

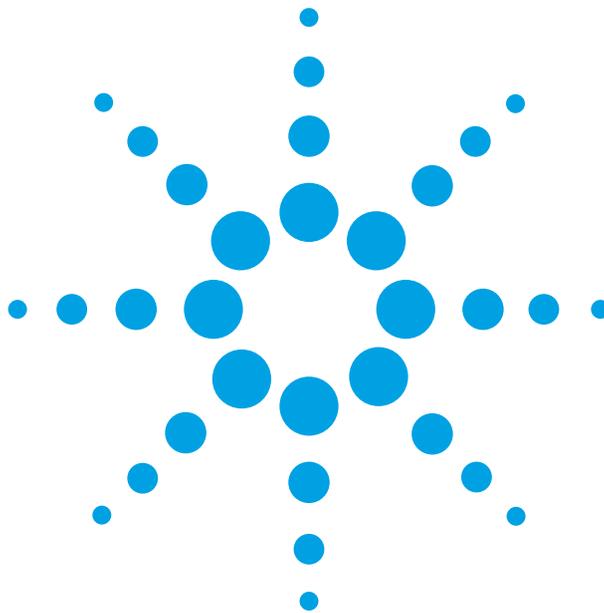


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Agilent Technologies
N1675A, N1676A, and N1677A
Service Advisor
SONET/SDH Test Modules

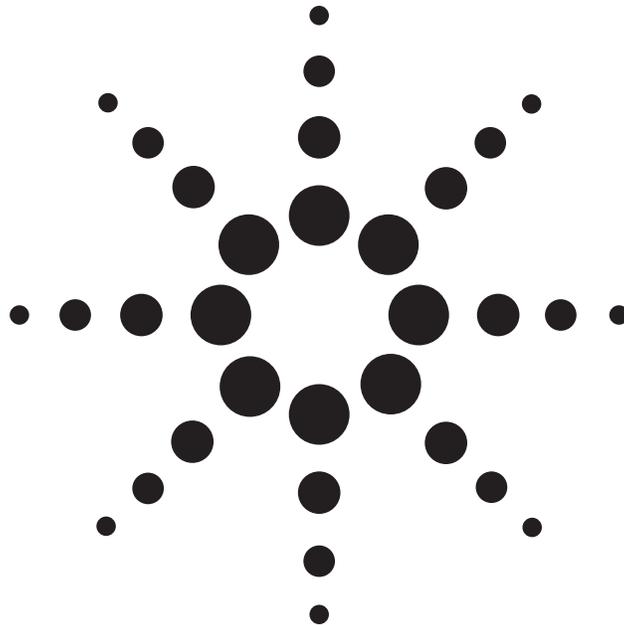
User's Manual



Agilent Technologies

**Agilent Technologies
N1675A, N1676A, and N1677A
Service Advisor
SONET/SDH Test Modules**

User's Manual



Agilent Technologies

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Safety Notices

Observe the following safety precautions whenever you operate the SONET/SDH Test Module. Failure to comply with these and other specific warnings and cautions in this manual is a violation of Agilent Technologies' safety standards of design, manufacturing, and intended use of the test module.

Agilent Technologies assumes no liability for the operator's failure to comply with these precautions.

Product Damage

Danger! Do not use this product if it shows visible damage, fails to perform, has been stored in unfavorable conditions, or has been subject to severe transportation stresses. Make the product inoperative and secure it against any unintended operation. Contact your Agilent Technologies representative for assistance.

Explosion Hazard

Danger! Do not operate a Service Advisor tester in the presence of flammable gases or fumes.

Electric Shock Hazard

Danger! To avoid the possibility of severe injury or death, observe the following precautions when using the Service Advisor Tablet or SONET/SDH Test Module.

Do not remove the system covers, and do not perform electrical tests if there are signs of shipping damage to the outer enclosure.

When connecting test cables to a line, do not touch the cable's metal contact points, or allow the cable leads to touch each other.

Use only the supplied power cords and connect only to a properly grounded wall outlet. Do not use extension cords that do not have a protective ground conductor.

Symbols

The following are general definitions of safety symbols used on equipment and in manuals.

Dangerous voltage.



Protective ground.



Frame or chassis ground.



Alternating current.



Direct current.



Alternating or direct current.



Caution! Read the manual.



About this Book

This section briefly describes the organization of this manual.

Chapter 1, *Getting Started*, introduces the SONET/SDH Modules and describes the connectors, indicators, and user interface test screen. This chapter also describes how to install the module in a Service Advisor tablet and power the system on.

Chapter 2, *Testing with the SONET/SDH Module*, provides step-by-step instructions for setting up and conducting tests with the N1675A, N1676A, or N1677A.

Chapter 3, *SONET Reference*, contains reference information for the SONET features of the N1675A, N1676A, and N1677A. This material describes the function and parameters for each of the SONET controls and indicators on the test screen.

Chapter 4, *SDH Reference*, contains reference information for the SDH features of the N1675A, N1676A, and N1677A. This material describes the function and parameters for each of the SDH controls and indicators on the test screen.

Chapter 5, *Results Reference*, contains reference information about all the measurements and results made by the SONET/SDH Module.

Chapter 6, *Printing and Reports*, describes how to connect a printer, and how to generate, save, and print reports.

About this Version

Applicability

This version of the *Agilent Technologies N1675A, N1676A, and N1677A Service Advisor SONET/SDH Test Modules User's Manual* applies to the Service Advisor Tablet running operating system software version **1.42** (or later) and N1675A, N1676A, and N1677A Test Modules running software version **1.22**.

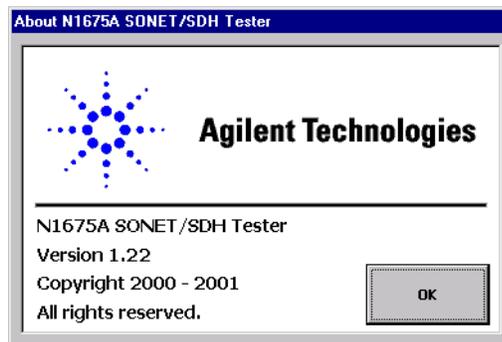
Note that some systems running earlier software may not provide all of the features described in this manual; systems running later versions of software may operate differently than described in this manual. Be sure to refer to any user's manual supplements or release notes that came with the unit, or call Agilent Customer Care at 1-877-878-8018.

Service Advisor SONET/SDH Test Module User's Manual printing history

| Version | Release date | Notes |
|---------|----------------|--|
| 1.0 | August, 2001 | First release. |
| 2.0 | December, 2001 | Revised to include software release 1.22 and the N1677A. |

Check the Software Version

You can check the software version number by pressing the **Help** button on the tablet control screens, or by checking the **Tablet Control** tab of the Service Advisor Manager.



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Getting Started

The Service Advisor SONET/SDH Modules

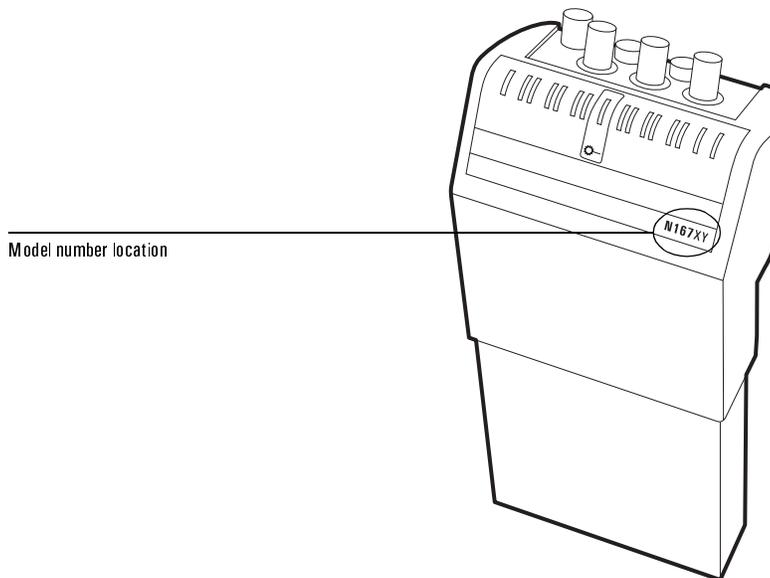
The Agilent line of Service Advisor SONET/SDH Modules includes the N1675A, the N1676A and the N1677A. These are single-slot modules that plug into the Service Advisor Test Tablet (N1610A or N1610B) or into the Service Advisor Undercradle (N1700A). Each module provides the ability to test SONET and SDH optical signals at 622 Mbs (OC-12 or STM-4) and 155 Mbs (OC-3 or STM-1).

The N1676A and N1677A also provide the ability to test SONET and SDH electrical signals at 51 Mbs (STS-1 or STM-0e). The N1676A and N1677A provide two electrical receivers and one electrical transmitter.

The N1677A further provides the ability to test 155 Mbs electrical signals (SONET STS-3 or SDH STM-1e).

Identifying Your SONET/SDH Module

The packaging and connectors on different Service Advisor SONET/SDH Modules can look very similar. To determine which module you have, verify the model number as shown in the following illustration.



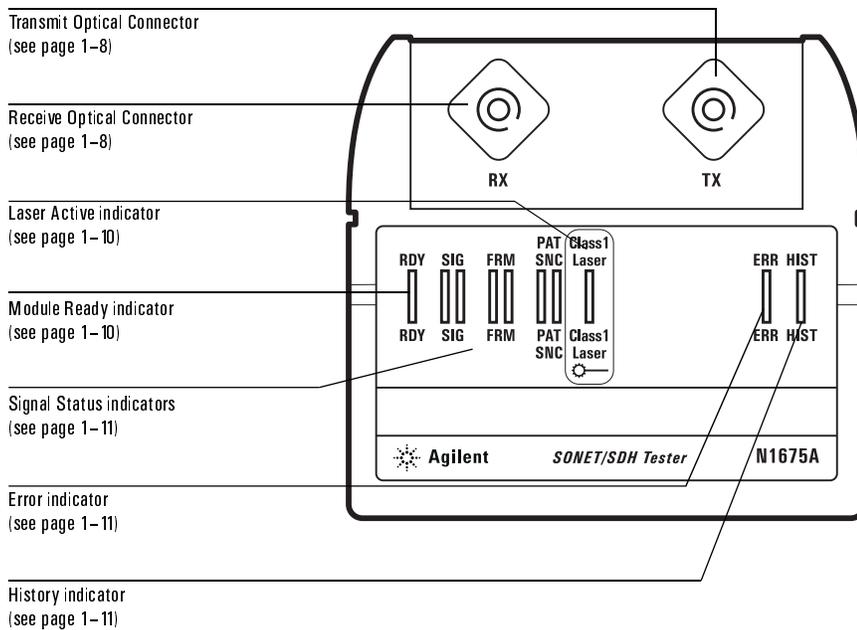
The table on the following page describes the available options and testing for the SONET/SDH Test Modules.

| N1675A, N1676A, and N1677A SONET/SDH Module Connector/Testing Options | | | |
|--|---------------|--|-----------------|
| Module | Option | Connector type and quantity | Testing |
| N1675A (see pg 1–4) | 001 | FC type optical connectors (1 Tx, 1 Rx) | 622 and 155 Mbs |
| | 003 | ST type optical connectors (1 Tx, 1 Rx) | 622 and 155 Mbs |
| | 005 | SC type optical connectors (1 Tx, 1 Rx) | 622 and 155 Mbs |
| N1676A (see pg 1–5) | 001 | FC type optical connectors (1 Tx, 1 Rx) | 622 and 155 Mbs |
| | | WECO 440 type electrical connectors (1 Tx, 2 Rx) | 51 Mbs |
| | 003 | ST type optical connectors (1 Tx, 1 Rx) | 622 and 155 Mbs |
| | | WECO 440 type electrical connectors (1 Tx, 2 Rx) | 51 Mbs |
| | 005 | SC type optical connectors (1 Tx, 1 Rx) | 622 and 155 Mbs |
| | | WECO 440 type electrical connectors (1 Tx, 2 Rx) | 51 Mbs |
| (see pg 1–6) | 011 | FC type optical connectors (1 Tx, 1 Rx) | 622 and 155 Mbs |
| | | BNC type electrical connectors (1 Tx, 2 Rx) | 51 Mbs |
| | 013 | ST type optical connectors (1 Tx, 1 Rx) | 622 and 155 Mbs |
| | | BNC type electrical connectors (1 Tx, 2 Rx) | 51 Mbs |
| | 015 | SC type optical connectors (1 Tx, 1 Rx) | 622 and 155 Mbs |
| | | BNC type electrical connectors (1 Tx, 2 Rx) | 51 Mbs |
| N1677A (see pg 1–7) | 001 | FC type optical connectors (1 Tx, 1 Rx) | 622 and 155 Mbs |
| | | BNC type electrical connectors (1 Tx, 2 Rx) | 155 and 51 Mbs |
| | 003 | ST type optical connectors (1 Tx, 1 Rx) | 622 and 155 Mbs |
| | | BNC type electrical connectors (1 Tx, 2 Rx) | 155 and 51 Mbs |
| | 005 | SC type optical connectors (1 Tx, 1 Rx) | 622 and 155 Mbs |
| | | BNC type electrical connectors (1 Tx, 2 Rx) | 155 and 51 Mbs |

The N1675A SONET/SDH Module at a Glance

The following illustration identifies the connectors and indicators on the N1675A SONET/SDH Test Module. The connectors on your module depend on which options you purchased (see *N1675A, N1676A, and N1677A SONET/SDH Module Connector/Testing Options*, page 1-3).

Refer to the referenced pages for more information.

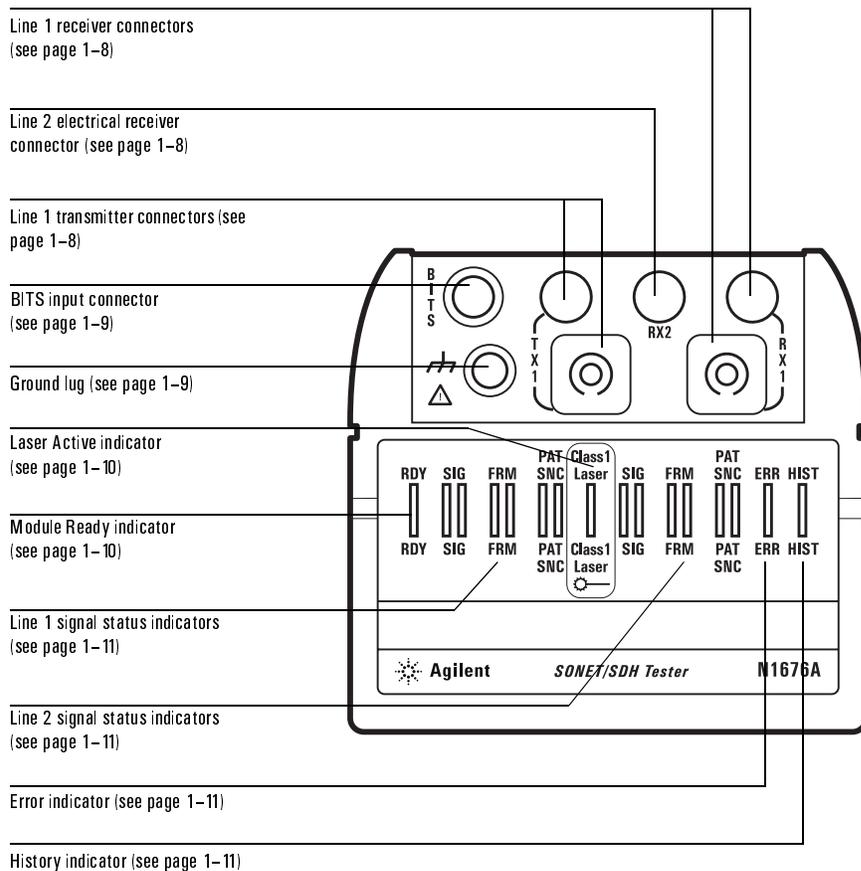


The N1676A SONET/SDH Module at a Glance

The following illustrations identify the connectors and indicators on the N1676A SONET/SDH Test Module. The connectors on your module depend on which options you purchased (see *N1675A, N1676A, and N1677A SONET/SDH Module Connector/Testing Options*, page 1-3).

Refer to the referenced pages for more information.

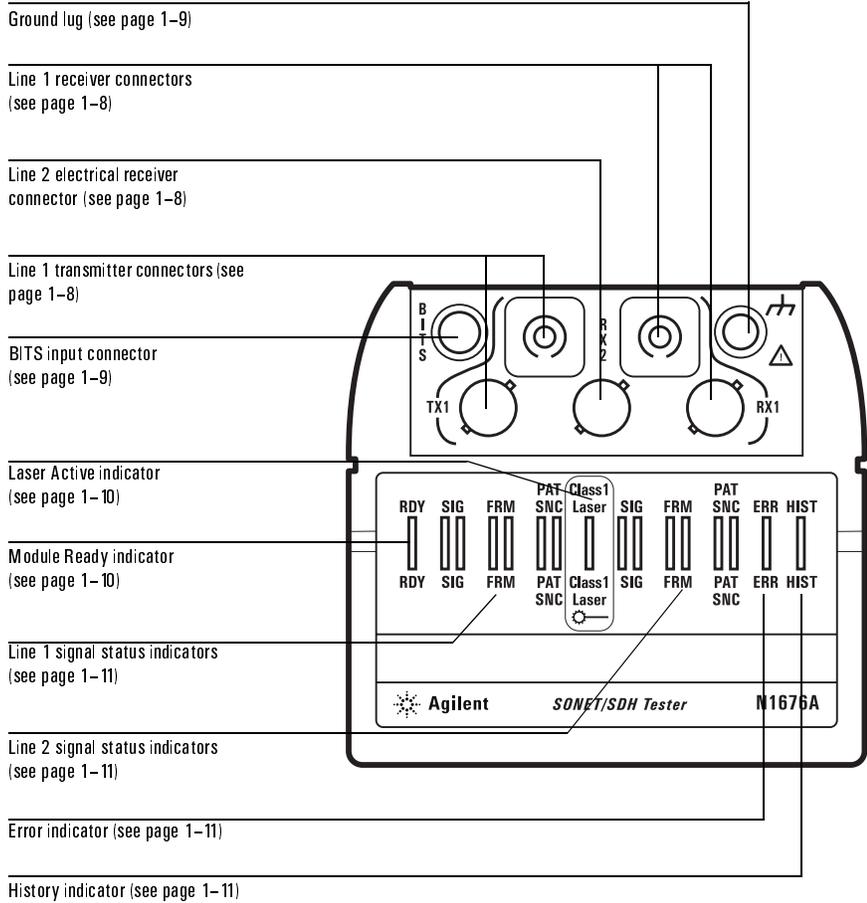
N1676A-001, -003, -005 — Optical and WEC0 440 Connectors



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The N1676A SONET/SDH Module at a Glance

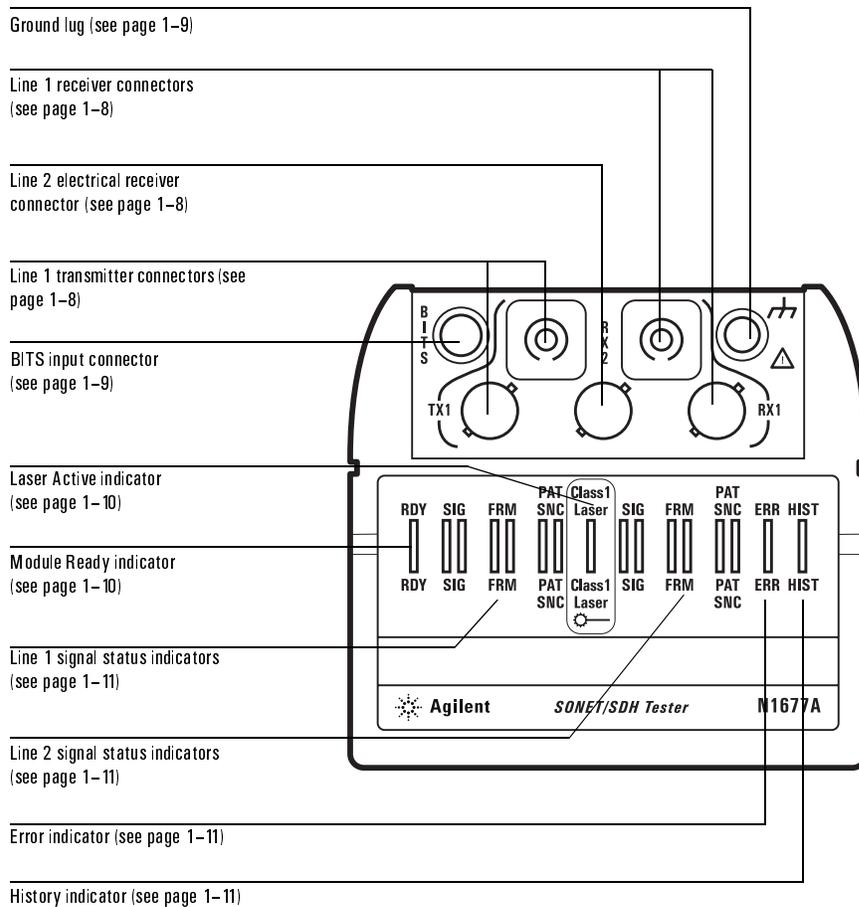
N1676A-011, -013, -015 — Optical and BNC Connectors



The N1677A SONET/SDH Module at a Glance

The following illustrations identify the connectors and indicators on the N1677A SONET/SDH Test Module. The connectors on your module depend on which options you purchased (see *N1675A, N1676A, and N1677A SONET/SDH Module Connector/Testing Options*, page 1-3).

Refer to the referenced pages for more information.



Module Connectors

This section describes the signal connectors on the top of the SONET/SDH Module. Refer to the illustrations on page 1–4 (N1675A), pages 1–5 and 1–6 (N1676A), and page 1–7 (N1677A).

Line 1 Receiver Connectors

The RX1 connectors (RX on the N1675A) accept the received signal from the system under test. The optical connector (all models) and electrical connector (N1676A and N1677A only) can be used to connect to the following signals:

Optical RX/RX1: The optical input provides a fiberoptic connector for testing SONET OC-12 or OC-3 and SDH STM-4 and STM-1 signals. The type of connector installed in your module depends on which option you ordered. Refer to the table on page 1–3.

Electrical RX1 (N1676A and N1677A only): The electrical input provides a WECO 440 or BNC connector for testing SONET STS-1 or SDH STM-0e signals. The type of connector installed in your module depends on which option you ordered. Refer to the table on page 1–3.

Line 2 Receiver Connector (N1676A and N1677A only)

The RX2 connector accepts a second electrical input signal — either a SONET STS-1 signal or an SDH STM-0e signal. The type of connector will be the same as for the RX1 electrical input. Refer to the table on page 1–3.

Line 1 Transmitter Connectors

The TX1 connectors (TX on the N1675A) provides a transmit signal to the system under test. The optical connector (all models) and electrical connector (N1676A and N1677A only) can be used to connect to the following signals:

Optical TX/TX1: The optical output provides a fiberoptic connector for testing SONET OC-12 or OC-3 and SDH STM-4 and STM-1 signals. The type of connector on your module depends on the option you ordered. Refer to the table on page 1–3.

Electrical TX1 (N1676A and N1677A only): The electrical output provides a WECO 440 or BNC jack for testing SONET STS-1 or SDH STM-0e signals. The type of connector on your module depends on the option you ordered. Refer to the table on page 1–3.

BITS Input Connector (N1676A and N1677A only)

The BITS (building integrated timing source) connector on the SONET/SDH test module allows you to connect an external signal clock. This Bantam style connector accepts a standard DS1 BITS or E1 MTS (master timing source) signal. For information on using the BITS input, see *Timing Source*, page 3–4 (SONET) or *Timing Source*, page 4–4 (SDH).

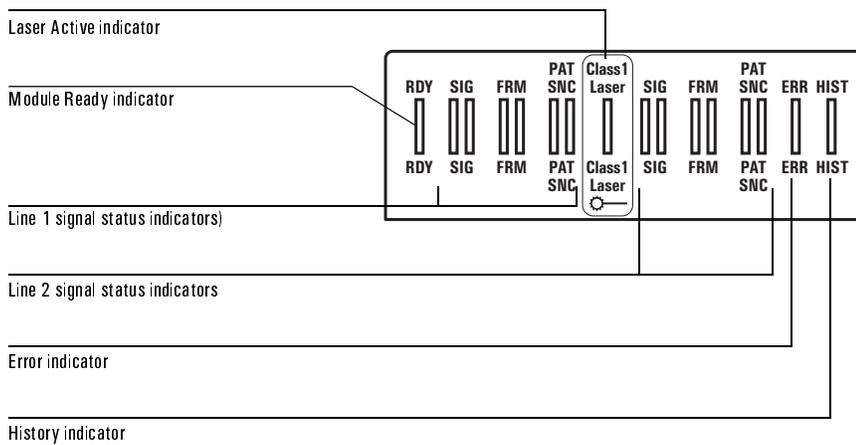
Ground Lug

The ground lug provides a connection to safety or earth ground.

Warning! Because the Tablet can be used as a battery powered portable instrument, to prevent the possibility of severe injury or death you must connect the Ground lug on the SONET/SDH module to a safety ground when any non-optical input is connected.

Module Indicators

This section describes the indicator lights on the top of the SONET/SDH Module. The figure below shows a typical set of indicators. Refer to the figures on page 1–4 (N1675A), pages 1–5 and 1–6 (N1676A), and page 1–7 (N1677A) for the indicators on your specific module.



Laser Active Indicator

The Class 1 Laser indicator lights to indicate that the transmit laser is on (transmitting). To turn the laser on and off press the Laser button on the test screen (see *Activating and Deactivating the Laser*, page 2–11).

Module Ready Indicator

The RDY indicator lights green and remains lit when the self test is finished and the SONET/SDH Module is ready to perform tests.

Signal Status Indicators

The SONET/SDH Module provides three indicators that describe the status of the system under test. The N1675A, has one set of indicators. The N1676A and N1677A, have two sets of indicators: one for each received line. The status indicators on the left apply to Line 1; the indicators on the right apply to Line 2.

SIG: Lights to indicate a valid signal has been detected for the line (based on the current test setup, see also *LOS*, page 5–6).

FRM: Lights to indicate that valid framing format has been detected and synchronized on line based on the current frame selection.

PAT SNC: Lights to indicate that pattern synchronization has been established on the line based on the currently selected patter (see *SONET BER Patterns*, page 3–5, and *SDH BER Patterns*, page 4–5).

Error Indicator

The ERR indicator lights when an error has been detected on the line (Line 1 or Line 2 for the N1676A). With intermittent errors, the indicator will blink occasionally. During heavily errored periods, the indicator may stay lit.

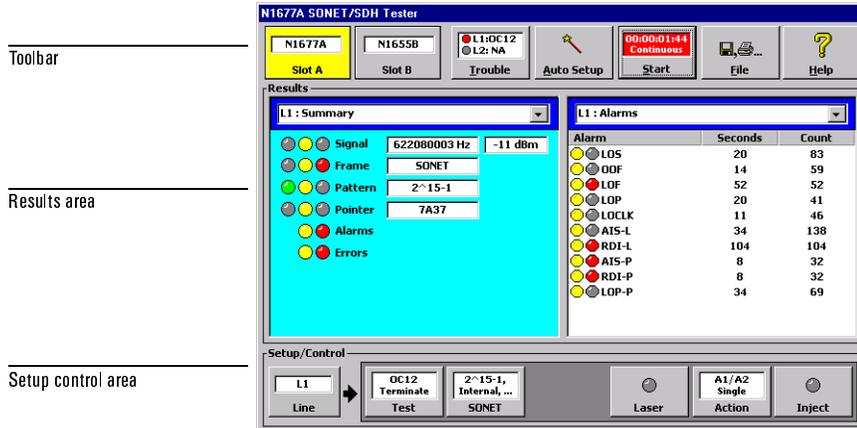
History Indicator

The HIST indicator lights when one or more errors have occurred previously during the current test. HIST will remain lit until a new test is started, or until Clear History is selected from the Trouble button menu.



Clear History: Tapping Clear History resets not only the indicator on the top of the module, but also the history indicators on the SONET/SDH testing screen. Error results and current alarms are maintained, but all history (yellow) indicators are reset to off.

The SONET/SDH Testing Screen at a Glance



Toolbar

The toolbar contains buttons for selecting modules and controlling tests.

Slot Buttons: The Slot A and Slot B buttons select the active test module if two modules are installed the Service Advisor Tablet. If the second module is not a SONET/SDH Module, that module's interface will be displayed.

Trouble Scan Button: This button allows you to quickly find any errors or alarms present on the signal. See *Using Trouble Scan*, page 2–14.

Auto Setup Button: This button trigger's the SONET/SDH Module's automatic test configuration feature. Tap Auto Setup to have the module automatically analyze and configure itself to the input signal. See *Using Auto Setup*, page 2–4.

Start/Stop Button: The test Start/Stop button controls testing. When testing is stopped, the button reads "Start". Tapping Start begins the test. When a test is running, the button reads "Stop" and tapping it halts the test.

File Button: Tapping the File button calls the File menu, which provides access to data report printing and storage (see *Printing and Reports*, page 6–1), test time setup, and factory default settings.

Help Button: Tap the Help button to display the SONET/SDH Module's software version data.

Results Area

The SONET/SDH Test Module interface features a two-paned Results display area. This area allows you to view two sets of results simultaneously. For example, you can view errors in one pane and alarms in the other pane. Or you can view live Section overhead in one pane, and Path overhead in the other.

With the N1676A or N1677A module, you can view results from both receivers (Line 1 and Line 2) simultaneously.

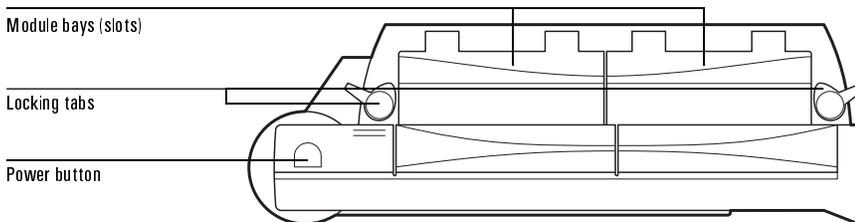
Setup Control Area

The Setup Control area at the bottom of the SONET/SDH Test Module screen provides buttons for configuring the module setup parameters. For more information, see *Setting Up the Test*, page 2-5.

Installing and Switching On

This procedure describes how to install the SONET/SDH Test Module in a Service Advisor Test Tablet and switch the system on. For more information on Test Tablet operations, refer to the *User's Manual* that came with your tablet.

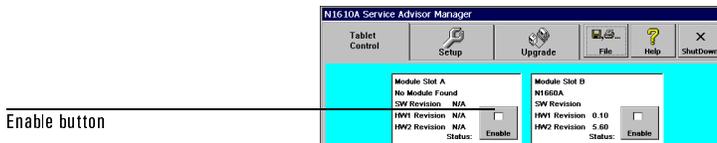
1. Select an unused module bay (slot) in the Service Advisor Tablet.



The SONET/SDH Module uses one slot in the Tablet. Either slot can be used.

2. Open the module bay cover and align the module with the bay. The module's label must face toward the front of the Tablet.
3. Slide the SONET/SDH Module into the bay until it is firmly seated.
4. Rotate the locking tab to secure the module in the bay.
5. Power on the Tablet by pressing and holding the power switch. During power up, the Tablet will sound a tone and display the Service Advisor Manager screen.
6. If the Auto Start Module feature is enabled on the Tablet, powering on the tablet also powers on the SONET/SDH Module and the SONET/SDH Testing screen is automatically launched.

If the Auto Start Module feature is not enabled, tap the appropriate Enable button on the Service Advisor Manager Tablet Control screen.



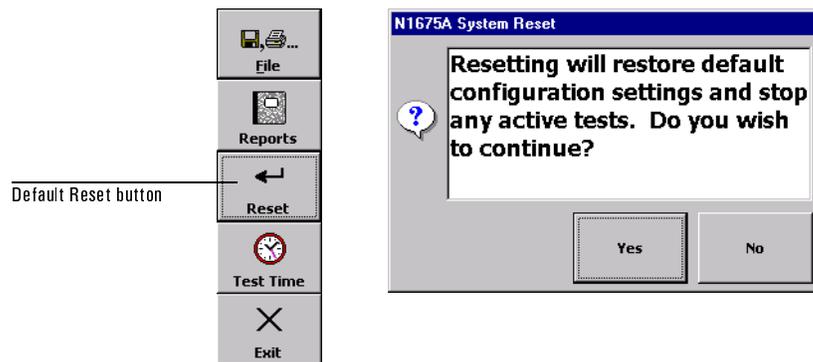
7. When the SONET/SDH module's RDY (ready) indicator lights, the unit is ready for use.

Restoring Factory Defaults

If you want to return the SONET/SDH Module to its initial configuration as shipped from the factory, follow this procedure:

1. Tap the File button in the toolbar. The File menu is displayed.
2. Tap the Reset button. The System Reset window appears.
3. Tap Yes to reset the module to its factory defaults.

Tap No to cancel the factory reset.



Resetting the module stops any active tests and resets all configuration parameters to their factory default settings. Stored data is not affected.

Getting Started

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Testing with the SONET/SDH Module

Testing Overview

The following steps describe the basic testing procedure for the SONET/SDH Module. For each step you will need to make selections and changes to meet your specific testing needs. Further details are provided in subsequent sections.

Note: Before you begin testing, make sure the SONET/SDH module is properly installed and the Service Advisor system is powered on. See *Installing and Switching On*, page 1–14.

1. Connect the SONET/SDH Module to the system to be tested. See page 2–3.
2. If you want the SONET/SDH Module to automatically configure itself for the system under test, tap the Auto Setup button. If you use Auto Setup, skip steps 3 through 7. See *Using Auto Setup*, page 2–4.
3. If you are using both receivers (RX1 and RX2; N1676A only) tap the Line button to select the line you want to configure.

Note: Only Line 1 has both a transmitter (TX1) and a receiver (RX1).

4. Select the type of test you want to perform by tapping the Test button in the Setup/Control area. Choose the Standard (SONET or SDH), Rate, Payload, and Mode for the test. See page 2–5.
5. Configure signal parameters beginning with the highest-rate signal in your test.
6. Tap the SONET or SDH button to configure the signal parameters. Only one of these buttons will be displayed, depending on which standard you selected in step 4.
7. Configure the Overhead, Clock, Pattern, and APS functions as appropriate for your test. See page 2–6 for SONET; see page 2–8 for SDH.
8. If desired, set up the Action button for your test. See page 2–10.
9. Activate the transmit laser, if applicable. See page 2–11.
10. Select a test time mode and begin the test. See page 2–12.
11. View test results as desired. See page 2–13.
12. Use the Trouble button to locate problems. See page 2–14.

Connecting the Module to the System Under Test

The following procedure describes how to connect the SONET/SDH Module to the system to be tested.

Note: The type of connectors on your module, and therefore the type of cables you should use, are determined by the options ordered when you purchased your module. See *N1675A, N1676A, and N1677A SONET/SDH Module Connector/Testing Options*, page 1–3.

1. If you are performing electrical testing (N1676A and N1677A only) be sure to connect the module's ground lug to an appropriate safety ground.

Warning! Because the Tablet can be used as a battery powered portable instrument, to prevent the possibility of severe injury or death you must connect the Ground lug on the SONET/SDH module to a safety ground when any non-optical input is connected.

2. Use an appropriate patch cable to connect the signal coming from the system under test to the RX (RX1) jack on the module.
 - *All models:* Use the optical connector for OC-12 and OC-3 SONET signals or for STM-4 and STM-1 SDH signals.
 - *N1676A and N1677A:* Use the electrical connector for STS-1 SONET signals or STM-0e SDH signals.
 - *N1677A only:* Use the electrical connector for STS-3 SONET signals or STM-1e SDH signals.
3. Use an appropriate patch cable to connect the signal going to the system under test from the TX (TX1) jack on the module. Refer to the connector information given in step 2.
4. If you are performing a dual-receiver test, connect the second signal coming from the system under test to the RX2 jack on the module (N1676A and N1677A only).
5. If you will be using an external timing source (BITS or MTS), use a bantam patch cord to connect that signal to the BITS jack on the module.

Using Auto Setup

The SONET/SDH Module's Auto Setup feature allows the module to automatically detect and configure the signal rate, payload, and data pattern on the receive signal. The module then configures the transmitter to match.

The following procedure describes how to use the Auto Setup feature.

1. Connect the SONET/SDH Module to the system under test. See *Connecting the Module to the System Under Test*, page 2–3.

Note: The Auto Setup feature only works on Line 1 (L1, N1676A and N1677A only).

2. On the main testing screen toolbar, tap the Auto Setup button.



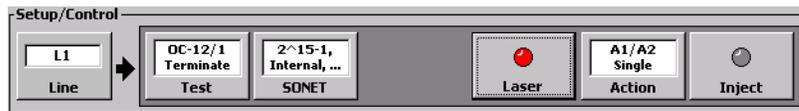
The module begins analyzing the received signal to detect its characteristics. Auto Setup first determines the signal Rate, beginning with the optical input. Next Auto Setup determines the Payload present on the received signal. The Auto Setup feature then determines the Pattern being carried on the Payload.

After Auto Setup determines the configuration of the input signal, the module sets the transmit signal to match it. The parameters are displayed on the Setup/Control screens.

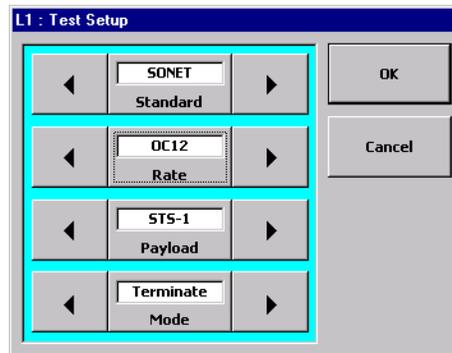
3. To start a test, tap the Start button. To end the test, tap the Stop button.
4. View test results as desired. See *Viewing Results*, page 2–13.

Setting Up the Test

This procedure describes how to select and configure the module's interface for the system under test. The current configuration is displayed in the Setup/Control area of the screen.



1. If you are performing a dual-receiver test (N1676A or N1677A only), tap the Line button to select which line you want to configure. Note that only Line 1 has a transmitter.
2. Tap the Test button to call the Test Setup screen.



3. Tap the Standard button to select the type of signal being tested (SONET or SDH). Note that this button determines which selections are available for the other buttons on this screen.
4. Tap the Rate button to select the speed of the signal being tested.
5. Tap the Payload button to select the payload of the currently select signal.
6. Tap the Mode button to select a test mode for the module. You can select either Terminate or Monitor.
7. When you have finished configuring the Test Setup screen, tap OK to accept your changes and close the window. Tap Cancel to close the window without making any changes.

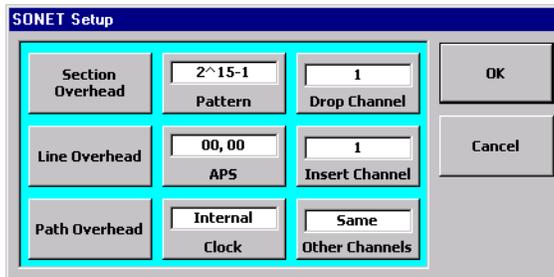
Configuring the SONET Parameters

This procedure describes how to configure the SONET signal parameters for the system under test.

1. Select the SONET standard using the Test Setup button. See *Setting Up the Test*, page 2–5. In the Setup/Control area, the SONET button will be displayed.

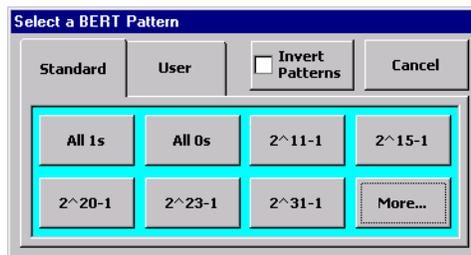


2. Tap the SONET button to call the SONET Test Setup screen.



Note that the screen may appear differently depending on which module you are using.

3. Tap the Clock button to select a transmit timing source (Internal, Loop, or BITS). See *Timing Source*, page 3–4.
4. Tap the Pattern button to call the Select BERT Pattern window.



Tap the pattern you want to use, or press Cancel to keep the current selection. See *SONET BER Patterns*, page 3–5.

Testing with the SONET/SDH Module
Configuring the SONET Parameters

5. Tap the APS button to configure the Automatic Protection Switching function (K1 and K2 bytes).

| Field | Value |
|--------------------|------------------|
| K1 Byte | 00 |
| No Request Message | No Request |
| Request | 0 |
| K2 Byte | 00 |
| Bridge | 0 |
| Architecture | 1+1 Future (000) |

Use the buttons on this screen to configure the APS channel values. See *APS Control*, page 3–8.

6. Tap the Section Overhead button on the SONET Setup screen to configure the SONET Section overhead bytes.

| Field | Value |
|-----------|--------|
| STS | 1 |
| A1 | N/A |
| A2 | N/A |
| Buffer J0 | Buffer |
| B1 | N/A |
| E1 | 0x00 |
| F1 | 0x00 |
| D1 | 0x00 |
| D2 | 0x00 |
| D3 | 0x00 |

Use the arrow buttons to select the STS frame you want to configure. Tap the byte buttons to edit their values. When you have finished, tap OK to close the window. See *Section Overhead*, page 3–12.

7. Tap the Line Overhead and Path Overhead buttons to configure additional SONET overhead bytes as you did in step 6. See *Line Overhead*, page 3–15 and *Path Overhead*, page 3–17.
8. When you have finished configuring the SONET parameters, tap OK to confirm your changes and close the window. Tap Cancel to close the window without making any changes.

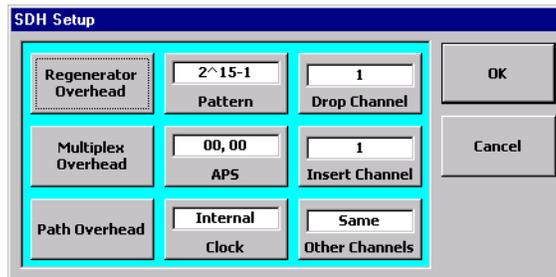
Configuring the SDH Parameters

This procedure describes how to configure the SDH signal parameters for the system under test.

1. Select the SDH standard using the Test Setup button. See *Setting Up the Test*, page 2–5. In the Setup/Control area, the SDH button will be displayed.

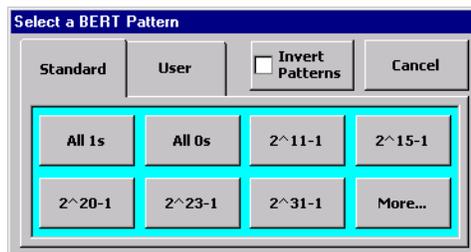


2. Tap the SDH button to call the SDH Test Setup screen.



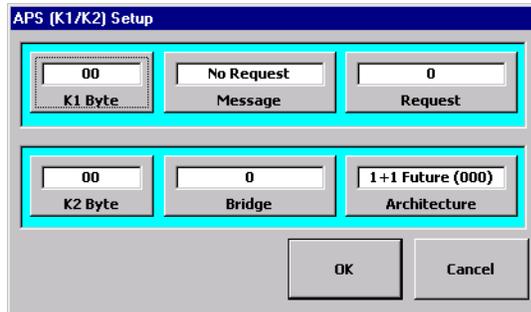
Note that the screen may appear differently depending on which module you are using.

3. Tap the Clock button to select a transmit timing source — Internal, Loop, or BITS (MTS). See *Timing Source*, page 4–4.
4. Tap the Pattern button to call the Select BERT Pattern window.



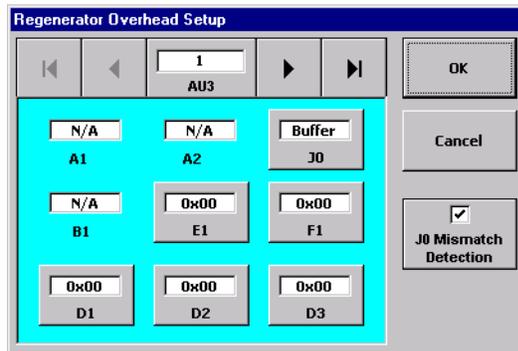
Tap the pattern you want to use, or press Cancel to keep the current selection. See *SDH BER Patterns*, page 4–5.

5. Tap the APS button to configure the Automatic Protection Switching function (K1 and K2 bytes).



Use the buttons on this screen to configure the APS channel values. See *APS Control*, page 4–8.

6. Tap the Regenerator Overhead button on the SDH Setup screen to configure the SDH Regenerator Section overhead bytes.



Use the arrow buttons to select the AU3 frame you want to configure. Tap the byte buttons to edit their values. When you have finished, tap OK to close the window. See *Regenerator Section Overhead*, page 4–12.

7. Tap the Multiplex Overhead and Path Overhead buttons to configure additional SDH overhead bytes as you did in step 6. See *Multiplex Section Overhead*, page 4–15 and *Path Overhead*, page 4–17.
8. When you have finished configuring the SDH parameters, tap OK to confirm your changes and close the window. Tap Cancel to close the window without making any changes.

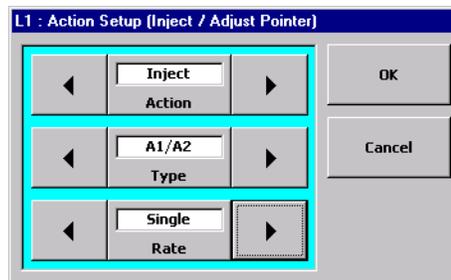
Setting Up the Action Button

Setting Up the Action Button

The Action button allows you to inject errors and alarms, and perform pointer adjustments. This procedure describes how to configure the Action button.



1. Tap the Action button to call the Action Setup window.



2. Tap the Action button, or use its arrow buttons, to select error and alarm injection (Inject) or pointer adjustments (Pointer).
3. Tap the Type button or arrows to select the type of error, alarm, or pointer adjustment to be injected when the Inject/Adjust button is tapped. See *Pointer Control*, page 3-20 and *Error and Alarm Injection*, page 3-21 (SONET) or page 4-20 and 4-21 (SDH).
4. Tap the Rate button, or use its arrows, to select the error or alarm injection rate (this button is not displayed when Action is set to Pointer).

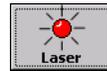
You can select single, continuous, or consecutive (Con) injection rates. See *Error and Alarm Injection*, page 3-21 (SONET) or page 4-21 (SDH).
5. When you have finished configuring the Action button, tap OK to confirm your changes and close the window. Tap Cancel to close the window without making changes.
6. The function that you define for the Action button are executed when you tap the Inject/Adjust button in the Setup/Control area of the screen. This button will be labeled either Inject or Adjust depending on what you select for Action in step 2.



Activating and Deactivating the Laser

For safety and to prolong battery time, the SONET/SDH module's transmit laser can be switched on and off.

- To activate the laser, tap the Laser button in the Setup/Control area.



When the laser is on, the indicator on the Laser button is red. The Laser indicator on the top of the SONET/SDH Module lights as well.

- To deactivate the laser, tap the Laser button.



When the laser is off, the indicator on the Laser button is gray. The Laser indicator on the top of the SONET/SDH Module is not lit also.

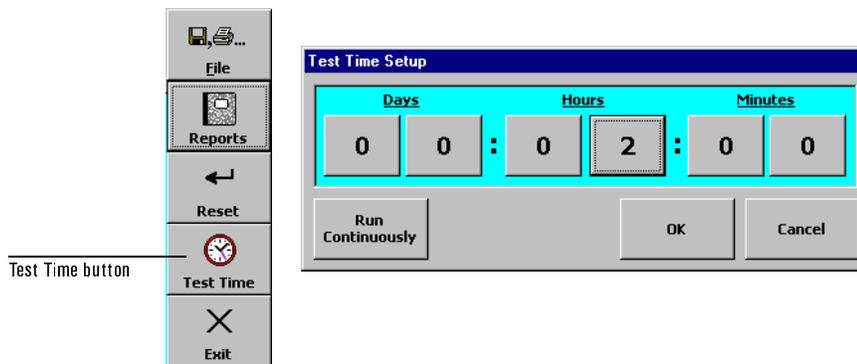
The default setting for the laser is off.

Starting the Test

Starting the Test

The procedure describes how to set the test time mode and begin a test.

1. After you have configured the SONET/SDH Module for your application, select a test time mode by tapping the File button in the toolbar.
2. Tap the Test Time button to call the Test Time Setup window.



3. Select a time mode by either tapping the Run Continuously button (default) or by tapping the digit buttons to set the duration you want for a timed test. Tap OK to confirm your selection and close the window or tap Cancel to close the window without making changes.
4. To begin the test tap the Start button.



The Start button will change to the Stop button. The elapsed and remaining time will be displayed as appropriate on the Start/Stop button.

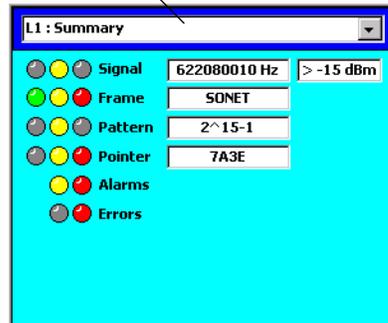
5. To end a test tap the Stop button.



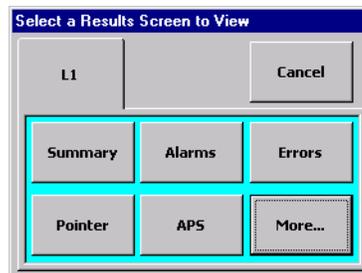
Viewing Results

This procedure describes how to view the various test results available on the SONET/SDH Module's screen.

Results selector



1. Test results are displayed in two side-by-side panes in the results area of the SONET/SDH Module window. To select which results are displayed in a pane, tap the results selector button. The Select a Results Screen to View window is displayed.



2. If more than one Line tab is displayed, tap one (L1 or L2) to select which line's results are displayed in that pane.
3. Tap a screen button to select the results screen you want to display, or tap Cancel to close the window without making changes.
4. Configure the other results display pane as desired. Each results pane is independent of the other.

For more information refer to Chapter 5, *Results Reference*.

Using Trouble Scan

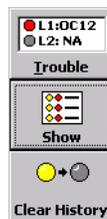
Using Trouble Scan

This procedure describes how to use the Trouble Scan feature on the SONET/SDH Module. Trouble Scan allows you to quickly find any errors or alarms present on the signal.

1. Observe the Trouble button in the toolbar.

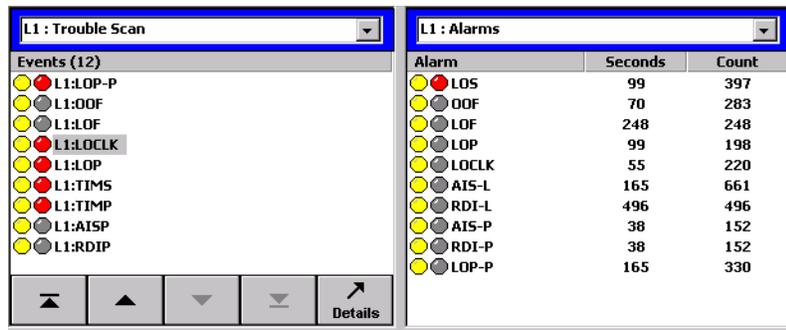
The button has two indicators, one for line 1 (L1) and one for line 2 (L2; N1676A and N1677A only). These indicators will be red if an error or alarm condition is detected on their corresponding line, or yellow if a history of an error or alarm exists.

2. When the L1 or L2 indicator is red on the Trouble button, tap the button to display the Trouble Scan menu.



3. To view the detected trouble, tap the Show button. To reset history indicators on the Trouble button, results screens, and module, tap Clear History.

When you tap Show, the Trouble Scan results screen is displayed in the right results pane.



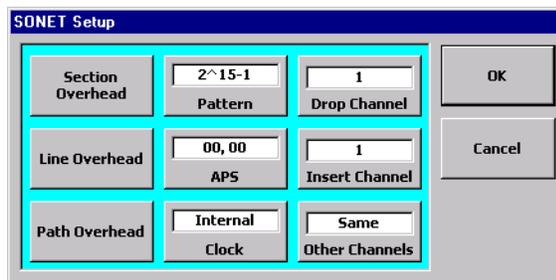
4. Use the arrow buttons to scroll through the list of detected troubles. When you have selected an item, tap the Details button to display the corresponding results screen in the right results pane.

Performing a Round-Trip Delay Test

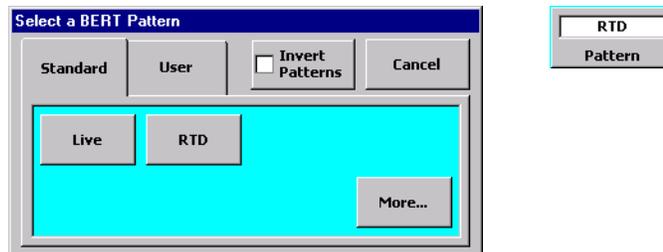
The SONET/SDH Module allows you to perform a round-trip delay measurement on the system under test. This test determines how long it takes the signal to leave the module's transmit port and return to the receive port.

The following procedure describes how to perform a round-trip delay test.

1. Connect the SONET/SDH Module to the system under test. See *Connecting the Module to the System Under Test*, page 2–3.
2. Configure the module to match the system being tested. You can use Auto Setup (see page 2–4) or configure manually (SONET see page 2–6, SDH see page 2–8).
3. For this test the Pattern must be set to RTD. Tap the SONET or SDH button to call the appropriate Setup window, then tap Payload.



4. Tap the More button and then tap the RTD button to set the Payload to RTD.



5. If necessary, tap the Laser button to activate the laser.
6. On the main test screen, tap the Start button to begin the test.
7. Observe the RTD results on the Summary results screen.

Testing with the SONET/SDH Module

3

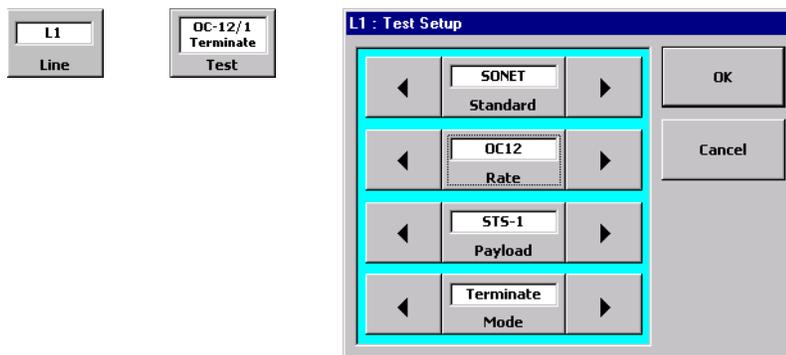
| | |
|---------------------------|------|
| SONET Test Setup | 3-2 |
| Timing Source | 3-4 |
| SONET BER Patterns | 3-5 |
| APS Control | 3-8 |
| Section Overhead | 3-12 |
| Line Overhead | 3-15 |
| Path Overhead | 3-17 |
| Pointer Control | 3-20 |
| Error and Alarm Injection | 3-21 |

SONET Reference

SONET Test Setup

SONET Test Selection

The SONET/SDH Module can test SONET signals when Standard is set to SONET in the Test Setup window for L1 or L2 (see *Setting Up the Test*, page 2–5).



When Standard is set to SONET, the other parameters on the Test Setup window have the following functions:

Rate: Selects the SONET rate to be used. Tap this button to select OC-12 (622 Mbs), OC-3 (155 Mbs), or STS-1 (51 Mbs; N1676A and N1677A only).

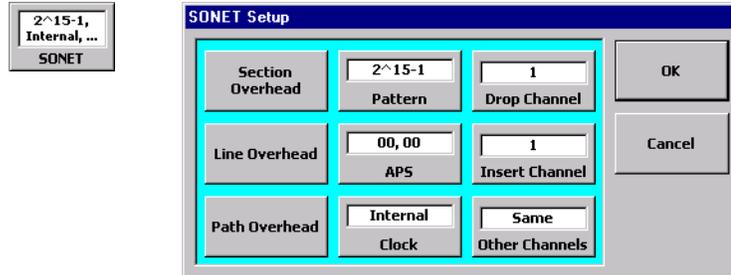
Payload: Selects the SONET payload for the signal. The choices available vary depending on which SONET/SDH model you have, and which Rate you select. The following table lists the Payload selections.

| Payload | Description |
|---------|--|
| STS-12C | STS-12 concatenated (clear channel) signal. 622 Mbs. |
| STS-3C | STS-3 concatenated (clear channel) signal. 155 Mbs. |
| STS-1 | STS-1 signal. 51 Mbs. |
| BERT | Payload only, no channelized signals. |

Mode: Selects the termination mode for the module. Tap this button to select Terminate or Monitor.

SONET Setup Window

When Standard is set to SONET, the SONET button is displayed in the Setup/Control area. Tap this button to call the SONET Setup window.



The following table lists the controls found on the SONET Setup window.

| SONET Setup control | More information |
|---------------------------|---|
| Clock | See <i>Timing Source</i> , page 3–4. |
| Pattern | See <i>SONET BER Patterns</i> , page 3–5. |
| APS | See <i>APS Control</i> , page 3–8. |
| Section Overhead | See <i>Section Overhead</i> , page 3–12. |
| Line Overhead | See <i>Line Overhead</i> , page 3–15. |
| Path Overhead | See <i>Path Overhead</i> , page 3–17. |
| Drop/Insert/Other Channel | See <i>Drop and Insert Control</i> , page 3–19. |

Timing Source

The Clock button in the SONET Setup window configures the source of the transmit timing for the SONET signal.



Tap the Clock button to select of the following timing sources:

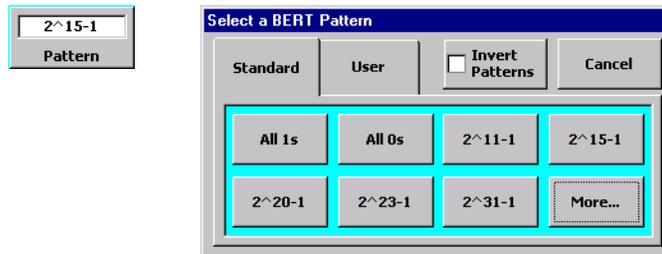
Internal: Timing is from the SONET/SDH Module's built-in oscillator.

Loop: Timing is recovered from the received signal.

BITS: (N1676A and N1677A only) Timing is derived from an external BITS (building integrated timing source) signal. This is a 1.544 MHz signal applied to the module's BITS connector. Impedance for this signal is 120 ohm for the N1676A and N1677A; 75 ohm is available for N1677A.

SONET BER Patterns

The SONET/SDH Module offers a number of choices for the pattern used in SONET BER (bit error ratio) testing. To select a pattern, tap the Pattern button on the SONET Setup window to call the Select Pattern window.



Category Tabs: use the tabs on the Select Pattern window to select the category of pattern you want. Standard (fixed, see page 3–6) and User (user-programmed, see page 3–7) patterns are available.

Pattern Inversion: Tapping the Invert Patterns button inverts all of the test patterns. Inverted patterns are displayed preceded by a slash (“/”).

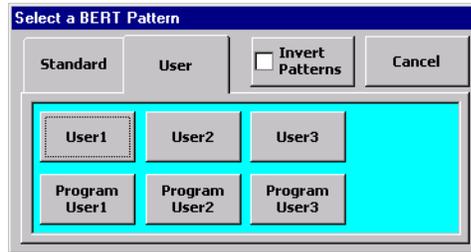
Standard Patterns

The following table describes the standard SONET patterns available. Note that not all of the Standard patterns can be displayed on the same screen. Tap the More button to display additional patterns.

| Pattern | Description |
|----------------|---|
| All 1s | An all-ones (binary 1111...) pattern. |
| All 0s | An all-zeros (binary 0000...) pattern. |
| $2^{11}-1$ | A $2^{11}-1$ pseudorandom bit sequence (PRBS). |
| $2^{15}-1$ | A $2^{15}-1$ PRBS. |
| $2^{20}-1$ | A $2^{20}-1$ PRBS. |
| $2^{23}-1$ | A $2^{23}-1$ PRBS. |
| $2^{31}-1$ | A $2^{31}-1$ PRBS. |
| Live | No pattern. The received payload is retransmitted on the outgoing signal. |
| RTD | Round-trip delay test pattern. This is a special pattern that allows you to measure how long it takes data to leave the SONET/SDH Module transmitter and return to the receiver. See <i>Performing a Round-Trip Delay Test</i> , page 2-15. |

User-Programmable Patterns

Selecting the User tab on the Select Pattern window displays the User Pattern category.



Tap a User button to select that pattern. To view or edit a user pattern, tap the corresponding Program User button. This calls the Edit User Pattern window.



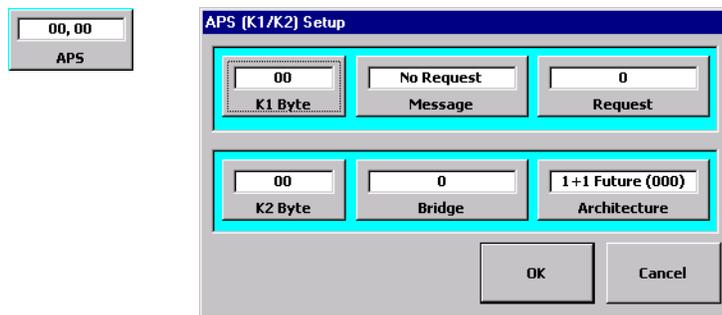
Use the buttons on the Edit Pattern keypad to configure the pattern the way you want. The SONET user patterns are entered in hexadecimal notation from 0 through FFFFFFFF. The binary equivalent of this pattern will be transmitted as the pattern. If you do not enter eight digits, leading zeros will be added (though not displayed).

Note: After you have programmed a user pattern, be sure to tap the appropriate button on the Select Pattern window to select it for use in your test.

APS Control

The SONET/SDH Module allows you to control the automatic protection switching (APS) channel of the SONET signal. The APS channel comprises the K1 and K2 bytes of the SONET overhead.

Tap the APS button on the SONET Setup window to call the APS Setup screen.



K1 Byte: This button displays the current value of the K1 overhead byte in hexadecimal notation. Bits 1 through 4 of the K1 byte (represented by the first digit of the K1 Byte button) define the APS message. Bits 5 through 8 of K1 (represented by the second digit) define the APS requested channel.

Tapping this button calls a window that allows you to directly enter the value for the K1 byte. The K1 byte value is also controlled by the Message and Request buttons.

K2 Byte: This button displays the current value of the K2 overhead byte in hexadecimal notation. Bits 1 through 4 of the K2 byte (represented by the first digit of the K2 Byte button) define the bridge channel. Bit 5 sets the architecture and bits 6 through 8 define the APS mode. These bits are represented by the second digit of the K2 Byte button.

Tapping this button calls a window that allows you to directly enter the value for the K2 byte. The K2 byte value is also controlled by the Bridge and Architecture buttons.

APS Message

The Message button displays the text of the currently selected APS message. The message is carried in the first four bits of K1. Tapping the Message button cycles through the APS messages. The following table lists the APS messages.

| APS Messages | | |
|---------------------|---|---------------------|
| APS Message | K1 Byte Display (first digit, hex) | Bit Sequence |
| No Request | 0x | 0000 |
| Do Not Revert | 1x | 0001 |
| Reverse Request | 2x | 0010 |
| Not Used | 3x | 0011 |
| Exercise | 4x | 0110 |
| Not Used | 5x | 0101 |
| Wait-to-Restore | 6x | 0110 |
| Not Used | 7x | 0111 |
| Manual Switch | 8x | 1000 |
| Not Used | 9x | 1001 |
| SD-Low Priority | Ax | 1010 |
| SD-High Priority | Bx | 1011 |
| SF-Low Priority | Cx | 1100 |
| SF-High Priority | Dx | 1101 |
| Forced Switch | Ex | 1110 |
| Lockout Protect | Fx | 1111 |

APS Control**Requested Channel**

The Request button displays the current requested channel to which the APS message applies. The binary value of the channel number (0–15 = 0000–1111) is sent in bits 5–8 of K1. This is shown in the second digit of the K1 Byte button in hexadecimal. Tapping the Request button calls a window in which you can enter the channel number. This value is also controlled by the K1 Byte button.

Bridge Channel

The Bridge button displays the current APS bridge channel. The binary equivalent of the channel number (0–15 = 0000–1111) is transmitted in bits 1–4 of K2. This value is shown in the first digit of the K2 Byte button in hexadecimal. Tapping the Bridge button calls a window in which you can enter the channel number. This value is also controlled by the K2 Byte button.

APS Mode and Architecture

The Architecture button displays the APS architecture and mode. Tapping this button cycles through the available selections.

The APS architecture is determined by bit 5 of the K2 byte. When bit 5 is set to 0, the architecture is 1+1. When bit 5 is set to 1, the architecture is 1:n.

The APS mode is determined by bits 6 through 8 of the K2 byte.

The following table lists the APS architecture and mode settings available through the Architecture button.

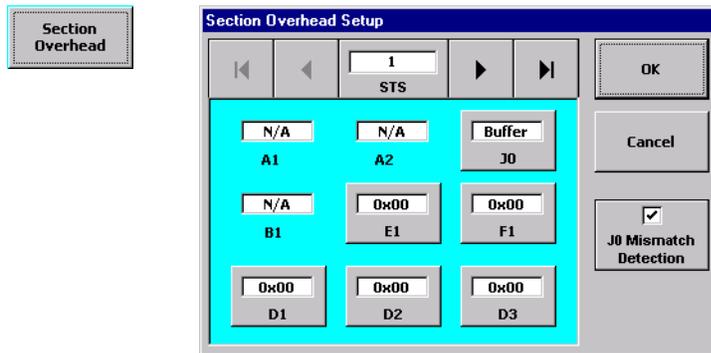
| SONET APS Architecture & Mode Settings | | | | |
|---|-----------------------------------|----------|----------|----------|
| Architecture button setting | K2 byte bits (5 through 8) | | | |
| | 5 | 6 | 7 | 8 |
| 1+1 Future (000) | 0 | 0 | 0 | 0 |
| 1+1 Future (001) | 0 | 0 | 0 | 1 |
| 1+1 Future (010) | 0 | 0 | 1 | 0 |
| 1+1 Future (011) | 0 | 0 | 1 | 1 |
| 1+1 Unidirection | 0 | 1 | 0 | 0 |

SONET APS Architecture & Mode Settings, continued

| Architecture button setting | K2 byte bits (5 through 8) | | | |
|-----------------------------|----------------------------|---|---|---|
| | 5 | 6 | 7 | 8 |
| 1+1 Bidirection | 0 | 1 | 0 | 1 |
| 1+1 RDI-L (LFERF) | 0 | 1 | 1 | 0 |
| 1+1 AIS-L (LAIS) | 0 | 1 | 1 | 1 |
| 1:n Future (000) | 1 | 0 | 0 | 0 |
| 1:n Future (001) | 1 | 0 | 0 | 1 |
| 1:n Future (010) | 1 | 0 | 1 | 0 |
| 1:n Future (011) | 1 | 0 | 1 | 1 |
| 1:n Unidirection | 1 | 1 | 0 | 0 |
| 1:n Bidirection | 1 | 1 | 0 | 1 |
| 1:n RDI-L (LFERF) | 1 | 1 | 1 | 0 |
| 1:n AIS-L (LAIS) | 1 | 1 | 1 | 1 |

Section Overhead

The SONET/SDH Module allows you to control the SONET section overhead bytes. To edit the values of these bytes, tap the Section Overhead button on the SONET Setup window.



The Section Overhead Setup window displays the currently selected STS frame and the section overhead bytes associated with that frame.

STS button: This button allows you to select the STS frame you want to view. The currently select frame is shown on the button. Tap the button or the arrow keys to select an STS frame. The associated section bytes for the selected STS are shown in the lower part of the window.

Byte buttons: The byte buttons (E1, D2, and so on) display the current value of each byte. To edit a byte's value, tap the button and enter the new value in the data entry window.

Note: The J0 byte has a more extensive editing window than the other bytes. See *Editing the J0 (Section Trace) and J1 (Path Trace) Bytes*, page 3–14.

Other bytes: The values of section overhead bytes that are not editable (for example A1 and A2) are displayed on the window as well.

J0 Mismatch button: This button enables and disables the J0 buffer alarm on the SONET Section overhead results screen. See *SONET Section Overhead Results Screen*, page 5–12.

The following table describes the section overhead bytes.

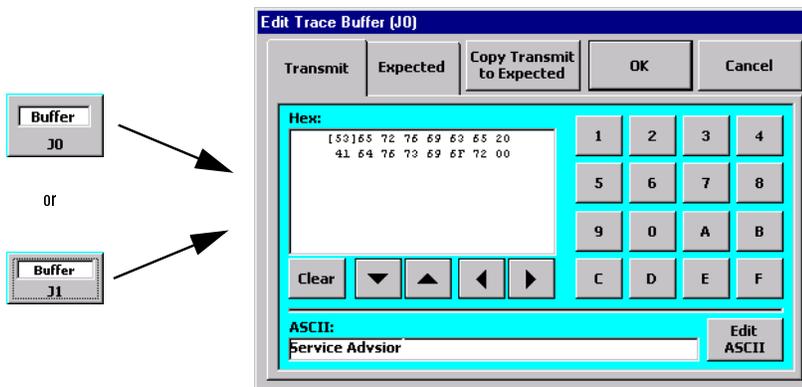
SONET Section Overhead Bytes

| Byte | Description |
|-------------|---|
| A1/A2 | Framing. Pattern = 11110110 00101000 (F6 28 hex). Not editable |
| J0 | (STS-1 #1 only) Section trace. See <i>Editing the J0 (Section Trace) and J1 (Path Trace) Bytes</i> , page 3–14. |
| B1 | Section bit-interleaved parity (BIP-8) code. Not editable. |
| E1 | Local orderwire channel. |
| F1 | Section user channel. |
| D1–D3 | Section data communication channel (DCC). |
| Z0 | (STS-1 #2 and higher only) Growth byte (formerly C1). |

Editing the J0 (Section Trace) and J1 (Path Trace) Bytes

The SONET/SDH Module allows you to program each byte of the 64-byte STS Section Trace string (J0) and Path Trace string (J1) byte. Each byte of the string is transmitted in the J0 or J1 bytes of 64 consecutive frames.

When you tap the J0 byte button (on the Section Overhead Setup screen) or J1 byte button (on the Path Overhead Setup Screen), the Edit Trace Buffer window is displayed. The J0 window is shown here.



Transmit and Expected tabs: These two tabs are similar. The Transmit tab allows you to program the trace string that is transmitted on the output SONET signal. The Expected tab allows you to program the string that the SONET/SDH module uses to compare with the received string on the input SONET signal.

Copy Transmit to Expected: This button allows you to easily copy the values set on the Transmit tab to the Expected tab.

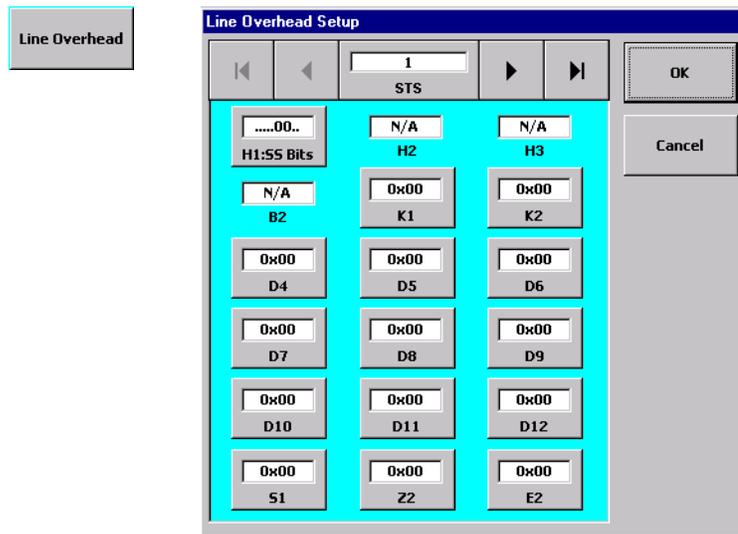
Note: The SONET/SDH Modules use the trace string programmed into the Expected tab to compare with the received J0 or J1 traces. A mismatch will be reported if J0/J1 Mismatch is checked (on). See *J0 Mismatch button*, page 3-12.

Hex display: The Hex display area shows the value of the trace bytes in hexadecimal notation. You can edit these values using the arrow keys to select a byte, and the number/letter keypad to set their values. Changes you make in this display are also reflected in the ASCII display area.

ASCII display: The ASCII display area shows the value of the trace bytes as ASCII text. You can edit the ASCII string by tapping the Edit ASCII button and then using the keyboard to type the string you want. Changes you make in this display are also reflected in the Hex display area.

Line Overhead

The SONET/SDH Module allows you to control the SONET line overhead bytes. To edit the values of these bytes, tap the Line Overhead button on the SONET Setup window.



The Line Overhead Setup window displays the currently selected STS frame and the line overhead bytes associated with that frame.

STS button: This button allows you to select the STS frame you want to view. The currently select frame is shown on the button. Tap the button or the arrow keys to select an STS frame. The associated line bytes for the selected STS are shown in the lower part of the window.

Byte buttons: The byte buttons (H1:SS, K1, D4, and so on) display the current value of each byte. To edit a byte's value, tap the button and enter the new value in the data entry window.

Other bytes: The values of line overhead bytes that are not editable (for example H2 and H3) are displayed on the window as well.

The following table describes the line overhead bytes.

SONET Reference

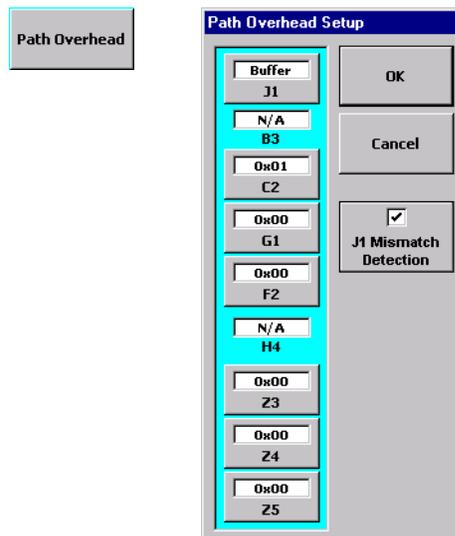
Line Overhead

SONET Line Overhead Bytes

| Byte | Description |
|-------------|--|
| H1:SS Bits | Payload offset bits. These are bits 5 and 6 of the H1 byte. |
| H2-H3 | Payload pointers. Not editable on this screen. |
| B2 | Line bit-interleaved parity (BIP-8) code. Not editable. |
| K1/K2 | Automatic protection switching (APS) channel, also Line AIS (AIS-L) and Line RDI (RDI-L) indication. |
| D4-D12 | Line data communication channel (DCC). |
| S1/Z1 | S1 (STS-1 #1) = Synchronization status. Z1 = Growth. |
| M0 | M0 (STS-1/OC-1 signals only): bits 5-8 = Line FEBE |
| M1 | M1 (STS-1 #3 of STS-N \geq 3 signals) = Line FEBE. |
| Z2 | Z2 (other STS-1s) = Growth. |
| E2 | Express orderwire channel. |

Path Overhead

The SONET/SDH Module allows you to control the SONET path overhead bytes. To edit the values of these bytes, tap the Path Overhead button on the SONET Setup window.



The Path Overhead Setup window displays the path overhead bytes for the SONET frame.

Byte buttons: The byte buttons (C2, G2, and so on) display the current value of each byte. To edit a byte's value, tap the button and enter the new value in the data entry window.

Note: The J1 byte has a more extensive editing window than the other bytes. See *Editing the J0 (Section Trace) and J1 (Path Trace) Bytes*, page 3–14.

Other bytes: The values of path overhead bytes that are not editable (for example B3 and H4) are displayed on the window as well.

J1 Mismatch button: This button enables and disables the J1 buffer alarm on the SONET Path overhead results screen. See *SONET and SDH Path Results Screen*, page 5–16.

The following table describes the path overhead bytes.

SONET Reference

Path Overhead

SONET Path Overhead Bytes

| Byte | Description |
|-------------|--|
| J1 | Path trace. See <i>Editing the J0 (Section Trace) and J1 (Path Trace) Bytes</i> , page 3–14. |
| B3 | Path bit-interleaved parity (BIP-8) code. Not editable. |
| C2 | Path signal label. |
| G1 | Path status. Bits 1–4 = path FEBE; bits 5–6 = path ROI. |
| F2 | Path user channel. |
| H4 | VT multiframe phase indicator. Not editable. |
| Z3/Z4 | Future growth. |
| Z5 | Tandem connection error count and data link. |

Drop and Insert Control

When the SONET signal is carrying subrate traffic (for example OC-12 carrying STS-3c or STS-1 channels), use the Drop Channel and Insert Channel buttons to control which subrate channels are demultiplexed and multiplexed to and from the OC-12.

The Drop Channel, Insert Channel, and Other Channel buttons are only displayed when the SONET/SDH Module is configured for subrate traffic (Payload set to STS-3c or STS-1 for OC-12, or STS-1 for OC-3).

The image shows a dialog box titled "SONET Setup" with a blue title bar. The dialog is divided into three rows of configuration options, each with a label on the left and a control on the right. The controls are highlighted with a cyan border. On the right side of the dialog are "OK" and "Cancel" buttons.

| Section | Control |
|------------------|---------------------------------------|
| Section Overhead | Pattern: 2^15-1, Drop Channel: 1 |
| Line Overhead | APS: 00,00, Insert Channel: 1 |
| Path Overhead | Clock: Internal, Other Channels: Same |

Drop Channel: Selects which STS-3c (1 to 4, OC-12 only) or STS-1 (1 to 12 for OC-12; 1 to 3 for OC-3) is dropped from the received SONET optical signal.

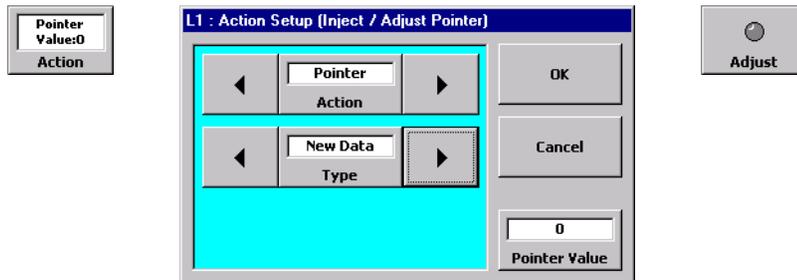
Insert Channel: Selects which STS-3c (1 to 4, OC-12 only) or STS-1 (1 to 12 for OC-12; 1 to 3 for OC-3) is inserted to the transmit SONET optical signal.

Other Channels: Configures what is carried on the remaining STS-3c or STS-1 channels (not selected by Drop or Insert). This can be set to Same (same data as carried on the drop/insert channels), Inverted (binary inversion), PAIS (Path alarm indication signal), or Unequipped.

Pointer Control

The SONET/SDH Module allows you to control the SONET H1/H2 pointers. You can increment, decrement, or cause new data flags on the pointer.

Tapping the Action button calls the Action Setup window.



Pointer adjustments can be made when Action is set to Pointer. When Pointer is selected, the Inject/Adjust button changes to Adjust on the main window.

To select which type of pointer adjustment is made, tap the Type button or use the arrow keys to select one of the following:

Increment: This selection causes the H1/H2 pointer value to increase each time the Adjust button is tapped.

Decrement: This selection causes the H1/H2 pointer value to decrease each time the Adjust button is tapped.

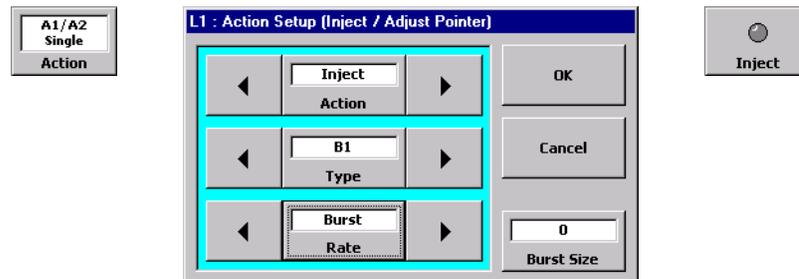
New Data: This selection activates the Pointer Value button (see below). When New Data is selected, the value set by the Pointer Value button is applied to the H1/H2 pointer each time the Adjust button is tapped.

Pointer Value: This button allows you to enter a value for the H1/H2 pointer when Type is set to New Data. Tapping this button calls a data entry keypad on which you can enter a pointer value from 0 to 30E hexadecimal.

Error and Alarm Injection

SONET error and alarm injection is controlled using the Action and Inject/Adjust buttons. You can inject error or alarm conditions on the transmit SONET signal.

Tapping the Action button calls the Action Setup window.



Errors and alarms can be injected when Action is set to Inject. When Inject is selected, the Inject/Adjust button changes to Inject on the main window.

Type: This button selects which type of error or alarm is to be injected. The table on page 3-22 lists the types of errors and alarms available. Tap Type or use the arrow buttons to select the error or alarm to use.

Rate: This button sets the injection speed or number of repetitions for the currently selected error type. (This button is not displayed when Type is set to an alarm.) The Rates are described in the table on page 3-23. Note that different types of errors have different rate available.

SONET Reference

Error and Alarm Injection

| SONET Error and Alarm Injection Types | |
|--|---|
| Error/Alarm Type | Description |
| A1/A2 | Frame word error. Inverts the 16-bit frame word formed by the A1 and A2 bytes. |
| B1 | B1 byte error. Inverts the B1 byte on the SONET transmit signal for one frame. This will affect the parity byte. |
| B2 | B2 byte error. Inverts all B2 bytes on the SONET transmit signal for one frame. This will cause line code violations (24 in OC-3, 96 in OC-12). |
| B3 | B3 byte error. Inverts B3 parity byte for one frame. This causes path code violations. |
| REI-L | Line Remote Event Indication (line FEBE). Generates line REIs using bits 2 through 8 of the M0 or M1 bytes. |
| REI-P | Path Remote Event Indication (path FEBE). Generates path REIs on the G1 byte. |
| Data | Data payload errors. Generates payload bit errors on the Transmit SONET signal. |
| LOS | Loss of Signal alarm. Simulates a loss of signal by transmitting all zeros. |
| OOF | Out of Frame alarm. Simulates an out-of-frame condition. |
| LOF | Loss of Frame synchronization alarm. Simulates a loss of frame by transmitting errored framing patterns. |
| AIS-L | Line Alarm Indication signal. |
| RDI-L | Line Remote Defect Indication. |
| LOP-P | Path Loss of Pattern alarm. |
| AIS-P | Path Alarm Indication Signal. |
| RDI-P | Path Remote Defect Indications. |

SONET Error Injection Rates

| Error Rate | Description |
|-------------------|---|
| Single | Injects one individual occurrence of the selected error type each time the Inject button is tapped. |
| xxCon | Injects xx consecutive occurrences of the selected error type each time the Inject button is tapped. |
| Continuous | Injects errors into every bit or byte of the currently selected type. Continuous injection is toggled on and off using the Inject key. |
| Burst | Injects a single sequence of xx occurrences of the selected error type. The number of errors in a burst is defined by the Burst Size button on the Action Setup window. Tap Burst Size to edit the value. |
| 1E-n | Injects a steady rate of the selected type of error at the defined ratio. 1E-n indicates a ratio of 1×10^{-n} in which 1 out of every 10^n bits are errored. For example, 1E-2 would error 1×10^{-2} bits, or one bit out of every $10^2 = 100$ bits. |

SONET Reference

4

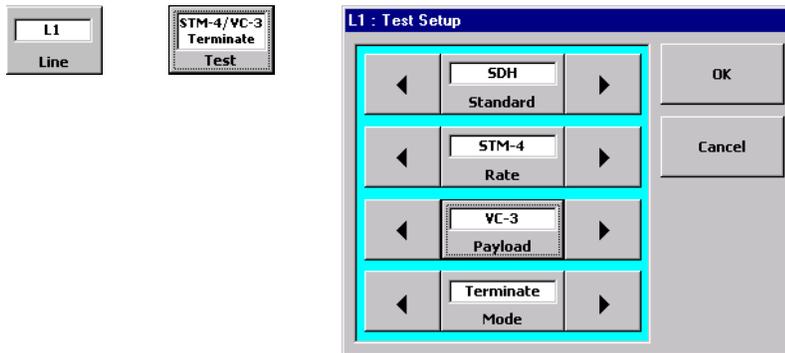
| | |
|------------------------------|------|
| SDH Test Setup | 4-2 |
| Timing Source | 4-4 |
| SDH BER Patterns | 4-5 |
| APS Control | 4-8 |
| Regenerator Section Overhead | 4-12 |
| Multiplex Section Overhead | 4-15 |
| Path Overhead | 4-17 |
| Drop and Insert Control | 4-19 |
| Pointer Control | 4-20 |
| Error and Alarm Injection | 4-21 |

SDH Reference

SDH Test Setup

SDH Test Selection

The SONET/SDH Module can test SDH signals when Standard is set to SDH in the Test Setup window for L1 or L2 (see *Setting Up the Test*, page 2–5).



When Standard is set to SDH, the other parameters on the Test Setup window have the following functions:

Rate: Selects the SDH rate. Tap this button to select STM-4 (622 Mbs), STM-1 (optical 155 Mbs), STM-1e (electrical 155 Mbs), or STM-0e (electrical 51 Mbs). Note that STM-1e and STM-0e are available for the N1676A and N1677A only.

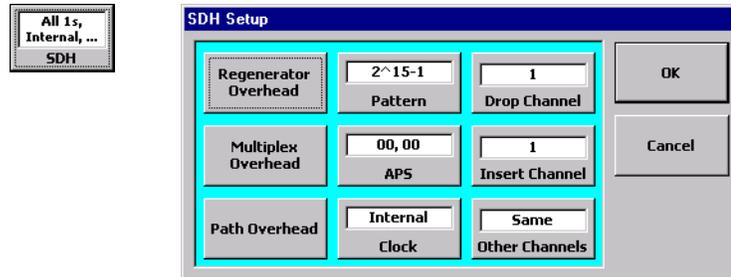
Payload: Selects the SDH payload for the signal. The choices vary depending on your module and the Rate. The following table lists the Payload selections.

| Payload | Description |
|---------|---|
| VC-4-4C | STM-4 signal only: four concatenated (combined) VC-4 virtual containers. Payload bandwidth is 601 Mbs. |
| VC-4 | STM-4 signal: four separate VC-4 virtual containers, or "channels". STM-1 signal: one VC-4. Each VC-4 bandwidth is 150 Mbs |
| VC-3 | STM-4 signal: 12 VC-3 channels. STM-1 signal: three VC-3s. Each VC-3 bandwidth is 49 Mbs. |

Mode: Selects the terminal mode for the module. Tap this button to select Terminate or Monitor.

SDH Setup Window

When Standard is set to SDH, the SDH button is displayed in the Setup/Control area. Tap this button to call the SDH Setup window.



The following table lists the controls found on the SDH Setup window.

| SONET Setup control | More information |
|---------------------------|---|
| Clock | See <i>Timing Source</i> , page 4-4 |
| Pattern | See <i>SDH BER Patterns</i> , page 4-5 |
| APS | See <i>APS Control</i> , page 4-8 |
| Regenerator Overhead | See <i>Regenerator Section Overhead</i> , page 4-12 |
| Multiplex Overhead | See <i>Multiplex Section Overhead</i> , page 4-15 |
| Path Overhead | See <i>Path Overhead</i> , page 4-17 |
| Drop/Insert/Other Channel | See <i>Drop and Insert Control</i> , page 4-19 |

Timing Source

The Clock button in the SDH Setup window configures the source of the transmit timing for the SDH signal.



Tap the Clock button to select of the following timing sources:

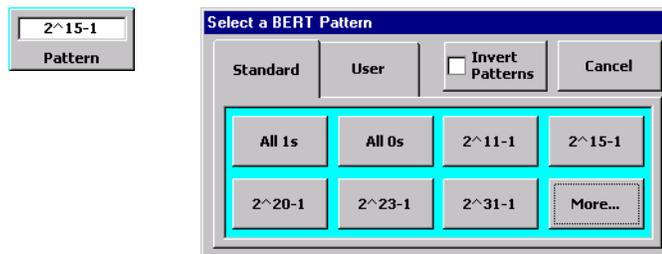
Internal: Timing is from the SONET/SDH Module's built-in oscillator.

Loop: Timing is recovered from the received signal.

BITS: (N1676A and N1677A only) Timing is derived from an external MTS (master timing source) signal. This is a 2.048 MHz signal applied to the module's BITS connector. Impedance for this signal is 120 ohm for the N1676A and N1677A; 75 ohm is available for N1677A.

SDH BER Patterns

The SONET/SDH Module offers a number of choices for the pattern used in SDH BER (bit error ratio) testing. To select a pattern, tap the Pattern button on the SDH Setup window to call the Select Pattern window.



Category Tabs: use the tabs on the Select Pattern window to select the category of pattern you want. Standard (fixed, see page 4–6) and User (user-programmed, see page 4–7) patterns are available.

Pattern Inversion: Tapping the Invert Patterns button inverts all of the test patterns. Inverted patterns are displayed preceded by a slash (“/”).

SDH Reference

SDH BER Patterns

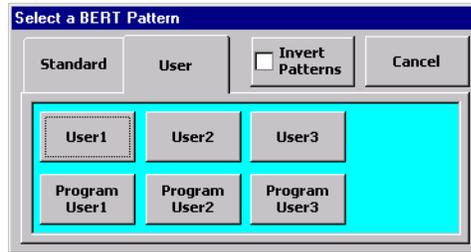
Standard Patterns

The following table describes the standard SDH patterns available. Note that not all of the Standard patterns can be displayed on the same screen. Tap the More button to display additional patterns.

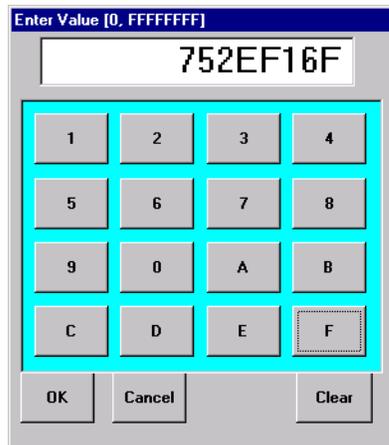
| Pattern | Description |
|------------|---|
| All 1s | An all-ones (binary 1111...) pattern. |
| All 0s | An all-zeros (binary 0000...) pattern. |
| $2^{11}-1$ | A $2^{11}-1$ pseudorandom bit sequence (PRBS). |
| $2^{15}-1$ | A $2^{15}-1$ PRBS. |
| $2^{20}-1$ | A $2^{20}-1$ PRBS. |
| $2^{23}-1$ | A $2^{23}-1$ PRBS. |
| $2^{31}-1$ | A $2^{31}-1$ PRBS. |
| Live | No pattern. The received payload is retransmitted on the outgoing signal. |
| RTD | Round-trip delay test pattern. This is a special pattern that allows you to measure how long it takes data to leave the SONET/SDH Module transmitter and return to the receiver. See <i>Performing a Round-Trip Delay Test</i> , page 2–15. |

User-Programmable Patterns

Selecting the User tab on the Select Pattern window displays the User Pattern category.



Tap a User button to select that pattern. To view or edit a user pattern, tap the corresponding Program User button. This calls the Edit User Pattern window.



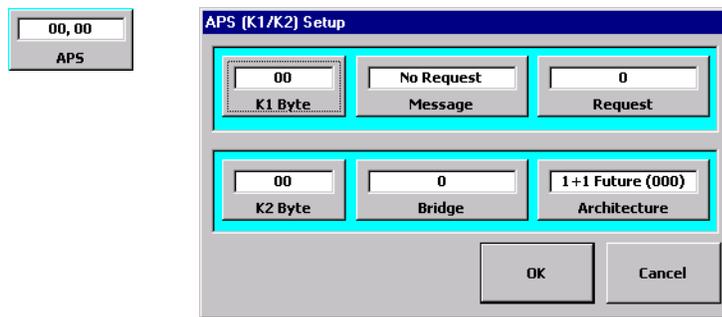
Use the buttons on the Edit Pattern keypad to configure the pattern the way you want. The SDH user patterns are entered in hexadecimal notation from 0 through FFFFFFFF. The binary equivalent of this pattern will be transmitted as the pattern. If you do not enter eight digits, leading zeros will be added (though not displayed).

Note: After you have programmed a user pattern, be sure to tap the appropriate button on the Select Pattern window to select it for use in your test.

APS Control

The SONET/SDH Module allows you to control the automatic protection switching (APS) channel of the SDH signal. The APS channel comprises the K1 and K2 bytes of the SDH overhead.

Tap the APS button on the SDH Setup window to call the APS Setup screen.



K1 Byte: This button displays the current value of the K1 overhead byte in hexadecimal notation. Bits 1 through 4 of the K1 byte (represented by the first digit of the K1 Byte button) define the APS message. Bits 5 through 8 of K1 (represented by the second digit) define the APS requested channel.

Tapping this button calls a window that allows you to directly enter the value for the K1 byte. The K1 byte value is also controlled by the Message and Request buttons.

K2 Byte: This button displays the current value of the K2 overhead byte in hexadecimal notation. Bits 1 through 4 of the K2 byte (represented by the first digit of the K2 Byte button) define the bridge channel. Bit 5 sets the architecture and bits 6 through 8 define the APS mode. These bits are represented by the second digit of the K2 Byte button.

Tapping this button calls a window that allows you to directly enter the value for the K2 byte. The K2 byte value is also controlled by the Bridge and Architecture buttons.

APS Message

The Message button displays the text of the currently selected APS message. The message is carried in the first four bits of K1. Tapping the Message button cycles through the APS messages. The following table lists the APS messages.

| APS Messages | | |
|---------------------|---|---------------------|
| APS Message | K1 Byte Display (first digit, hex) | Bit Sequence |
| No Request | 0x | 0000 |
| Do Not Revert | 1x | 0001 |
| Reverse Request | 2x | 0010 |
| Not Used | 3x | 0011 |
| Exercise | 4x | 0110 |
| Not Used | 5x | 0101 |
| Wait-to-Restore | 6x | 0110 |
| Not Used | 7x | 0111 |
| Manual Switch | 8x | 1000 |
| Not Used | 9x | 1001 |
| SD-Low Priority | Ax | 1010 |
| SD-High Priority | Bx | 1011 |
| SF-Low Priority | Cx | 1100 |
| SF-High Priority | Dx | 1101 |
| Forced Switch | Ex | 1110 |
| Lockout Protect | Fx | 1111 |

Requested Channel

The Request button displays the current requested channel to which the APS message applies. The binary value of the channel number (0–15 = 0000–1111) is sent in bits 5–8 of K1. This is shown in the second digit of the K1 Byte button in hexadecimal. Tapping the Request button calls a window in which you can enter the channel number. This value is also controlled by the K1 Byte button.

Bridge Channel

The Bridge button displays the current APS bridge channel. The binary equivalent of the channel number (0–15 = 0000–1111) is transmitted in bits 1–4 of K2. This value is shown in the first digit of the K2 Byte button in hexadecimal. Tapping the Bridge button calls a window in which you can enter the channel number. This value is also controlled by the K2 Byte button.

APS Mode and Architecture

The Architecture button displays the APS architecture and mode. Tapping this button cycles through the available selections.

The APS architecture is determined by bit 5 of the K2 byte. When bit 5 is set to 0, the architecture is 1+1. When bit 5 is set to 1, the architecture is 1:n.

The APS mode is determined by bits 6 through 8 of the K2 byte.

The following table lists the APS architecture and mode settings available through the Architecture button.

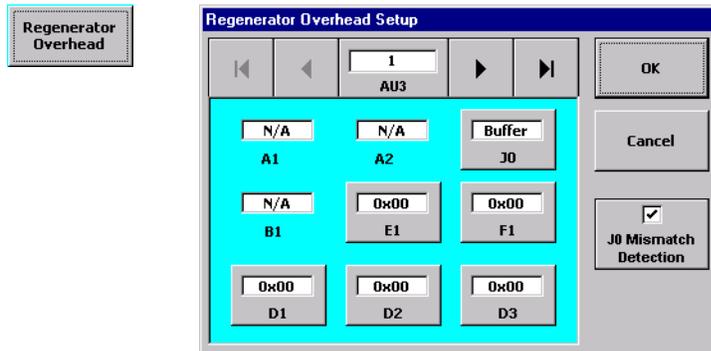
| SDH APS Architecture & Mode Settings | | | | |
|---|-----------------------------------|----------|----------|----------|
| Architecture button setting | K2 byte bits (5 through 8) | | | |
| | 5 | 6 | 7 | 8 |
| 1+1 Future (000) | 0 | 0 | 0 | 0 |
| 1+1 Future (001) | 0 | 0 | 0 | 1 |
| 1+1 Future (010) | 0 | 0 | 1 | 0 |
| 1+1 Future (011) | 0 | 0 | 1 | 1 |
| 1+1 Unidirection | 0 | 1 | 0 | 0 |

SDH APS Architecture & Mode Settings, continued

| Architecture button setting | K2 byte bits (5 through 8) | | | |
|-----------------------------|----------------------------|---|---|---|
| | 5 | 6 | 7 | 8 |
| 1+1 Bidirection | 0 | 1 | 0 | 1 |
| 1+1 RDI-L (LFEF) | 0 | 1 | 1 | 0 |
| 1+1 AIS-L (LAIS) | 0 | 1 | 1 | 1 |
| 1:n Future (000) | 1 | 0 | 0 | 0 |
| 1:n Future (001) | 1 | 0 | 0 | 1 |
| 1:n Future (010) | 1 | 0 | 1 | 0 |
| 1:n Future (011) | 1 | 0 | 1 | 1 |
| 1:n Unidirection | 1 | 1 | 0 | 0 |
| 1:n Bidirection | 1 | 1 | 0 | 1 |
| 1:n RDI-MS | 1 | 1 | 1 | 0 |
| 1:n AIS-MS | 1 | 1 | 1 | 1 |

Regenerator Section Overhead

The SONET/SDH Module allows you to control the SDH Regenerator Section overhead bytes. To edit the values of these bytes, tap the Regenerator Overhead button on the SDH Setup window.



The Regenerator Section Overhead Setup window displays the currently selected AU3 frame and the Regenerator Section overhead bytes associated with that frame.

AU3 button: This button allows you to select the administrative unit (AU3) frame you want to view. The currently select frame is shown on the button. Tap the button or the arrow keys to select an AU3 frame. The associated bytes for the selected AU3 are shown in the lower part of the window.

Byte buttons: The byte buttons (E1, D2, and so on) display the current value of each byte. To edit a byte's value, tap the button and enter the new value in the data entry window.

Note: The J0 byte has a more extensive editing window than the other bytes. See *Editing the J0 (Trail Trace) and J1 (Path Trace) Bytes*, page 4–14.

Other bytes: The values of Regenerator Section overhead bytes that are not editable (for example A1 and A2) are displayed on the window as well.

J0 Mismatch button: This button enables and disables the J0 buffer alarm on the SDH Regenerator Section overhead results screen. See *SDH Regenerator Section Overhead Results Screen*, page 5–14.

The following table describes the Regenerator Section overhead bytes.

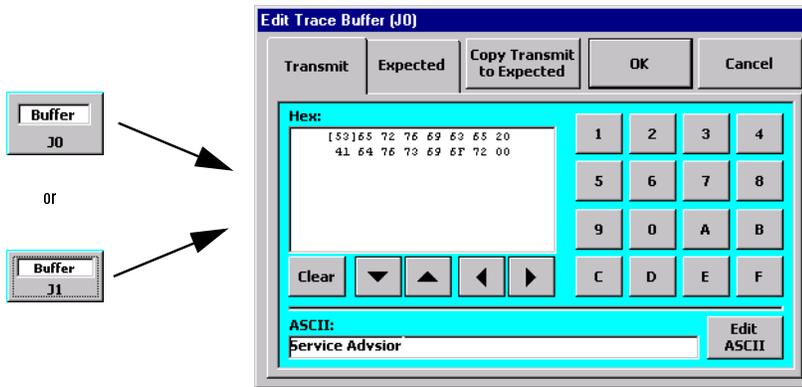
SDH Regenerator Section Overhead Bytes

| Byte | Description |
|-------------|---|
| A1/A2 | Framing. Pattern = 11110110 00101000 (F6 28 hex). Not editable |
| J0 | (AU3-1 #1 only) Regenerator Section trace. See <i>Editing the J0 (Trail Trace) and J1 (Path Trace) Bytes</i> , page 4–14. |
| B1 | Regenerator Section bit-interleaved parity (BIP-8) code. Not editable. |
| E1 | Local orderwire channel. |
| F1 | Regenerator Section user channel. |
| D1–D3 | Regenerator Section data communication channel (DCC). |
| Z0 | (AU3-1 #2 and higher only) Growth byte (formerly C1). |

Regenerator Section Overhead**Editing the J0 (Trail Trace) and J1 (Path Trace) Bytes**

The SONET/SDH Module allows you to program each byte of the 16-byte STM Trail Trace string (J0) and 64-byte Path Trace string (J1) byte. Each byte of the string is transmitted in the appropriate bytes of 16 (J0) or 64 (J1) consecutive frames.

When you tap the J0 byte button (on the Regenerator Overhead Setup screen) or J1 byte button (on the Path Overhead Setup Screen), the Edit Trace Buffer window is displayed. The J0 window is shown here.



Transmit and Expected tabs: These two tabs are similar. The Transmit tab allows you to program the trace string that is transmitted on the output SDH signal. The Expected tab allows you to program the string that the SONET/SDH module uses to compare with the received string on the input SDH signal.

Copy Transmit to Expected: This button allows you to easily copy the values set on the Transmit tab to the Expected tab.

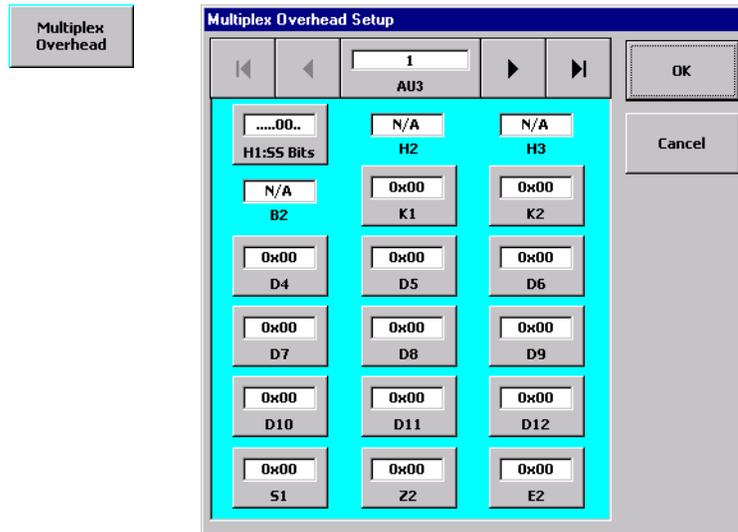
Note: The SONET/SDH Modules use the trace string programmed into the Expected tab to compare with the received J0 or J1 traces. A mismatch will be reported if J0/J1 Mismatch is checked (on). See *J0 Mismatch button*, page 4-12.

Hex display: The Hex display area shows the value of the trace bytes in hexadecimal notation. You can edit these values using the arrow keys to select a byte, and the number/letter keypad to set their values. Changes you make in this display are also reflected in the ASCII display area.

ASCII display: The ASCII display area shows the value of the trace bytes as ASCII text. You can edit the ASCII string by tapping the Edit ASCII button and then using the keyboard to type the string you want. Changes you make in this display are also reflected in the Hex display area.

Multiplex Section Overhead

The SONET/SDH Module allows you to control the SDH multiplex section overhead bytes. To edit the values of these bytes, tap the Multiplex Overhead button on the SDH Setup window.



The Multiplex Overhead Setup window displays the currently selected AU3 frame and the multiplex section overhead bytes associated with that frame.

AU3 button: This button allows you to select the administrative unit (AU3) frame you want to view. The currently select frame is shown on the button. Tap the button or the arrow keys to select an AU3 frame. The associated multiplex section bytes for the selected AU3 are shown in the lower part of the window.

Byte buttons: The byte buttons (H1:SS, K1, D4, and so on) display the current value of each byte. To edit a byte's value, tap the button and enter the new value in the data entry window.

Other bytes: The values of multiplex section overhead bytes that are not editable (for example H1 and H2) are displayed on the window as well.

The following table describes the multiplex section overhead bytes.

SDH Reference

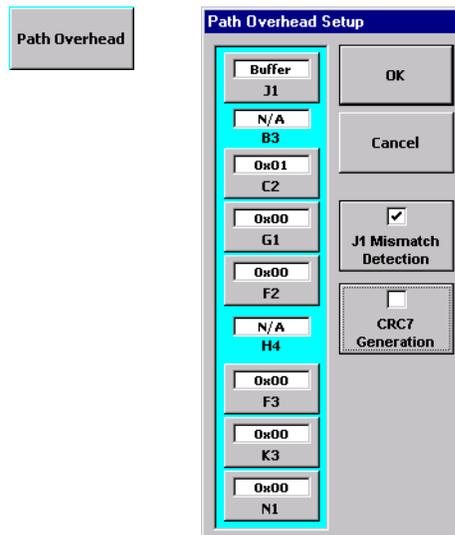
Multiplex Section Overhead

SDH Multiplex Section Overhead Bytes

| Byte | Description |
|-------------|---|
| H1:SS Bits | Payload offset bits. These are bits 5 and 6 of the H1 byte. |
| H2–H3 | Payload pointers. Not editable on this screen. |
| B2 | Multiplex section bit-interleaved parity (BIP-24) code. Not editable. |
| K1/K2 | Automatic protection switching (APS) channel, also MS-AIS and MS-RDI indication. |
| D4–D12 | Multiplex section data communication channel (DCC). |
| S1/Z1 | S1 (AU3-1 #1) = Synchronization status. Z1 = Growth. |
| M1/Z2 | M1 (AU3 #3 of STM-N \geq 3 signals) = Remote error indication. Z2 (other AU3s) = Growth. |
| E2 | Express orderwire channel. |

Path Overhead

The SONET/SDH Module allows you to control the SDH Path overhead bytes. To edit the values of these bytes, tap the Path Overhead button on the SDH Setup window.



Byte buttons: The byte buttons (C2, G1, and so on) display the current value of each byte. To edit a byte's value, tap the button and enter the new value in the data entry window.

Note: The J1 byte has a more extensive editing window than the other bytes. See *Editing the J0 (Trail Trace) and J1 (Path Trace) Bytes*, page 4–14.

Other bytes: The values of path overhead bytes that are not editable (for example B3 and H4) are displayed on the window as well.

J1 Mismatch button: This button enables and disables the J1 buffer alarm on the SDH Path overhead results screen. See *SONET and SDH Path Results Screen*, page 5–16.

CRC7 Generation button: This button toggles the generation of the CRC-7 (cyclic redundancy checksum) for the J1 buffer.

The following table describes the path overhead bytes.

SDH Reference

Path Overhead

SDH Path Overhead Bytes

| Byte | Description |
|-------------|---|
| J1 | Path trace. See <i>Editing the J0 (Trail Trace) and J1 (Path Trace) Bytes</i> , page 4–14. This is a 16 byte buffer. When CRC-7 Generation is enabled (see page 4–17) one byte is used for the CRC-7 and the J1 trace is 15 bytes. |
| B3 | Path bit-interleaved parity (BIP-8) code. Not editable. |
| C2 | Path signal label. |
| G1 | Path status. Bits 1–4 = path REI; bit 5 = path RDI; bits 6–7 = reserved; bit 8 = spare. |
| F2 | Path user channel. |
| H4 | TU (tributary unit) multiframe phase indicator. Not editable. |
| F3 | Path user channel. |
| K3 | Future growth. |
| N1 | Tandem connection error count and data link. |

Drop and Insert Control

When the SDH signal is carrying subrate traffic (for example STM-4 carrying VC-4 or VC-3 channels), use the Drop Channel and Insert Channel buttons to control which subrate channels are demultiplexed and multiplexed to and from the SDH signal.

The Drop Channel, Insert Channel, and Other Channel buttons are only displayed when the SONET/SDH Module is configured for subrate traffic (Payload set to VC-4-4C, VC-4, or VC-3 for STM-4; or VC-4 or VC-3 for STM-1).

The image shows a dialog box titled "SONET Setup" with a blue title bar. The dialog is divided into three rows of configuration options, each with a label on the left and a control on the right. The controls are highlighted with a cyan border. On the far right, there are "OK" and "Cancel" buttons.

| Section | Control |
|------------------|---------------------------------------|
| Section Overhead | Pattern: 2^15-1, Drop Channel: 1 |
| Line Overhead | APS: 00, 00, Insert Channel: 1 |
| Path Overhead | Clock: Internal, Other Channels: Same |

Drop Channel: Selects which VC-4 (1 to 4, STM-4 only) or VC-3 (1 to 12 for STM-4; 1 to 3 for STM-1) is dropped from the received SDH optical signal.

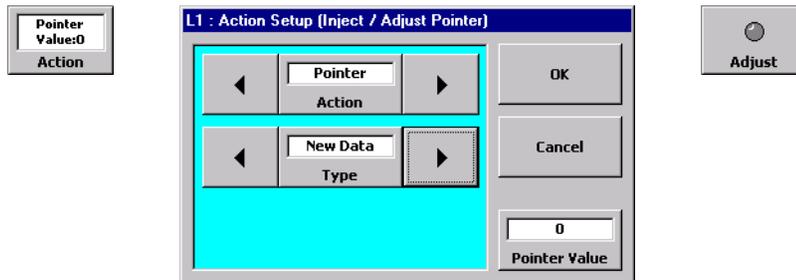
Insert Channel: Selects which VC-4 (1 to 4, STM-4 only) or VC-3 (1 to 12 for STM-4; 1 to 3 for STM-1) is inserted to the transmit SDH optical signal.

Other Channels: Configures what is carried on the remaining VC-4 or VC-3 channels (not selected by Drop or Insert). This can be set to Same (same data as carried on the drop/insert channels), Inverted (binary inversion), PAIS (Path alarm indication signal), or Unequipped.

Pointer Control

The SONET/SDH Module allows you to control the SDH H1/H2 pointers. You can increment, decrement, or cause new data flags on the pointer.

Tapping the Action button calls the Action Setup window.



Pointer adjustments can be made when Action is set to Pointer. When Pointer is selected, the Inject/Adjust button changes to Adjust on the main window.

To select which type of pointer adjustment is made, tap the Type button or use the arrow keys to select one of the following:

Increment: This selection causes the H1/H2 pointer value to increase each time the Adjust button is tapped.

Decrement: This selection causes the H1/H2 pointer value to decrease each time the Adjust button is tapped.

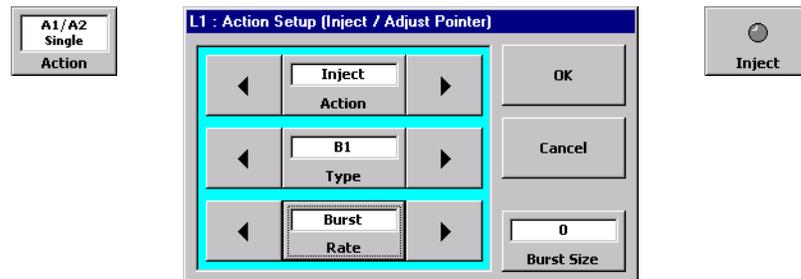
New Data: This selection activates the Pointer Value button (see below). When New Data is selected, the value set by the Pointer Value button is applied to the H1/H2 pointer each time the Adjust button is tapped.

Pointer Value: This button allows you to enter a value for the H1/H2 pointer when Type is set to New Data. Tapping this button calls a data entry keypad on which you can enter a pointer value from 0 to 30E hexadecimal.

Error and Alarm Injection

SDH error and alarm injection is controlled using the Action and Inject/Adjust buttons. You can inject error or alarm conditions on the transmit SDH signal.

Tapping the Action button calls the Action Setup window.



Errors and alarms can be injected when Action is set to Inject. When Inject is selected, the Inject/Adjust button changes to Inject on the main window.

Type: This button selects which type of error or alarm is to be injected. The table on page 4–22 lists the types of errors and alarms available. Tap Type or use the arrow buttons to select the error or alarm to use.

Rate: This button sets the injection speed or number of repetitions for the currently selected error type. (This button is not displayed when Type is set to an alarm.) The Rates are described in the table on page 4–23. Note that different types of errors have different rates available.

SDH Reference

Error and Alarm Injection

| SDH Error and Alarm Injection Types | |
|--|---|
| Error/Alarm Type | Description |
| A1/A2 | Frame word error. Inverts the 16-bit frame word formed by the A1 and A2 bytes. |
| B1 | B1 byte error. Inverts the B1 byte on the SDH transmit signal for one frame. This will affect the parity byte. |
| B2 | B2 byte error. Inverts all B2 bytes on the SDH transmit signal for one frame. This will cause line code violations. |
| B3 | B3 byte error. Inverts B3 parity byte for one frame. This causes path code violations. |
| MS-REI | Multiplex Section Remote Event Indication. Generates multiplex REIs using bits 2 through 8 of the M1 bytes. |
| HP-REI | Higher-order Path Remote Event Indication. Generates REIs on the G1 byte. |
| Data | Data payload errors. Generates payload bit errors on the transmit SDH signal. |
| LOS | Loss of Signal alarm. Simulates a loss of signal by transmitting all zeros. |
| OOF | Out of Frame alarm. Simulates an out-of-frame condition. |
| LOF | Loss of Frame synchronization alarm. Simulates a loss of frame by transmitting errored framing patterns. |
| MS-AIS | Multiplex Section Alarm Indication signal. |
| MS-RDI | Multiplex Section Remote Defect Indication. |
| AU-LOP | Administrative unit Loss of Pattern alarm. |
| AU-AIS | Administrative unit Alarm Indication Signal. |
| HP-RDI | Higher-order Path Remote Defect Indications. |

SDH Error Injection Rates

| Error Rate | Description |
|-------------------|---|
| Single | Injects one individual occurrence of the selected error type each time the Inject button is tapped. |
| xxCon | Injects xx consecutive occurrences of the selected error type each time the Inject button is tapped. |
| Continuous | Injects errors into every bit or byte of the currently selected type. Continuous injection is toggled on and off using the Inject key. |
| Burst | Injects a single sequence of xx occurrences of the selected error type. The number of errors in a burst is defined by the Burst Size button on the Action Setup window. Tap Burst Size to edit the value. |
| 1E-n | Injects a steady rate of the selected type of error at the defined ratio. 1E-n indicates a ratio of 1×10^{-n} in which 1 out of every 10^n bits are errored. For example, 1E-2 would error 1×10^{-2} bits, or one bit out of every $10^2 = 100$ bits. |

SDH Reference

5

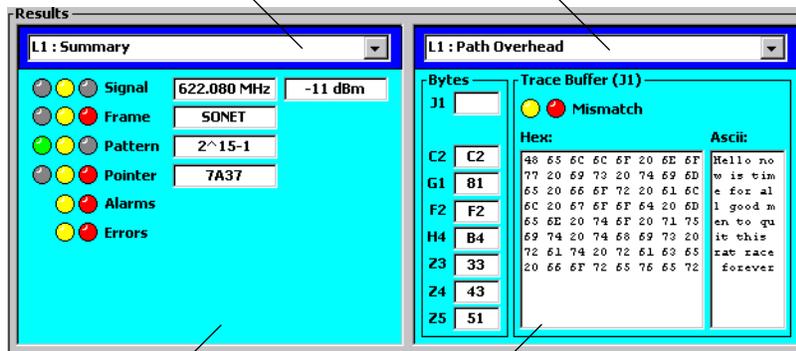
| | |
|---|------|
| Results Display | 5-2 |
| Results Selection Window | 5-3 |
| Summary Results Screen | 5-5 |
| Alarms Results Screen | 5-6 |
| Errors Results Screen | 5-8 |
| Pointer Results Screen | 5-10 |
| APS Results Screen | 5-11 |
| SONET Section Overhead Results Screen | 5-12 |
| SONET Line Overhead Results Screen | 5-13 |
| SDH Regenerator Section Overhead Results Screen | 5-14 |
| SDH Multiplex Section Overhead Results Screen | 5-15 |
| SONET and SDH Path Results Screen | 5-16 |

Results Reference

Results Display

The SONET/SDH Module displays test results on two side-by-side panes in the results area of the main window. Each result pane can be configured separately, allowing for flexible display of results.

Results selectors



Display areas

Results Selector

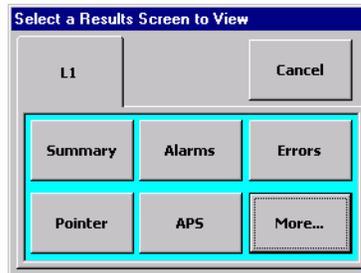
The results selector on each pane allows you to choose which measurements are displayed in that pane. Tapping a selector calls the Results Selection window (see *Results Selection Window*, page 5-3).

Display Area

The display area of each results pane shows the measurement data you have selected. The display areas change based on the selected results. Because each pane is independent, you have a lot of flexibility in selecting what is displayed. For example, you can view results from each line (L1 and L2; N1676A and N1677A only) side-by-side to compare them. You can also view error results in one pane, and view path overhead byte results in the other pane simultaneously.

Results Selection Window

Tapping a results selector calls the Results Selection window for that pane.



The tabs and buttons on the Results Selection window allow you to configure what is displayed on the results pane.

L1 and L2 tabs: The tabs select which line the displayed measurements are from. Only the L1 tab is available for the N1675A module. On the N1676A and N1677A, the L2 tab allows you to select results on the second electrical receiver.

Results buttons: The buttons on the L1 and L2 tabs allow you to select the results you want to view. Tap a button to have those results shown in the results pane. Tap the More button to view additional choices.

The following table briefly describes each Results buttons.

| Results Selection Buttons | | | |
|----------------------------------|-----------------|--|--------------------|
| Result button | Standard | Description | See also... |
| Summary | SONET and SDH | General summary results | page 5-5 |
| Alarms | SONET and SDH | Alarms results | page 5-6 |
| Errors | SONET and SDH | Bit and pattern errors | page 5-8 |
| Pointer | SONET and SDH | Pointer status results | page 5-10 |
| APS | SONET and SDH | Automatic protection switching status and messages | page 5-11 |

Results Reference

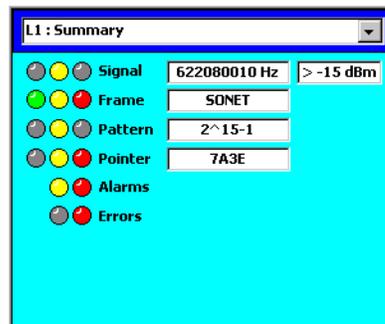
Results Selection Window

Results Selection Buttons, continued

| Result button | Standard | Description | See also... |
|----------------------|-----------------|---|--------------------|
| Section Overhead | SONET only | Section overhead byte status and values | page 5–12 |
| Line Overhead | SONET only | Line overhead byte status and values | page 5–13 |
| Regenerator Overhead | SDH only | Regenerator section overhead byte status and values | page 5–14 |
| Multiplex Overhead | SDH only | Multiplex section overhead byte status and values | page 5–15 |
| Path | SONET and SDH | Path overhead byte status and values | page 5–16 |
| Event Log | SONET and SDH | Log of detected test events | page 5–17 |

Summary Results Screen

The Summary results screen is available for SONET and SDH. This screen displays general signal information.



Signal: The results boxes show the input signal frequency and the signal level. The indicators denote a valid signal (green), loss of signal (red; see *LOS*, page 5–6), and previous occurrence of LOS (yellow).

Frame: The results box displays the input signal framing standard: either SONET or SDH. The indicators denote valid framing (green), loss of frame (red; see *LOF*, page 5–6), and previous occurrence of loss of frame.

Pattern: The results box displays the transmit payload pattern. The indicators denote receive signal pattern synchronization (green), loss of pattern (red; see *LOP*, page 5–6), and previous occurrence of loss of pattern (yellow). Note that this result is not displayed when Pattern is set to RTD (see below).

RTD: This result is the *round trip delay*; the amount of time it takes the transmit signal to travel from the transmitter, through the system under test, and back to the receiver. RTD is only displayed when Pattern is set to RTD. See *Performing a Round-Trip Delay Test*, page 2–15.

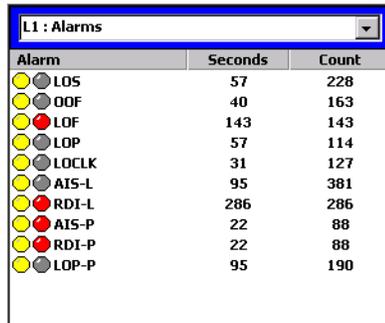
Pointer: The results box displays the value of the received H1/H2 pointer. The indicators denote a valid pointer (green), invalid pointer (red), and previous occurrence of an invalid pointer (yellow). See *Pointer Results Screen*, page 5–10.

Alarms: These indicators show if an alarm has been detected. See *Alarms Results Screen*, page 5–6.

Errors: These indicators show if one or more errors have been detected. Red indicates an error is currently present; yellow indicate the past occurrence of an error. See *Errors Results Screen*, page 5–8.

Alarms Results Screen

The alarms results screen displays the status of alarm conditions for the selected line. It is available for all tests.



| Alarm | Seconds | Count |
|-------|---------|-------|
| LOS | 57 | 228 |
| OOF | 40 | 163 |
| LOF | 143 | 143 |
| LOP | 57 | 114 |
| LOCLK | 31 | 127 |
| AIS-L | 95 | 381 |
| RDI-L | 286 | 286 |
| AIS-P | 22 | 88 |
| RDI-P | 22 | 88 |
| LOP-P | 95 | 190 |

Seconds and Count: The Seconds field displays the number of one-second periods during which one or more of the indicated alarms occurred. The Count field shows the total number of alarm occurrences.

Indicators: The right indicators show red when the indicated alarm condition is currently occurring. The left indicators show yellow to indicate the previous occurrence of the alarm.

Alarms: The following table describes the alarms.

SONET/SDH Alarms

| Alarm | Description |
|-------|---|
| LOS | Loss of signal. This alarm is declared when between 10 to 100 microseconds of all zeros are detected. |
| OOF | Out of frame. This alarm is declared when consecutive invalid framing words (A1/A2 bytes) are detected. |
| LOF | Loss of frame. This condition is declared when an OOF condition is present for 24 consecutive frames. |
| LOP | Loss of pattern. This alarm is declared when the pattern error ratio is 25% or higher. |

SONET/SDH Alarms, continued

| Alarm | Description |
|-----------------|---|
| LOCLK | Loss of clock. This alarm is declared when the external timing source is no longer detected (when Clock is set to Loop, XREF). |
| AIS-L MS-AIS | Line (SONET) or multiplex section (SDH) alarm indication signal. This condition is declared when five consecutive K2 bytes are received containing xxxxx111 (all-ones in bits 6–8). |
| RDI-L MS-RDI | Line (SONET) or multiplex section (SDH) remote defect indication. This condition is declared when five consecutive K2 bytes are received containing xxxxx110. |
| AIS-P | Path alarm indication signal. This alarm is declared when all-ones is received in H1/H2 for three consecutive frames. |
| RDI-P | Path remote defect indication. This alarm is declared when 10 consecutive frames are received with bit 5 of the G1 byte set to 1. |
| LOP-P | Path loss of pointer. This condition is declared when eight consecutive frames are received that do not have a valid pointer value (normal flag/value or new data flag). |

Errors Results Screen

The Errors results screen shows various error measurements for the receive signal of the selected line.

| | BIT | A1/A2 | B1 | B2 |
|--------|--------|--------|--------|--------|
| Count | 3.42e9 | 3.42e9 | 3.30e9 | 5.84e6 |
| Rate | 1.1e-2 | 0.0 | 1.0e-2 | 1.8e-5 |
| Avg Rt | 1.1e-2 | 0.0 | 1.0e-2 | 1.8e-5 |
| EF5 | 0 | 47 | 0 | 47 |
| ES | 524 | 477 | 524 | 477 |
| SES | 0 | 524 | 0 | 524 |
| CSES | 0 | 7 | 0 | 7 |
| UAS | 0 | 47 | 0 | 47 |

Navigation buttons: Left arrow, Right arrow, % Stats (checkbox), Left arrow, Right arrow.

The types of errors are displayed across the top of the pane. The measurements are listed down the side of the pane. To scroll through the error types, use the arrow buttons. You can display the results as a percentage by tapping the % Stats button.

For each *type* of error, various *measurements* are available. The following two tables describe the error types and error measurements.

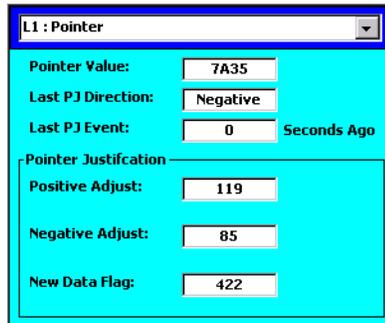
SONET/SDH Error Definitions

| Error Type | Description |
|-----------------|--|
| Bit | Pattern bit errors: These are errors detected in the payload test (BERT) pattern. |
| A1/A2 | Frame bit errors: These are errors in the framing word of the A1 and A2 bytes. |
| B1 | B1 byte bit error: These are Section or Regenerator parity (BIP-8) bit errors. |
| B2 | B2 byte bit error: These are Line or Multiplex Section parity (BIP-24) bit errors. |
| B3 | B3 byte bit error: These are Path parity (BIP-8) bit errors. |
| REI-P | Path remote error indication: These are block code violations reported by the far end using bits 1 through 4 of the G1 byte. Formerly called "FEBE". |
| REI-L MS-REI | Line (SONET) or multiplex section (SDH) remote error indication: These are REIs reported by the far end using bits 2 through 8 of the M1 byte. Formerly called "FEBE". |

| SONET/SDH Error Measurements | |
|-------------------------------------|--|
| Measurement | Description |
| Count | The total number of errors since the beginning of the test. |
| Rate | The ratio of errored bits to the total number of bits transmitted during the previous one second. |
| Avg Rate | Average ratio: The ratio of errored bits to the number of bits transmitted since the beginning of the test. |
| EFS EFS% | Error-free seconds: The number of seconds during which no errors occurred. Also, percent error-free seconds: The percentage of all seconds that were error-free. |
| ES %ES | Errored seconds: The number of seconds during which at least one error occurred. Also, percent errored seconds: The percentage of all seconds that were errored. |
| SES %SES | Severely errored seconds: The number of seconds in which the error ratio exceeded 10^{-3} . Also, percent severely errored seconds. The percentage of all seconds that were SESs. |
| CSES CSES% | Consecutively errored seconds: The number of severely errored seconds (SESs) for which the previous two seconds were also SESs. This count is reset during LOS, LOF, and LOP. |
| UAS UAS% | Unavailable seconds: The number of seconds during which the signal was unavailable. The signal is declared unavailable after ten seconds of SES or LOP. The signal is declared available again after ten consecutive seconds with no SESs or LOPs. |

Pointer Results Screen

The Pointer results screen displays measurements and status of the SONET or SDH pointer based on the received H1/H2 bytes.



The screenshot shows a window titled "L1 : Pointer". It contains several fields with their respective values:

| | | |
|-----------------------|----------|-------------|
| Pointer Value: | 7A35 | |
| Last PJ Direction: | Negative | |
| Last PJ Event: | 0 | Seconds Ago |
| Pointer Justification | | |
| Positive Adjust: | 119 | |
| Negative Adjust: | 85 | |
| New Data Flag: | 422 | |

Pointer Value: This results box displays the currently received value of the H1 and H2 bytes in hexadecimal.

Last PJ Direction: This results box displays the direction of the most recent pointer justification (either Negative or Positive).

Last PJ Event: This results box displays the amount of time since the last pointer justification occurred (in seconds).

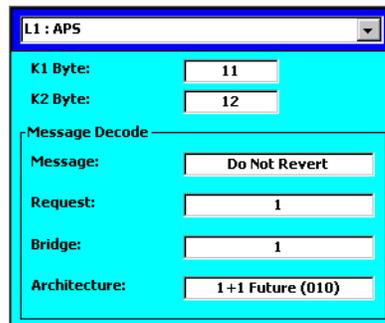
Positive Adjust: This results box displays the number of positive pointer justifications that have occurred.

Negative Adjust: This results box displays the number of negative pointer justifications that have occurred.

New Data Flag: This results box displays the number of new data flag events that have occurred.

APS Results Screen

The APS results screen displays the value and messages of the received automatic protection switching bytes (K1 and K2).



The screenshot shows a software interface for APS results. At the top, there is a dropdown menu labeled 'L1 : APS'. Below it, there are two input fields: 'K1 Byte:' with the value '11' and 'K2 Byte:' with the value '12'. A section titled 'Message Decode' contains five more input fields: 'Message:' with 'Do Not Revert', 'Request:' with '1', 'Bridge:' with '1', and 'Architecture:' with '1+1 Future (010)'. The entire interface is set against a light blue background.

K1 Byte: This results box displays the value of the K1 byte in hexadecimal.

K2 Byte: This results box displays the value of the K2 byte in hexadecimal.

Message: This result box displays the APS request message, based on bits 1 through 4 of the K1 byte.

Request: This results box displays the number of the channel to which the message applies. This code is received on bits 5 through 8 of the K1 byte.

Bridge: This results box displays the number of the channel currently bridged onto the protection line at the far end. This code is received on bits 1 through 4 of the K2 byte.

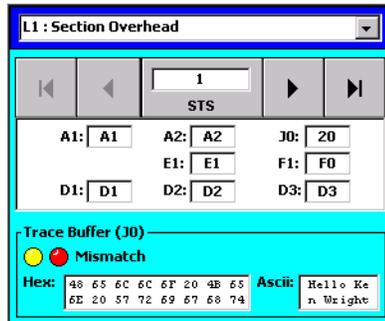
Architecture: This results box displays the APS architecture used at the far end. This code is received on bit 5 of K2.

For additional information APS, see *APS Control*, page 3–8 (SONET) or *APS Control*, page 4–8 (SDH).

SONET Section Overhead Results Screen

SONET Section Overhead Results Screen

The Section Overhead results screen displays the current values of the SONET Section overhead bytes. It also displays the received J0 trace buffer.



STS button: This button displays the number of the currently selected STS-1 frame. Tap this button or use the arrows to select the STS frame to display.

Byte values: The results boxes display the received values of the overhead bytes in hexadecimal. The table below describes the bytes.

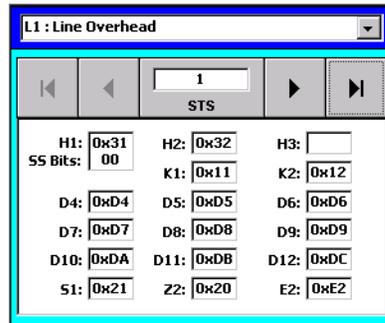
Trace Buffer (J0) area: This area of the results screen displays the received J0 trace in both hexadecimal and ASCII. The Mismatch indicators show whether the received trace buffer matches the expected value (see *Transmit and Expected tabs*, page 3–14).

SONET Section Overhead Bytes

| Byte | Description |
|-------|---|
| A1/A2 | Framing. |
| J0 | Section trace. |
| E1 | Local orderwire channel. |
| F1 | Section user channel. |
| D1–D3 | Section data communication channel (DCC). |
| Z0 | (STS-1 #2 and higher only) Growth byte. |

SONET Line Overhead Results Screen

The Line Overhead results screen displays the current values of the SONET Line overhead bytes.



STS button: This button displays the number of the currently selected STS-1 frame. Tap this button or use the arrows to select the STS frame to display.

Byte values: The results boxes display the received values of the overhead bytes in hexadecimal. The table below describes the bytes.

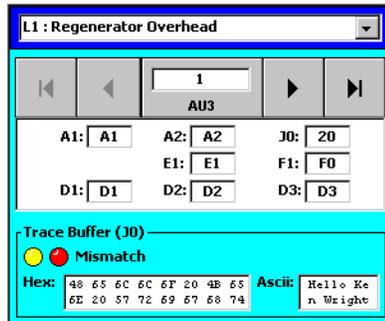
SONET Line Overhead Bytes

| Byte | Description |
|----------------|---|
| H1 and SS Bits | H1 payload pointer byte and SS bits (payload offset). |
| H2–H3 | Payload pointers. |
| K1/K2 | Automatic protection switching (APS) channel. |
| D4–D12 | Line data communication channel (DCC). |
| S1/Z1 | S1 (STS-1 #1) = Synchronization status. Z1 = Growth. |
| M0 | M0 (STS-1/OC-1 signals only): bits 5–8 = Line FEBE |
| M1 | M1 (STS-1 #3 of STS-N≥3 signals) = Line FEBE. |
| Z2 | Z2 (other STS-1s) = Growth. |
| E2 | Express orderwire channel. |

SDH Regenerator Section Overhead Results Screen

SDH Regenerator Section Overhead Results Screen

The Regenerator Overhead results screen displays the current values of the SDH Regenerator Section overhead bytes. It also displays the received J0 trace buffer.



AU3 button: This button displays the number of the currently selected administrative unit. Tap this button or use the arrows to select the AU3 to display.

Byte values: The results boxes display the received values of the overhead bytes in hexadecimal. The table below describes the bytes.

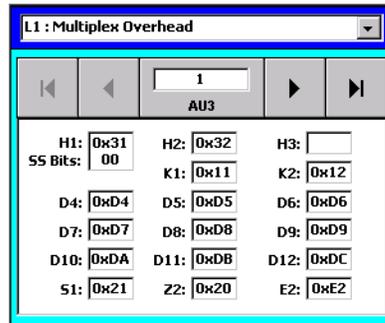
Trace Buffer (J0) area: This area of the results screen displays the received J0 trace in both hexadecimal and ASCII. The Mismatch indicators show whether the received trace buffer matches the expected value (see *Transmit and Expected tabs*, page 4–14).

SDH Regenerator Section Overhead Bytes

| Byte | Description |
|-------|---|
| A1/A2 | Framing. |
| J0 | (AU3-1 #1 only) Regenerator Section trace. |
| E1 | Local orderwire channel. |
| F1 | Regenerator Section user channel. |
| D1–D3 | Regenerator Section data communication channel (DCC). |
| Z0 | (AU3-1 #2 and higher only) Growth byte (formerly C1). |

SDH Multiplex Section Overhead Results Screen

The Multiplex Overhead results screen displays the current values of the SDH Multiplex Section overhead bytes.



AU3 button: This button displays the number of the currently selected administrative unit. Tap this button or use the arrows to select the AU3 to display.

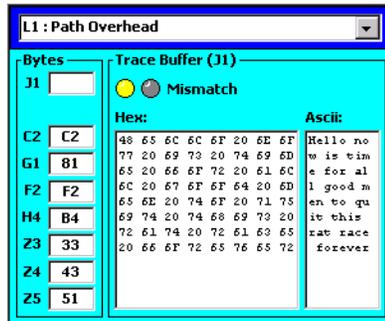
Byte values: The results boxes display the received values of the overhead bytes in hexadecimal. The table below describes the bytes.

SDH Multiplex Section Overhead Bytes

| Byte | Description |
|----------------|--|
| H1 and SS Bits | H1 payload pointer byte and SS bits (payload offset). |
| H2–H3 | Payload pointers. |
| K1/K2 | Automatic protection switching (APS) channel, also Multiplex Section AIS and Multiplex Section ROI indication. |
| D4–D12 | Multiplex section data communication channel (DCC). |
| S1/Z1 | S1 (AU3-1 #1) = Synchronization status. Z1 = Growth. |
| M1/Z2 | M1 (AU3 #3 of STM-N \geq 3 signals) = Remote error indication. Z2 (other AU3s) = Growth. |
| E2 | Express orderwire channel. |

SONET and SDH Path Results Screen

The Path Overhead results screen displays the current values of the SONET or SDH Path overhead bytes. It also displays the received J1 trace buffer.



Byte values: The results boxes display the received values of the overhead bytes in hexadecimal. The table below describes the bytes.

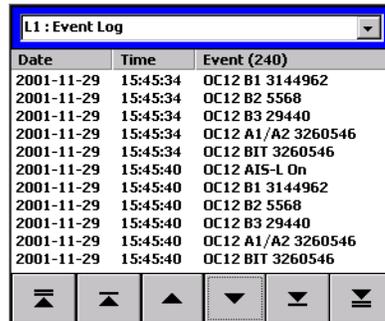
Trace Buffer (J1) area: This area of the results screen displays the received J1 trace in both hexadecimal and ASCII. The Mismatch indicators show whether the received trace buffer matches the expected value (see *Transmit and Expected tabs*, page 3–14 or page 4–14).

SONET and SDH Path Overhead Bytes

| Byte | Description |
|-------|---|
| J1 | Path trace. |
| C2 | Path signal label. |
| G1 | Path status. Bits 1–4 = path FEBE; bits 5–6 = path ROI. |
| F2 | Path user channel. |
| H4 | VT multiframe phase indicator. Not editable. |
| Z3/Z4 | Future growth. |
| Z5 | Tandem connection error count and data link. |

Event Log Results Screen

The Event Log results screen displays a list of all the events that occurred during the test. This results screen is available for both SONET and SDH tests.



The screenshot shows a window titled "L1 : Event Log" with a dropdown arrow. Below the title bar is a table with three columns: "Date", "Time", and "Event (240)". The table contains 12 rows of event data. Below the table is a row of six navigation buttons: a home button (house icon), a left arrow button, an up arrow button, a right arrow button, a down arrow button, and an end button (house icon).

| Date | Time | Event (240) |
|------------|----------|--------------------|
| 2001-11-29 | 15:45:34 | OC12 B1 3144962 |
| 2001-11-29 | 15:45:34 | OC12 B2 5568 |
| 2001-11-29 | 15:45:34 | OC12 B3 29440 |
| 2001-11-29 | 15:45:34 | OC12 A1/A2 3260546 |
| 2001-11-29 | 15:45:34 | OC12 BIT 3260546 |
| 2001-11-29 | 15:45:40 | OC12 AIS-L On |
| 2001-11-29 | 15:45:40 | OC12 B1 3144962 |
| 2001-11-29 | 15:45:40 | OC12 B2 5568 |
| 2001-11-29 | 15:45:40 | OC12 B3 29440 |
| 2001-11-29 | 15:45:40 | OC12 A1/A2 3260546 |
| 2001-11-29 | 15:45:40 | OC12 BIT 3260546 |

Event list: The list of events includes the date and time that the event occurred, as well as a description of the event. The description indicates the line rate and the type of event detected.

Arrow buttons: The arrow buttons allow you to navigate through the event list.

Results Reference

6

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Printing and Reports

About SONET/SDH Module Reports

The N1675A, N1676A, and N1677A SONET/SDH Modules allow you to create, print, and save reports. These reports contain information about test configuration, test results, event log data, and other test information. Reports can be stored in the module's memory, or on a PC card inserted in the Service Advisor Tablet.

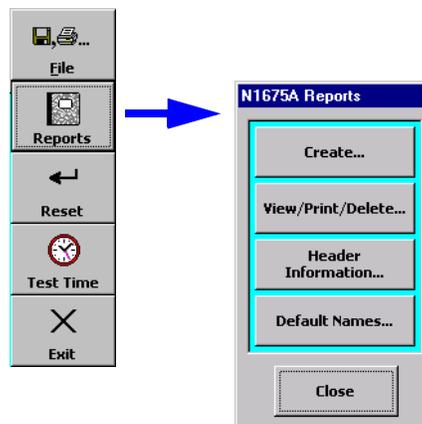
The basic procedure for generating reports is as follows:

1. Customize report headers and file names (optional). See page 6-7.
2. Create a report. See page 6-3.
3. Save the report (optional). See page 6-4.
4. Print the report (optional). See page 6-6.

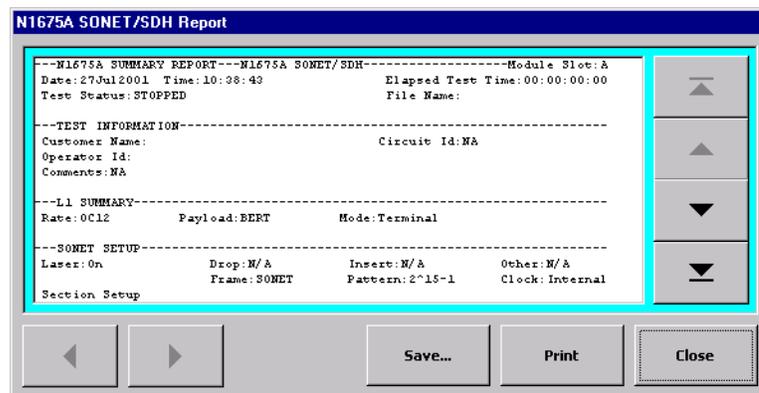
Creating a Report

This section describes how to create a report. You can create a report while a test is running or stopped. You can create a report whether or not there are any test results (for example, if you had not started a test).

1. Tap the File button to call the File menu. Next tap Reports to call the Reports menu.



2. Tap the Create button to call the Reports window.

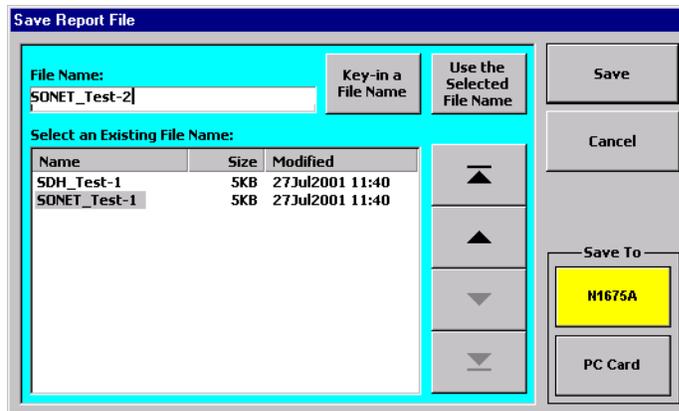


3. Use the arrow buttons to scroll through the displayed report. Tap the Save button to save the report (See page 6-4) or tap the Print button to print it (See page 6-6).

Saving a Report

When you have created a report (See page 6-3) you can save it in the SONET/SDH Module's internal memory, or in a PC card inserted in the Service Advisor Tablet.

1. Create a report. See *Creating a Report*, page 6-3.
2. On the Reports window, tap the Save button. The Save Report File window is displayed.

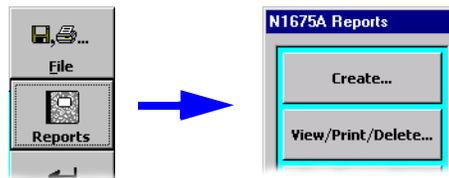


3. Select a storage destination by tapping a “Save To” button. The “Module” button (N1675A, etc) stores the report in the module. The PC Card button stores the report on a PC card inserted in the Service Advisor Test Tablet.
4. Choose a filename for the report. You can choose to do one of three things:
 - Use the suggested filename shown in the File Name box. (For information on changing the default filename, see page 6-9.)
 - Tap the Key-in a File Name button to enter your own filename. This will open the on-screen keyboard. Tap the keys to enter the file name.
 - Use the arrow buttons to select an existing filename (if any), then tap the Use the Selected File Name button.
5. Tap the Save button to store your report.
Tap the Cancel button to close the window without saving your report.

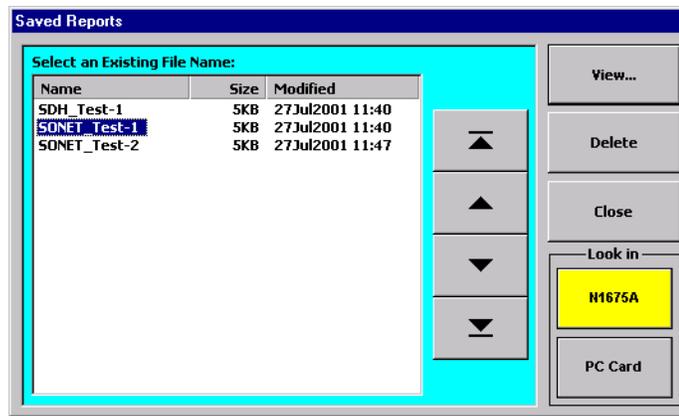
Opening and Deleting Saved Reports

This section describes how to work with reports that have been previously saved.

1. To access stored reports, tap the File button to call the File menu. Next tap Reports to call the Reports window.



2. Tap the View/Print/Delete button to call the Saved Reports window.



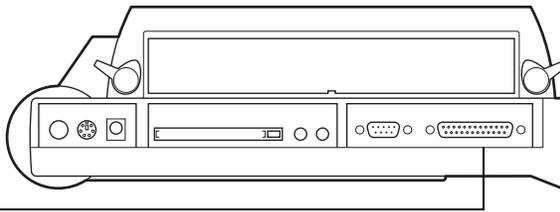
3. Use the Look In buttons to select a storage location. Tap the "Module" button (N1676A, etc) to access reports stored in the SONENT/SDH Module. Tap PC Card to access reports stored on a PC card inserted in the Service Advisor Tablet.
4. Use the arrow buttons to highlight a report on the file list.
5. Tap the View button to open the stored report you selected. When the report is open you can print it by tapping the Print button.
6. Tap the Delete button to remove a report from storage. You will be prompted to confirm that you want to remove the file.

Printing Reports

You can print reports if you have a HP Deskjet™ printer connected to your Service Advisor Test Tablet or to your Internet Advisor with Service Advisor Undercradle.

Connecting a Printer

- If you are using the SONET/SDH Module in a Service Advisor Test Tablet (N1610B), use a DB-25 pin cable to connect the printer to the Tablet's parallel port.



Parallel port

- If you are using your SONET/SDH Module in a Service Advisor Undercradle (N1700A), use a DB-25 pin cable to connect the printer to the parallel port on the side of the Agilent Advisor (for example J2300D). Refer to the manual that came with your Advisor for information on connecting printers.

Printing a Report

1. After you have connected a printer to your system, create a new report or open a stored report.
 - See *Creating a Report*, page 6-3
 - See *Opening and Deleting Saved Reports*, page 6-5
2. When the report is displayed, tap the Print button to print it.

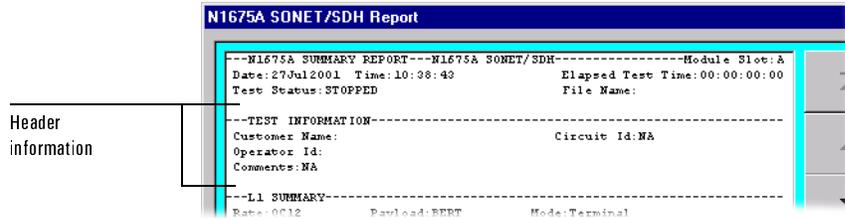
Caution: If no printer is connected, sending the Print command freezes the Service Advisor, and requires a restart. Unsaved data is lost.

Customizing Reports

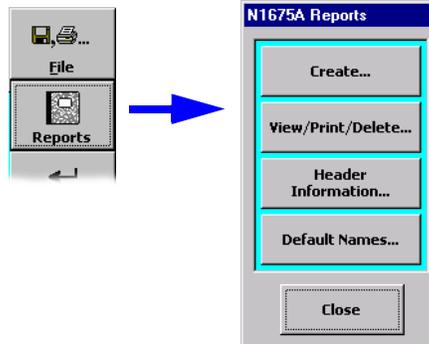
You can customize the header information on reports. You can also customize the default file names assigned to reports you are saving.

Editing Report Headers

This procedure describes how to change the test report header information.

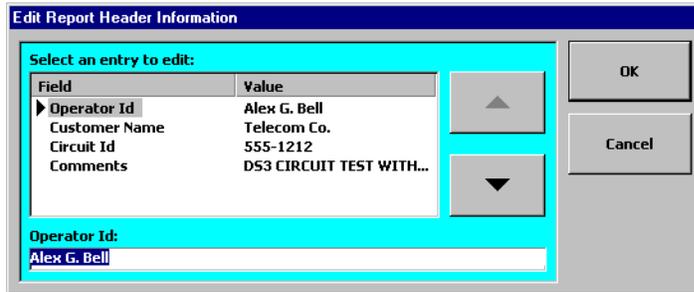


1. Tap the File button to call the File menu. Next tap Reports to call the Reports window.

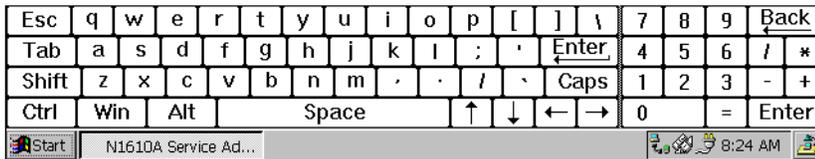


2. Tap the Header Information button. The Edit Report Header Information window is displayed.

Printing and Reports
Customizing Reports



- Use the arrow buttons to select the field to edit.
- Tap the keyboard icon at the bottom of the screen in the Service Advisor Tablet task bar. The on-screen keyboard is displayed. Next tap the keys to edit the report header fields.



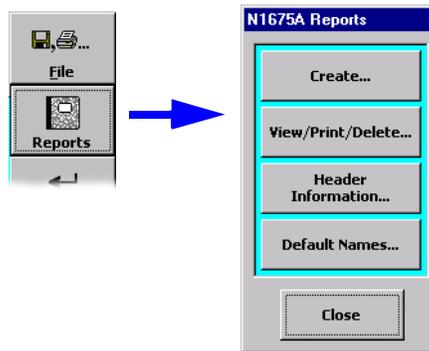
- Tap the keyboard icon again to close the keyboard when you have finished.
- Tap OK to close the window and accept your changes. Tap Cancel to close the window without making any changes to the headers.

The header information you enter is included in future reports that you create.

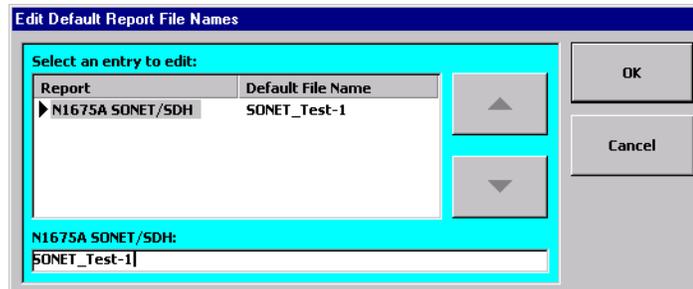
Editing Report Filenames

This procedure describes how to define the default file names used when you store reports.

1. Tap the File button to call the File menu. Next tap Reports to call the Reports window.



2. Tap the Default Names button. The Edit Default Report File Names window is displayed.



3. Use the arrow buttons to select the type of report to rename.
4. Tap the keyboard icon at the bottom of the screen in the Service Advisor Tablet task bar. The on-screen keyboard is displayed. Next tap the keys to edit the report file name (see step 4, page 6–8).
5. Tap OK to close the window and accept your changes. Tap Cancel to close the window without making any changes.

The filename you enter is used when you save a report. See *Saving a Report*, page 6–4.

Printing and Reports

Glossary

- ac:** Alternating current.
- ADM:** Add/drop multiplexer.
- AIS:** Alarm indication signal. Originally called a “Blue” alarm.
- all-ones:** A bit pattern made up entirely of binary 1s.
- AMI:** Alternate Mark Inversion. A line coding scheme.
- ANSI:** American National Standards Institute.
- APS:** Automatic protection switching.
- asynchronous:** Not synchronized; not timed to an outside clock source.
- AU:** Administrative unit (SDH).
- bandwidth:** A network or channel’s capacity to carry traffic.
- BER:** Bit error ratio. The number of errored bits over the total number of bits. This term is often used interchangeably with bit error rate (the number of errored bits per second).
- BERT:** Bit error ratio testing. This term is often used interchangeably with bit error rate testing.
- BIP-n:** Bit-interleaved parity n. An error monitoring scheme in which an n-bit code is used to provide proper parity over a specific part of a signal.
- B-ISDN:** Broadband ISDN. See also ISDN.
- bit:** A basic unit of data. A bit can be set to either a zero or a one.
- BITS:** Building integrated timing supply. A stratum 1 clock source, typically in a CO.
- Blue alarm:** See *AIS*.
- BnZS:** Bipolar with *n*-zero substitution. A line coding scheme in which *n* consecutive zeros are replaced by a substitution code to maintain a high pulse density. Typical codes are B3ZS for DS3 and B8ZS for DS1.
- BPV:** Bipolar violation. The occurrence of a pulse that breaks the alternating polarity rule
- BW:** See *bandwidth*.
- byte:** Eight bits. Usually refers to a particular location in a frame.
- CCITT:** Consultative Committee on International Telegraph and Telephone, now the International Telecommunications Union (*ITU*). The standards produced by this organization are called ITU-T Recommendations.
- clock:** The timing of, or timing source for, digital telecom equipment.
- CMI:** Code mark inversion. A line coding scheme.
- concatenation:** The grouping of SONET STS or SDH STM payloads to form one large payload.
- CRC:** Cyclic redundancy checksum. A basic error-checking technique.
- CSES:** Consecutively severely errored second.

Glossary

CV: Code violation.

D4: See *SF*.

Daly pattern: A repeating 55 octet pattern.

datalink: A transmission path for data.

dB: Decibel. Standard unit for transmission loss, gain, and relative power ratios.

dBdsx: Decibels relative to the DSX level.

dBm: Decibels relative to one milliwatt.

dc: Direct current.

DCC: Data communications channel.

DCE: Data circuit-terminating equipment. Equipment that provides the interface between a DTE device and a transmission circuit. For example, a modem.

decimal: A base-10 numbering system in which the digits range from 0 to 9.

DRS: Digital reference signal.

DS0: ANSI digital signal level 0; typically 64 or 56 kbs.

DS1: ANSI digital signal level 1; 1.544 Mbps.

DS2: ANSI digital signal level 2; 6.312 Mbs

DS3: ANSI digital signal level 3; 44.736 Mbs.

DSX: A digital signal cross-connect and patch bay.

DTE: Data terminal equipment. Equipment that converts user information into data signals for transmission (for example, a PC).

E0: ITU-T digital signal level 0; 64 kbs

E1: ITU-T digital signal level 1; 2.048 Mbs.

E2: ITU-T digital signal level 2; 8.448 Mbs.

E3: ITU-T digital signal level 3; 34.368 Mbs.

E4: ITU-T digital signal level 4; 139.264 Mbs.

EFS: Error-free second.

EIA: Electronics Industry Association

error rate: The number of errors per second. Compare *error ratio*.

error ratio: The number of errors over the total number of bits. This term is often used interchangeably with *error rate*, although they are two different measurements.

ES: Errored second. A second in which at least one error occurred.

ESD: Electrostatic discharge. The discharge of static electricity, which has the potential to damage electronic circuitry.

ESF: Extended Superframe framing format (DS1).

FE1: Fractional E1. A subrate signal on an E1, comprising N number of timeslots (channels). See also $N \times 64$.

- FEBE:** Far-end block error.
- FERF:** Far-end receive failure.
- FFCV:** Frame format coding violation.
- FFM:** Frame format mismatch.
- frame:** A group of bits, timeslots, or bytes whose unique positions can be identified relative an alignment signal or pointer.
- FT1:** Fractional T1. A subrate signal on a DS1, comprising N number of DS0 channels. See also $N \times 64$.
- Gb or Gbit:** Gigabit. One billion bits.
- Gbs:** Gigabits per second.
- GUI:** Graphical user interface.
- hexadecimal:** A base-16 numbering system in which the digits range from 0 through F. A subscript “h” is used to denote a hexadecimal value (for example, $2A0F_{16}$).
- HDB3:** High-density bipolar with three-zero substitution. A line coding scheme.
- HSSI:** High speed serial interface. Uses a SCSI-2 50-pin connector.
- Hz:** Hertz. Measure of frequency, one cycle per second.
- idle signal:** A signal transmitted to indicate that a channel is not in use.
- IP:** Internet Protocol.
- ISDN:** Integrated Services Digital Network.
- ISO:** International Standards Organization.
- ITU:** International Telecommunications Union, formerly the *CCITT*. The standards produced by this organization are called ITU-T Recommendations.
- jitter:** Short-term variation in the phase of a digital signal (includes phase variation above 10 Hz).
- kb or kbit:** Kilobit. A thousand bits.
- KB or Kbyte:** Kilobyte. One thousand bytes.
- kbs:** Kilobits per second.
- kHz:** Kilohertz. Measure of frequency, one thousand cycles per second.
- LBO:** See *line build-out*.
- LCD:** Liquid Crystal Display.
- LCVA:** Line code violation alarm.
- LCVR:** Line code violation rate.
- LED:** Light-emitting diode.
- line:** In a SONET network, the part of the *path* between two consecutive line terminating network elements. called *multiplex section* in SDH.
- line build-out:** A circuit that simulates the signal attenuation of a specified cable length.
- LOF:** Loss of frame.
- loopback:** A state in which the transmit signal is reversed back as the receive signal, typically by a far-end network element.
- LOS:** Loss of signal.
- mA:** Milliampere. Measure of current, one thousandth of an ampere.

Glossary

Mb or Mbit: Megabit. One million bits.

MB or Mbyte: Megabyte. One million bytes.

MBLT: Mobile both-line terminal framing format.

Mbs: Megabits per second. One megabit equals one million bits.

M-frame: See *multiframe*.

MFA: Multiframe alignment. See *multiframe*.

MHz: Megahertz. Measure of frequency, one million cycles per second.

monitor level: The signal level at a DSX Monitor point.

ms: Millisecond. One thousandth of a second.

multiframe: A set of consecutive frames in which the position of each is defined in relation to a multiframe alignment signal.

multiplex section: In an SDH network, the part of the *path* between two consecutive line terminating network elements. Called *line* in SONET.

N × 64/N × 56: A subrate signal on a DS1 or E1 formed by using N number of 64 kbs or 56 kbs channels.

NiMH: Nickel Metal Hydride. A type of rechargeable battery.

NIU: Network interface unit.

nm: Nanometer. One billionth of a meter.

NNI: Network–network interface. The demarcation point between two networks.

node: Any addressable device in the network, such as a host.

OC-1: Optical carrier signal, level 1 (51.84 Mbs).

OC-3: Optical carrier signal, level 3 (155.52 Mbs).

OC-12: Optical carrier signal, level 12 (622.08 Mbs).

OC-48: Optical carrier signal, level 48 (2488.32 Mbs, or 2.48 Gbs).

OC-N: Optical carrier signal, level N (N number of OC-1s).

octet: Eight bits. Typically refers to a group of bits that spans more than one byte. Compare *byte*.

OH: See *overhead*.

OOF: Out of frame.

orderwire: A voice or data circuit used for maintenance purposes.

overhead: The bits or bytes in a frame or cell that are not the payload. Overhead provides for signal control and monitoring.

parity: An error checking method that uses extra bits to provide even or odd parity for a specific group of bits.

path: In a network, the connection between the point where the frame for a signal is assembled, and the point where it is disassembled.

- payload:** The information bits of a frame or cell. Those bits that are not part of the *overhead*.
- PDH:** Plesiochronous digital hierarchy.
- ppm:** Parts per million.
- PRBS:** Pseudorandom bit sequence. A test pattern that simulates live, random traffic.
- QRSS:** Quasirandom sequence signal.
- RAI:** Remote alarm indication.
- RAM:** Random access memory.
- RDI:** Remote defect indication.
- regenerator section:** The part of an SDH network *path* between a terminal network element and a regenerator, or between two regenerators. Called *section* in SONET.
- REI:** Remote event indication.
- ROM:** Read-only memory.
- SCPI:** Standard Commands for Programmable Instruments.
- SCSI:** Small Computer Serial Interface
- SDH:** Synchronous digital hierarchy.
- section:** The part of a SONET network *path* between a terminal network element and a regenerator, or between two regenerators. Called *regenerator section* in SDH.
- SEE:** Severely errored event.
- SF:** Superframe format. DS1 framing format.
- SLC-96™:** Subscriber loop carrier system 96. An AT&T T1 framing format.
- SONET:** Synchronous optical network.
- STM:** Synchronous transport module (SDH).
- STM-0:** SDH synchronous transport module, level 0 (51.84 Mbs).
- STM-1:** The basic SDH synchronous transport module (155.52 Mbs).
- STM-4:** SDH synchronous transport module, level 4 (622.08 Mbs).
- STM-16:** SDH synchronous transport module, level 16 (2488.32 Mbs, or 2.48 Gbs).
- STS:** Synchronous transport signal (SONET).
- STS-1:** The basic SONET synchronous transport signal. A 125 μ s frame (51.840 Mbs).
- STS-N:** Synchronous transport signal N, where N indicates the number of STS-1s interleaved to generate the signal.
- STS-Nc:** Concatenated STS signal. An STS-N in which the payloads are grouped to carry a super rate signal.
- sub-multiframe:** A division of a multiframe that also contains multiple frames. Also called an M-subframe.
- synchronous:** Synchronized. Occurring at the same rate or period; sharing common timing with an outside timing source.

Glossary

T1: See *DS1*.

TDR: Time domain reflectometer.

timeslot: A unique, cyclic time interval; typically providing a single channel.

timing: See *clock*.

TLP: Transmission Level Point.

TS: See *timeslot*.

TS0: Timeslot zero. The first timeslot in an E1 frame.

TS16: Timeslot sixteen. The 17th timeslot in an E1 signal, used to provide channel associated signaling.

TTL: Transistor to transistor logic. A standard transmission level with a logic low of 0 volts and a logic high of 5 volts.

TU: Tributary unit (SDH).

TUG: Tributary unit group (SDH).

UAS: Unavailable seconds.

UI: Unit interval. The duration of one clock cycle, or pulse period, for a given rate.

UNI: User-Network Interface. The demarcation point between the customer premise and the network.

V: Volt.

Vac: Volt, alternating current.

VC: (SDH) Virtual Container. Independent data unit used to transport tributary signals on an SDH payload.

VC-3: SDH virtual container with a bandwidth of 48.860 Mbs.

VC-4: SDH virtual container with a bandwidth of 150.336 Mbs.

Vdc: Volt, direct current.

VF: Voice frequency.

V pk: Volt peak.

V p-p: Volt, peak-to-peak.

VT: Virtual tributary (SONET).

VT1.5: A virtual tributary carrying a DS1 (1.544 Mbs) signal.

xDSL: Digital subscriber line.

Yellow alarm: (DS1) Also called a remote alarm or RAI, this alarm indicates a near-to-far transmission failure.

µsec: Microsecond. One-millionth of a second.

Warranty, Calibration, and Service

Agilent Technologies Limited Warranty Statement

Agilent Product: N1675A, N1676A, and N1677A SONET/SDH Test Module

Duration of Limited Warranty: Three years

1. Agilent warrants to you, the end-user customer, that Agilent hardware, accessories and supplies will be free from defects in materials and workmanship after the date of purchase, for the period specified above. If Agilent receives notice of such defects during the warranty period, Agilent will, at its option, either repair or replace products which prove to be defective. Replacement products may be either new or equivalent in performance to new.
2. Agilent warrants to you that Agilent software will not fail to execute its programming instructions after the date of purchase, for the period specified above, due to defects in material and workmanship when properly installed and used. If Agilent receives notice of such defects during the warranty period, Agilent will replace software which does not execute its programming instructions due to such defects.
3. Agilent does not warrant that the operation of Agilent products will be uninterrupted or error free. If Agilent is unable, within a reasonable time, to repair or replace any product to a condition as warranted, you will be entitled to a refund of the purchase price upon prompt return of the product.
4. Agilent products may contain remanufactured parts equivalent to new in performance or may have been subject to incidental use.
5. Warranty does not apply to defects resulting from (a) improper or inadequate maintenance or calibration, (b) software, interfacing, parts or supplies not supplied by Agilent, (c) unauthorized modification or misuse, (d) operation outside of the published environmental specifications for the product, or (e) improper site preparation or maintenance.
6. Agilent warrants that the Agilent Product described above will be able to accurately process date data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000, including leap year calculations, when used in accordance with the Product documentation provided by Agilent (including any instructions for installing patches or upgrades), provided that all other products (e.g. hardware, software, firmware) used in combination with such Agilent Product(s) properly exchange date data with it. If the Specifications require that specific Agilent Products must perform as a system in accordance with the foregoing

Warranty, Calibration, and Service
Agilent Technologies Limited Warranty Statement

warranty, then that warranty will apply to those Agilent Products as a system, and Customer retains sole responsibility to ensure the Year 2000 readiness of its information technology and business environment. The duration of this warranty extends through January 31, 2001. To the extent permitted by local law, this warranty applies only to branded Agilent Products and not to products manufactured by others that may be sold or distributed by Agilent. The warranty in this paragraph 6) applies only to Agilent Products shipped after July 01, 1998. The remedies applicable to this paragraph 6) are those provided in paragraphs 1, 2, and 3.

7. Products purchased from Agilent outside the U.S. will receive the standard warranty in the country of purchase. If end user customer moves such Products to another country where Agilent has Support presence, then end user customer will receive the destination country standard warranty.
8. Products purchased in the U.S. based on the U.S. list prices will only receive standard warranty in the U.S., except for Products with a global warranty. A global warranty means that the Product will include the destination country's standard warranty in any country where the Product is moved provided that Agilent has Support presence in that country.
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10. TO THE EXTENT ALLOWED BY LOCAL LAW, THE REMEDIES IN THIS WARRANTY STATEMENT ARE YOUR SOLE AND EXCLUSIVE REMEDIES. EXCEPT AS INDICATED ABOVE, IN NO EVENT WILL AGILENT OR ITS SUPPLIERS BE LIABLE FOR LOSS OF DATA OR FOR DIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL (INCLUDING LOST PROFIT OR DATA), OR OTHER DAMAGE, WHETHER BASED IN CONTRACT, TORT, OR OTHERWISE. Some countries, states or provinces do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

THE WARRANTY TERMS CONTAINED IN THIS STATEMENT, EXCEPT TO THE EXTENT LAWFULLY PERMITTED, DO NOT EXCLUDE, RESTRICT OR MODIFY AND ARE IN ADDITION TO THE MANDATORY STATUTORY RIGHTS APPLICABLE TO THE SALE OF THIS PRODUCT TO YOU.

Support

If you have a question or need help with your N1675A or N1676A SONET/SDH Test Module, please refer to one of the following sources of assistance.

- Read this manual to see if the information you seek is here. To help you locate information more quickly, use the Index at the back of the manual, and the Table of Contents at the front of the manual.
- Carefully check your test setup, connections, and power. Be sure that the module is installed in the Service Advisor tablet properly.
- Refer to the Agilent Technologies website at <http://www.agilent.com>
- Call the Agilent Call Center at 800-452-4844.

Calibration and Service

Calibration

This instrument must be calibrated only by authorized Agilent Technologies personnel. Unauthorized service or calibration will void the warranty.

- Agilent Technologies suggests that the SONET/SDH Test Module (N1675A, N1676A, and N1677A) be calibrated every three years.

To arrange for calibration, please contact the Agilent Instrument Support Center at 800-403-0801 to obtain an RMA (return material authorization) number and receive shipping instructions.

Service

If your SONET/SDH module is not operating properly, carefully check all configuration parameters and connections. Improper selection of timing modes or drop channels, for example, can cause unexpected operation. Also check that the module is seated properly in the Tablet or Undercradle.

If you are still experiencing problems or feel that your module requires service, contact the Agilent Call Center at 800-452-4844. Trained personnel are available to help solve your problem or determine if the module must be returned for repair.

If your module must be returned, a Call Center representative will assign an RMA (return material authorization) number and give you shipping instructions. No product will be accepted for service without an RMA number.

Contact the Instrument Support Center at 800-403-0801.

Warranty, Calibration, and Service

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