Service Advisor
SONET/SDH
Line Interface Test Module

User Manual

Agilent Technologies
Innovating the HP Way

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Warranty

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Agilent Technologies' Service Test Division (STD) is an International Standards Organization (ISO) 9001 registered company, recognizing that the quality system operated by STD meets the requirements established in accordance with ISO 9001. STD manufactures test equipment in strict compliance with this quality system.

STD received ISO 9001 certification (no. 6969) from National Quality Assurance (NQA) on August 30, 1995.

Certificate No. 6969

Agilent Technologies
Service Test Division
2 Robbins Road
Westford, Massachusetts 01886 USA

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 set.

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 the instrument in the presence of flammable gases.

Electric Shock Hazard

Danger! To avoid the possibility of severe injury or death, observe the following precautions when using the 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.

Battery Operation

Danger! During battery operation, connect the chassis ground lug to earth ground.

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.

Declaration of Conformity

according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name: Agilent Technologies, Inc.

Manufacturer's Address: Service Test Division – Massachusetts
2 Robbins Road
Westford, MA 01886-4113

Declares that the product

Product Name: SONET/SDH Line Interface Test Module
Model Numbers: N1645A
Product Options: This declaration covers all options of the above product.

Conforms to the following Product Specifications:

EMC: EN 55011:1991 / CISPR 11:1990 (Group 1, Class A)
EN 50082-1:1992

IEC 801-2:1984	8 kV AD
IEC 801-3:1984	3 V/m
IEC 801-4:1988	0.5 kV signal lines
	1 kV AC power lines

Supplementary Information:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and carries the CE marking accordingly.

The product was tested in a full configuration.

Denis E. Viel
Quality Manager

September 14, 1999
Westford, MA, USA

European Contact: Your local Agilent Technologies Sales and Service Office or Agilent Technologies GmbH, Department ZQ/Standards Europe, Herrenberger Strass 130, D-71034 Boeblingen, Germany (FAX +49-7031-14-3143).

About This Book

Using the SONET/SDH Line Interface Module

Chapter 1 introduces the SONET/SDH Line Interface module (N1660A), provides the installation procedure, and a brief description of the test screens and the options available from the toolbar.

Configuring a SONET/SDH Test

Chapter 2 contains step-by-step instructions for configuring and running a SONET or SDH test.

Viewing Test Results

Chapter 3 describes the results screens that provide information about errors and alarms that may have occured during a test.

SONET/SDH SCPI Commands

Chapter 4 contains reference information for using SCPI commands to operate the SONET/SDH Line Interface module remotely.

Specifications

Chapter 5 lists technical specifications of the SONET/SDH Line Interface module, along with information about how to order accessories.

About This Version

Applicability

This version of the *Service Advisor SONET/SDH Line Interface Module User's Manual* applies to the N1610A Service Advisor Test Tablet and N1645A SONET/SDH Line Interface module running operating software version **1.23** (or later); and references the N1640 ATM Cell Processor module running operating software version **1.23** (or later).

Be sure to refer to any user's manual supplements or release notes that came with the unit, or call 1-800-923-7522.

SONET/SDH Line Interface Module User's Manual printing history

Version	Release date	Notes
1.0	*November, 1999*	*This is the first printing of this manual.*

Check the Software Version

You can check the software version number by pressing the **Help** button, or by checking the **Tablet Control** tab of the Service Advisor Manager (see the *Service Advisor Portable Test Tablet User's Manual*).

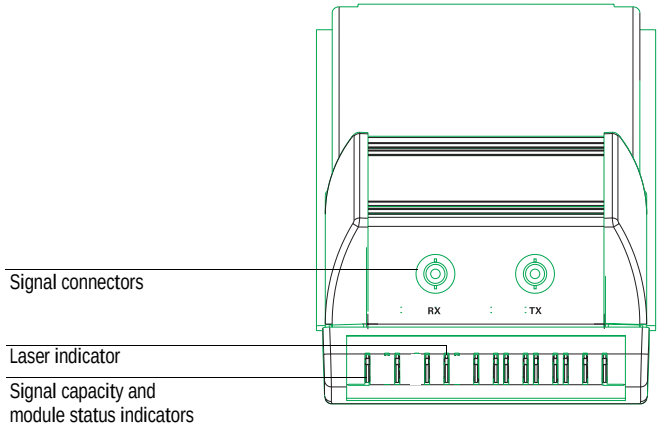
Contents

1

Using the SONET/SDH Line Interface Module

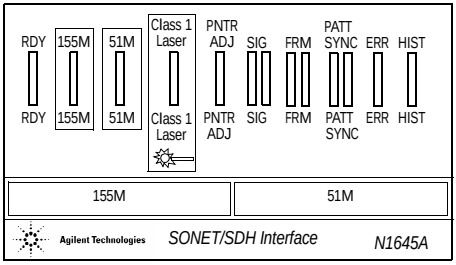
The SONET/SDH Line Interface Module (N1645A) at a Glance

The SONET/SDH module plugs into the Service Advisor Tablet (N1610A), or the Service Advisor Undercradle (N1700A). The module provides the capabilities to test SONET in broadband networks. The following illustration shows a SONET/SDH module with ST connectors.



Module Status Indicators

The status LEDs on the front of the module provide a visual indicator of when the module is ready for testing, and the different conditions that occur, such as signal detection and loss of signal, during a test.



The table below describes the status indicators on the SONET/SDH plug-in module.

Plug-in Module Status Indicators

Indicator	Description
RDY LED	Green LED indicates the SONET/SDH module is ready for testing.
155M LED	Green LED indicates the line rate is 155 Mbps.
51M LED	Green LED indicates the line rate is 51 Mbps.
Class 1 Laser LED	Green LED indicates the optical transmitter is ON.
PNTR ADJ LED	Green LED indicates the pointer value has changed.
SIG LEDs	Green LED indicates the tester has detected a signal. Red LED indicates there is a loss of signal (LOS).
FRM LEDs	Green LED indicates the tester has detected framing. Red LED indicates there is a loss of framing (LOF).
PATT SYNC LEDs	Green LED indicates the tester has detected a BERT pattern. Red LED indicates there is a loss of pattern (LOP).
ERR LEDs	Red LED indicates the tester has detected an alarm or error condition.
HIST LED	Red LED indicates an error or alarm condition occurred in the previous test.

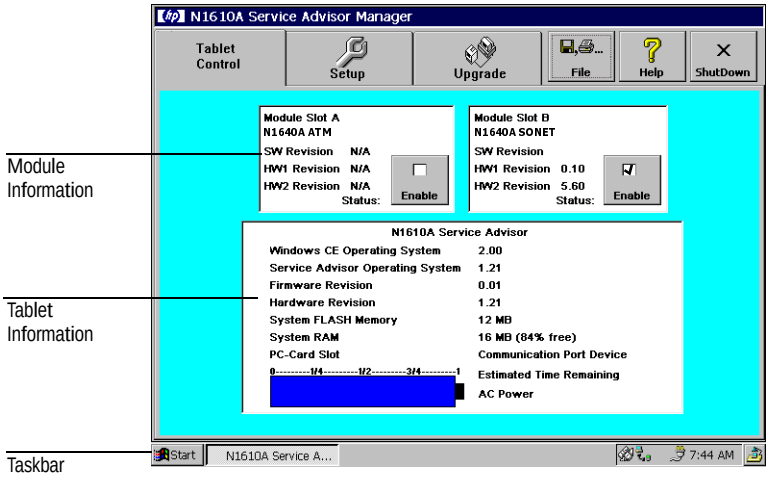
Connecting a Service Advisor to a SONET Circuit

To perform SONET testing, an ATM Cell Processor Test Module (N1640A) and a SONET Line Interface Module (N1645A) must be installed in the Service Advisor.

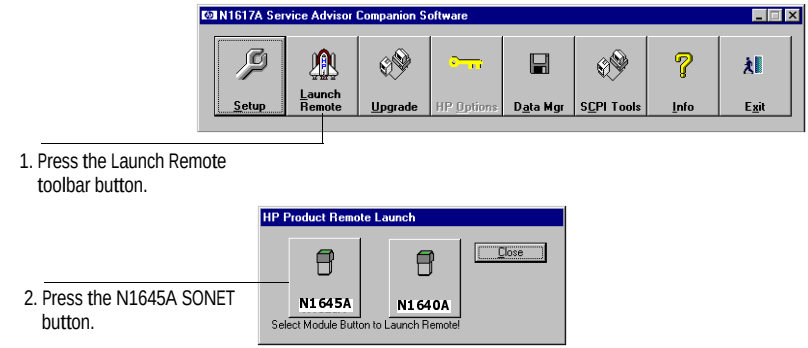
1. Insert a SONET Line Interface module and an ATM Cell Processor Test Module into a Service Advisor platform. See the appropriate manual for instructions:
   - *Service Advisor Portable Test Tablet User's Manual* (N1610-90000)
   - *Service Advisor Undercradle User's Manual* (N1700-90000)
2. Install the appropriate optical cables between the SONET/SDH module's TX and RX connections and the circuit you plan to test (see *SONET/SDH Cable Options*, page 1–6).

Caution! *Read the manual. Use the correct cables to connect the SONET/SDH Line Interface module to the circuit. Using the incorrect cables to complete this procedure could cause damage to the tester or to the operator.*

3. Power ON your Service Advisor platform or your Service Advisor Undercradle.
4. If you're using the Service Advisor Tablet, press the **Enable** button for the SONET Test module in the Service Advisor Manager program.



5. If you're using the Internet Advisor, press the **Launch Remote** button on the SACompanion Software toolbar. Then press the **N1645A** module button on the Product Remote Launch screen. You'll see the main SONET Setup screen appear (see page 1–8).



When you see the SONET Setup screen on your test set, you can begin running SONET, SDH, or ATM tests on the circuits. See *Using the SONET/SDH Toolbar*, page 1–12.

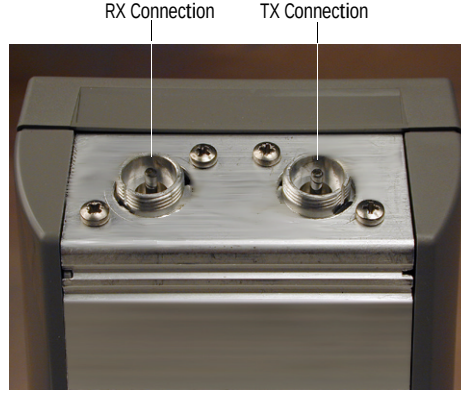
SONET/SDH Cable Options

There are different models of the SONET/SDH Line Interface module available to accommodate standard lasers, and transceivers and connectors. Use the following table to determine how to connect the tester to a SONET/SDH circuit.

Option	Connectors	
100	1310 nm single mode intermediate reach (IR) laser with FC/PC connectors	
101	1310 nm single mode intermediate reach (IR) laser with SC connectors	
102	1310 nm single mode intermediate reach (IR) laser with ST connectors	
103	1310 nm single mode intermediate reach (IR) laser withD4 connectors	
111	1310 nm multi-mode intermediate reach (IR) transceiver with ST connectors	
112	1310 nm multi-mode intermediate reach (IR) transceiver with SC connectors	

Interchangeable Optics Option

Agilent Technologies has designed a new N1645A backpack feature that lets you attach various optical connectors to the TX and RX module connections. The interchangeable optical connectors let you perform SONET and SDH testing without having to purchase individual SONET/SDH modules to accommodate the different types of cables used to connect to the various circuits.



The following table lists the three optional adapters you can connect to the nodule connectors when you purchase the SONET/SDH module with Option 300.

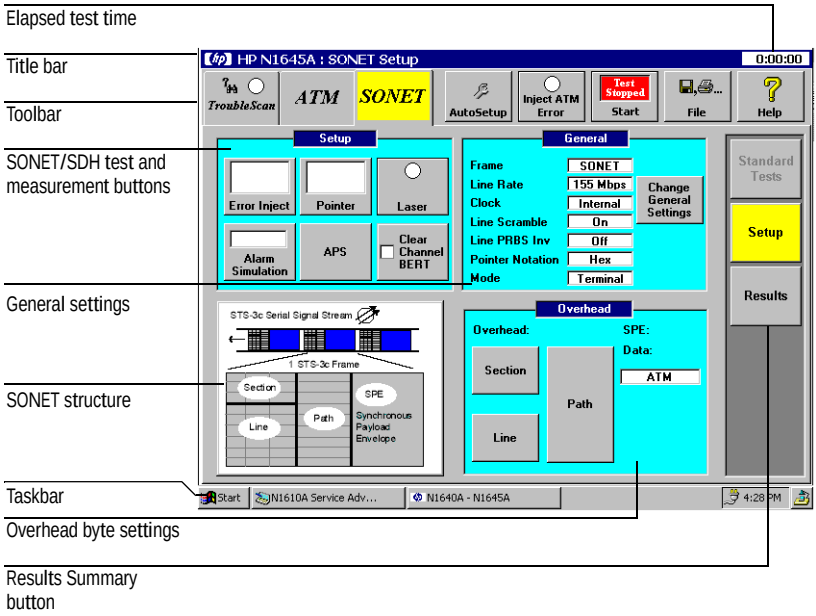
Option	Connectors	
301	2xFC/PC optical adapters	
302	2xST optical adapters	
304	2xSC optical adapters	

The Main SONET/SDH Setup Screens

When you select the SONET (SDH) module in the Service Advisor Manager program, the following SONET Setup screen appears.

Main SONET Setup Screen

The major components of the SONET Setup screen are shown here.

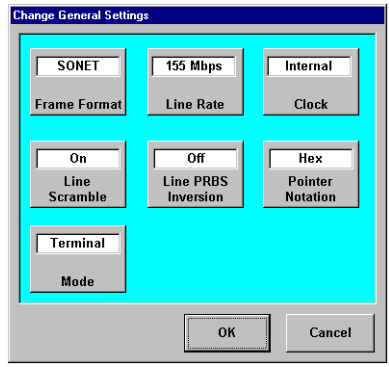


Note: *To transmit an optical signal, be sure the LED on the **Laser** button in green. If it is not green, press the Laser button to turn on this feature.*

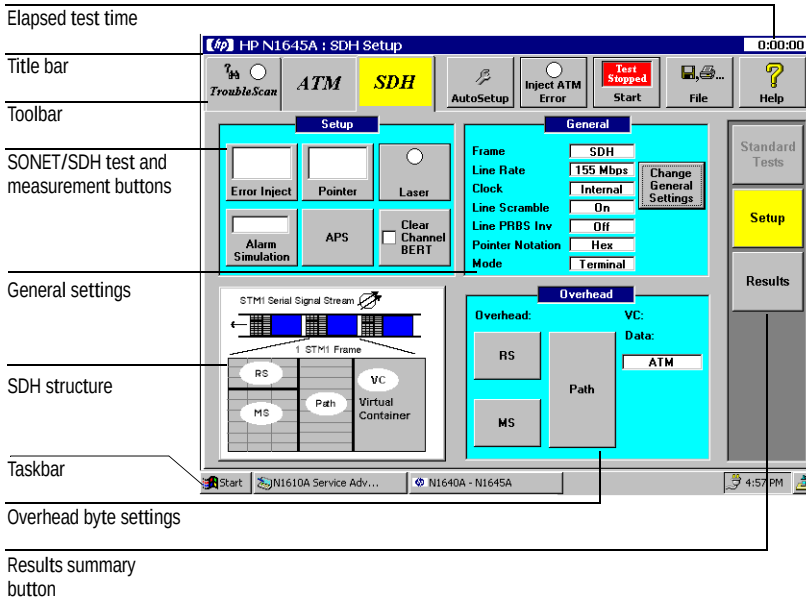
For a description of the screen components, see *Major Screen Components*, page 1–10.

Main SDH Setup Screen

To access the SDH main screen, press the **Change General Settings** button. When the Change General Settings screen appears, press the **Frame Format** button until SDH appears in the display. Then press **OK** to go to the SDH main screen.



The major components of the SDH Setup screen are shown here.



Note: *To transmit an optical signal, be sure to press the **Laser** button in the Setup section of this screen.*

For a description of the screen components, see *Major Screen Components*, page 1–10.

Major Screen Components

Elapsed Test Time: This field shows the length of time the current test has been running (hours:minutes:seconds). Selecting the **Start** button, to start a new test or restart a stopped test, resets elapsed test time to 0.

Title Bar: Displays the title of the current screen.

Toolbar: Contains options and controls for executing various tasks and functions.

SONET/SDH test and measurement buttons: Contains the buttons used to access a particular SONET test or measurement function. Pressing a button opens that test or measurement screen.

General settings: Displays the SONET parameter settings and contains the button that lets you access the screen to change these settings.

SONET/SDH structure: Displays the general structure of a SONET (SDH) signal.

Taskbar: Provides access to the Windows® Start menu, and any software running on the Service Advisor (for example, the GUI for the installed plug-in module and the Service Advisor Manager). See *Using the Taskbar*, page 1–11.

Overhead byte settings: Contains the Section, Line, and Path buttons that provide access to the configuration settings for SONET overhead.

Results summary button: Displays a summary of the current test results, and provides access to additional test results.

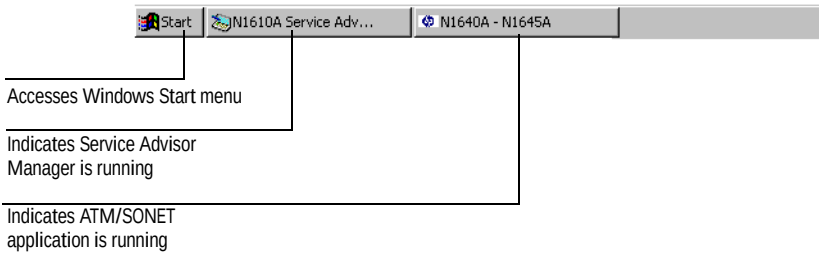
GUI Navigation Basics

Following is a list of basic steps for navigating the GUI.

- Select options and buttons by simply touching them on the screen. Use your finger or use the stylus that came with the Service Advisor. (The stylus is stored in the back of the module bay.)
- Select **OK** to perform a particular task. **Cancel** closes the current screen without doing anything.
- When you select an option that requires a numeric value, the GUI displays a keypad popup containing a list of digits and/or options. Select the appropriate buttons to specify a value.

  Select **OK** to write the value to the field (the popup box closes automatically). Use the **Clear** button to enter a new value; or, **Cancel** to close the popup box without specifying a value.
- Select the **Exit** button under the **File** toolbar option to quit out of the GUI.

Using the Taskbar



Following is a description of the buttons found on the Taskbar.

- **Start** button lets you start an application stored on your PC.
- **N1610A Service Advisor** button lets you *toggle between the application GUI and the Service Advisor screen*.
- **N1640A - N1645A** button opens and minimizes the active SONET/SDH screen. After minimizing the active screen, press this button again to activate the SONET/SDH application.

Using the SONET/SDH Toolbar

The SONET toolbar contains several tabs and buttons, each of which represents a particular function. When you click a tab (such as **SONET**), it turns yellow to indicate which test or function is active. Note that the toolbar functions are available on any SONET/SDH screen.

Troublescan: Select this option to examine the SONET/SDH line and display information about any errors and alarms detected.
See *Performing a Trouble Scan*, page 1–15 for more information.

ATM: Select this option to configure and run ATM tests on the circuit. See the *Service Advisor ATM Cell Processor Test Module User's Manual* (N1640-90000) for more information.

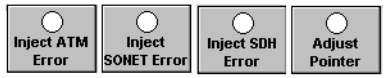
Note: *If the Clear Channel BERT option is ON, you cannot perform any ATM tests.*

SONET/SDH: Select this option to configure and run SONET or SDH tests on the circuit.

Auto Setup: Select this option if you want the tester to configure its transmitter to the receiver's line configuration. See *Performing an Auto Setup*, page 1–14 for more information.

Inject Error/Adjust Pointer: Select this option to inject configured SONET/SDH/ATM errors into the connected circuit, or activate pointer adjustments.

When you select a pointer adjustment or NDF (using the **Pointer** Setup button), this toolbar button become an **Adjust Pointer** button (see *Making a Pointer Adjustment*, page 2–19).



Start/Stop: Select this option to start the selected test (this button turns into a Stop button). Press **Stop** to freeze error counters, alarm indicators, and history counters, and halt a test.

Pressing the **Start** button starts a new test and resets the elapsed test time (displayed on the title bar) to zero.

File: Provides access to SONET control and file-management functions.

Save lets you save test results or an ASCII report text file in the test module or the Flash Memory Card (see *Saving a SONET Report*, page 1–17).

Print lets you send the displayed screen or the report file associated with the current screen to the printer connected to the Service Advisor's parallel port (see *Printing Results*, page 1–19). Also lets you enter an operator ID, customer name, circuit ID, and comments, which print on reports.

Reset stops any active tests and resets the SONET (SDH) test module to the factory default settings.

Exit saves your configuration settings, closes the SONET/SDH GUI, and returns control to the Service Advisor Manager (see the *Service Advisor Portable Tablet User's Manual* for information on the Manager).

Note: *If you power off the Service Advisor without exiting the SONET/SDH application using the Exit option under the File toolbar menu, your configuration settings are not saved; the settings return to the last saved settings.*

Help: Displays the version of software and firmware running on the module. (*Future versions of software should have detailed help available.)*

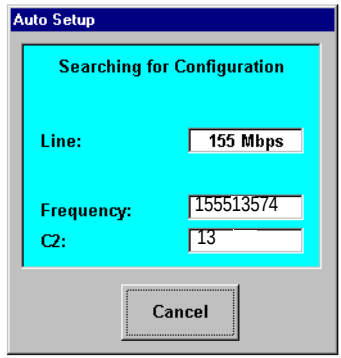
Performing an Auto Setup

The Auto Setup function scans the receive signal to determine its characteristics, and then automatically configures the Service Advisor for that type of configuration. This function is useful for configuring the Service Advisor when you're unsure of the network configuration.

Note: *After running Auto Setup, you can run a Trouble Scan to determine whether there are any problems on the line (see Performing a Trouble Scan, page 1–15).*

Follow these steps to perform an Auto Setup.

1. Make sure the Service Advisor is powered ON and connected to a SONET/SDH circuit (see *Connecting a Service Advisor to a SONET Circuit*, page 1–4).
2. Press the **AutoSetup** toolbar option. The Service Advisor scans the receive signal and displays signal characteristics in the Auto Setup screen.



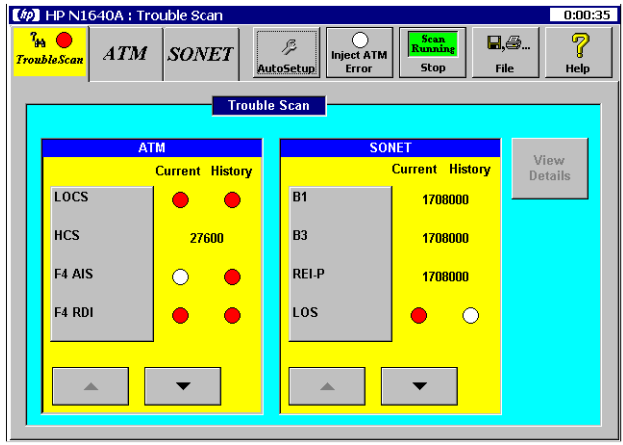
3. Observe the screen for information about the receive signal.

Performing a Trouble Scan

The Trouble Scan function examines the SONET line and displays information about any errors and alarms detected.

Follow these steps to run a trouble scan.

1. Press the **TroubleScan** toolbar button. The Service Advisor scans the line for errors, and displays the results in the Trouble Scan screen.



2. Observe the Trouble Scan screen and the LEDs on the installed modules to determine whether there are problems on the line. Use the ▲ or ▼ buttons to move through the list.

Note: *"History" LEDs indicate a previous occurrence of an error or alarm.*

3. To display detailed information about a particular error or alarm, use the ▲ or ▼ buttons to scroll through the list, and press an alarm or error in the list. Then press the **View Results** button to see a detailed alarm or error results screen (see *Viewing Test Results*, page 3–1).

   For information about the ATM alarms and errors, see the *Service Advisor ATM Cell Processor Test Module User's Manual* (N1640-90000).

SONET/SDH Alarms

The following table provides a brief descriptions of the errors and alarms listed on the Trouble Scan screen. The names in square brackets (for example, [MS-AIS]) are the names you see when you have selected the SDH frame format. For more detailed information, see *Alarms Summary*, page 3–7.

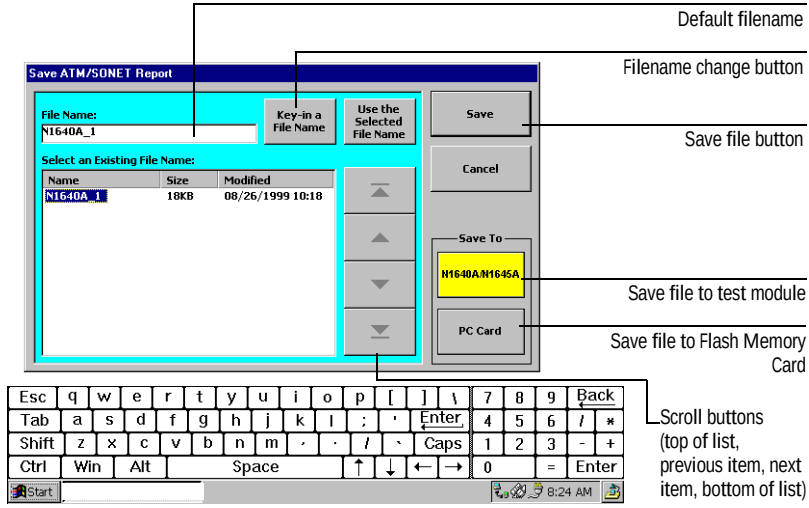
Alarm Name	Description
B1	Shows the content of the B1 byte.
B2	Shows the content of the B2 byte.
B3	Shows the content of the B3 byte.
REI-L [MSREI]	Shows the line remote error indication.
REI-P [PREI]	Shows the path remote error indication for the G1 byte.
LOS	Loss of signal.
OOF	Out-of-frame.
AIS-L [MS-AIS]	Alarm indication signal-line.
RDI-L [MS-RDI]	Remote defect indication-line.
AIS-P [AU-AIS]	Alarm indication signal-path.
RDI-P [AU-RDI]	Remote defect indication-path.
LOP-P	Path loss of pointer (formerly LOPNTR).

Saving a SONET Report

You can save SONET/SDH report as a file, either while a test is in progress or after it has been stopped, in the SONET/SDH Line Interface module or the Flash Memory Card.

Follow these steps to save an event log.

1. Press the **File** toolbar button and select the **Save** option.



When the Save ATM/SONET Report screen appears, you'll see the default name the test module will automatically assign to the test information currently being generated. (All report files are saved in ASCII text format.)

2. To use an existing filename (to overwrite a file), use the scroll buttons to move through the list.

   When the desired name is highlighted, press the **Use the Selected File Name** button. You'll see the name appear in the File Name field.

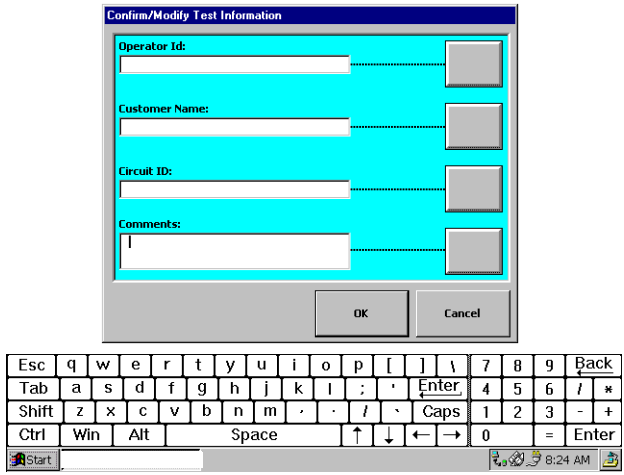
3. To change the default name, press the **Key-in a File Name** button, and enter a new name using the popup keypad.

4. Press the **N1640A-N1645A** button to indicate that you want to save the file in the SONET/SDH Line Interface module, or press the **PC Card** button to indicate that you want to save the file in the Flash Memory Card.

Note: *If the PC Card button is grayed-out, there is no flash memory card installed on your tester.*

5. Press the **Save** button to save the file, or press the **Cancel** button to avoid saving a file and return to the previous screen.

6. When the following screen appears, press the button for each field and enter the appropriate information. This information appears on the report file.



- The *Operator ID* and *Customer Name* are saved on the Service Advisor. This allows the information to be available to use with other test modules.

- The *Circuit ID* and *Comments* are saved on the test module because they are module-specific.

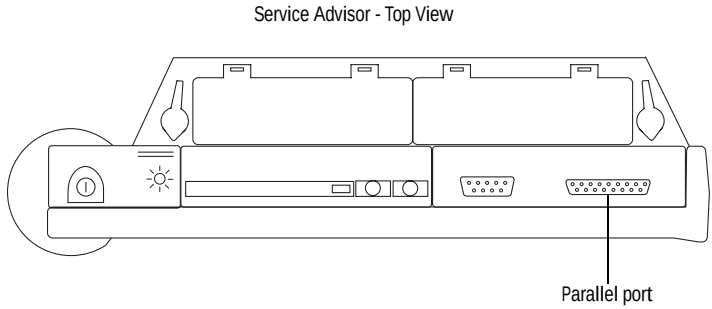
7. Press **OK** to save the information and send the report to the printer.

Printing Results

You can print the currently displayed screen, or a report that contains the information from the current screen when you have an HP LaserJet™ printer connected to your Service Advisor.

To connect a printer to the Service Advisor, follow these steps:

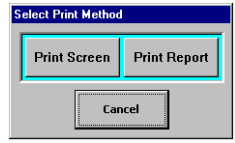
1. On top of the Service Advisor, open the panel that protects the serial and parallel ports.



2. Install a DB-25 cable between the parallel port on the Service Advisor and your printer.

Print Screen Option

1. Display the desired screen.
2. Press the **File** toolbar button and select the **Print** option.
3. When the Select Print Method popup appears, press the **Print Screen** button.



4. The screen, as it appears on your tester, is sent to the connected printer.

Print ASCII Report Option

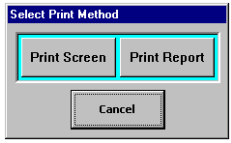
Depending on the configured Setup settings (see *Running a SONET/SDH Test*, page 2–16) you can print a report that contains ATM and SONET information, or just SONET information.

If you have selected the Clear Channel BERT option (see *Using the Clear-Channel BERT Button*, page 2–27), the SONET/SDH information appears in the printed report; otherwise you receive the full report with both the ATM and SONET/SDH information.

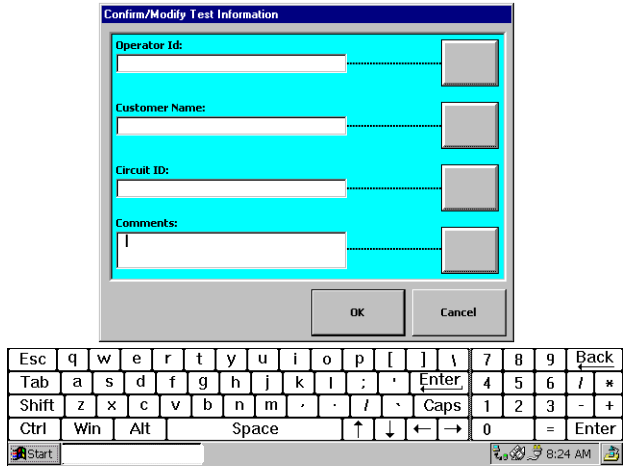
See the sample SONET/SDH report starting on page 1–27. This information prints every time you select the Print Report option. The ATM information (starting on page 1–22) prints if the Clear Channel BERT option is *not* selected.

To print a report, complete these steps.

1. Display the desired screen.
2. Press the **File** toolbar button and select the **Print** option.
3. When the Select Print Method popup appears, press the **Print Report** button.



4. When the following screen appears, press the button for each field and enter the appropriate information. This information appears on the report file.



   - The *Operator ID* and *Customer Name* are saved on the Service Advisor. This allows the information to be available to use with other test modules.
   - The *Circuit ID* and *Comments* are saved on the test module because they are module-specific.

5. Press **OK** to save the information and send the report to the printer.

Sample ATM Report Information

---N1640A/N1645A SUMMARY REPORT ATM/SONET Full Report Module Slot:A
Date:09-08-1999 Time:12:15:14 Elapsed Test Time: 00:02:03
Test Status: Stopped File Name: N1640A_FULL2.txt

---TEST INFORMATION----------
Customer Name: XYZ COMPANY Circuit ID: C1256GH875
Operator ID: John
Comments: ATM CIRCUIT QUALIFICATION

---ATM RESULTS ----------

---VP / VC Scan ----------

Scan Channel Count ----------4

Channel	Bandwidth	Channel	Bandwidth
01 / 0001	70	03 / 0001	15
02 / 0001	15	01 / 0004	0

--- ALARMS ----------

Alarm	Status	Sec	Sec Ago
LOCS ----------	History	2	48
SCNR ----------	Current	1	0
LOP ----------	Current	5	0
F4 AIS ----------	Off	0	0
F4 RDI ----------	Off	0	0
F5 AIS ----------	Off	0	0
F5 RDI ----------	Off	0	0

--- ERROR RESULTS ----------

ERROR COUNTS	Error Count	Errored Secs (ES)	Severely ES (SES)	Error Free Secs (EFS)	Sec Ago
HCS (Corrected) ----------	0	N/A	N/A	N/A	N/A
HCS (Uncorrected) ----------	6	N/A	N/A	N/A	N/A
HCS (Total) ----------	6	N/A	N/A	N/A	N/A
AAL-1 Cell Loss ----------	26356677	86	84	49	16
AAL-1 CRC/Parity ----------	148	39	2	96	17
AAL-1 Mis-insert ----------	4537957	84	84	51	16

ERROR RATES	Rate Current	Rate Average	ES%	EFS%
HCS (Corrected) ----------	N/A	N/A	N/A	N/A
HCS (Uncorrected) ----------	N/A	N/A	N/A	N/A
HCS (Total) ----------	N/A	1.01e-007	N/A	N/A
AAL-1 Cell Loss ----------	0.00e+000	9.04e-000	63.70	36.30
AAL-1 CRC/Parity ----------	0.00e+000	5.08e-005	N/A	71.11
AAL-1 Mis-insert ----------	0.00e+000	1.56e+000	62.22	37.78

Sample ATM Report Information (*continued*)

```
---BERT ----------------------------------------------------------------------------------------------------------------------

Pattern Sync ----------------------  OFF
LOP (Pattern Loss) Seconds -------  5
LOP (Pattern Loss) Seconds Ago -    0

                                    Error       Errored     Severely    Error Free    Sec Ago
                                    Count       Secs (ES)   ES (SES)    Secs (EFS)
Error Counts ----------------------  24607       33          33          102           16

                                    Rate        Rate        ES%         EFS%
                                    Current     Average
Error Rates -----------------------  0.00e+000   7.88e-005   24.44       75.56

--- TOTAL CELL STREAM ------------------------------------------------------------------------------------------------------

Cell Count ----------                5.67e+007

Bandwidth           Current         Average         Maximum         Minimum
Percent -------------  100          99              99              98
Frequency ----------  149018474     148323803       148906819       147144960
Cells Per Second --  351458         349816          351194          353193

--- SELECTED CELL STREAM ---------------------------------------------------------------------------------------------------

Cell VPI/VCI -----   01 / 0001
Cell Count --------  1.70e+308

Bandwidth           Current         Average         Maximum         Minimum
Percent -------------  0            19              69              19
Frequency ----------  0            28326291        103591340       28326291
Cells Per Second --  0              66910           243829          66910

--- CELL INTERARRIVAL TIME -------------------------------------------------------------------------------------------------

                    Current         Maximum         Minimum         Typical
Interarrival Time-------N/A         N/A             2.21e+002       N/A

--- CELL TRANSFER DELAY ----------------------------------------------------------------------------------------------------

                    Current         Maximum         Minimum         Typical
Transfer Delay -------  N/A         N/A             2.21e+002       N/A

--- 1 PT CDV ---------------------------------------------------------------------------------------------------------------

Expected 1 pt CDV -- 100

Current Avg         Early           Late            Typical
                    (Peak)          (Peak)
                    N/A             N/A             N/A

---CELL CAPTURE RESULTS ------------------------------------------------------------------
--------------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------
---RX SETUP ------------------------------------------------------------------------------

Mode --------------------------------  All Cells
Range -------------------------------  VPI = All, VCI = All
```

Sample ATM Report Information (*continued*)

```
---CAPTURE CELLS ----------------------------------------------------------------------------------------------------------

Range Match ----------------------   On
Cell Count -----------------------   500

--- RX RESULTS -----------------------------------------------------------------------------------------------------------

Cell Number ----------------------   1
Cell Header ----------------------   00 10 00 10 XX
                                     VPI ---- 01      VCI ---- 0001   GFC ---- 0
                                     PT ---- 0        CLP ---- 0

Cell Payload ---------------------    Hexadecimal                    ASCII
                                      9D 86 B2 E8 51 8E 1A DB
                                      A1 26 39 2B 69 04 89 E4
                                      CB A5 46 20 6B 3E 85 78
                                      E0 ED BD 92 72 92 D0 91
                                      1C 99 B4 A4 44 02 67 F2
                                      AF D0 1F 1F BD BE 72 04

---ATM SETUP ---------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------------------------------
---GENERAL -----------------------------------------------------------------------------------

Interface ------------------------------   UNI
Delineation ----------------------------   HCS
Header Correction ----------------------   On
Cell Scramble --------------------------   On
Cell PRBS Invert -----------------------   Off
VP/VC Notation -------------------------   Hex
Bandwidth ------------------------------   Mbps

--- SETUP ----------------------------------------------------------------------------------------------------------------

Error Type -----------------------------   HCS Bit
Error Inject Rate ----------------------   Single
Error Inject ---------------------------   Off

Cell Timestamp -------------------------   Off
Expect 1-pt CDV PCR --------------------   100 %

Forefround OAM Alarms
Type -----------------------------------   End to End
F4 AIS ---------------------------------   Off
F4 RDI ---------------------------------   Off
F5 AIS ---------------------------------   Off
F5 RDI ---------------------------------   Off

Background OAM Alarms
Type -----------------------------------   End to End
F4 AIS ---------------------------------   Off
F4 RDI ---------------------------------   Off
F5 AIS ---------------------------------   Off
F5 RDI ---------------------------------   Off
```

Sample ATM Report Information (*continued*)

```
AAL1 Misinsert ---------- Off
     Periodic ---------- Off
     Single ---------- On
     Period ---------- 0.1
     All 1's ---------- On
     All 0's ---------- Off
     32-bit Pattern ---------- Off
     Pattern ---------- 12345678
ATM Cell BERT
     Pattern ---------- 2^15 - 1
     Current User Pattern ---------12345678
     User Pattern 1 ---------- 0
     User Pattern 2 ---------- 0
     User Pattern 3 ---------- 0
     User Pattern 4 ---------- 0
     User Pattern 5 ---------- 0

--- RECEIVE CHANNEL ----------------------------------------------------------------------------------------------------

AAL ---------- AAL1
VPI / VCI ---------- 01 / 0001
Cell Payload ---------- BERT

--- TRANSMIT CHANNEL ---------------------------------------------------------------------------------------------------

Froeground
     AAL ---------- AAL1
     GFC ---------- 0
     VPI / VCI ---------- 01 / 0001
     PT ---------- 0
     CLP ---------- 0
     Cell Payload ---------- ATM Cell BERT
     Service Type ---------- CBR
     Conformance (Leaky Bucket) Off
     Cell Interleaving ---------- Contin.
     Period ---------- 0.1 Secs

Background 1
     AAL ---------- AAL5
     GFC ---------- 0
     VPI / VCI ---------- 02 / 0001
     PT ---------- 0
     CLP ---------- 0
     Cell Payload ---------- All Zeros
     Pattern ---------- 12345678
     Service Type ---------- CBR

Background 2
     AAL ---------- AAL5
     GFC ---------- 0
     VPI / VCI ---------- 03 / 0001
     PT ---------- 0
     CLP ---------- 0
     Cell Payload ---------- All Zeros
     Pattern ---------- 12345678
     Service Type ---------- CBR
```

Sample ATM Report Information (*continued*)

```
Background 3
        AAL ---------------------------  AAL5
        GFC ---------------------------  0
        VPI / VCI ---------------------  04 / 0001
        PT ----------------------------  0
        CLP ---------------------------  0
        Cell Payload ------------------  All Zeros
        Pattern -----------------------  12345678
        Service Type ------------------  CBR

Background 4
        AAL ---------------------------  AAL5
        GFC ---------------------------  0
        VPI / VCI ---------------------  05 / 0001
        PT ----------------------------  0
        CLP ---------------------------  0
        Cell Payload ------------------  All Zeros
        Pattern -----------------------  12345678
        Service Type ------------------  CBR

Idle
        GFC ---------------------------  0
        PT ----------------------------  0
        CLP ---------------------------  0
        Pattern -----------------------  0

--- BANDWIDTH CONTROL ----------------------------------------------------------------------------------------

Channel              State          Bandwidth          PCR          SCR          MBS

Foreground ----------  On           104.9 Mbps         104.9 Mbps   15.0 Mbps    100 Cells
Idle ----------------                0.0 Mbps
Background 1 --------  On           15.0 Mbps
Background 2 -------   On           15.0 Mbps
Background 3 --------  On           15.0 Mbps
Background 4 --------  Off          0.0 Mbps
```

If you are running the ATM application, or the Clear Channel BERT option is *not* selected, the following SONET/SDH report information prints when you select the Print Report option.

Sample SONET/SDH Report

```
---N1640A/N1645A SUMMARY REPORT  ATM/SONET Full Report        Module Slot:A
 Date:09-08-1999 Time:12:15:14                          Elapsed Test Time: 00:00:03
 Test Status: Stopped                                   File Name: N1640A_FULL2.txt

---TEST INFORMATION-------------------------------------------------------------------------------
 Customer Name: XYZ COMPANY              Circuit ID: XYZ-001
 Operator ID: John
 Comments: ATM CIRCUIT QUALIFICATION

---SONET SETUP-----------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
---GENERAL---------------------------------------------------------------------------------------

Frame ---------------------------------- SONET
Line Rate ------------------------------ 155 Mbps
Clock ---------------------------------- Internal
Line Scramble -------------------------- On
Line PRBS Invert ----------------------- Off
Pointer Notation ----------------------- Hex
Mode ----------------------------------- Terminal

---SETUP-----------------------------------------------------------------------------------------

Laser ---------------------------------- On

Error Type ----------------------------- N/A
Error Injection Rate ------------------- N/A
Error Injection ------------------------ N/A

H Pointer Adjustment ------------------- Off
H Pointer Value ------------------------ 20A

LOS Alarm ------------------------------ Off
OOF Alarm ------------------------------ Off
LOF Alarm ------------------------------ Off
AIS-L [MS-AIS] Alarm ------------------- Off
RDI-L [MS-RDI] Alarm ------------------- Off
AIS-P [AU-AIS] Alarm ------------------- Off
RDI-P [AU-RDI] Alarm ------------------- Off
LOP-P Alarm ---------------------------- Off

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

Payload Type --------------------------BERT
      Pattern ------------------------ 2^15 - 1
      Current User Pattern ----------- 1234567
      User Pattern 1 ----------------- 0
      User Pattern 2 ----------------- 0
      User Pattern 3 ----------------- 0
      User Pattern 4 ----------------- 0
      User Pattern 5 ----------------- 0
```

Sample SONET/SDH Report (*continued*)

```
---SECTION [RS] OVERHEAD ------------------------------------------------------------------------------------------------------------

STS1-1  [STM0-1]
  A1 ----------  F6
  A2 ----------  28
  J0 ----------  01
  E1 ----------  00
  F1 ----------  00
  D1 ----------  00
  D2 ----------  00
  D3 ----------  00

STS1-2  [STM0-2]
  A1 ----------  F6
  A2 ----------  28
  Z0 ----------  02

STS1-3  [STM0-3]
  A1 ----------  F6
  A2 ----------  28
  Z0 ----------  03

TRANSMIT TRACE BUFFER (J0) -  Hexadecimal                ACSII
                              30 30 30 30 30 30 30 30    00000000
                              30 30 30 30 30 30 30 30    00000000

EXPECTED TRACE BUFFER (J0) -  Hexadecimal                ACSII
                              30 30 30 30 30 30 30 30    00000000
                              30 30 30 30 30 30 30 30    00000000

Buffer Enable ---------------------------------- Off
Buffer Sync Enable ----------------------------- Off

--- LINE [MS] OVERHEAD ----------------------------------------------------------------------------------------------------------------

STS1-1  [STM0-1]
  K1 ----------  00
  K2 ----------  00
  D4 ----------  01
  D7 ----------  00
  D8 ----------  00
  D9 ----------  00
  D10 ---------  00
  D11 ---------  00
  D12 ---------  00
  S1 ----------  00
  Z2 ----------  01
  E2 ----------  00

STS1-2  [STM0-2]
  Z1 ----------  00
  Z2 ----------  00

STS1-3  [STM0-3]
  Z1 ----------  00
  M1 ----------  00
```

Sample SONET/SDH Report (*continued*)

---PATH OVERHEAD ----------

J1 ---------- 00
KC ---------- 13
G1 ---------- 00
F2 ---------- 00
H4 ---------- 00
Z3 ---------- 00
Z4 ---------- 00
Z5 ---------- 00

TRANSMIT TRACE BUFFER (J1) -	Hexadecimal	ACSII
	30 30 30 30 30 30 30 30	00000000
	30 30 30 30 30 30 30 30	00000000
	30 30 30 30 30 30 30 30	00000000
	30 30 30 30 30 30 30 30	00000000
	30 30 30 30 30 30 30 30	00000000
	30 30 30 30 30 30 30 30	00000000
	30 30 30 30 30 30 30 30	00000000
	30 30 30 30 30 30 30 30	00000000

EXPECTED TRACE BUFFER (J1) -	Hexadecimal	ACSII
	30 30 30 30 30 30 30 30	00000000
	30 30 30 30 30 30 30 30	00000000
	30 30 30 30 30 30 30 30	00000000
	30 30 30 30 30 30 30 30	00000000
	30 30 30 30 30 30 30 30	00000000
	30 30 30 30 30 30 30 30	00000000
	30 30 30 30 30 30 30 30	00000000
	30 30 30 30 30 30 30 30	00000000

Buffer Enable ---------- Off
Buffer Sync Enable ---------- Off

--- SONET RESULTS ----------

---SIGNAL SUMMARY----------

Line (Mbps) ---------- 155
Frequency (Hz) ---------- 155539000

--- ALARMS ----------

Alarm	Status	Sec	Sec Ago
LOS (Signal Loss) ----------	History	1	48
OOF ----------	History	1	48
LOF (Frame Loss) ----------	History	1	48
AIS-L [MS-AIS] ----------	History	1	48
RDI-L [MS-RDI] ----------	Off	0	0
AIS-P [AU-AIS] ----------	History	1	48
RDI-P [AU-RDI] ----------	History	1	48
LOP-P (Pattern Loss) ----------	Off	0	0

Sample SONET/SDH Report (*continued*)

---ERROR RESULTS ----------

ERROR COUNTS	Error Count	Errored Secs (ES)	Severely ES (SES)	Error Free Secs (EFS)	Sec Ago
B1 (Section) ----------	9802	2	1	133	48
B2 (Line) ----------	42	2	1	133	48
B3 (Path) ----------	8	1	1	134	49
REI-L [MSREI] (Line) ----------	23	1	0	134	49
REI-P [PREI] (Path) ----------	2	1	1	134	48

ERROR RATES	Rate Current	Rate Average	ES%	EFS%
B1 (Section/RS) ----------	0.00e+000	3.90e-007	1.48	98.52
B2 (Line/MS) ----------	0.00e+000	1.67e-009	1.48	98.52
B3 (Path) ----------	0.00e+000	3.18e-010	0.74	99.26
REI-L [MSREI] (Line) ----------	0.00e+000	9.14e-010	0.74	99.26
REI-P [PREI] (Path) ----------	0.00e+000	7.95e-011	0.74	99.26

---BERT ----------

Pattern Sync ----------	OFF
LOP (Pattern Loss) Seconds -------	5
LOP (Pattern Loss) Seconds Ago -	5

	Error Count	Errored Secs (ES)	Severely ES (SES)	Error Free Secs (EFS)	Sec Ago
Error Counts ----------	0	0	0	0	0

	Rate Current	Rate Average	ES%	EFS%
Error Rates ----------	0.00e+000	0.00e+000	0.00	0.00

--- POINTER ----------

Pointer Value ----------	20A
Last PJ Direction ----------	0
Positive Event Count ----------	0
Negative Event Count ----------	0
Positive Event Sec ----------	0
Negative Event Sec ----------	0
New Data Flag Count ----------	0

--- APS BYTE VALUES ----------

K1 ----------	00
K2 ----------	00

--- APS MESSAGE DECODE ----------

Message ----------	No Request
Request ----------	Null
Bridge ----------	00
Architecture ----------	1+1 Future (000)

Sample SONET/SDH Report (*continued*)

```
---SECTION [RS] OVERHEAD ----------------------------------------------------------------------------------------------------

STS1-1 [STM0-1]                 STS1-2 [STM0-2]             STS1-3 [STM0-3]
A1 --- F6                       Z0 --- 02                   Z0 --- 03
A2 --- 28
J0 --- 01
E1 --- 00
F1 --- 00
D1 --- 00
D2 --- 00
D3 --- 00

TRACE BUFFER (J0) ALARMS
Mismatched ----------------------   Current
Unstable ------------------------   Off

TRACE BUFFER (J0) -------       Hexadecimal                 ACSII
                                01 01 01 01 01 01 01 01
                                01 01 01 01 01 01 01 01

---LINE [MS] OVERHEAD -------------------------------------------------------------------------------------------------------

BYTE VALUES
STS1-1 [STM0-1]                 STS1-2 [STM0-2]             STS1-3 [STM0-3]
H1 --- 62                       Z1 --- 00                   Z1 --- 00
H2 --- 0A                       Z2 --- 00                   M1 --- 00
K1 --- 00
K2 --- 00
D4 --- 00
D5 --- 00
D6 --- 00
D7 --- 00
D8 --- 00
D9 --- 00
D10 -- 00
D11 -- 00
D12 -- 00
S1 --- 00
M0 --- 00
E2 --- 00

--- PATH OVERHEAD ---------------------------------------------------------------------------------------------------------

BYTE VALUES
J1 --- 00
C2 --- 13
G1 --- 00
F2 --- 00
H4 --- 00
Z3 --- 00
Z4 --- 00
Z5 --- 00

TRACE BUFFER (J1) ALARMS
Mismatched ----------------------   Off
Unstable ------------------------   Off

TRACE BUFFER (J1) -------       Hexadecimal                 ACSII
                                00 00 00 00 00 00 00 00
                                00 00 00 00 00 00 00 00
--- END REPORT -- N1640A/N1645A SW REV:1.21 -- HW REV:1 -- SN: ------------------------------------------------------------
```

2

Configuring a SONET/SDH Test

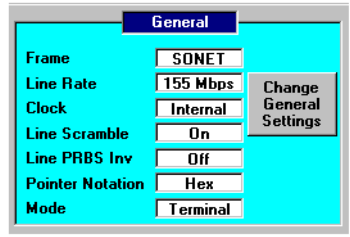
SONET and SDH Tests

You install the ATM Cell Processor Test module (N1640A) and the SONET/SDH Line Interface module (N1645A) in a Service Advisor platform to test SONET circuits. The supported test transmission formats and rates are as follows:

Transmission Standard	Frame Format	Transmission Rate	Payload Mapping
SONET	OC1	51.84 Mbps	OC1:STS-1
	OC3	155.52 Mbps	OC3:STS-3c
SDH	STM-0	51.84 Mbps	STM-0: VC-3, C3
	STM-1	155.52 Mbps	STM-1: VC-4, C4

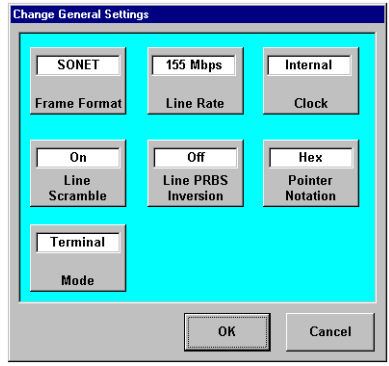
Configuring General SONET/SDH Settings

The General section of the SONET Setup screen lets you configure the settings for the outgoing SONET or SDH frames.



Note: *To transmit an optical signal, make sure the Laser LED is green. If not, press the Laser button on the Setup screen.*

1. Press the **Change General Settings** button on the Setup screen to display the Change General Settings screen.



2. Press each button until the desired setting appears in the button's display area. The following table describes each button.

SONET Setup General Settings

Button Name	Settings	Description
Frame Format	SONET SDH	Sets the framing format for the circuit you have the tester connected to. This format is used for transmitting and receiving data over the connected circuit.
Line Rate	155 Mbps 51 Mbps	Sets the line rate of the transmitted frames.
Clock	Internal Recovered	Sets the type of clocking you want to use. Internal indicates that the timing is based on the SONET/SDH module's internal oscillator. Recovered indicates timing is based on loop timing.
Line Scramble	ON off	Indicates whether SONET/SDH line scrambling is turned ON or off.
Line PRBS Inversion	ON off	Indicates whether the pseudorandom bit sequence (PRBS) insertion feature is ON or off.
Pointer Notation	Hexadecimal Decimal	Indicates the notation system used in the payload pointer; either hexadecimal (hex) or decimal.
Mode	Terminal Pass Thru	Indicates the Service Advisor's operating mode.

3. Press **OK** to activate your selections and return to the Setup screen. Press **Cancel** to exit the screen without changing anything.

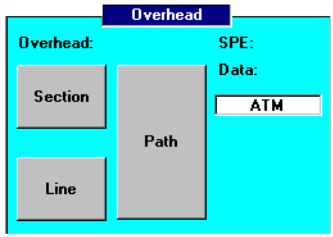
Configuring SONET/SDH Overhead Bytes

The Overhead section of the Setup screen lets you configure the overhead bytes in the outgoing SONET or SDH frames (indicated by the Frame Format in the General section of the screen).

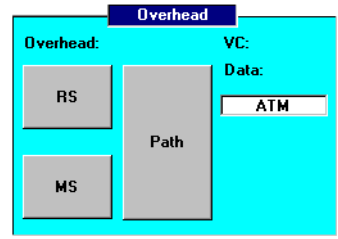
- When the Frame Format is set to SONET, you use the **Section**, **Line**, and **Path** buttons on the Setup screen to configure SONET overhead bytes.
- When the Frame Format is set to SDH, you use the **RS** (regenerator section), **MS** (multiplex section), and **Path** buttons on the Setup screen to configure SDH overhead bytes.

Configuring the SONET and SDH overhead bytes is similar. Use the following instructions for both frame formats. When the screens or instructions vary, remember to follow the instructions for the frame format set in the General section of the Setup screen.

SONET Overhead Buttons



SDH Overhead Buttons

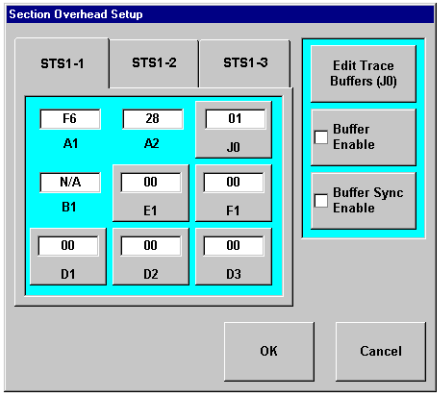


Section/RS Overhead

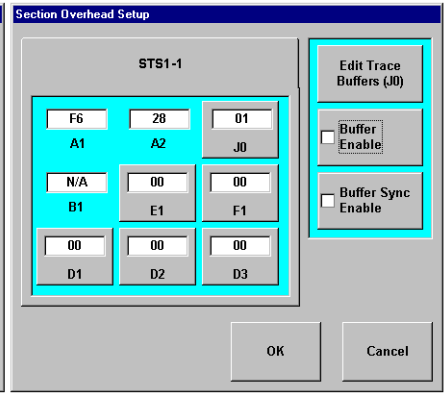
The **Section** button lets you configure SONET Section Overhead (SOH) bytes. The **RS** button lets you configure SDH Regenerator Section Overhead (RSOH) bytes.

1. Press the **Section** or **RS** button in the Setup screen to display the Overhead Setup screen. Fixed overhead values are displayed, but are not buttons.

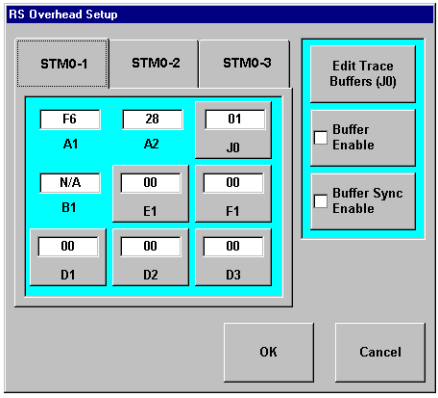
STS-3



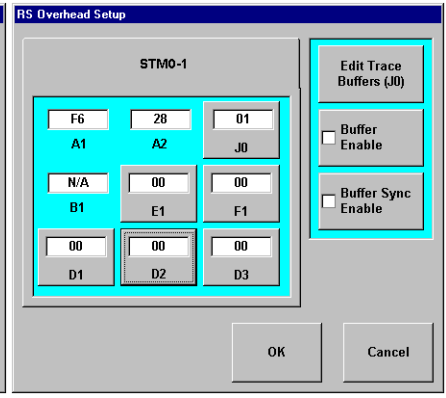
STS-1



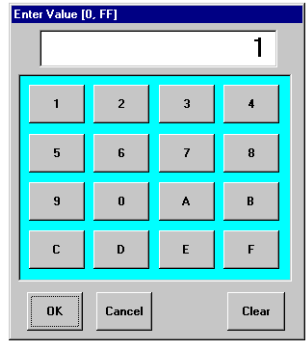
STM-1



STM-0



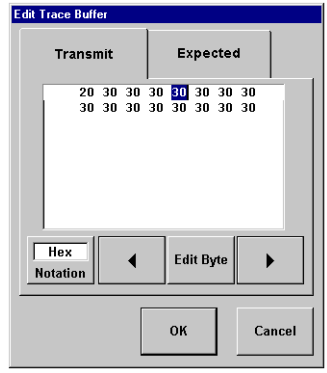
2. Press a byte button (**J0** through **Z0**) and use the displayed popup keypad to enter a value.



Following are descriptions of the SOH/RSOH bytes. The STS1/STM0 tabs enable you to set or view SOH/RSOH bytes for STS1/STM0 signals. (Bytes that don't apply appear grayed out.)

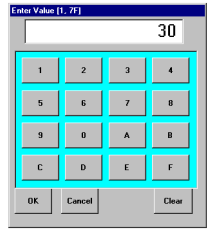
Byte	Function
A1, A2	Framing bits
J0	Section trace byte
B1	Parity byte, bit-interleaved parity-8 (BIP-8)
E1	Local orderwire channel
F1	Section user channel
D1, D2, D3	Section data communications channel (DCC)
Z0	Reserved for future use

3. Press the **Edit Trace Buffers** button to edit the J0 trace buffer.



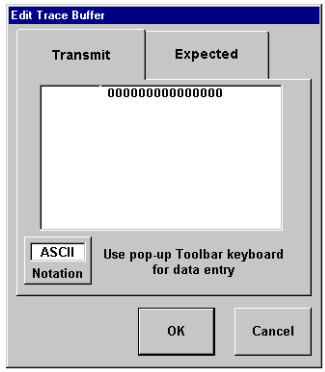
- Press the **Notation** button to select *Hex* or *ASCII*.

  To edit *Hex* Transmit or Expected bytes, use the ◀ and ▶ buttons to move to the byte you want to change. Then press the **Edit Byte** button. Enter the desired value using the popup keypad.



  Press **OK** to set the value and return to the Edit Trace Buffer screen, or press **Cancel** to return to the previous screen without saving the entered setting.

- To edit *ASCII* Transmit or Expected bytes, highlight the value you want to change and type in the new value using the displayed keypad.



  Press **OK** to activate your selections and return to the Section/RS Overhead Setup screen. Press **Cancel** to exit the screen without changing anything.

4. Press the **Buffer Enable** button to enable the J0 trace buffer.
5. Press the **Buffer Sync Enable** button to enable the J0 trace buffer to transmit a fixed Most Significant Bit (MSB) of the first byte in the section trace buffer.
6. Press **OK** to save the settings and return to the SONET/SDH Setup screen. Press **Cancel** to exit the screen (if you have made changes on the STS1 or STM0 tab screens, these changes are saved).

See *Section/RS Tab*, page 3–11 for information about viewing the SOH errors.

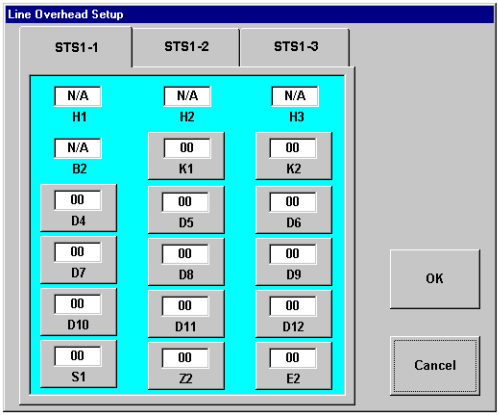
Line/MS Overhead

The **Line** button lets you configure SONET Line Overhead (LOH) bytes. The **MS** button lets you configure SDH Multiplex Section Overhead (MSOH) bytes (when the frame format is SDH).

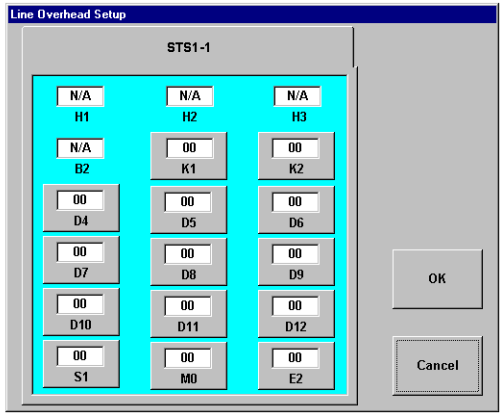
To configure LOH/MSOH bytes, complete the following steps.

1. Press the **Line** or **MS** button in the Setup screen to display the Overhead Setup screen.

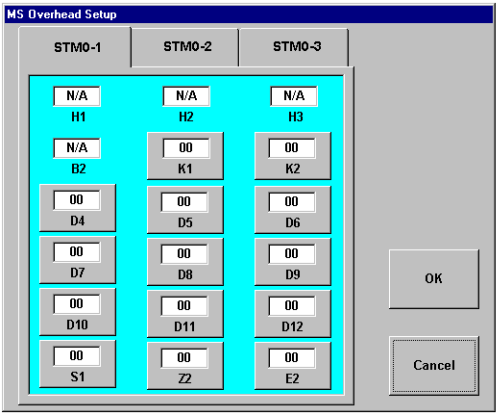
STS-3



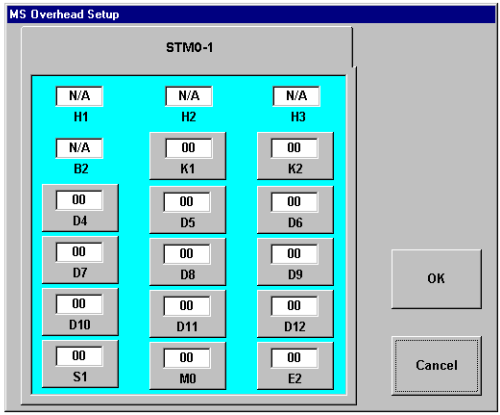
STS-1



STM-1



STM-0



2. Press a byte button (**K1** through **E2**) and use the displayed popup keypad to enter an overhead value.

   Following are descriptions of the line/MS overhead bytes. The STS1/STM0 tabs enable you to set or view LOH bytes for STS1/STM0 signals. (Bytes that don't apply appear grayed out.)

Byte	Function
H1, H2, H3	Payload pointer bytes
B2	Parity
K1, K2	APS and alarm information
D4–D12	Line data communications channel (DCC)
S1	Synchronization status
Z1, Z2	Reserved for future use
E2	Line orderwire
M0, M1	Line status

3. Press **OK** to activate your selections and return to the Setup screen. Press **Cancel** to exit the screen (if you have made changes on the STS1/STM0 tab screens, these changes are saved).

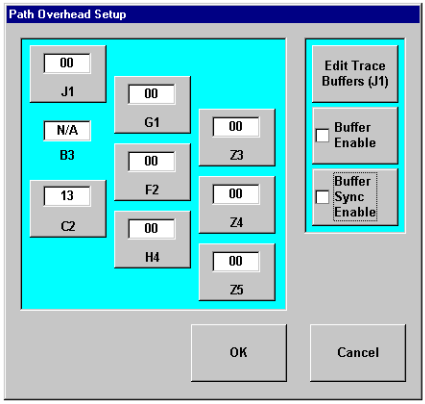
See *Line/MS Tab*, page 3–13 for information about viewing the LOH/MSOH errors.

Path Overhead

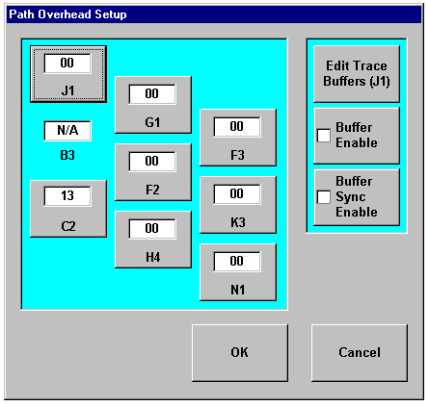
The Path Overhead screen provides access to the SONET path overhead (POH) bytes. To configure POH bytes, complete the following steps.

1. Press the **Path** button in the Setup screen to display the Path Overhead Setup screen.

SONET Path Overhead Setup

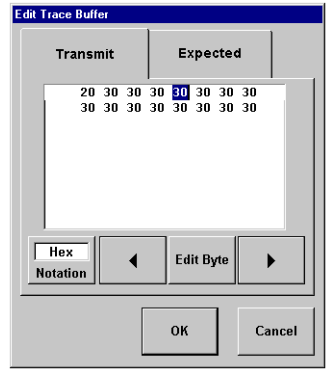


SDH Path Overhead Setup

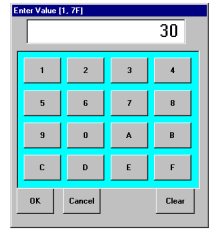


2. Press a byte button (**J1** to **Z5** or **N1**) and use the displayed popup keypad to enter the desired value. See *Path Overhead Bytes*, page 2–14 for a description of each POH byte.

3. Press the **Edit Trace Buffers** button to edit the J1 trace buffer.

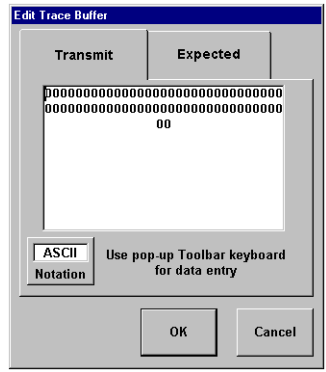


- Press the **Notation** button to select *Hex* or *ASCII*.
- To edit *Hex* Transmit or Expected bytes, use the ◀ and ▶ buttons to move to the byte you want to change. Then press the **Edit Byte** button. Enter the desired value using the popup keypad.



Press **OK** to set the value and return to the Edit Trace Buffer screen, or press **Cancel** to return to the previous screen without saving the entered setting.

- To edit *ASCII* Transmit or Expected bytes, highlight the value you want to change and type in the new value using the displayed keypad.



Press **OK** to activate your selections and return to the Path Overhead Setup screen. Press **Cancel** to exit the screen without changing anything.

4. Press the **Buffer Enable** button enable the J1 trace buffer.
5. Press the **Buffer Sync Enable** button to enable the J1 trace buffer to transmit a fixed Most Significant Bit (MSB) of the first byte in the section trace buffer.
6. Press **OK** to save the settings and return to the SONET Setup screen. Press **Cancel** to exit the screen (if you have made changes using the **Edit Trace Buffers** button, these changes are saved).

See *Path Tab*, page 3–14 for information about viewing the POH errors.

Path Overhead Bytes

Following are descriptions of the POH bytes. (Bytes that don't apply appear grayed out.)

Path Overhead (POH) Bytes

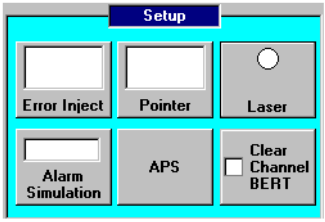
Byte	Function
J1	Path trace string, 62-bytes (path signal source)
B3	Parity for previous SPE

Path Overhead (POH) Bytes

Byte	Function	
C2	Payload type label	
	00	Unequipped
	01	Equipped, non-specific payload
	02	Floating VT type
	03	Locked VT type
	04	Asynchronous mapping for DS3
	05	Not used
	12	Asynchronous mapping for DS4NA
	13	Mapping for ATM
	14	Mapping for DQDB
	15	Asynchronous mapping for FDDI
G1	Path status and performance	
F2	Path user channel	
H4	VT multiframe phase indicator (STS-3 only)	
Z3, Z4	Reserved for future use	
Z5	Tandem connection error count and datalink	
K3	Higher order path automatic protection switching	
F3	Higher order path user channel	
N1	High order tandem connection monitoring	

Running a SONET/SDH Test

This section describes how to use the Setup buttons on the main Setup screen. You use the buttons in this section to control error-injection, make a pointer adjustment, configure the alarm simulation feature and automatic protection switching testing, and select a BERT pattern if you want to run a bit-error rate test.



Using the Laser Button

To transmit an optical signal, be sure to press the **Laser** button in the SONET/SDH Setup screen. The LED on the **Laser** button turns green to indicate that this function is ON.

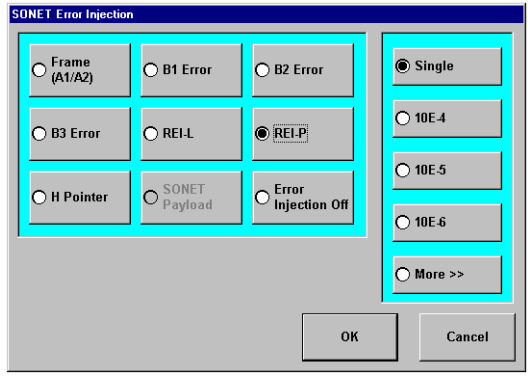
Using the SONET/SDH Error-injection Feature

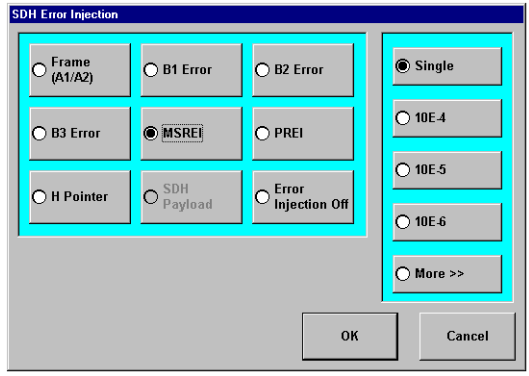
The SONET/SDH error-injection feature enables you to inject errors into the network in order to measure how network elements respond. Running an error-injection test simulates network responses to real errors.

Follow these steps to run an error-injection test.

Note: *To transmit an optical signal, make sure the Laser LED is green. If not, press the Laser button on the Setup screen.*

1. In the SONET/SDH Setup screen, press the **Error Inject** button to display the Error Injection screen.





2. Press one of the error-type buttons to select the type of error to inject into the signal.

   Use the error-rate buttons (on the right), displayed when you select an error type, to specify the rate at which to inject the selected

error(s). The error types are defined below. If the SONET and SDH button names are different, the SDH names are entered in square brackets ([ ]).

Error Types

Frame (A1/A2) – Generates frame errors by inverting the bits in the A1 and A2 overhead bytes. *Rates*: Continuous.

B1 Error – Generates section code violations by inverting the bits in the B1 byte. *Rates*: Single, Continuous.

B2 Error – Generates line code violations by inverting the bits in the B2 byte. *Rates*: Single, Continuous.

B3 Error – Generates path code violations by inverting the bits in the B3 byte. *Rates*: Single, Continuous.

REI-L [MSREI] – Generates a remote error indication-line. OC-1/STM-0 transmits the REI-L in bits 2 – 8 of the M0 byte. OC-3/STM-1 transmits the REI-L in the M1 byte. *Rates*: Single, 10E-4 through 10E-8.

REI-P [PREI] – Generates a remote error indication-path in the G1 byte. *Rates*: Single, 10E-4 through 10E-8.

H Pointer – Generates a pointer error and subsequent loss of pointer (LOP-P) alarm by transmitting an out-of-range pointer value in the H1–H3 overhead bytes. *Rates*: Continuous.

SONET [SDH] Payload – Generates bit errors in the SONET/SDH payload. *Rates*: Single, 10E-3, 10E-6.

Error Injection Off – When selected, turns off the error-injection feature.

Error Rates

Single – A single error of the selected type is transmitted each time you press the **Error Inject** button.

Continuous – A steady error rate of the selected type begins when you press the **Error Inject** button, and stops when you press the **Error Inject** button again.

10E-*n* – Inject errors at the selected rate (where *n* is 3–8) when you press the **Error Inject** button. For example, 10E-3 is 1×10^{-3}, or 1 error every 1,000 bits.

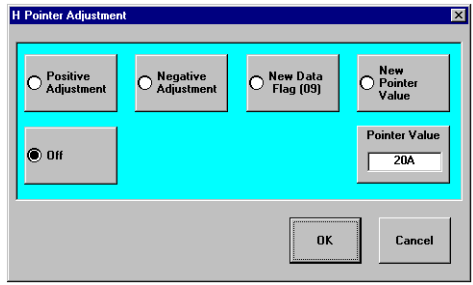
3. Press **OK** to save the setting and return to the Setup screen. **Cancel** closes the screen without saving your selection.
4. Press the **Start** toolbar button to start a test. (The Start button turns green and displays the words “Test Running”.) Press the button again to stop the test.
5. Press the **Inject Error** toolbar button to transmit errors into the line.
6. Press the **Results** button to view test results (see *Results Summary Screen*, page 3–6).

Making a Pointer Adjustment

The SONET/SDH Pointer feature lets you increment and decrement the pointer value, or cause a new data flag (NDF) condition. Follow these steps to run pointer adjustment sequences.

Note: *To transmit an optical signal, make sure the LED on the Laser button is green. If not, press the Laser button.*

1. In the SONET/SDH Setup screen, press the **Pointer** button to display the H Pointer Adjustment screen.



2. Select the H1/H2 pointer sequence you want to run.

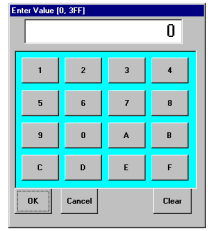
   Positive Adjustment – Causes a positive pointer adjustment by incrementing the H1/H2 pointer value.

   Negative Adjustment – Causes a negative pointer adjustment by decrementing the H1/H2 pointer value.

   New Data Flag – Sets the new data flag value.

   New Pointer Value – Assigns a new pointer value. Use the Pointer Value button to enter the new pointer value (see next item).

Pointer Value – Lets you enter a new pointer value. Press the **Pointer Value** button and use the displayed popup keypad to enter the value.



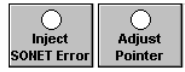
Press **OK** on the keypad to save the value you entered and return to the H Pointer Adjustment screen. The **Clear** button clears the displayed entry, and the **Cancel** button does not save you entry.

Off – Turns the pointer-adjustment feature off.

3. Press **OK** to save the setting and return to the SONET/SDH Setup screen. **Cancel** closes the screen without saving your selection.

4. Press the **Adjust Pointer** toolbar button to cause the selected pointer adjustment to take effect.

   When you make a pointer adjustment using the **Pointer** button, the **Inject Error** button becomes the **Adjust Pointer** button.



5. Press the **Results** button to view test results (see *Pointer Adjustment Results*, page 3–15).

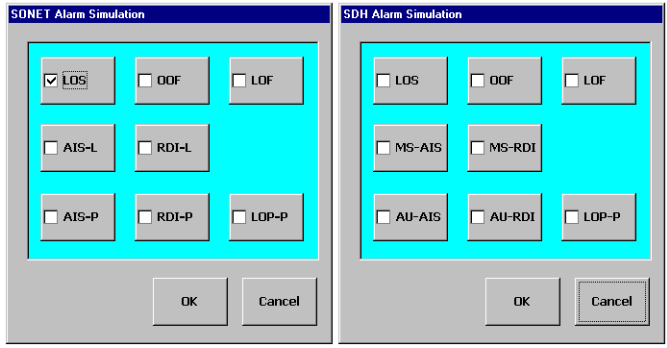
Using the SONET/SDH Alarm Simulation Feature

The Alarm Simulation buttons lets you select and inject SONET/SDH alarms into the network, and measure whether network devices respond correctly to the alarms.

To run an alarm-simulation test, perform these steps from the SONET/SDH Setup screen.

Note: *To transmit an optical signal, make sure the LED on the Laser button is green. If not, press the Laser button.*

1. Press the **Alarm Simulation** button to display the SONET/SDH Alarm Setup screen.



2. Press the desired alarm button. See *SONET/SDH Alarms*, page 2–21 for a description of each type of alarm.

3. Press **OK** to save the setting and return to the SONET Setup screen. **Cancel** closes the screen without saving your selection.

   When you return to the setup screen, you'll notice that the **Alarm Simulation** button will indicate that this feature is "Active" or "Multiple" (means you have selected more than one type of alarm). Alarm simulation becomes active immediately after you select the alarm-type and press **OK** on the SONET/SDH Alarm Simulation screen.

4. Observe the SONET Results Summary screen or the SONET Alarms screen for test results (see *Alarm Results*, page 3–9).

SONET/SDH Alarms

The following table describes the SONET and SDH alarm settings. When the names are different, the SDH alarm names appear in square brackets ([ ]).

Alarm	Description
LOS	Loss of signal. Declared when between 10 and 100 µs of all-zeros pattern is detected. Nominal detect time is 55 µs. The alarm is cleared when a non-zero pulse is detected.

Alarm	Description
OOF	Out-of-frame. Declared when four consecutive error framing patterns are detected.
LOF	Loss of frame synchronization. Declared when an OOF condition is detected for 24 consecutive frames (3 ms). The alarm is cleared after 24 consecutive frames of correct framing patterns.
AIS-L [MS-AIS]	Alarm indication signal-line. Declared when five consecutive K2 bytes are received containing XXXXX111. The alarm is cleared when five consecutive K2 bytes do not contain XXXXX111.
RDI-L [MS-RDI]	Remote defect indication-line. Declared when five consecutive K2 bytes are received containing XXXXX110. The alarm is cleared when five consecutive K2 bytes do not contain XXXXX110.
AIS-P [AU-AIS]	Alarm indication signal-path. Declared when all-ones is received in H1/H2 for three consecutive frames. This alarm is cleared when all-ones is not received in H1/H2 for three consecutive frames.
RDI-P [AU-RDI]	Remote defect indication-path. Declared when ten consecutive frames are received containing bit 5 of the G1 byte set to 1. The alarm is cleared when ten consecutive frames are received containing bit 5 of the G1 byte set to 0.
LOP-P	Loss of pointer. Declared when eight consecutive frames are received that do not meet at least one of the following conditions: • Normal flag (0110) and valid value (0–782). • New data flag (1001) and valid value (0–782). • Normal flag and valid value in STS-1 #1, and concatenation indicator (1001XX1111111111) in the other STS-1s. LOP-P is not declared during AIS-P. The alarm is cleared when a consistent, valid pointer is received for three consecutive frames.

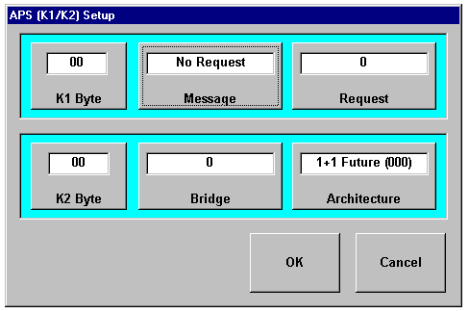
Configuring Automatic Protection Switching Testing

The SONET/SDH automatic protection switching (APS) feature tests the ability of network devices to switch traffic onto another line when problems occur (such as error rates that fall above or below quality-of-service requirements), or during heavy network congestion.

Follow these steps to perform SONET/SDH APS testing.

Note: *To transmit an optical signal, make sure the LED on the Laser button is green. If not, press the Laser button.*

1. Press the **APS** button in the SONET/SDH Setup screen. The APS (K1/K2) Setup screen is displayed.



2. Press the APS buttons to set the APS message type and request channel, the APS bridge channel, the architecture, and the mode. Use the following table to determine which buttons to press.

APS Button	Description
K1 Byte	Sets the K1 byte directly. When the keypad popup screen appears, enter a field value. See *Configuring the APS K1 Byte*, page 2–25 for more information. **Note:** *The hexadecimal value you specify is transmitted as binary in the K1/K2 bytes.*
Message	Selects the APS switching mode at the far-end.

APS Button	Description
Request	Specifies the channel (0-15) to which the configured Message (configured with the Message button) applies.
K2 Byte	Sets the K2 byte directly. When the keypad popup screen appears, specify a field value. See *Configuring the APS K2 Byte*, page 2–26 for more information. **Note:** *The hexadecimal value you specify is transmitted as binary in the K1/K2 bytes.*
Bridge	Sets the channel (1-15) currently bridged onto the protection line at the far-end.
Architecture	Selects the architecture type at the far-end.

3. Press **OK** to save the setting and return to the SONET/SDH Setup screen. **Cancel** closes the screen without saving your selection.

   When you return to the setup screen, the selected APS settings become active.

4. Use the APS results screen to view test results (see *APS Measurements*, page 3–16).

Configuring the APS K1 Byte

The APS K1 byte sets the APS message type and request channel.

Note: *The K1/K2 bytes are transmitted as binary notation; therefore, you must determine the appropriate values.*

Bits 1–4 define the APS message type, as follows:

APS Message	Binary Bit Sequence
No Request	0000
Do Not Revert	0001
Reverse Request	0010
Not Used	0011
Exercise	0110
Not Used	0101
Wait-to-Restore	0110
Not Used	0111
Manual Switch	1000
Not Used	1001
SD-Low Priority	1010
SD-High Priority	1011
SF-Low Priority	1100
SF-High Priority	1101
Forced Switch	1110
Lockout Protect	1111

Bits 5–8 define the request channel that the message applies to (0–15).

Configuring the APS K2 Byte

The APS K2 byte sets the APS bridge channel, the architecture, and mode.

Bits 1–4 define the bridge channel (0–15).

Note: *During automatic protection switching, traffic on the request channel is routed onto the bridge channel.*

Bit 5–8 defines the APS architecture: **0** for 1+1, **1** for 1:n. and the APS mode, as follows:

APS Mode	K2 Bits 6–8 Binary Setting
Future	000 – 011
Unidirection	100
Bidirection	101
LFERF Alarm	110
LAIS Alarm	111

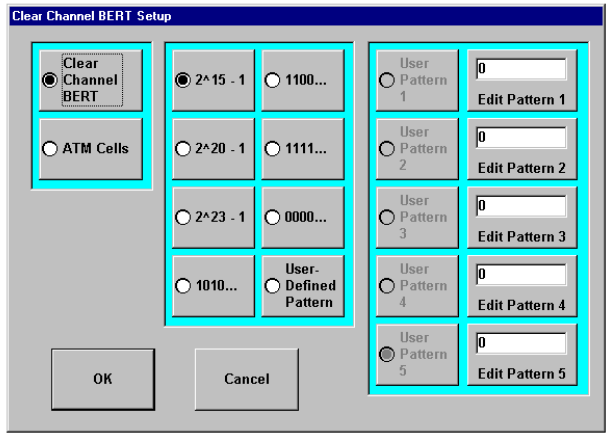
Using the Clear-Channel BERT Button

This section provides instructions for setting up and running a clear-channel Bit Error Ratio Test (BERT). In a bit-error ratio test (BERT), a test pattern is transmitted in the SONET/SDH payload. The received pattern is compared to the transmit pattern, and any differences are considered errors.

Follow these steps to run a clear-channel BERT.

Note: *To transmit an optical signal, be sure to select Laser in the setup screen.*

1. Press the **Clear Channel BERT** button to display the BERT Setup screen.



2. Specify whether to insert the BERT data pattern in the SONET/SDH payload (**Clear Channel BERT**) or the ATM cell payload (**ATM Cells**).

Note: *If you specify ATM, you must use the ATM GUI to select the data pattern.*

3. Select a BERT data pattern.

   2^15-1, 2^20-1, 2^23-1 – PRBSs (2^15-1 is a 2^{15}–1 PRBS).

   1010 – A repeating pattern of alternating ones and zeros (1010...).

   1100 – Repeating pattern of two ones alternating with two zeros (1100...).

   All 1s – A continuous all-ones pattern (1111...).

   All 0s – A continuous all-zeros pattern (0000...).

   User Defined Pattern – Lets you define a BERT pattern. Press a **User Pattern (1 - 5)** button, and use the corresponding **Edit Pattern** button to specify the pattern. Use the popup keypad to enter the pattern. Press **OK** to save the pattern and return to the Clear Channel BERT Setup screen.

   The **Cancel** button on the popup keypad cancels your entry and returns you to the previous screen; the **Clear** button clears the displayed value on the popup keypad.

4. Press **OK** to activate your selections, or press **Cancel** to exit the screen without changing anything.

Note: *If you entered a User Pattern on the popup keypad, and pressed OK to save your entry, the modified User Pattern is saved even though you press Cancel on the Clear Channel BERT Setup screen.*

5. Press the **Start** toolbar button to start the BERT.

6. Use the **BERT** results screen to view test results (see *Viewing BERT Results*, page 3–24).

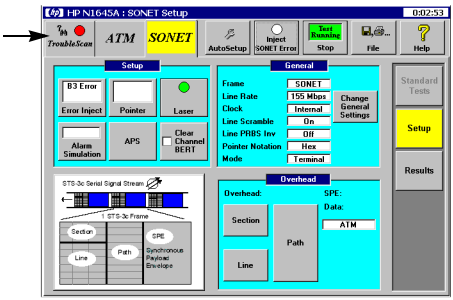
3

Viewing Test Results

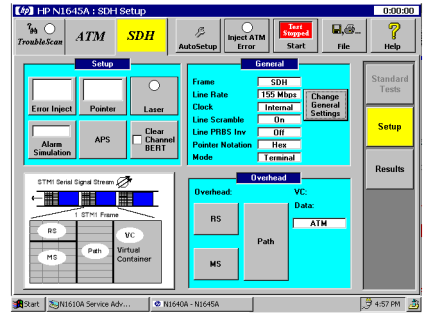
Viewing Results

After configuring and running SONET/SDH tests, you can view results using several methods. When an error or alarm occurs, the LED on the **TroubleScan** button turns red.

SONET



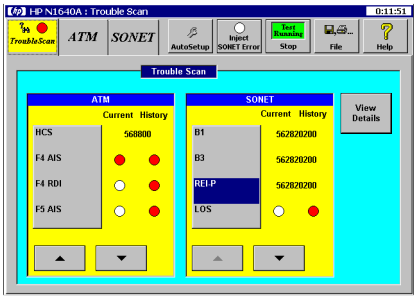
SDH



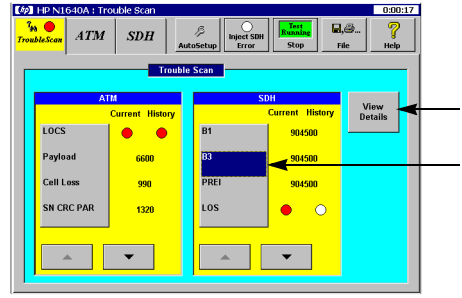
Using the TroubleScan Button

To view error and alarm information, you can press the **TroubleScan** button and view Current and History LEDS, and error counts associated with the different alarm and error types (see *Performing a Trouble Scan*, page 1–15).

SONET



SDH

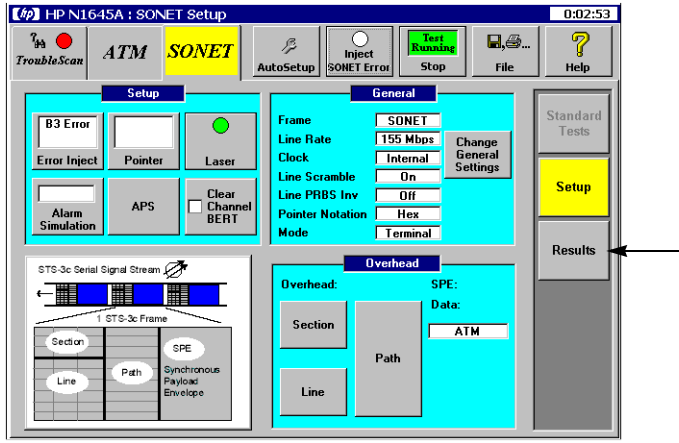


To view more detailed information about a listed alarm or error, you can press an error-type (such as B3 above) and then the **View Details** button. The associated results screen appears. These are the same results screens

you can access when you press the **Results** button on the SONET/SDH Setup screen (see next section).

Using the Results Button

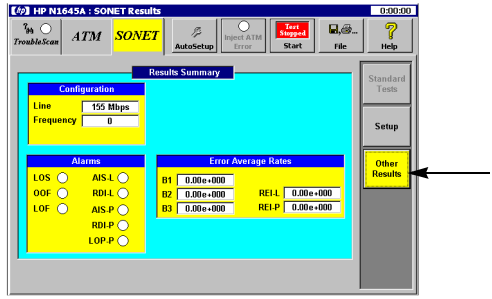
Another way to view errors and alarms is to use the **Results** button on the SONET/SDH Setup screen.



The first screen you see is the Results Summary screen (see *Results Summary Screen*, page 3–6), which provides a summary of the current test results. (You may see one of the other results screens if you were using the TroubleScan feature, or looking at other test results after running a previous test. The application automatically returns to the previously displayed results screen when you press the **Results** button, or to the Results Summary screen if it's the first time you are accessing test results.)

Notice the **Results** button on the right side becomes an **Other Results** button. You use this button to move between results screens. For example, if you are on the Results Summary screen and you want to see the Error results screen, press the **Other Results** button to go to the

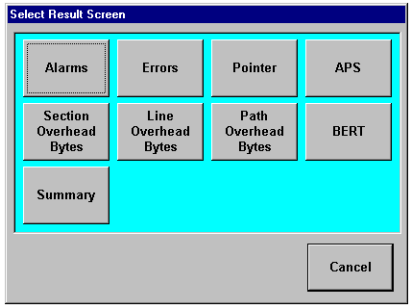
Select Results Screen (page 3–4) and then press the **Errors** button to access the Errors screen (page 3–10).



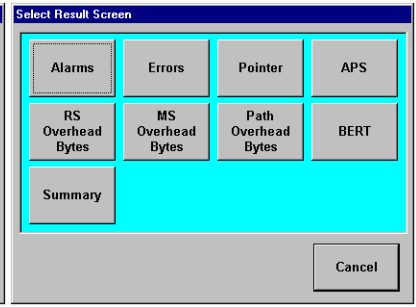
Using the Other Results Button

The **Other Results** menu button lets you access a screen that provides buttons to view additional test results.

SONET



SDH



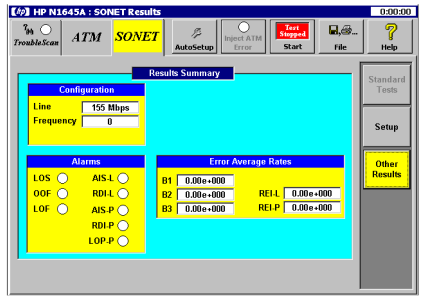
Button	Displays	Go to
Alarms	Alarms screen	Alarm Results 3–9
Errors	Errors screen	Error Summary 3–10
Pointers	Pointers screen	Pointer Adjustment Results 3–15
APS	APS (K1/K2) screen	APS Measurements 3–16

Button	Displays	Go to
Section [RS] Overhead Bytes	Section Overhead screen	Section [RS] Overhead Byte Results 3–19
Line [MS] Overhead Bytes	Line [MS] Overhead screen	Line [MS] Overhead Results 3–21
Path Overhead Bytes	Path Overhead screen	Path Overhead Results 3–22
BERT	BERT screen	Viewing BERT Results 3–24
Summary	Results Summary screen	Results Summary Screen 3–6

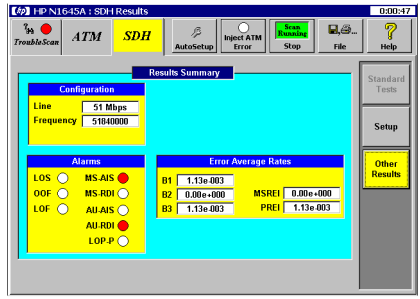
Results Summary Screen

The Results Summary screen displays a summary of the current test results, and provides access to additional test results. To access this screen, press the **Results** button on the SONET/SDH setup screen.

SONET



SDH



Configuration Summary

The Configuration section shows the current signal characteristics.

Line: Indicates the signal rate for the line connected to the SONET/SDH module.

Frequency: Shows the line frequency for the line connected to the SONET/SDH module.

Alarms Summary

The Alarms section shows whether there are alarms on the signal. The following chart describes each type of alarm.

Alarm	Description
LOS	Loss of signal. Declared when between 10 and 100 µs of all-zeros pattern is detected. Nominal detect time is 55 µs. The alarm is cleared when a non-zero pulse is detected.
OOF	Out-of-frame. Declared when four consecutive error framing patterns are detected.
LOF	Loss of frame synchronization. Declared when an OOF condition is detected for 24 consecutive frames (3 ms). The alarm is cleared after 24 consecutive frames of correct framing patterns.
AIS-L [MS-AIS]	Alarm indication signal-line. Declared when five consecutive K2 bytes are received containing XXXXX111. The alarm is cleared when five consecutive K2 bytes do not contain XXXXX111.
RDI-L [MS-RDI]	Remote defect indication-line. Declared when five consecutive K2 bytes are received containing XXXXX110. The alarm is cleared when five consecutive K2 bytes do not contain XXXXX110.
AIS-P [AU-AIS]	Alarm indication signal-path. Declared when all-ones is received in H1/H2 for three consecutive frames. This alarm is cleared when all-ones is not received in H1/H2 for three consecutive frames.
RDI-P [AU-RDI]	Remote defect indication-path. Declared when ten consecutive frames are received containing bit 5 of the G1 byte set to 1. The alarm is cleared when ten consecutive frames are received containing bit 5 of the G1 byte set to 0.

Alarm	Description
LOP-P	Loss of pointer. Declared when eight consecutive frames are received that do not meet at least one of the following conditions: • Normal flag (0110) and valid value (0–782). • New data flag (1001) and valid value (0–782). • Normal flag and valid value in STS-1 #1, and concatenation indicator (1001XX1111111111) in the other STS-1s. LOP-P is not declared during AIS-P. The alarm is cleared when a consistent, valid pointer is received for three consecutive frames.

Error Average Rates Summary

The Errors section shows whether there are errors in the signal. The following list describes each type of error.

B1 Error: Shows the average rate of B1 errors.

B2 Error: Shows the average rate of B2 errors.

B3 Error: Shows the average rate of B3 errors.

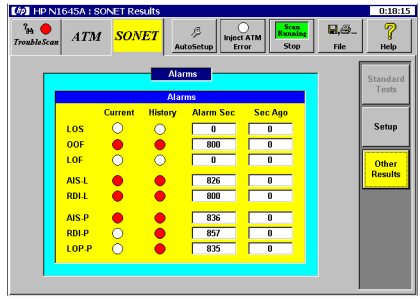
REI-L [MSREI]: Shows the line remote error indication for the M0 byte for STS-1 (STM-0) or M1 byte for STS-3 (STM-1).

REI-P [PREI]: Shows the path remote error indication for the G1 byte.

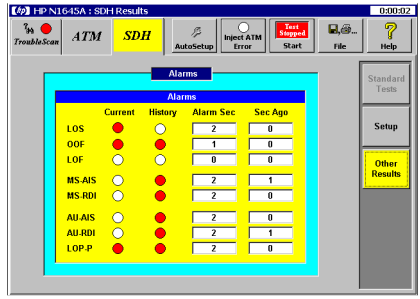
Alarm Results

The Alarms screen shows the number and types of alarms detected in the signal. To view the Alarms summary screen, press the **Results** button on the SONET/SDH Setup screen, and then press the **Alarms** button on the Results Summary screen.

SONET



SDH



Current alarms column: LED turns red to indicate an alarm was detected during the most recent test.

History column: LED turns red to indicate an alarm was detected during the previous test.

Alarm Sec column: Shows the number of seconds in which at least one alarm occurred.

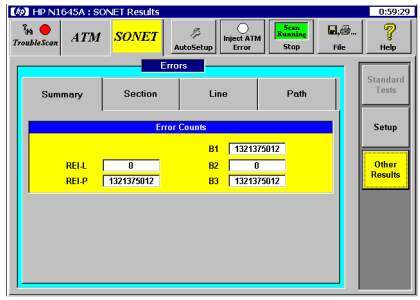
Sec Ago column: Shows the number of seconds since the alarm last occurred.

For a description of the alarms, see *Alarms Summary*, page 3–7.

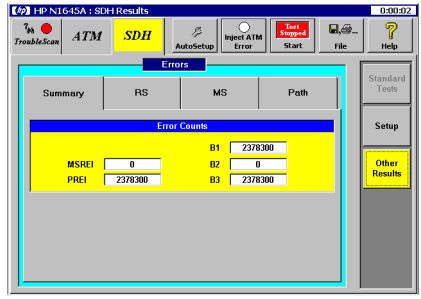
Error Summary

The Error summary screen shows the results of an error-injection test. To view the Errors summary screen, press the **Results** button on the SONET/SDH Setup screen, and then press the **Errors** button on the Results Summary screen.

SONET



SDH



Summary Tab

The Summary tab counts occurrences of section, line, and path errors.

REI-L [MSREI]: Shows the line remote error indication.

REI-P [PREI]: Shows the path remote error indication.

B1 Error: Shows the content of the B1 byte.

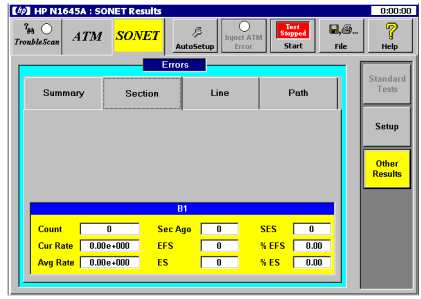
B2 Error: Shows the content of the B2 byte.

B3 Error: Shows the content of the B3 byte.

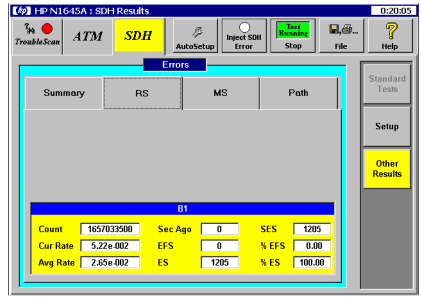
Section/RS Tab

The Section/RS tab presents information about B1 parity errors. Press the **Section [RS]** tab to display the following screen.

SONET



SDH



Section/RS, Line/MS, and Path Field Definitions

Count: The number of times the error occurred since the test began.

Cur Rate: The number of times the error occurred in the past 2.25 seconds.

Avg Rate: The average number of times the error occurred during the test.

Sec Ago: The number of seconds since the error last occurred.

EFS: Error free seconds. The number of seconds in which the error did not occur.

ES: Errored seconds. The number of seconds in which the error occurred one or more times.

SES: Severely errored seconds.

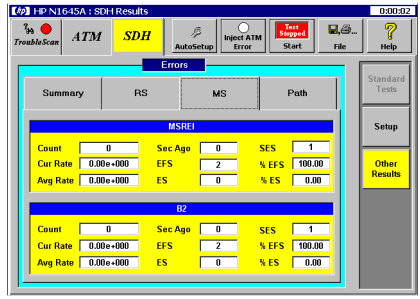
% EFS: Percent of error-free seconds. EFS expressed as a percentage of the total number of seconds since the beginning if the test.

% ES: Percent of errored seconds. ES expressed as a percentage of the total number of seconds since the beginning if the test.

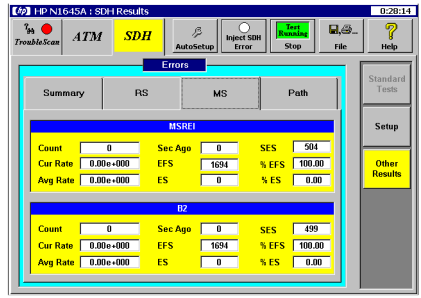
Line/MS Tab

The **Line [MS]** tab shows information about REI-L [MSREI] errors and B2 parity errors. Press the **Line [MS]** tab to display the following screen. See *Section/RS, Line/MS, and Path Field Definitions*, page 3–11 for definitions of the fields displayed on this screen.

SONET



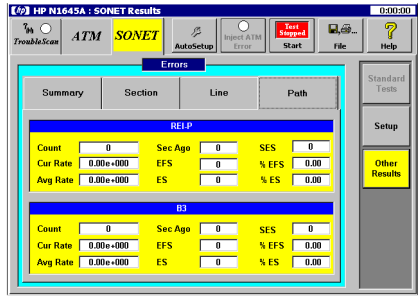
SDH



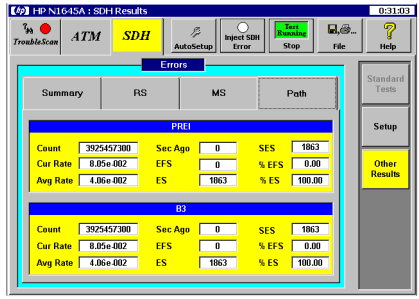
Path Tab

The Path tab presents information about REI-P [PREI] errors and B3 parity errors. Press the **Path** tab to display the following screen. See *Section/RS, Line/MS, and Path Field Definitions*, page 3–11 for definitions of the fields displayed on this screen.

SONET

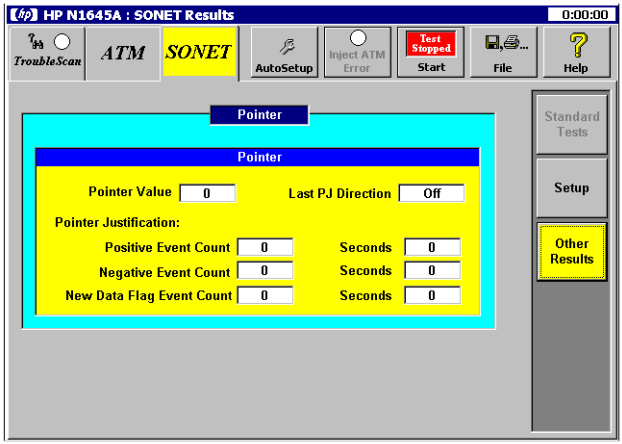


SDH



Pointer Adjustment Results

The Pointer screen shows you H1/H2 pointer values used in the current test. To view the Pointer summary screen, press the **Results** button on the SONET/SDH Setup screen, and then press the **Pointer** button on the Results Summary screen.



Pointer value: The decimal value of the H1/H2 pointer.

Last PJ Direction: Last pointer justification direction. The direction (positive or negative) of the previous pointer justification.

Positive Event Count: Number of positive pointer adjustments. ***Seconds****:* The number of seconds during which at least one positive pointer justification occurred.

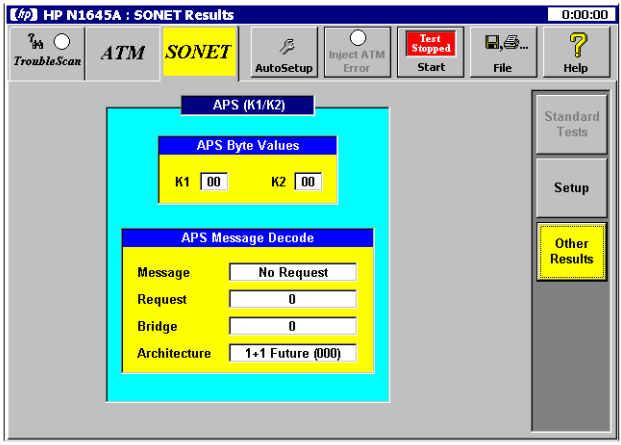
Negative Event Count: Number of negative pointer adjustments. ***Seconds****:* The number of seconds during which at least one negative pointer justification occurred.

New Data Flag Event Count: Number of NDFs set during a test. An NDF indicates an SPE alignment change. Bits 1–4 of the pointer carry the NDF, which permits an arbitrary change in the pointer value due to a change in the payload. ***Seconds****:* The number of seconds in which an NDF occurred.

APS Measurements

The APS screen shows you the results of an Automatic Protection Switching (APS) test.

To view the APS summary screen, press the **Results** button on the SONET/SDH Setup screen, and then press the **APS** button on the Results Summary screen.



APS KI/K2 Byte Values: The hexadecimal values of the K1 and K2 bytes.

Message: APS switching mode at the far-end: Indicates one of the modes listed in the tables on page 3–18. The mode is received on bits 6–8 of K2.

Request: APS requested channel: The number of the channel (0–15) to which the received condition message applies. This code is received in bits 5 through 8 of the K1 byte.

Bridge: APS bridged channel: The number of the channel (1–15) currently bridged onto the protection line at the far end. This code is bits 1 through 4 of the K2 byte.

Architecture: APS architecture type at the far-end. The result indicates either **1+1** (K2 bit 5 set to 0) or **1:n** (K2 bit 5 set to 1).

APS Signal State Code (K2 byte, bits 1 through 4)

APS Message	Binary Bit Sequence
No Request	0000
Do Not Revert	0001
Reverse Request	0010
Not Used	0011
Exercise	0110
Not Used	0101
Wait-to-Restore	0110
Not Used	0111
Manual Switch	1000
Not Used	1001
SD-Low Priority	1010
SD-High Priority	1011
SF-Low Priority	1100
SF-High Priority	1101
Forced Switch	1110
Lockout Protect	1111

APS Switching Mode Code (K2 byte, bits 6 through 8)

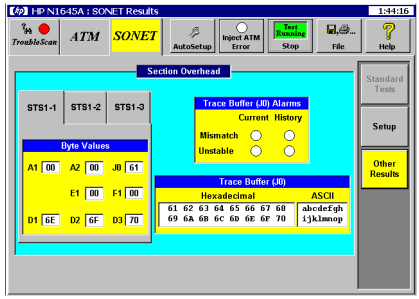
APS Mode	Binary Bit Sequence
Future	000 – 011
Unidirection	100
Bidirection	101
RDI-L	110
AIS-L	111

Section [RS] Overhead Byte Results

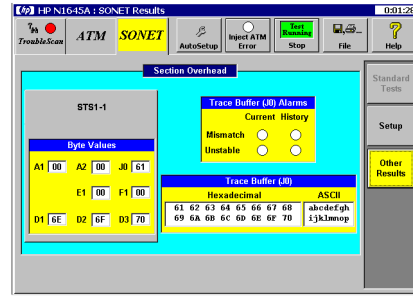
The Section/RS Overhead screen shows you the received SONET Section Overhead (SOH) bytes or the SDH Regenerator Section Overhead (RSOH) bytes.

To view the Section/RS Overhead screen, press the **Results** button on the SONET/SDH Setup screen, and then press the **Section [RS] Overhead Bytes** button on the Results Summary screen. See *Section/RS Overhead*, page 2–6 for more information about the Section/RS overhead bytes.

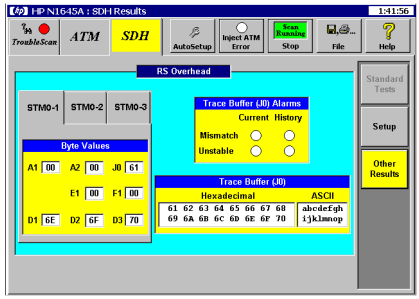
STS-3



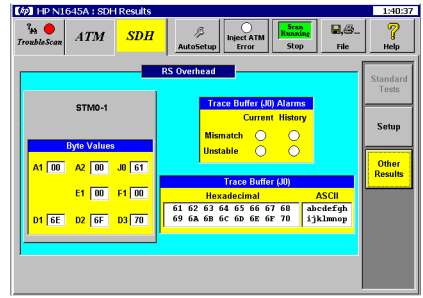
STS-1



STM-1



STM-0



STS1/STM0 Byte Values: Shows you the values received for the SOH [RSOH] bytes in the STM1/STM0 signals. See *Section/RS Overhead*, page 2–6 for a description of each overhead byte.

Trace Buffer (J0) Alarms: The Mismatch Current LED turns red when the J0 message received does not match the expected J0 message set with the **Edit Trace Buffer** button on the Section [RS] Overhead Setup screen (**see *Section/RS Overhead***, page 2–6).

The Unstable Current LED turns red when the received J0 message has not matched for eight consecutive messages.

The History LEDs turn red to indicate the condition occurred in the previous test.

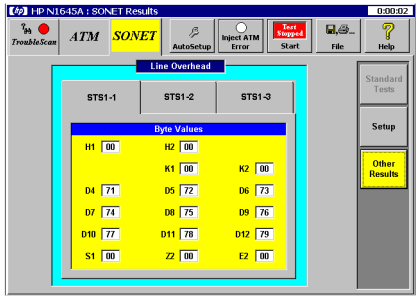
Trace Buffer (J0): Shows the HEX and ASCII J0 trace buffer.

Line [MS] Overhead Results

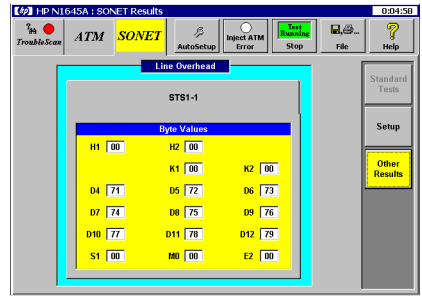
The Line/MS Overhead screen shows you the received LOH (MSOH) bytes. To view the Line/MS Overhead screen, press the **Results** button on the SONET/SDH Setup screen, and then press the **Line [MS] Overhead Bytes** button on the Results Summary screen.

Press the STS1/STM0 tabs to see the additional byte settings. See *Line/MS Overhead*, page 2–10 for a description of the LOH bytes.

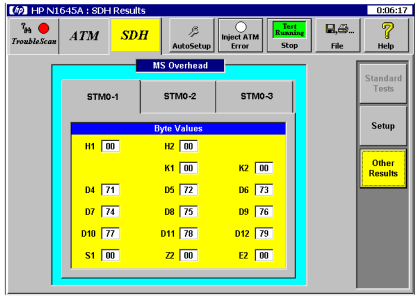
STS-3



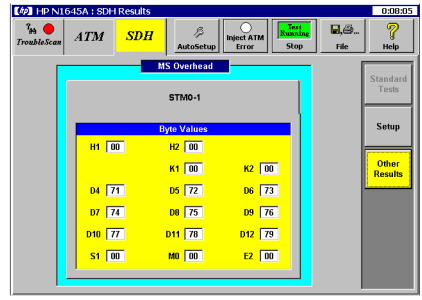
STS-1



STM-1



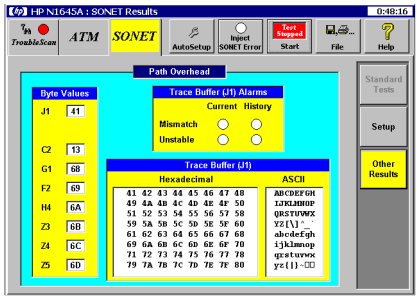
STM-0



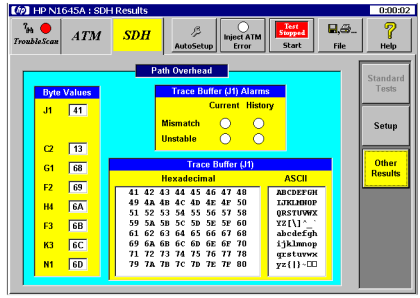
Path Overhead Results

The Path Overhead screen shows you the received POH bytes. To view the Path Overhead screen, press the **Results** button on the SONET/SDH Setup screen, and then press the **Path Overhead Bytes** button on the Results Summary screen. See *Path Overhead*, page 2–12 for a description of the POH bytes.

SONET



SDH



Byte Values: Shows the values received for the POH bytes. See *Path Overhead*, page 2–12 for a description of each overhead byte.

Trace Buffer (J1) Alarms: The Mismatch Current LED turns red when the J1 message received does not match the expected J1 message set with the **Edit Trace Buffer** button on the Path Overhead Setup screen (**see *Path Overhead***, page 2–12).

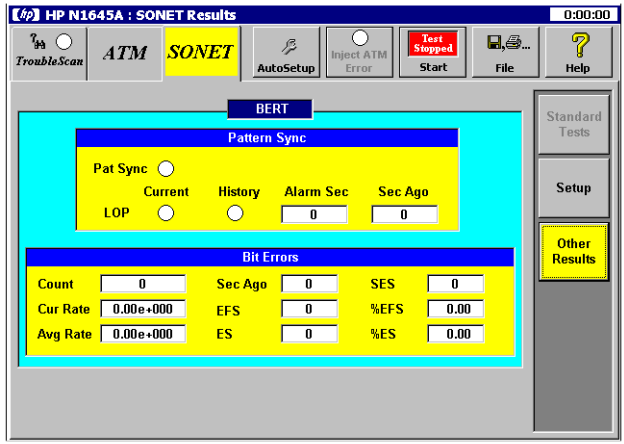
The Unstable Current LED turns red when the J1 message received has not matched for eight consecutive messages.

The History LEDs turn red to indicate the condition occurred in the previous test.

Trace Buffer (J1): Shows the HEX and ASCII J1 trace buffer

Viewing BERT Results

The BERT screen presents the current SONET/SDH Clear Channel BERT results. To view the BERT summary screen, press the **Results** button on the SONET/SDH Setup screen, and then press the **BERT** button on the Results Summary screen.



Pattern Synchronization

Pat Sync: This LED lights to indicate that the tester has synchronized on the receive signal pattern.

LOP: These LEDs indicate a loss of data pattern.

- **Current** LED turns red if an LOP error occurs.
- **History** LED turns red if there is a previous occurrence of an LOP error.
- **Alarm Sec** shows the number of seconds during which an LOP error occurred during a test.
- **Sec Ago** shows the number of seconds since the LOP error last occurred.

Bit Errors

These fields provide information about bit errors detected during the test.

Count: The number of bit errors that occurred since the test began.

Cur Rate: the number of bit errors in the past 2.25 seconds.

Avg Rate: The average number of bit errors that occurred during the test.

Sec Ago: The number of seconds since the last bit error.

EFS Error Free Seconds: The number of seconds without a bit error.

ES Errored Seconds: The number of seconds in which at least one bit error occurred.

SES Severely Errored Seconds: The number of seconds in which more than one bit error occurred.

% EFS: A percentage of the total number of seconds since the beginning of the test.

% ES: A percentage of the total number of seconds since the beginning of the test.

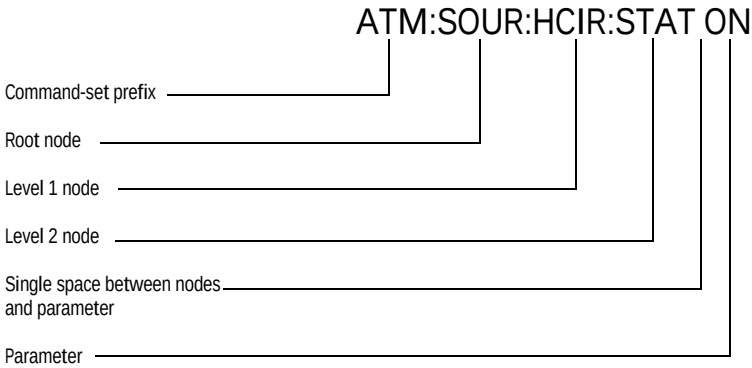
4

SONET/SDH SCPI Commands

SCPI Command Syntax

Standard Commands for Programmable Instruments (SCPI) is a command language used to control electronic test and measurement plug-in modules. SCPI commands are sent from a PC to a Service Advisor's test module to configure and perform tests, and gather data.

Each SCPI command consists of a command-set prefix (such as ATM), a root node, one or more lower level nodes, followed by an applicable parameter. (There is a space between the last level node and the parameter.)



The test module uses this structure to interpret the SCPI command. Generally, each root and lower level node is preceded by a colon (:), but the command-set prefix is not. This helps the instrument correctly parse the command's component parts.

For example, you can enter the following command:

ATM:SOUR:BGNDCH:OAM:TYP ENDT

The ATM prefix indicates the command is referencing the ATM or SONET command set, the root node is :SOURce, the level 1 node is :BGNDCH, the level 2 node is :OAM, the level 3 node is :TYP, and the associated parameter is ENDT.

Command-Set Prefix

The Tablet (the Service Advisor with a SONET and ATM module installed) uses the command-set prefix (ATM) to determine which plug-in module to access to initiate a SCPI command.

Root Nodes

The following root nodes are supported by the SONET/SDH test module.

Root Node	Description
:SELect	Lets you set up signal paths in the test module.
:SOURce	Lets you set the transmitter functions for the test module.
:INITiate	Starts running a test.
:FETCh	Lets you retrieve test results and configured settings from the SONET/SDH module output queue.
:ABORt	Stops a test and freezes the test results.

Long Form and Short Form

SCPI commands have both a long and short version; for example :SOURCE and :SOUR. The Service Advisor responds to either version, but will not respond to variations of either version, such as :SOURC.

The SCPI interface does not differentiate between upper-case and lower-case letters, but only the long *or* short form of a command is valid. Notice the examples in the following table.

Correct Entry	Incorrect Entry
:SOURCE	:SOURC
:SourCe	:sou
:sour	:Sourc

Using Parameters

Parameters provide a setting for the command (for example, ON or OFF). They follow the nodes of commands and are listed in angle brackets (< >).

Multiple command parameter are separated by a vertical bar (|). Specify only one parameter when you issue the command.

Separating Commands and Parameters

The following table lists the different separators you can use between commands and parameter.

To Separate...	Use...	Example
A command-set prefix from a root node	Colon (:)	
A root node from a lower level node	Colon (:)	
Multiple commands entered in a command string	Semicolon (;)	
A parameter from a command	Space	

Sending Multiple Commands in a Command String

You can send multiple SCPI commands in the same command string. The commands execute one at a time, in the order in which you have entered them. To separate the commands, use a semicolon (;). See the example in the table above.

Note: *You must always enter the ATM:*RST command by itself on a command-line.*

Programming a SONET/SDH Test

This section explains how to reset a Service Advisor before running a test, provides a guideline for entering commands in the proper sequence, and contains some sample tests you can enter to become familiar with programming tests.

Resetting Your Test Set

Before you program a SONET/SDH test, you should always enter the ATM:*RST command to reset the test module. When you issue this command, the SONET/SDH test module:

- sets all SONET/SDH test results and configuration values to their defined default setting. Default settings are listed in the individual command descriptions.
- clears the SCPI control registers in the test module
- stops a SONET/SDH test if one is currently running

When you become familiar with the SCPI default settings you will notice that, in many cases, you can enter just a few commands to run a test or make a measurement.

Note: *If you enter *RST without specifying a command-set prefix, you get an error message.*

Command Sequence

When programming a SONET/SDH test with SCPI commands, you always:

- reset the tester to default settings
- select the type of test you want to run
- configure general SONET/SDH parameters
- configure the parameters to control error-injection, make a pointer adjustment, configure the alarm simulation feature and automatic protection switching testing, and select a BERT pattern if you want to run a bit-error ration test
- initiate the test
- retrieve test results
- abort the test

Basic Test Commands

This section describes the SCPI commands you use with most tests. See *Command Sequence*, page 4–6 for more information about the sequencing of the SONET/SDH SCPI commands.

Root	Level 1
ATM:SELect	:TEST *<test sequence>*
ATM:INITiate	
ATM:ABORT	

:SELect:TEST <*test sequence*>

This command selects the type of test or test sequence you want the test module to run.

Test Sequence	Description
STANdard	Run the standard ATM and SONET/SDH tests.
CCAPture	Run the Cell capture test sequence.
ASETup	Run the Auto Setup test (see *Performing an Auto Setup*, page 1–14).
CSCAN	Run the Channel Scan test sequence.

Default: STANdard

:INITiate

This command starts the selected test, resets results counters on the test module to zero, and enables results processing. If you are running a STANdard, CCAPture, or CSCAN test, Trouble Scan is automatically started (see *Performing a Trouble Scan*, page 1–15).

Note: *You check the state of the test by entering the ATM:FETCH:TEST:STATE command.*

:ABORT

This command stops the current test and retains the current processed results.

General Configuration Commands

This section describes the :SOURce commands, which are used to configure the single foreground, the four background, and the single idle transmit channel circuits.

Root	Level 1	Level 2
ATM:SOURce	:AINJect <*action*>	
	:LASer <ON | OFF>	
	:FRAMe	:TYPe <SONet | SDH>
		:SCRamble <ON | OFF>
	:TRANsmit	:TIMing <INTernal | RECovered>
		:MAP <TERMinal | PTHRu>
	:SPE	:TYPe <ATM | BERT>
		:DATa <*BERT data type*>
		:PATTern <*BERT pattern*>
		:PINVert <ON | OFF>

:SOURce:AINJect <*action*>

This command causes a pointer adjustment or a misinserted cell injection into the circuit.

Action	Description
OFF	No action.
PoiNTeR	Pointer adjustment
MISinsert	Misinserted cell injection.

Default: OFF

:SOURce:LASer <ON | OFF>

This command turns the transmit laser ON and off. If you're testing an optical signal, turn the laser ON.

Default: OFF

:SOURce:FRAMe:TYPe <SONet | SDH>

This command indicates the frame format used for the SONET signal.

Default: SONet

:SOURce:FRAMe:SCRamble <ON | OFF>

This command turns the signal scrambler ON or off.

Default: OFF

:SOURce:TRANsmit:TIMing <INTernal | RECovered>

This command indicates the type of clocking you want to use.

Clock Type	Description
INTernal	Timing is based on the Service Advisor's internal oscillator.
RECovered	Timing is derived from the receive SONET signal.

Default: INTernal

:SOURce:TRANsmit:MAP <TERMinal | PTHRu>

This command indicates the type of transmit signal mapping you want to use.

Mapping	Description
TERMinal	Terminal mode (independent TX and RX)
PTHRu	Pass-thru mode where TX = RX

Default: TERMinal

:SOURce:SPE:TYPe <ATM | BERT>

This command sets the Synchronous Payload Envelope (SPE) type.

Notes: *You cannot set the SPE type to ATM when the error injection type is BPAY. You cannot set the SPE type to BERT when the error injection type is PAYL. See :SOURce:ERRor:TYPe <error type>, page 4–16 .*

Default: ATM

:SOURce:SPE:DATa <*data type*>

This command sets the Synchronous Payload Envelope clear channel BERT data type.

Data Type	Description
0'S	All zeros.
1'S	All ones.
32BIT	32-bit user-defined pattern specified in the :SOUR:SPE:PATT command (see next command).
2^15-1	Pseudorandom bit sequence (PRBS). For example, 2^15-1 is a 2^{15}–1 PRBS. This pattern is used to stress clock recovery circuits with a maximum of 14 consecutive zeros.
2^20-1	Standard stress pattern.
2^23-1	Standard stress pattern that is similar to customer data.
1010	Bit pattern of alternating ones and zeros, starting with one.
1100	Bit pattern of two ones, followed by two zeros.

Default: 2^15-1

:SOURce:SPE:PATTern <*data pattern*>

This command sets the Synchronous Payload Envelope clear channel BERT data pattern.

Parameter Range: 0 to 0xFFFFFFFF

Default: 0x01234567

:SOURce:SPE:PINVert <ON|OFF>

Sets the Synchronous Payload Envelope clear channel BERT PRBS Invert ON or off.

Default: OFF

Error Injection Commands

This section describes the :SOURce commands used to inject errors into the network in order to measure how network elements respond

Root	Level 1	Level 2
ATM:SOURce	:ERRor	:TYPe <*error type*>
		:RATe <*error rate*>
		:STATe <ON | OFF>

:SOURce:ERRor:TYPe *<error type>*

This command sets the type of error you want to inject into the network.

Error Type	Description
BYTe	HCS byte error
BIT	HCS bit error
PAYLoad	Payload error Use this error-type only when the SONET synchronous payload type envelope-type is set to ATM (see *:SOURce:SPE:TYPe <ATM | BERT>*, page 4–12).
MCELI	Misinserted cell error Use this error-type only when the foreground channel AAL type is set to AAL1 (see the :ATM:SOUR:FGNDCH:AAL command in the *ATM Cell Processor Test Module User's Manual*).
CLOSs	Cell loss error Use this error-type only when the foreground channel AAL type is set to AAL1 (see :ATM:SOUR:FGNDCH:AAL command in the *ATM Cell Processor Test Module User's Manual*).
SNCRcpar	Sequence number CRC (parity error) Use this error-type only when the foreground channel AAL type is set to AAL1 (see :ATM:SOUR:FGNDCH:AAL command in the *ATM Cell Processor Test Module User's Manual*).
A1A2	SONET frame error
B1	SONET BIP B1 error
B2	SONET BIP B2 error
B3	SONET BIP B3 error

Error Type	Description
REIL	SDH line remote event indicator error
REIP	SDH path remote event indicator error
BPAYload	SONET BERT payload error Use this error-type only when the SONET synchronous payload type envelope-type is set to BERT (see *:SOURce:SPE:TYPe <ATM | BERT>*, page 4–12).
HPoiNTeR	SONET H-pointer error

Default: BIT

Supported Error-rates for Each Type of Error

The following chart lists the error rates that you can use with each type of error. Use this chart when configuring the error-infection parameters. See *:SOURce:ERRor:RATe <error rate>*, page 4–18 for a description of the error rates.

Error Type	Valid Error Rates
BYTe	OFF, SINGle, 6CONsecutive, 7CONsecutive, 8CONsecutive, CONTinuous
BIT	OFF, SINGle, 6CONsecutive, 7CONsecutive, 8CONsecutive, CONTinuous
PAYLoad	OFF, SINGle, 10E3, 10E6
MCELI	OFF, SINGle, PERiodic
CLOSs	OFF, SINGle
SNCRcpar	OFF, SINGle
A1A2	OFF, SINGle, CONTinuous

Error Type	Valid Error Rates
B1	OFF, SINGle, CONTinuous
B2	OFF, SINGle, CONTinuous
B3	OFF, SINGle, CONTinuous
REIL	OFF, SINGle, 10E4 – 10E8
REIP	OFF, SINGle, 10E4 – 10E8
BPAYload	OFF, SINGle, 10E3, 10E6
HPoiNTeR	OFF, SINGle, CONTinuous

:SOURce:ERRor:RATe <*error rate*>

This command sets the error-injection rate. See *Supported Error-rates for Each Type of Error,* page 4–17 for information about the error-types that use the following error rates.

Error Rate	Description
OFF	Turns off error-injection feature.
SINGle	Injects a single error into the BERT payload pattern.
BURSt	Injects a burst of errors.
CONTinuous	Continuously injects errors until you enter the ATM:ABORT SCPI command.
10E3 – 10E8	Injects errors into the BERT payload pattern at the selected rate. For example, 1.E–3 is 1×10^{-3}, or 1 bit error every 1,000 bits.
6CONsecutive	Injects six consecutive errors.
7CONsecutive	Injects seven consecutive errors

Error Rate	Description
8CONsecutive	Injects eight consecutive errors

Default: SINGLe

:SOURce:ERRor:STATe <OFF | ON>

This command turns the error-injection state ON and off.

If you set the error-injection rate to SING, 6CON, 7CON, 8CON (See *:SOURce:ERRor:RATe <error rate>*, page 4–18), the error-state is automatically set to OFF after the configured test has finished processing.

Default: OFF

Alarm Commands

This section describes the :SOURce commands used to set the different SONET/SDH alarms ON or off.

Root	Level 1	Level 2
ATM:SOURce	:ALARm	:LOS <ON | OFF>
		:LOF <ON | OFF>
		:OOF <ON | OFF>
		:AISL <ON | OFF>
		:RDIL <ON | OFF>
		:AISP <ON | OFF>
		:RDIP <ON | OFF>
		:LOPP <ON | OFF>

:SOURce:ALARm:LOS <ON | OFF>

This command turns the Loss of Signal alarm insertion ON or off.

Default: OFF

:SOURce:ALARm:LOF <ON | OFF>

This command turns the Loss of Frame alarm insertion ON or off.

Default: OFF

:SOURce:ALARm:OOF <ON | OFF>

This command turns the Out of Frame alarm insertion ON or off.

Default: OFF

:SOURce:ALARm:AISL <ON | OFF>

This command turns the line Alarm Indicator Signal alarm insertion ON or off.

Default: OFF

:SOURce:ALARm:RDIL <ON | OFF>

This command turns the Line Remote Defect Indicator insertion ON or off.

Default: OFF

:SOURce:ALARm:AISP <ON | OFF>

This command turns the Path Alarm Indicator Signal insertion ON or off.

Default: OFF

:SOURce:ALARm:RDIP <ON | OFF>

This command turns the Path Remote Defect Indicator insertion ON or off.

Default: OFF

:SOURce:ALARm:LOPP <ON | OFF>

This command turns the Path Loss of Pointer Indicator insertion ON or off.

Default: OFF

Pointer Control Commands

This section describes the :SOURce commands used to increment and decrement the pointer value, or cause a new data flag (NDF) condition.

Root	Level 1	Level 2
ATM:SOURce	:POINTer	:ADJust <*pointer adjustment*>
		:NDFLag <*NDF value*>
		:VALue <*pointer data value*>
ATM:SELect	:POINTer	:NOTation <DECimal | HEXidecimal>

:SOURce:POINTer:ADJust <*pointer adjustment*>

This command lets you increment or decrement the pointer value, or cause a new data flag (NDF) condition.

Pointer Adjustment	Description
OFF	Turns off the pointer-adjustment feature.
POSitive	Causes a positive pointer adjustment by incrementing the H1/H2 pointer value.
NEGative	Causes a negative pointer adjustment by decrementing the H1/H2 pointer value.
NDFlag	Indicates that you want to use the NDF value set with the :SOUR:POINT:NDFL command (see page 4–24).
NPValue	Indicates that you want to use the pointer data value set with the :SOUR:POINT:VAL command (see page 4–25)

Default: OFF

:SOURce:POINTer:NDFLag <*NDF value*>

This command sets the NDF value. Make sure you include the :SOUR:POINT:ADJ NDF command (see page 4–24).

Parameter Range: 0 to 15 (0xF)

Default: 9

:SOURce:POINTer:VALue <*pointer data value*>

This command sets the pointer value. Make sure you include the :SOUR:POINT:ADJ NDV command (see page 4–24).

Parameter Range: 0 to 1023 (0x3FF)

Default: 522 (0x20A)

:SELect:POINTer:NOTation <DECimal | HEX>

This command lets you select the notation used to display a pointer value.

Default: DECimal

Section[RS], Line[MS], and Path Overhead Commands

This section describes the :SOURce commands used to set the overhead bytes in the outgoing SONET or SDH frames.

Root	Level 1	Level 2
ATM:SOURce	:SECTion	:TXMessage <*transmit trace message*>
		:RXMessage <*receive trace message*>
		:TXBYte <*JO section byte*>
		:BENable <ON | OFF>
		:SENable <ON | OFF>
		:D1 <*value*>
		:D2 <*value*>
		:D3 <*value*>
		:Z0-2 <*value*>
		:Z0-3 <*value*>
		:E1 <*value*>
		:F1 <*value*>
	:LINE	:S1 <*sync status*>
		:K1 | K2 <*APS/alarm information*>
		:D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 <*DCC*>
		:Z1-2 <*value*>
		:Z1-3 <*value*>
		:Z2-1 <*value*>
		:Z2-2 <*value*>

Root	Level 1	Level 2
ATM:SOURce	:LINE	:M1 <*value*>
		:E2 <*value*>
	:PATH	:TXMessage <*transmit trace message*>
		:RXMessage <receive trace message>
		:TXBYte *<JO section byte>*
		:BENable <ON | OFF>
		:SENable <ON | OFF>
		:C2 <*payload label*>
		:G1 <*status*>
		:F2 <*user channel*>
		:H4 <*phase indicator*>
		:Z3 | :Z4 | :Z5 <*future growth*>

:SOURce:SECTion:TXMessage <*transmit trace message*>

This command sets the J0 section transmit trace message (see *Section/RS Overhead*, page 2–6).

Parameter Range: 1 to 16 characters, consisting of any of the valid 7-bit ASCII characters

Default: 16 ASCII zeros

:SOURce:SECTion:RXMessage <*receive trace message*>

This command sets the expected J0 section receive trace message (see *Section/RS Overhead*, page 2–6).

Parameter Range: 1 to 16 characters, consisting of any of the valid 7-bit ASCII characters

Default: 16 ASCII zeros

:SOURce:SECTion:TXBYte <*value*>

This command sets the J0 section data byte (see *Section/RS Overhead*, page 2–6).

Parameter Range: 0 to 255

Default: 1

:SOURce:SECTion:BENable <ON | OFF>

This command turns the trace buffer ON and off.

Buffer State	Description
ON	Indicates that the trace buffer can receive characters.
OFF	Indicates that the trace buffer cannot receive characters.

Default: OFF

:SOURce:SECTion:SENable <ON | OFF>

This command turns the trace buffer synchronization ON and off.

Buffer State	Description
ON	Indicates that the trace buffer synchronization is active.
OFF	Indicates that the trace buffer synchronization is not active.

Default: OFF

:SOURce:SECTion:D1 <*value*>

This command sets byte 1 on the data communications channel.

Parameter Range: 0 to 255

Default: 0

:SOURce:SECTion:D2 <*value*>

This command sets byte 2 on the data communications channel.

Parameter Range: 0 to 255

Default: 0

:SOURce:SECTion:D3 <*value*>

This command sets byte 3 on the data communications channel.

Parameter Range: 0 to 255

Default: 0

:SOURce:SECTion:Z0-2 <*value*>

This command sets a future growth byte.

Parameter Range: 0 to 255

Default: 2

:SOURce:SECTion:Z0-3 <*value*>

This command sets a future growth byte.

Parameter Range: 0 to 255

Default: 3

:SOURce:SECTion:E1 <*value*>

This command sets the orderwire byte.

Parameter Range: 0 to 255

Default: 0

:SOURce:SECTion:F1 <*value*>

This command sets the User Channel byte.

Parameter Range: 0 to 255

Default: 0

:SOURce:LINE:S1 <*sync status*>

This command sets the line synchronization status.

Parameter Range: 0 to 255

Default: 0

:SOURce:LINE:K1 | K2 <*APS/alarm information*>

This command sets the line automatic protection switch. If you use the :SOUR:LINE:K1 command, you should also include the :SOUR:LINE:K2 command, and vice versa (see *Configuring Automatic Protection Switching Testing*, page 2–23).

Parameter Range: 0 to 255

Default: 0

:SOURce:LINE:D4|D5|D6|D7|D8|D9|D10|D11|D12 <*DCC*>

This command sets the line data communication byte.

Parameter Range: 0 to 255

Default: 0

:SOURce:LINE:Z1-2 <*value*>

This command sets a future growth byte.

Parameter Range: 0 to 255

Default: 2

:SOURce:LINE:Z1-3 <*value*>

This command sets a future growth byte.

Parameter Range: 0 to 255

Default: 0

:SOURce:LINE:Z2-1 <*value*>

This command sets a future growth byte.

Parameter Range: 0 to 255

Default: 0

:SOURce:LINE:Z2-2 <*value*>

This command sets a future growth byte.

Parameter Range: 0 to 255

Default: 0

:SOURce:LINE:M1 <*value*>

This command sets the Far End Block Error (FEBE) byte.

Parameter Range: 0 to 255

Default: 0

:SOURce:LINE:E2 <*value*>

This command sets the orderwire byte.

Parameter Range: 0 to 255

Default: 0

:SOURce:PATH:TXMessage <*transmit trace message*>

This command sets the J1 path transmit trace message (see *Path Overhead*, page 2–12).

Parameter Range: 1 to 64 characters, consisting of any of the valid 7-bit ASCII characters

Default: 64 ASCII zeros

:SOURce:PATH:RXMessage <*receive trace message*>

This command sets the expected J1 path receive trace message (see *Path Overhead*, page 2–12).

Parameter Range: 1 to 64 characters, consisting of any of the valid 7-bit ASCII characters

Default: 64 ASCII zeros

:SOURce:PATH:TXBYte <*value*>

This command sets the J1 path data byte (see *Path Overhead*, page 2–12).

Parameter Range: 0 to 255

Default: 1

:SOURce:PATH:BENable <ON | OFF>

This command turns the trace buffer ON and off.

Buffer State	Description
ON	Indicates that the trace buffer can receive characters.
OFF	Indicates that the trace buffer cannot receive characters.

Default: OFF

:SOURce:PATH:SENable <ON | OFF>

This command turns the trace buffer synchronization ON and off.

Buffer State	Description
ON	Indicates that the trace buffer synchronization is active.
OFF	Indicates that the trace buffer synchronization is not active.

Default: OFF

:SOURce:PATH:C2 <*payload label*>

This command sets the payload type label.

Payload Label	Description
00	Unequipped
01	Equipped, non-specific payload
02	Floating VT type
03	Locked VT type
04	Asynchronous mapping for DS3
12	Asynchronous mapping for DS4NA
13	Mapping for ATM
14	Mapping for DQDB
15	Asynchronous mapping for FDDI

Parameter Range: 0 to 255

Default: 13

:SOURce:PATH:G1 <*status*>

This command sets the path status byte.

Parameter Range: 0 to 255

Default: 0

:SOURce:PATH:F2 <*user channel*>

This command sets the path user channel.

Parameter Range: 0 to 255

Default: 0

:SOURce:PATH:H4 <*phase indicator*>

This command sets the path cell offset indicator.

Parameter Range: 0 to 255

Default: 0

:SOURce:PATH:Z3 | :Z4 | :Z5 <*future growth*>

This command sets the path growth #1 byte.

Parameter Range: 0 to 255

Default: 0

Entering User-defined BERT Patterns

This section describes the :SOURce commands used to configure five user-defined BERT payload patterns, which can be used as the foreground channel cell payload or the BERT payload.

Root	Level 1	Level 2	Level 3
ATM:SOURce	:PATTern	:SON	:BERT1 <*pattern*>
			:BERT2 <*pattern*>
			:BERT3 <*pattern*>
			:BERT4 <*pattern*>
			:BERT5 <*pattern*>

:SOURce:PATTern:SON:BERT1|BERT2|BERT3 |BERT4|BERT5 <*pattern*>

Use this command to configure a 32-bit user-defined pattern, which can be used as the foreground channel cell payload or BERT payload.

Parameter Range: 0 to 0xFFFFFFFF

Default: 0

Using Query Commands to Retrieve Results

You can enter all the SCPI commands, except :INIT and :ABORT, as *query* commands. A query command looks like the following:

```
:FETC:TEST:STAT ?
:SOUR:POINT:VAL ?
```

The :FETC *root node* is the most commonly used query command and is followed by one or more level nodes, all separated by a colon (:). Notice the question mark after the last level node (STAT) – all query (or FETC) commands end with a question mark.

In general, query commands instruct a test module to retrieve the current result, error, or alarm information specified by the parameter, and display the result on the PC. For example, the command :FETC:TEST:STAT ? returns either a **0** to indicate a test has stopped, a **1** to indicate a test is still running, or a **3** to indicate a test is still running, but is temporarily waiting for the tester to reach a stable state before measuring data.

General Query Commands

This section lists the commands that let you query the status of the tester.

:FETCh:TEST:STATe ?

This command returns one of the following values:

Return Value	Description
0	Test has stopped.
1	Test is running and measuring data.
3	Test is running, but is waiting for the system to reach a stable state before measuring data.

:FETCh:PLAYer:FREQuency ?

This command returns the frequency of the physical layer.

SONET/SDH Alarm Query Commands

This section describes the SCPI commands used to query the status of the different SONET/SDH alarms. The :STATus and :HISTory commands return either a 1 (alarm has been detected) or 0 (alarm has not been detected), or a number to indicate the number of seconds count with an alarm occurrence.

Loss of Signal (LOS) Alarm Status

Command	Queries....
:FETCh:LOS:STATus ?	Loss of signal alarm status (1=ON, 0=off)
:FETCh:LOS:HISTory ?	A history status (1) occurs when an LOS alarm is detected and then stops within the same test (1=ON, 0=off)
:FETCh:LOS:SEConds ?	Total number of seconds with a loss-of-signal alarm occurrence since the test started.

Loss of Frame (LOF) Alarm Status

Command	Queries....
:FETCh:LOF:STATus ?	Loss of frame alarm status (1=ON, 0=off)
:FETCh:LOF:HISTory ?	A history status (1) occurs when an LOF alarm is detected and then stops within the same test (1=ON, 0=off)
:FETCh:LOF:SEConds ?	Total number of seconds with a loss-of-frame alarm occurrence since the test started.

Out of Frame (OOF) Alarm Status

Command	Queries....
:FETCh:OOF:STATus ?	Out of frame alarm status (1=ON, 0=off)
:FETCh:OOF:HISTory ?	A history status (1) occurs when an OOF alarm is detected and then stops within the same test (1=ON, 0=off)
:FETCh:OOF:SEConds ?	Total number of seconds with an out-of-frame alarm occurrence since the test started.

Alarm Indicator Signal (AISL) Status

Command	Queries....
:FETCh:AISL:STATus ?	Alarm indicator signal status (1=ON, 0=off)
:FETCh:AISL:HISTory ?	A history status (1) occurs when an AIS alarm is detected and then stops within the same test (1=ON, 0=off)
:FETCh:AISL:SEConds ?	Total number of seconds with an alarm indicator signal alarm occurrence since the test started.

Line Remote Defect Indicator (RDIL) Status

Command	Queries....
:FETCh:RDIL:STATus ?	Line remote defect indicator status (1=ON, 0=off)
:FETCh:RDIL:HISTory ?	A history status (1) occurs when an RDI alarm is detected and then stops within the same test (1=ON, 0=off)
:FETCh:RDIL:SEConds ?	Total number of seconds with a line remote-defect indicator alarm occurrence since the test started.

Path Alarm Indicator Signal (AISP) Status

Command	Queries....
:FETCh:AISP:STATus ?	Path alarm indicator signal alarm status (1=ON, 0=off)
:FETCh:AISP:HISTory ?	A history status (1) occurs when an AIS alarm is detected and then stops within the same test (1=ON, 0=off)
:FETCh:AISP:SEConds ?	Total number of seconds with a path alarm-indicator signal alarm occurrence since the test started.

Path Remote Defect Indicator (RDIP) Status

Command	Queries....
:FETCh:RDIP:STATus ?	Path remote defect indicator alarm status (1=ON, 0=off)
:FETCh:RDIP:HISTory ?	A history status (1) occurs when an RDIP alarm is detected and then stops within the same test (1=ON, 0=off)
:FETCh:RDIP:SEConds ?	Total number of seconds with a path remote-defect indicator alarm occurrence since the test started.

Path Loss of Pointer Alarm (LOPP) Status

Command	Queries....
:FETCh:LOPP:STATus ?	Path loss of pointer alarm status (1=ON, 0=off)
:FETCh:LOPP:HISTory ?	A history status (1) occurs when an LOPP alarm is detected and then stops within the same test (1=ON, 0=off)
:FETCh:LOPP:SEConds	Total number of seconds with a path loss-of-pointer alarm occurrence since the test started.

BERT Loss of Pattern Synchronization Alarm (LOPS) Status

Command	Queries....
:FETCh:LOPS:STATus ?	Loss of pattern sync alarm status (1=ON, 0=off)
:FETCh:LOPS:HISTory ?	A history status (1) occurs when an LOPS alarm is detected and then stops within the same test (1=ON, 0=off)
:FETCh:LOPS:SEConds ?	Total number of seconds with a loss-of-pattern sync alarm occurrence since the test started.

SONET/SDH Error Query Commands

This section describes the SCPI commands used to query the status of the different SONET/SDH errors.

B1 BIP Error Status

Command	Queries....
:FETCh:B1:ECount ?	Total number of B1 BIP errors detected.
:FETCh:B1:ETime ?	Elapsed time (in seconds) since the previous B1 BIP error was detected.
:FETCh:B1:ERAVerage ?	Number of B1 BIP errors over the number of cells received since the test started.
:FETCh:B1:ERCurrent ?	Average B1 BIP error ratio for the previous 2.25 seconds.
:FETCh:B1:ESEConds ?	Number of seconds in which at least one B1 BIP error occurred since the test started.
:FETCh:B1:EFSeconds ?	Number of seconds during which no B1 BIP errors were detected.
:FETCh:B1:SESeconds ?	Number of severely errored seconds during which more than 2500 B1 BIP errors were detected.
:FETCh:B1:%ESEConds ?	Percent of all seconds during which at least one B1 BIP error occurred since the test started.
:FETCh:B1:%EFSeconds ?	Percent of all seconds during which no B1 BIP error were detected.

B2 BIP Error Status

Command	Queries....
:FETCh:B2:ECount ?	Total number of B2 BIP errors detected.
:FETCh:B2:ETime ?	Elapsed time (in seconds) since the previous B2 BIP error was detected.
:FETCh:B2:ERAVerage ?	Number of B2 BIP errors over the number of cells received since the test started.
:FETCh:B2:ERCurrent ?	Average B2 BIP error ratio for the previous 2.25 seconds.
:FETCh:B2:ESEConds ?	Number of seconds in which at least one B2 BIP error occurred since the test started.
:FETCh:B2:EFSeconds ?	Number of seconds during which no B2 BIP errors were detected.
:FETCh:B2:SESeconds ?	Number of severely errored seconds during which more than 2500 B2 BIP errors were detected.
:FETCh:B2:%ESEConds ?	Percent of all seconds during which at least one B2 BIP error occurred since the test started.
:FETCh:B2:%EFSeconds ?	Percent of all seconds during which no B2 BIP error were detected.

B3 BIP Error Status

Command	Queries....
:FETCh:B3:ECount ?	Total number of B3 BIP errors detected.
:FETCh:B3:ETime ?	Elapsed time (in seconds) since the previous B3 BIP error was detected.
:FETCh:B3:ERAVerage ?	Number of B3 BIP errors over the number of cells received since the test started.
:FETCh:B2:ERCurrent ?	Average B3 BIP error ratio for the previous 2.25 seconds.
:FETCh:B3:ESEConds ?	Number of seconds in which at least one B3 BIP error occurred since the test started.
:FETCh:B3:EFSeconds ?	Number of seconds during which no B3 BIP errors were detected.
:FETCh:B3:SESeconds ?	Number of severely errored seconds during which more than 2500 B3 BIP errors were detected.
:FETCh:B3:%ESEConds ?	Percent of all seconds during which at least one B3 BIP error occurred since the test started.
:FETCh:B3:%EFSeconds ?	Percent of all seconds during which no B3 BIP error were detected.

Line Remote Event Indicator (REIL) Error Status

Command	Queries....
:FETCh:REIL:ECount ?	Total number of REIL errors detected.
:FETCh:REIL:ETime ?	Elapsed time (in seconds) since the previous REIL error was detected.
:FETCh:REIL:ERAVerage ?	Number of REIL errors over the number of cells received since the test started.
:FETCh:REIL:ERCurrent ?	Average REIL error ratio for the previous 2.25 seconds.
:FETCh:REIL:ESEConds ?	Number of seconds in which at least one REIL error occurred since the test started.
:FETCh:REIL:EFSeconds ?	Number of seconds during which no REIL errors were detected.
:FETCh:REIL:SESeconds ?	Number of severely errored seconds during which more than 2500 REIL errors were detected.
:FETCh:REIL:%ESEConds ?	Percent of all seconds during which at least one REIL error occurred since the test started.
:FETCh:REIL:%EFSeconds ?	Percent of all seconds during which no REIL error were detected.

Path Remote Event Indicator (REIP) Error Status

Command	Queries....
:FETCh:REIP:ECount ?	Total number of REIP errors detected.
:FETCh:REIP:ETime ?	Elapsed time (in seconds) since the previous REIP error was detected.
:FETCh:REIP:ERAVerage ?	Number of REIP errors over the number of cells received since the test started.
:FETCh:REIP:ERCurrent ?	Average REIP error ratio for the previous 2.25 seconds.
:FETCh:REIP:ESEConds ?	Number of seconds in which at least one REIP error occurred since the test started.
:FETCh:REIP:EFSeconds ?	Number of seconds during which no REIP errors were detected.
:FETCh:REIP:SESeconds ?	Number of severely errored seconds during which more than 2500 REIP errors were detected.
:FETCh:REIP:%ESEConds ?	Percent of all seconds during which at least one REIP error occurred since the test started.
:FETCh:REIP:%EFSeconds ?	Percent of all seconds during which no REIP error were detected.

BERT Payload Error Status

Command	Queries....
:FETCh:BERT:ECount ?	Total number of BERT payload errors detected.
:FETCh:BERT:ETime ?	Elapsed time (in seconds) since the previous BERT payload error was detected.
:FETCh:BERT:ERAVerage ?	Number of BERT payload errors over the number of cells received since the test started.
:FETCh:BERT:ERCurrent ?	Average BERT payload error ratio for the previous 2.25 seconds.
:FETCh:BERT:ESEConds ?	Number of seconds in which at least one BERT payload error occurred since the test started.
:FETCh:BERT:EFSeconds ?	Number of seconds during which no BERT payload errors were detected.
:FETCh:BERT:SESeconds ?	Number of severely errored seconds during which more than 2500 BERT payload errors were detected.
:FETCh:BERT:%ESEConds ?	Percent of all seconds during which at least one BERT payload error occurred since the test started.
:FETCh:BERT:%EFSeconds ?	Percent of all seconds during which no BERT payload error were detected.

Pointer Adjustment Query Commands

This section describes the SCPI commands used to query the status of the SONET/SDH pointer value.

Command	Queries....
:FETCh:POINter:VALue ?	Current pointer value.
:FETCh:POINter:PJUStification:DIRection ?	Last pointer justification direction; 0=off, 1=positive, 2=negative.
:FETCh:POINter:PJUStification:COUNt ?	Number of positive pointer justification occurrences detected.
:FETCh:POINter:PJUStification:SEConds ?	Number of seconds in which at least one positive pointer justification was detected.
:FETCh:POINter:NJUStification:COUNt ?	Number of negative pointer justification occurrences detected.
:FETCh:POINter:NJUStification:SEConds ?	Number of seconds in which at least one positive pointer justification was detected.
:FETCh:POINter:NDATa:COUNt ?	Number of new data pointer occurrences detected.
:FETCh:POINter:NDATa:SEConds ?	Number of seconds in which at least one new data pointer occurrence was detected.

Querying Overhead Results

This section describes the SCPI commands used to query the section, line, and path overhead information.

Section Overhead Fetch Commands

Command	Queries....
:FETCh:SECTion:RXTRace:MESSage ?	Section receive trace message (J0).
:FETCh:SECTion:RXTRace:MISMatch:STATus ?	Current section receive trace message (J0) mismatch status (0=no mismatch detected, 1=mismatch detected).
:FETCh:SECTion:RXTRace:MISMatch:HISTory ?	Indicates is a mismatch was detected in a previous test (0=no history mismatch detected, 1=history mismatch detected).
:FETCh:SECTion:RXTRace:UNSTable:STATus ?	Current section receive trace message (J0) unstable status (0=no unstable status detected, 1=unstable status detected).
:FETCh:SECTion:RXTRace:UNSTable:HISTory ?	Indicates is an unstable status was detected in a previous test (0=no history unstable status detected, 1=history unstable status detected).
:FETCh:SECTion:D1 ?	Section data communications byte.
:FETCh:SECTion:D2 ?	Section data communications byte.
:FETCh:SECTion:D3 ?	Section data communications byte.

Command	Queries....
:FETCh:SECTion:A1-1 ?	Frame alignment byte.
:FETCh:SECTion:A1-2 ?	Frame alignment byte.
:FETCh:SECTion:A1-3 ?	Frame alignment byte.
:FETCh:SECTion:A2-1 ?	Frame alignment byte.
:FETCh:SECTion:A2-2 ?	Frame alignment byte.
:FETCh:SECTion:A2-3 ?	Frame alignment byte.
:FETCh:SECTion:Z0-2 ?	Future growth byte.
:FETCh:SECTion:Z0-3 ?	Future growth byte.
:FETCh:SECTion:B1 ?	B1 byte.
:FETCh:SECTion:E1 ?	Orderwire byte.
:FETCh:SECTion:F1 ?	User channel byte.

Line Overhead Fetch Commands

Command	Queries....
:FETCh:LINE:S1 ?	Line synchronization status message.
:FETCh:LINE:K1 ?	Line automatic protection switch message.
:FETCh:LINE:K2 ?	Line automatic protection switch message.
:FETCh:LINE:D4 ?	Line data communications byte.
:FETCh:LINE:D5 ?	Line data communications byte.
:FETCh:LINE:D6 ?	Line data communications byte.
:FETCh:LINE:D7 ?	Line data communications byte.

Command	Queries....
:FETCh:LINE:D8 ?	Line data communications byte.
:FETCh:LINE:D9 ?	Line data communications byte.
:FETCh:LINE:D10 ?	Line data communications byte.
:FETCh:LINE:D11 ?	Line data communications byte.
:FETCh:LINE:D12 ?	Line data communications byte.
:FETCh:LINE:H1-1 ?	Payload pointer byte.
:FETCh:LINE:H1-2 ?	Payload pointer byte.
:FETCh:LINE:H1-3 ?	Payload pointer byte.
:FETCh:LINE:H2-1 ?	Payload pointer byte.
:FETCh:LINE:H2-2 ?	Payload pointer byte.
:FETCh:LINE:H2-3 ?	Payload pointer byte.
:FETCh:LINE:B2-1 ?	BIP byte.
:FETCh:LINE:B2-2 ?	BIP byte.
:FETCh:LINE:B2-3 ?	BIP byte.
:FETCh:LINE:Z1-2 ?	Future growth byte.
:FETCh:LINE:Z1-3 ?	Future growth byte.
:FETCh:LINE:Z2-1 ?	Future growth byte.
:FETCh:LINE:Z2-2 ?	Future growth byte.
:FETCh:LINE:M1 ?	Far End Block Error (FEBE) byte.
:FETCh:LINE:E2 ?	Orderwire byte.

Path Overhead Fetch Commands

Command	Queries....
:FETCh:PATH:RXTRace:MESSage ?	Path receive trace message (J1).
:FETCh:PATH:RXTRace:MISMatch:STATus ?	Current path receive trace message (J1) mismatch status (0=no mismatch detected, 1=mismatch detected).
:FETCh:PATH:RXTRace:MISMatch:HISTory ?	Indicates is a mismatch was detected in a previous test (0=no history mismatch detected, 1=history mismatch detected).
:FETCh:PATH:RXTRace:UNSTable:STATus ?	Current path receive trace message (J1) unstable status (0=no unstable status detected, 1=unstable status detected).
:FETCh:PATH:RXTRace:UNSTable:HISTory ?	Indicates is an unstable status was detected in a previous test (0=no history unstable status detected, 1=history unstable status detected).
:FETCh:PATH:C2 ?	Path signal label.
:FETCh:PATH:G1 ?	Path status byte.
:FETCh:PATH:F2 ?	Path user channel.
:FETCh:PATH:H4 ?	Path cell offset indicator.
:FETCh:PATH:Z3 ?	Path growth #1.
:FETCh:PATH:Z4 ?	Path growth #1.
:FETCh:PATH:Z5 ?	Path growth #1.

User-defined Payload Pattern Query Commands

This section describes the SCPI commands used to query the configured user-defined BERT payload patterns. You can configure up to five different payload patterns. The SCPI command uses the following format, where :BERT*n* can be BERT1 – BERT5.

:FETCh:PATTern:SON:BERTn ?

Querying the TroubleScan Status

Use the following command to query the TroubleScan status in a condensed summary form, including the status of all trouble scan error and alarms.

:FETCh:SONTScan:STATus ?

The return status is a 15-bit code, which can be broken down into the following information:

Bit	Description
0	Frame error.
1	BIP B1 error.
2	BIP B2 error.
3	B3 BIP error.
4	Line remote event indicator error.
5	Path remote event indicator error.
6	Clear channel BERT payload error.
7	Loss of signal alarm.
8	Loss of frame alarm.

Bit	Description
9	Out-of-frame alarm.
10	Line alarm indicator signal alarm.
11	Line remote defect indicator alarm.
12	Path alarm indicator signal alarm.
13	Path remote defect indicator alarm.
14	Path loss-of-pointer alarm.
15	BERT pattern synchronization alarm.

SCPI Return Codes

Each SCPI command returns a code that indicates whether the command was successful, or if an error occurred.

Code	Meaning
1	Command executed successfully.
–100	Command error.
–109	Required parameter missing.
–112	Command keyword too long.
–120	Parameter value out-of-range.
–221	Invalid mode setting for command.
–223	Command line longer than 80 characters.
–350	Error lost due to overflow in error queue.

5

Specifications

SONET/SDH Line Interface Module Specifications

Physical Module Characteristics

Size (W×H×D)	3.5 × 8.5 × 1 inches 89 × 215 × 25 millimeters
Weight	1.5 pounds (.6 kg)
Temperature	Operating: 0° to +40° C (32° to 104° F) Storage: –20° to +60° C (-4° to 140° F)
Power	7 Watts (provided by Service Advisor)
EMI	CISPIR 11 Class A
Mechanical	Agilent Handheld Class 2B

SONET/SDH Features

Auto Setup	Scans the receive signal to determine its characteristics, and then automatically configures the Service Advisor for that type of configuration.
TroubleScan	Examines the SONET/SDH line and displays information about any errors and alarms detected.
ASCII Reports	Can print or save a SONET/SDH report during a test or after you have stopped a test. Reports are 75 columns wide, and you can enter header information (Operator ID, Customer Name, Circuit ID, Comments) for the report.
Data and File Management	Local: store last configuration, restore last configuration, and reset default configuration; remote: download program Flash-ROM updates.
Printing	Can print-screen or report for displayed screen.

Storing and Printing Results	**Printer/Remote Control:** Controlled by user interface or customer- written interface. Printer control by user's PC (serial or parallel). **Results and setup storage:** Test setups and results can be saved to hard drive or floppy disk.
Remote Control	SCPI command line interface and remote graphical user interface (GUI) for PC
Connectors for Module	TX and RX (FC/PC, SC, ST, or D4) connectors
Module LEDs	Ready (RDY), 155M, 51M, Class 1 Laser, pointer adjustment (PNTR ADJ), signal (SIG), frame (FRM), pattern synchronization (PATT SYNC), error (ERR), and history (HIST).

General Signal Characteristics

Line Rates	SONET	OC-3 is 155.52 Mbps OC-1 is 51.85 Mbps
	SDH	STM-1 is 155.52 Mbps STM-0 is 51.85 Mbps
Payload Mappings	SONET	OC-3 is STS-3c OC-1 is STS-1
	SDH	STM-1 is VC-4, C-4 STM-0 is VC-3, C-3
Line Scramble	Can be set to ON or off.	
BERT Payload Patterns	Cross-cell PRBS	2^15-1, 2^20-1, 2^23-1, inv 2^15-1, inv 2^20-1, inv 2^23-1
	Fixed patterns	All ones, all zeros, 1100, 1010
	User-programmable patterns	Can enter five 32-bit patterns

Optics	TX: Single Mode Intermediate Reach (IR)	• Transmitters are InGasAsP lasers optically coupled to a 8 μm core, single mode fiber pigtail. • Average minimum optical power is -15 dBm, average maximum optical power is -8 dBm, typical optical power is -11 dBm • Average minimum optical wavelength is 1260 nm, average maximum optical wavelength is 1360 nm, typical optical wavelength is 1310 nm
	RX: Single Mode Intermediate Reach (IR)	• Receivers are InGasAs PIN photodetectors with a 62.5 multi-mode fiber pigtail. • Minimum optical sensitivity is -28 dBm, typical optical sensitivity is -32 dBm • Peak input power is -7 dBm • Minimum optical wavelength is 1240 nm, maximum optical wavelength is 1380 nm

Optics (*continued*)	TX: Multi-mode Intermediate Reach (IR)	• Transmitters are InGasAsP LEDs compatible with 62.5/125 µm fiber. • Average minimum optical power is -20 dBm, average maximum optical power is -14 dBm • Average minimum optical wavelength is 1270 nm, average maximum optical wavelength is 1380 nm, typical optical wavelength is 1310 nm
	RX: Multi-mode Intermediate Reach (IR)	• Receivers are InGasAs PIN photodetectors compatible with 62.5/125 µm fiber. • Minimum optical sensitivity is -31 dBm • Peak input power is -14 dBm • Minimum optical wavelength is 1260 nm, maximum optical wavelength is 1360 nm

Transmitter Characteristics

Characteristic	Settings
Clock (TX timing)	Internal (+/- 20 ppm) or recovered
Modes	Terminal or Pass-thru
Error Inject	• Frame (A1/A2) *Rates:* off or continuous • B1, B2, or B3 Error *Rates:* off, single, or Continuous • REI-L [MSREI] Error *Rates:* off, single, or 10E-4 through 10E-8 • REI-P [PREI] Error *Rates:* off, single, or 10E-4 through 10E-8 • H Pointer *Rates:* off or continuous • SONET/SDH Payload *Rates:* off, single, or 10E-3 through 10E-6
Alarm Simulation	• LOS (Loss of Signal) • OOF (Out-of-Frame) • LOF (Loss of Frame) • AIS-L [MS-AIS] (Alarm Indication Signal-line) • RDI-L [MS-RDI] (Remote Defect Indication-line) • AIS-P [AU-AIS] (Alarm Indication Signal-path) • RDI-P [AU-RDI] (Remote Defect Indication-path) • LOP-P (Loss of Pointer Path)
Pointer control	Off, positive, negative, new data flag (NDF), or new pointer value
APS	K1 and K2 in English-language format

Overhead Bytes and APS Characteristics

Section [RS] Overhead	STS-3c [STM-1]	• Tab 1: J0, E1, F1, D1, D2, D3 • Tab 2: Z0 • Tab 3: Z0
	STS-1 [STM-0]	E1, F1, D1, D2, D3
	J0 Trace Buffer	16-byte buffer, programmable in hexadecimal format (01h to 7Fh) and ASCII format
	J0 Expect Trace Buffer	16-byte buffer, programmable in hexadecimal format (01h to 7Fh) and ASCII format, synchronization enable (sets the MSB=1), and alarm match enable
Line (MS) Overhead	STS-3c [STM-1]	• Tab 1: K1, K2, D4, D5, D6, D7, D8, D9, D10, D11, D12, S1, Z2, E2 • Tab 2: Z1, Z2 (STS-3c only) • Tab 3: Z1, M1 (STS-3c only)
	STS-1 [STM-0]	K1, K2, D4, D5, D6, D7, D8, D9, D10, D11, D12, S1, Z2, E2
Path Overhead	STS-3c [STM-1] and STS-1 [STM-0]	J1, G1, Z3, F2, Z4, C2, H4, Z5
	J1 Trace Buffer	64-byte buffer, programmable in hexadecimal format (01h to 7Fh) and ASCII format
	J1 Expect Trace Buffer	64-byte buffer, programmable in hexadecimal format (01h to 7Fh), synchronization enable (inserts carriage-return and line-feed; this limits programming to 62 bytes), and alarm match enable

Displayed Results

Results Summary screen: Shows the current signal characteristics. Includes signal rate and frequency detected on the line, alarm LEDs, and error average rates for B1, B2, B3, REI-L [MSREI], and REI-P [PREI] errors. See *Results Summary Screen*, page 3–6.

Alarms screen: LEDs indicate if the tester detects current or history (previous test) alarms, shows alarm second count and seconds ago count for each alarm. See *Alarm Results*, page 3–9

Errors screen: Shows the results of an error-injection test. Summary tab shows the number of times a B1, B2, B3, REI-L [MSREI], and REI-P [PREI] error was detected. The Section [RS], Line [MS], and Path tabs show the count, current rate, average rate, seconds ago, error free seconds (EFS), errored seconds (ES), severely errored seconds (SES), % of error-free seconds (EFS), and % errored seconds (ES) for each type of error. See *Error Summary*, page 3–10

Pointer screen: Shows the pointer value; the last pointer justification direction; the positive, negative, and new data flag counts; and the number of seconds during which a positive pointer justification, negative pointer justification, and new data flag occurred. See *Pointer Adjustment Results*, page 3–15

APS screen: Shows the results of an APS test. This includes the K1 and K2 APS byte values; and the message, request, bridge, and architecture settings. See *APS Measurements*, page 3–16

Overhead Byte results screens: Shows the received overhead byte settings, and contains LEDs to indicate when a mismatch message or unstable (eight consecutive messages) condition is detected. See *Section [RS] Overhead Byte Results*, page 3–19

BERT screen: shows pattern synchronization indicators, and the count, current rate, average rate, seconds ago, error free seconds (EFS), errored seconds (ES), severely errored seconds (SES), % of error-free seconds (EFS), and % errored seconds (ES) for bit errors detected. See *Viewing BERT Results*, page 3–24

Ordering Information

Contact your Agilent Technologies representative to purchase any of the following products or accessories.

SONET/SDH Line Interface Module Ordering Information

Part Number	Part Number
N1640A	ATM Cell Processor Test Module
N1610A	Service Advisor Portable Test Tablet
N1645A	SONET/SDH Line Interface Module with one of the following options: • Option 100 – 1310 nm IR single-mode FC/PC connectors • Option 101 – 1310 nm IR single-mode ST connectors • Option 102 – 1310 nm IR single-mode SC connectors • Option 103 – 1310 nm IR single-mode D4 connectors • Option 111 – 1310 nm IR multi-mode ST connectors • Option 112 – 1310 nm IR multi-mode SC connectors • Option 300 – 1310 nm IR single-mode interchangeable connectors. With this option, please indicate the type of adapters you need; Option 301 is 2xFC/PC optical adapters; Option 302 is 2xST optical adapters, Option 304 is 2xSC optical adapters.
N1617A	SACompanion CD-ROM
N1645A-910	Additional user's manual

Glossary

ac: Alternating current.

all-ones: A bit pattern made up entirely of binary ones (*1111....*).

asynchronous: Not synchronized; not timed to an outside clock source.

bandwidth: A network's 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.

bit: A basic unit of data. A bit can be set to either a zero or a one.

Blue alarm: Original name for alarm indication signal.

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.

CRC: Cyclic redundancy checksum. A basic error-checking technique.

CSES: Consecutively severely errored second.

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

dBm: Decibels relative to one milliwatt.

dBrnc: Decibels relative to network carrier.

dc: Direct current.

DCC: Data communications channel.

DCS: Digital cross-connect system.

DDL: Derived Data Link.

DLC: Digital loop-carrier system.

DRS: Digital reference signal.

EFS: Error-free second.

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.

ESF: Extended Superframe framing format (DS1).

frame: A group of bits, timeslots, or bytes whose unique positions can be identified relative to an alignment signal or pointer.

hexadecimal: A base-16 numbering system in which the digits range from 0 through F. A hexadecimal value is noted

with a subscript "h," for example: "$2A0F_h$."

Hz: Hertz.

idle signal: A signal transmitted to indicate that a channel is not in use.

ISO: International Standards Organization.

ITU: International Telecommunications Union, formerly the Consultative Committee on International Telegraph and Telephone (CCITT). The standards produced by this organization are called ITU-T Recommendations.

Kb: Kilobit. A thousand bits.

Kb/s: Kilobits per second.

kHz: Kilohertz.

LCD: Liquid crystal display.

LOF: Loss of frame.

LOS: Loss of signal.

Mb: Megabit. One million bits.

Mb/s: Megabits per second.

MHz: Megahertz.

ms: Millisecond.

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

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

OOF: Out of frame.

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.

payload: The information bits of a frame or cell. Those bits that are not part of the *overhead*.

PRBS: Pseudorandom bit sequence. A test pattern that simulates live, random traffic.

QRSS: Quasirandom sequence signal.

Results (.rls) file: Contains test measurement data.

Setup (.stp) file: Contains test configuration information for setting up tests.

synchronous: Synchronized. Occurring at the same rate or period; sharing common timing with an outside timing source.

test set: The hardware portion of the Service Advisor (the Undercradle or Standalone unit).

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

timing: See *clock*.

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

UAS: Unavailable seconds.

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

V: Volt.

Vac: Volt, alternating current.

Vdc: Volt, direct current.

VF: Voice frequency.

V pk: Volt peak.

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

Warranty

The N1645A Service Advisor SONET/SDH Line Interface Module is warranted by Agilent Technologies against defects in materials and workmanship for three years after shipment to the Customer. The three-year warranty period applies only to the original purchaser and is not transferable without the express written permission of Agilent Technologies. If Agilent Technologies receives notice of such defects during the warranty period Agilent Technologies will, at its option, repair or replace the equipment which proves to be defective. Agilent Technologies does not warrant that the operation of the equipment will be uninterrupted or error free. If Agilent Technologies is unable, within a reasonable time, to repair or replace any equipment to a condition as warranted, the Customer will be entitled to a refund of the purchase price upon prompt return of the equipment to Agilent Technologies. This warranty does not apply to defects resulting from improper or inadequate maintenance or calibration by the Customer, Customer-supplied software, interfacing or supplies, unauthorized modification or improper use, operation outside of the published environmental specifications for the equipment, or improper site preparation or maintenance by Customer.

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Calibration and Service

Calibration

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

The Service Advisor SONET/SDH Line Interface Module (N1645A) requires calibration every three years. To arrange for calibration, please contact Technical Support at 1-800-923-7522 or 978-266-3300.

Service

If your SONET/SDH Line Interface Module does not appear to be 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 Service Advisor Test Tablet.

If you feel that your SONET/SDH Line Interface Module may require service, call Technical Support at 1-800-923-7522 or 978-266-3300. Trained personnel are available to help solve your problem or determine if the unit must be returned for repair.

Returning a Unit for Repair

If your SONET/SDH Line Interface Module must be returned, a Technical Support representative will assign a Return Material Authorization (RMA) number. No product will be accepted for service without an RMA number.

Ship the instrument to:

Repair Department
Agilent Technologies, Inc.
Service Test Division
2 Robbins Road
Westford, MA 01886 USA

Be sure to mark the RMA number on the outside of the shipping container. In addition, be sure to include the following information:

- Model number (N1645A) and name (Service Advisor SONET/SDH Line Interface Module)
- Serial number
- Your name and phone number
- A written description of the problem
- Return “ship to” address
- Invoice address
- Payment information (if unit is out of warranty)

Index

A

B

J

K

L

M

N

O

P

R

S

T

V

W

Z