayed; if the signal rate is STM-4, 12 pairs of SS bits are displayed.

To display the current state of the SS overhead bits using SCPI, use a command similar to the following:

```
SENS(@8):OVER:SSB ?
```

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STM-4/1 TX AND TXPG TRANSMITTER WINDOWS

The topics in this section explain how to configure set-up options, alarm and error insertion, payload generation, and overhead data values for the STM-4/1 transmitter (TX) and the STM-4/1 transmitter with a payload generator (TXPG) module installed.

Instructions are provided for using EPXam to configure the module, along with SCPI equivalents.

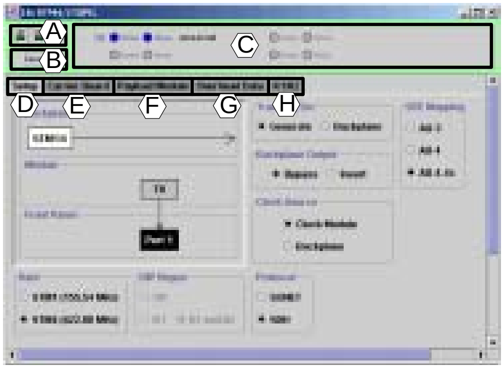
Tip STM-4/1 TX and TXPG modules can be switched between SONET and SDH functionality. See “Protocol” on page 462 and “Using the SONET/SDH Switcher” on page 121.

See “STM-4/1 TX and TXPG Transmitter Windows” on page 457 for information about configuration settings and features for these modules in SONET protocol mode.

For more information about EPXam, see “Using EPXam” on page 3.

Main View

The following figure shows the main features of the STM-4/1 TX and TXPG module windows.



A **Identify**—When pressed, flashes the Active LED on the front panel of the module associated with this window.

B Save or restore module/slot configuration; restore factory default setting. See “Using Module Window Save and Restore Controls” on page 108.

C Module status summary—View summary defect status, alarm indicators, and other module information. See “Expanded Logical View Indicators” on page 8.

D **Setup**—Configure signal rate, clock source, backplane input and output, and switch the protocol between SONET and SDH. See “Setup” on page 459.

E **Carrier Board**—Configure carrier board alarm and error insertion or override SS bit values. See “Carrier Board” on page 463.

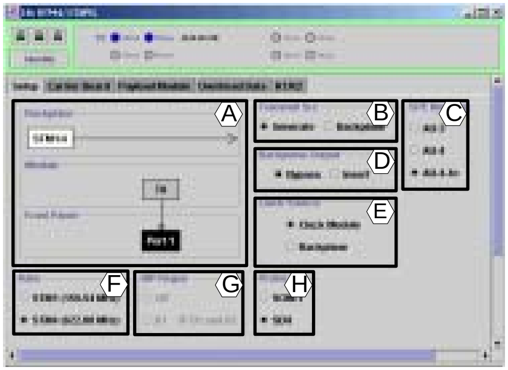
F **Payload Modul**e—Configure payload generator alarm and error insertion (TXPG only). See “Payload Module (TXPG)” on page 466.

G **Overhead Data**—View or modify SDH transport and path overhead bytes (TXPG only). See “Overhead Data (TXPG)” on page 472.

H K1/K2—Set K1/K2 byte values or set K1/K2 bits to encode APS channel messages. See “K1/K2 Settings (TXPG)” on page 475.

Setup

The following figure shows the main features of the STM-4/1 TX and TXPG **Setup** tab.



A View graphic display of currently selected module input and output options.

B **Transmit Source**—Select whether the transmit source is generated by the installed Payload Generator module or comes from an adjacent module via the test system backplane. See "Transmit Source (TXPG)" on page 459.

C **SPE Mapping**—Set the administrative unit (AU) data size. See "SPE Mapping (TXPG)" on page 460.

D **Backplane Output**—Specify whether a generated signal is inserted onto the backplane or bypasses the backplane. See "Backplane Output (TXPG)" on page 460.

E **Clock Source**—Set the clock source for the payload generator. See "Clock Source (TXPG)" on page 461.

F **Rate**—Set the module's output signal rate to STM-1 or STM-4. See "Rate" on page 461.

G **BIP Regen**—Enable/disable BIP B1 and B2 regenerators. See "BIP Regen" on page 461.

H **Protocol**—Switch the protocol between SONET and SDH. See "Protocol" on page 462.

Transmit Source (TXPG)

The Transmit Source determines whether signal source is generated by the installed Payload Generator module or comes from an adjacent module via the test system backplane.

When the Transmit Source is set to Backplane, the following limitations apply:

- Error injection is limited to Physical errors, B1, and B2 errors (assuming B1/B2 error injection is enabled via the BIP Regen setting).
- The Clock Source setting is set to Backplane.
- Overhead byte insertion, trace message insertion, K1/K2 byte manipulation, APS channel message encoding, pointer manipulation, and payload pattern selection are not available.

Transmit Source Setting	Description
Generate	The STM-4/1 Transmitter with Payload Module generates the signal to be transmitted.
Backplane	The transmit source is a signal on the Test System backplane from the STM-4/1 Receiver installed in the adjacent slot to the left of the transmitter.

SCPI Examples:

```
SOUR(@6):DATA:SOUR  PMOD
SOUR(@6):DATA:SOUR  BACK
```

Related Topics

"Using the Backplane" on page 41

SPE Mapping (TXPG)

The SPE Mapping option sets the expected virtual container (VC) size and mapping for the generated signal. This setting affects options for the STM and AU selections in the **Payload Module** and **Overhead** tabs. Changing the SPE Mapping also returns the VC-n selection to the default of Broadcast.

Note This setting is not available when the Transmit Source is set to Backplane.

SPE Mapping	Description
AU-3	Selects an AU-3-sized payload.
AU-4	Selects an AU-4-sized payload .
AU-4-4c	Selects an AU-4-4c-sized payload.

SCPI Examples:

```
PMOD(@7):SOUR:DATA:SIZE AU3
PMOD(@7):SOUR:DATA:SIZE AU4
PMOD(@7):SOUR:DATA:SIZE AU44C
```

Backplane Output (TXPG)

The Backplane Output setting determines whether the transmitter module inserts the signal from the Payload Generator onto the backplane.

Backplane Output Setting	Description
Bypass	The data currently on the backplane is sent back to the backplane. It is not modified and continues to the next slot for use.
Insert	The signal from the module's Payload Generator is inserted on the backplane, replacing any existing STM-4/1 backplane signal.

SCPI Examples:

```
SYST:BOAR(@6):BACK:MODE  PMOD
SYST:BOAR(@6):BACK:MODE  BYP
```

Related Topics

"Using the Backplane" on page 41

Clock Source (TXPG)

The Clock Source setting selects the timing reference that the Payload Generator uses to generate the SONET/SDH payload.

When Backplane is selected as the Transmit Source, the Clock Source can only be Backplane.

Clock Source Setting	Description
Clock Module	Selects the timing reference from the EPX Test System's clock module. Verify that the EPX clock module is correctly providing a SONET/SDH timing reference for the slot in which the STM-4/1Transmitter is installed.
Backplane	The module gets its timing reference from another source via the backplane. This option is always selected when the Transmit Source is signal from the test system backplane.

SCPI Examples:

```
PMOD(@7):SOUR:CLOC:SOUR  CLKB
PMOD(@7):SOUR:CLOC:SOUR  BACK
```

Related Topics

"Configuring the EPX100 Clock Module" on page 25

Rate

The STM-4/1 TX and TXPG modules can transmit at STM-1 or STM-4 signal rates.

Note When you modify the transmit signal rate, check that the settings for the receiver of the signal (such as the receive signal rate, channel, payload, SPE mapping, backplane I/O, and so on) are appropriately configured for the new signal rate.

Rate Setting	Description
STM-1 (155.54 MHz)	Selects STM-1 signal rate.
STM-4 (622.08 MHz)	Selects STM-4 signal rate.

SCPI Examples:

```
OUTP(@3):RATE  stm1
OUTP(@3):RATE  stm4
```

BIP Regen

The BIP Regen setting controls B1 and B2 byte regeneration when the Transmit Source is set to Backplane.

BIP Regen Setting	Description
Off	Disable B1 and B2 BIP regenerators. The signal is retransmitted as it is received from the backplane, and only physical layer errors can be inserted. If the error type is B1or B2 and this setting is chosen, the Error Type setting is forced to physical.
B1	Enable B1 BIP regenerator. The B1 byte is recaculated before the signal is retransmitted. Only physical layer and B1 errors can be inserted when the transmit source is a signal from the backplane. If the Error Type is set to B2 and this setting is chosen, the Error Type setting is forced to physical.
B1 and B2	Enable B1 and B2 BIP regenerators. The B2 and B2 bytes are recalculated before the signal is retransmitted. Physical, B1, and B2 errors can be inserted when the transmit source is a signal from the backplane.

SCPI Examples:

```
SOUR(@3):OVER:BIPR  B1
SOUR(@3):OVER:BIPR  B1_B2
SOUR(@3):OVER:BIPR  OFF
```

Related Topics:

“Transmit Source (TXPG)” on page 459

Protocol

The Protocol setting switches the module between SONET and SDH. When the switch is complete, EPXam displays the appropriate protocol configuration options and field labels for the module and updates all references to the module to use the correct protocol.

Note Switching between SONET and SDH protocol does *not* require a restart of the test system or EPXam.

Restrictions:

- Modules that are locked via the Group Manager cannot be switched by other users.
- Active test and logging sessions associated with a module at the time of a switch are cancelled.

  If tests or logging sessions are in progress on any of the modules being switched, a warning dialog is displayed. Click **Cancel** to abort the switch or **Continue** to complete the switch. If you choose **Continue**, running tests and logging sessions are cancelled. Otherwise, a dialog opens that displays the switching progress.

Setting	Description
SONET	Switches the module to SONET without restarting the test system or EPXam. This is the default setting in the factory configuration.
SDH	Switches the module to SDH without restarting the test system or EPXam.

SCPI Examples:

```
SYST:BOAR(@7):PROT:TYPE SON
SYST:BOAR(@7):PROT:TYPE SDH
SYST:BOAR(@7):PROT:STAT?
```

See “OC-12/3 TX and TXPG Transmitter Windows” on page 315 for a description of this module’s SONET features and configuration.

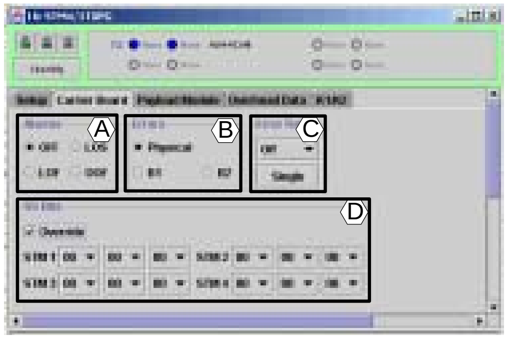
See the following topics for more information about SONET/SDH switching:

- “Using the SONET/SDH Switcher” on page 121
- “SONET/SDH Switching and Custom Configuration Files” on page 123
- “Switching Modules Using SCPI” on page 123

Carrier Board

Alarms and errors that can be inserted by STM-4/1 TX carrier board are configured in the **Carrier Board** tab.

The following figure illustrates the main areas of the STM-4/1 TX/TXPG **Carrier Board** tab.



A **Alarms**—Select the type of alarm to insert, as described in “Alarms” on page 464.

B **Errors**—Select the type of error to insert, as described in “Errors” on page 464.

C **Error Rate**—Set the error insertion rate, as described in “Error Rate” on page 465.

D **SS Bits**—Override the values for the SS bits, as described in “SS Bits” on page 465.

Alarms

The Alarms setting determines the type of alarm that can be inserted into the transmit stream.

Alarm setting	Description
Off	Disables alarm insertion.
LOS	Loss of Signal **Implementation**:LOS is generated by disabling the signal output. When LOS insertion is turned off, the transmit drivers are re-enabled.
LOF	Loss of Frame **Implementation**: LOF is forced by continuously inverting the A1 and A2 framing bytes. When LOF insertion is turned off, the A1 and A2 framing bytes are generated with the correct values.
OOF	Out of Frame **Implementation**: OOF is forced by inverting the A1 and A2 framing bytes for 4 frames, followed by 40 frames with a normal framing pattern. This is repeated until OOF insertion is turned off.
SCPI Examples: SOUR(@3):ALAR OFF SOUR(@3):ALAR OOF SOUR(@3):ALAR LOF SOUR(@3):ALAR LOS	

Errors

The Errors and Error Rate settings control the type of error which is inserted into the transmit stream. Whenever the Error Type setting is modified, the Error Rate setting is always reset to Off.

Note When the Transmit Src is set to Backplane, B1 and B2 error insertion depends on the BIP Regen setting. Conflicts can occur if you attempt to set the error type to B1 or B2 and the BIP Regen option is not set correctly. See “BIP Regen” on page 461 for more information.

Error Type	Description
Physical	Insert physical layer (or random) errors into the stream. The BIP Regen setting does not affect physical error insertion when the Transmit Source is set to Backplane.
B1 (Line)	Insert B1 BIP-8 errors into the stream. The BIP Regen setting must be either **B1** or **B1 and B2** to insert B1 errors when the Transmit Source is set to Backplane.
B2 (Section)	Insert B2 BIP-8 errors into the stream. The BIP Regen setting must be set to **B1 and B2** to insert B2 errors when the Transmit Source is set to Backplane.

Error Type	Description

SCPI Examples:
`SOUR(@3):ERR:TYPE B1ER`
`SOUR(@3):ERR:TYPE B2ER`
`SOUR(@3):ERR:TYPE PHYS`	

Error Rate

The Error Rate setting enables and disables carrior board error insertion and controls the rate at which errors are inserted into the stream.

Note The Error Rate setting is always reset to OFF whenever the Error Type is changed.

Error Rate Setting	Description
Off	Sets the error rate to 0, effectively disabling error insertion.
IE-3 through IE-9	Set the error ratio to 10 x 10^-3, 10 x 10^-4, and so on. IE-3 does not apply to Section (B1) errors. Set the Error Type to Line (B2) and BIP Regen to B1 and B2 to use IE-3.
Single	Error Rate must be set to Off to enable single error insertion. When this option is available, click this button to insert a single error into the transmit stream.

Error Rate Setting	Description

SCPI Examples:
`SOUR(@3):ERR:RAT OFF`
`SOUR(@3):ERR:RAT ALL`
`SOUR(@3):ERR:RAT RIE-4`
`SOUR(@3):ERR:RAT SING`	

SS Bits

Use the SS Bits Override setting to modify the SS overhead bits that are inserted into the H1 overhead byte in the STM-1 or STM-4 stream. By default, these bits are not modified.

The SS bits are bits 5 and 6 of the H1 overhead byte. They indicate whether the signal is carrying SONET traffic (value of 00) or SDH traffic (value of 10).

- When the signal rate is set to STM-1, 3 bit pairs can be modified.
- When the signal rate is set to STM-4 12 bit pairs can be modified.

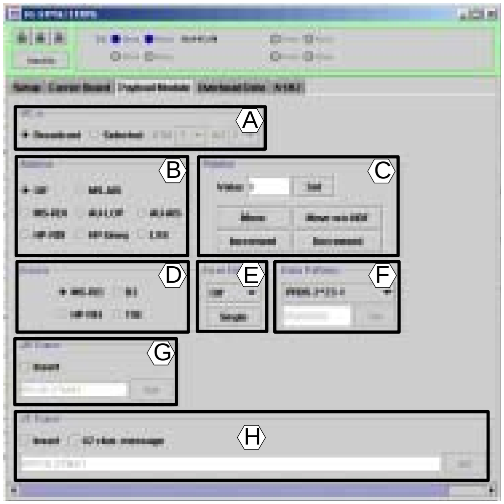
SS Bits Settings	Description
Override	If checked, the binary values specified override the default SS bit values.
STM 1 - STM 4	Specify a binary value for each bit pair (00, 01, 10, or 11).

SS Bits Settings	Description
SCPI Examples:	
`SOUR(@3):OVER:SS 11;11;11`	
`SOUR(@3):OVER:SS OFF`	

Payload Module (TXPG)

The following figure illustrates the options available on the STM-4/1 TXPG **Payload Module** tab.

Note The settings on the **Payload Module** tab do not apply when the Transmit Source is set to Backplane.



A **VC-n**—Specify whether the generated payload is mapped to a specific STM and AU time slot or broadcast to all channels, as described in “VC-n” on page 467.

B **Alarms**—Select the type of payload module alarm to insert, as described in “Alarms” on page 468.

C **Pointer**—Set payload pointer values or perform actions on current payload pointer, as described in “Pointer” on page 471.

D **Errors**—Select the type of payload module error to insert, as described in “Errors” on page 469.

E **Error Rate**—Set the payload module error insertion rate, as described in “Error Rate” on page 470.

F **Data Pattern**—Specify the data pattern to place into the generated payload, as described in “Data Pattern” on page 472.

G **J0 Trace**—Define and insert J0 trace message, as described in “J0 Trace Message” on page 470.

H **J1 Trace**—Define and insert J1 trace message, as described in “J1 Trace Message” on page 470.

VC-n

The VC-n settings specify the virtual container mapping for the generated payload. The generated payload can be mapped to a single STM and AU time slot or broadcast to all channels.

The number of available channels depends on the SPE mapping that is selected on the **Setup** tab. The VC-n setting is reset to broadcast when the SPE Mapping is changed.

Settings	Description
Broadcast	Map the generated payload to all STM and AU time slots. When **Broadcast** is selected, STM and AU selection is unavailable. This is the default in the factory configuration.
Selected	Map the generated payload to the time slot specified by the **STM** and **AU** settings.
STM	Select the STM channel in which to insert the generated payload. This option is not available in broadcast mode. This field is linked to the STM field in the **Overhead Data** tab. The number of STM channels depends on the currently selected SPE mapping: • If the AU size is AU-3 or AU-4, select 1 of 4 channels for STM-4. Only one STM is available for STM-1. • If the AU size is AU-4-4c, only one STM is available for STM-4.
AU	Select the number of the Administrative Unit (AU) time slot to map the generated payload. This option is not available in broadcast mode. This field is linked to the AU field in the **Overhead Data** tab. The number of AUs depends on the currently selected SPE Mapping. • If the AU Mapping is AU-3, select 1 of 3. • Otherwise, there is only one AU.

SCPI Examples:

```
PMOD(@6):SOUR:DATA:MODE  BRO
PMOD(@6):SOUR:DATA:MODE  SEL
PMOD(@6):SOUR:DATA:AUN   1
PMOD(@6):SOUR:DATA:STM  1
```

Related Topics:

"SPE Mapping (TXPG)" on page 460

"STM Path Overhead Data" on page 474

Alarms

The **Alarms** setting determines the type of alarm that is inserted into the transmit stream.

Note If Backplane is selected as the Transmit Source, alarm injection from the payload module is not available.

STM Line/ Path Alarms	Description
OFF	Disable all alarms.
MS-AIS	Multiplex Section Alarm Indication Signal. **Implementation**: The STM-4/1 TXPG module generates MS-AIS by continuously inserting all ones into the STM payload, excluding the Regenerator Section Overhead (RSOH). When MS-AIS insertion is turned off, the STM payload is generated normally.
MS-RDI	Multiplex Section Remote Defect Indicator. **Implementation**: The STM-4/1 TXPG module generates MS-RDI by continuously injecting a value of 110b into bits 6, 7, and 8 of the K2 byte. When MS-RDI insertion is turned off, a value of 100 is inserted into bits 6, 7, and 8 of the K2 byte.
AU-LOP	Administrative Unit Loss of Pointer. **Implementation**: TheSTM-4/1 TXPG module generates AU-LOP by continuously setting the H1 and H2 pointer bytes to 6B and 0F, respectively. When AU-LOP insertion is turned off, the H1 and H2 pointer bytes are returned to the previous pointer values.
AU-AIS	Administrative Unit Alarm Indication Signal. **Implementation**: The STM-4/1 TXPG module generates AU-AIS by continuously inserting all ones into the H1, H2, and H3 bytes, path overhead, and all of the AU. When AU-AIS insertion is turned off, the original overhead values are restored, along with the data patterns.
HP-RDI	High-Order Path Remote Defect Indicator. **Implementation**: The STM-4/1 TXPG module generates HP-RDI by setting bit 5 of the G1 byte to 1. When HP-RDI insertion is turned off, bit 5 of the G1 byte is set to 0.

STM Line/ Path Alarms	Description
HP-UNEQ	High-Order Path Unequipped. **Implementation**: STM-4/1 TXPG module generates HP-UNEQ by setting the C2 byte to zero (0). When HP-UNEQ insertion is turned off, the previous C2 byte value is restored.
LSS	Loss of Sequence Sync. **Implementation**: The STM-4/1 TXPG module generates LSS by continuously sending a pattern that differs from the expected pattern. If the expected pattern is PRBS 2^20, a PRBS 2^23 pattern is transmitted. For all other patterns, a PRBS 2^20 pattern is transmitted. When LSS insertion is turned off, the expected pattern is transmitted.

SCPI Examples:

```
PMOD(@6):SOUR:ALAR  OFF
PMOD(@6):SOUR:ALAR  MSA
PMOD(@6):SOUR:ALAR  MSRC
PMOD(@6):SOUR:ALAR  AUL
PMOD(@6):SOUR:ALAR  AUA
PMOD(@6):SOUR:ALAR  HPUN
PMOD(@6):SOUR:ALAR  LSS
```

Errors

The **Errors** setting controls the type of error that is inserted into the transmit stream. Whenever the Error setting is modified, the Error Rate setting is always reset to Off.

Note If Backplane is selected as the Transmit Source, error injection on the payload module is not available.

Settings	Description
MS-REI	Multiplex Section Remote Error Indicator Inserts error counts in the M1 byte.
B3	Inserts B3 errors.
HP-REI	High order Path Remote Error Indicator Insert error counts in the G1 byte (bits 1 to 4).
TSE	Test Sequence Errors Inserts errors into the bits of the payload so that the transmitted payload does not match the expected pattern.

SCPI Examples:

```
PMOD(@6):SOUR:ERR:TYPE  MSR
PMOD(@6):SOUR:ERR:TYPE  B3
PMOD(@6):SOUR:ERR:TYPE  HPR
PMOD(@6):SOUR:ERR:TYPE  TSE
```

Error Rate

The Error Rate setting enables and disables error insertion and controls the rate at which errors are inserted into the stream.

The Error Rate setting is always reset to OFF whenever the Error Type is changed.

Error Rate Setting	Description
Off	Disables error insertion. This is the default setting in the factory configuration.
IE-3 through IE-9	Set the error insertion ratio to 10 x 10^-3, 10 x 10^-4, etc. The IE-3 setting does not apply to B3 and HP-REI errors.
All	Inserts errors into all bits in the B3 BIP-8, MS-REI or HP-REI bytes. This mode does not apply to TSE errors.
Single	Inserts a single error. Error Rate must be set to Off to enable single error insertion.

SCPI Examples:
`PMOD(@6):SOUR:ERR:RAT OFF`
`PMOD(@6):SOUR:ERR:RAT SING`
`PMOD(@6):SOUR:ERR:RAT RIE-4`	

J0 Trace Message

Create and insert a user-defined regenerator section J0 trace message.

Note The J0 trace message cannot be modified when the Transmit Source is set to Backplane. In the factory configuration, the default setting is off.

1 Click **Insert**.

2 Enter a trace message.

Note Messages can be no longer than 15 characters.

3 Click **Set** to apply the changes.

If you do not click **Set**, the modified message is not inserted.

To enable J0 trace and insert a trace message using SCPI, use commands similar to the following:

```
PMOD(@6):SOUR:DATA:SECT:TREN ON
PMOD(@6):SOUR:DATA:SECT:TRAC “My J0 trace msg”
```

Note When using SCPI, you must enclose the message in quotation marks. Otherwise, only the characters before the first space are used as the trace message.

J1 Trace Message

Create and insert a user-defined path J1 trace message.

Note The J1 trace message cannot be modified when the Transmit Source is set to Backplane. In the factory configuration, the default setting is off.

1 Click **Insert**.

2 Click **62 char. message** to insert a message with 62 characters.

3 Enter the trace message.

Note Messages can be no longer than 15 characters unless **62 char. message** is checked.

4 Click **Set** to apply the changes.

If you do not click **Set**, the modified message is not inserted.

To enable J1 trace and insert a trace message using SCPI, use a pair of commands similar to the following:

```
PMOD(@6):SOUR:DATA:PATH:TREN ON
PMOD(@6):SOUR:DATA:PATH:TRL 64
PMOD(@6):SOUR:DATA:PATH:TRAC “J1 trace
msg”
```

Note When using SCPI, you must enclose the message in quotation marks. Otherwise, only the characters before the first space are used as the trace message.

Pointer

Use the Pointer settings to move or set the value of the payload pointer.

Note The AU pointer cannot be modified when the Transmit Source is set to Backplane.

Pointer Settings	Description
Value	Manually set the pointer. Enter an integer value from 0 to 782. The value entered is displayed as a hexadecimal number.
Set	You must click **Set** to apply the change to the pointer value entered in the **Value** field.
Move	Move pointer with the New Data Flag (bits 1 to 4 of the H1 overhead byte). This causes a large change to the pointer value, and the NDF flag in the H1 overhead byte is updated appropriately. The moves alternate between increment and decrement.
Move w/o NDF	Move pointer without the New Data Flag. This causes a large change in the pointer value without the appropriate NDF indication in the H1 overhead byte. The moves alternate between increment and decrement.
Increment Decrement	Increment or decrement the AU pointer value by 1.

SCPI Examples:

```
PMOD(@6):SOUR:POIN:VAL  574
PMOD(@6):SOUR:POIN:ACT  INCR
PMOD(@6):SOUR:POIN:ACT  DECR
PMOD(@6):SOUR:POIN:ACT  NDF
PMOD(@6):SOUR:POIN:ACT  MNDF
```

Data Pattern

The Data Pattern setting selects the type of pattern to place into the generated payload.

Settings	Description
PRBS 2^15-1 **PRBS 2^20-1** **PRBS 2^23-1** **Inv. PRBS 2^23-1** **Inv. PRBS 2^20-1** **Inv. PRBS 2^15-1**	Pseudo-random bit sequence (PRBS) patterns and inverted PRBS patterns. The default setting is PRBS 2^23-1
1111	All Ones.
0000	All Zeroes.
0101	Alternating zero-ones (0b01010101) pattern.
1010	Alternating one-zeros (0b10101010) pattern.
User	8-bit binary user-defined payload pattern.
Set	If a custom user-defined payload pattern is defined, click **Set** to apply the changed user payload pattern.

SCPI Examples:

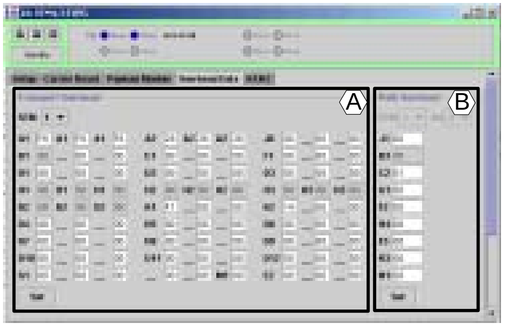
```
PMOD(@6):SOUR:PAYL:PATT:TYPE PR215
PMOD(@6):SOUR:PAYL:PATT:TYPE PR220
PMOD(@6):SOUR:PAYL:PATT:TYPE IPR223
PMOD(@6):SOUR:PAYL:PATT:TYPE USER
PMOD(@6):SOUR:PAYL:PATT:USER 0b00010001
```

Overhead Data (TXPG)

The **Overhead Data** tab provides options for modifying individual path and transport overhead data values for a given time slot.

The following figure shows the main features of the **Overhead Data** tab.

Note Overhead data cannot be modified when the Transmit Source is set to Backplane.



A **Transport Overhead**—Set transport overhead byte values for the selected STM-1 channel, as described in “Transport Overhead Data” on page 472.

B **Path Overhead**—Set path overhead byte values for the selected STM channel and AU, as described in “STM Path Overhead Data” on page 474.

Transport Overhead Data

The Transport Overhead area shows all three bytes where applicable.

Perform the following steps to modify specific transport overhead bytes for a specific time slot in the internally generated virtual container.

1 Select an STM channel (time slot).
2 Enter hexadecimal values.
3 Click **Set** to apply the changes.

The following notes apply to modifying transport overhead bytes:

- Overhead bytes that cannot be modified are indicated with “XX” greyed out in the user interface.
- The B1 and B2 bytes can only be modified through the B1 and B2 error insertion, as described in “Errors” on page 464.

Settings	Description
STM	Select the STM in the internally generated payload for which you want to modify transport overhead bytes. The number of STM time slots is either 1 or 4, depending on whether the output signal rate is STM-1 or STM-4.
A1, A2	Section overhead framing bytes. Modifying A1 and A2 bytes causes receivers to lose framing.
C1 (J0)	Formerly C1 (STM-1 ID), now redefined as the J0 section trace byte. Modifying J0 in STM-1, AU 1only takes effect if J0 section trace insertion is disabled.
E1	Orderwire section byte located in first STM-1 of an STM-N.
F1	Section user channel byte located in first STM-1 of an STM-N.
D1, D2, D3	Section data communication channel bytes located in first STM-1 of an STM-N.
K1, K2	APS channel bytes. Modifying the K1 and K2 bytes is possible through this interface, but to ensure proper K1 and K2 updates, use the K1/K2 interface on the **Payload Module** tab. Enabling alarms (MS-RDI, AU-AIS) override changes to K2.
H1, H2	SPE payload pointer bytes.
H3	SPE pointer action byte.
D4 through D12	Line data communications channel bytes.
S1	Synchronization status byte.
M1	Line Remote Error Indicator (Line REI) byte. Modifying M1 of STM-1 does not override enabled error injection of MS-REI.
E2	Express orderwire byte.
Set	You must click **Set** to apply any changes to the transport overhead byte values.

Settings	Description
SCPI Examples:	
	pmod(@13):sour:data:tran:over[1]:ord 1 1 0x11
	pmod(@13):sour:data:tran:over[1]:ord 1 2 0x11
	pmod(@13):sour:data:tran:over[1]:ord 1 3 0x11
	pmod(@13):sour:data:tran:over[1]:ord 1 6 0x22
	pmod(@13):sour:data:tran:over[1]:ord 2 3 0x10

STM Path Overhead Data

Perform the following steps to modify specific path overhead bytes for a specific STM and AU in the internally generated signal.

1 Select a channel.

Note STM and AU selections are only available when the VC-n is set to Selected, as described in “VC-n” on page 467.

2 Enter hexadecimal values for the appropriate fields.

3 Click **Set** to apply the changes to the STS path overhead bytes for the selected time slot.

The following notes apply to modifying STS path overhead bytes:

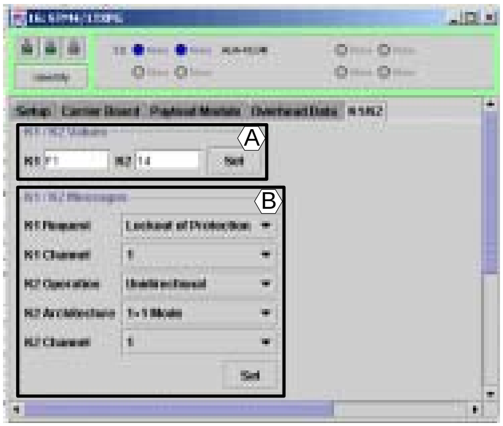
- Overhead bytes that cannot be modified are indicated with “XX” greyed out in the user interface.
- The B3 byte cannot be modified using this interface. See “Errors” on page 469.

Settings	Description
STM and AU	Select the time slot in the internally generated STM and AU for which you want to modify path overhead bytes If the output signal rate is STM-4 and the AU mapping is set to AU-4 or AU-3, select 1 of 4 STM time slots. Otherwise, there is only 1 STM time slot.
J1	STM path trace byte. Modifying J1 only takes effect if J1 path trace message insertion is disabled, as described in “J1 Trace Message” on page 470.
C2	STM path signal label.
G1	Path terminating status byte. Modifying G1 does not override an enabled alarm (HP-RDI) or enabled error injection on HP-REI.
F2	Path user channel byte.
H4	Indicator allocated for use as a mapping-specific indicator byte.
Z3, Z4	Allocated for future growth.
Z5	Tandem connection byte.
Set	You must click **Set** to apply any changes to the transport overhead byte values.

Settings	Description
SCPI Examples:	
`pmod(@13):sour:data:path:over:ord 1 0x11`	
`pmod(@13):sour:data:path:over:ord 3 0x01`	
`pmod(@13):sour:data:path:over:ord 4 0x11`	
`pmod(@13):sour:data:path:over:ord 5 0x11`	
`pmod(@13):sour:data:path:over:ord 6 0x11`	
`pmod(@13):sour:data:path:over:ord 7 0x11`	
`pmod(@13):sour:data:path:over:ord 8 0x11`	
`pmod(@13):sour:data:path:over:ord 9 0x11`	

K1/K2 Settings (TXPG)

The following figure shows the main features of the **K1/K2** tab for the STM-4/1 TXPG module.



A **K1/K2 Values**—Directly set K1/K2 hexadecimal values.

B **K1/K2 Messages**—Set K1/K2 bits to encode APS (automated protection switching) channel messages.

The following sections describe these settings in more detail.

K1/K2 Values

Use the K1/K2 Values settings to directly set values in the K1and K2 bytes. As you modify K1/K2 values, the K1/K2 Message setting fields are updated appropriately.

K1/K2 Value Settings	Description
K1	The default value is F1. Bits 1 through 4 control the request message, and bits 5 through 8 control the channel message code.
K2	The default value is 14. Bits 1 through 4 of the K2 byte control the channel number, bit 5 controls the architecture, and bits 6 thorough 8 indicate the mode of operation.
Set	You must click **Set** to update and transmit new K1/K2 values entered here.
SCPI Examples: `PMOD(@6):SOUR:APS:K1K2 0xF2,0x14`	
Related Topics: “J0 Trace Message” on page 470	

K1/K2 Messages

Use the fields in the K1/K2 message panel to set K1 and K2 bits to generate APS (automated protection switching) channel messages.

As you set K1/K2 message fields, the hexadecimal values displayed in the **K1/K2 Values** field update accordingly.

K1/K2 Message Settings	Description
K1 Request	Sets bits 1 through 4 of K1 with one of the following request messages.
	Lockout of Protection. Sets bits 1 through 4 to 1111.
	Forced Switch. Sets bits 1 through 4 to 1110.
	SF - High Priority. Sets bits 1 through 4 to 1101.
	SF - Low Priority. Sets bits 1 through 4 to 1100.
	SD - High Priority. Sets bits 1 through 4 to 1011.
	SD - Low Priority. Sets bits 1 through 4 to 1010.
	Manual Switch. Sets bits 1 through 4 to 1000.
	Wait-to-Restore. Sets bits 1 through 4 to 0110.
	Exercise. Sets bits 1 through 4 to 0100.
	Revert Request. Sets bits 1 through 4 to 0100
	Do Not Revert. Sets bits 1 through 4 to 0001
	No Request — Sets bits 1 through 4 to 0000.
K1 Channel	Selects the channel to apply the requesting message (sets bits 5 through 8 of K1 with the channel message code): • 0 selects the Null channel. • 1 through 14 — Channel 1 through 14. • 15 — Extra traffic channel.
K2 Operation	Sets the operational mode of the APS. Bits 6 through 8 of the K2 byte carry this information. **Unidirectional**. Sets bits 6 to 8 to 100. **Bidirectional**. Sets bits 6 to 8 to 101.
K2 Architecture	Sets the architecture mode for the APS. Bit 5 of K2 carries this information. **Architecture 1+1**. Sets bit 5 to 0. **Architecture 1:n**. Sets bit 5 to 1.

K1/K2 Message Settings	Description
K2 Channel	Selects the channel to apply the requesting message (sets bits 1through 4 of K1 with the channel message code): **0**. Null channel. **1** to **14**. Channel 1 to 14. **15**. Extra traffic channel.
Set	You must click **Set** to update and apply the K1/K2 Message settings.
SCPI Examples:	

```
pmod(@10):sour:aps:k1en:req lops
pmod(@10):sour:aps:k1en:chan 1
pmod(@10):sour:aps:k2en:arch a1_1
pmod(@10):sour:aps:k2en:oper unid
pmod(@10):sour:aps:k2en:chan 1
pmod(@10):sour:aps:upd
```

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STM-16 Receiver Window

The topics in this section explain set-up and monitoring options and monitored performance data for the STM-16 Receiver:

Instructions are provided for using EPXam to configure the module, along with SCPI equivalents.

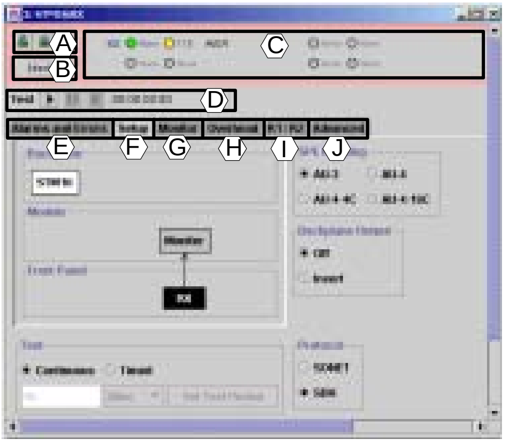
Tip STM-16 Receivers can be switched between SONET and SDH functionality. See “Protocol” on page 483 and “Using the SONET/SDH Switcher” on page 121.

See “OC-48 Receiver Window” on page 337 for a description of the features and user interface for this module in SONET protocol mode.

For more information about EPXam, see “Using EPXam” on page 3.

Main View

The following figure illustrates the main features of the STM-16 Receiver window.



A Save or restore custom module/slot configuration; restore factory defaults. See “Using Module Window Save and Restore Controls” on page 108.

B **Identify**—When pressed, it flashes the Active LED on the front panel of the module associated with this window

C View summary defect status, alarm indicators, and other module information. See “Expanded Logical View Indicators” on page 8.

D Start, stop, pause, or resume test; view elapsed time. See “Using Module Window Test Controls” on page 118.

E **Alarms and Errors**—View alarm indicators, error counts, error ratios, and service disruption data for current test. See “Alarms and Errors” on page 484 and “Service Disruption Monitoring” on page 487.

F **Setup**—Configure payload mapping, backplane enable or disable, test type, and duration, and set the protocol (either SONET or SDH). See “Setup” on page 481.

G **Monitor**—Monitor SPE pointer values and pointer event counts, set the type of payload data pattern to monitor, and monitor J0 and J1 trace messages. See “Monitor Settings” on page 490.

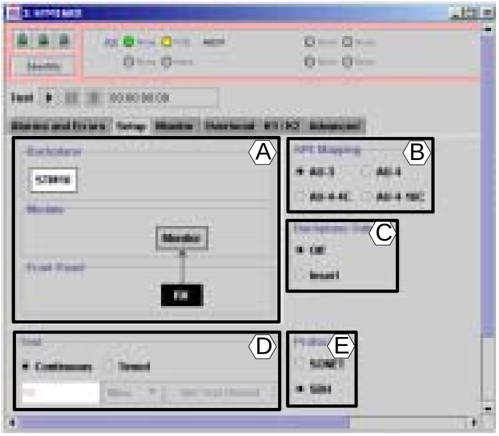
H **Overhead Data**—Monitor individual overhead byte values for a selected channel. See “Overhead Data” on page 494.

I **K1/K2**—Monitor K1 and K2 byte values and decoded APS channel messages. “K1/K2 Settings” on page 496.

J **Advanced**—Specify error filter options, and whether the received K1/K2 values are broadcast to an STM-16 module in the adjacent, higher-numbered slot. See “Advanced Settings” on page 498.

Setup

The following figure illustrates the settings that are configured on the **Setup** tab.



A View graphic display of current signal source and backplane output settings.

B **SPE Mapping**—Set the expected size and mapping of the monitored virtual container (VC). See “SPE Mapping” on page 481.

C **Backplane Output**—Specify whether the incoming signal on the STM-16 RX front panel is passed through to the backplane or the backplane signal is unchanged (bypass). See “Backplane Output” on page 482.

D **Test**—Set the test type and duration. See “Test” on page 482.

E **Protocol**—Switch the module protocol between SONET and SDH. See “Protocol” on page 483.

SPE Mapping

The SPE Mapping option sets the expected virtual container (VC) size and mapping for the monitored signal. This setting affects STM and AU selection in the Monitor and Overhead tabs.

SPE Mapping	Description
AU3	Selects an AU-4 sized payload.
AU4	Selects an AU-4 sized payload.
AU-4-4c	Selects an AU-4-4c sized payload. Selecting this option can force updates to STM and AU selections.
AU-4-16c	Selects an AU-4-16c sized payload. Selecting this option can force updates to STM and AU selections. This is the default setting in the factory configuration.

SCPI Examples:

```
SENS(@7):DATA:SIZE AU3
SENS(@7):DATA:SIZE AU4
SENS(@7):DATA:SIZE AU44C
SENS(@7):DATA:SIZE AU416C
```

Related Topics:

“STM and AU” on page 491

“Path Overhead” on page 495

Backplane Output

The Backplane Output setting determines whether the data from the front panel connector is sent to the backplane or the backplane signal is unchanged.

The graphic display of the current backplane setting, backplane signal, and signal path are updated when you change these settings.

Note Modules must be installed contiguously to transmit and receive signals along with backplane.

Setting	Description
Off	The incoming STM-16 signal is not passed through to the backplane, and the signal on the backplane is not modified. This is the default setting in the factory configuration.
Insert	The incoming STM-16 signal is inserted onto the backplane. This enables the STM-16 TX module in the adjacent slot to the right of the receiver to use the signal from the backplane as its transmit source.

SCPI Examples:
`SENS(@7):DATA:BACK ENAB 1`
`SENS(@7):DATA:BACK ENAB 0`	

Test

The Test area defines the type and duration of the test that the receiver runs. To start and stop tests, use the controls in the module window or, to start tests for multiple modules, use the Test Controls window. See “Controlling Tests” on page 115.

Note Selecting a new test type automatically stops the current test.

Test Setting	Description
Continuous	Selects a continuous test that must be manually stopped and started.
Timed	Selects a timed test. When Timed is selected: **1** Specify a number and select a unit (seconds, minutes, hours, and days) for the test duration. **2** Click **Set** to apply the settings. **3** Use the controls at the top of the window to start the test.

SCPI Examples:
`sens(@3):test:type cont`
`sens(@3):test:type tim`
`sens(@3):test:unit min`
`sens(@3):test:per 10`
To control tests use the following commands:
`sens(@3):test:mode star`
`sens(@3):test:mode stop`
`sens(@3):test:mode rest`
`sens(@3):test:mode pause`
Related Topics:
“Logging” on page 63
“Controlling Tests” on page 115	

Protocol

The Protocol setting switches the module between SONET and SDH. When the switch is complete, EPXam displays the appropriate protocol configuration options and field labels for the module and updates all references to the module to use the correct protocol.

Note Switching between SONET and SDH protocol does *not* require a restart of the test system or EPXam.

Restrictions:

- Modules that are locked via the Group Manager cannot be switched by other users.
- Active test and logging sessions associated with a module at the time of a switch are cancelled.

  If tests or logging sessions are in progress on any of the modules being switched, a warning dialog is displayed. Click **Cancel** to abort the switch or **Continue** to complete the switch. If you choose **Continue**, running tests and logging sessions are cancelled. Otherwise, a dialog opens that displays the switching progress.

Setting	Description
SONET	Switches the module to SONET without restarting the test system or EPXam. This is the default setting in the factory configuration.
SDH	Switches the module to SDH without restarting the test system or EPXam.

SCPI Examples:

```
SYST:BOAR(@7):PROT:TYPE SON
SYST:BOAR(@7):PROT:TYPE SDH
SYST:BOAR(@7):PROT:STAT?
```

See “OC-48 Receiver Window” on page 337 for a description of this module’s SDH features and configuration.

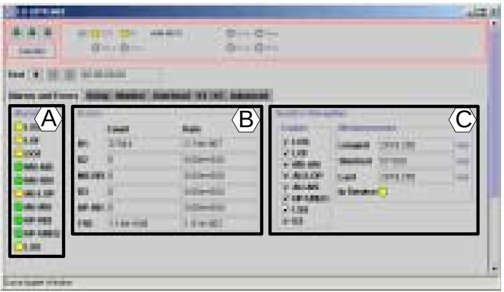
See the following topics for more information about SONET/SDH switching:

- “Using the SONET/SDH Switcher” on page 121
- “SONET/SDH Switching and Custom Configuration Files” on page 123
- “Switching Modules Using SCPI” on page 123

Alarms and Errors

The **Alarms and Errors** tab displays alarm status indicators, error counts, and error ratios for the current test.

The following figure shows the main features of the STM-16 Receiver **Alarms and Errors** tab.



A **Alarms**—Alarm status indicators for current test. See “Alarms” on page 484.

B **Errors**—Error counts and error ratios for current test. See “Errors” on page 486.

C **Service Disruption**—Service disruption data for current test. See “Service Disruption Monitoring” on page 487.

Alarms

The Alarm area displays status indicators for the current test.

Alarm indicator colors are defined below.

Note If the status indicator for an alarm is grey, that type of alarm is not available for monitoring.

Green	Yellow	Red
No alarms are detected: signal is clear or monitoring is not started.	Alarm history: an alarm was detected but is not active in the current test.	An alarm is active and currently detected on the monitored signal.

The following alarms are monitored.

Alarm Indicator	Description
LOS	Loss of Signal An LOS alarm condition is declared either when a received signal with an all-zeroes pattern has insufficient data bit transitions or when the as received clock cannot be recovered from the received signal because the optical power is insufficient. LOS ends when a received signal has a minimum optical power and data bit transitions so that the as received clocked can be recovered, and two consecutive valid frame alignment patterns occur without LOS defects.
LOF	Loss of Frame LOF is declared when the OOF state exists for 3 ms. LOF is cleared when an in-frame condition exists continuously for 3 ms.
OOF	Out-of-Frame The STM-16 Receiver declares OOF when 4 consecutive SDH frames are received with invalid (errored) framing patterns (A1 and A2 bytes). OOF is cleared when two consecutive SDH frames are received with valid framing patterns.

Alarm Indicator	Description
MS-AIS	Multiplex Section Alarm Indication Signal MS-AIS is declared when the STM-1, excluding the Regenerator Section Overhead (RSOH), is all ones. MS-AIS is cleared when the above condition is not met.
MS-RDI	Multiplex Section - Remote Defect Indicator MS-RDI is declared when bits 6, 7, and 8 of the K2 byte (before scrambling) are set to 110b. MS-RDI is cleared when bits 6,7,and 8 of the K2 byte are not set to 110b.
AU-LOP	Administrative Unit Loss of Pointer AU-LOP is declared when 10 consecutive invalid pointers are received. AU-LOP state is cleared when three equal valid pointers or three consecutive AIS indications are received.
AU-AIS	Administrative Unit - Alarm Indication Signal AU-AIS is declared when the AU, including the AU pointer, is all ones. AU-AIS is cleared when the above condition is not met.

Alarm Indicator	Description
HP-RDI	Higher order - Path Remote Defect Indicator HP-RDI is declared when bit 5 of the G1 path overhead byte is set to 1 for 5 consecutive frames. HP-RDI is cleared when bit 5 of the G1 path overhead byte is set to 0.
HP-UNEQ	Higher order - Path Unequipped HP-UNEQ is declared when the C2 byte is set to zero for 5 consecutive frames. HP-UNEQ is cleared when the C2 byte is non-zero.
LSS	Loss of Sequence Synchronization. LSS is declared when the received bit error rate is too high (at least one in three consecutive 128-bit sequences), indicating that a selected pattern cannot be matched for the received payload. LSS terminates when no errors in three consecutive payload patterns are detected.

SCPI Examples:
`SENS(@3):ALAR OOF?`
`SENS(@3):ALAR MSA?`
`SENS(@3):ALAR MSRD?`
`SENS(@3):ALAR AUL?`
`SENS(@3):ALAR LSS?`
`SENS(@3):ALAR HPRD?`
`SENS(@3):ALAR LOF?`
`SENS(@3):ALAR HPUN?`	

Errors

The Errors area displays error counts and ratios for the current test.

The error data is cumulative. To get data for intervals, see “Logging” on page 63. Once a test is restarted, the error history is cleared.

Error Type or Setting	Description
B1	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B1 section parity byte. Only in framed mode.
B2	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B2 line parity byte. Only in framed mode.
MS-REI	The Multiplex Section Remote Error Indicator error is declared when the M1 byte has a non-zero value. A maximum of 255 errors are reported per frame.
B3	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B3 path parity byte. Only in framed mode.

Error Type or Setting	Description
HP-REI	The High-Order Path Remote Error Indicator error is declared when bits 1-4 of the G1 byte have a non-zero value. A maximum of eight errors are reported per frame.
TSE (Payload)	This error is declared when the payload pattern of the received signal does not match the pattern selected.
Count	Number of errors of the specified type detected in the current test.
Rate	Computed error ratio for the specified error type for the current test.
SCPI Examples: SENS(@18):ERR:COUN:B1ER? SENS(@18):ERR:RAT:B1ER? SENS(@18):ERR:COUN:B2ER? SENS(@18):ERR:RAT:B2ER? SENS(@18):ERR:COUN:B3ER? SENS(@18):ERR:RAT:B3ER? SENS(@18):ERR:COUN:TSE? SENS(@18):ERR:RAT:TSE? SENS(@18):ERR:COUN:MSR? SENS(@18):ERR:RAT:MSR? SENS(@18):ERR:COUN:HPR? SENS(@18):ERR:RAT:HPR?	

Service Disruption Monitoring

The **Service Disruption** tab displays In-Service status and the time, in milliseconds of the longest, shortest, and most recent service disruptions detected during the current test. This tab also provides controls for selectively enabling alarms for service disruption monitoring.

- "Service Disruption Detection" on page 487
- "Service Disruption Limitations" on page 488
- "Controls, Measurements, and Indicators" on page 488

SERVICE DISRUPTION DETECTION

A service disruption condition is detected when one or more of the following alarms that are enabled for service disruption monitoring are detected in the monitored signal.

- LOS—Loss of Signal
- LOF—Loss of Frame
- MS-AIS—Multiplex Section - Alarm Indicator Signal
- AU-LOP—Administrative Unit - Path Loss of Pointer
- AU-AIS—Administrative Unit - Alarm Indicator Signal
- HP-UNEQ—High-order Path - Unequipped
- LSS—Loss of sequence synchronization.
- B3 (Path CV)—Path code violation

A Path CV alarm condition is detected when there are 4 consecutive frames containing Path CV (B3) errors. The Path CV alarm condition is cleared when there are 4 consecutive frames without Path CV (B3) errors.

See “Alarms” on page 484 for a description of these alarms.

Service disruption alarm states are updated at each SONET/SDH frame, or once every 125 microseconds. The service disruption condition is cleared when none of the above conditions are present in the monitored signal.

SERVICE DISRUPTION LIMITATIONS

The following limitations apply to service disruption monitoring on the STM-16 Receiver:

- When multiple alarms are enabled, the last and longest service disruption measurements start with the first detected alarm and end with the last detected alarm. The start and end alarms may not be the same type.
- Service disruption tests must start with a clear signal with no alarms or errors.
  - Start a test.
  - Enable service disruption for the desired alarm(s).
  - Inject alarms.
- An AU-LOP alarm may not cause a service disruption in the default service disruption configuration, in which only LSS (Loss of Pattern Sync) is enabled. AU-LOP (Loss of Pointer) must be enabled to guarantee service disruption for AU-LOP-only alarms.
- The service disruption time limit is 15 minutes. Longer disruptions will produce false measurements.
- Event counter overflow can occur when multiple alarms are enabled for service disruption monitoring and a major alarm, such as LOF, is bouncing. Overflow is indicated when 'Last' displays 9,999,999.000 mS. Limit the number of alarms that are enabled to reduce the chance of an overflow.

CONTROLS, MEASUREMENTS, AND INDICATORS

Service disruption alarm enable controls, measurements, and indicators are described in the following table.

Setting or Field	Description
Enable	When the Enable box for a type of alarm is checked, a service disruption event is triggered when that alarm is detected and service disruption measurement begins. This is how you specify which types of alarms are monitored for service disruption. To disable service disruption monitoring, uncheck the boxes for all alarm types. By default, all alarms are enabled for service disruption monitoring.
Measurement	The following service disruption measurement statistics are displayed: • **Longest**—Time, in milliseconds, of the longest service disruption period for the current test. • **Shortest**—Time, in milliseconds, of the shortest disruption period for the current test. • **Last**—Time, in milliseconds, of the most recent service disruption that occurred during the current test.

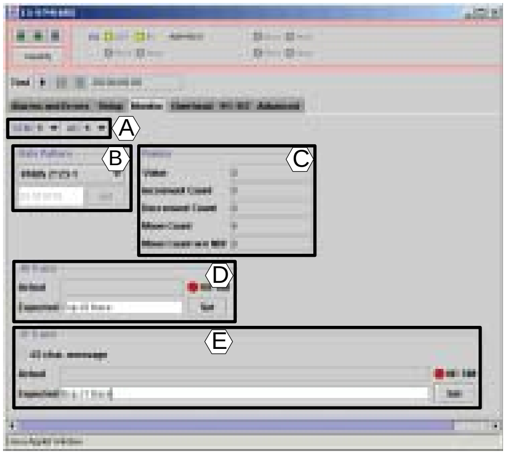
Setting or Field	Description
In-Service Indicator	The In-Service indicator colors are interpreted as follows: • **Green**—No service disruptions have occurred since the last test restart. • **Red**—A service disruption condition is present in the current test. • **Yellow**—At least one service disruption was detected since the last test restart, but none is currently detected.

Setting or Field	Description

SCPI Examples:
To monitor service disruption data:
`SENS(@6):DISR:LONG ?`
`SENS(@6):DISR:SHOR ?`
`SENS(@6):DISR:LAST ?`
`SENS(@6):DISR:INS ?`
To subscribe to service disruption events:
`SUBS(@6)SENS:DISR:ALL 1`
To unsubscribe to service disruption events:
`SUBS(@6)SENS:DISR:ALL 0`
To disable service disruption monitoring:
`SENS(@6):DISR ENAB OFF`
To enable service disruption monitoring and specify which alarms trigger service disruption events, use the `SENS(@1:18):DISR:ENAB` command and specify a list of alarms to enable. Each instance of this command overwrites the previous setting.
Separate alarms in the list with semi-colons and do not include any spaces in the list. Valid values for the alarm parameter list are `LOF`, `MSA`, `AUL`, `AUA`, `HPUN`, `LSS`, and `B3`. For example, the following command specifies that only AU-AIS and MS-AIS alarms trigger service disruption events.
`SENS(@6):DISR:ENAB MSA;AUA`
To update the alarm enable setting, reissue the `SENS(@1:18):DISR:ENAB` command with a new alarm parameter list.	

Monitor Settings

The following figure illustrates the main features of the STM-16 RX **Monitor** tab. These settings are described in more detail in the the following sections.



A **STM and AU**—Select an STM and AU to monitor. See “STM and AU” on page 491.

B **Data Pattern**—Select a payload data pattern or specify a custom payload data pattern to monitor in the received payload. See “Data Pattern” on page 491.

C **Pointer**—Monitor pointer values and event counts. See “Pointer” on page 492.

D **J0 Trace**—Monitor J0 section trace message, set expected J0 trace message, and view RS-TIM alarm status. See “J0 Trace” on page 493

E **J1 Trace**—Monitor J1 section trace message, set expected J1 trace message, and view HP-TIM alarm status. See “J1 Trace” on page 493.

STM and AU

The STM and AU settings determines which STM channel and Administrative Unit (AU) time slot is monitored. Available STM and AU selections depend on the currently selected SPE mapping.

<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td>STM</td><td>Select the STM to monitor in the received payload. This field is linked to the SPE field in the Overhead tab.

The number of STM channels depends on the setting for the SPE mapping (SPE size). Channel 1 is the default in the factory configuration.
If the mapping is AU-3 or AU-4, select 1 of 16.
If the mapping is AU-4-4c, select 1 of 4.
If the mapping is AU-4-16c, there is only 1 STM.</td></tr>
<tr><td>AU</td><td>Select the number of the Administrative Unit (AU) time slot to monitor. The number of AUs depends on the currently selected AU Mapping.
If the AU size is AU-3, select 1 of 3. AU 1 is the default for the factory configuration.
Otherwise, there is only one AU.</td></tr>
</table>

<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td colspan="2">SCPI Examples:
<code>SENS(@6):DATA:STM 4</code>
<code>SENS(@6):DATA:AUN 2</code>
Related Topics:
“SPE Mapping” on page 481
“Path Overhead” on page 495</td></tr>
</table>

Data Pattern

The Payload Pattern selects the type of pattern to monitor in the generated payload.

<table>
<tr><th>Settings</th><th>Description</th></tr>
<tr><td>PRBS 2^15-1
PRBS 2^20-1
PRBS 2^23-1
Inv. PRBS 2^23-1
Inv. PRBS 2^20-1
Inv. PRBS 2^15-1</td><td>Pseudo random bit patterns. The default setting is PRBS 2^23-1</td></tr>
<tr><td>Live</td><td>Monitor payload pattern in live signal.</td></tr>
<tr><td>User</td><td>8-bit binary user-defined payload pattern.</td></tr>
<tr><td>Set</td><td>This selection is only available if User is selected as the payload pattern type.

If a custom user-defined payload pattern type is selected, enter a binary number for the pattern, then click Set to apply the changes to the user-defined payload pattern</td></tr>
</table>

Settings	Description
SCPI Examples: SENS(@6):PAYL:MON:PATT:TYPE PR215 SENS(@6):PAYL:MON:PATT:TYPE PR223 SENS(@6):PAYL:MON:PATT:TYPE IPR215 SENS(@6):PAYL:MON:PATT:TYPE LIVE SENS(@6):PAYL:MON:PATT:TYPE USER SENS(@3):PAYL:MON:PATT:USER 0b00110011	

Pointer

The Pointer area of the **Payload Module** tab displays AU pointer values and event counts.

AU pointer event counters are reset at the start of each test period.

Pointer Field	Description
Value	Displays the current value in hexadecimal of the administrative unit (AU) pointer. This value is what the hardware pointer processor interprets as the current pointer.
Increment Count	Number of AU pointer increment events since the last restart.
Decrement Count	Number of AU pointer decrement events since the last restart.
Move Count	Number of times the pointer generator moved to a new pointer value using the New Data Flag (bits 1 to 4 of the H1 pointer byte).
Move w/o NDF Count	Number of times the pointer generator moved to a new pointer value without the New Data Flag (missing NDF).
SCPI Examples: SENS(@6):POIN:VAL? SEMS(@6):POIN:COUN:INCR? SEMS(@6):POIN:COUN:DECR? SEMS(@6):POIN:COUN:NDF? SEMS(@6):POIN:COUN:MNDF?	

J0 Trace

The J0 Trace area displays the received J0 trace message, RS-TIM alarm status, and allows you to define and enable monitoring of the expected J0 trace message.

Field/ Indicator	Description
Actual	Displays the received 15-byte J0 section trace message.
Expected	Enter a 15-byte character string to be used as the expected trace message for the RS-TIM (Regenerator Section-Trace Identifier Mismatch) alarm.
Set	Click **Set** to enable monitoring of the expected J0 trace message.
RS-TIM Alarm Indicator	Displays the status of the Regenerator Section-Trace Identifier Mismatch (RS-TIM) alarm.
SCPI Examples: `SENS(@3):DATA:SECT:TRAC?` `SENS(@3):DATA:SECT:EXP “15-byte msg”` `SENS(@3):DATA:SECT:TIM?`	

J1 Trace

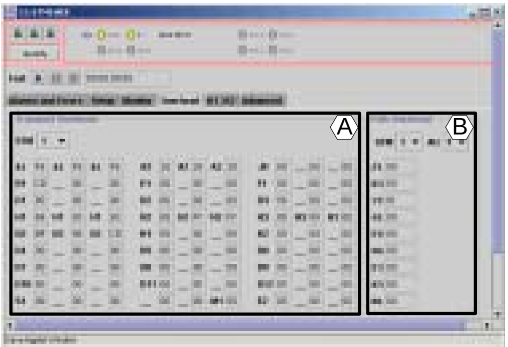
The J1 Trace area displays the received J1 trace message, HP-TIM alarm status, and enables you to define and enable monitoring of the expected J1 trace message.

Field/ Indicator	Description
62-char. Message	When checked, this selection enables 64-byte J1 trace message length. The default is disabled, which selects a 15-byte J1 trace message.
Actual	Displays the received 15 or 62-byte J1 trace message.
Expected	Enter a 15- or 62-byte character string to be used as the expected J1 trace message for the HP-TIM (High order Path Trace Identifier Mismatch) alarm. For a 64-byte message, two bytes are used for the newline and string terminator; for a 16-byte message, one byte is used for a CRC.
Set	Click **Set** to enable monitoring of the expected J1 trace message.
HP-TIM Alarm Indicator	Displays the status of the High order Path-Trace Identifier Mismatch (HP-TIM) alarm. **Green**—The actual message matches the expected message. **Red**—A mismatch is active. **Yellow**—A mismatch was detected during the current test but is not active.

Field/ Indicator	Description
SCPI Examples: SENS(@3):DATA:PATH:TRL 64 SENS(@3):DATA:PATH:EXP “J1 trace msg” SENS(@3):DATA:PATH:TRAC ? SENS(@3):DATA:PATH:TIM ?	

Overhead Data

The following figure shows the main features of the **Overhead** tab.



A View transport overhead data for all three AUs within the selected STM, as described in “Transport Overhead” on page 494.

B Select the STM and administrative unit (AU) time slot within the STM for which path overhead data is displayed, as described in “Path Overhead” on page 495.

Transport Overhead

The following table describes the STM Regenerator and Multiplex section overhead fields and values. Where applicable, values for all three AUs are displayed. "__" indicates that the overhead byte is not applicable for that AU.

Transport Overhead	Description
STM	Select 1 of 48 STS channels for which you want to view transport overhead bytes. Channel 1 is the default in the factory configuration.
A1, A2	Section overhead framing bytes.
B1	Regenerator Section BIP-8 parity check byte.
J0 (C1)	Formerly C1 (STS-1 ID), now redefined as the J0 section trace byte.
E1	Orderwire section byte located in first STS-1 of an STS-N.
F1	Section user channel byte located in first STS-1 of an STS-N.
D1, D2, D3	Section data communication channel bytes located in first STS-1 of an STS-N.
K1, K2	APS (automatic protection switching) channel bytes.
H1, H2	Payload pointer bytes.
H3	Pointer action byte.

Transport Overhead	Description
B2	Multiplex Section BIP-8 parity check byte.
D4 through D12	Line data communications channel bytes.
S1	Synchronization status byte.
M1	Line Remote Error Indicator (Line REI) byte in STS channel 7, (the 3rd byte in order of appearance).
E2	Express orderwire byte.
Z0, Z1, Z2	Allocated for future growth.

SCPI Examples:
Use the following command to query the values for bytes A1;A2;J0;B1;E1;F1;D1;D2;D3.
`SENS(@6):DATA:SECT:OVER:BYT?`
Use the following command to set the values for bytes H1;H2;H3;B2;K1;K2;D4;D5;D6;D7;D8;D9;D10;D11;D12;S1;M1;E2.
`SENS(@6):DATA:LINE:OVER:BYT?`	

Path Overhead

The following table describes path overhead bytes.

Path Overhead	Description
STM	Select the STM channel to monitor for path overhead. The number of available STMs depends on the currently selected SPE mapping.
AU	Selects the administrative unit (AU) for which the path overhead data is displayed. Select 1 of 3 available AUs if the SPE mapping is set to AU-3. Otherwise, there is only 1 AU. AU 1 is the default in the factory configuration.
J1	STS path trace byte.
B3	Parity check byte.
C2	STS path signal label indicating the construction of the SPE.
G1	Path terminating status byte.
F2	Path user channel byte.
H4	Indicator allocated for use as a mapping-specific indicator byte.
F3	Path user channel byte for communication between path elements.
K3	APS signalling byte for VC-4/3.

Path Overhead	Description
N1	Network operator byte.
Z3, Z4	Allocated for future growth.
Z5	Tandem connection byte.

SCPI Examples:

Use the following command to set the values for bytes J1;B3;C2;G1;F2;H4;Z3;Z4;Z5.

```
SENS(@6):DATA:PATH:OVER:BYT?
```

For detailed information, see “Overhead” on page 602.

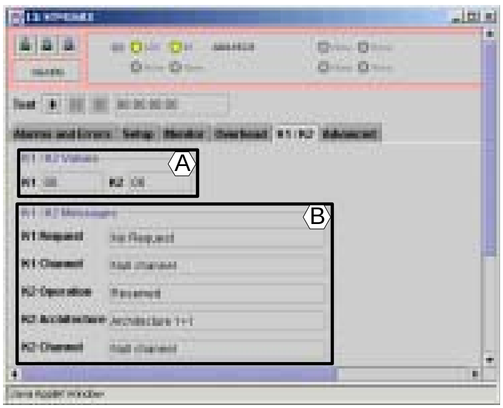
Related Topics:

“SPE Mapping” on page 481

“STM and AU” on page 491

K1/K2 Settings

The following figure shows the main features of the **K1/K2** tab.



A **K1/K2 Values**—Displays hexadecimal values of the K1 and K2 bytes. See “K1/K2 Values” on page 496.

B **K1/K2 Messages**—Displays automated protection switching (APS) channel messages decoded from the K1/K2 bytes. See “K1/K2 Values” on page 496.

K1/K2 Values

The K1/K2 Values field displays the hexadecimal values of the automated protection switching (APS) channel K1 and K2 bytes for the monitored signal.

Field/ Setting	Description
K1	Bits 1 through 4 contain the request message, and bits 5 through 8 control the channel message code.
K2	Bits 1 through 4 of the K2 byte contain the channel number, bit 5 specifies the architecture, and bits 6 thorough 8 indicate the mode of operation.

SCPI Examples:

```
SENS(@3):TRAN:APS:K1K2 ?
```

K1/K2 Messages

This field displays automated protection switching (APS) channel messages decoded from the K1/K2 bytes.

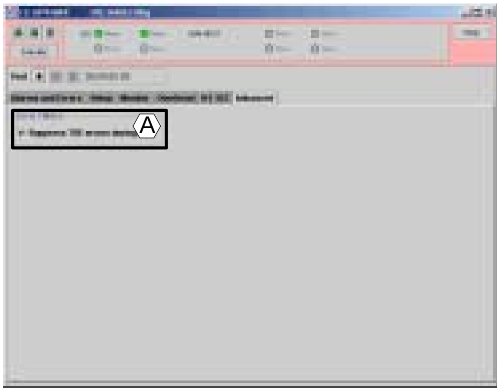
K1/K2 Messages	Description
K1 Request	Bits 1 through 4 of K1 can contain the following request messages. **Lockout of Protection**. Bits 1 through 4 have a value of 1111. **Forced Switch**. Bits 1 through 4 contain 1110. **SF - High Priority**. Bits 1 through 4 Have a value of 1101. **SF - Low Priority**. Bits 1 through 4 have a value of 1100. **SD - High Priority**. Bits 1 through 4 have a value of 1011. **SD - Low Priority**. Bits 1 through 4 have a value of 1010. **Manual Switch**. Bits 1 through 4 have a value of 1000. **Wait-to-Restore**. Bits 1 through 4 have a value of 0110. **Exercise**. Bits 1 through 4 have a value of 0100. **Revert Request**. Bits 1 through 4 have a value of 0100. **Do Not Revert**. Bits 1 through 4 have a value of 0001. **No Request** — Bits 1 through 4 have a value of 0000. This is the default setting in the factory configuration.

K1/K2 Messages	Description
K1 Channel	Channel selection for the requesting message (bits 5 through 8 of K1 carry the channel message code): **0**. Null channel. This setting is the default in the factory configuration. **1** to **14**. Channel 1 through 14. **15**. Extra traffic channel.
K2 Operation	Operational mode of the APS. Bits 6 through 8 of the K2 byte carry this information. **Unidirectional**. Bits 6 to 8 have a value of 100. This setting is the default in the factory configuration. **Bidirectional**. Bits 6 to 8 have a value of 101.
K2 Architecture	Architecture mode for the APS. Bit 5 of K2 carries this information. **Architecture 1+1**. Bit 5 is 0. This setting is the default in the factory configuration. **Architecture 1:n**. Bit 5 is 1.
K2 Channel	Channel selection for the requesting message (bits 1 through 4 of K2 carry the channel message code): **0**. Null channel. This setting is the default in the factory configuration. **1** to **14**. Channel 1 to 14. **15**. Extra traffic channel.

K1/K2 Messages	Description
SCPI Examples: SENS(@8):APS:K1D:REQ? SENS(@8):APS:K1D:CHAN? SENS(@8):APS:K2D:OPER? SENS(@8):APS:K2D:ARCH? SENS(@8):APS:K2D:CHAN?	

Advanced Settings

The following figure illustrates the settings that are configured on the STM-16 Receiver **Advanced** tab.



A **Error Filters**—Option for suppressing bit errors when LPS alarm is detected, as described in “Error Filters” on page 498.

Error Filters

Because TSE error counts can be high while an LSS alarm occurs, you can suppress, or filter, the bit error count.

Filter Setting	Description
Suppress TSE Errors	When checked, TSE errors are not counted when an LSS alarm is active. When unchecked, TSE errors are counted when an LSS alarm is active
SCPI Examples: SENS(@18):ALAR:IGN LSS OFF SENS(@18):ALAR:IGN LSS ON	

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STM-16 TRANSMITTER WINDOW

The topics in this section explain how to configure set-up options, alarm and error insertion, payload generation, and overhead data values for the STM-16 Transmitter.

- “Main View” on page 500
- “Setup” on page 501
- “Generate Settings” on page 504
- “Overhead Data” on page 511
- “K1/K2 Settings” on page 514

Instructions are provided for using EPXam to configure the module, along with SCPI equivalents.

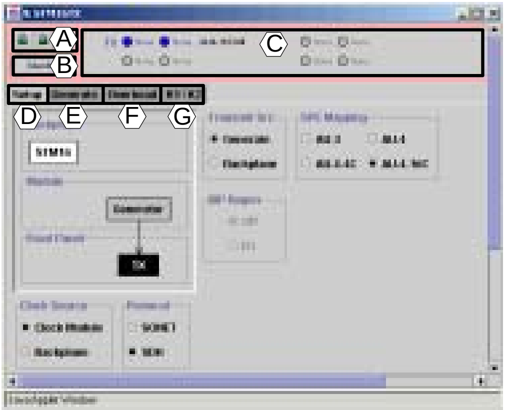
Tip STM-16 Transmitters can be switched between SONET and SDH functionality. See “Protocol” on page 503 and “Using the SONET/SDH Switcher” on page 121.

See “OC-48 Transmitter Window” on page 359 for a description of the features and user interface for this module in SONET protocol mode.

For more information about EPXam, see “Using EPXam” on page 3.

Main View

The following figure illustrates the main features of the STM-16 Transmitter window.



A Save and restore module/slot configuration or restore factory default settings. See "Using Module Window Save and Restore Controls" on page 108.

B **Identify**—When pressed, it flashes the Active front panel LED on the module associated with this window.

C View summary defect status, alarm indicators, and other module information. See "Expanded Logical View Indicators" on page 8 for more information.

D **Setup**—Configure clock source, transmit source, B1 byte regeneration, AU mapping or switch the module between SDH and SONET protocol. See "Setup" on page 501.

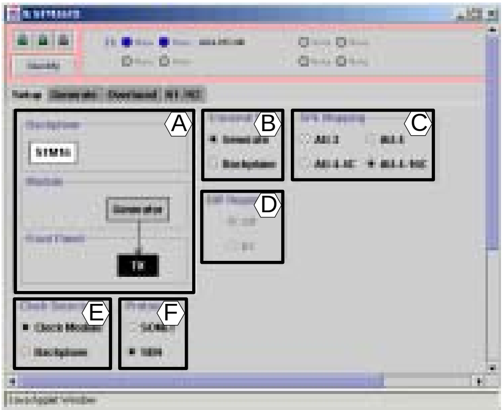
E **Generate**—Configure alarm and error insertion, enable and specify J1 and J0 trace messages, and manipulate pointer values. See "Generate Settings" on page 504.

F **Overhead**—View or modify transport and path overhead byte values in the generated signal. "Overhead Data" on page 511.

G **K1/K2**—Modify K1 and K2 byte values and specify APS channel message encoding. See "K1/K2 Settings" on page 514.

Setup

The following figure illustrates the main features of the STM-16 TX **Setup** tab.



A View graphic display of current module input/output configuration.

B **Transmit Source**—Select the source for the transmitted signal, either internally generated or input from the backplane. See “Transmit Source” on page 501.

C **SPE Mapping**—Set the expected size and mapping of the transmitted virtual container (VC). See “SPE Mapping” on page 502.

D **BIP Regen**—Controls B1 byte regeneration when the source for the STM-16 Transmitter is a signal received from the backplane. See “BIP Regen” on page 502.

E **Clock Source**—Select the clock source that provides the timing reference that is used to generate the SONET/SDH payload. See “Clock Source” on page 503.

F **Protocol**—Switch between SONET and SDH protocol. “Protocol” on page 503.

Transmit Source

The Transmit Source setting selects the source of the transmitted signal, either internally generated or as received from the backplane.

If Backplane is selected as the Transmit Source, the following conditions exist:

- Alarm injection is limited to LOS only.
- Error injection is limited to Physical errors or B1 errors (assuming B1 error injection is enabled via the BIP Regen setting).
- Overhead byte insertion, trace message insertion, K1/K2 byte manipulation and APS channel message encoding, pointer manipulation, and payload pattern modification are not available.

Setting	Description
Generate	The STM-16 tansmitter generates the signal to be transmitted. This is the default setting in the factory configuration.

Setting	Description
Backplane	The transmit source is a signal on the Test System backplane from the STM-16 Receiver installed in the adjacent slot to the left of the transmitter.

SCPI Examples:

```
SOUR(@7):DATA:SOUR  NORM
SOUR(@7):DATA:SOUR  BACK
SOUR(@7):DATA:SOUR  ?
```

SPE Mapping

The SPE Mapping option sets the expected virtual container (VC) size and mapping for the generated signal. This setting affects options for the STM and AU selections in the **Generate** and **Overhead** tabs. Changing the SPE Mapping also returns the VC-n selection to the default of Broadcast.

Note This option is not available with the Transmit Source is set to Backplane.

SPE Mapping	Description
AU3	Selects an AU-4 sized payload.
AU4	Selects an AU-4 sized payload.
AU-4-4c	Selects an AU-4-4c sized payload. Selecting this option can force updates to STM and AU selections.
AU-4-16c	Selects an AU-4-16c sized payload. Selecting this option can force updates to STM and AU selections.

SCPI Examples:

```
SOUR(@7):DATA:SIZE AU3
SOUR(@7):DATA:SIZE AU4
SOUR(@7):DATA:SIZE AU44C
SOUR(@7):DATA:SIZE AU416C
```

Related Topics:

“VC-n” on page 505

“Path Overhead” on page 513

BIP Regen

The BIP Regen setting controls B1 byte regeneration when the Transmit Source is set to Backplane.

Setting	Description
Off	Disables B1 BIP regenerator. The signal is retransmitted as it is received from the backplane, and only physical layer errors can be inserted.
B1	Enables B1 BIP regenerator. The B1 byte is recaculated before the signal is retransmitted. Only physical layer and section (B1) errors can be inserted.

SCPI Examples:

```
SOUR(@7):OVER:BIPR  NORM
SOUR(@7):OVER:BIPR  BONE
SOUR(@7):OVER:BIPR  ?
```

Related Topics:

“Transmit Source” on page 501

Clock Source

The Clock Source setting selects the timing reference that is used to generate the SONET/SDH payload.

When Backplane is selected as the Transmit Source, the Clock Source can only be Backplane.

Clock Source Setting	Description
Clock Module	Selects the timing reference from the EPX Test System's clock module. Verify that the EPX clock module is correctly providing a SONET/SDH timing reference for the slot in which the STM-16 Transmitter is installed. This setting is the default in the factory configuration.
Backplane	Selects the timing reference from the signal transmitted via the Test System backplane from the STM-16 Receiver installed in the adjacent slot to the left of the transmitter.

SCPI Examples:
`SOUR(@7):CLOC CLKB`
`SOUR(@7):CLOC BACK`
Related Topics
"Configuring the EPX100 Clock Module" on page 25	

Protocol

The Protocol setting switches the module between SONET and SDH. When the switch is complete, EPXam displays the appropriate protocol configuration options and field labels for the module and updates all references to the module to use the correct protocol.

Note Switching between SONET and SDH protocol does *not* require a restart of the test system or EPXam.

Restrictions:

- Modules that are locked via the Group Manager cannot be switched by other users.
- Active test and logging sessions associated with a module at the time of a switch are cancelled.

  If tests or logging sessions are in progress on any of the modules being switched, a warning dialog is displayed. Click **Cancel** to abort the switch or **Continue** to complete the switch. If you choose **Continue**, running tests and logging sessions are cancelled. Otherwise, a dialog opens that displays the switching progress.

Setting	Description
SONET	Switches the module to SONET without restarting the test system or EPXam. This is the default setting in the factory configuration.
SDH	Switches the module to SDH without restarting the test system or EPXam.

SCPI Examples:
`SYST:BOAR(@7):PROT:TYPE SON`
`SYST:BOAR(@7):PROT:TYPE SDH`
`SYST:BOAR(@7):PROT:STAT?`	

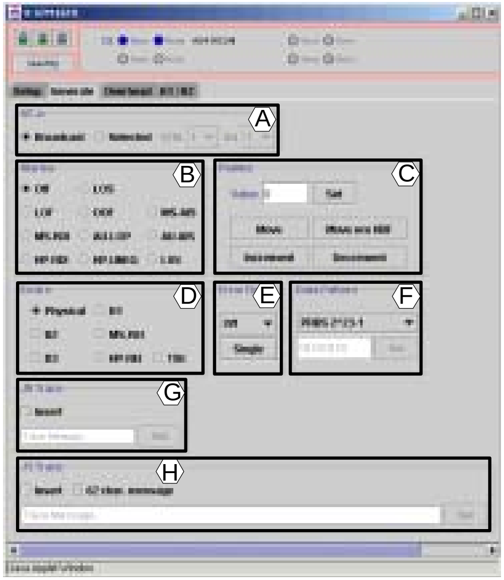
See “OC-48 Transmitter Window” on page 359 for a description of this module’s SONET features and configuration.

See the following topics for more information about SONET/SDH switching:

- “Using the SONET/SDH Switcher” on page 121
- “SONET/SDH Switching and Custom Configuration Files” on page 123
- “Switching Modules Using SCPI” on page 123

Generate Settings

The following figure illustrates the settings that are configured on the STM-16 Transmitter **Generate** tab.



A **VC-n**—Select a specific STM and AU to map the generated payload into or broadcast to all time slots. See “VC-n” on page 505.

B **Alarms**—Select the type of alarm to insert. See “Alarms” on page 506.

C **Pointer**—View or modify pointer values. See “Pointer” on page 508.

D **Errors**—Select the type of error to insert. See “Errors” on page 508.

E **Rate**—Set the error insertion rate. See “Error Rate” on page 509.

F **Data Pattern**—Select the payload data pattern to insert into the transmitted signal. See “Data Pattern” on page 509.

G **J0 Trace**—Specify and insert a J0 section trace message. See “J0 Trace” on page 510.

H **J1 Trace**—Specify and insert a J1 section trace message. “J1 Trace” on page 510.

These settings are described in more detail in the following sections.

VC-n

The VC-n settings specify the virtual container mapping for the generated payload. The generated payload can be mapped to a single STM and AU time slot or broadcast to all channels.

The number of available channels depends on the SPE mapping that is selected on the **Setup** tab. The VC-n setting is reset to broadcast when the SPE Mapping is changed.

Settings	Description
Broadcast	Maps the generated payload to all STM and AU time slots. When **Broadcast** is selected, STM and AU selection is unavailable. This is the default in the factory configuration.
Selected	Maps the generated payload to time slot specified by the **STM** and **AU** settings.

Settings	Description
STM	Selects the STM channel in which to insert the generated payload. This option is not available in broadcast mode. This field is linked to the STM field in the **Overhead** tab. The number of STM channels depends on the currently selected SPE mapping: • If the AU size is AU-3 or AU-4, select 1 of 16. • If the AU size is AU-4-4c, select 1 of 4. • If the AU size is AU-4-16c, there is only 1 STM.
AU	Selects the number of the Administrative Unit (AU) time slot to map the generated payload. This option is not available in broadcast mode. This field is linked to the AU field in the **Overhead** tab. The number of AUs depends on the currently selected SPE Mapping. • If the AU Mapping is AU-3, select 1 of 3. • Otherwise, there is only one AU.

SCPI Examples:

To broadcast to all time slots:

```
SOUR(@6):DATA:MODE  BRO
```

To map the generated payload to a specific STM and AU time slot:

```
SOUR(@6):DATA:MODE  SEL
SOUR(@6):DATA:STM  1
sour(@6):DATA:AUN  1
```

Alarms

The Alarm setting determines the type of SDH alarm that is inserted into the transmit stream.

Note If Backplane is selected as the Transmit Source, alarm injection is limited to LOS only.

Alarm setting	Description
Off	Disables alarm insertion. This is the default setting in the factory configuration.
LOS	Loss of Signal **Implementation**: LOS is forced by continuously disabling the transmit drivers. When LOS insertion is turned off, the transmit drivers are re-enabled.
LOF	Loss of Frame **Implementation**: LOF is forced by continuously inverting the A1 and A2 framing bytes. When LOF insertion is turned off, the A1 and A2 framing bytes are generated with the correct values.
OOF	Out of Frame **Implementation**: OOF is forced by inverting the A1 and A2 framing bytes for 4 frames, followed by 252 frames with a normal framing pattern. This is repeated until OOF insertion is turned off.

Alarm setting	Description
MS-AIS	Multiplex Section Alarm Indication Signal **Implementation**: The STM-16 Transmitter generates MS-AIS by continuously inserting all ones into the STM payload, excluding the Regenerator Section Overhead (RSOH). When MS-AIS insertion is turned off, the STM payload is generated normally.
MS-RDI	Multiplex Section Remote Defect Indicator **Implementation**: The STM-16 Transmitter generates MS-RDI by continuously injecting a value of 110b into bits 6, 7, and 8 of the K2 byte. When MS-RDI insertion is turned off, a value of 100 is inserted into bits 6, 7, and 8 of the K2 byte.
AU-LOP	Administrative Unit Loss of Pointer **Implementation**: The STM-16 Transmitter generates AU-LOP by continuously setting the H1 and H2 pointer bytes to 6B and 0F, respectively. When AU-LOP insertion is turned off, the H1 and H2 pointer bytes are returned to the previous pointer values.

Alarm setting	Description
AU-AIS	High order Path Alarm Indication Signal **Implementation**: The STM-16 Transmitter generates HP-AIS by continuously inserting all ones into the H1, H2, and H3 bytes, path overhead, and all of the SPE. When HP-AIS insertion is turned off, the original overhead values are restored, along with the data patterns.
HP-RDI	High-Order Path Remote Defect Indicator **Implementation**: The STM-16 Transmitter generates HP-RDI by setting bit 5 of the G1 byte to 1. When HP-RDI insertion is turned off, bit 5 of the G1 byte is set to 0.
HP-UNEQ	High-Order Path Unequipped **Implementation**: The STM-16 Transmitter generates HP-UNEQ by setting the C2 byte to zero (0). When HP-UNEQ insertion is turned off, the previous C2 byte value is restored.

Alarm setting	Description
LSS	Loss of Sequence Sync **Implementation**: The STM-16 Transmitter generates LSS by continuously sending a pattern that differs from the expected pattern. If the expected pattern is PRBS 2^20, a PRBS 2^23 pattern is transmitted. For all other patterns, a PRBS 2^20 pattern is transmitted. When LSS insertion is turned off, the expected pattern is transmitted.

SCPI Examples:

```
SOUR(@3):ALAR  OFF
SOUR(@3):ALAR  LOS
SOUR(@3):ALAR  LOF
SOUR(@3):ALAR  OOF
SOUR(@3):ALAR  MSA
SOUR(@3):ALAR  MSRD
SOUR(@3):ALAR  AUA
SOUR(@3):ALAR  AUL
SOUR(@3):ALAR  HPRD
SOUR(@3):ALAR HPUN
SOUR(@3):ALAAR LSS
```

Pointer

Use the Pointer settings to move or set the value of the AU pointer.

Note The AU pointer cannot be modified when the Transmit Source is set to Backplane.

Pointer Settings	Description
Value	Manually set the AU pointer. Enter an integer value from 0 to 782. The value entered is displayed as a hexadecimal number.
Set	You must click **Set** to apply the change to the AU pointer value entered in the **Value** field.
Move	Move pointer with the New Data Flag (bits 1 to 4 of the H1 overhead byte). This causes a large change to the pointer value, and the NDF flag in the H1 overhead byte is updated appropriately. The moves alternate between increment and decrement.
Move w/o NDF	Move pointer without the New Data Flag. This causes a large change in the pointer value without the appropriate NDF indication in the H1 overhead byte. The moves alternate between increment and decrement.
Increment Decrement	Increment or decrement the pointer value by 1.

Pointer Settings	Description
SCPI Examples: SOUR(@6):POIN:VAL 260 SOUR(@6):POIN:ACT INCR SOUR(@6):POIN:ACT DECR SOUR(@6):POIN:ACT NDF SOUR(@6):POIN:ACT MNDF	

Errors

The Errors setting controls the type of error that it is inserted into the transmit stream. Whenever the Error Type setting is modified, the Error Rate setting is always reset to Off.

Note If Backplane is selected as the Transmit Source, error injection is limited to Physical errors or B1 errors (assuming B1 error injection is enabled via the BIP Regen setting).

Error Type	Description
Physical	Inserts physical layer (or random) errors. One bit is inverted, and no bit is inverted twice before all bits in the frame have been inverted. This setting is the default in the factory configuration.
B1	Inserts B1 BIP-8 errors.
B2	Inserts B2 BIP-8 errors.
MS-REI	Multiplex Section Remote Error Indicator Inserts error counts in the M1 byte.

Error Type	Description
B3	Inserts Path (B3) errors.
HP-REI	High order Path Remote Error Indicator Inserts error counts in the G1 byte (bits 1-4).
TSE	Inserts test sequence errors (bit errors) so that the transmitted payload does not match the expected pattern.

SCPI Examples:
`SOUR(@3):ERR:TYPE B1ER`
`SOUR(@3):ERR:TYPE B2ER`
`SOUR(@3):ERR:TYPE MSR`
`SOUR(@3):ERR:TYPE B3ER`
`SOUR(@3):ERR:TYPE HPR`
`SOUR(@3):ERR:TYPE TSE`
`SOUR(@3):ERR:TYPE PHYS`	

Error Rate

The Error Rate setting enables and disables error insertion and controls the rate at which errors are inserted into the stream.

The Error Rate setting is always reset to OFF whenever the Error Type is changed.

Error Rate Setting	Description
Off	Sets the error rate to 0, effectively disabling error insertion. This is the default setting in the factory configuration.
IE-3 through IE-9	Set the error insertion ratio to 10 x 10^-3, 10 x 10^-4, etc.
Single	Error Rate must be set to Off to enable single error insertion. When this option is available, click this button to insert a single error into the transmit stream.

SCPI Examples:
`SOUR(@3):ERR:RAT OFF`
`SOUR(@3):ERR:RAT RIE-4`
`SOUR(@3):ERR:RAT SING`	

Data Pattern

The Data Pattern setting selects the type of pattern to place into the generated payload. The payload data pattern cannot be modified when the Transmit Source is set to Backplane.

Settings	Description
PRBS 2^15-1 **PRBS 2^20-1** **PRBS 2^23-1** **Inv. PRBS 2^23-1** **Inv. PRBS 2^20-1** **Inv. PRBS 2^15-1**	Selects a pseudo-random bit sequence (PRBS) pattern or inverted PRBS pattern. The default setting is PRBS 2^23-1
User	Selectss an 8-bit binary user-defined payload pattern.
Set	If a custom user-defined payload pattern is defined, click **Set** to apply the changed user payload pattern.

Settings	Description
SCPI Examples: SOUR(@6)PAYL:GEN:PATT:TYPE PR215 SOUR(@6)PAYL:GEN:PATT:TYPE PR223 SOUR(@6)PAYL:GEN:PATT:TYPE IPR215 SOUR(@3):PAYL:GEN:PATT:TYPE USER SOUR(@3):PAYL:GEN:PATT:USER 0b00110011	

J0 Trace

Create and insert a user-defined regenerator section J0 trace message.

Note The J0 trace message cannot be modified when the Transmit Source is set to Backplane. In the factory configuration, the default setting is off.

1 Click **Insert**.

2 Enter the trace message.

Note Messages can be no longer than 15 characters.

3 Click **Set** to apply the changes.

If you do not click **Set**, the modified message is not inserted.

To enable J0 trace and insert a trace message using SCPI, use commands similar to the following:

```
SOUR(@6):DATA:SECT:TREN ON
SOUR(@6):DATA:SECT:TRAC “15-byte trace
msg”
```

Note When using SCPI, you must enclose the message in quotation marks. Otherwise, only the characters before the first space are used as the trace message.

J1 Trace

Create and insert a user-defined path J1 trace message.

Note The J1 trace message cannot be modified when the Transmit Source is set to Backplane. In the factory configuration, the default setting is off.

1 Click **Insert**.

2 Click **62 char. message** to insert a message with 62 characters.

3 Enter the trace message.

Note Messages can be no longer than 15 characters unless **62 char. message** is checked.

4 Click **Set** to apply the changes.

If you do not click **Set**, the modified message is not inserted.

To enable J1 trace and insert a trace message using SCPI, use a pair of commands similar to the following:

```
SOUR(@6):DATA:PATH:TRL 64
SOUR(@6):DATA:PATH:TREN ON
SOUR(@6):DATA:PATH:TRAC “J1 trace msg”
```

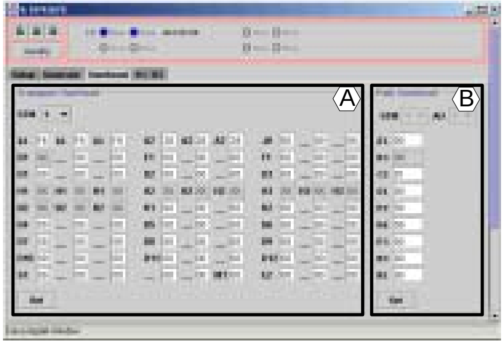
Note When using SCPI, you must enclose the message in quotation marks. Otherwise, only the characters before the first space are used as the trace message.

Overhead Data

The **Overhead Data** tab provides options for modifying individual path and transport overhead data values for a given time slot.

The following figure shows the main features of the **Overhead Data** tab.

Note Overhead insertion is not available if the Transmit Src is set to Backplane.



A **Transport Overhead**—Select an STM and AU time slot for viewing or modifying transport overhead bytes. See “Transport Overhead” on page 511.

B **Path Overhead**—Modify path overhead byte values for the selected STM and AU. See “Path Overhead” on page 513.

Transport Overhead

To modify specific transport overhead bytes.

1 Select an STM-1 channel (time slot).

2 Enter hexadecimal values.

3 Click **Set** to apply the changes.

The following notes apply to modifying transport overhead bytes:

- Overhead bytes that cannot be modified are indicated with “XX” greyed out in the user interface.
- The B1 and B2 bytes cannot be modified using this interface. Use the B1 and B2 error insertion setting on the **Generate** tab.

Settings	Description
STM	Selects the number of the time slot in the internally generated STM-1 for which you want to modify transport overhead bytes. Channel 1 is the default in the factory configuration.
A1, A2	Framing alignment bytes. Modifying A1 and A2 bytes causes receivers to lose framing.
B1	BIP-8 parity check byte. This byte cannot be modified through this interface. The B1 byte can only be modified through the error insertion setting as described in “Errors” on page 508.
J0 (C1)	Formerly C1 (STM-1 ID), now redefined as the J0 trace byte. Modifying J0 in STM-1, AU 1 only takes effect if J0 trace insertion is disabled. See “J0 Trace” on page 510.
E1	Orderwire section byte located in first STM-1 of an STM-N.

Settings	Description
F1	Section user channel byte located in first STM-1 of an STM-N.
D1, D2, D3	Section data communication channel bytes located in first STM-1 of an STM-N.
K1, K2	APS channel bytes. Modifying the K1 and K2 bytes is possible through this interface, but to ensure proper K1 and K2 updates, see “K1/K2 Settings” on page 514. Enabling alarms (MS-RDI, AU-AIS) override changes to K2.
H1, H2	AU payload pointer bytes.
H3	AU pointer action byte.
D4 through D12	Line data communications channel bytes.
S1/Z1	Synchronization status/growth bytes.
Z2/M1	Z2—Growth M1—Line Remote Error Indicator (Line REI) byte. Modifying M1 does not override enabled error injection of MS-REI.
E2	Express orderwire byte.
Set	You must click **Set** to apply any changes to the transport overhead byte values.

Settings	Description
SCPI Examples:	

Use the following command to set the values for bytes A1;A2;J0;B1;E1;F1;D1;D2;D3.

```
sour(@7):data:rsoh:byt
F6F6F6;282828;011121;XX0000;000000;00000
0;000000;000000;000000;
```

Use the following command to set the values for bytes H1;H2;H3;B2;K1;K2;D4;D5;D6;D7;D8;D9;D10;D11;D12;S1;M1;E2.

```
sour(@7):data:msoh:byt
XXXXXX;000000;000000;000000;000000;00000
0;000000;000000;000000;000000;000000;000
000;000000;000000;000000
```

Path Overhead

Perform the following steps to modify specific path overhead bytes for a specific STM and AU in the internally generated signal.

1 Select a channel.

Note STM and AU selections are only available when the VC-n is set to Selected, as described in “VC-n” on page 505.

Note

2 Enter hexadecimal values for the appropriate fields.

3 Click **Set** to apply the changes to the STS path overhead bytes for the selected time slot.

Settings	Description
STM and AU	Select the STM and AU time slot for which you want to modify path overhead bytes. AU selection is disabled in Broadcast mode, because the generated payload is mapped into all AUs. Channel 1 is the default in the factory configuration. The available channels depends on the selected SPE mapping. This field is linked to the SPE field in the Generate tab and is only available when the SPE field is set to Selected.
J1	Path trace byte. Modifying J1 only takes effect if J1 trace message insertion is disabled, as described in “J1 Trace” on page 510.
C2	VC signal label.
B3	Parity check byte. The B3 byte cannot be modified through this interface. See “Errors” on page 508.
G1	Path terminating status byte. Modifying G1 does not override an enabled alarm (HP-RDI) or enabled error injection on HP-REI.
F2	Path user channel byte.
H4	Multiframe indicator byte.
Z3, Z4	Allocated for future growth.
Z5	Tandem connection byte.

The following notes apply to modifying STS path overhead bytes:

- Overhead bytes that cannot be modified are indicated with “XX” greyed out in the user interface.

Settings	Description
Set	You must click **Set** to apply any changes to the transport overhead byte values.

SCPI Examples:

Use the following command to set the values for bytes J1;B3;C2;G1;F2;H4;Z3;Z4;Z5.

```
sour(@7):data:path:over:byt
00;XX;01;00;00;00;00;00;00
```

7 OKRelated Topics:

"SPE Mapping" on page 502

"VC-n" on page 505

K1/K2 Settings

The following figure shows the main features of the STM-16 TX **K1/K2** tab.

A **K1/K2 Values**—Directoy set K1 and K2 byte values. See "K1/K2 Values" on page 514.

B **K1/K2/Messages**—Set K1 and K2 bits to encode APS channel messages. See "K1/K2 Messages" on page 515.

K1/K2 Values

The K1/K2 Values setting enables you to directly set values in the automated protection switching (APS) channel K1 and K2 bytes.

Note K1/K2 bytes cannot be modified when the Transmit source is set to Backplane.

K1/K2 Values	Description
K1	The default value is 0xF1. Bits 1 through 4 control the request message, and bits 5 through 8 control the channel message code.
K2	The default value is 0x14. Bits 1 through 4 of the K2 byte control the channel number, bit 5 controls the architecture, and bits 6 thorough 8 indicate the mode of operation.
Set	You must click **Set** to update and transmit new K1/K2 values entered here.

SCPI Examples:

```
SOUR(@6):APS:K1K2 0xF2,0x14
```

K1/K2 Messages

Use the fields in the K1/K2 message panel to set K1 and K2 bits to encode APS channel messages.

As you set K1/K2 message fields, the hexadecimal values displayed in the **K1/K2 Values** field update accordingly.

K1/K2 Message Settings	Description
K1 Request	Sets bits 1 through 4 of K1 with one of the following request messages. **Lockout of Protection**. Sets bits 1 through 4 to 1111. **Forced Switch**. Sets bits 1 through 4 to 1110. **SF - High Priority**. Sets bits 1 through 4 to 1101. **SF - Low Priority**. Sets bits 1 through 4 to 1100. **SD - High Priority**. Sets bits 1 through 4 to 1011. **SD - Low Priority**. Sets bits 1 through 4 to 1010. **Manual Switch**. Sets bits 1 through 4 to 1000. **Wait-to-Restore**. Sets bits 1 through 4 to 0110.
	Exercise. Sets bits 1 through 4 to 0100. **Revert Request**. Sets bits 1 through 4 to 0100 **Do Not Revert**. Sets bits 1 through 4 to 0001 **No Request** — Sets bits 1 through 4 to 0000. This is the default setting in the factory configuration.
K1 Channel	Selects the channel to apply the requesting message (sets bits 5 through 8 of K1 with the channel message code): **0**. The Null channel. This is the default setting in the factory configuration. **1** to **14**. Channel 1 through 14. **15**. Extra traffic channel.
K2 Operation	Sets the operational mode of the APS. Bits 6 through 8 of the K2 byte carry this information. **Unidirectional**. Sets bits 6 to 8 to 100. This is the default setting in the factory configuration. **Bidirectional**. Sets bits 6 to 8 to 101.

K1/K2 Message Settings	Description
K2 Architecture	Sets the architecture mode for the APS. Bit 5 of K2 carries this information. **Architecture 1+1**. Sets bit 5 to 0. This is the default setting in the factory configuration. **Architecture 1:n**. Sets bit 5 to 1.
K2 Channel	Selects the channel to apply the requesting message (sets bits 1 through 4 of K1 with the channel message code): **0**. Null channel. **1** to **14**. Channel 1 to 14. **15**. Extra traffic channel.
Set	You must click **Set** to update and apply the K1/K2 Message settings.

SCPI Examples:

```
sour(@4):tran:aps:k1k2 0x00 0x00
sour(@4):aps:k1en:req lops
sour(@4):aps:k1en:chan 1
sour(@4):aps:k2en:oper bid
sour(@4):aps:k2en:arch a1_n
sour(@4):aps:k2en:chan 1
sour(@4):aps:upd
```

35

STM-16 TRANSCEIVER WINDOW

The topics in this section explain set-up options, alarm and error insertion, and monitoring options for the STM-16 Transceiver module:

Instructions are provided for using EPXam to configure the module, along with SCPI equivalents.

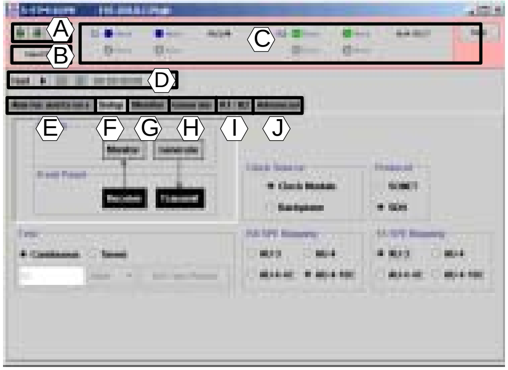
Tip STM-16 Transceivers can be switched between SONET and SDH functionality. See “Protocol” on page 520 and “Using the SONET/SDH Switcher” on page 121.

See “OC-48 Transceiver Window” on page 377 for a description of this module’s features and user interface in SDH protocol mode.

For more information about EPXam, see “Using EPXam” on page 3.

Main View

The following figure shows the main features of the STM-16 Transceiver window.



A Save or restore custom module/slot configurations or restore factory defaults (see "Using Module Window Save and Restore Controls" on page 108).

B **Identify**—When pressed, it flashes the Active LED on the module associated with this window.

C View summary defect status, alarm indicators, and other module information. See "Expanded Logical View Indicators" on page 8 for more information.

D Start, stop, or pause test; view elapsed time. See "Using Module Window Test Controls" on page 118.

E **Alarms and Errors**—Monitor alarm status, error counts, and error ratios for current test. See "Alarms and Errors" on page 532.

F **Setup**—Configure clock source, test type and duration, Virtual Container (VC) mapping for transmit and receive, or switch module protcol between SDH and SONET. See "Setup" on page 519.

G **Generate**—Configure TX alarm and error generation, payload data pattern, K1/K2 values and messages, and J0 trace message insertion. See "Generate Settings" on page 522.

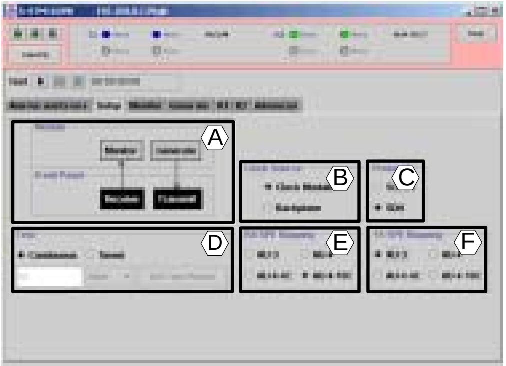
H **Monitor**—Monitor J0 section trace message, set the expected J0 trace message, monitor the RS-TIM alarm, and set the type of payload data pattern to monitor. See "Monitor Settings" on page 526.

I **K1/K2**—Monitor or generate K1 and K2 byte values and messages and configure K1/K2 Broadcast to Tx. See "K1/K2 Settings" on page 528.

J **Advanced**—Specify error filter options, and whether the received K1/K2 values are broadcast to an STM-16 module in the adjacent, higher-numbered slot. See "Advanced" on page 534

Setup

The following figure illustrates the settings that can be configured on the STM-16 Transceiver **Setup** tab.



A Graphical view of currently selected STM-16 Transceiver module input and output

B **Clock Source**—Select the source for the transmitted signal, either internally generated, input from the backplane, or as received from the monitor port. See “Clock Source” on page 519.

C **Protocol**—Switch the module protocol between SONET and SDH. See “Protocol” on page 520.

D **Test**—Set the test type and duration. See “Test” on page 521.

E **RX SPE Mapping**—Set the Virtual Container (VC) payload mapping for the receiver. See “RX SPE Mapping” on page 521.

F **TX SPE Mapping**—Set the Virtual Container (VC) payload mapping for the transmitter. See “TX SPE Mapping” on page 522.

These settings are explained in more detail in the following sections.

Clock Source

The Clock Source setting controls whether the STM-16 transceiver module uses the EPX clock module in slot 1, an “as received” clock from a RX port on the transceiver, or the backplane as the clock source for payload generation.

Rate Setting	Description
Clock Module	Selects the timing reference from the EPX Test System’s clock module. Verify that the EPX clock module is correctly providing a SONET/SDH timing reference for the slot in which the STM-16 Transmitter is installed. This setting is the default in the factory configuration.
Backplane	Selects the timing reference from the signal transmitted via the Test System backplane from the STM-16 Receiver installed in the adjacent slot to the left of the transmitter.
As Received	Selects the “as received” clock from the signal received on the RX port on the STM-16 Transceiver.

Rate Setting	Description
SCPI Examples: SOUR(@18):CLOC CLKB SOUR(@18):CLOC BACK SOUR(@10):CLOC ASRX	
Related Topics “Configuring the EPX100 Clock Module” on page 25	

Protocol

The Protocol setting switches the module between SONET and SDH. When the switch is complete, EPXam displays the appropriate protocol configuration options and field labels for the module and updates all references to the module to use the correct protocol.

Note Switching between SONET and SDH protocol does *not* require a restart of the test system or EPXam.

Restrictions:

- Modules that are locked via the Group Manager cannot be switched by other users.
- Active test and logging sessions associated with a module at the time of a switch are cancelled.

  If tests or logging sessions are in progress on any of the modules being switched, a warning dialog is displayed. Click **Cancel** to abort the switch or **Continue** to complete the switch. If you choose **Continue**, running tests and logging sessions are cancelled. Otherwise, a dialog opens that displays the switching progress.

Setting	Description
SONET	Switches the module to SONET without restarting the test system or EPXam. This is the default setting in the factory configuration.
SDH	Switches the module to SDH without restarting the test system or EPXam.
SCPI Examples: SYST:BOAR(@7):PROT:TYPE SON SYST:BOAR(@7):PROT:TYPE SDH SYST:BOAR(@7):PROT:STAT?	

See “OC-48 Transceiver Window” on page 377 for a description of this module’s SONET features and configuration.

See the following topics for more information about SONET/SDH switching:

- “Using the SONET/SDH Switcher” on page 121
- “SONET/SDH Switching and Custom Configuration Files” on page 123
- “Switching Modules Using SCPI” on page 123

Test

The Test area defines the type and duration of the test that the receiver runs. To start and stop tests, use the controls in the module window or, to start tests for multiple modules, use the Test Controls window. See “Controlling Tests” on page 115.

Note Selecting a new test type automatically stops the current test.

Test Setting	Description
Continuous	Selects a continuous test that must be manually stopped and started.
Timed	Selects a timed test. When Timed is selected: **1** Specify a number and select a unit (seconds, minutes, hours, and days) for the test duration. **2** Click **Set** to apply the settings. **3** Use the controls at the top of the window to start the test. **Note** If you enable logging and are saving the log file to the test system, gnubi advises you to limit the test period to a maximum of 72 hours (3 days).

Test Setting	Description

SCPI Examples:
`sens(@3):test:type cont`
`sens(@3):test:type tim`
`sens(@3):test:unit min`
`sens(@3):test:per 10`
To control tests use the following commands:
`sens(@3):test:mode star`
`sens(@3):test:mode stop`
`sens(@3):test:mode rest`
`sens(@3):test:mode pause`
Related Topics:
“Logging” on page 63
“Controlling Tests” on page 115	

RX SPE Mapping

The RX SPE Mapping option sets the expected virtual container (VC) size and mapping for the monitored signal. This setting affects options for the STM and AU selections in the Monitor tab.

RX VC Mapping	Description
AU-3	Selects an AU-3 Virtual Container mapping.
AU-4	Selects an AU-4 Virtual Container mapping.
AU-4-4c	Selects an AU-4-4c Virtual Container mapping.
AU-4-16c	Selects an AU-4-16c Virtual Container mapping.

RX VC Mapping	Description
SCPI Examples: SENS(@18):DATA:SIZE AU3 SENS(@18):DATA:SIZE AU4 SENS(@18):DATA:SIZE AU44C SENS(@18):DATA:SIZE AU416C **Related Topics:** “STM and AU” on page 527.	

TX SPE Mapping

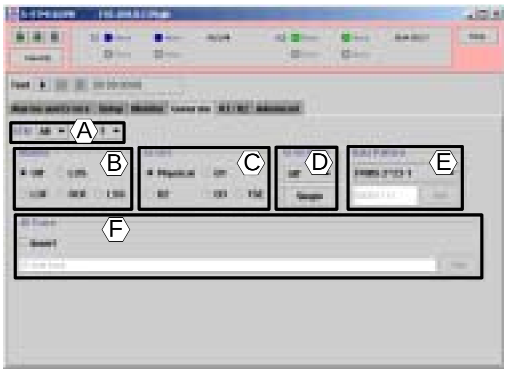
The TX SPE Mapping option sets the expected virtual container (VC) size and mapping for the generated signal. This setting affects options for the STM and AU selections in the Generate tab.

TX VC Mapping	Description
AU-3	Selects an AU-3 Virtual Container mapping.
AU-4	Selects an AU-4 Virtual Container mapping.
AU-4-4c	Selects an AU-4-4c Virtual Container mapping.
AU-4-16c	Selects an AU-4-16c Virtual Container mapping.

TX VC Mapping	Description
SCPI Examples: SOUR(@18):DATA:SIZE AU3 SOUR(@18):DATA:SIZE AU4 SOUR(@18):DATA:SIZE AU44C SOUR(@18):DATA:SIZE AUr16C **Related Topics:** “STM and AU” on page 523.	

Generate Settings

The following figure illustrates the main features of the STM-16 Transceiver **Generate** tab.



A **STM**, **AU**—Specify whether the internally generated payload is mapped to a specific STM and AU time slot or broadcast it to all channels. See “STM and AU” on page 523.

B **Alarms**—Select the type of alarm condition to generate. See “Alarms” on page 524.

C **Errors**—Select the type of error to insert. See “Errors” on page 525.

D **Error Rate**—Set the error insertion rate. See “Error Rate” on page 525.

E **Data Pattern**—Select the type of payload data pattern to generate. See “Data Pattern” on page 526.

F **J0 Trace**—Define and insert a J0 trace message. See “Data Pattern” on page 526.

STM and AU

The STM and AU selection specifies whether the nternally generated payload is mapped to a specific STM and AU time slot or broadcast to all channels.

The number of available time slots varies, depending on the currently selected TX vitual container mapping.

Channel	Description
All	Broadcast mode. The hardware maps the generated payload into all channels.
STM	Select the STM in which to insert the generated payload. The number of STMs depends on the currently selected AU mapping: • If the VC size is AU-3 or AU-4, select 1 of 16. • If the VC size is AU-4-4c, select 1 of 4. • If the VC size is AU-4-16c, there is only 1 STM. This setting does not apply when Broadcast mode is selected.
AUN	Select the number of the Administrative Unit (AU) time slot to map the generated payload. The number of AUNs depends on the currently selected VC Mapping. • If the VC Mapping is AU-3, select 1 of 3. • Otherwise, there is only one AUN. This setting does not apply when Broadcast mode is selected.

SCPI Examples:

```
SOUR(@18):DATA:MODE  SEL
SOUR(@18):DATA:STM  1
sour(@10):DATA:AUN 1
SOUR(@18):DATA:MODE BRO
```

Alarms

The Alarms setting determines the type of section-level SONET alarm that is inserted into the transmit stream.

Alarm setting	Description
Off	Alarm insertion is disabled.
LOS	Loss of Signal **Implementation**: LOS is forced by continuously disabling the transmit drivers. When LOS insertion is turned off, the transmit drivers are re-enabled.
LOF	Loss of Frame **Implementation**: LOF is forced by continuously inverting the A1 and A2 framing bytes. When LOF insertion is turned off, the A1 and A2 framing bytes are generated with the correct values.
OOF	Out of Frame **Implementation**: OOF is forced by inverting the A1 and A2 framing bytes for 4 frames, followed by 252 frames with a normal framing pattern. This is repeated until OOF insertion is turned off.
LSS	Loss of Sequence Sync **Implementation**: LSS is generatd by continuously sending a pattern that differs from the expected pattern. If the expected pattern is PRBS 2^20, a PRBS 2^23 pattern is transmitted. For all other patterns, a PRBS 2^20 pattern is transmitted. When LSS insertion is turned off, the expected pattern is transmitted.

SCPI Examples:

```
SOUR(@3):ALAR OFF
SOUR(@3):ALAR LOS
SOUR(@3):ALAR LOF
SOUR(@3):ALAR OOF
SOUR(@3):ALAR LSS
```

Errors

The Error Type and Error Rate settings control the type of error and the rate at which it is inserted into the transmit stream.

Whenever the Error Type setting is modified, the Error Rate setting is always reset to Off.

Error Type	Description
Physical	Inserts physical layer (or random) errors. One bit is inverted, and no bit is inverted twice before all bits in the frame have been inverted. This setting is the default in the factory configuration.
B1	Inserts B1 BIP-8 errors.
B2	Inserts B2 BIP-8 errors.
B3	Insert B3 errors into the stream.
TSE	Inserts test sequence errors (bit errors) so that the transmitted payload does not match the expected pattern.

SCPI Examples:

```
SOUR(@3):ERR:TYPE  B1ERR
SOUR(@3):ERR:TYPE  B2ERR
SOUR(@3):ERR:TYPE  PHYS
SOUR(@3):ERR:TYPE  B3ERR
SOUR(@3):ERR:TYPE  TSE
```

Error Rate

The Error Rate setting enables and disables error insertion and controls the rate at which errors are inserted into the stream.

The Error Rate setting is always reset to OFF whenever the Error Type is changed.

Error Rate Setting	Description
Off	Sets the error rate to 0, effectively disabling error insertion.
IE-3 through IE-9	Set the error ratio to 10 x 10^-3, 10 x 10^-4, and so on. The IE-3 rate does not apply to Section (B1) errors.
Single	The Error Rate must be set to Off to enable single error insertion. When this option is available, click **Single** to insert a single error of the currently selected Error Type into the transmit stream.

SCPI Examples:

```
SOUR(@3):ERR:RAT  OFF
SOUR(@3):ERR:RAT  RIE-4
SOUR(@3):ERR:RAT  SING
```

Data Pattern

The Payload Pattern selects the type of pattern to place into the generated payload.

Settings	Description
PRBS 2^15-1 **PRBS 2^20-1** **PRBS 2^23-1** **Inv. PRBS 2^23-1** **Inv. PRBS 2^20-1** **Inv. PRBS 2^15-1**	Selects a pseudo-random bit sequence (PRBS) pattern or inverted PRBS pattern. The default setting is PRBS 2^23-1
User	Selectss an 8-bit binary user-defined payload pattern.
Set	If a custom user-defined payload pattern is defined, click **Set** to apply the changed user payload pattern.

SCPI Examples:

```
SOUR(@6):PAYL:GEN:PATT:TYPE PR215
SOUR(@6):PAYL:GEN:PATT:TYPE PR223
SOUR(@6):PAYL:GEN:PATT:TYPE iPR215
SOUR(@6):PAYL:GEN:PATT:TYPE  USER
SOUR(@6):PAYL:GEN:PATT:USER  0b00110011
```

J0 Trace Message

To create and insert a user-defined STS section J0 trace message:

1 Click **Insert**.

2 Enter the trace message.

3 Click **Set** to apply the changes.

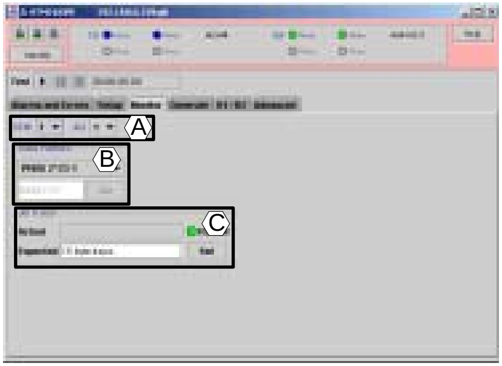
   If you do not click **Set**, the modified message is not inserted.

To enable J0 trace and insert a trace message using SCPI, use the following pair of commands:

```
SOUR(@18):DATA:SECT:TREN ON
SOUR(@18):DATA:SECT:TRAC "J0 trace msg"
```

Monitor Settings

The following figure illustrates the options available on the OC-48 Transceiver **Monitor** tab.



A Select the STM and AU time slot to monitor, as described in “STM and AU” on page 527.

B Select the type of payload data pattern to monitor, as described in “Data Pattern” on page 527.

C Monitor J0 trace message and RS-TIM alarm status, as described in “J0 Trace Message” on page 527.

STM and AU

The STM and AU settings determines which STM channel and Administrative Unit (AU) time slot is monitored. Available STM and AU selections depend on the currently selected SPE mapping.

Setting	Description
STM	Select the STM to monitor in the received payload. The number of STMs depends on the currently selected VC mapping: • If the VC size is AU-3 or AU-4, select 1 of 16. • If the AU size is AU-4-4c, select 1 of 4. • If the AU size is AU-4-16c, there is only 1 STM.
AUN	Select the number of the Administrative Unit (AU) time slot to monitor. The number of AUNs depends on the currently selected VC Mapping. • If the VC size is AU-3, select 1 of 3. • Otherwise, there is only one AUN.

SCPI Examples:
`SENS(@6):DATA:STM   4`
`SENS(@6):DATA:AUN 1`
Related Topics:
“RX SPE Mapping” on page 521	

Data Pattern

The Data Pattern setting on the Monitor tab selects the type of payload pattern to monitor in the received signal.

Settings	Description
PRBS 2^15-1 **PRBS 2^20-1** **PRBS 2^23-1** **Inv. PRBS 2^23-1** **Inv. PRBS 2^20-1** **Inv. PRBS 2^15-1**	Selects a pseudo-random bit sequence (PRBS) pattern or inverted PRBS pattern. The default setting is PRBS 2^23-1
User	Selectss an 8-bit binary user-defined payload pattern.
Set	If a custom user-defined payload pattern is defined, click **Set** to apply the changed user payload pattern.

SCPI Examples:
`SENS(@6):PAYL:GEN:PATT:TYPE PR215`
`SENS(@6):PAYL:GEN:PATT:TYPE PR223`
`SENS(@6):PAYL:GEN:PATT:TYPE iPR215`
`SENS(@6):PAYL:GEN:PATT:TYPE  USER`
`SENS(@6):PAYL:GEN:PATT:USER  0b00110011`	

J0 Trace Message

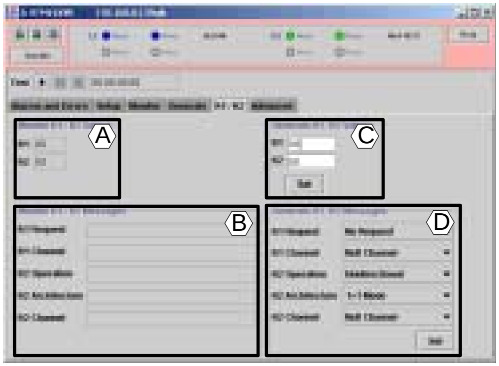
The J0 Trace Message field displays the J0 section trace message.

To query the J0 trace message using SCPI, use a command similar to the following:

```
SENS(@16):DATA:SECT:TRAC ?
```

K1/K2 Settings

The following figure shows the main features of the STM-16 Transceiver **K1/K2** tab.



- **A** **Monitor K1/K2 Values**—View current K1/K2 byte values and select whether they are broadcast to an adjacent slot. See “Monitor K1/K2 Values” on page 530.
- **B** **Monitor K1/K2 Messages**—View APS channel messages decoded from K1/K2 byte values. See “Monitor K1/K2 Messages” on page 530.
- **C** **Generate K1/K2 Values**—Set K1/K2 values. See “Generate K1/K2 Values (TX)” on page 528.
- **D** **Generate K1/K2 Messages**—Set K1/K2 bits to encode APS channel messages. See “Generate K1/K2 Messages” on page 528.

Generate K1/K2 Values (TX)

The Generate K1/K2 Values setting enables you to directly set and transmit hexadecimal values in the automated protection switching (APS) channel K1 and K2 bytes.

K1/K2 Value Settings	Description
K1	The default value is 0xF1. Bits 1 through 4 control the request message, and bits 5 through 8 control the channel message code.
K2	The default value is 0x14. Bits 1 through 4 of the K2 byte control the channel number, bit 5 controls the architecture, and bits 6 thorough 8 indicate the mode of operation.
Set	You must click **Set** to update and transmit new K1/K2 values entered here.
SCPI Examples: `SENS(@3):TRAN:APS:K1K2 ?`	

Generate K1/K2 Messages

Use the fields in the K1/K2 message panel to set K1 and K2 bits to encode APS channel messages.

As you set K1/K2 message fields, the hexadecimal values displayed in the **K1/K2 Values** field update accordingly.

K1/K2 Message Settings	Description
K1 Request	Sets bits 1 through 4 of K1 with one of the following request messages.
	Lockout of Protection. Sets bits 1 through 4 to 1111.
	Forced Switch. Sets bits 1 through 4 to 1110.
	SF - High Priority. Sets bits 1 through 4 to 1101.
	SF - Low Priority. Sets bits 1 through 4 to 1100.
	SD - High Priority. Sets bits 1 through 4 to 1011.
	SD - Low Priority. Sets bits 1 through 4 to 1010.
	Manual Switch. Sets bits 1 through 4 to 1000.
	Wait-to-Restore. Sets bits 1 through 4 to 0110.
	Exercise. Sets bits 1 through 4 to 0100.
	Revert Request. Sets bits 1 through 4 to 0100
	Do Not Revert. Sets bits 1 through 4 to 0001
	No Request — Sets bits 1 through 4 to 0000.

K1/K2 Message Settings	Description
K1 Channel	Selects the channel to apply the requesting message (sets bits 5 through 8 of K1 with the channel message code): • 0 selects the Null channel. • 1 through 14 — Channel 1 through 14. • 15 — Extra traffic channel.
K2 Operation	Sets the operational mode of the APS. Bits 6 through 8 of the K2 byte carry this information. **Unidirectional**. Sets bits 6 to 8 to 100. **Bidirectional**. Sets bits 6 to 8 to 101.
K2 Architecture	Sets the architecture mode for the APS. Bit 5 of K2 carries this information. **Architecture 1+1**. Sets bit 5 to 0. **Architecture 1:n**. Sets bit 5 to 1.
K2 Channel	Selects the channel to apply the requesting message (sets bits 1 through 4 of K1 with the channel message code): **0**. Null channel. **1** to **14**. Channel 1 to 14. **15**. Extra traffic channel.
Set	You must click **Set** to update and apply the K1/K2 Message settings.

K1/K2 Message Settings	Description

SCPI Examples:
`sour(@4):tran:aps:k1k2 0x00 0x00`
`sour(@4):aps:k1en:req lops`
`sour(@4):aps:k1en:chan 1`
`sour(@4):aps:k2en:oper bid`
`sour(@4):aps:k2en:arch a1_n`
`sour(@4):aps:k2en:chan 1`
`sour(@4):aps:upd`	

Monitor K1/K2 Values

The Monitor K1/K2 Values field displays the K1 and K2 APS channel byte values in hexadecimal.

K1/K2 Value Settings	Description
K1	The default value is 0xF1. Bits 1 through 4 control the request message, and bits 5 through 8 control the channel message code.
K2	The default value is 0x14. Bits 1 through 4 of the K2 byte control the channel number, bit 5 controls the architecture, and bits 6 thorough 8 indicate the mode of operation.
Broadcast to TX	Enable or disable broadcasting of the received APS K1 and K2 bytes to an STM-16 Transceiver in the adjacent , higher-numbered slot. By default, this setting is disabled.
SCPI Examples: `SENS(@3):TRAN:APS:K1K2 ?`	

Monitor K1/K2 Messages

This field displays automated protection switching (APS) channel messages decoded from the K1/K2 bytes.

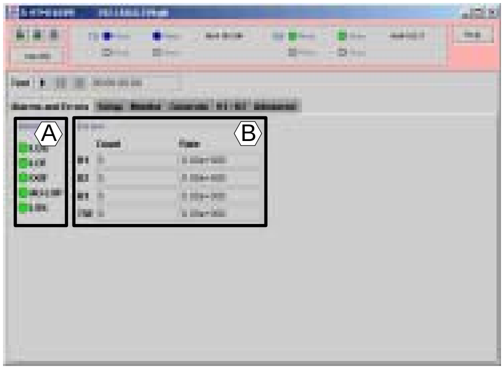
K1/K2 Messages	Description
K1 Request	Bits 1 through 4 of K1 can contain the following request messages. **Lockout of Protection**. Bits 1 through 4 have a value of 1111. **Forced Switch**. Bits 1 through 4 contain 1110. **SF - High Priority**. Bits 1 through 4 Have a value of 1101. **SF - Low Priority**. Bits 1 through 4 have a value of 1100. **SD - High Priority**. Bits 1 through 4 have a value of 1011. **SD - Low Priority**. Bits 1 through 4 have a value of 1010. **Manual Switch**. Bits 1 through 4 have a value of 1000. **Wait-to-Restore**. Bits 1 through 4 have a value of 0110. **Exercise**. Bits 1 through 4 have a value of 0100. **Revert Request**. Bits 1 through 4 have a value of 0100. **Do Not Revert**. Bits 1 through 4 have a value of 0001. **No Request** — Bits 1 through 4 have a value of 0000. This is the default setting in the factory configuration.

K1/K2 Messages	Description
K1 Channel	Channel selection for the requesting message (bits 5 through 8 of K1 carry the channel message code): **0**. Null channel. This setting is the default in the factory configuration. **1** to **14**. Channel 1 through 14. **15**. Extra traffic channel.
K2 Operation	Operational mode of the APS. Bits 6 through 8 of the K2 byte carry this information. **Unidirectional**. Bits 6 to 8 have a value of 100. This setting is the default in the factory configuration. **Bidirectional**. Bits 6 to 8 have a value of 101.
K2 Architecture	Architecture mode for the APS. Bit 5 of K2 carries this information. **Architecture 1+1**. Bit 5 is 0. This setting is the default in the factory configuration. **Architecture 1:n**. Bit 5 is 1.
K2 Channel	Channel selection for the requesting message (bits 1 through 4 of K2 carry the channel message code): **0**. Null channel. This setting is the default in the factory configuration. **1** to **14**. Channel 1 to 14. **15**. Extra traffic channel.

K1/K2 Messages	Description
SCPI Examples:	
SENS(@8):APS:K1D:REQ? SENS(@8):APS:K1D:CHAN? SENS(@8):APS:K2D:OPER? SENS(@8):APS:K2D:ARCH? SENS(@8):APS:K2D:CHAN?	

Alarms and Errors

The **Alarms and Errors** tab displays alarm status indicators, error counts, and error ratios for the current test.



A **Alarms**—Alarm status indicators for current test. See “Alarms” on page 532.

B **Errors**—Error counts and ratios for current test. See “Errors” on page 534.

Alarms

The Alarm area displays status indicators for the current test.

The alarm indicator colors are defined below.

Note If the status indicator for an alarm is grey, that type of alarm is not available for monitoring.

Green	Yellow	Red
No alarms are detected: signal is clear or monitoring is not started.	Alarm history: an alarm was detected but is not active in the current test.	An alarm is active and currently detected on the monitored signal.

The following alarms can be monitored.

Alarm Indicator	Description
LOS	Loss of Signal An LOS alarm condition is declared either when a received signal with an all-zeroes pattern has insufficient data bit transitions or when the as received clock cannot be recovered from the received signal because the optical power is insufficient. LOS ends when a received signal has a minimum optical power and data bit transitions so that the as received clocked can be recovered, and two consecutive valid frame alignment patterns occur without LOS defects.
LOF	Loss of Frame LOF is declared when the OOF state exists for 3 ms. LOF is cleared when an in-frame condition exists continuously for 3 ms.
OOF	Out-of-Frame OOF is declared when 4 consecutive SDH frames are received with invalid (errored) framing patterns (A1 and A2 bytes). OOF is cleared when two consecutive SDH frames are received with valid framing patterns.

Alarm Indicator	Description
LSS	Loss of Sequence Synchronization. LSS is declared when the received bit error rate is too high (at least one in three consecutive 128-bit sequences), indicating that a selected pattern cannot be matched for the received payload. LSS terminates when no errors in three consecutive payload patterns are detected.

SCPI Examples:

```
SENS(@3):ALAR:LOS ?
SENS(@3):ALAR:LOF ?
SENS(@3):ALAR:OOF ?
SENS(@3):ALAR:LSS ?
```

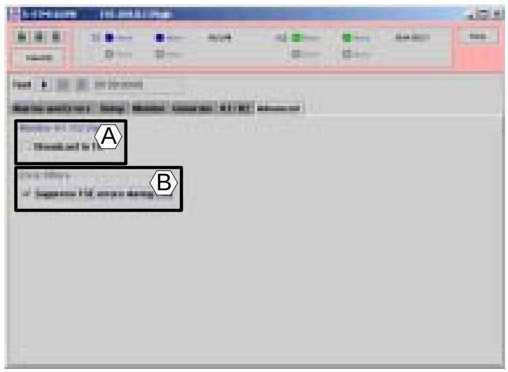
Errors

The Errors section displays monitored error counts and ratios for the current test, as described in the following table.

Error Type or Setting	Description
B1	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B1 section parity byte. Only in framed mode.
B2	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B2 line parity byte. Only in framed mode.
B3	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B3 path parity byte. Only in framed mode.
TSE (Payload)	This error is declared when the payload pattern of the received signal does not match the pattern selected.
Count	Number of errors of the specified type detected in the current test.
Rate	Computed error ratio for the specified error type for the current test.
SCPI Examples: SENS(@18):ERR:COUN:B1ER? SENS(@18):ERR:RAT:B1ER? SENS(@18):ERR:COUN:B2ER? SENS(@18):ERR:RAT:B2ER? SENS(@18):ERR:COUN:TSE? SENS(@18):ERR:RAT:TSE?	

Advanced

The following figure illustrates the settings that are configured on the STM-16 Transceiver **Advanced** tab.



A **Monitor K1/K2 Values**—Select whether or not the K1/K2 byte values are broadcast to the transmitter in the next slot to the right. See “K1/K2 Broadcast” on page 535

B **Error Filters**—Specify whether bit errors are suppressed (not counted) during an LPS alarm condition. See “Error Filters” on page 535.

K1/K2 Broadcast

The following table describes the K1/K2 setting for the STM-16 Transceiver.

Field/ Setting	Description
Broadcast to TX	Enable or disable broadcasting of the received APS K1 and K2 bytes to a transmitter in the adjacent slot to the right of the receiver. The default setting is disabled in the factory configuration.
SCPI Examples:	
`SENS(@18):APS:ENAB 1` `SENS(@18):APS:ENAB 0`	

Error Filters

The Error Filters setting specifies whether the bit errors are suppressed when an LSS alarm condition is active.

Field/ Setting	Description
Suppress Bit errors	When this setting is checked, bit errors are not counted when the LSS alarm is active. When unchecked, bit errors are counted when the LSS alarm is active. Disabled is the default setting in the factory configuration.
SCPI Examples:	
`SENS(@3):FILT:BIT ON` `SENS(@3):FILT:BIT OFF`	

36

STM-64 RECEIVER WINDOW

The topics in this section explain how to configure received signals and how to monitor data for the STM-64 receiver.

Instructions are provided for using EPXam to configure the module, along with SCPI equivalents.

Tip STM-64 Receivers can be switched between SONET and SDH functionality. See “Protocol” on page 547 and “Using the SONET/SDH Switcher” on page 121.

See “OC-192 Receiver Window” on page 397 for a description of this module’s features and user interface in SONET mode.

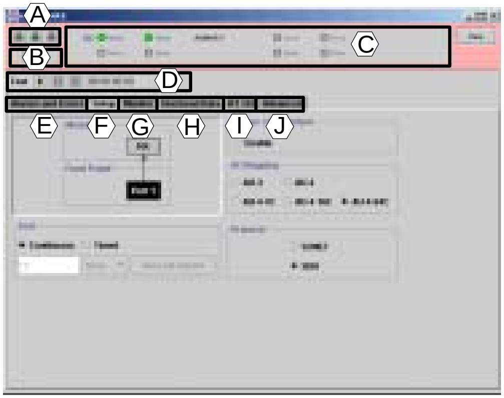
- For more information about EPXam, see “Using EPXam” on page 3.
- For information about changing and installing STM-64 modules, see “Changing Modules” on page 126.

Main View

The STM-64 receiver window has tabs for configuring setup options and monitoring error and alarm data.

The main view of the STM-64 receiver also has standard controls for running tests, saving and restoring configuration, and viewing alarm/error status, current signal rate and channel.

The following figure shows the main features of the STM-64 receiver window.



A Save or restore module/slot configuration or factory defaults, as described in“Saving and Restoring Test Configurations” on page 107.

B **Identify**—When pressed, **Identify** flashes the Active LED on the module associated with this window.

C View summary defect status, alarm indicators, and other module information. See “Expanded Logical View Indicators” on page 8.

D Start, stop, or pause test; view elapsed time.

E **Alarms and Errors**—Monitor service disruption data, alarm status, errors counts, and error ratios for current test, as described in “Alarms and Errors” on page 539.

F **Setup**—Set test type and duration, clock output trigger, and payload mapping; enable service disruption; and view status, as described in “Setup” on page 544.

G **Monitor**—Monitor trace messages and pointer events; select framing mode, channel, and data pattern, as described in “Monitor” on page 548.

H **Overhead Data**—View transport and path overhead byte values for the selected STM-1 time slot, as described in “Overhead Data” on page 551.

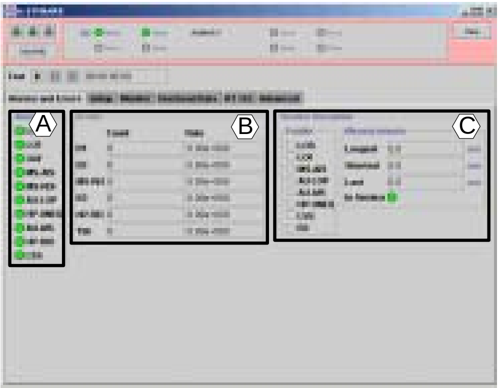
I **K1/K2**— Monitor K1 and K2 values and messages, as described in “K1/K2 Values” on page 554.

J **Advanced**— Set bit filtering, as described in “Advanced Settings” on page 556.

Alarms and Errors

The **Alarms and Errors** tab displays alarm status indicators, error counts, and error ratios for the current test.

The following figure shows the main features of the STM-64 receiver **Alarms and Errors** tab.



A **Alarms**—View alarm status indicators for current test, as described in “Alarms” on page 539.

B **Errors**—View error counts and error ratios for current test, as described in “Errors” on page 541.

C **Service Disruption**—Enable one or more alarm types for service disruption monitoring and view service disruption in-service status and data for the current test. See “Service Disruption Monitoring” on page 542.

Alarms

The Alarm area displays status indicators for the current test.

Alarm indicator colors are defined in the following table.

Note If an alarm is greyed out in this view, it means that alarm does not apply to the current test configuration.

Green	Yellow	Red
No alarms are detected: signal is clear, or monitoring is not started.	Alarm history: an alarm was detected but is not active in the current test.	An alarm is active and currently detected on the monitored signal.

The following alarms can be monitored.

Alarm Indicator	Description
LOS	Loss of Signal LOS is declared either when a received signal with an all-zeroes pattern has insufficient data bit transitions or when the as received clock cannot be recovered from the received signal because the optical power is insufficient. LOS ends when a received signal has a minimum optical power and data bit transitions so that the as received clocked can be recovered, and two consecutive valid frame alignment patterns occur without LOS defects.
LOF	Loss of Frame LOF occurs when an OOF condition occurs and does not clear for more than 3 milliseconds. LOF ends 3 milliseconds after OOF ends.
OOF	Out of Frame OOF occurs when 4 consecutive frames do not contain a valid frame word. OOF ends when two successive error-free framing patterns are detected.
MS-AIS	Multiplex Section Alarm Indicator Signal MS-AIS is a static, all ones data pattern in the line. It is detected in the K2 byte (bits 6,7,8) when all ones are present for 5 consecutive frames. MS-AIS is cleared after five frames with a pattern other than all ones in K2.

Alarm Indicator	Description
MS-RDI	Multiplex Section Remote Defect Indication MS-RDI is detected when K2 (bits 6,7,8) is 110 for 5 consecutive frames. MS-RDI is cleared when K2 (bits 6,7,8) is not 110 for 5 consecutive frames.
AU-LOP	Administrative Unit Loss of Pointer The AU-LOP alarm is declared when a detected pointer-offset value is out of range, is greater than 782, or has an invalid New Data Flag (NDF) value, the four most significant bits of pointer byte H1 do not conform to a majority rule for a normal or NDF.
HP-UNEQ	High-Order Path Unequipped HP-UNEQ is detected after 5 consecutive frames of all zeroes in the C2 byte of the path overhead. HP-UNEQ is cleared when 5 consecutive frames containing valid data in the C2 byte are detected (that is, the C2 byte is not 0x00).
AU-AIS	Adminstrative Unit Alarm Indication Signal The AU-AIS alarm is indicated by a persistent all ones data pattern in the AU and its associated pointers (H1, H2). AU-AIS is cleared when 3 consecutive frames with valid pointers are detected, and the pointer bytes are not all ones.

Alarm Indicator	Description
HP-RDI	High-Order Path Remote Defect Indicator RDI-P is declared when bit 5 (this is fourth from LSB) of G1 is 1 for 10 consecutive frames. RDI-P is cleared when bit 5 of G1 is 0 for 10 consecutive frames.
LSS	Loss of Sequence Sync LSS is declared when the received bit error rate is too high (at least one in three consecutive 128-bit sequences), indicating that a selected pattern cannot be matched for the received payload. LSS terminates when no errors in three consecutive payload patterns are detected. The LSS alarm does not apply to Live payload data monitoring.

SCPI Examples:
`SENS(@3):ALAR:LOS?`
`SENS(@3):ALAR:LOF?`
`SENS(@3):ALAR:OOF?`
`SENS(@3):ALAR:AUL?`
`SENS(@3):ALAR:LSS?`
`SENS(@3):ALAR:MSA?`
`SENS(@3):ALAR:MSRD?`
`SENS(@3):ALAR:HPUN?`
`SENS(@3):ALAR:MSR?`
`SENS(@3):ALAR:HPR?`	

Errors

The Errors area displays error counts and ratios for the current test.

The error data is cumulative. To get data for intervals, see “Logging” on page 63. Once a test is restarted, the error history is cleared.

Error Type or Setting	Description
B1	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B1 section parity byte. Only in framed mode.
B2	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B2 line parity byte. Only in framed mode.
MS-REI	The Multiplex Section Remote Error Indicator error is declared when the M1 byte has a non-zero value. A maximum of 255 errors are reported per frame.
B3	This error is declared when the BIP-8 value calculated on the received signal does not match the value of the received B3 path parity byte. Only in framed mode.

Error Type or Setting	Description
HP-REI	The High-Order Path Remote Error Indicator error is declared when bits 1-4 of the G1 byte have a non-zero value. A maximum of eight errors are reported per frame.
TSE (Payload)	This error is declared when the payload pattern of the received signal does not match the pattern selected.
Count	Number of errors of the specified type detected in the current test.
Rate	Computed error ratio for the specified error type for the current test.

SCPI Examples:

```
SENS(@18):ERR:COUN:B1ER?
SENS(@18):ERR:RAT:B1ER?
SENS(@18):ERR:COUN:B2ER?
SENS(@18):ERR:RAT:B2ER?
SENS(@18):ERR:COUN:B3ER?
SENS(@18):ERR:RAT:B3ER?
SENS(@18):ERR:COUN:TSE?
SENS(@18):ERR:RAT:TSE?
SENS(@18):ERR:COUN:MSR?
SENS(@18):ERR:RAT:MSR?
SENS(@18):ERR:COUN:HPR?
SENS(@18):ERR:RAT:HPR?
```

Service Disruption Monitoring

The **Service Disruption** tab displays In-Service status and the time, in milliseconds of the longest, shortest, and most recent service disruptions detected during the current test. This tab also provides controls for selectively enabling alarms for service disruption monitoring.

- "Service Disruption Detection" on page 542
- "Service Disruption Limitations" on page 543
- "Controls, Measurements, and Indicators" on page 543

SERVICE DISRUPTION DETECTION

A service disruption condition is detected when one or more of the following alarms that are enabled for service disruption monitoring are detected in the monitored signal.

- LOS—Loss of Signal
- LOF—Loss of Frame
- MS-AIS—Multiplex Section Alarm Indicator Signal
- AU-LOP—Administrative Unit Loss of Pointer
- B3 (Path CV)—Path code violation

  A Path CV alarm condition is detected when there are 4 consecutive frames containing Path CV (B3) errors.
- AU-AIS—Administrative Unit Alarm Indicator Signal
- HP-UNEQ—High-Order Path Unequipped

- LSS—Loss of sequence synchronization.

See “Alarms” on page 539 for a description of these alarms.

Service disruption alarm states are updated at each SONET/SDH frame, or once every 125 microseconds. The service disruption condition is cleared when none of the above conditions are present in the monitored signal.

SERVICE DISRUPTION LIMITATIONS

The following limitations apply to service disruption monitoring on the STM-64 Receiver:

- When multiple alarms are enabled, the last and longest service disruption measurements start with the first detected alarm and end with the last detected alarm. The start and end alarms may not be the same type.
- Service disruption tests must start with a clear signal with no alarms or errors.
  - Start a test.
  - Enable service disruption for the desired alarm(s).
  - Inject alarms.
- An AU-LOP alarm may not cause a service disruption in the default service disruption configuration, in which only LSS (Loss of Sequence Sync) is enabled. AU-LOP (Loss of Pointer) must must be enabled to guarantee service disruption measurement for AU-LOP-only alarms.
- The service disruption time limit is 16777215 frames or approximately 35 minutes. Longer disruptions produce false measurements.
- Event counter overflow can occur when multiple alarms are enabled for service disruption monitoring and a major alarm, such as LOF, is bouncing. Overflow is indicated when **Last** displays 9,999,999.000 ms. Limit the number of alarms that are enabled to reduce the chance of an overflow.

CONTROLS, MEASUREMENTS, AND INDICATORS

Service disruption alarm enable controls, measurements, and indicators are described in the following table.

Setting or Field	Description
Enable	When the Enable box for a type of alarm is checked, a service disruption event is triggered when that alarm is detected and service disruption measurement begins. This is how you specify which types of alarms are monitored for service disruption. To disable service disruption monitoring, uncheck the boxes for all alarm types. By default, only LPS alarms are enabled for service disruption monitoring.

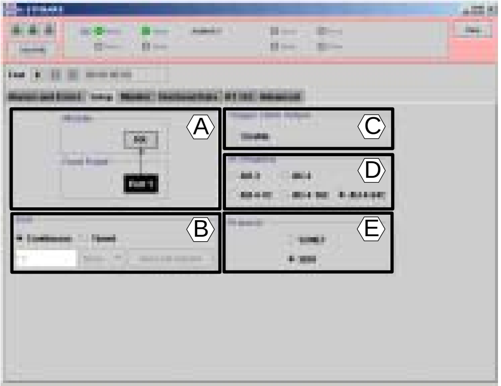
Setting or Field	Description
Measurement	The following service disruption measurement statistics are displayed: • **Longest**—Time, in milliseconds, of the longest service disruption period for the current test. • **Shortest**—Time, in milliseconds, of the shortest disruption period for the current test. • **Last**—Time, in milliseconds, of the most recent service disruption that occurred during the current test.
In-Service Indicator	The In-Service indicator colors are interpreted as follows: • **Green**—No service disruptions have occurred since the last test restart. • **Red**—A service disruption condition is present in the current test. • **Yellow**—At least one service disruption was detected since the last test restart, but none is currently detected.

Setting or Field	Description

SCPI Examples:
To monitor service disruption data:
`SENS(@6):DISR:LONG ?`
`SENS(@6):DISR:SHOR ?`
`SENS(@6):DISR:LAST ?`
`SENS(@6):DISR:INS ?`
To subscribe to service disruption events:
`SUBS(@6)SENS:DISR:ALL 1`
To unsubscribe to service disruption events:
`SUBS(@6)SENS:DISR:ALL 0`
To disable service disruption monitoring:
`SENS(@6):DISR ENAB OFF`
To enable service disruption monitoring and specify which alarms trigger service disruption events, use the `SENS(@1:18):DISR:ENAB` command and specify a list of alarms to enable. Separate alarms in the list with semi-colons and do not include any spaces in the list. Valid values for the alarm parameter list are `LOF`, `MS-AIS`, `AU-LOP`, `AU-AIS`, HP-`UNEQ`, `LSS`, and `B3`.
`sens(@6):disr:enab LOS;LOF;MS-AIS;AU-LOP`	

Setup

The following figure illustrates the main features of the **Setup** tab.



A View graphic display of signal source and backplane output settings. This configuration cannot be modified for the STM-64 Receiver.

B **Test**—Set the test type and duration, as described in “Test” on page 545.

C **Trigger Clock Output**—Enable or disable clock trigger output on the STM-64 front panel connector (CLK_OUT), as described in “Trigger Clock Output” on page 546.

D **SPE Mapping**—Set the expected size and mapping of the monitored virtual container (VC)., as described in “SPE Mapping” on page 546.

E **Protocol**—Switch the module protocol between SONET and SDH, as described in “Protocol” on page 547.

Test

The Test area defines the type and duration of the test that the receiver runs. To start and stop tests, use the controls in the module window or, to start tests for multiple modules, use the Test Controls window. See “Controlling Tests” on page 115.

Note Selecting a new test type automatically stops the current test.

Test Setting	Description
Continuous	Selects a continuous test that must be manually stopped and started.
Timed	Selects a timed test. When Timed is selected: **1** Specify a number and select a unit (seconds, minutes, hours, and days) for the test duration. **2** Click **Set** to apply the settings. **3** Use the controls at the top of the window to start the test.

SCPI Examples:

```
sens(@3):test:type cont
sens(@3):test:type tim
sens(@3):test:unit min
sens(@3):test:per 10
```

To control tests use the following commands:

```
sens(@3):test:mode star
sens(@3):test:mode stop
sens(@3):test:mode rest
sens(@3):test:mode pause
```

Related Topics:

“Logging” on page 63

“Controlling Tests” on page 115

Trigger Clock Output

The **Clock Trigger Output** enables a synchronized clock output on the TRIG_CLK SMA connector on the module's front panel.

This clock output is synchronized to the optical signal input. The clock trigger operates at the received clock frequency.

Output Setting	Description
Enable	When checked, the clock trigger is active, and a signal is transmitted out on the CLK_OUT port. When unchecked, the clock trigger is not active, and no signal is transmitted out on the CLK_OUT port.

SCPI Examples:
`SENS(@7):TRIG:CLOC:ENAB ON`
`SENS(@7):TRIG:CLOC:ENAB OFF`	

SPE Mapping

The SPE Mapping option sets the expected virtual container (VC) size and mapping for the monitored signal. This setting affects STM and AU selection in the Monitor and Overhead Data tabs.

SPE Mapping	Description
AU-3	Selects an AU-3 sized payload for the VC.
AU-4	Selects an STS-3C sized payload for the VC.
AU-4-4C	Selects an STS-12C sized payload for the VC.
AU-4-16C	Selects an STS-48c sized payload for the VC.
AU-4-64C	Selects an STS-192c sized payload for the VC.

SCPI Examples:
`SENS(@7):DATA:SIZE AU3`
`SENS(@7):DATA:SIZE AU4`
`SENS(@7):DATA:SIZE AU44C`
`SENS(@7):DATA:SIZE AU416C`
`SENS(@7):DATA:SIZE AU464C`
Related Topics:
“STM and AU” on page 548
“Path Overhead” on page 553	

Protocol

The Protocol setting switches the module between SONET and SDH. When the switch is complete, EPXam displays the appropriate protocol configuration options and field labels for the module and updates all references to the module to use the correct protocol.

Note Switching between SONET and SDH protocol does *not* require a restart of the test system or EPXam.

Restrictions:

- Modules that are locked via the Group Manager cannot be switched by other users.
- Active test and logging sessions associated with a module at the time of a switch are cancelled.

  If tests or logging sessions are in progress on any of the modules being switched, a warning dialog is displayed. Click **Cancel** to abort the switch or **Continue** to complete the switch. If you choose **Continue**, running tests and logging sessions are cancelled. Otherwise, a dialog opens that displays the switching progress.

Setting	Description
SONET	Switches the module to SONET without restarting the test system or EPXam. This is the default setting in the factory configuration.
SDH	Switches the module to SDH without restarting the test system or EPXam.

SCPI Examples:
`SYST:BOAR(@7):PROT:TYPE SON`
`SYST:BOAR(@7):PROT:TYPE SDH`
`SYST:BOAR(@7):PROT:STAT?`	

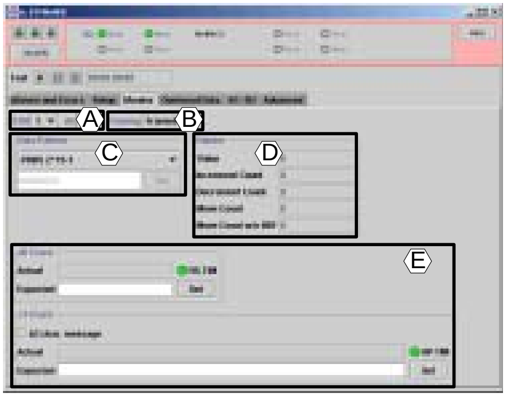
See “OC-192 Receiver Window” on page 397 for a description of this module’s SDH features and configuration.

See the following topics for more information about SONET/SDH switching:

- “Using the SONET/SDH Switcher” on page 121
- “SONET/SDH Switching and Custom Configuration Files” on page 123
- “Switching Modules Using SCPI” on page 123

Monitor

The following figure illustrates the main areas on the **Monitor** tab.



A **STM and AU**—Select an STM and AU to monitor, as described in "STM and AU" on page 548.

B **Framing**—Select framed or unframed mode, as described in "Framing" on page 549.

C **Data Pattern**—Select a payload data pattern or specify a custom payload data pattern to monitor in the received payload, as described in "Data Pattern" on page 549.

D **Pointer**—Monitor the STS pointer value and pointer event counts, as described in "Pointer" on page 550.

E **Trace**—Monitor J0 section and J1 path trace messages in the received signal, as described in "J0 Trace" on page 550 and "J1 Trace" on page 551.

STM and AU

The STM and AU settings determines which STM channel and Administrative Unit (AU) time slot is monitored. Available STM and AU selections depend on the currently selected SPE mapping.

Setting	Description
STM	Select the STM to monitor in the received payload. This field is linked to the SPE field in the **Overhead** tab. The number of STM channels depends on the setting for the SPE mapping (SPE size). Channel 1 is the default in the factory configuration. • If the mapping is AU-3 or AU-4, select 1 of 64. • If the mapping is AU-4-4c, select 1 of 16. • If the mapping is AU-4-16c, select 1 of 4. • If the mapping is AU-4-16c, there is only 1 STM.
AU	Select the number of the Administrative Unit (AU) time slot to monitor. The number of AUs depends on the currently selected AU Mapping. • If the AU size is AU-3, select 1 of 3. AU 1 is the default for the factory configuration. • Otherwise, there is only one AU.

Setting	Description

SCPI Example:
`SENS(@6):DATA:STM 4`
`SENS(@6):DATA:AUN 3`
Related Topics:
“SPE Mapping” on page 546	

Framing

The Framing area selects whether the monitored signal is framed or unframed.

Setting	Description
Framed	Sets the monitored signal to framed mode with transport overhead per GR-253-CORE and GR-1377-CORE.
Unframed	Sets the monitored signal to unframed mode with no transport overhead. Several features are not available in unframed mode: • Selectable SPE mappings • Only LOS and LSS alarm monitoring • Pointer monitoring • Overhead monitoring • Only TSE error monitoring

SCPI Examples:
`SENS(@6):DATA:MODE FRAM`
`SENS(@6):DATA:MODE UNFR`	

Data Pattern

The Payload Pattern selects the type of pattern to monitor in the generated payload.

Settings	Description
PRBS 2^7-1 **PRBS 2^15-1** **PRBS 2^20-1** **PRBS 2^23-1** **PRBS 2^31-1**	Pseudo random bit patterns. The default setting is PRBS 2^15-1. PRBS 2^7-1 is only available in unframed mode.
Inv. PRBS 2^7-1 **Inv. PRBS 2^15-1** **Inv. PRBS 2^20-1** **Inv. PRBS 2^23-1** **Inv. PRBS 2^31-1**	Inverted pseudo random bit patterns. The default setting is PRBS 2^15-1. Inv. PRBS 2^7-1 is only available in unframed mode.
Live	Monitor live payload data pattern. Only in framed mode.
User	Defines an 8-bit or 16-bit binary user-defined payload pattern. Only in framed mode.
Set	If a custom user-defined payload pattern is defined, click **Set** to apply the changed user payload pattern.

SCPI Examples:
`SENS(@6):PAYL:MON:PATT:TYPE PR215`
`SENS(@6):PAYL:MON:PATT:TYPE PR223`
To generate a custom payload pattern using SCPI, set the pattern type to USER and define the bit pattern.
`SENS(@3):PAYL:MON:PATT:TYPE USER`
`SENS(@3):PAYL:MON:PATT:USER 0b00110011`	

Pointer

The **Pointer** area displays Administrative Unit (AU) pointer values and event counts.

AU pointer event counters are reset at the start of each test period.

Pointer Field	Description
Value	Displays the current value in hexadecimal of the Administrative Unit (AU) pointer. This value is what the hardware pointer processor interprets as the current pointer.
Increment Count	Number of AU pointer increment events since the last restart.
Decrement Count	Number of AU pointer decrement events since the last restart.
Move Count	Number of times the pointer moved to a new pointer value using the New Data Flag (bits 1 to 4 of the H1 pointer byte).
Move w/o NDF Count	Number of times the pointer moved to a new pointer value without the New Data Flag (missing NDF).

SCPI Examples:

```
SENS(@6):POIN:VAL  ?
SENS(@6):POIN:COUN:INCR?
SENS(@6):POIN:COUN:DECR?
SENS(@6):POIN:COUN:NDF?
SENS(@6):POIN:COUN:MNDF?
```

J0 Trace

The J0 Trace area displays the received J0 trace message, RS-TIM alarm status, and allows you to define and enable monitoring of the expected J0 trace message.

Field/ Indicator	Description
Actual	Displays the received 15-byte J0 section trace message.
Expected	Enter a 15-byte character string to be used as the expected trace message for the RS-TIM (Regenerator Section-Trace Identifier Mismatch) alarm.
Set	Click **Set** to enable monitoring of the expected J0 trace message.
RS-TIM Alarm Indicator	Displays the status of the Regenerator Section-Trace Identifier Mismatch (RS-TIM) alarm. **Green**—The actual message matches the expected message. **Red**—A mismatch is active. **Yellow**—A mismatch was detected during the current test but is not active.

SCPI Examples:

```
SENS(@3):DATA:SECT:TRAC?
SENS(@3):DATA:SECT:EXP “15-byte msg”
SENS(@3):DATA:SECT:TIM?
```

J1 Trace

The J1 Trace area displays the received J1 trace message, HP-TIM alarm status, and enables you to define and enable monitoring of the expected J1 trace message.

Field/ Indicator	Description
62-char. Message	When checked, this selection enables 64-byte J1 trace message length. The default is disabled, which selects a 15-byte J1 trace message.
Actual	Displays the received 15 or 62-byte J1 trace message.
Expected	Enter a 15- or 62-byte character string to be used as the expected J1 trace message for the HP-TIM (High order Path Trace Identifier Mismatch) alarm. For a 64-byte message, two bytes are used for the newline and string terminator; for a 16-byte message, one byte is used for a CRC.
Set	Click **Set** to enable monitoring of the expected J1 trace message.
HP-TIM Alarm Indicator	Displays the status of the High order Path-Trace Identifier Mismatch (HP-TIM) alarm. **Green**—The actual message matches the expected message. **Red**—A mismatch is active. **Yellow**—A mismatch was detected during the current test but is not active.

Field/ Indicator	Description

SCPI Examples:
`SENS(@3):DATA:PATH:TRL 64`
`SENS(@3):DATA:PATH:EXP "J1 trace msg"`
`SENS(@3):DATA:PATH:TRAC?`
`SENS(@3):DATA:PATH:TIM?`	

Overhead Data

The STM-64 **Overhead Data** tab displays the current values of the STS section, line, and path overhead bytes for the selected STS channel.

Overhead bytes are labeled according to GR-253 standards. In some cases, an overhead byte is only defined in the first STS-1 of an STS-*n*; in other cases, bytes in the same position in different STS channels have different labels. For example, the J0 byte is defined in the first STS-1 of an STS-n, but the same byte position is labeled Z0 in the remaining STS channels.

Note Dashes (--) are displayed for bytes that are undefined by GRE-253.

The following figure shows the layout of the STM-64 **Overhead Data** tab.

A **Transport Overhead**—View transport overhead (section and line) byte values for the selected STS channel, as described in "TransPort Overhead" on page 552.

B **Path Overhead**—View path overhead byte values for the selected SPE, as described in "TransPort Overhead" on page 552

TransPort Overhead

The following table describes the STS transport overhead fields and values.

Transport Overhead	Description
STM	Select 1 of 192 STM-1 channels for which you want to view regenerator and multiplex section overhead bytes. Channel 1 is the default in the factory configuration.
A1, A2	Section overhead framing bytes.
J0	Regenerat section (RS) trace byte.
E1	RS orderwire byte
F1	RS user channel byte located in first STS-1 of an STS-N.
D1, D2, D3	RS data communication channel bytes.
K1, K2	APS (automatic protection switching) channel bytes.
H1, H2	Payload pointer bytes.
H3	Pointer action byte.
D4 through D12	Multiplex sections (MS) data communications channel bytes.
S1	Synchronization status byte.
M1	MS Remote Error Indicator (MS-REI) byte.
E2	MS orderwire byte.
Z0, Z1, Z2	Allocated for future growth.

Transport Overhead	Description

SCPI Examples:
Use the following command to query the values for bytes A1;A2;J0;B1;E1;F1;D1;D2;D3.
`SENS(@6):DATA:SECT:OVER:BYT?`
Use the following command to set the values for bytes H1;H2;H3;B2;K1;K2;D4;D5;D6;D7;D8;D9;D10;D11;D12;S1;M1;E2.
`SENS(@6):DATA:LINE:OVER:BYT?`
For detailed information, see"Overhead Queries" on page 606.	

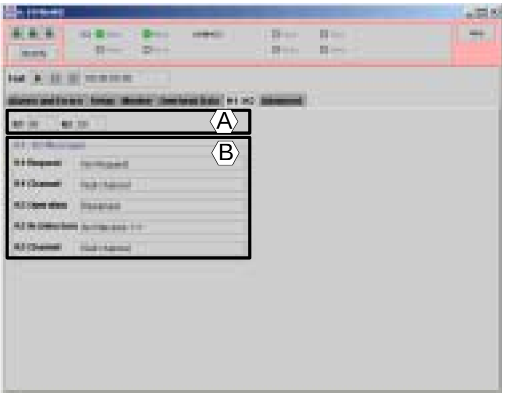
Path Overhead

The following table describes path overhead bytes.

Path Overhead	Description
STM and AU	Select the STM and AU time slot for which you want to monitor path overhead bytes. Channel 1 is the default in the factory configuration. The available channels depends on the selected AU mapping. This field is linked to the STM and AU fields in the **Monitor** tab.
J1	High-order VC-N path trace byte.
C2	Path signal label.
G1	Path terminating status byte.
F2, F3	Path user channel bytse.
H4	Indicator allocated for use as a mapping-specific indicator byte.
K3	APS signalling in bits 1-4. Bits 5-8 are reserved for future use.
N1	Network operator byte for tandem connection monitoring.
SCPI Examples: Use the following command to set the values for bytes J1;B3;C2;G1;F2;H4;Z3;Z4;Z5. `SENS(@6):DATA:PATH:OVER:BYT?` For detailed information, see "Overhead Queries" on page 606. **Related Topics:** "SPE Mapping" on page 546	

K1/K2 Settings

The following figure shows the main features of the **K1/K2** tab.



A **K1/K2 Values**—Hexadecimal values of the automated protection switching (APS) channel K1 and K2 bytes, as described in “K1/K2 Values” on page 554.

B **K1/K2 Messages**—Displays automated protection switching (APS) channel messages decoded from the K1/K2 bytes, as described in “K1/K2 Messages” on page 555.

K1/K2 Values

The **K1/K2 Values** field displays the hexadecimal values of the automated protection switching (APS) channel K1 and K2 bytes for the monitored signal.

Field/ Setting	Description
K1	Bits 1 through 4 control the request message, and bits 5 through 8 control the channel message code.
K2	Bits 1 through 4 of the K2 byte control the channel number, bit 5 controls the architecture, and bits 6 thorough 8 indicate the mode of operation.
SCPI Examples: `SENS(@18):TRAN:APS:K1K2?`	

K1/K2 Messages

This field displays automated protection switching (APS) channel messages decoded from the K1/K2 bytes.

K1/K2 Messages	Description
K1 Request	Bits 1 through 4 of K1 can contain the following request messages. **Lockout of Protection**. Bits 1 through 4 have a value of 1111. **Forced Switch**. Bits 1 through 4 contain 1110. **SF - High Priority**. Bits 1 through 4 Have a value of 1101. **SF - Low Priority**. Bits 1 through 4 have a value of 1100. **SD - High Priority**. Bits 1 through 4 have a value of 1011. **SD - Low Priority**. Bits 1 through 4 have a value of 1010. **Manual Switch**. Bits 1 through 4 have a value of 1000. **Wait-to-Restore**. Bits 1 through 4 have a value of 0110. **Exercise**. Bits 1 through 4 have a value of 0100. **Revert Request**. Bits 1 through 4 have a value of 0100. **Do Not Revert**. Bits 1 through 4 have a value of 0001. **No Request**. Bits 1 through 4 have a value of 0000. This is the default in the factory configuration.

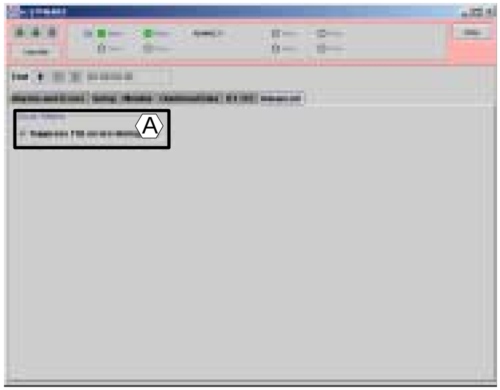
K1/K2 Messages	Description
K1 Channel	Channel selection for the requesting message (bits 5 through 8 of K1 carry the channel message code): **0**. Null channel. **1** to **14**. Channel 1 through 14. **15**. Extra traffic channel.
K2 Operation	Operational mode of the APS. Bits 6 through 8 of the K2 byte carry this information. **Unidirectional**. Bits 6 to 8 have a value of 100. **Bidirectional**. Bits 6 to 8 have a value of 101.
K2 Architecture	Architecture mode for the APS. Bit 5 of K2 carries this information. **Architecture 1+1**. Bit 5 is 0. **Architecture 1:n**. Bit 5 is 1.
K2 Channel	Channel selection for the requesting message (bits 1 through 4 of K2 carry the channel message code): **0**. Null channel. **1** to **14**. Channel 1 to 14. **15**. Extra traffic channel.

SCPI Examples:

```
SENS(@8):APS:ENAB 1
SENS(@8):APS:K1D:REQ?
SENS(@8):APS:K1D:CHAN?
SENS(@8):APS:K2D:OPER?
SENS(@8):APS:K2D:ARCH?
SENS(@8):APS:K2D:CHAN?
```

Advanced Settings

The following figure illustrates the settings that are configured on the STM-64 receiver **Advanced** tab.



A **Error Filters**—Option for suppressing bit errors when LPS alarm is detected, as described in “Bit Error Suppression” on page 556.

Bit Error Suppression

Because TSE error counts can be high while an LSS alarm occurs, you can suppress, or filter, the bit error count.

Filter Setting	Description
Suppress Bit Errors	When checked, TSE errors are not counted when an LSS alarm is active. When unchecked, TSE errors are counted when an LSS alarm is active

SCPI Examples:

```
SENS(@18):ALAR:IGN LSS OFF
SENS(@18):ALAR:IGN LSS ON
```

37

STM-64 Transmitter Window

The topics in this section explain how to configure setup options, alarm and error insertion, payload generation, and overhead data values for the STM-64 transmitter.

Instructions are provided for using EPXam to configure the module, along with SCPI equivalents.

Tip STM-64 Transmitters can be switched between SONET and SDH functionality. See “Protocol” on page 562 and “Using the SONET/SDH Switcher” on page 121.

See “OC-192 Transmitter Window” on page 419 for a description of this module’s features and user interface in SONET mode.

- For more information about EPXam, see “Using EPXam” on page 3.
- For information about changing and installing STM-64 modules, see “Changing Modules” on page 126.

Main View

The following figure illustrates the main features of the STM-64 Transmitter window. The features are described in the following sections.

A Save and restore module configurations or restore factory default settings, as described in "Saving and Restoring Test Configurations" on page 107.

B **Identify**—When pressed, **Identify** flashes the Active LED on the module associated with this window.

C Error and alarm status indicators, as described in "Alarms" on page 567. This includes the currently selected signal rate and channel. For more detail about the summary view, see "Expanded Module Status Summary" on page 6 and "Expanded Logical View Indicators" on page 8.

D **Setup**—Configure transmitter clock source, enable triggers, enable laser output, and define the SPE mapping, as described in "Setup" on page 561.

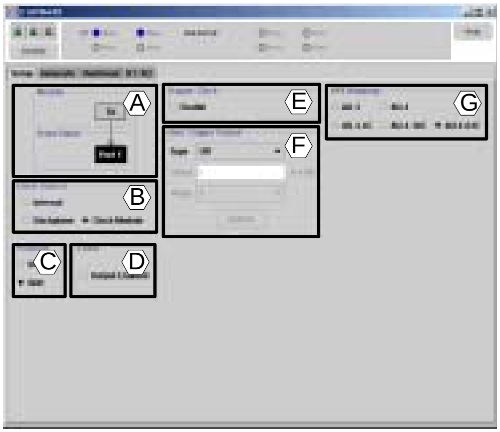
E **Generate**—Configure alarm and error insertion, trace messages, pointer values, K1/K2 bytes, data pattern, channel selection, and framing, as described in "Generate Settings" on page 565.

F **Overhead Data**—Modify bytes for path and transport overhead for selected STS channels, as described in "Overhead Data" on page 573.

G **K1/K2**— Set , as described in "K1/K2 Settings" on page 576.

Setup

The following figure illustrates the main features of the STM-64 TX **Setup** tab. These features are explained in more detail in the following sections.



A View graphic display of signal source and backplane output settings. This configuration cannot be modified for the STM-64 Transmitter.

B **Clock Source**—Select the source for the timing reference that is used to generate the SONET payload, as described in "Clock Source" on page 561.

C **Protocol**—Switch between SONET and SDH protocol, as described in "Protocol" on page 562.

D **Laser**—Enable or disable the laser output to the port on the transmitter's front panel, as described in "Laser Output Enabled" on page 563.

E **Trigger Clock**—Enable or disable a clock trigger output to the connector on the transmitter's front panel, as described in "Clock Trigger Output" on page 563.

F **User Trigger Output**—Enable or disable a user trigger output to the connector on the transmitter's front panel and configure the delay and duration of the trigger, as described in "User Trigger Output" on page 563.

G **SPE Mapping**—Configure the synchronous payload envelope mapping for the transmitted signal, as described in "SPE Mapping" on page 565.

Clock Source

The **Clock Source** setting selects the timing reference that is used to generate the SONET payload.

Clock Source Setting	Description
Internal	Selects the on-board oscillator for the timing reference..
Backplane	Selects the backplane signal for the timing reference. This clock is the clock provided by the adjacent receiver to the left in the chassis. The clock frequency must be 622.08 MHz.

Clock Source Setting	Description
Clock Module	Selects the timing reference from the EPX Test System's clock module. Verify that the EPX clock module is correctly providing a SONET/SDH timing reference for the slot in which the STM-64 Transmitter is installed.

SCPI Examples:
`SOUR(@7):CLOC INT`
`SOUR(@7):CLOC CLKB`
`SOUR(@7):CLOC BACK`
Related Topics
"Configuring the EPX100 Clock Module" on page 25	

Protocol

The Protocol setting switches the module between SONET and SDH. When the switch is complete, EPXam displays the appropriate protocol configuration options and field labels for the module and updates all references to the module to use the correct protocol.

Note Switching between SONET and SDH protocol does *not* require a restart of the test system or EPXam.

Restrictions:

- Modules that are locked via the Group Manager cannot be switched by other users.
- Active test and logging sessions associated with a module at the time of a switch are cancelled.

  If tests or logging sessions are in progress on any of the modules being switched, a warning dialog is displayed. Click **Cancel** to abort the switch or **Continue** to complete the switch. If you choose **Continue**, running tests and logging sessions are cancelled. Otherwise, a dialog opens that displays the switching progress.

Setting	Description
SONET	Switches the module to SONET without restarting the test system or EPXam. This is the default setting in the factory configuration.
SDH	Switches the module to SDH without restarting the test system or EPXam.

SCPI Examples:
`SENS(@7):DATA:BACK ENAB 1`
`SENS(@7):DATA:BACK ENAB 0`	

See "OC-192 Transmitter Window" on page 419 for a description of this module's SONET features and configuration.

See the following topics for more information about SONET/SDH switching:

- “Using the SONET/SDH Switcher” on page 121
- “SONET/SDH Switching and Custom Configuration Files” on page 123
- “Switching Modules Using SCPI” on page 123

Laser Output Enabled

The **Output Enabled** selection controls whether or not an optical signal is sent to the output connector on the transmitter’s front panel. By default, the signal output is disabled.

When checked, an optical signal is sent to the output connector. When unchecked, no signal is sent.

SCPI Examples:

```
SOUR(@7):SIGN:ENAB ON
SOUR(@7):SIGN:ENAB OFF
```

Clock Trigger Output

The **Clock Trigger Output** enables a synchronized clock output on the TRIG_CLK SMA connector on the module's front panel. This clock output is synchronized to the optical signal output. The clock trigger operates at the frequency of the selected clock source. See “Clock Source” on page 561 for setting the clock source.

Clock Trigger Setting	Description
Enable	When checked, a trigger clock output is sent to the front panel connector. When unchecked, no trigger clock output is sent.
SCPI Examples: SOUR(@7):TRIG:CLOC:ENAB ON SOUR(@7):TRIG:CLOC:ENAB OFF	

User Trigger Output

The **User Trigger Output** enables a trigger pulse output on the USER_TRIG SMA connector on the Transmitter 's front panel.

User Trigger Setting	Description
Type	Selects when the trigger pulse occurs. The following settings are available. **Off**—This setting disables sending any pulse to the USER_TRIG connector. **8KHz Frame Pulse**—Available in framed mode only, this setting enables pattern (or user) triggering that is synchronized to the SDH frame. **Start of PRBS**—This setting enables pattern (or user) triggering that is synchronized to the currently selected PRBS pattern for the payload. This setting is only available when the signal is unframed and when the payload pattern is either 2^7-1 or inverted 2^7-1 PRBS. **Event**—Available in framed mode only, this setting enables event triggering that is synchronized to events as defined in Telcordia GR-253-CORE, section 5.3.3. Inject one of the following defects: • LOS alarm • LOF alarm • AIS-L alarm • Line (B2) BER—Any rate triggers the event. The rate does not have to exceed 10-3.

User Trigger Setting	Description
Offset x 1 Bit	Defines the delay of the trigger pulse in increments of a single bit. This setting is available only when **Type** is set to **Start of PRBS**. This setting is not changed until **Submit** is clicked. This setting uses the `SOUR(@`*slot*`):TRIG:PATT:FINE` command.
Width	Defines the duration of the trigger pulse in clock pulse units. The available values are 0-127. This setting is available only when **Type** is set to **Start of PRBS**. This setting is not changed until **Submit** is clicked. This setting uses the `SOUR(@`*slot*`):TRIG:PATT:LENG` command.
Submit	Sets the Offset and Width parameters to the user-defined values. If **Submit** is not clicked, no changes are applied.

SCPI Examples:

```
SOUR(@7):TRIG:TYPE FRAM
SOUR(@7):TRIG:TYPE EVENT
SOUR(@7):TRIG:TYPE OFF
SOUR(@7):TRIG:PATT:FINE 1
SOUR(@7):TRIG:PATT:LENG 8
```

Related Topics

“Framing” on page 570

“VC-n” on page 566

“Data Pattern” on page 572

SPE Mapping

The SPE Mapping option sets the virtual container (VC) size and mapping for the generated signal.

This setting affects options for the STM and AU selections in the **Generate** and **Overhead** tabs. Changing the SPE Mapping also returns the VC-n selection to the default of Broadcast.

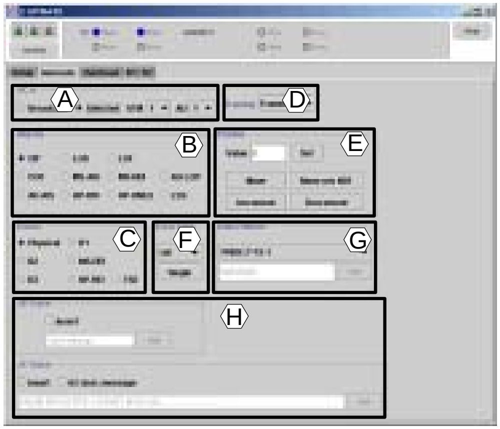
SPE Mapping	Description
AU-3	Selects an AU-3 sized payload for the VC.
AU-4	Selects an STS-3C sized payload for the VC.
AU-4-4C	Selects an STS-12C sized payload for the VC.
AU-4-16C	Selects an STS-48c sized payload for the VC.
AU-4-64C	Selects an STS-192c sized payload for the VC.

SCPI Examples:

```
SOUR(@7):DATA:SIZE AU3
SOUR(@7):DATA:SIZE AU4
SOUR(@7):DATA:SIZE AU44C
SOUR(@7):DATA:SIZE AU416C
SOUR(@7):DATA:SIZE AU464C
```

Generate Settings

The following figure illustrates the settings that are configured on the STM-64 Transmitter **Generate** tab.



A **VC-n**—Select a specific channel (SPE time slot) into which to transmit the generated signal or broadcast the payload to all time slots, as described in “VC-n” on page 566.

B **Alarms**—Select the type of alarm to insert, as described in “Alarms” on page 567.

C **Errors**—Select the type of error to insert, as described in “Error” on page 569.

D **Framing**—Select to use a framed or unframed signal, as described in “VC-n” on page 566.

E **Pointer**—Set SPE pointer byte values or perform pointer actions, as described in “Pointer” on page 571.

F **Error Rate**—Set the error insertion rate, as described in “Error Rate” on page 570.

G **Data Pattern**—Select the payload data pattern to insert into the transmitted signal, as described in “Data Pattern” on page 572.

H **J0 and J1 Trace**—Define and insert a J0 section trace message, as described in “J0 Trace Message” on page 572 and “J1 Trace Message” on page 573.

VC-n

The VC-n settings specify the virtual container mapping for the generated payload. The generated payload can be mapped to a single STM and AU time slot or broadcast to all channels.

The number of available channels depends on the SPE mapping that is selected on the **Setup** tab. The VC-n setting is reset to broadcast when the SPE Mapping is changed.

Settings	Description
Broadcast	Maps the generated payload to all STM and AU time slots. When **Broadcast** is selected, STM and AU selection is unavailable. This is the default in the factory configuration.
Selected	Maps the generated payload to the time slot specified by the **STM** and **AU** settings.

Settings	Description
STM	Selects the STM channel in which to insert the generated payload. This option is not available in broadcast mode. This field is linked to the STM field in the **Overhead** tab. The number of STM channels depends on the currently selected SPE mapping: • If the AU size is AU-3 or AU-4, select 1 of 64. • If the AU size is AU-4-4c, select 1 of 16. • If the AU size is AU-4-16c, select 1 of 4. • If the AU size is AU-4-64c, there is only 1 STM.
AU	Selects the number of the Administrative Unit (AU) time slot to map the generated payload. This option is not available in broadcast mode. This field is linked to the AU field in the **Overhead** tab. The number of AUs depends on the currently selected SPE Mapping. • If the AU Mapping is AU-3, select 1 of 3. • Otherwise, there is only one AU.

SCPI Examples:

```
SOUR(@6):DATA:MODE  BRO
SOUR(@6):DATA:MODE  SEL
SOUR(@6):DATA:STM   2
SOUR(@6):DATA:AUN   1
```

Related Topics:

"SPE Mapping" on page 565

"Path Overhead" on page 575

Alarms

The **Alarms** setting determines the type of alarm that is inserted into the transmit stream. Only LOS and LSS alarms are available in Unframed mode.

Alarm setting	Description
Off	Disables alarm insertion.
LOS	Loss of signal alarm LOS is generated by disabling the signal output.
LOF	Loss of Frame LOF is generated by inverting the framing bytes (A1, A2) in the SONET overhead for at least 3 microseconds. LOF is only available in Framed mode.
OOF	Out Of Frame OOF is generated by inverting the framing bytes (A1, A2) in the overhead for at least four consecutive frames and then reverting to the correct values to avoid causing LOF. OOF is only available in Framed mode.
MS-AIS	Multiplex Section Alarm Indication Signal MS-AIS is generated by forcing the entire line (payload?) to all ones. When MS-AIS alarm insertion is turned off, the normal line data is restored. MS-AIS is only available in Framed mode.

Alarm setting	Description
MS-RDI	Multiplex Section Remote Defect Indicator alarm MS-RDI is generated by continuously injecting a value of 110b into bits 6, 7, and 8 of the K2 byte. When MS-RDI insertion is turned off, the K2 byte is restored. MS-RDI is only available in Framed mode.
AU-LOP	Administrative Unit Loss of Pointer AU-LOP is generated by transmitting an out-of-range pointer value equal to or greater than 783. AU-LOP is only available in Framed mode.
AU-AIS	Administrative Unit Alarm Indication Signal AU-AIS is generated by setting the pointer bytes and all path data to all ones. When AU-AIS insertion is turned off, the pointer bytes and path data are restored. AU-AIS is only available in Framed mode.
HP-RDI	High-Order Path Remote Defect Indicator alarm HP-RDI is generated by setting bit 5 of the G1 byte in the path overhead. When HP-RDI insertion is turned off, bit 5 of the G1 byte is cleared. HP-RDI is only available in Framed mode.
UNEQ-P	High-Order Path unequipped alarm HP-UNEQ is generated by forcing the path data to all zeroes. When HP-UNEQ insertion is turned off, the path data is restored. HP-UNEQ is only available in Framed mode.
LSS	Loss of Sequence Synchronization LSS is generated by setting the payload pattern in the generated payload to a value other than what is specified in the Payload Data Pattern setting.

SCPI Examples:

```
SOUR(@3):ALAR OFF
SOUR(@3):ALAR OOF
SOUR(@3):ALAR LOF
SOUR(@3):ALAR LOS
```

Error

The **Error** setting controls the type of error which is inserted into the transmit stream. Whenever the Error setting is modified, the Error Rate setting is always reset to Off.

Only TSE errors are availabe in Unframed mode.

Error Type	Description
Physical	Inserts physical layer (or random) errors into the stream. One bit is inverted, and no bit is inverted twice before all bits in the frame have been inverted. This setting is the default in the factory configuration.
B1	Inserts B1 BIP-8 errors into the stream by inverting one B1 parity bit.
B2	Inserts B2 BIP-8 errors into the stream by inverting one B2 parity bit.
B3	Inserts path (B3 BIP 8) errors into the stream by inverting one B3 parity bit.
TSE	Inserts test sequence errors (bit errors) so that the transmitted payload does not match the expected pattern.
MS-REI	Multiplex Section Remote Error Indicator Inserts error counts in the M1 byte.
HP-REI	High order Path Remote Error Indicator Inserts error counts in the G1 byte (bits 1-4).

SCPI Examples:

```
SOUR(@3):ERR:TYPE  B1ER
SOUR(@3):ERR:TYPE  B2ER
SOUR(@3):ERR:TYPE  B3ER
SOUR(@3):ERR:TYPE  PHYS
SOUR(@3):ERR:TYPE  MSR
SOUR(@3):ERR:TYPE  TSE
```

Related Topics:

“Error Rate” on page 570

Error Rate

The **Error Rate** setting enables and disables error insertion and controls the rate at which errors are inserted into the transmitted signal.

The Error Rate setting is always reset to OFF whenever the Error Type is changed.

Error Rate Setting	Description
Off	Sets the error rate to 0, disabling error insertion.
All	Inserts errors into all bits in the B2 byte.
IE-3 through IE-14	Sets the error ratio to 1.0 x 10^-3, 1.0 x 10^-4, and so on. Some rates are not supported for all types of errors. For all payload mappings, the maxmum ratio for MS-REI errors is 1.0 x 10^5. For B1 errors, the maxmum ratio is 1.0 x 10^6. For AU-4-64C, the maxmum ratio for HP-REI errors is 1.0 x 10^6. For AU-4-16C, the maxmum ratio for HP-REI errors is 1.0 x 10^5. For AU-4-4C, the maxmum ratio for HP-REI errors is 1.0 x 10^4. For AU-4, the maxmum ratio for HP-REI errors is 1.0 x 10^4. For AU-3, the maxmum ratio for HP-REI errors 1.0 x 10^3.
Single	Error Rate must be set to Off to enable single error insertion. When this option is available, click this button to insert a single error into the transmit stream.

SCPI Examples:

```
SOUR(@3):ERR:RAT  OFF
SOUR(@3):ERR:RAT  RIE-4
SOUR(@3):ERR:RAT  SING
```

Related Topics:

"SPE Mapping" on page 565
"Error" on page 569

Framing

The **Framing Mode** setting specifies the frame format for the generated STM-64 signal.

Some types of alarm and error insertion are turned off whenever the Framing Mode setting is changed. For details, see "Alarms" on page 567 and "Error" on page 569.

Setting	Description
Framed	Generates a framed STM-64 signal with transport overhead.

Setting	Description
Unframed	Generates an unframed STM-64 signal with no transport overhead. Only the following features are available in unframed mode: • LOS and LSS alarm insertion • TSE error insertion • Data pattern selection

SCPI Examples:
`SOUR(@3):DATA:MODE FRAM`
`SOUR(@3):DATA:MODE UNFR`	

Pointer

Use the **Pointer** settings to move or set the value of the AU payload pointer.

Pointer Settings	Description
Value	Manually sets the AU pointer. Enter an integer value from 0 to 782. The value is a hexadecimal number.
Set	You must click **Set** to apply the change to the AU pointer value entered in the **Value** field.
Move	Moves pointer with the New Data Flag (bits 1 to 4 of the H1 overhead byte). This changes the pointer value, and the NDF flag in the H1 overhead byte is updated appropriately. The moves alternate between increment and decrement.

Pointer Settings	Description
Move w/o NDF	Moves pointer without the New Data Flag. This causes a large change in the pointer value without the appropriate NDF indication in the H1 overhead byte. The moves alternate between increment and decrement.
Increment Decrement	Increment or decrement the AU pointer value by 1.

SCPI Examples:
`SOUR(@6):POIN:VAL 260`
`SOUR(@6):POIN:ACT INCR`
`SOUR(@6):POIN:ACT DECR`
`SOUR(@6):POIN:ACT NDF`
`SOUR(@6):POIN:ACT MNDF`	

Data Pattern

The **Data Pattern** setting selects the type of pattern to place into the generated payload.

Settings	Description
PRBS 2^7-1 **PRBS 2^15-1** **PRBS 2^20-1** **PRBS 2^23-1** **PRBS 2^31-1**	Selects a pseudo random bit pattern. PRBS 2^7-1 is only available in unframed mode.
Inv. PRBS 2^7-1 **Inv. PRBS 2^15-1** **Inv. PRBS 2^20-1** **Inv. PRBS 2^23-1** **Inv. PRBS 2^31-1**	Selects an inverted Pseudo-random bit pattern. PRBS 2^7-1 is only available in unframed mode.
User	Defines an 8-bit or 16-bit binary user-defined pattern.
Set	If a custom user-defined payload pattern is defined, click **Set** to apply the changed user payload pattern.

SCPI Examples:

```
SOUR(@6)PAYL:GEN:PATT:TYPE PR215
SOUR(@6)PAYL:GEN:PATT:TYPE PR220
```

To generate a custom payload pattern, set the pattern type to USER and define the bit pattern.

```
SOUR(@3):PAYL:GEN:PATT:TYPE  USER
SOUR(@3):PAYL:GEN:PATT:USER  0b00110011
```

J0 Trace Message

Create and insert a user-defined regenerator section J0 trace message.

1 Click **Insert**.

2 Enter the trace message.

Note Messages can be no longer than 15 characters.

3 Click **Set** to apply the changes.

If you do not click **Set**, the modified message is not inserted.

To enable J0 trace and insert a trace message using SCPI, use commands similar to the following:

```
SOUR(@6):DATA:SECT:TREN ON
SOUR(@6):DATA:SECT:TRAC “STM64TX in slot 6”
```

Note When using SCPI, you must enclose the message in quotation marks. Otherwise, only the characters before the first space are used as the trace message.

J1 Trace Message

Create and insert a user-defined path J1 trace message.

1 Click **Insert**.

2 Click **62 char. message** to insert a message with 62 characters.

3 Enter the trace message.

Note Messages can be no longer than 15 characters unless **62 char. message** is checked.

4 Click **Set** to apply the changes.

If you do not click **Set**, the modified message is not inserted.

To enable J1 trace and insert a trace message using SCPI, use a pair of commands similar to the following:

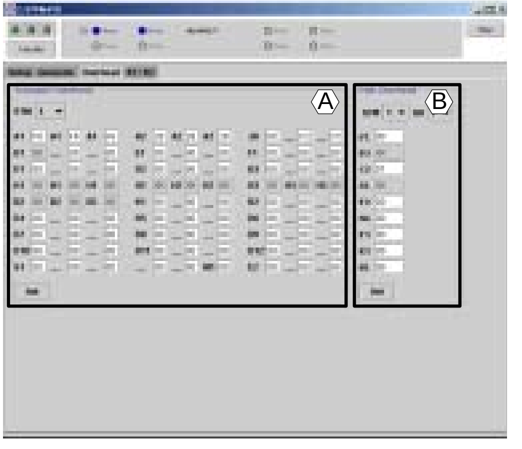
```
SOUR(@6):DATA:PATH:TREN ON
SOUR(@6):DATA:PATH:TRL 64
SOUR(@6):DATA:PATH:TRAC “STM64TX in slot
6”
```

Note When using SCPI, you must enclose the message in quotation marks. Otherwise, only the characters before the first space are used as the trace message.

Overhead Data

The **Overhead Data** tab provides options for modifying individual path and transport overhead data values for a given time slot.

The following figure shows the main features of the **Overhead Data** tab.



A **Transport Overhead**—Set transport overhead byte values for the selected STM-1 channel, as described in “Transport Overhead” on page 574.

B **Path Overhead**—Set path overhead byte values for the selected STM channel and AU, as described in “Path Overhead” on page 575.

Transport Overhead

The Transport Overhead area shows all three bytes where applicable.

Perform the following steps to modify specific transport overhead bytes for a specific time slot in the internally generated virtual container.

1. Select an STM channel (time slot).
2. Enter hexadecimal values.
3. Click **Set** to apply the changes.

The following notes apply to modifying transport overhead bytes:

- Overhead bytes that cannot be modified are indicated with “XX” greyed out in the user interface.
- The B1 and B2 bytes can only be modified through the B1 and B2 error insertion, as described in “Error” on page 569.

Settings	Description
STM	Selects the number of the time slot in the internally generated STM-1 for which you want to modify transport overhead bytes. Channel 1 is the default in the factory configuration.
A1, A2	Framing bytes. Modifying A1 and A2 bytes causes receivers to lose framing.

Settings	Description
J0	Regenerator section (RS) trace byte. Modifying J0 only takes effect if section trace message insertion is disabled, as described in “J1 Trace Message” on page 573.
E1	RS orderwire byte.
F1	RS user channel byte located in first STS-1 of an STS-N.
D1, D2, D3	RS data communication channel bytes.
K1, K2	APS channel bytes. Modifying K1 and K2 is possible through this interface, but to ensure proper K1 and K2 updates, see “K1/K2 Settings” on page 576. Enabled alarms (MS-RDI, MS-AIS) override changes to K2.
H1, H2, H3	Payload pointer bytes. H1, H2, and H3 bytes cannot be modified.
D4 through D12	Multiplex sections (MS) data communications channel bytes.
S1	Synchronization status byte.
M1	MS Remote Error Indicator (MS-REI) byte. Modifying M1 of STM-1, channel 7, does not override enabled error injection of MS-REI.
E2	MS orderwire byte.

Settings	Description
Set	You must click **Set** to apply any changes to the transport overhead byte values.

SCPI Examples:

Use the following command to set the values for bytes A1;A2;J0;B1;E1;F1;D1;D2;D3.

```
sour(@2):data:rsoh:byt
F6F6F6;282828;00CCCC;XX0000;000000;09090
0;000000;000000;000000
```

Use the following command to set the values for bytes H1;H2;H3;B2;K1;K2;D4;D5;D6;D7;D8;D9;D10;D11;D12;S1;M1;E2.

```
sour(@2):data:msoh:byt
XXXXXX;000000;000000;000000;000000;00000
0;000000;000000;000000;000000;000000;000
000;000000;000000;000000
```

For detailed information, see “Overhead Access” on page 605.

Path Overhead

Perform the following steps to modify specific path overhead bytes for a specific STM and AU in the internally generated signal.

1. Select a channel.

Note STM and AU selections are only available when the signal is framed and when the VC-n is set to Selected. See “Framing” on page 570 and “VC-n” on page 566.

2. Enter hexadecimal values for the appropriate fields.
3. Click **Set** to apply the changes to the STS path overhead bytes for the selected time slot.

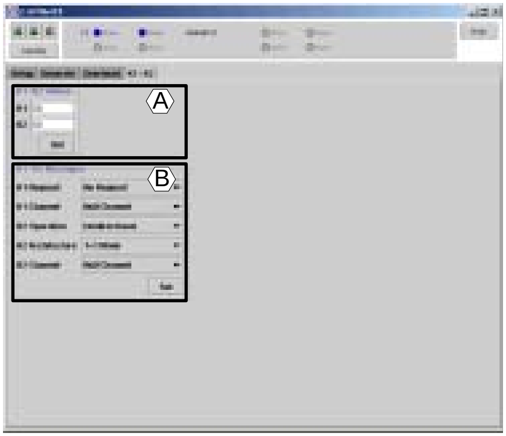
The following notes apply to modifying STS path overhead bytes:

- Overhead bytes that cannot be modified are indicated with “XX” greyed out in the user interface.
- The B3 byte cannot be modified using this interface. See “Error” on page 569.

Settings	Description
STM and AU	Selects the STM and AU time slot for which you want to modify path overhead bytes. AU selection is disabled in Broadcast mode, because the generated payload is mapped into all AUs. Channel 1 is the default in the factory configuration. The available channels depends on the selected SPE mapping. This field is linked to the SPE field in the **Generate** tab and is only available when the SPE field is set to Selected.
J1	High-order VC-N path trace byte. Modifying J1 only takes effect if J1 trace message insertion is disabled.
C2	Path signal label.
G1	Path terminating status byte. This byte cannot be modified.
F2, F3	Path user channel bytse.
H4	Indicator allocated for use as a mapping-specific indicator byte.
K3	APS signalling in bits 1-4. Bits 5-8 are reserved for future use.
N1	Network operator byte for tandem connection monitoring.
Set	You must click **Set** to apply any changes to the transport overhead byte values.
	SCPI Examples: Use the following command to set the values for bytes J1;B3;C2;G1;F2;H4;F3;K3;N1. `sour(@2):data:path:over:byt 00;XX;01;XX;00;00;00;00;00` For detailed information, see “Overhead Access” on page 605. **Related Topics:** “SPE Mapping” on page 565 “VC-n” on page 566

K1/K2 Settings

The following figure shows the main features of the K1/K2 tab.



A **K1/K2 Values**—Set K1/K2 byte (APS channel) values, as described in “K1/K2 Values” on page 577.

B **K1/K2/Messages**—Set K1 and K2 bits to encode APS channel messages, as described in “K1/K2 Messages” on page 577.

K1/K2 Values

The **K1/K2 Values** setting enables you to directly set values in the automated protection switching (APS) channel K1 and K2 bytes.

K1/K2 Values	Description
K1	Bits 1 through 4 control the request message, and bits 5 through 8 control the channel message code.
K2	Bits 1 through 4 of the K2 byte control the channel number, bit 5 controls the architecture, and bits 6 thorough 8 indicate the mode of operation.
Set	You must click **Set** to update and transmit new K1/K2 values. As you set K1/K2 values, the **K1/K2 Messages** fields update accordingly.
SCPI Examples: `SOUR(@6):TRAN:APS:K1K2 0xF2,0x14`	

K1/K2 Messages

Use the fields in the K1/K2 Messages panel to set K1 and K2 bits to encode APS channel messages.

As you set K1/K2 message fields, the hexadecimal values displayed in the **K1/K2 Values** field update accordingly.

K1/K2 Message Settings	Description
K1 Request	Sets bits 1 through 4 of K1 with one of the following request messages. **Lockout of Protection**. Sets bits 1 through 4 to 1111. **Forced Switch**. Sets bits 1 through 4 to 1110. **SF - High Priority**. Sets bits 1 through 4 to 1101. **SF - Low Priority**. Sets bits 1 through 4 to 1100. **SD - High Priority**. Sets bits 1 through 4 to 1011. **SD - Low Priority**. Sets bits 1 through 4 to 1010. **Manual Switch**. Sets bits 1 through 4 to 1000. **Wait-to-Restore**. Sets bits 1 through 4 to 0110. **Exercise**. Sets bits 1 through 4 to 0100. **Revert Request**. Sets bits 1 through 4 to 0100.

K1/K2 Message Settings	Description
	Exercise. Sets bits 1 through 4 to 0100. **Revert Request**. Sets bits 1 through 4 to 0100. **Do Not Revert**. Sets bits 1 through 4 to 0001. **No Request** — Sets bits 1 through 4 to 0000. This setting is the default in the factory configuration.
K1 Channel	Selects the channel to apply the requesting message (sets bits 5 through 8 of K1 with the channel message code): **0**. The Null channel. This setting is the default in the factory configuration. **1** to **14**. Channel 1 through 14. **15**. Extra traffic channel.
K2 Operation	Sets the operational mode of the APS. Bits 6 through 8 of the K2 byte carry this information. **Unidirectional**. Sets bits 6 to 8 to 100. This setting is the default in the factory configuration. **Bidirectional**. Sets bits 6 to 8 to 101.

K1/K2 Message Settings	Description
K2 Architecture	Sets the architecture mode for the APS. Bit 5 of K2 carries this information. **Architecture 1+1**. Sets bit 5 to 0. This setting is the default in the factory configuration. **Architecture 1:n**. Sets bit 5 to 1.
K2 Channel	Selects the channel to apply the requesting message (sets bits 1 through 4 of K1 with the channel message code): **0**. Null channel. This setting is the default in the factory configuration. **1** to **14**. Channel 1 to 14. **15**. Extra traffic channel.
Set	You must click **Set** to update and apply the K1/K2 Message settings.

SCPI Examples:

```
sour(@4):tran:aps:k1k2 0x00 0x00
sour(@4):aps:k1en:req lops
sour(@4):aps:k1en:chan 1
sour(@4):aps:k2en:oper bid
sour(@4):aps:k2en:arch a1_n
sour(@4):aps:k2en:chan 1
sour(@4):aps:upd
```

38

EPX Optical Switch Module Window

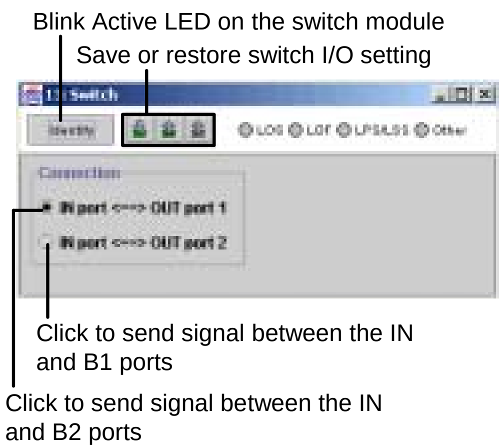
The Switch window controls I/O port selection for the EPX Optical Switch module. The A, B1, and B2 ports on the Optical Switch front panel are bi-directional: they can be either input or output ports.

Using the EPX Optical Switch module, you enable either B1 or B2 port:

- Select to transmit and receive signals between the A and B1 ports.
- Select to transmit and receive signals between the A and B2 ports.

Tip Use the EPXam main window in Physical View. The Optical Switch has two LEDs (B1 and B2) that indicate which port is enabled.

The following figure illustrates the features of the Switch window:



To control I/O port selection for the EPX Optical Switch module using SCPI, use commands similar to the following:

To switch to port B1 for I/O:

```
SWITCH(@5):SEL 1
```

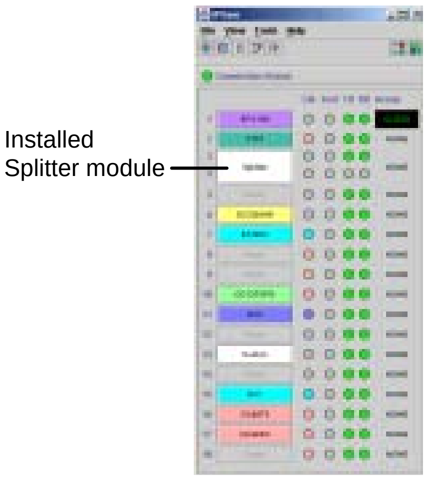
To switch to port B2 for I/O:

```
SWITCH(@5):SEL 2
```

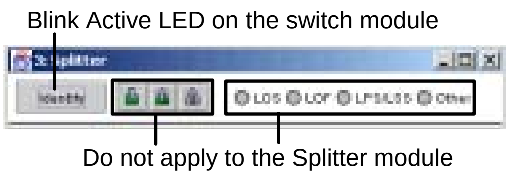
SPLITTER MODULE

The Splitter module splits an input signal and sends the signals to the output ports on the front panel.

The following figure show how the Splitter appears in the EPXam main window. Splitters with four and eight output ports use two slots in the EPX Test System. Splitters with twelve output ports use three slots.



The following figure shows the features of the Splitter window:



Because the Splitter module is a passive device, it has no settings to save and restore, and it does not insert or monitor alarms and errors.

Part 3

EPX Test System SCPI Reference

The EPX Test System SCPI Reference contains the following sections:

40

Reference

EPX Test System Directory Structure

This section describes the file directory structure on the EPX Test System.

CAUTION: None of these files or directories should be modified except by gnubi trained personnel.

\

The root directory contains executable and initialization files, as well as the parser for SCPI.

\DLLS

This directory contains the configuration and DLL files for the different module types that are copied to the slot directories when an EPX Test System is started.

\GROUPS

The group directory contains group configuration files. These files are created and saved with Group Manager SCPI and the Group Manager Window. The files are saved in numbered sequence (such as 0.GDF and 1.GDF), not by group names.

\HTML

The HTML directory contains HTML help files and Java applet files (for example, the EPX GUI) as well as the .jar files.

\HTML\LOG

The LOG directory stores the logging files in directories for each slot.

\ICUBE

The ICUBE directory stores files that defines how signals are sent on the EPX backplane.

\SLOT_01 . . .

Each slot has a directory which contains the factory and custom configuration files and the module type DLL. The factory configuration and DLL files are copied from the DLLS directory when the test system is started. The custom configuration file is created and modified with module SCPI and through the Save/Restore feature in EPXam.

Modules that can be switched between SONET and SDH have SONET/ and SDH/ subdirectories for maintaining separate SONET and SDH configuration files. This is so that when modules are switched between SONET and SDH protocols, the appropriate configuration file is loaded.

SCPI Reference

Standard Commands for Programmable Instruments (SCPI) are available for all EPX modules and the EPX system. SCPI is used by the EPX GUI and are available for customer use.

Please check the latest EPX OS release notes for problems with commands.

Note The following SCPI documentation is for the latest version. Some commands may not be available to you if you have not upgraded to the latest OS or module DLLs.

Group Manager

Groups

- Group List
- Add Group
- Select Group
- Lock Group
- Delete Group
- Unlock Group
- Rename Group
- Change Password
- Change Color
- Save Group
- Restore Group
- Add Module
- List Modules
- Select Modules
- Allocate Modules
- Deallocate Modules
- Compatibility Query
- Availability Query
- Start/Stop Tests
- Test Period
- Test Unit of time
- Test Type

Module

- Delete Modules
- Rename Modules
- Set Position
- Set Slot
- Set Type
- Compatibility Query

- Availability Query

Slot Manager

- Lock Slots
- Unlock Slots

Subscribe

- Group Manager Events
- Lock Events
- Name Events
- Color Events

Clock Module

Configuration

- Save Configuration
- Restore Configuration

Module Data

- Module Data

Clock Input

- BITS LOS
- External Frequency

Clock Source

- OC3
- DS3
- DS1

Clock Output

- External Clock
- Slot Select

Subscribe

- Configuration

Chassis Thermal Management System (CTMS)

Warnings

- Under Temperature
- Over Temperature

Failures

- Under Temperature
- Over Temperature
- Cooling System

DS1

Configuration

- Save Configuration
- Restore Configuration

System

- Module Data
- Backplane Output
- Backplane Input

MODULE

- Port Configuration
- Group A LED
- Group B LED

INPUT

- Peak Voltage Query
- Port Select
- Line Code
- Frequency Query
- Voltage Input

OUTPUT

- Line Code
- Voltage Output

SENSE

- Alarm Query
- Loopback Status

SENSE DATA

- Monitor Data Source
- Error Count
- Error Ratio
- Error Count (Unsquelched)
- Error Ratio (Unsquelched)
- Framing Mode
- Demapped Payload
- Channel Select
- Payload Pattern
- User Pattern
- Pattern Bits
- Alarmed Seconds Count
- Path Errors
- Errored Seconds
- Error-free Seconds
- Error Percent
- Error-free Percent
- Loopback Activate Pattern
- Loopback Activate Bits
- Loopback Deactivate Pattern
- Loopback Deactivate Bits
- ESF Data Link Code
- ESF Data Link Message

SENSE TEST

- Test Mode
- Test Type
- Test Period
- Test Time Unit
- Log Mode
- Log Seconds

SOURCE

- Tx Clock Source
- Alarms
- Framing Mode
- Payload Map

- Payload Channel
- Pattern Type
- User Pattern
- Pattern Bits
- Loopback State
- Loopback Activate Pattern
- Loopback Activate Bits
- Loopback Deactivate Pattern
- Loopback Deactivate Bits
- ESF Data Link Type
- ESF Data Link Pattern
- Tx Data Source

Source Error

- Error Ratio
- Error Type

Subscribe

- Configuration
- Input Frequency
- Input Peak Voltage
- Loopback
- ESF Data Link
- Alarms
- Error Ratio
- Error Count
- Error Ratio (Unsquelched)
- Error Count (Unsquelched)
- Alarm Seconds
- Errored Seconds
- Error-free Seconds
- Path Errors
- All Errors

DS3

Backplane

- Backplane Output Source
- Destination for Hybrid or Selected Output
- Source for Hybrid or Selected Output

DS2 Settings

- DS2 Alarm Status
- DS2 Alarm Insertion
- DS2 Hybrid Source
- DS2 Receive Mapping Mode
- DS2 Source Mapping Mode
- DS2 Source Signal

Configuration

- Save Configuration
- Restore Configuration

System

- Module Data

Module

- Group A LED

- Group B LED

Input
- Peak Voltage Query
- Frequency Query
- Voltage Input

Output
- Voltage Output

Sense
- Alarm Query
- Monitor Data Source
- Error Count
- Error Ratio
- Bit Error filter
- Framing Mode
- Demapped Payload
- Payload Pattern
- User Pattern
- Pattern Bits

Sense Test
- Test Mode
- Test Type
- Test Period
- Test Time Unit
- Log Mode
- Log Seconds

Source
- Tx Clock Source
- Alarms
- Framing Mode
- Payload Type
- DS1 Insert
- DS1 Destination
- Pattern Type
- User Pattern
- Pattern Bits
- Tx Data Source

Source Error
- Error Ratio
- Error Type

Subscribe
- Configuration
- Input Frequency
- Input Peak Voltage
- Alarms
- Error Ratio
- Error Count

E1

Configuration
- Save Configuration
- Restore Configuration

System

- Module Data
- Backplane Output
- Backplane Input

Module

- Port Configuration

Input

- Peak Voltage Query
- Port Select
- Line Code
- Frequency Query
- Voltage Input

Output

- Line Code
- Voltage Output

Data Queries

- Alarm Query
- Monitor Data Source
- Error Count
- Error Ratio
- Error Count (Unsquelched)
- Error Ratio (Unsquelched)
- Framing Mode
- Demapped Payload
- Channel Select
- Payload Pattern
- User Pattern
- Pattern Bits
- Alarmed Seconds Count
- Path Errors
- Errored Seconds
- Error-free Seconds
- Error Percent
- Error-free Percent

Sense Test

- Test Mode
- Test Type
- Test Period
- Test Time Unit
- Log Mode
- Log Seconds

Source

- Tx Clock Source
- Alarms
- Framing Mode
- Payload Map
- Payload Channel
- Pattern Type
- User Pattern
- Pattern Bits
- Tx Data Source

Source Error

- Error Ratio
- Error Type

Subscribe

- Configuration
- Input Frequency
- Input Peak Voltage
- Alarms
- Error Ratio
- Error Count
- Error Ratio (Unsquelched)
- Error Count (Unsquelched)
- Alarm Seconds
- Errored Seconds
- Error-free Seconds
- Path Errors
- All Errors

STM-1 CMI Receiver

Administrative Unit Mode

- AU Size
- AU Time Slot
- Data Source
- STM Monitor

Alarm and Error Queries

- Alarm Query
- Error Count (Carrior Board)
- Error Ratio (Carrier Board)
- Alarms (PMOD)
- Error Count (PMOD)
- Error Ratio (PMOD)

APS

- K1K2 Value
- K1 Bits 1-4
- K1 Bits 5-8
- K2 Bit 5 Architecture
- K2 Operation Bits 6-8
- K2 Channel Bits 1-4

Configuration

- Save Configuration
- Restore Configuration

Input

- Frequency Query
- Rate Query

Overhead Queries

- Section Trace Message
- Section Expected Message
- Section Trace Mismatch
- Regenerator Section Bytes
- Multiplex Section Bytes
- Path Trace Message

- Path Trace Length
- Path Expected Message
- Path Trace Mismatch
- Path Bytes
- Overhead SS bits

Payload Pattern

- Pattern Type
- User Pattern

PMOD Test

- Test Link
- Start/Stop Test
- Test Type
- Test Period
- Test Time Unit

Pointer

- High Order Pointer Bytes
- SPE Pointer Value
- SPE Pointer Action Counts

Sense Test

- Test Start/Stop
- Test Type
- Test Period
- Test Time Unit
- Log Mode
- Log Seconds

Subscribe

- Configuration
- Configuration (PMOD)
- All Events
- APS
- Alarms
- Alarms PMOD
- Error Count
- Error Ratio
- Error Count PMOD
- Error Ratio PMOD
- Input Frequency
- Overhead
- Pointer Change
- Pointer Counter
- Regenerator Section Overhead
- Multiplex Section Overhead
- High Order Pointer Bytes
- Section Trace
- Path Trace
- Path Overhead

System

- Module Data
- Backplane

STM-1 CMI Transmitter

Administrative Unit Mode

- Size
- Mapping Mode
- Time Slot
- Insert AU

Alarms and Errors

- Alarms
- Error Type
- Error Insertion Rate
- PMOD Alarms
- PMOD Error Type
- PMOD Error Insertion Rate

APS

- Update
- K1K2 Value
- K1 Bits 1-4
- K1 Bits 5-8
- K2 Bit 5 Architecture
- K2 Operation Bits 6-8
- K2 Channel Bits 1-4

Clock Source

- Clock for Data Generation

Configuration

- Save Configuration
- Restore Configuration

Output

- Output Rate

Overhead Access

- Transport Overhead Byte
- Trace Message Enable
- Trace Message Value
- Regenerated Section Overhead Byte
- Multiplex Section Overhead Byte
- Path Message Enable
- Path Message Length
- Path Message Value
- Path Overhead 9 Bytes
- Specified Path Overhead Byte

Payload

- Pattern Type
- User Pattern

Pointer

- SPE Pointer Value
- SPE Pointer Action

Source

- Data Transmit
- SS Overhead Bits
- B1/B2 BIP

Subscribe

- Configuration
- PMOD Configuration
- APS (K1K2)
- Pointer
- Section Trace
- Regenerator Section Overhead
- Multiplex Section Overhead
- Path Trace
- Path Overhead

System

- Module Data
- Backplane

STS-1 Transceiver

Alarm and Error Insertion

- STS-1 Transport Alarm Insertion
- STS-1 Path Alarm Insertion
- STS Payload Error Type
- STS Payload Error Ratio
- STS-1 Transport Error Type
- STS-1 Transport Error Ratio
- DS3 Alarms Insert
- DS3 Error Type
- DS3 Error Ratio
- DS1 Alarms Insert
- DS1 Error Type
- DS1 Error Ratio
- VT1.5 Tx Alarms
- VT1.5 Error Type
- VT1.5 Error Ratio

Alarm and Error Queries

- STS-1 Error Count
- STS-1 Error Ratio
- STS-1 Alarm Query (All)
- STS-1 Error Status (All)
- STS-1 Alarm Query (Individual)
- STS-1 Transport Alarm Query (Individual)
- STS-1 Transport Alarm Query (All)
- STS-1 Transport Error Count (Individual)
- STS-1 Transport Error Ratio (Individual)
- STS-1 Transport Error Status (All)
- DS1 Rx Alarm Query (Individual)
- DS1 Rx Error Status (All)
- DS1 Rx Alarm Status (All)
- DS1 Rx Error Count
- DS1 Rx Error Ratio
- DS3 Rx Alarm Query (Individual)
- DS3 Rx Error Count
- DS3 Rx Error Ratio
- DS3 Rx Error Status (All)
- DS3 Rx Alarm Status (All)
- VT1.5 Alarm Query (Individual)

- VT1.5 Error Count
- VT1.5 Error Ratio
- VT1.5 Error Status (All)
- VT1.5 Alarm Status (All)

Backplane

- Rate
- Input Channel
- Output Channel
- Output Source
- Output Mode

Configuration

- Save Configuration
- Restore Configuration

Clock

- Clock Source

Input

- Input Frequency

Payload Pattern

- STS-1 Rx Pattern Type
- STS-1 Rx User Pattern
- STS-1 Rx Path Source
- STS-1 Tx Payload Pattern
- STS-1 Tx User Pattern
- DS3 Rx Pattern Type
- DS3 Rx User Pattern
- DS3 Tx Payload Pattern
- DS3 Tx User Pattern
- DS1 Rx Pattern Type
- DS1 Rx User Pattern
- DS1 Tx Payload Pattern
- DS1 Tx User Pattern

Payload Mapping and Framing

- STS-1 Rx Payload Mapping
- STS-1 Tx Payload Mapping
- DS3 Rx Payload Mapping
- DS3 Rx Payload Framing
- DS3 Rx Channel
- DS3 Tx Payload Mapping
- DS3 Tx Framing Mode
- DS3 Tx Channel Insert
- DS1 Rx Payload Framing
- DS1 to VT1.5 Mapping
- DS1 Tx Framing Mode
- DS1 Source to VT1.5
- DS1 Source to DS3
- DS1 Backplane Channel into VT1.5 (NOT IMPLEMENTED)
- VT1.5 Rx Payload Mapping
- VT1.5 Rx Channel
- VT1.5 Tx Payload Mapping
- VT1.5 Tx Insert Channel

Pointer

- STS-1 Tx Payload Pointer Move
- VT1.5 Rx Pointer Value Query
- VT1.5 Rx Pointer Count
- STS-1 Rx Pointer Value Query
- STS-1 Rx Pointer Count

Source

- Transmit and Monitor
- STS-1 Path Source

Test

- Test Start/Stop
- Test Type
- Test Period
- Test Time Unit
- Log Mode
- Log Seconds

Trace Messages

- STS-1 Transport Trace Message Capture
- STS-1 Transport Trace Message Enable
- STS-1 Transport Trace Message Set
- STS-1 Payload Trace Message Capture
- STS Payload Trace Message Enable
- STS Payload Trace Message Set

System

- Module Data
- Java Class Data

Subscribe

- Configuration
- All Events

OC-12/3 STM-4/1 Transmitter

Alarms and Errors

- Section Alarms
- Error Type
- Error Ratio Insertion
- PMOD Alarms
- PMOD Error Type
- PMOD Error Ratio Insertion
-

APS

- Update
- K1K2 Value
- K1 Request Bits 1-4
- K1 Channel Bits 5-8
- K2 Bit 5 Architecture
- K2 Operation Bits 6-8
- K2 Channel Bits 1-4

Board Properties

- List Properties
- Get Property Data

Clock Source

- Clock for Data Generation

Configuration
- Save Configuration
- Restore Configuration

Overhead Access
- Specified Transport Overhead Byte
- Regenerator Section Overhead Byte (SDH)
- Multiplex Section Overhead Byte (SDH)
- J0 Trace Message Enable
- J0 Trace Message Value
- Section Overhead Byte
- Line Overhead Byte
- J1 Message Enable
- J1 Message Value
- J1 Message Length (SDH)
- Path Overhead Bytes
- Specified Path Overhead Byte
- SS Overhead Bits
- B1/B2 Regeneration

Output
- Output Rate

Payload
- Pattern Type
- User Pattern
- Stuff Columns (SONET)
-

Pointer
- SPE Pointer Value
- SPE Pointer Action

Protocol
- SONET/SDH Switching
- SONET/SDH Status

Source
- Data Transmit

SPE/VC
- Size
- Mapping Mode
- Time Slot (SONET)
- STM Selection (SDH)
- AU Selection (SDH)

Subscribe
- Configuration

System
- Module Data
- Backplane

OC-12/3 STM-4/1 Receiver

Alarm and Error Queries
- Alarms (PMOD)
- Bit/TSE Error Filter
- Error Count (PMOD)

- Error Ratio (PMOD)
- Alarm Query
- Error Count
- Error Ratio
- Performance Monitoring (SONET)

APS

- K1K2 Value
- K1 Request Bits 1-4
- K1 Channel Bits 5-8
- K2 Bit 5 Architecture
- K2 Operation Bits 6-8
- K2 Channel Bits 1-4

Board Properties

- List Properties
- Get Property Data

Configuration

- Save Configuration
- Restore Configuration

Input

- Power Query
- Frequency Query
- Rate

Monitoring Source

- Data Source

PMOD Test

- Test Link
- Start/Stop Test
- Test Type
- Test Period
- Test Time Unit

Overhead Queries

- J0 Trace Message (PMOD)
- Expected J0 Trace Message (PMOD) (SDH)
- Regenerator Trace Identifier (PMOD) (SDH)
- Section Bytes (PMOD)
- Line Bytes (PMOD)
- Regenerator Bytes (PMOD) (SDH)
- Multiplex Section Bytes (PMOD) (SDH)
- J1 Trace Message (PMOD)
- J1 Trace Message Length (PMOD) (SDH)
- Expected J1 Trace Message (PMOD) (SDH)
- High-Order Path Trace Identifier (PMOD) (SDH)
- Path Bytes (PMOD)
- Overhead SS bits

Payload

- Pattern Type
- User Pattern
- Stuff Columns (SONET)

Protocol

- SONET/SDH Switching
- SONET/SDH Status

Pointer

- SPE Pointer Value
- SPE Pointer Move Counts

SPE/VC

- SPE Size
- SPE Time Slot (SONET)
- STM Selection (SDH)
- AU Selection (SDH)

Subscribe

- All Events
- Alarms
- Configuration
- Error Count
- Error Ratio
- Configuration (PMOD)
- APS
- Alarms PMOD
- Error Count PMOD
- Error Ratio PMOD
- Input Power
- Input Frequency
- Overhead
- Section Trace
- Section Overhead
- Line Overhead
- Path Trace
- Path Overhead

System

- Module Data
- Backplane Mode

Tests

- Test Start/Stop
- Test Type
- Test Period
- Test Time Unit
- Log Mode
- Log Seconds

OC-48/STM-16 Transmitter

Alarms and Errors

- Alarm Insertion
- Error Type
- Error Ratio

APS

- K1K2 Value
- K1K2 Update
- K1 Request Bits 1-4
- K1 Channel Bits 5-8

- K2 Bit 5 Architecture
- K2 Operation Bits 6-8
- K2 Channel Bits 1-4

Board Properties

- List Properties
- Get Property Data

Configuration

- Save Configuration
- Restore Configuration

Clock Source

- Clock for Generated Data

Data Source

- Transmit Source

Overhead Access

- B1 BIP Regeneration
- Transport Overhead STS Channel (SONET)
- Transport Overhead STM Channel (SDH)
- J0 Trace Message Enable
- J0 Trace Message Value
- Section Overhead Byte (SONET)
- Line Overhead Byte (SONET)
- Regenerator Section Overhead Byte (SDH)
- Multiplex Section Overhead Byte (SDH)
- Path Message Enable
- Path Message Value
- Path Message Length (SDH)
- Path Overhead Bytes

Payload Pattern

- Pattern Type
- User Pattern
- STS-1 Stuff Columns (SONET)

Pointer

- SPE Pointer Value
- SPE Pointer Action

Protocol

- SONET/SDH Switching
- SONET/SDH Status

SPE/VC

- SPE Size
- SPE Time Slot
- SPE Mapping
- STM Selection (SDH)
- AU Selection (SDH)

Subscribe

- All Events
- Configuration

System

- Module Data

OC-48/STM-16 Receiver

Alarm and Error Queries

- Alarm Query
- Bit/TSE Error Filter
- Error Count
- Error Ratio
- Performance Monitoring (SONET)

APS

- K1K2 Value
- Broadcast to Transmitter
- K1 Request Bits 1-4
- K1 Channel Bits 5-8
- K2 Bit 5 Architecture
- K2 Operation Bits 6-8
- K2 Channel Bits 1-4

Backplane Enable

- Backplane Enable

Board Properties

- List Properties
- Get Property Data

Configuration

- Save Configuration
- Restore Configuration

Overhead

- Transport Overhead STS Channel (SONET)
- Transport Overhead STM Channel (SDH)
- Transport Overhead AU Time Slot (SDH)
- J0 Trace Message Query
- J0 Trace Message Expected (SDH)
- J0 Trace Message Identifier (SDH)
- Section Overhead Bytes (SONET)
- Line Overhead Bytes (SONET)
- Regenerator Section Overhead Bytes (SDH)
- Multiplex Section Overhead Bytes (SDH)
- Path Trace Message
- Path Trace Message Length (SDH)
- Path Trace Message Expected (SDH)
- Path Trace Message Identifier (SDH)
- Path Overhead Bytes

Payload Pattern

- Pattern Type
- User Pattern
- STS-1 STuff Columns

Pointer

- SPE Pointer Value
- SPE Pointer Action Counts

Protocol

- SONET/SDH Switching
- SONET/SDH Status

Service Disruption

- Service Disruption Query (Longest)
- Service Disruption Query (Shortest)
- Service Disruption Query (Most Recent)
- In-Service Status
- Service Disruption Alarm Trigger Enable

SPE/VC

- SPE Size
- SPE Time Slot
- STM Select (SDH)
- AU Select (SDH)

Subscribe

- Configuration
- All Events
- Alarms
- Error Count
- Error Ratio
- Section Trace
- Service Disruption

System

- Module Data

Test

- Test Start/Stop
- Test Type
- Test Period
- Test Time Unit
- Log Mode
- Log Seconds

OC-48/STM-16 Transceiver

Alarm and Error Insertion

- Alarm
- Error Type
- Error Ratio

Alarm and Error Queries

- Alarm Query
- Bit/TSE Error Filter
- Error Count
- Error Ratio

APS Generate

- K1K2 Value Set
- K1K2 Value Update
- K1 Request Bits 1-4
- K1 Channel Bits 5-8
- K2 Bit 5 Architecture
- K2 Operation Bits 6-8
- K2 Channel Bits 1-4

APS Monitor

- K1K2 Value Monitor
- Broadcast to Transmitter
- K1 Request Bits 1-4

- K1 Channel Bits 5-8
- K2 Bit 5 Architecture
- K2 Operation Bits 6-8
- K2 Channel Bits 1-4

Board Properties

- List Properties
- Get Property Data

Configuration

- Save Configuration
- Restore Configuration

Payload

- Pattern Type for Transmit
- User Pattern for Transmit
- Stuff Columns for Transmit (SONET)
- Pattern Type for Monitor
- User Pattern for Monitor
- Stuff Columns for Monitor (SONET)

Protocol

- SONET/SDH Switching
- SONET/SDH Status

SPE/VC Generate

- SPE Size
- SPE Time Slot (SONET)
- STM Select (SDH)
- AU Select (SDH)
- SPE Mapping

SPE/VC Monitor

- SPE Size
- SPE Time Slot (SONET)
- STM Select (SDH)
- AU Select (SDH)

Overhead Queries

- J0 Trace Message Query
- J0 Trace Message Expected (SDH)
- J0 Trace Message Identifier (SDH)

Overhead Insertion

- J0 Message Set
- J0 Message Enable

Source Clock

- Clock for Generated Data

Subscribe

- Configuration for Transmit
- Configuration for Monitor
- All Events
- Alarms
- Error Count
- Error Ratio
- Section Trace

System

- Module Data

Test

- Test Start/Stop
- Test Type
- Test Period
- Test Time Unit
- Log Mode
- Log Seconds

OC-192/STM-64 Transmitter

Alarms and Errors

- Alarm Insertion
- Error Type
- Error Ratio

APS

- K1K2 Value
- K1K2 Update
- K1 Request Bits 1-4
- K1 Channel Bits 5-8
- K2 Bit 5 Architecture
- K2 Operation Bits 6-8
- K2 Channel Bits 1-4

Board Properties

- List Properties
- Get Property Data

Configuration

- Save Configuration
- Restore Configuration

Clock

- Clock for Generated Data
- Clock Trigger for Output

Signal

- Enable|Disable Output
- Framed|Unframed Output

Overhead Access

- J0 Trace Message Set
- J0 Trace Message Enable
- Section Overhead Bytes (SONET)
- Regenerator Section Overhead Bytes (SDH)
- Path Trace Message Set
- Path Trace Message Enable
- Path Overhead Bytes
- Line Overhead Bytes (SONET)
- Multiplex Section Overhead Bytes (SDH)
- Transport STS Channel Select (SONET)
- Transport STM Channel Select (SDH)

Payload

- Pattern Type
- User Pattern
- Stuff Columns

Pointer
- Pointer Value
- Pointer Move

Protocol
- SONET/SDH Switching
- SONET/SDH Status

SPE/VC
- SPE Size
- SPE Time Slot (SONET)
- Framing Mode
- STM Select (SDH)
- AU Select (SDH)
- Mapping

Subscribe
- Configuration

System
- Module Data

Trigger Output
- Clock Trigger for Output
- Trigger Type Select
- Pattern Trigger Enable
- Pattern Length
- Pattern Delay by 1-bit Increments
- Pattern Delay by 128-bit Increments
- Event Trigger Enable

OC-192/STM-64 Receiver

Alarm and Error Queries
- Alarm Query
- Bit/TSE Error Filter
- Error Count
- Error Ratio
- Bit Error Filter
- Performance Monitoring (SONET)

APS Monitor
- K1K2 Value Monitor
- K1 Request Bits 1-4
- K1 Channel Bits 5-8
- K2 Bit 5 Architecture
- K2 Operation Bits 6-8
- K2 Channel Bits 1-4

Board Properties
- List Properties
- Get Property Data
- LIU Type

Configuration
- Save Configuration
- Restore Configuration

Overhead Queries
- Trace Message
- Transport Overhead STM Channel (SDH)

- Transport Overhead AU Channel (SDH)
- J0 Trace Message
- J0 Trace Message Expected (SDH)
- J0 Trace Message Identifier (SDH)
- Section Overhead Bytes (SONET)
- Line Overhead Bytes (SONET)
- Regenerator Section Overhead Bytes (SDH)
- Multiplex Section Overhead Bytes (SDH)
- Path Trace Message
- Path Trace Message Expected (SDH)
- Path Trace Message Identifier (SDH)
- Path Trace Message Length (SDH)
- Path Overhead Bytes

Payload Pattern

- Pattern Type
- User Pattern
- Stuff Columns

Pointer

- SPE Pointer Value
- SPE Pointer Action Counts

Protocol

- SONET/SDH Switching
- SONET/SDH Status

Service Disruption

- Service Disruption Query (Longest)
- Service Disruption Query (Shortest)
- Service Disruption Query (Most Recent)
- In-Service Status
- Service Disruption Alarm Trigger Enable

Signal

- Framed|Unframed Input

SPE/VC

- SPE Size
- SPE Time Slot (SONET)
- Framing Mode
- STM Select (SDH)
- AU Select (SDH)

Subscribe

- Configuration
- All Events
- Alarms
- Error Count
- Error Ratio
- Section Trace

System

- Module Data

Test

- Test Start/Stop
- Test Type
- Test Period

- Test Time Unit
- Log Mode
- Log Seconds

Trigger

- Clock Trigger Output Enabled

Optical Switch

- Select Port

System

Checkpoint/Resume

- Checkpoint History
- Resume History

Client

- Tag Mode
- Port Query
- Connected Clients
- Disconnecting Clients

Host

- IP Address
- Subnet Address
- Gateway Address
- DNS
- Time
- Date
- MAC Address
- List Host Properties
- Get Host Property Data
-

License

- Add Permanent or Evaluation License
- Check for Valid Permanent License
- Query Permanent License Status
- Check for Valid Evaluation License
- Query Evaluation License Status for all Products
- Query Remaining Days for Evaluation License

Protocol

- SONET/SDH Switching
- SONET/SDH Status

Security

- Login

Subscribe

- Active Tests
- Active Alarms
- Pending Alarms
- Active Errors
- Pending Errors