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Find the *Keysight / Agilent J1407A OmniBER 720* at our website: *Click HERE*

In This Book

This book tells you how to select and use the various instrument functions available.

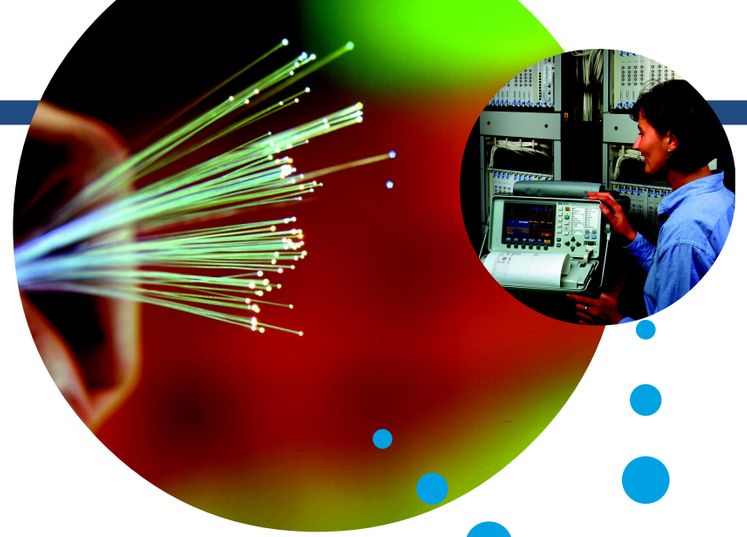
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Agilent Technologies

OmniBER 720

User Guide

Agilent Technologies



User Guide

OmniBER 720

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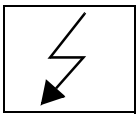
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WARNING

Warning Symbols Used on the Product



The product is marked with this symbol when the user should refer to the instruction manual in order to protect the apparatus against damage.



The product is marked with this symbol to indicate that hazardous voltages are present



The product is marked with this symbol to indicate that a laser is fitted. The user should refer to the laser safety information in the Verification Manual.

Agilent Technologies UK Limited
Telecommunications Networks Test Division
South Queensferry
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User Guide

OmniBER 720

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About This Book

This book tells you how to select the features that you want to use for your test.

The selections available are presented in the following groups:

- Transmit and receive interfaces
- Test features, for example, the addition of errors and alarms to the test signal
- Measurements including test timing
- Storing, logging and printing results with general printer information
- Using instrument and disk storage
- Using the “OTHER” features.

The selections available will depend on the options fitted to your instrument. The examples given in this book cover all options and therefore may include selections which are not available on your instrument.

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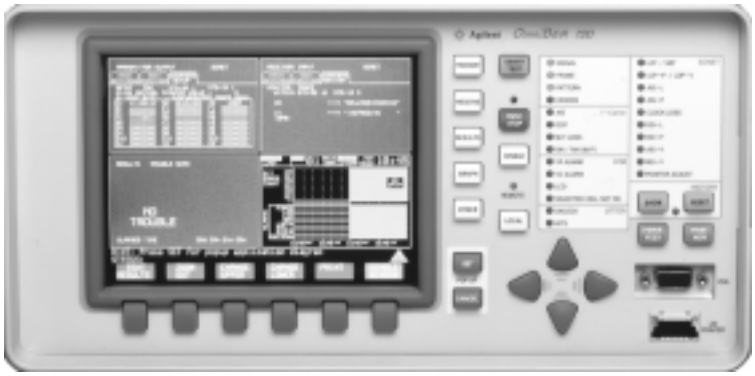
Introduction

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Introduction

Product Description

The OmniBER Communications Performance Analyzer provides all the test capability you need to fully verify the performance of today's high-capacity transmission systems and networks.



The main features of a dual standard (SDH/SONET) instrument are as follows:

- Multi-rate transmission testing from OC-1 to OC-48 and STM-0 to STM-16 optical.
- Supports concatenated payloads of STS-48c to VT 1.5 and AU-4-16c to TU-11.
- Optical power and line frequency measurements.
- Powerful thru-mode testing for SDH/SONET ring turn-up.
- Comprehensive SDH/SONET overhead testing.
- J0 section trace for DWDM testing
- J1 and J2 path trace for network path testing
- Line frequency offset
- Optional integrated graphical printer
- Fast access to key measurement tasks via SmartTest.

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Conventions

The conventions used in this manual to illustrate instrument keys and display information are as follows:

TRANSMIT

This is an example of a hardkey. Hardkeys (located to the right of the display) are used to give access to different sets of instrument settings, or select dedicated instrument functions. The key shown here displays the transmit settings.

PARALLEL

This is an example of a softkey. Softkeys (located below the display) are used to select instrument settings. The values associated with softkeys change as you move the display cursor from one instrument setting to another.



These are the cursor control keys. They are used to move the display cursor from one instrument setting to another.



This is an example of a pop-up menu. Pop-up menus are an alternative way of selecting instruments settings (instead of using softkeys). To access a pop-up menu, highlight an instrument setting, then use the **SET** key.



This symbol (when it appears next to settings on the display) indicates that there is a pop-up application associated with the instrument setting. To access a pop-up application, highlight the instrument setting which has this symbol, then use the **SET** key.



This symbol appears at the bottom right of the display when an optical transmit module is fitted to the instrument. The symbol's background changes from black to yellow when the optical output goes active.

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Connecting to the Network

The network connectors are located on the modules at the side of the instrument. The connections available depend on the options fitted to your instrument.

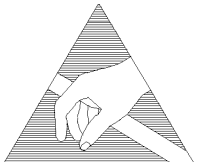
Before Connecting, note the Warning and Caution information given.

Removing/Inserting Modules

Modules should only be removed or inserted by trained personnel.

All Connectors

CAUTION



When connecting or disconnecting, ensure that you are grounded or, make contact with the metal surface of the Mainframe with your free hand to bring you, the module, and the mainframe to the same static potential.
Modules remain susceptible to ESD damage while the module is installed in the Mainframe.
Additional ESD information is required when servicing, see your Verification manual for further information.

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Optical Interface Connectors

For your protection, review all laser information given in this manual and the Verification manual before installing or using the instrument.

WARNING **To prevent personal injury, avoid use that may be hazardous to others, and maintain the module in a safe condition. Ensure the information given below is reviewed before operating the module.**

Laser Product Classification

All optical modules are classified as Class I (non-hazardous) laser product in the USA which complies with the United States Food and Drug Administration (FDA) Standard 21 CFR Ch.1 1040.10, and are classified as Class 1 (non-hazardous) laser products in Europe which complies with EN 60825-1 (1994).

To avoid hazardous exposure to laser radiation, it is recommended that the following practices are observed during system operation:

- **ALWAYS DEACTIVATE THE LASER BEFORE CONNECTING OR DISCONNECTING OPTICAL CABLES.**
- When connecting or disconnecting optical cables between the module and device-under-test, observe the connection sequences given below.

Connecting: Connect the optical cable to the input of the device-under-test **before** connecting to the module's *Optical Out* connector.

Disconnecting: Disconnect the optical cable from the module's *Optical Out* connector **before** disconnecting from the device-under-test. Always fit the fibre optic connector dust caps over the laser aperture.

- NEVER examine or stare into the open end of a broken, severed, or disconnected optical cable when it is connected to the module's *Optical Out* connector.
- Arrange for service-trained personnel, who are aware of the hazards involved, to repair optical cables.

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CAUTION

1. Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
2. Always fit the fibre optic connector dust caps on each connector when not in use. Before connection is made, *always* clean the connector ferrule tip with acetone or alcohol and a cotton swab. Dry the connector with compressed air. Failure to maintain cleanliness of connectors is liable to cause excessive insertion loss.

Laser Warning Symbols

The front panel of the optical module has the following label:

CLASS 1 LASER PRODUCT

NOTE

CLASS 1 LASER PRODUCT translates as follows:

Finnish - LUOKAN 1 LASERLAITE

Finnish/Swedish - KLASS 1 LASER APPARAT

This label indicates that the radiant energy present in this instrument is non-hazardous.

OPTICAL IN

Allows connection of an optical signal, wavelength 1200 to 1600 nm, at a maximum input power level of -8 dBm. **NEVER EXCEED +3 dBm**.
Accepts SONET signals OC-1, OC-3, OC-12 and OC-48 and SDH signals STM-0, STM-1, STM-4 and STM-16 depending on the instrument options fitted.

OPTICAL OUT

Provides optical signals OC-1, OC-3, OC-12 or OC-48 at wavelength 1290 nm to 1330 nm, at a typical power level of +1 dBm. Also provides SDH signals STM-0, STM-1, STM-4 and STM-16 depending on the instrument options fitted.

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Cleaning Optical Connectors

It is recommended that the optical connectors be cleaned at regular intervals using the following materials:

Description	HP Part Number
Blow Brush	9300-1131
Isopropyl Alcohol	8500-5344
Lens Cleaning Paper	9300-0761
Adhesive Tape Kit	15475-68701

CAUTION Do not insert any tool or object into the IN or OUT ports of the instrument as damage to or contamination of the optical fibre may result.

1. Recall Default settings (STORED SETTINGS 0) and remove the power from the OmniBER 720.
2. Remove the adapters from the IN and OUT ports. Use an 11 mm spanner to slacken the nut securing the adapter. On re-assembly tighten the nut using a torque spanner to 1.5 Nm.
3. Using the blow brush with the brush removed blow through the ferrule of the standard flexible connector and the adapter.

CAUTION If the optical fibre of the fixed connector requires further cleaning this entails disassembly of the module which should only be carried out by suitably trained service personnel.

4. Apply some isopropyl alcohol to a piece of the cleaning paper and clean the barrel of the adapter. Using a new piece of cleaning paper, clean the face of the adapter. Repeat this operation, using a new piece of cleaning paper each time.
5. Lightly press the adhesive side of the tape provided against the front of the adapter, then remove it quickly - repeat twice. This removes any particles of cleaning paper which may be present.
6. Replace the adapters on the flexible connector.

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Connecting Accessories

LID Provides the output for the option 602 printer which is fitted in the cover (LID) of the instrument.

VGA Provides the output for a display monitor.

Printer GPIB, RS232, PARALLEL ONLY External printer connection details are given in Chapter 7 page 154 .
The port selected for external printer use is not available for remote control.

Remote Control GPIB, RS232, 10 BASE -T Remote control connection is given in the Remote Control Manual.
The port selected for remote control use is not available for an external printer.

10 Base-T Lan Connection Radiated Emissions

To ensure compliance with EN 55011 (1991) a category 5, FTP patch lead, RJ45 cable should be used to connect the LAN port on the processor module marked “10 Base-T”.

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Front Panel Soft Recovery (Cold Start)

Use the following procedure if you need to perform a front panel soft recovery (i.e. cold start) of the instrument.

Soft Recovery Procedure

1 Switch off the instrument.

2 On the instrument front panel - press and hold softkeys 0 and 4 simultaneously (the softkeys immediately below the display; key 0 is on the extreme left).

3 Power up the OmniBER 720 while holding the softkeys pressed.

4 When the LOS LED has flashed OFF and then ON again, the keys can be released.

5 The LOS LED will flash OFF/ON again several times (7), followed by an audible 'beep' and the display indicating 'Initializing Instrument'.

6 Once the initialization is complete the display will indicate:
'Firmware Revision Update'
'Default settings assumed'
Hit any key to attempt restart'

7 Hit any key, then wait approximately 10 seconds. The instrument should return to its default settings and normal operation.

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OmniBER 720 Options

This section explains the features offered with each instrument and its associated options.

Description	Product/Option
OmniBER 720 communications performance analyzer mainframe	J1407A
OC-48/12/3/1 and STM-16/4/1/0 transmit and receive 1310 nm optical interfaces	104
SDH only	001
SDH/SONET dual standard	002
SONET only	003
LAN, GPIB and RS-232 remote control	601
In-lid printer	602
SC connectors	610
ST connectors	611

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"Setting Transmit Interface" page 20

"Setting THRU Mode" page 24

"Using Smart Test" page 27

"Setting Receive Interface" page 30

Setting the Interfaces - SDH Operation

This chapter tells you how to set the instrument interfaces to match the network being tested.

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Setting Transmit Interface

Payload Selection

One of the key features of the OmniBER 720 is the ability to test concatenated payloads. The following gives a brief description of concatenated payloads, and the benefits of using them.

Concatenated Payloads

Bulk filled or contiguous payload structures e.g. (STM-4c) are designed for carrying broadband services. The entire payload area is used to carry the service with no structured mapping or channelization.
In the case of a concatenated STM-4 (denoted STM-4c), the virtual container area is entirely filled by a single VC-4-4c. This VC-4-4c consists of one Path Overhead and a single container capable of carrying a tributary signal at rates up to approximately 600 Mb/s. Once assembled a VC-4-4c is multiplexed, switched and transported through the network as a single entity.

Benefits: Test the entire bandwidth in one go, and reduce test times. The following table illustrates the reduced test times using concatenated payloads.

Table 1 Test times using concatenated payloads

	Test Time (based on 100 errors)	
Performance test limit	**STM-4c Container**	**STM-1 Bulk Payload**
10^{-14}	12 days	48 days
10^{-13}	1.2 days	4.8 days
10^{-12}	2.90 hours	11.6 hours
10^{-11}	0.3 hour	1.2 hour
10^{-10}	1.75 minutes	7 minutes

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Setting Transmit Interface

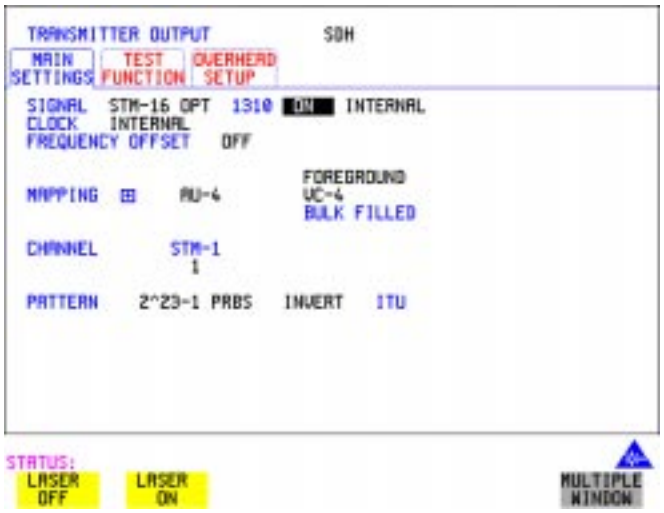
Description The transmit interface settings should match the network equipment settings of rate, wavelength and mapping, determine the payload to be tested and set background conditions to prevent alarms while testing.

TIP: If you wish to set the OmniBER 720 transmitter and receiver to the same interface settings choose OTHER SETTINGS CONTROL COUPLED

Laser On/Off Control

If you wish to switch off the laser when connecting/disconnecting cables, set the field between the wavelength and INTERNAL selections to OFF. When the laser is on the laser symbol at the bottom right of the display is illuminated (yellow).

.



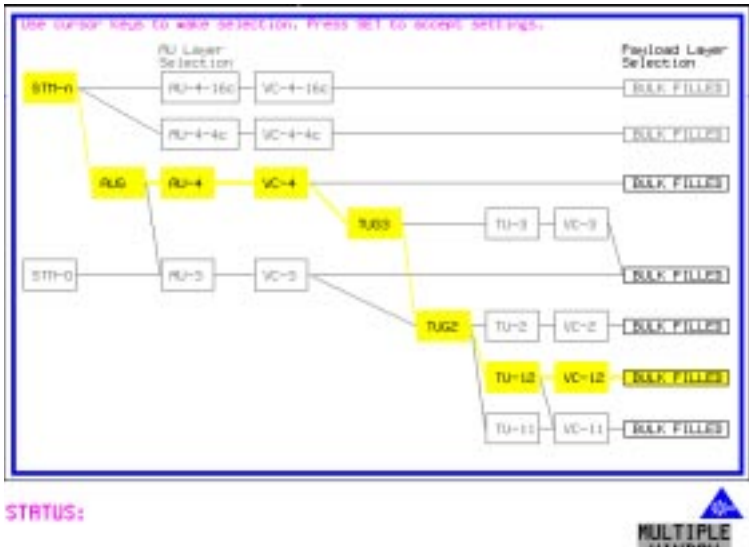
HOW TO:

1. Make your choice of SIGNAL rate.
   Choose INTERNAL unless THRU MODE is required. If THRU MODE is chosen, see "Setting THRU Mode " page 24.
2. Make your choice of CLOCK source. The clock can be internally sourced from the instrument, recovered from the signal at the optical RECEIVE port or externally sourced from the CLOCK REF IN ports (MTS 64 kb/s, BITS 1.5 Mb/s or 10 MHz REF).
3. If required choose the FREQUENCY OFFSET value. See “Adding Frequency Offset” page 84.

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4 Choose the required **F/G MAPPING** and PAYLOAD TYPE, then select **B/G MAPPING** and the BACKGROUND selection. The FOREGROUND selection is the channel that is chosen for test purposes. The BACKGROUND patterns are not used for test purposes and are either the same as the test channel or set to UNEQUIPPED.

Mapping may be selected from a pictorial display by moving the cursor to MAPPING and pressing **SET**.



Use ➡ and ⬅ to move between AU Layer choice, TU Layer choice and Payload Layer choice. Use ⬆ and ⬇ to choose the mapping.
Use **SET** to confirm your choice and return to the **SDH | MAIN SETTINGS** display.

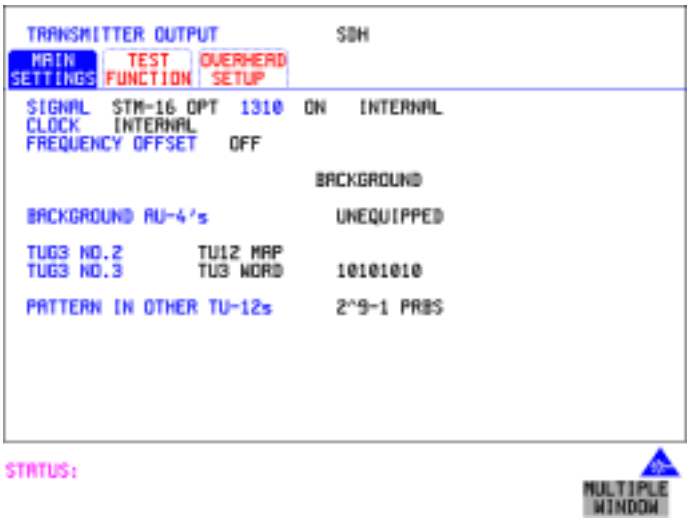
5 If TU-2 mapping is chosen, TU CONCATENATION selection is enabled, choose **OFF** or the tributary at which the concatenation begins, TU2-2C through TU2-6C. The BACKGROUND, PATTERN IN OTHER TU-2's is fixed at NUMBERED, that is, each TU-2 contains a unique number to allow identification in case of routing problems.

6 If TU-3, TU-2, TU-12 or TU-11 mapping is chosen, choose the test tributary CHANNEL, including the STM-1 for an STM-1/STM-16 signal.

7 Choose the PATTERN type and PRBS polarity.

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8 Choose the mapping required in the background (non-test) TUG-3's. Refer to Appendix A for a table of background patterns for AU-3 and TUG-3.



9 If TU-12 mapping is chosen for the test TUG-3, choose the PATTERN IN OTHER TU-12's.

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Setting THRU Mode

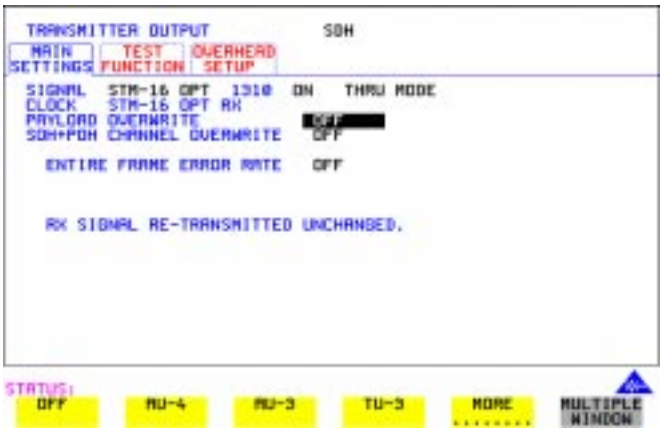
Description

THRU mode is used to non-intrusively monitor SDH lines where no protected monitor points are available. To enable THRU mode select the **TRANSMIT** **MAIN SETTINGS** page. Select SIGNAL RATE before selecting THRU mode.

The entire frame can be errorred at a user defined rate if PAYLOAD OVERWRITE and SOH+POH CHANNEL OVERWRITE are both set to **OFF**. If either overwrite is enabled the ENTIRE FRAME ERROR RATE function is disabled.

There are nominally three modes of operation as follows:

1. Transparent mode: This is the case when the PAYLOAD OVERWRITE field is set to OFF. The received signal is passed through the transmitter completely unchanged. The figure below illustrates the settings for this mode.



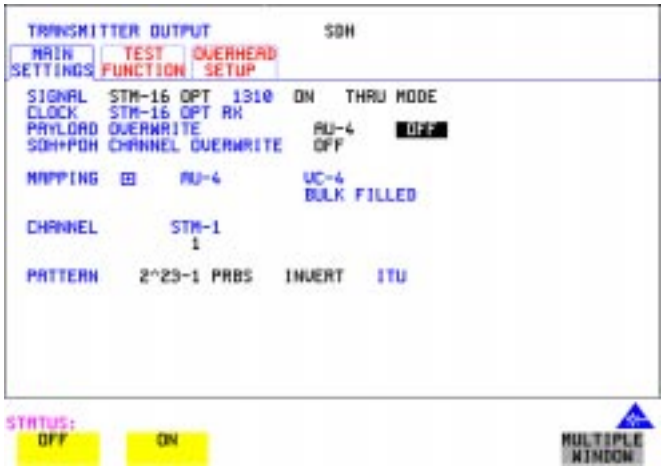
2. Hitless THRU Mode: This mode enables you to change the channel under test and the payload mapping without causing errors in the line signal or any other payload channel, or having to switch out of THRU mode. When you select a Payload Overwrite choice (other than OFF) an additional field is displayed which allows you to enable/ disable Payload Overwrite. If Payload Overwrite is disabled the instrument remains transmitting while you select another channel/tributary (see figure on next page). In this mode any Section or Line B1, B2 BIP errors are recalculated before transmission.

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3. Payload/Channel Overwrite: This mode allows you to substitute a new payload, Section and Line Overhead (SOH) or Path overhead (POH) in the received signal. Any Path B3 BIP errors are recalculated before transmission.

STM-0 optical, STM-1 optical
You can substitute a new payload, Section Overhead (SOH) and Path Overhead (POH) in the received STM-0/1 signal for testing.

STM-4 optical, STM-16 optical
The overhead and payload may be overwritten for AU-4 and AU3. PAYLOAD OVERWRITE is not available for AU-4-4c or AU-4-16c.
SOH overwrite is available for AU-4-4C and AU-4-16c.



HOW TO:

1 Make the required SIGNAL RATE choice, and select THRU MODE on the SDH **TRANSMIT** display, See "Setting Transmit Interface " page 20.

2 Make the PAYLOAD OVERWRITE choice required.
Hitless Mode: The Payload Overwrite enable/disable field (next to the PAYLOAD OVERWRITE field) defaults to OFF.

If AU-4, AU-3, TU-3, TU-2 or TU-12 is chosen, the B1, B2 and B3 BIP's are recalculated before transmission and the Mapping, Selected TU, TU Payload, Pattern, Tributary Offset and Pattern in other TU's settings are displayed. To choose the settings in these, See "Setting Transmit Interface " page 20, steps 4 through 9.

3 Switch the PAYLOAD OVERWRITE enable/disable field to ON. Test functions are available whilst Payload Overwrite is enabled. Select the **TEST FUNCTION** folder and setup as required.

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4 Make the SOH+POH CHANNEL OVERWRITE choice required. The B1, B2 and B3 BIP's are recalculated before transmission.

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Using Smart Test

Smart Setup

The Smart Setup feature simplifies instrument operation by:

- Allowing the instrument to auto-configure on the incoming signal. It will attempt to identify signal structure, and detect mixed payload signal structures and alarms. The OmniBER 720 automatically displays all of the J1 trace identifiers. Once the received signal has been identified you can select a channel of interest and explore further into the payload.

Smart Tests

Allows you to quickly access the most commonly used instrument features such as:

- Signal quality
- Functional tests
- Settings (stored, logging, Tx/Rx coupling and trigger output enable)

HOW TO:

1 Connect the OmniBER 720 to the network.

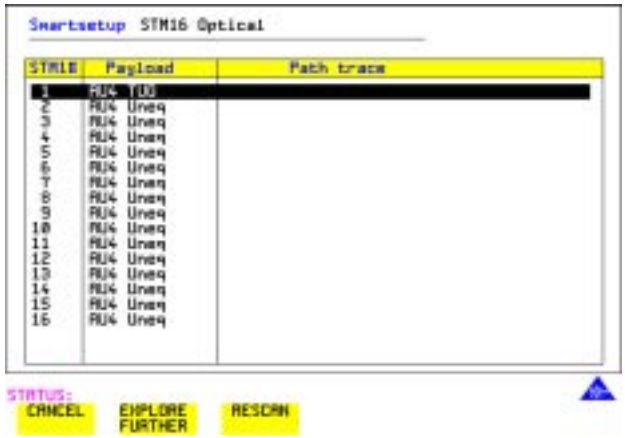
2 Press **SMART TEST**.



3 With Smartsetup highlighted, press **START** to auto-discover information about the receive signal. Or press **CANCEL** to exit Smart Tests.

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An example of a typical display after choosing to RUN Smartsetup is shown below.
Note: The channel information displayed is the one obtained the last time a scan was performed. If you have changed the input signal since the last Smartsetup you must perform a RESCAN now.



SET UP RX key — If you select an individual channel using the cursor control keys, and then select **SET UP RX**, the instrument exits smartsetup and sets the receiver to the test pattern detected in the selected channel.

HOW TO: **Run a Smart Test (Signal Quality - Frequency Measurement):**

1. Ensure a valid signal is connected to the instrument's RECEIVE port.
2. Press **SMART TEST**.
3. Use the up and down cursor control keys to select Signal quality.
4. Use the left and right cursor control keys to access the tests.
5. Use the up and down cursor control keys to select Frequency Measurement.

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6 Press **SELECT** to display the frequency screen. Or press **CANCEL** to exit Smart Tests.

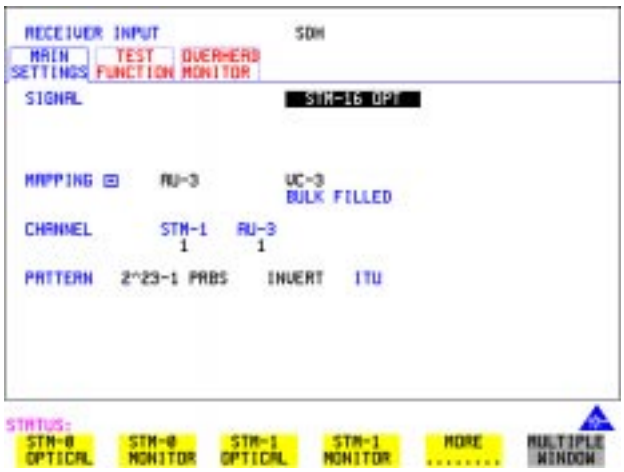
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Setting Receive Interface

Description The receive interface settings should match the network equipment settings of rate and mapping, and determine the payload to be tested.

TIP: If you wish to set the OmniBER 720 transmitter and receiver to the same interface settings, choose OTHER | SETTINGS CONTROL | COUPLED. This causes the receiver to be configured to the same settings as the transmitter,



HOW TO:

1. Choose the required SIGNAL source.
2. Choose mapping and type of payload.
3. If TU-2 mapping is chosen, and CONCATENATION is enabled, choose the tributary at which the concatenation begins.
   If TU-2, TU-3, TU-12 or TU-11 mapping is chosen, choose the test tributary under CHANNEL.
4. Choose the PATTERN type and PRBS polarity.

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3

"Using Transmit Overhead Setup" page 32
"Using Receive Overhead Monitor" page 34
"Setting Overhead Trace Messages" page 36
"Setting Overhead Labels" page 37
"Generating Overhead Sequences" page 38
"Using Receive Overhead Capture" page 40
"Adding Frequency Offset" page 42
"Adding Errors and Alarms" page 43
"Adding Pointer Adjustments" page 44
"Using Pointer Graph Test Function" page 52
"Stressing Optical Clock Recovery Circuits" page 54
"Generating Automatic Protection Switch Messages" page 56
"Inserting and Dropping the Data Communications Channel" page 57

Selecting Test Features - SDH Operation

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Using Transmit Overhead Setup

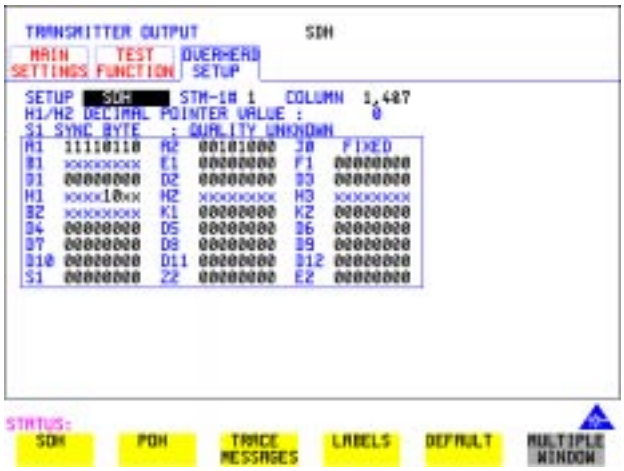
Description

You can set an overhead byte to a known static state to aid troubleshooting, for example to quickly check for “stuck bits” in path overhead bytes. Section Overhead, Path Overhead, Trace Messages and Labels can be set using this feature.

HOW TO:

1 Set up the SDH transmit interface and payload required. See "Setting Transmit Interface " page 20.

2 Choose the type of overhead to SETUP.



If STM-4 OPT or STM-16 OPT is chosen as the SDH interface, choose the STM-1 you wish to set up.
DEFAULT - Use to set all overhead bytes to the standard values defined by ITU-T.
If a test function is active then the overhead byte value is determined by the choices made in the Test Function. If APS Messages is chosen, for example, K1K2 value is set by the APS Messages setup.

3 If SOH (Section Overhead) is chosen, choose the COLUMN to be displayed. Many bytes in COLS 2,5,8 and 3,6,9 are unlabeled as the other overhead functions have not yet been defined.
If ALL COLUMNS is chosen, the hexadecimal value of all 81 bytes of the STM-1 section overhead selected are displayed (all 324 bytes of an STM-4 or 1,296 bytes of an STM-16 are displayed 81 bytes at a time by selecting each STM-1 in turn). The value of the bytes can be set using **DECREASE DIGIT**

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INCREASE DIGIT ← →.
If BYTE NAMES is chosen, the labels for the ALL COLUMNS overhead bytes are displayed.

4 If POH (Path Overhead) is chosen, choose the TYPE of overhead within STM-1 under test to be setup.
J1 and J2 bytes can be set under Path Overhead or Trace Messages. H4 byte has a choice of sequences for TU-12, TU11 and TU-2 mapping:
Full Sequence - 48 byte binary sequence.
Reduced Sequence - Binary count sequence of 0 to 3 i.e. 111111(00 to 11).
COC1 Sequence - Binary count sequence of 0 to 3 i.e. 110000(00 to 11).

5 If TRACE MESSAGES is chosen, see "Setting Overhead Trace Messages " page 36.

NOTE Any bit of an overhead byte which is displayed as x or s cannot be set at any time. All other bits can be set to 0 or 1.

TIP: You can set all overhead bytes to the default state by selecting SETUP **DEFAULT**.

You can set all overhead bytes and test functions to the default state by recalling Stored Settings [0] on the **OTHER** display.

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Using Receive Overhead Monitor

Description

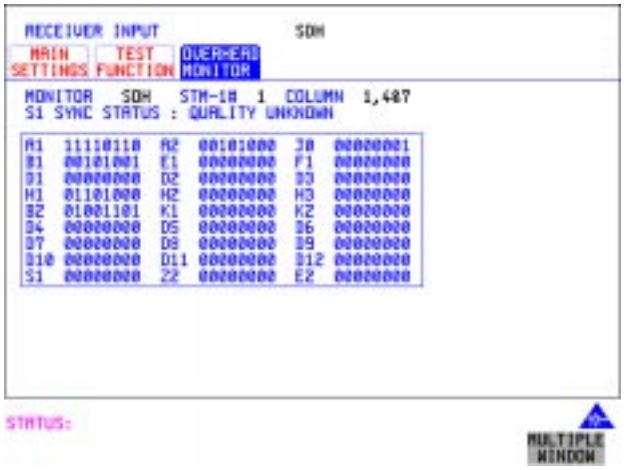
When first connecting to a SDH network, a start up confidence check can be made by viewing the behavior of all the overhead bytes. If the SDH network shows alarm indications, some diagnosis of the problem may be gained from viewing all the overhead bytes.The OVERHEAD MONITOR display is updated once per second (once per 8000 frames) approximately.

TIP:

A snapshot of the received overhead can be logged to the chosen logging device. See "Logging on Demand " page 146.

HOW TO:

1. Set up the receive SDH interface and payload as required. See “Setting Receive Interface” page 30.
2. Choose the type of overhead to MONITOR.



3. If SOH (Section Overhead) is chosen, choose the STM-1 number and COLUMN to be displayed.
   Many bytes in COLS 2,5,8 and 3,6,9 are unlabeled because the other overhead functions have not yet been defined.
   If ALL COLUMNS is chosen, the hexadecimal value of all 81 bytes of section overhead is displayed (all 324 bytes of an STM-4 or 1,296 bytes of an STM-16 are displayed 81 bytes at a time by selecting each STM-1 in turn).The value of the bytes can be set using **DECREASE DIGIT** **INCREASE DIGIT** ⬅ ➡.

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If BYTE NAMES is chosen, the labels for the ALL COLUMNS overhead bytes are displayed.

4 If POH (Path Overhead) is chosen, choose the source of the overhead, VC-4-Nc, VC-4, VC-3, VC-2, VC-12 or VC-11.
J1 and J2 bytes can be monitored under Path Overhead or Trace Messages

5 If TRACE MESSAGES is chosen, you can monitor a data message to verify portions of the network.
If the 16 byte CRC7 message structure is detected, the 15 characters within the message are displayed.
If the CRC7 structure is not detected in J1, the 64 byte message format is assumed and displayed.
If the CRC7 structure is not detected for J0 or J2, all 16 bytes are displayed.

6 If LABELS is chosen, the S1 sync status, HP path label (C2) and the LP Path label (V5) are monitored.

7 If APS MESSAGES is chosen, choose the TOPOLOGY, **LINEAR** (G.783) or **RING** (G.481). The K1 and K2 bits are monitored.

TIP: If any abnormal behavior is observed on a particular path or section overhead byte, or an associated group of bytes (3XA1,3XA2; D1 - D3), the **RECEIVE** **TEST FUNCTION** display of **OVERHEAD CAPTURE** can be used to “Zoom” in on the suspect byte or bytes on a frame by frame basis. See "Using Receive Overhead Capture " page 40.

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Setting Overhead Trace Messages

Description

You can insert a data message to verify portions of the network:

J0 verifies the regenerator section overhead.
J1 verifies the VC-3, VC-4 or VC-4-Nc path connection.
J2 verifies the VC-2, VC-12 or VC-11 path connection.



HOW TO:

Edit User Messages

1 Choose the message for insertion in the chosen trace channel.

2 There are two ways you can edit a user message as follows;

- Use the edit keys at the bottom of the display JUMP, PREVIOUS CHAR, NEXT CHAR ⬅ and ➡ that are displayed when you position the cursor on a User message or:
- Use the POP UP alphanumerical keypad that is displayed when you press the front panel **SET** key. Detailed instructions on how to change instrument settings using the POP UP keypad is given in the Quick Start Guide (page 14) under the heading “Changing Instrument Settings”.

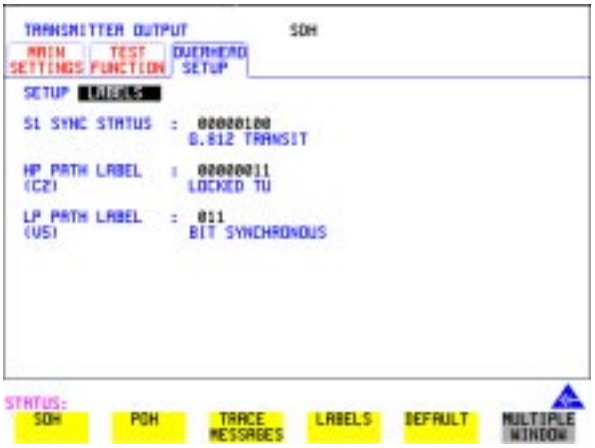
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Setting Overhead Labels

Description

Choosing LABELS allows the setting of the S1 SYNC STATUS, HP PATH LABEL (C2) and LP PATH LABEL (V5).



HOW TO:

1. Choose the overhead label that you want to edit.
2. Edit the label using the softkeys at the bottom of the display. If you select USER, use the softkeys at the bottom of the display to edit the label key, or press **SET**, then use the softkeys and pop-up keypad to edit the label. Detailed instructions on how to change instrument settings using the pop-up keypad is given in the Quick Start Guide (page 13) under the heading “Changing Instrument Settings”.

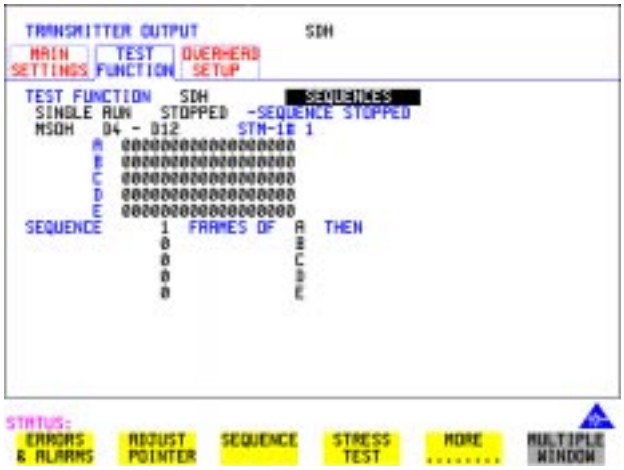
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Generating Overhead Sequences

Description

You may insert a sequence of patterns into a functional group of overhead bytes for testing or troubleshooting purposes.



HOW TO:

1. Set up the SDH transmit interface and payload required. See “Setting Transmit Interface” page 20.
2. Select **TEST FUNCTION**, SDH, SEQUENCES as shown above.
3. Choose the type of sequence required.
   SINGLE RUN - runs the sequence once and then stops.
   REPEAT RUN - runs the sequence repeatedly until STOPPED is chosen.
4. Choose the overhead type as required.
   RSOH- Regenerator Section Overhead
   MSOH - Line Overhead
   POH - Path Overhead
5. Choose the byte or bytes of overhead required.
6. Set up the required number of data patterns and the number of frames in which each data pattern should appear.
   Your sequence is derived from up to 5 blocks of hexadecimal data. Each block can be transmitted in up to 64,000 frames.
   The data and the number of frames are set using **DECREASE DIGIT** **INCREASE DIGIT** ← →.

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7 Start the sequence by choosing **START**.

NOTE When you start the sequence illustrated, one Out of Frame alarm and one Loss of Frame alarm should occur every eight seconds.

A1A2 Boundary Function

A1A2 provide a frame alignment pattern (A1=F6 H, A2=28 H). Use A1A2 to test the 6 framing bytes at the A1A2 boundary in the section overhead (see display on previous page). The 6 bytes across the boundary are:

STM-n

STM-1 channel:	#n-2	#n-1	#n	#1	#2	#3
Overhead byte:	A1 #3	A1 #3	A1 #3	A2 #1	A2 #1	A2 #1

A network element, typically only uses three of these bytes (which ones are not defined in the standards, so will vary between manufacturers) to gain and maintain frame synchronization. In many cases the A1A2 bytes selected are those at the A1A2 boundary (i.e. the A1 bytes in the last STS-1 channel and the A2 bytes in the first STS-1 channel). Therefore, the ability to stress test across the boundary is necessary to verify a correct synchronization algorithm within a network element.

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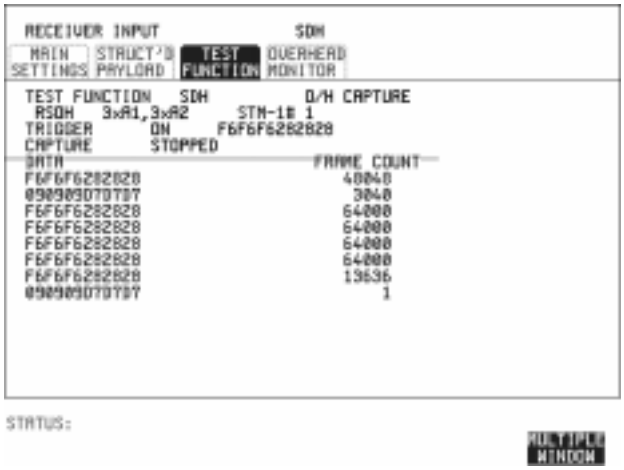
Using Receive Overhead Capture

Description

Regenerator section, Multiplexer section and Path overhead provide network support functions, responding dynamically to network conditions and needs. It is therefore useful to capture overhead activity on a frame by frame basis.

TIP:

The Overhead Capture display can be logged to the chosen logging device. See "Logging on Demand " page 146.



HOW TO:

1. Set up the receive SDH interface and payload as required. See “Setting Receive Interface” page 30.
2. Select **TEST FUNCTION**, SDH, O/H CAPTURE as shown above.
3. Choose the overhead type as required.
   RSOH- Regenerator Section Overhead
   MSOH- Multiplexer Section Overhead
   POH- Path Overhead
4. Choose the Byte or bytes of overhead to be captured.

Choose the TRIGGER to determine the start point of the capture.
OFF - starts immediately the capture is initiated. Can be used to provide a frame by frame monitor of the chosen byte or bytes.
ON -captures activity after your specified overhead state has occurred. Can be used for transient detection from a specified expected state.

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ON NOT - captures activity after the first occurrence of a deviation from your specified overhead state. Can be used for transient detection from a specified expected state.

5 Up to 16 records of overhead state are provided. Each record will represent between 1 and 64,000 frames. A capture is started by pressing CAPTURE **START** and terminates when up to 16 records have been captured. The capture can be terminated earlier by pressing CAPTURE **STOP**.

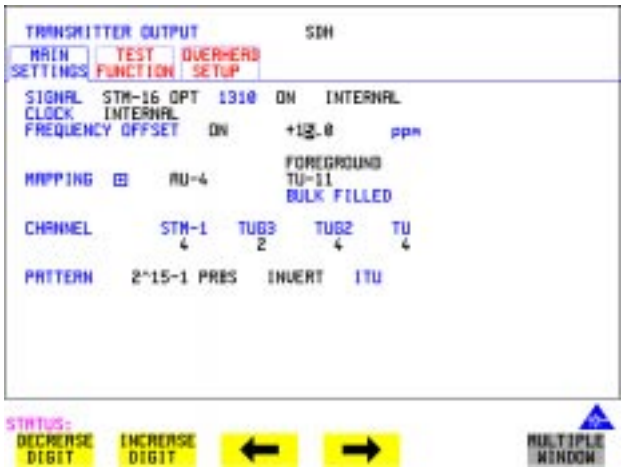
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Adding Frequency Offset

Description

Frequency offset can be added to the SDH interface rate signal and to the payload signal.



HOW TO:

Add SDH Line Rate Offset

Choose the amount of frequency offset required.
You can set the Frequency Offset in the range -999 ppm to +999 ppm in 1 ppm steps using **DECREASE DIGIT** **INCREASE DIGIT** ← and → or press **SET** for a pop-up numerical keypad.
The amount of applied Frequency Offset can be varied while measurements are taking place.
If the value of the SDH line rate offset chosen is sufficient to cause the maximum stuff rate to be exceeded, the asynchronous payload is offset to prevent bit errors occurring and the maximum stuff rate is maintained.

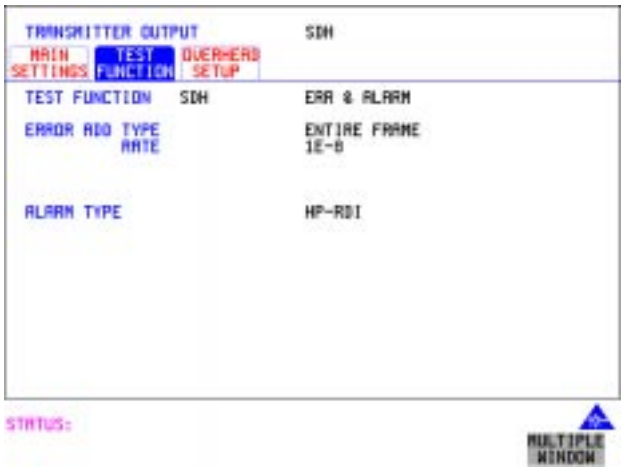
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Adding Errors and Alarms

Description

Errors and alarms can be added to an SDH signal during testing.



HOW TO:

1. Set up the SDH transmit interface and payload required. See "Setting Transmit Interface " page 20.
2. Select **TEST FUNCTION**, SDH, ERR & ALARM as shown above.
3. Choose the ERROR ADD TYPE and RATE required.
   Errors can be added at preset rates and at USER programmable rate. With the exception of ENTIRE FRAME, A1A2 FRAME and BIT, errors can be added at ERROR ALL rate.
   If B2 BIP errors are chosen errors can be added to trigger an APS THRESHOLD. This takes the form of N errors in T time period. N and T are both selectable.
4. Choose the ALARM TYPE
   Errors and Alarms can be added at the same time.

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Adding Pointer Adjustments

Introduction

Pointers perform a critical role in the error free transmission of payload data (subscriber data) through an SDH network. They also enable individual payload channels to be inserted or extracted from a high speed STM-n line signal (for example the functionality provided by ADM's).

Pointer adjustments are often necessary to compensate for asynchronous operation between different nodes within an SDH network.These adjustments however can result in jitter being added to a PDH signal transmitted from an SDH network element.

Jitter caused by Pointer Adjustments

Pointer adjustments are the mechanisms within SDH to compensate for frequency and phase differences between VCs and outgoing SDH frames. These pointer adjustments are byte wide and since they can occur randomly, they may cause significant amounts of payload signal jitter. It is therefore necessary to control the jitter on payload signals that is due to pointer adjustments.

Pointer adjustment activity within a network can be randomly spaced individual pointer adjustments, pointer bursts or periodic pointer adjustments.

The ITU-T G.783 and ETSI TM-1015 recommendations define a set of pointer sequences to be used when evaluating an NE's pointer adjustment jitter performance.

The OmniBER 720 generates a set of test sequences which can be used to simulate network pointer adjustment activity. This allows the amount of tributary jitter due to different types of pointer adjustment to be measured in the OmniBER 720.

Pointer adjustment activity within a network can be randomly spaced individual pointer adjustments, pointer bursts or periodic pointer adjustments.

The Bellcore GR-253 and ANSI T1.105 standards define a set of pointer sequences to be used when evaluating an NE's pointer adjustment jitter performance.

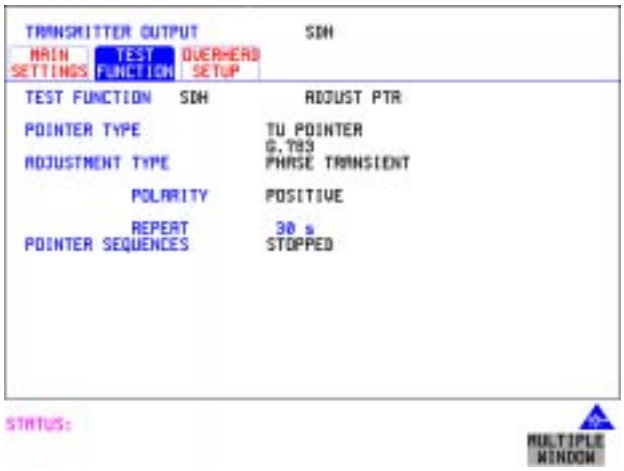
The OmniBER 720 generates a set of test sequences which can be used to simulate network pointer adjustment activity.

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Adding Pointer Adjustments

Description

The transmitted AU or TU pointer value can be adjusted for testing purposes.



HOW TO:

1. Set up the SDH transmit interface and payload required. See "Setting Transmit Interface " page 60.
2. Choose the POINTER TYPE.
3. Choose the ADJUSTMENT TYPE required.
   BURST - You determine the size of the burst by the number of PLACES chosen. If, for example, you choose 5 PLACES the pointer value will be stepped 5 times in unit steps e.g. 0 (start value), 1, 2, 3, 4, 5 (final value). The interval between steps is as follows:
   For AU and TU-3, the minimum spacing between adjustments is 500 us. For TU except TU-3, the minimum spacing between adjustments is 2 ms.
   Choose ADJUST POINTER [ON] to add the chosen burst

   NEW POINTER - You can choose a pointer value in the range 0 to 782 with or without a New Data Flag.
   The current pointer value is displayed for information purposes.
   Choose ADJUST POINTER [ON] to transmit the new pointer value.

   OFFSET - You can frequency offset the line rate or the VC/TU rate, relative to each other, thus producing pointer movements. If you offset the AU pointer, an 87:3 sequence of pointer movements is generated. The available configurations are listed in the following table.
   If you are currently adding Frequency Offset to the SDH interface or payload, pointer OFFSET is not available

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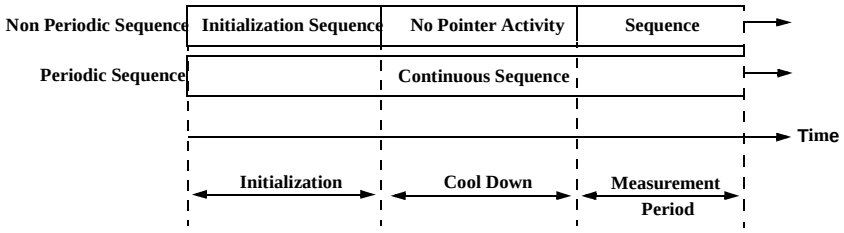
Pointer Type	Line Rate	AU Payload (VC) Rate	TU Payload (TU) Rate
AU	Constant	Offset	Tracks AU Payload
AU	Offset	Constant	Constant
TU	Constant	Constant	Offset
TU	Offset	Tracks Line Rate	Constant

4 **G.783** - Provides pointer movements according to ITU-T G.783:
Choose the G.783 ADJUSTMENT TYPE.
Choose the POLARITY, INTERVAL and PATTERN (where applicable) for the selected sequence.
Choose POINTER SEQUENCES **START INIT** to generate the selected G.783 sequence and **STOP INIT** to stop the pointer sequences.

G.783 Pointer Sequences Explained

In addition to the BURST, NEW POINTER and OFFSET pointer movements described, the OmniBER 720 can also generate pointer sequences (pointer movements) according to ITU-T G.783, T1.105.03 and GR-253. Note that T.105.03/ GR-253 sequences are explained on page 88 in the SONET Test Features Chapter.

Before running a pointer sequence you can elect to run an initialization sequence, followed by a cool down period, and then run the chosen sequence. This is selected using the **START INIT** key shown in the display on the previous page. Initialized pointer sequences are made up of three periods: the *Initialization Period*, the *Cool Down Period*, and the *Sequence (Measurement) Period*, illustrated in the following figure:



Note: SINGLE (e), BURST (f) and PHASE TRANSIENT are Non Periodic Sequences.

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Initialization Period

For SINGLE e), BURST f) and PHASE TRANSIENT sequences the initialization sequence consists of 60 seconds of pointer adjustments applied at a rate of 2 adjustments per second and in the same direction as the specified pointer sequence.

Cool Down Period

A period following the initialization period which for SINGLE e), BURST f) and PHASE TRANSIENT sequences is 30 seconds long when no pointer activity is present.

Sequence (Measurement) Period

The period following the Cool Down period where the specified pointer sequence runs continuously.

Periodic Test Sequences

For periodic test sequences (for example “PERIODIC ADD g/h”) both the 60 second initialization and 30 second cool down periods consist of the same sequence as used for the subsequent measurement sequence. If the product of the period T and the selected optional background pattern (87+3 or 26+1) exceeds 60 seconds then the longer period is used for the initialization. For example, if T is set for 10 seconds then the initialization period may be extended to 900 seconds.

The OmniBER 720 displays a message indicating which phase (initialization, cool down or measurement) the transmitter is currently generating.

NOTE

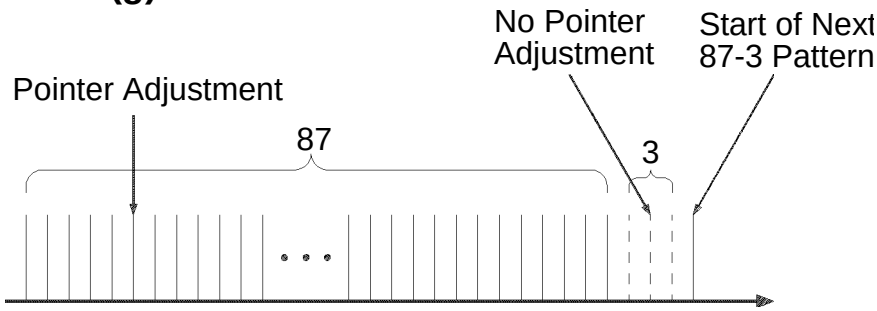
The following conditions apply for pointer sequence generation:
The sequences can only be applied to the AU pointer when the AU does not contain a TU structure, otherwise it is applied to the TU pointer. Pointer sequence generation is not available when a frequency offset is being applied to the Line Rate.

The following figure gives an example of a G.783 (g) 87-3 Pointer Sequence.

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G.783(g) 87-3 Pattern



An Example of a Pointer Sequence

Pointer Sequence	Description
G.783(a) PERIODIC SINGLE	Periodic Single adjustments, each with opposite polarity to the preceding adjustment. The interval between pointer adjustments is user selectable (see Note 1 page 50).
G.783 (b) PERIODIC ADD	Periodic Single adjustments, with selectable polarity and added adjustment (1 extra). The spacing between the added adjustment and the previous adjustment is set to the minimum, (see Note 2 page 50). The interval between pointer adjustments is user selectable (see Note 1). Added adjustments occur every 30 seconds.
G.783 (c) PERIODIC CANCEL	Periodic Single adjustments, with selectable polarity and cancelled adjustment (1 less). The interval between pointer adjustments is user selectable (see Note 1 page 50). Cancelled adjustments occur every 30 seconds.
G.783(d) PERIODIC DOUBLE	Periodic Double adjustments (pair of adjustments). The pair alternate in polarity. The spacing between pairs of adjustments, of like polarity is set to the minimum (see Note 2). The interval between pointer adjustments is user selectable (see Note 1).
G.783 (e) SINGLE	Periodic Single adjustments, all of the same polarity which is selectable. Separation between pointer adjustments is fixed at approximately 30 seconds.

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Pointer Sequence	Description
G.783 (f) BURST	Periodic bursts of 3 adjustments, all of the same polarity which is selectable. The interval between bursts is fixed at approximately 30 seconds. The interval between adjustments within a burst is set to the minimum (see Note 2 page 50).
PHASE TRANSIENT	Phase transient pointer adjustment burst test sequence. All adjustments are of the same polarity, which is selectable. The interval between bursts is fixed at 30 seconds. Each burst consists of 7 pointer movement. The first 3 in each burst are 0.25 s apart, and the interval between the 3 and 4 movement, and each remaining movement 0.5 seconds.
G.783 (g) PERIODIC NORMAL (87-3 Pattern)	An 87-3 pattern is selected. The sequence pattern is 87 pointer movements followed by 3 missing pointer movements. Pointer polarity is selectable and the time interval between pointer adjustments settable (see Note 1 page 50).
G.783 (g) PERIODIC ADD (87-3 Pattern)	An 87-3 pattern is selected. The sequence pattern is 87 pointer movements followed by 3 missing pointer movements with an added pointer movement after the 43rd pointer. The spacing between the added adjustment and the previous adjustment is set to the minimum, (see Note 2 page 50). Pointer polarity is selectable. The time interval between pointer adjustments can be set (see Note 1). Added adjustments occur every 30 seconds or every repeat of the 87-3 pattern, whichever is longer.
G.783 (g) PERIODIC CANCEL (87-3 pattern)	An 87-3 pattern is selected. The sequence pattern is 87 pointer movements followed by 3 missing pointer movements with a cancelled pointer movement at the 87th pointer. Pointer polarity is selectable, and the time interval between pointer adjustments can be set (see Note 1). Cancelled adjustments occur every 30 seconds or every repeat of the 87-3 pattern, whichever is longer.
G.783 (h) PERIODIC NORMAL (Continuous Pattern)	Provides a continuous sequence of pointer adjustments. The polarity of the adjustments is selectable, and the time interval between adjustments can be set (see Note 1).
G.783 (h) PERIODIC ADD (Continuous Pattern)	Periodic Single adjustments, with selectable polarity and added adjustment (1 extra). The spacing between the added adjustment and the previous adjustment is set to the minimum, (see Note 2). The time interval between pointer adjustments can be set (see Note 1). Added adjustments occur every 30 seconds or every repeat of the 87-3 pattern, whichever is longer.

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Pointer Sequence	Description
G.783 (h) PERIODIC CANCEL (Continuous Pattern)	Periodic Single adjustments, with selectable polarity and cancelled adjustment (1 less). The time interval between pointer adjustments can be set (see Note 1). Cancelled adjustments occur every 30 seconds or every repeat of the 87-3 pattern, whichever is longer.
PERIODIC NORMAL (26-1 Pattern)	This selection is only available if you have selected TU11 mapping, or TU12 with ASYNC DS1 selected. The sequence pattern is 26 pointer movements followed by 1 missing pointer movement. Pointer polarity is selectable and the time interval between pointer adjustments programmable to 200 ms, 500 ms, 1 s, 2 s, 5 s or 10 seconds.
PERIODIC ADD (26-1 Pattern)	This selection is only available if you have selected TU11 mapping, or TU12 with ASYNC DS1 selected. The sequence pattern is 26 pointer movements followed by 1 missing pointer movement. The added adjustment occurs 2 ms after the 13th pointer adjustment. Pointer polarity is selectable and the time interval between pointer adjustments programmable to 200 ms, 500 ms, 1 s, 2 s, 5 s or 10 s. Added adjustments occur every 30 seconds or every repeat of the 26-1 pattern, whichever is longer.
PERIODIC CANCEL (26-1 pattern)	This selection is only available if you have selected TU11 mapping, or TU12 with ASYNC DS1 selected. The sequence pattern is 26 pointer movements followed by 1 missing pointer movement. The cancelled adjustment is the 26th pointer adjustment, that is the one before the regular gap of 1. Pointer polarity is selectable and the time interval between pointer adjustments programmable to 200 ms, 500 ms, 1 s, 2 s, 5 s or 10s. Cancelled adjustments occur every 30 seconds or every repeat of the 26-1 pattern, whichever is longer.

Pointer Sequence Notes

Note 1: For AU and TU-3, the sequence interval is selectable from:
7.5 ms, 10, 20, 30, 34 ms, 40 to 100 ms in 10 ms steps, 100 to 1000 ms in 100 ms steps, 1, 2, 5, 10 seconds.
For TU except TU-3, the sequence interval is selectable from:
200 ms, 500 ms, 1, 2, 5 and 10 seconds.

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Note 2: For AU and TU-3, the minimum spacing between adjustments is 500 us. For TU except TU-3, the minimum spacing between adjustments is 2 ms.

Table 2 O.172 - G.783 pointer test sequence description

G.783 Pointer Test Sequence	SDH tributary bit rate (kbits) and SDH container					
Description	**1.544 TU-11**	**6.312 TU-12**	**2.048 TU-2**	**34.368 TU-3**	**44.736 AU-3**	**139.264 AU-4**
G.783(a) Periodic Single		X		X		X
G.783 (b) Periodic Add		X		X		X
G.783 (c)Periodic Cancel		X		X		X
G.783 (d)Periodic Double				X		X
G.783 (e) Single	X		X		X	
G.783 (f) Burst	X		X		X	
G.783 (g) Periodic Normal (87-3 Pattern)					X	X
G.783 (g) Periodic Add (87-3 Pattern)					X	X
G.783 (g) Periodic Cancel (87-3 Pattern)					X	X
G.783 (h) Periodic Normal	X		X		X	
G.783 (h) Periodic Add	X		X		X	
G.783 (h) Periodic Cancel	X		X		X	

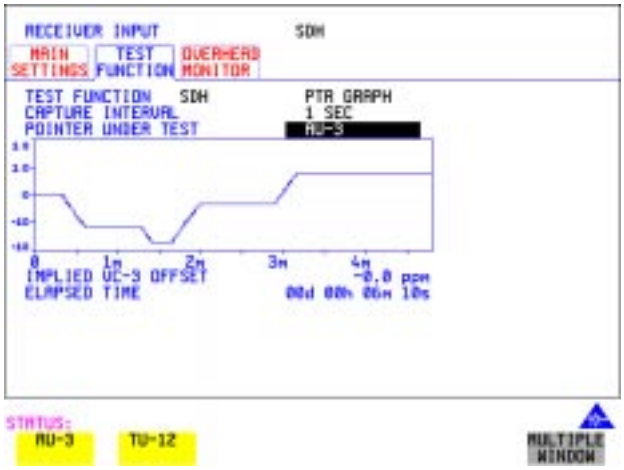
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Using Pointer Graph Test Function

Pointer Graph shows the relative offset during the measurement period. This allows the time relationship of AU or TU pointer movements to be observed. Up to 4 days of storage allows long term effects such as Wander to be observed. If an alarm occurs during the measurement period, a new graph starts at the centre of the display (offset zero) after recovery from the alarm.

TIP: The Pointer Graph display can be logged to the chosen logging device. See "Logging on Demand " page 146.



TIP: The graph can also be viewed on the **RESULTS** **SDH RESULTS** display at the end of the measurement.

HOW TO:

1. Set up the receive SDH interface and payload as required. See “Setting Receive Interface” page 70.
2. On the RECEIVE Test Function page, select **PTR GRAPH** then choose the CAPTURE INTERVAL required.
   The capture interval determines the time between captures. Low values of capture interval should be chosen when a high degree of pointer movements is expected. High values of capture interval should be chosen when a low degree of pointer movements is expected, for example Wander over 1 day, use 5 MINS and Wander over 4 days, use 20 MINS.
   If, during a long term measurement (4 days), an event occurs at a particular time each day, then the instrument can be set to log the results graph of that event.

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3 Choose the POINTER UNDER TEST type.

4 Press **RUN/STOP** to start the measurement.

TIP: If the event occurs outside normal working hours, a Timed Start measurement can be made.

The values of capture interval available and the approximate total capture window is as follows:

1 SEC - display window of approximately 5 minutes.
5 SECS - display window of approximately 25 minutes.
20 SECS - display window of approximately 1 hour 40 minutes.
1 MIN - display window of approximately 5 hours.
5 MIN - display window of approximately 1 day.
20 MIN - display window of approximately 4 days.

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Stressing Optical Clock Recovery Circuits

Description

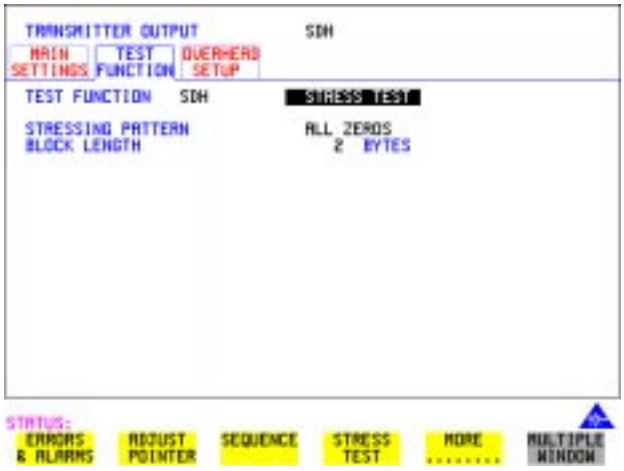
This test is essentially designed for testing optical clock recovery circuits in the presence of long runs of zero's or one's (after scrambling). The test function page allows control of the test pattern and the block length. The maximum block length is 2 bytes less than the width of the Virtual Container (VC).

When the test is enabled, the instrument applies the selected pattern immediately after the first row of Section Overhead bytes **after scrambling**. The location of the start of the pattern is byte 4 at 52 Mb/s (i.e. after the first three bytes of overhead), byte 10 at 155 Mb/s, byte 37 at 622 Mb/s and byte 145 at 2488 Mb/s. The remainder of the Virtual Container will contain the signal structure and pattern as defined on the TRANSMITTER, MAIN SETTINGS page.

The payload is overwritten in such a way that the transmitted B1 and B2 values are correct.

When using this feature to test network equipment clock recovery, long runs of zero's may be inserted at the input of the UUT (unit under test) and by monitoring B1 and B2 at the UUT output, error free transmission can be verified.

The stress test is available at all optical rates.



HOW TO:

1 Set up the SDH transmit interface and payload required. See "Setting Transmit Interface" on page 20.

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Choose the required STRESSING PATTERN.
The G.958 test pattern consists of 7 consecutive blocks of data as follows: the first row of section overhead bytes, ALL ONES, a PRBS, the first row of section overhead bytes, ALL ZEROS, a PRBS and the first row of section overhead bytes.

2 If you choose ALL ONES or ALL ZEROS as the stressing pattern, choose the number of bytes in the BLOCK LENGTH.

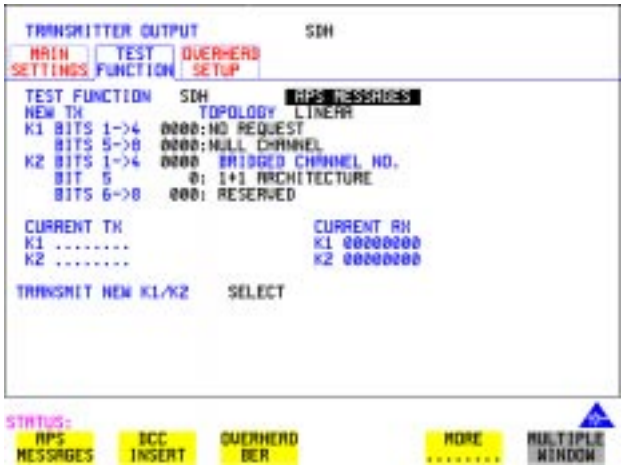
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Generating Automatic Protection Switch Messages

Description

You can program the K1 and K2 bytes to exercise the APS functions for Both LINEAR (ITU-T G.783) and RING (ITU-T G.841) topologies.



HOW TO:

1. Set up the SDH transmit interface and payload required. See “Setting Transmit Interface on page 20.
2. Choose the TOPOLOGY required.
3. Choose the message to be transmitted.
   If LINEAR topology is chosen, choose the CHANNEL, the BRIDGED CHANNEL NO., the ARCHITECTURE and the RESERVED bits you require.
   If RING topology is chosen, choose the DESTINATION NODE ID, the SOURCE NODE ID, the type of PATH and the status code (K2 Bits 6->8)
   The current TX and RX, K1 and K2, values are displayed for reference only.
4. Choose **DOWNLOAD** to transmit the new K1/K2 values.

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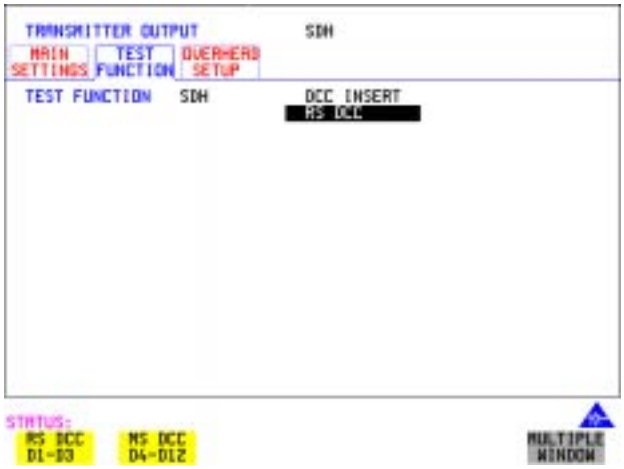
Inserting and Dropping the Data Communications Channel

Description

The Data Communications Channel (DCC) of the regenerator and multiplexer section overhead can be verified by protocol testing. The Insert and Drop capability provides access to the DCC via the RS-449 connector on the front panel of the Multirate Analyser module.

DCC INSERT is available on the **TRANSMIT**, **TEST FUNCTION** display. Select SDH, then use the right cursor key to access DCC INSERT selection.

DCC DROP is available on the **RECEIVE**, **TEST FUNCTION** display. Select SDH, then use the right cursor key to access DCC DROP selection.



HOW TO:

1. Connect the Protocol Analyzer to the DCC port on the Multirate Analyzer module.
2. Choose the required DCC.

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4

"Setting Transmit Interface" page 60

"Setting THRU Mode" page 64

"Using Smart Test" page 67

"Setting Receive Interface" page 70

Setting the Interfaces - SONET Operation

This chapter tells you how to set the instrument interfaces to match the network being tested.

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Setting Transmit Interface

Payload Selection

One of the key features of the OmniBER 720 is the ability to test concatenated payloads. The following gives a brief description of concatenated payloads, and the benefits of using them.

Concatenated Payloads

Bulk filled or contiguous payload structures (STS-3c, STS-12c or STS-48c) are designed for carrying broadband services. The entire payload area is used to carry the service with no structured mapping or channelization.
For example, in a concatenated STS-12 (denoted STS-12c), the virtual container area is entirely filled by a single STS-12c SPE. This STS-12c SPE consists one Path Overhead and a single container capable of carrying a tributary signal operating at rates up to approximately 600 Mb/s. Once assembled a STS-12c SPE is multiplexed, switched and transported through the network as a single entity.

Benefits: Test the entire bandwidth in one go, and reduce test times. The following table illustrates the reduced test times using concatenated payloads.

	Test Time (based on 100 errors)		
Performance test limit	**STS-48c SPE Container**	**STS-12c SPE Payload**	**STS-3c SPE Payload**
10^{-14}	48 days	192 days	>2 years
10^{-13}	4.8 days	19.2 days	77 days
10^{-12}	11.6 hours	1.9 days	7.7 days
10^{-11}	1.2 hour	4.8 hour	18.5 hours
10^{-10}	7 minutes	28 minutes	1.9 hours

Description The transmit interface settings should match the network equipment settings of rate, wavelength and mapping, determine the payload to be tested and set background conditions to prevent alarms while testing.

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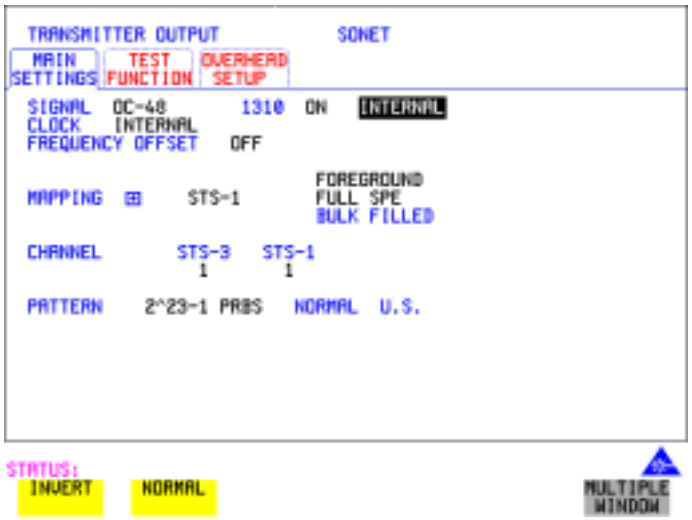
Setting Transmit Interface

TIP: If you wish to set the OmniBER 720 transmitter and receiver to the same interface settings choose OTHER **SETTINGS CONTROL** **COUPLED**

Laser On/Off Control

If you wish to switch off the laser when connecting/disconnecting cables, set the field between the wavelength and INTERNAL selections to OFF. When the laser is on the laser symbol at the bottom right of the display is illuminated (yellow).

.



HOW TO:

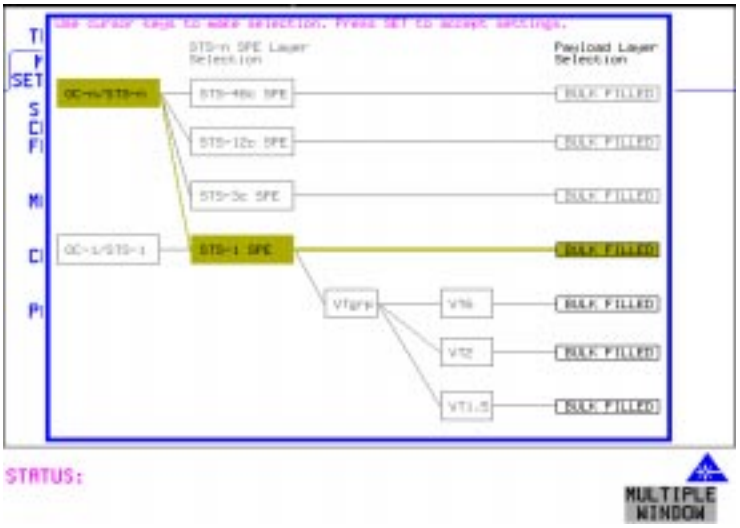
1. Make your choice of SIGNAL rate.
   Choose **INTERNAL** unless **THRU MODE** is required. If **THRU MODE** is chosen, see "Setting THRU Mode " page 64.
2. Make your choice of CLOCK source. The clock can be internally sourced from the instrument, recovered from the signal at the optical RECEIVE port or externally sourced from the CLOCK REF IN ports (MTS 64 kb/s, BITS 1.5 Mb/s or 10 MHz REF).
3. If required choose the FREQUENCY OFFSET value. See “Adding Frequency Offset” page 84.
4. Choose the required **F/G MAPPING** and PAYLOAD TYPE, then select **B/G MAPPING** and the BACKGROUND selection. The FOREGROUND selection is the channel that is chosen for test purposes. The BACKGROUND

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patterns are not used for test purposes and are either the same as the test channel or set to UNEQUIPPED.

Mapping may be selected from a pictorial display by moving the cursor to MAPPING and pressing SET.



Use → and ← to move between STS Layer choice, VT Layer choice and Payload Layer choice. Use ↑ and ↓ to choose the mapping.
Use SET to confirm your choice and return to the **SONET** | **MAIN SETTINGS** display.

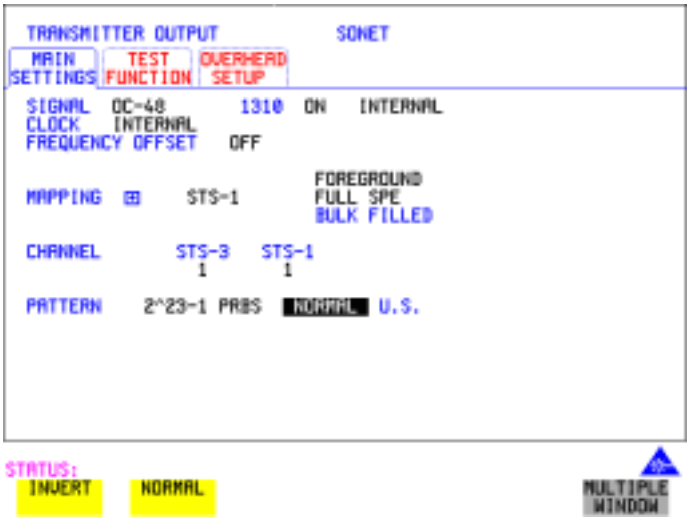
5 If VT-6 mapping is chosen, VT CONCATENATION selection is enabled, choose **OFF** or the tributary at which the concatenation begins, VT6-2C through VT6-6C.
The BACKGROUND, PATTERN IN OTHER VT-6s is fixed at NUMBERED, that is, each VT-6 contains a unique number to allow identification in case of routing problems.

6 If FULL SPE, VT-6, VT-2 or VT-1.5 mapping is chosen, choose the test tributary CHANNEL, including the STS-3 for an OC-12/OC-48 signal.

7 Choose the PATTERN type and PRBS polarity.

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Option 003 only

The definition of NORMAL and INVERTed polarity differs between ITU-T O.150 and common practice usage in the United States of America for 2^{15}-1 and 2^{23}-1 PRBS patterns.

The PRBS polarity control (see page 193) allows the user to select which definition is used on the TRANSMITTER and RECEIVER windows.

The ITU-T O.150 standard specifies that the NORMAL or default for all PRBS patterns should be inverted. This will produce a longest string of n-1 consecutive zeros in a 2^n-1 PRBS pattern. Therefore selecting INVERT with an ITU-T pattern will produce a longest string of n-1consecutive ones in a 2^n-1 pattern.

The ITU-T definition also applies in the US, except for 2^{15}-1 and 2^{23}-1 PRBS patterns. Through common practice, NORMAL indicates that the PRBS pattern is non-inverted. Therefore when the 'US' PRBS polarity control is enable and NORMAL is selected for these two patterns on the TRANSMITTER, a longest string of n-1 consecutive ones is produced. The pattern has to be INVERTed in order to produce a longest string of n-1 consecutive zeros.

8 Choose the mapping required in the background (non-test) STS's. Refer to Appendix A for a table of background patterns for STS-1 SPE.

9 If VT mapping is chosen for the test STS, choose the PATTERN IN OTHER VT's.

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Setting THRU Mode

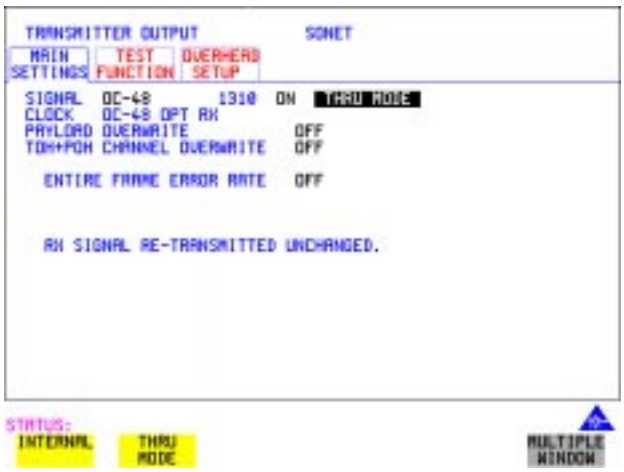
Description

THRU mode is used to non-intrusively monitor SONET lines where no protected monitor points are available. To enable THRU mode select the **TRANSMIT** **MAIN SETTINGS** page. Select SIGNAL RATE before selecting THRU mode.

The entire frame can be errorred at a user defined rate if PAYLOAD OVERWRITE and TOH+POH CHANNEL OVERWRITE are both set to **OFF**. If either overwrite is enabled the ENTIRE FRAME ERROR RATE function is disabled.

There are nominally three modes of operation as follows:

1. Transparent mode: This is the case when the PAYLOAD OVERWRITE field is set to OFF. The received signal is passed through the transmitter completely unchanged. The figure below illustrates the settings for this mode.



2. Hitless THRU Mode: This mode enables you to change the channel under test and the payload mapping without causing errors in the line signal or any other payload channel, or having to switch out of THRU mode. When you select a Payload Overwrite choice (other than OFF) an additional field is displayed which allows you to enable/disable Payload Overwrite. If Payload Overwrite is disabled the instrument remains transmitting while you select another channel/tributary (see figure on next page). In this mode any Section or Line CV errors are recalculated before transmission.

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3. Payload Overwrite: This mode allows you to substitute a new payload, Section and Line Overhead (TOH) or Path overhead (POH) in the received signal. The overhead and payload may be overwritten for STS-3c SPE, STS-1 SPE, VT-6, VT-2 or VT-1.5. Any Path CV errors are recalculated before transmission.

When the PAYLOAD OVERWRITE and/or TOH+POH CHANNEL functions are enabled, you can manipulate the overhead bytes via the instrument's TEST FUNCTION folder.

For STS-12C and STS-48C mapping, the PAYLOAD OVERWRITE feature is not available, and the TOH+POH CHANNEL overwrite feature is available.



HOW TO:

1 Make the required SIGNAL RATE choice, and select THRU MODE on the SONET **TRANSMIT** display, See "Setting Transmit Interface " page 60.

2 Make the PAYLOAD OVERWRITE choice required.
Hitless Mode: The Payload Overwrite enable/disable field (next to the PAYLOAD OVERWRITE field) defaults to OFF.

If STS-3c SPE, STS-1 SPE, VT-6, VT-2 or VT-1.5 is chosen, the Section, Line and Path CVs are recalculated before transmission and the Mapping, Selected VT, VT Payload, Pattern, Tributary Offset and Pattern in other VT's settings are displayed. To choose the settings in these, See "Setting Transmit Interface " page 60, steps 4 through 10.

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3 Switch the PAYLOAD OVERWRITE enable/disable field to ON. Test functions are available whilst Payload Overwrite is enabled. Select the **TEST FUNCTION** folder and setup as required.

4 Make the TOH+POH CHANNEL OVERWRITE choice required.
The Section, Line and Path CVs are recalculated before transmission.

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Using Smart Test

Smart Setup

The Smart Setup feature simplifies instrument operation by:

- Allowing the instrument to auto-configure on the incoming signal. It will attempt to identify signal structure, and detect mixed payload signal structures and alarms.
  The OmniBER 720 automatically displays all of the J1 trace identifiers. Once the received signal has been identified you can select a channel of interest and explore further into the payload.

Smart Tests

Allows you to quickly access the most commonly used instrument features such as:

- Signal quality
- Functional tests
- Settings (stored, logging, Tx/Rx coupling and trigger output enable)

HOW TO:

1 Connect the OmniBER 720 to the network.

2 Press **SMART TEST**.



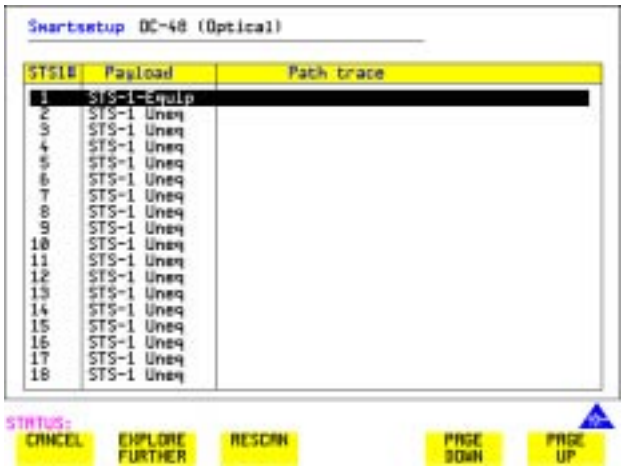
3 With Smartsetup highlighted, press **START** to auto-discover information about

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the receive signal. Or press **CANCEL** to exit Smart Tests.

An example of a typical display after choosing to RUN Smartsetup is shown below. **Note:** The channel information displayed is the one obtained the last time a scan was performed. If you have changed the input signal since the last Smartsetup you must perform a RESCAN now.



SET UP RX key — If you select an individual channel using the cursor control keys, and then select **SET UP RX**, the instrument exits smartsetup and sets the receiver to the test pattern detected in the selected channel.

HOW TO: **Run a Smart Test (Signal Quality - Frequency Measurement):**

1. Ensure a valid signal is connected to the instrument's RECEIVE port.
2. Press **SMART TEST**.
3. Use the up and down cursor control keys to select Signal quality.
4. Use the left and right cursor control keys to access the tests.
5. Use the up and down cursor control keys to select Frequency Measurement.

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6 Press **SELECT** to display the frequency screen. Or press **CANCEL** to exit Smart Tests.

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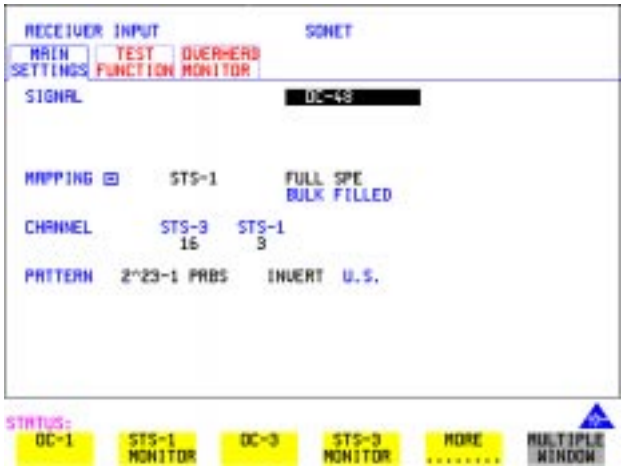
Setting Receive Interface

Description

The receive interface settings should match the network equipment settings of rate and mapping, and determine the payload to be tested.

TIP:

If you wish to set the OmniBER 720 transmitter and receiver to the same interface settings, choose OTHER | SETTINGS CONTROL | COUPLED. This causes the receiver to be configured to the same settings as the transmitter,



HOW TO:

1. Choose the required SIGNAL source.
2. Choose mapping and type of payload.
3. If VT-6 mapping is chosen, and CONCATENATION is enabled, choose the tributary at which the concatenation begins.
   If VT-6, VT-2 or VT-1.5 mapping is chosen, choose the test tributary under CHANNEL.
4. Choose the PATTERN type and PRBS polarity.
   The definition of NORMAL and INVERTed polarity differs between ITU-T O.150 and common practice usage in the United States of America for 2^{15}-1 and 2^{23}-1 PRBS patterns.

   The PRBS polarity control (see page 193) allows the user to select which definition is used on the TRANSMITTER and RECEIVER windows.

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The ITU-T O.150 standard specifies that the NORMAL or default for all PRBS patterns should be inverted. This will produce a longest string of n-1 consecutive zeros in a 2^n-1 PRBS pattern. Therefore selecting INVERT with an ITU-T pattern will produce a longest string of n-1consecutive ones in a 2^n-1 pattern.

The ITU-T definition also applies in the US, except for 2^{15}-1 and 2^{23}-1 PRBS patterns. Through common practice, NORMAL indicates that the PRBS pattern is non-inverted. Therefore when the 'US' PRBS polarity control is enable and NORMAL is selected for these two patterns on the TRANSMITTER, a longest string of n-1 consecutive ones is produced. The pattern has to be INVERTed in order to produce a longest string of n-1 consecutive zeros.

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5

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"Using Receive Overhead Monitor" page 76
"Setting Overhead Trace Messages" page 78
"Setting Overhead Labels" page 79
"Generating Overhead Sequences" page 80
"Using Receive Overhead Capture" page 82
"Adding Frequency Offset" page 84
"Adding Errors and Alarms" page 85
"Adding Pointer Adjustments" page 86
"Using Pointer Graph Test Function" page 94
"Stressing Optical Clock Recovery Circuits" page 96
"Generating Automatic Protection Switch Messages" page 98
"Inserting and Dropping the Data Communications Channel" page 99

Selecting Test Features - SONET Operation

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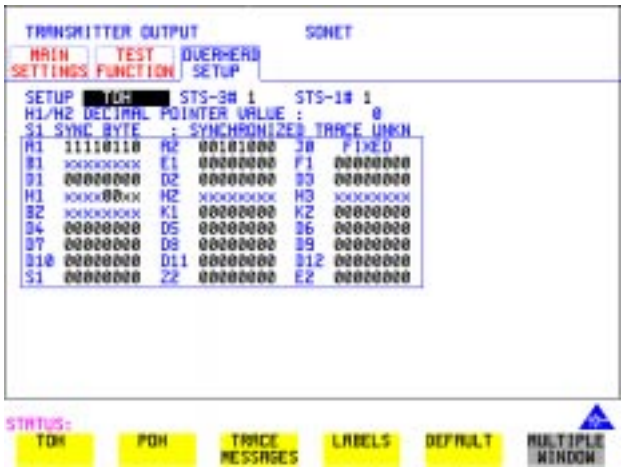
Using Transmit Overhead Setup

Description

You can set an overhead byte to a known static state to aid troubleshooting, for example to quickly check for “stuck bits” in path overhead bytes. Transport Overhead, Path Overhead, Trace Messages and Labels can be set using this feature.

HOW TO:

1. Set up the SONET transmit interface and payload required. See "Setting Transmit Interface " page 60.
2. Choose the type of overhead to SETUP.



If OC-12 or OC-48 is chosen as the SONET interface, choose the STS-3# and STS-1# you wish to set up.
If OC-3 is chosen as the SONET interface, choose the STS-1# you wish to set up.
DEFAULT - Use to set all overhead bytes to the standard values defined by BELLCORE/ANSI.
If a test function is active then the overhead byte value is determined by the choices made in the Test Function. If APS Messages is chosen, for example, K1K2 value is set by the APS Messages setup.
If **TOH** (Transport Overhead) is chosen, choose the STS-1 to be displayed. Many bytes in **STS-1# 2** and **STS-1#3** are unlabeled as the other overhead functions have not yet been defined.
If **STS-1# 1,2,3** is chosen, the hexadecimal value of all 81 bytes of the STS-3 section & line overhead selected are displayed (all 324 bytes of an OC-12 or 1,296 bytes of an OC-48 are displayed 81 bytes at a time by selecting each STS-

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3 in turn). The value of the bytes can be set using **DECREASE DIGIT** **INCREASE DIGIT** ← →.
If BYTE NAMES is chosen, the labels for the **STS-1# 1,2,3** overhead bytes are displayed.

3 If POH (Path Overhead) is chosen, choose the TYPE of overhead within STS-1 under test to be setup.
J1 and J2 bytes can be set under Path Overhead or Trace Messages. H4 byte has a choice of sequences for VT-2, VT-1.5 and VT-6 mapping:
Full Sequence - 48 byte binary sequence.
Reduced Sequence - Binary count sequence of 0 to 3 i.e. 111111(00 to 11).
COC1 Sequence - Binary count sequence of 0 to 3 i.e. 110000(00 to 11).

4 If TRACE MESSAGES is chosen, see "Setting Overhead Trace Messages " page 78.

NOTE Any bit of an overhead byte which is displayed as x or s cannot be set at any time. All other bits can be set to 0 or 1.

TIP: You can set all overhead bytes to the default state by selecting SETUP **DEFAULT**.

You can set all overhead bytes and test functions to the default state by recalling Stored Settings [0] on the **OTHER** display.

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Using Receive Overhead Monitor

Description

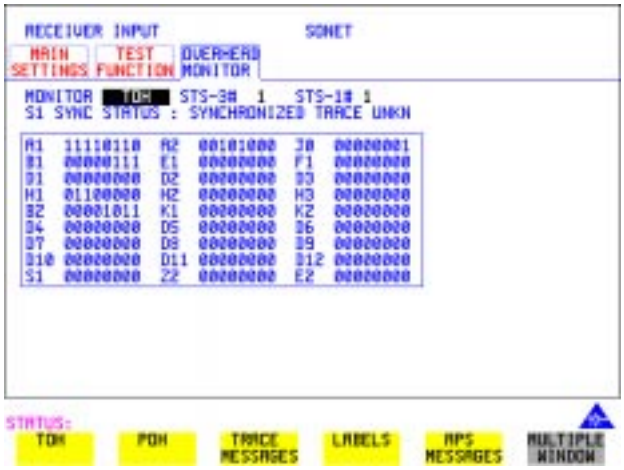
When first connecting to a SONET network, a start up confidence check can be made by viewing the behavior of all the overhead bytes. If the SONET network shows alarm indications, some diagnosis of the problem may be gained from viewing all the overhead bytes.The OVERHEAD MONITOR display is updated once per second (once per 8000 frames) approximately.

TIP:

A snapshot of the received overhead can be logged to the chosen logging device. See "Logging on Demand " page 146.

HOW TO:

1. Set up the receive SONET interface and payload as required. See “Setting Receive Interface” page 70.
2. Choose the type of overhead to MONITOR.



3. If **TOH** (Transport Overhead) is chosen, choose the STS-3 # and STS-1# to be displayed.
   Many bytes in **STS-1# 2** and **STS-1#3** are unlabeled because the other overhead functions have not yet been defined.
   If **STS-1# 1,2,3** is chosen, the hexadecimal value of all 81 bytes of section overhead is displayed (all 324 bytes of an OC-12 or 1,296 bytes of an OC-48 are displayed 81 bytes at a time by selecting each STS-3 in turn).
   If BYTE NAMES is chosen, the labels for the **STS-1# 1,2,3** overhead bytes are displayed.

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4 If POH (Path Overhead) is chosen, choose the source of the overhead, SPE or VTSPE.
J1 and J2 bytes can be monitored under Path Overhead or Trace Messages

5 If TRACE MESSAGES is chosen, you can monitor a data message to verify portions of the network.
If the 16 byte CRC7 message structure is detected, the 15 characters within the message are displayed.
If the CRC7 structure is not detected in J1, the 64 byte message format is assumed and displayed.
If the CRC7 structure is not detected for J0 or J2, all 16 bytes are displayed.

6 If LABELS is chosen, the S1 sync status, STS path label (C2) and the VT Path label (V5) are monitored.

7 If APS MESSAGES is chosen, choose the TOPOLOGY, **LINEAR** (GR-253) or **RING** (GR-1230). The K1 and K2 bits are monitored.

TIP: If any abnormal behavior is observed on a particular path or section overhead byte, or an associated group of bytes (3XA1,3XA2; D1 - D3), the **RECEIVE** **TEST FUNCTION** display of **OVERHEAD CAPTURE** can be used to “Zoom” in on the suspect byte or bytes on a frame by frame basis. See "Using Receive Overhead Capture " page 82.

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Setting Overhead Trace Messages

Description

You can insert a data message to verify portions of the network:

J0 verifies the section overhead.
J1 verifies the STS-1 SPE or STS-48c, STS-12c, STS-3c SPE path connection.
J2 verifies the VT SPE path connection.



HOW TO:

Edit User Messages

1. Choose the message for insertion in the chosen trace channel.
2. There are two ways you can edit a user message as follows;

- Use the edit keys at the bottom of the display JUMP, PREVIOUS CHAR, NEXT CHAR ⬅ and ➡ that are displayed when you position the cursor on a User message or:
- Use the POP UP alphanumerical keypad that is displayed when you press the front panel **SET** key. Detailed instructions on how to change instrument settings using the POP UP keypad is given in the Quick Start Guide (page 14) under the heading “Changing Instrument Settings”.

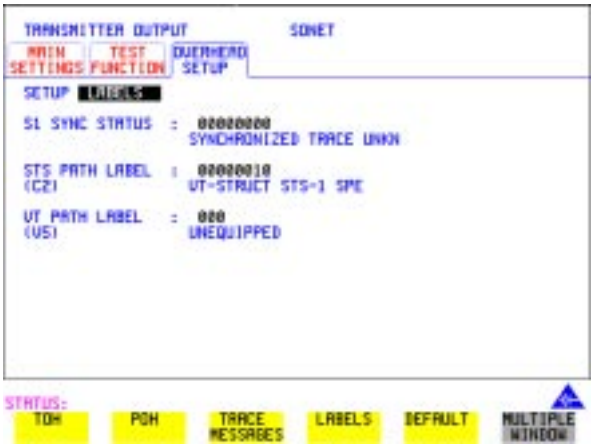
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Setting Overhead Labels

Description

Choosing LABELS in TRACE MESSAGES allows the setting of the S1 SYNC STATUS, STS PATH LABEL (C2) and VT PATH LABEL (V5).



HOW TO:

1. Choose the overhead label that you want to edit.
2. Edit the label using the softkeys at the bottom of the display. If you select USER, use the softkeys at the bottom of the display to edit the label key, or press **SET**, then use the softkeys and pop-up keypad to edit the label. Detailed instructions on how to change instrument settings using the pop-up keypad is given in the Quick Start Guide (page 13) under the heading “Changing Instrument Settings”.

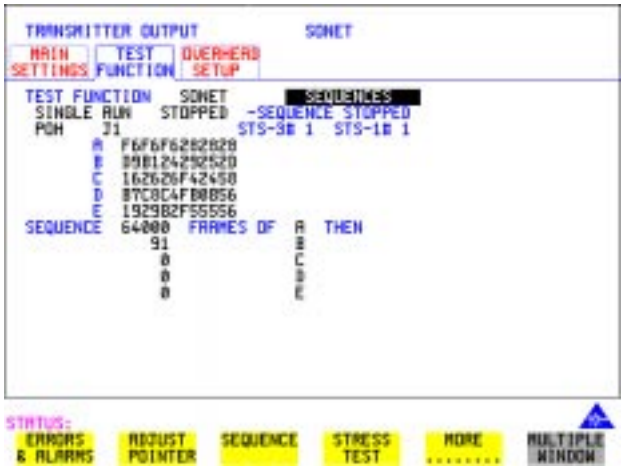
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Generating Overhead Sequences

Description

You may insert a sequence of patterns into a functional group of overhead bytes for testing or troubleshooting purposes.



HOW TO:

1. Set up the SONET transmit interface and payload required. See “Setting Transmit Interface” page 60.
2. Select **TEST FUNCTION**, SONET, SEQUENCES as shown above.
3. Choose the type of sequence required.
   SINGLE RUN - runs the sequence once and then stops.
   REPEAT RUN - runs the sequence repeatedly until STOPPED is chosen.
4. Choose the overhead type as required.
   SOH- Section Overhead
   LOH- Line Overhead
   POH - Path Overhead
5. Choose the byte or bytes of overhead required.
6. Set up the required number of data patterns and the number of frames in which each data pattern should appear.
   Your sequence is derived from up to 5 blocks of hexadecimal data. Each block can be transmitted in up to 64,000 frames.
   The data and the number of frames are set using **DECREASE DIGIT** **INCREASE DIGIT** ← →.

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7 Start the sequence by choosing **START**.

NOTE When you start the sequence illustrated, one Out of Frame alarm and one Loss of Frame alarm should occur every eight seconds.

A1A2 Boundary Function

A1A2 provide a frame alignment pattern (A1=F6 H, A2=28 H). Use A1A2 to test the 6 framing bytes at the A1A2 boundary in the section overhead (see display on previous page). The 6 bytes across the boundary are:

STS-n

STS-3 channel:	#n-2	#n-1	#n	#1	#2	#3
Overhead byte:	A1 #3	A1 #3	A1 #3	A2 #1	A2 #1	A2 #1

A network element, typically only uses three of these bytes (which ones are not defined in the standards, so will vary between manufacturers) to gain and maintain frame synchronization. In many cases the A1A2 bytes selected are those at the A1A2 boundary (i.e. the A1 bytes in the last STS-1 channel and the A2 bytes in the first STS-1 channel). Therefore, the ability to stress test across the boundary is necessary to verify a correct synchronization algorithm within a network element.

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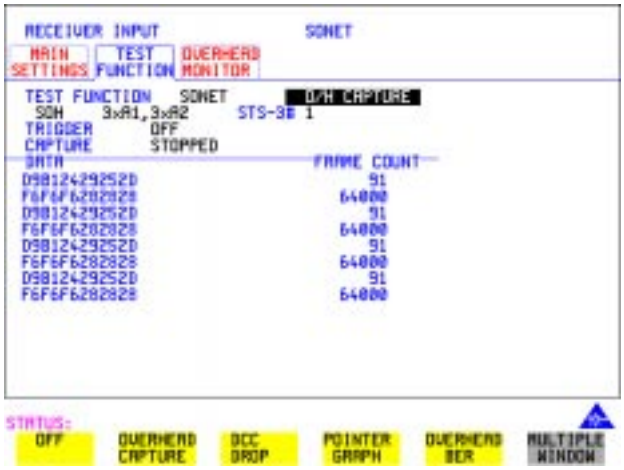
Using Receive Overhead Capture

Description

Section, Line and Path overhead provide network support functions, responding dynamically to network conditions and needs. It is therefore useful to capture overhead activity on a frame by frame basis.

TIP:

The Overhead Capture display can be logged to the chosen logging device. See "Logging on Demand " page 146.



HOW TO:

1. Set up the receive SONET interface and payload as required. See “Setting Receive Interface” page 70.
2. Select **TEST FUNCTION**, SONET, O/H CAPTURE as shown above.
3. Choose the overhead type as required.
   SOH- Section Overhead
   LOH- Line Overhead
   POH- Path Overhead
4. Choose the Byte or bytes of overhead to be captured.

Choose the TRIGGER to determine the start point of the capture.
OFF - starts immediately the capture is initiated. Can be used to provide a frame by frame monitor of the chosen byte or bytes.
ON -captures activity after your specified overhead state has occurred. Can be used for transient detection from a specified expected state.

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ON NOT - captures activity after the first occurrence of a deviation from your specified overhead state. Can be used for transient detection from a specified expected state.

5 Up to 16 records of overhead state are provided. Each record will represent between 1 and 64,000 frames. A capture is started by pressing CAPTURE **START** and terminates when up to 16 records have been captured. The capture can be terminated earlier by pressing CAPTURE **STOP**.

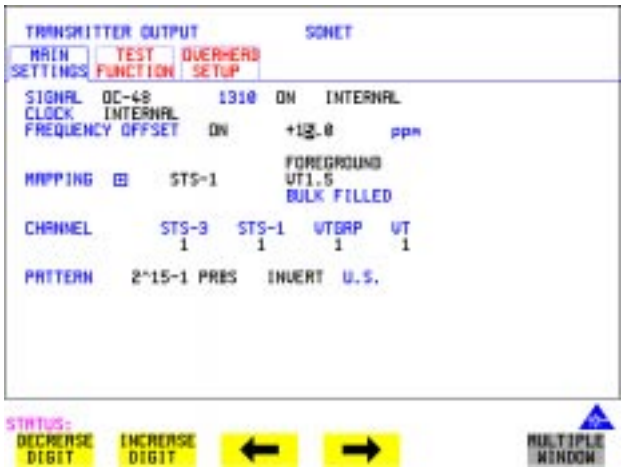
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Adding Frequency Offset

Description

Frequency offset can be added to the SONET interface rate signal and to the payload signal.



HOW TO:

Add SONET Line Rate Offset

Choose the amount of frequency offset required.
You can set the Frequency Offset in the range -999 ppm to +999 ppm in 1 ppm steps using **DECREASE DIGIT** **INCREASE DIGIT** ← and → or press **SET** for a pop-up numerical keypad.
The amount of applied Frequency Offset can be varied while measurements are taking place.
If the value of the SONET line rate offset chosen is sufficient to cause the maximum stuff rate to be exceeded, the asynchronous payload is offset to prevent bit errors occurring and the maximum stuff rate is maintained.

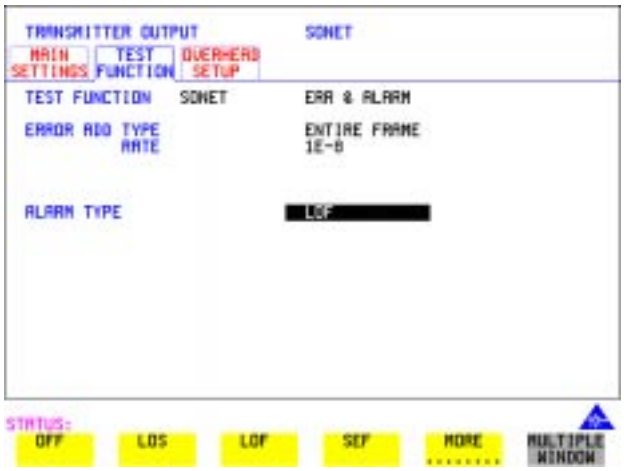
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Adding Errors and Alarms

Description

Errors and alarms can be added to an SONET signal during testing.



HOW TO:

1. Set up the SONET transmit interface and payload required. See "Setting Transmit Interface " page 60.
2. Select **TEST FUNCTION**, SONET, ERR & ALARM as shown above.
3. Choose the ERROR ADD TYPE and RATE required.
   Errors can be added at preset rates and at USER programmable rate. With the exception of ENTIRE FRAME, A1A2 FRAME and BIT, errors can be added at ERROR ALL rate.
   If CV-L errors are chosen errors can be added to trigger an APS THRESHOLD. This takes the form of N errors in T time period. N and T are both selectable.
4. Choose the ALARM TYPE
   Errors and Alarms can be added at the same time.

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Adding Pointer Adjustments

Introduction

Pointers perform a critical role in the error free transmission of payload data (subscriber data) through a SONET network. They also enable individual payload channels to be inserted or extracted from a high speed OC-n line signal (for example the functionality provided by ADMs).

Pointer adjustments are often necessary to compensate for asynchronous operation between different nodes within an SONET network.These adjustments however can result in jitter being added to a DSn signal output from an SONET network element.

Jitter Caused by Pointer Adjustments

Pointer adjustments are the mechanisms within SONET used to compensate for frequency and phase differences between STS-n SPE channels and the outgoing SONET frames. These pointer adjustments are byte wide and since they can occur randomly, they may cause significant amounts of payload signal jitter. It is therefore necessary to control the jitter on payload signals that is due to pointer adjustments.

Pointer adjustment activity within a network can be randomly spaced individual pointer adjustments, pointer bursts or periodic pointer adjustments.

The Bellcore GR-253 and ANSI T1.105 standards define a set of pointer sequences to be used when evaluating an NE’s pointer adjustment jitter performance.

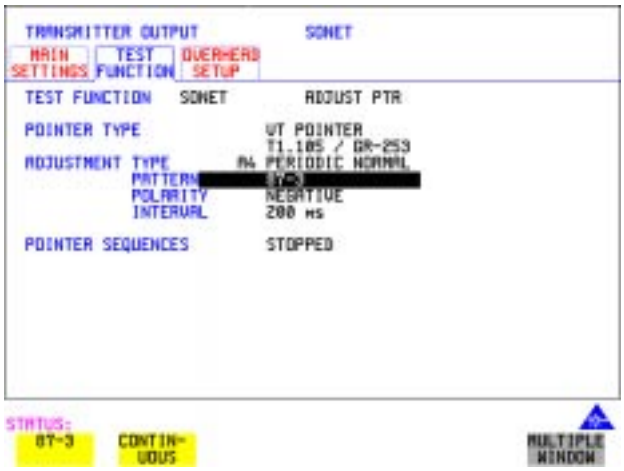
The OmniBER 720 generates a set of test sequences which can be used to simulate network pointer adjustment activity.

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Adding Pointer Adjustments

Description

The transmitted SPE or VT pointer value can be adjusted for testing purposes.



HOW TO:

1. Set up the SONET transmit interface and payload required. See "Setting Transmit Interface " page 60.
2. Choose the POINTER TYPE.
3. Choose the ADJUSTMENT TYPE required.
   BURST - You determine the size of the burst by the number of PLACES chosen. If, for example, you choose 5 PLACES the pointer value will be stepped 5 times in unit steps e.g. 0 (start value), 1, 2, 3, 4, 5 (final value). The interval between steps is as follows:
   For STS-SPE the minimum spacing between adjustments is 4 frames (500 ns).
   For VT the minimum spacing between adjustments is 4 multiframes (2 ms).
   Choose ADJUST POINTER [ON] to add the chosen burst.

   NEW POINTER - You can choose any pointer value in thedefined range (0 to 782 For an STS-1 pointer) with or without a New Data Flag, and transmit it. The current pointer value is displayed for information purposes.
   Choose ADJUST POINTER [ON] to transmit the new pointer value.

   OFFSET - You can frequency offset the line rate or the SPE/VT rate, relative to each other, thus producing pointer movements. If you offset the SPE pointer, an 87:3 sequence of pointer movements is generated. The available configurations are listed in the following table.
   If you are currently adding Frequency Offset to the SONET interface or payload, pointer OFFSET is not available.

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Pointer Type	Line Rate	SPE Rate	VT Rate
SPE	Constant	Offset	Tracks STS Payload
SPE	Offset	Constant	Constant
VT	Constant	Constant	Offset
VT	Offset	Tracks Line Rate	Constant

T1.105/GR-253 - Provides pointer movements according to T1.105 and GR-253:

4 Choose the T1.105/GR-253 ADJUSTMENT TYPE.

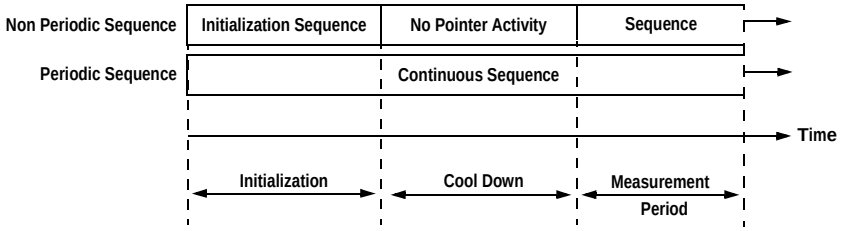
5 Choose the POLARITY, INTERVAL and PATTERN (where applicable) for the selected sequence.

6 Choose POINTER SEQUENCES **START INIT** to generate the selected sequence and **STOP INIT** to stop the pointer sequences.

T1.105/GR-253 Pointer Sequences Explained

In addition to the BURST, NEW POINTER and OFFSET pointer movements described, the OmniBER 720 can also generate pointer sequences (pointer movements) according to T1.105.03 and GR-253.

Before running a pointer sequence you can elect to run an initialization sequence, followed by a cool down period, and then run the chosen sequence. This is selected using the START INIT softkey shown in the display on the previous page. Initialized pointer sequences are made up of three periods: the *Initialization Period*, the *Cool Down Period*, and the *Sequence (Measurement) Period*, an example is given in the following figure:



Note: SINGLE (A1), BURST (A2) and PHASE TRANSIENT(A3) are Non Periodic Sequences.

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Initialization Period

For SINGLE A1, BURST A2 and PHASE TRANSIENT A3 sequences the initialization sequence consists of 60 seconds of pointer adjustments applied at a rate of 2 adjustments per second and in the same direction as the specified pointer sequence.

Cool Down Period

A period following the initialization period which for GR-253 SINGLE e) and BURST f) sequences, and PHASE TRANSIENT sequences is 30 seconds long when no pointer activity is present.

Sequence (Measurement) Period

The period following the Cool Down period where the specified pointer sequence runs continuously.

Periodic Test Sequences

For periodic test sequences (for example PERIODIC ADD) both the 60 second initialization and 30 second cool down periods consist of the same sequence as used for the subsequent measurement sequence. If the product of the period T and the selected Optional background pattern (87+3 or 26+1) exceeds 60 seconds then the longer period is used for the initialization. For example, if T is set for 10 seconds then the initialization period may be extended to 900 seconds.

The OmniBER 720 displays a message indicating which phase (initialization, cool down or measurement) the transmitter is currently generating.

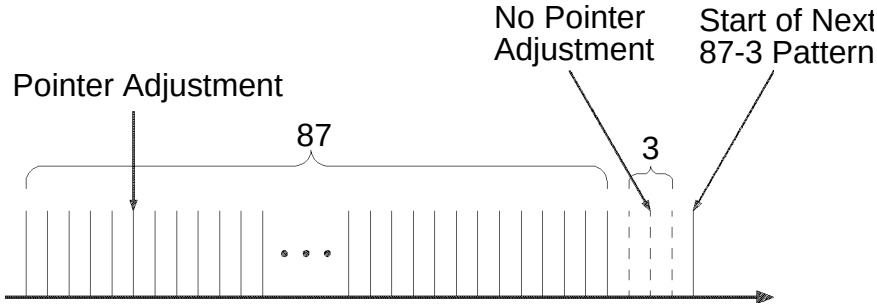
NOTE

The following conditions apply for pointer sequence generation:
The sequences can only be applied to the SPE pointer when the SPE does not contain a VT structure, otherwise it is applied to the VT pointer. Pointer sequence generation is not available when a frequency offset is being applied to the Line Rate.

The following figure gives an example of a T1.105/GR-253, 87-3 Pointer Sequence.

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T1.105 A4 and A5, 87-3 Pattern



An Example of a Pointer Sequence

Pointer Sequence	Description
T1.105 A1 SINGLE GR-253 5-29	Periodic Single adjustments, all of the same polarity which is selectable. Separation between pointer adjustments is fixed at approximately 30 seconds.
T1.105 A2 BURST OF 3 GR-253 5-30	Periodic bursts of 3 adjustments, all of the same polarity which is selectable. The interval between bursts is fixed at approximately 30 seconds. The interval between adjustments within a burst is set to the minimum.
T1.105 A3 PHASE TRANSIENT GR-253 5031	Phase transient pointer adjustment burst test sequence. All adjustments are of the same polarity, which is selectable. The interval between bursts is fixed at 30 seconds. Each burst consists of 7 pointer movement. The first 3 in each burst are 0.25 s apart, and the interval between the 3 and 4 movement, and each remaining movement 0.5 seconds.
T1.105 A4 PERIODIC NORMAL (87-3 Pattern) GR-253 5-33(b)	An 87-3 pattern is selected. The sequence pattern is 87 pointer movements followed by 3 missing pointer movements. Pointer polarity is selectable and the time interval between pointer adjustments settable.
T1.105 A4 PERIODIC NORMAL (Continuous Pattern) GR-253 5-34(b)	Provides a continuous sequence of pointer adjustments. The polarity of the adjustments is selectable, and the time interval between adjustments can be set (see Note 1).

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Pointer Sequence	Description
GR-253 5-32(b) PERIODIC NORMAL (26-1 Pattern)	This selection is only available if you have selected VT1.5 mapping. The sequence pattern is 26 pointer movements followed by 1 missing pointer movement. Pointer polarity is selectable and the time interval between pointer adjustments programmable to 200 ms, 500 ms, 1 s, 2 s, 5 s or 10 seconds.
T1.105 A5 PERIODIC ADD (87-3 Pattern) GR-253 5-33(c)	An 87-3 pattern is selected. The sequence pattern is 87 pointer movements followed by 3 missing pointer movements with an added pointer movement after the 43rd pointer. The spacing between the added adjustment and the previous adjustment is set to the minimum. Pointer polarity is selectable. The time interval between pointer adjustments can be set (see Note 1). Added adjustments occur every 30 seconds or every repeat of the 87-3 pattern, whichever is longer.
T1.105 A5 PERIODIC ADD (Continuous Pattern) GR-253 5-34(c)	Periodic Single adjustments, with selectable polarity and added adjustment (1 extra). The spacing between the added adjustment and the previous adjustment is set to the minimum, (see Note 2). The time interval between pointer adjustments can be set (see Note 1). Added adjustments occur every 30 seconds or every repeat of the 87-3 pattern, whichever is longer.
GR-253 5-32(c) PERIODIC ADD (26-1 Pattern)	This selection is only available if you have selected VT1.5 mapping. The sequence pattern is 26 pointer movements followed by 1 missing pointer movement. The added adjustment occurs 2 ms after the 13th pointer adjustment. Pointer polarity is selectable and the time interval between pointer adjustments programmable to 200 ms, 500 ms, 1 s, 2 s, 5 s or 10 s. Added adjustments occur every 30 seconds or every repeat of the 26-1 pattern, whichever is longer.
T1.105 A5 PERIODIC CANCEL (87-3 pattern) GR-253 5-33(d)	An 87-3 pattern is selected. The sequence pattern is 87 pointer movements followed by 3 missing pointer movements with a cancelled pointer movement at the 87th pointer. Pointer polarity is selectable, and the time interval between pointer adjustments can be set (see Note 1). Cancelled adjustments occur every 30 seconds or every repeat of the 87-3 pattern, whichever is longer.

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Pointer Sequence	Description
T1.105 A5 PERIODIC CANCEL (Continuous Pattern) GR-253 5-34(d)	Periodic Single adjustments, with selectable polarity and cancelled adjustment (1 less). The time interval between pointer adjustments can be set (see Note 1). Cancelled adjustments occur every 30 seconds or every repeat of the 87-3 pattern, whichever is longer.
GR-253 5-32(d) PERIODIC CANCEL (26-1 pattern)	This selection is only available if you have selected VT1.5 mapping. The sequence pattern is 26 pointer movements followed by 1 missing pointer movement. The cancelled adjustment is the 26th pointer adjustment, that is the one before the regular gap of 1. Pointer polarity is selectable and the time interval between pointer adjustments programmable to 200 ms, 500 ms, 1 s, 2 s, 5 s or 10s. Cancelled adjustments occur every 30 seconds or every repeat of the 26-1 pattern, whichever is longer.

NOTE

For SPE pointers the sequence interval is selectable from 7.5 ms, 10, 20, 30, 34 ms; 40 to 100 ms in 10 ms steps, 100 to 1000 ms in 100 ms steps, 1, 2, 5, 10 seconds.
For VT pointers the sequence interval is selectable from: 200 ms, 500 ms, 1, 2, 5 and 10 seconds.
For SPE pointers the minimum spacing between adjustments is 500 us.
For VT pointers the minimum spacing between adjustments is 2 ms.

Pointer Sequences Available with Selected Mapping

POINTER SEQUENCE	MAPPING		
	SPE	**VT6, VT2**	**VT1.5**
A1 SINGLE	√	√	√
A2 BURST OF 3	√	√	√
A3 PHASE TRANSIENT	√	√	√
A4 PERIODIC NORMAL(87-3)	√		
A4 PERIODIC NORMAL (Continuous)	√	√	√
PERIODIC NORMAL (26-1)			√

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Pointer Sequences Available with Selected Mapping

POINTER SEQUENCE	MAPPING		
	SPE	VT6, VT2	VT1.5
A5 PERIODIC ADD (87-3)	√		
A5 PERIODIC ADD (Continuous)	√	√	√
PERIODIC ADD (26-1)			√
A5 PERIODIC CANCEL (g) 87-3	√		
A5 PERIODIC CANCEL (Continuous)	√	√	√
PERIODIC CANCEL 26-1			√

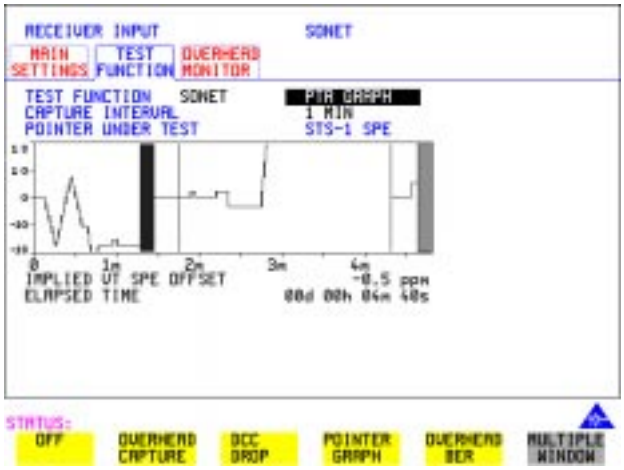
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Using Pointer Graph Test Function

Pointer Graph shows the relative offset during the measurement period. This allows the time relationship of SPE or VT pointer movements to be observed. Up to 4 days of storage allows long term effects such as Wander to be observed. If an alarm occurs during the measurement period, a new graph starts at the centre of the display (offset zero) after recovery from the alarm.

TIP: The Pointer Graph display can be logged to the chosen logging device. See "Logging on Demand " page 146.



TIP: The graph can also be viewed on the **RESULTS** **SONET RESULTS** display at the end of the measurement.

HOW TO:

1. Set up the receive SONET interface and payload as required. See “Setting Receive Interface” page 70.
2. On the RECEIVE Test Function page, select **PTR GRAPH** then choose the CAPTURE INTERVAL required.
   The capture interval determines the time between captures. Low values of capture interval should be chosen when a high degree of pointer movements is expected. High values of capture interval should be chosen when a low degree of pointer movements is expected, for example Wander over 1 day, use 5 MINS and Wander over 4 days, use 20 MINS.
   If, during a long term measurement (4 days), an event occurs at a particular time each day, then the instrument can be set to log the results graph of that event.

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3 Choose the POINTER UNDER TEST type.

4 Press **RUN/STOP** to start the measurement.

TIP: If the event occurs outside normal working hours, a Timed Start measurement can be made.

The values of capture interval available and the approximate total capture window is as follows:

1 SEC - display window of approximately 5 minutes.
5 SECS - display window of approximately 25 minutes.
20 SECS - display window of approximately 1 hour 40 minutes.
1 MIN - display window of approximately 5 hours.
5 MIN - display window of approximately 1 day.
20 MIN - display window of approximately 4 days.

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Stressing Optical Clock Recovery Circuits

Description

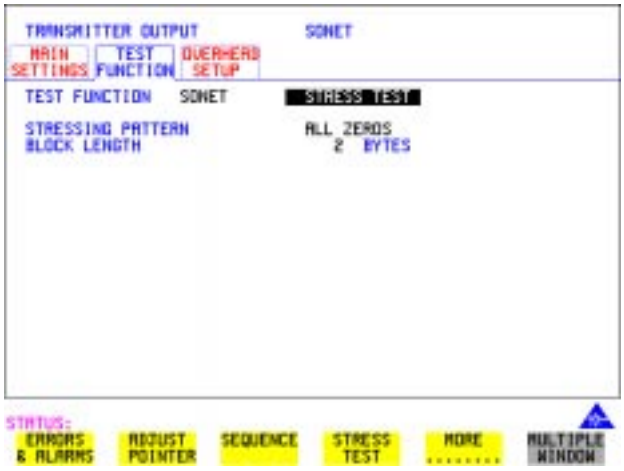
This test is essentially designed for testing optical clock recovery circuits in the presence of long runs of zero's or one's (after scrambling). The test function page allows control of the test pattern and the block length. The maximum block length is 2 bytes less than the width of the SPE.

When the test is enabled, the instrument applies the selected pattern immediately after the first row of Section Overhead bytes **after scrambling**. The location of the start of the pattern is byte 4 at 52 Mb/s (i.e. after the first three bytes of overhead), byte 10 at 155 Mb/s, byte 37 at 622 Mb/s and byte 145 at 2488 Mb/s. The remainder of the SPE will contain the signal structure and pattern as defined on the TRANSMITTER, MAIN SETTINGS page.

The payload is overwritten in such a way that the transmitted B1 and B2 values are correct.

When using this feature to test network equipment clock recovery, long runs of zero's may be inserted at the input of the UUT (unit under test) and by monitoring B1 and B2 at the UUT output, error free transmission can be verified.

The stress test is available at all optical rates.



HOW TO:

1 Set up the SONET transmit interface and payload required. See "Setting Transmit Interface " page 60.

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Choose the required STRESSING PATTERN.
The G.958 test pattern consists of 7 consecutive blocks of data as follows: the first row of section overhead bytes, ALL ONES, a PRBS, the first row of section overhead bytes, ALL ZEROS, a PRBS and the first row of section overhead bytes.

2 If you choose ALL ONES or ALL ZEROS as the stressing pattern, choose the number of bytes in the BLOCK LENGTH.

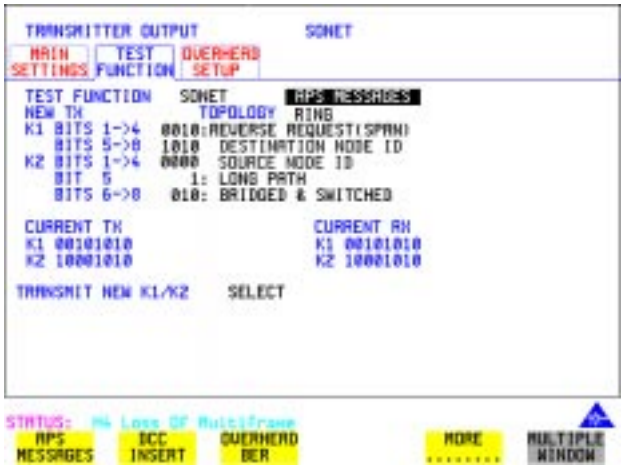
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Generating Automatic Protection Switch Messages

Description

You can program the K1 and K2 bytes to exercise the APS functions for Both LINEAR (GR-253) and RING (GR1230) topologies.



HOW TO:

1. Set up the SONET transmit interface and payload required. See "Setting Transmit Interface " page 60.
2. Choose the TOPOLOGY required.
3. Choose the message to be transmitted.
   If LINEAR topology is chosen, choose the CHANNEL, the BRIDGED CHANNEL NO., the ARCHITECTURE and the RESERVED bits you require.
   If RING topology is chosen, choose the DESTINATION NODE ID, the SOURCE NODE ID, the type of PATH and the status code (K2 Bits 6->8)
   The current TX and RX, K1 and K2, values are displayed for reference only.
4. Choose **DOWNLOAD** to transmit the new K1/K2 values.

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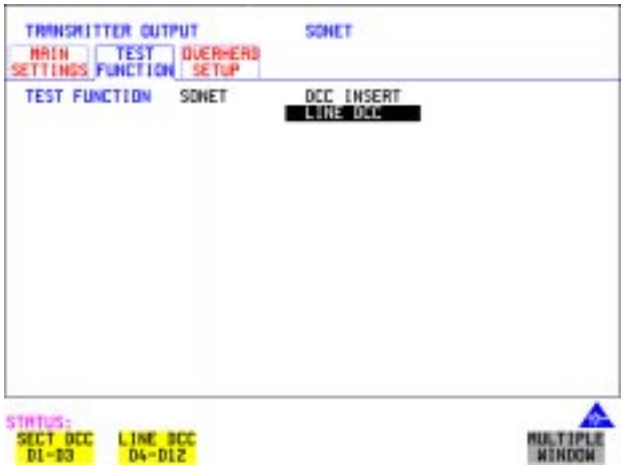
Inserting and Dropping the Data Communications Channel

Description

The Data Communications Channel (DCC) of the regenerator and multiplexer section overhead can be verified by protocol testing. The Insert and Drop capability provides access to the DCC via the RS-449 connector on the front panel of the Multirate Analyser module.

DCC INSERT is available on the TRANSMIT, TEST FUNCTION display. Select SONET, then use the right cursor key to access DCC INSERT selection.

DCC DROP is available on the RECEIVE, TEST FUNCTION display. Select SONET, then use the right cursor key to access DCC DROP selection.



HOW TO:

1. Connect the Protocol Analyzer to the DCC port on the Multirate Analyzer module.
2. Choose the required DCC.

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"Using Overhead BER Test Function" page 102
"Performing a Trouble Scan" page 103
"Test Timing" page 105
"Making Analysis Measurements" page 106
"Measuring Frequency" page 107
"Measuring Optical Power" page 108
"Performing a Tributary Scan" page 109
"Performing a SONET Alarm Scan" page 113

Making Measurements

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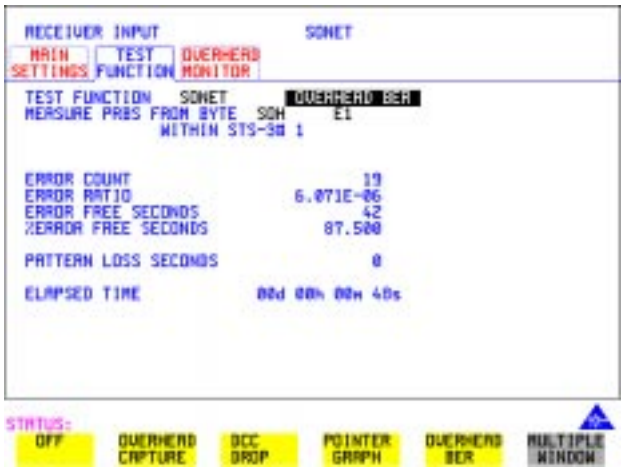
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Using Overhead BER Test Function

Description

You can perform a Bit Error Rate test on chosen bytes of the section, line and path overhead bytes.

The OVERHEAD BER controls are located under **TEST FUNCTION** in the TRANSMITTER and RECEIVER windows.



HOW TO:

1. Set up the SDH/SONET transmit interface and payload required. See “Setting Transmit Interface” on page 20 (for SDH) and page 60 (for SONET).
2. Set up the receive SDH/SONET interface and payload as required. See “Setting Receive Interface” on page 30 (for SDH) and page 70 (for SONET).
3. Choose the overhead byte to be tested on the **RECEIVE**, **TEST FUNCTION**, **SONET** display**.** Use the right cursor key, then select OVERHEAD BER.
4. Choose the overhead byte to be tested on the **TRANSMIT**, **TEST FUNCTION**, **SONET** display. Use the right cursor key, then select OVERHEAD BER.
5. Press **RUN/STOP** to start the test.
6. The PRBS pattern can be errored by pressing **SINGLE**.

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Performing a Trouble Scan

When first connecting to the network it can be useful to have an indication of any problems that exist before starting testing. In the OmniBER 720 this feature is provided by Trouble Scan.

All possible error sources and alarms are scanned simultaneously. If any error counts are not zero then these are displayed. Up to 4 non-zero error counts are displayed in priority order.



If all error counts are zero and any alarms are detected “ALARMS DETECTED” is displayed.

SHOW and the alarm led’s can be used to determine which alarms were detected.

If no alarms are detected and all error counts are zero then “NO TROUBLE” is displayed.

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Error Count Priority - the following Table gives a list of SDH/SONET error count priorities.

Error Count Priority

SDH	SONET
B1 BIP	CV-S
B2 BIP	CV-L
B3 BIP	CV-P
TU BIP	CV-V
FRAME	FRAME
CRC	CRC
FAS2 (DS3FR, DS1FR)	DS3FR (DS1FR, FAS2)
MS REI	REI-L
HP REI	REI-P
HP IEC	CV-IEC
LP REI	REI-V
BIT	BIT

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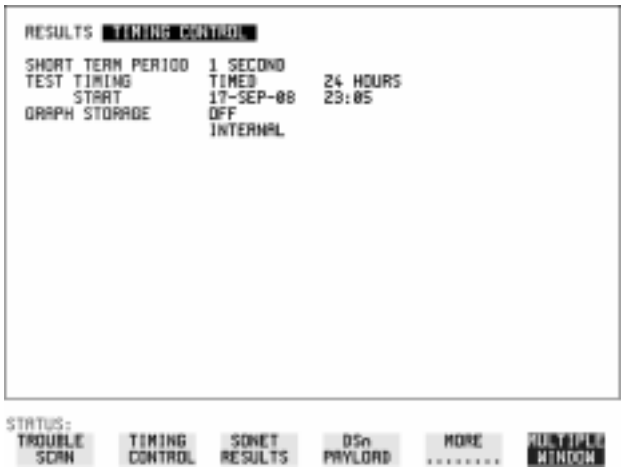
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Test Timing

Description

There are two aspects to test timing:

- Error results may be displayed as short term or cumulative over the measurement period. If short term error measurements are required, the short term period may be selected.
- The period of the test may be defined or controlled manually.



HOW TO:

1 Choose **TIMING CONTROL** on the **RESULTS** display.

2 Set the SHORT TERM PERIOD to the timing required for short term results.

3 Choose the type of TEST TIMING required:
For manual control with **RUN/STOP** choose **MANUAL**.
For a single timed measurement period started with **RUN/STOP**, choose **SINGLE** and choose the Test duration.
For a timed period starting at a specified time, choose **TIMED**, choose the Test duration and the test START date and time.

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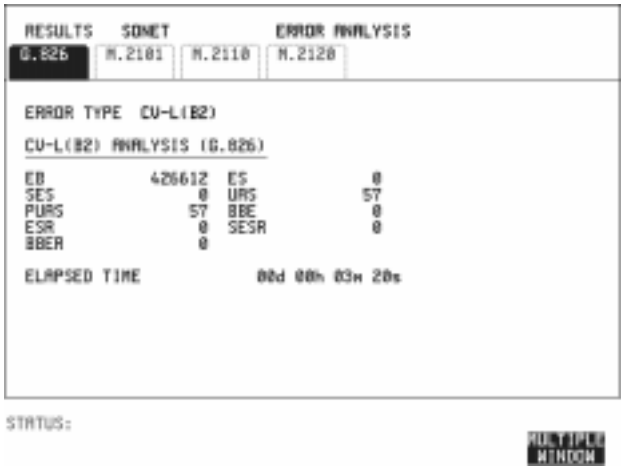
Making Analysis Measurements

Description

G.826, M.2101, M.2110 and M.2120 analysis results are provided for all relevant SDH/SONET error sources.

In addition the following results are provided:

Cumulative error count and error ratio
Short term error count and error ratio
Alarm seconds
Frequency and optical power
Pointer values and pointer adjustment counts
Pointer graph



HOW TO:

1. Set up the receive SDH/SONET interface and payload required. See “Setting Receive Interface” on page 30 (for SDH) and page 70 (for SONET).
2. If required set up the SDH/SONET transmit interface and payload. See “Setting Transmit Interface” on page 20 (for SDH) and page 60 (for SONET).
3. Press RUN/STOP to start the measurement.
4. You can view the analysis results on the RESULTS, SONET or SDH, ERROR ANALYSIS display.

TIP:

The measurement will not be affected if you switch between the different results provided.

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Measuring Frequency

Description

The signal frequency and the amount of offset from the standard rate can be measured to give an indication of probability of errors.



HOW TO:

1. Connect the signal to be measured to the IN port of the IN port of the Optical Interface module.
2. Choose the required SIGNAL rate and LEVEL on the RECEIVE MAIN SETTINGS display.

NOTE

1. Frequency measurement is always available even if test timing is off.
2. The result is only valid if a complete sweep of the highlighted bar has occurred since the input was applied.

Test Period

Two counter gate periods, selected in the **GATE** field are provided simultaneously, 1s and 16s. For the 16s gate period a “Fuel Gauge” indicates progress towards the next update.

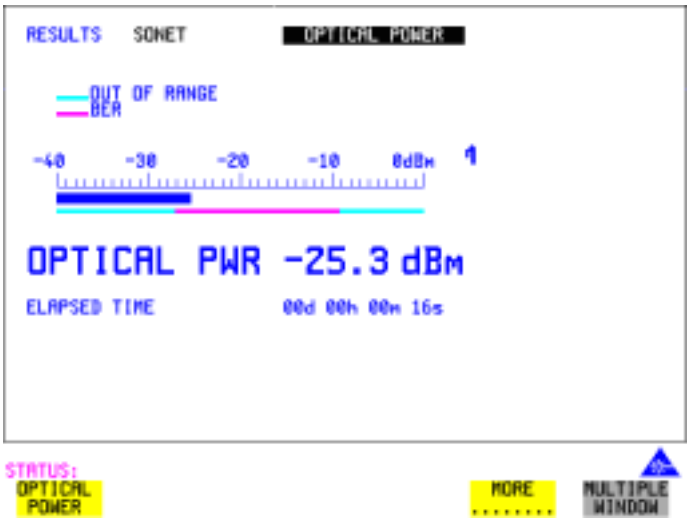
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Measuring Optical Power

Description

Optical power measurement can be performed on theSDH/ SONET signal connected to the Optical module IN port.



HOW TO:

1. Connect the SDH/SONET optical signal to the IN port of the Optical Interface module.
2. Choose the received input signal rate on the RECEIVE SONET or SDH display.
3. Select RESULTS, SONET or SDH , OPTICAL POWER as shown above.

NOTE

1. Optical power measurement is always available even if test timing is off.
2. The green portion of the colored bar shows the power range for accurate BER measurement.

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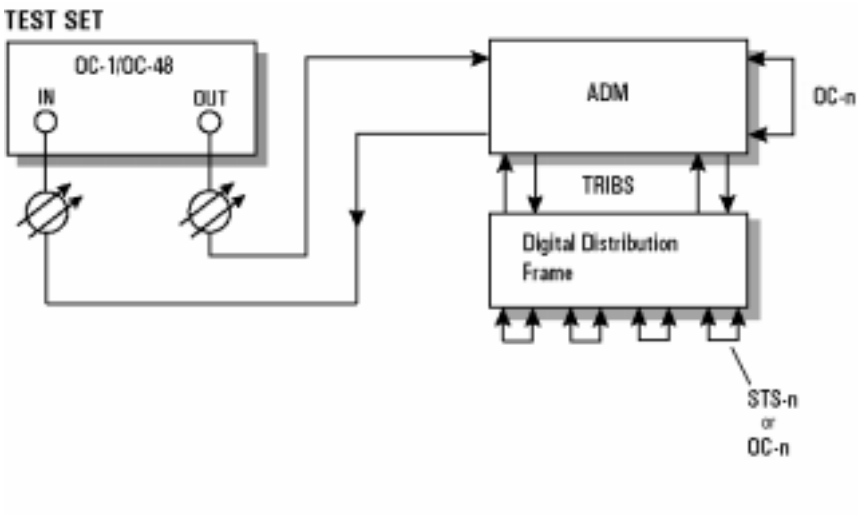
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Performing a Tributary Scan

Description

Verifying an ADM Installation

The OmniBER 720's tributary scan feature allows you to quickly test the routing of VC-n/STS-1 paths through digital cross connects and ADMs (when the tributary interfaces are synchronous). It does this by automatically testing each path through the network element for bit errors or a pattern loss. The example given below is applicable for both SONET and SDH applications.

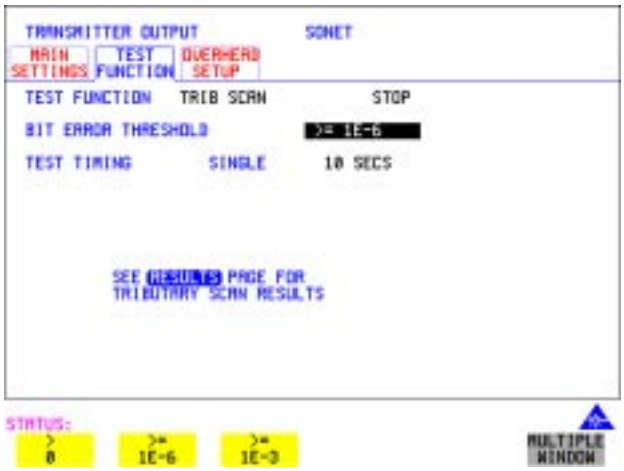


Tributary Scan tests each tributary for error free operation and no occurrence of Pattern Loss. A failure is indicated by highlighting the tributary in which the failure occurred. The TRANSMIT, MAIN SETTINGS mapping setup determines the tributary structure. The OmniBER 720 will configure the Transmitter to the Receiver and the PATTERN is forced to the payload it will fill.

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Performing a Tributary Scan

TIP: The SDH/SONET Tributary Scan display can be logged to the chosen logging device. See "Logging on Demand " page 146.



HOW TO:

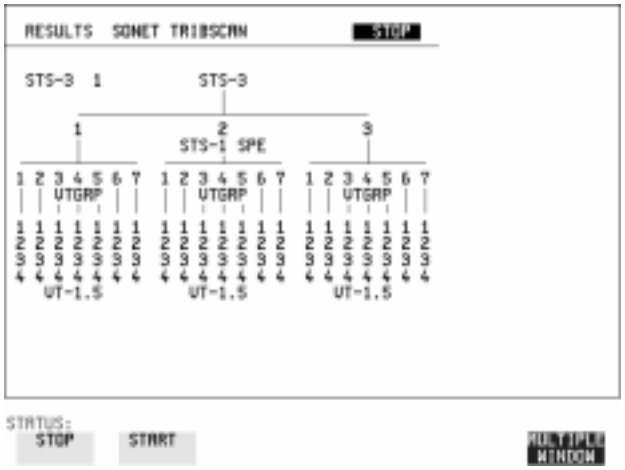
1. Set up the transmit and receive SDH/SONET interfaces and payload as required. See “Setting Transmit Interface” on page 20 (for SDH) and page 60 (for SONET) and also “Setting Receive Interface” on page 30 (for SDH) and page 70 (for SONET).
2. Choose the required BIT ERROR THRESHOLD.
   This determines the error rate above which a failure is declared.
3. Choose the required TEST TIMING.
   The value you choose is the test time for each individual tributary and not the total test time.
   For example, 28 VT-1.5 tributaries in an STS-1 SPE - the time taken to complete the Tributary Scan will be 28 X TEST TIMING choice.
4. The Tributary Scan results can be viewed on the **RESULTS**, **SONET TRIBSCAN** display.
   The Scan can be started on the **TRANSMIT**, **TEST FUNCTION**, **SONET TRIB SCAN** display or the **RESULTS** display by choosing START.
   If the Scan is started on the **TRANSMIT**, **TEST FUNCTION**, **SONET TRIB SCAN** display, the OmniBER 720 changes to the **RESULTS** display.

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If a full-bandwidth concatenated payload is selected (e.g. an STS-48c within an OC-48), then Tributary Scan is disabled.

NOTE The keyboard is locked during tributary scan.



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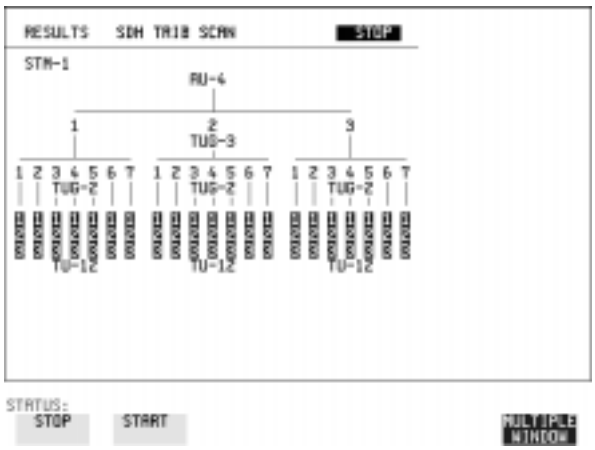
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Performing an SDH Alarm Scan

Description

This test can be performed In-Service without disturbing live traffic.
SDH Alarm Scan tests each channel for alarm free operation and identifies and indicates any Unequipped channels.
You can configure the Scan to check for the occurrence of any Path layer BIP errors above a chosen threshold. The channel in which an alarm occurred is highlighted if any of the following alarms occur:
AU-LOP, HP-RDI, AU-AIS, H4 Loss of Multiframe,
TU-AIS, LP-RDI, TU-LOP

The SDH Alarm Scan display can be logged to the chosen logging device. See "Logging on Demand " page 193.



HOW TO:

1. Set up the receive SDH interface and payload as required. See “Setting SDH Receive Interface” page 45.
2. Choose **SDH ALM SCAN** on the **RESULTS** display.
3. Choose AUTO or RX SETTINGS.
   RX SETTINGS: The scan checks the structure set on the **RECEIVE** **SDH** display.
   AUTO: The scan checks the structure being received. This can be particularly useful when receiving mixed payloads.
4. Choose the BIP error threshold.
5. Choose **START** to start the Alarm Scan.

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Performing a SONET Alarm Scan

Description

This test can be performed In-Service without disturbing live traffic.
The SONET Alarm Scan tests each channel for alarm free operation and identifies and indicates any Unequipped channels.
You can configure the Scan to check for the occurrence of any Path layer CV errors above a chosen threshold.
The channel in which an alarm occurred is highlighted if any of the following alarms occur:
STS SPE: LOP-P, RDI-P, AIS-P,
VT: LOP-V, AIS-V, RDI-V

TIP:

The SONET Alarm Scan display can be logged to the chosen logging device. See "Logging on Demand " page 146.



HOW TO:

1. Set up the receive SONET interface and payload as required. See “Setting Receive Interface” page 70.
2. Choose **SONET ALM SCAN** on the **RESULTS** display.
3. Choose AUTO or RX SETTINGS.
   RX SETTINGS: The scan checks the structure set on the **RECEIVE** **SONET** display.
   AUTO: The scan checks the structure being received. This can be particularly useful when receiving mixed payloads.
4. Choose the CV error threshold.

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5 Choose **START** to start the Alarm Scan.

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"Setting up the Transmitter for TCM Operation" page 117
"Setting up TCM Access Point Identifier (APId) messages" page 118
"Adding TCM errors" page 120
"Adding TCM Alarms" page 121
"Setting up the Receiver for TCM operation" page 122
"Detecting TCM APId messages" page 123
"Viewing TCM Errors and Alarms" page 125
"Tandem Connection Terminating Equipment (TCTE) Testing" page 127

Tandem Connection Monitoring

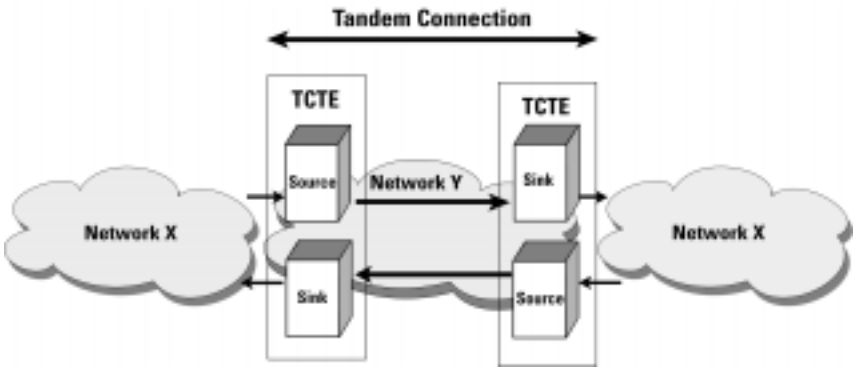
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Tandem Connection Monitoring (TCM)

What is a Tandem Connection?

A tandem connection is a bi-directional connection between two TCTEs (Tandem Connection Terminating Elements) along an SDH path, which is managed as a separate entity. The tandem path is formed from an SDH Virtual Container (VC) with special monitoring signals carried in the path overhead (POH) bytes. These bytes enable monitoring of tandem paths, performance analysis and fault location - the ability to finger point.



TCM Test Capability in OmniBER

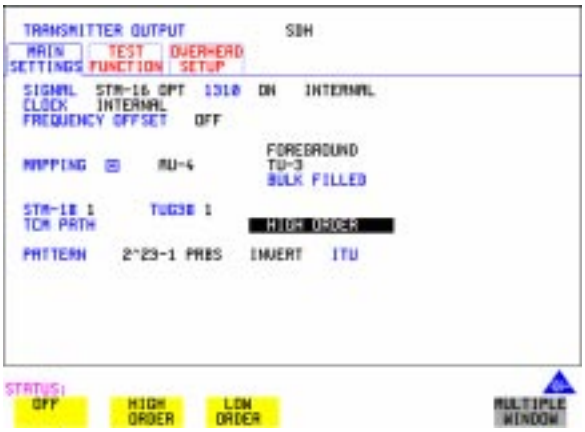
The TCM test functionality in the OmniBER 718 complies with G.707 Annex D and Annex E. Features included are alarm generation and detection, error generation and detection and access point indentifier generation and decode.

The functionality covers the requirements for both high order and low order paths.

High Order:	VC4 →AU4 and VC3→AU3 use N1 byte.
Low Order:	VC3→TU3 use N1 byte.
	VC2→TU2, VC11→TU11 and VC→TU12 use N2 byte.

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Setting up the Transmitter for TCM Operation



HOW TO

1. Press the **TRANSMIT** key and select **SDH**.
2. Select the **MAIN SETTINGS** folder.
3. Set up the Transmitter as required, see “Setting Transmit Interface” page 60.
4. Set the TCM PATH field to **HIGH ORDER** or **LOW ORDER** as required. The LOW ORDER selection is enabled when a TU mapping is selected.

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Setting up TCM Access Point Identifier (APId) messages

Description

The OmniBER offers the choice of transmitting in N1 (High Order Path or Low Order Path if TU-3) or N2 (Low Order Path) bytes the following messages:

- DEFAULT - A null APId message.
- TEST - A fixed test message "<serial number>"
- USER - A user definable 15 byte message followed by a one byte CRC.

The CRC is automatically calculated for all three message types.

HOWTO

1 Press the TRANSMIT key and select SDH.

2 Select the MAIN SETTINGS folder.

3 Set the TCM PATH field to HIGH ORDER or LOW ORDER as required.

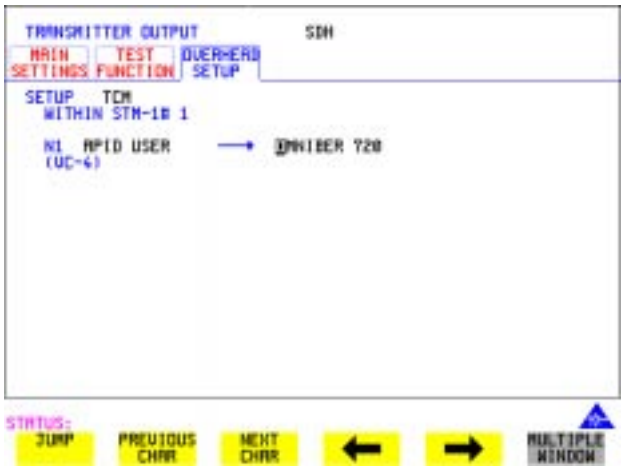
4 Select the OVERHEAD SETUP folder and set up the APId messages using one of the following two methods:

Method 1:

5 Select the SETUP field and choose TCM MESSAGE.

6 Set the N1 or N2 field as required from DEFAULT, TEST or USER. If you select USER, use the edit keys at the bottom of the screen to set up your message.

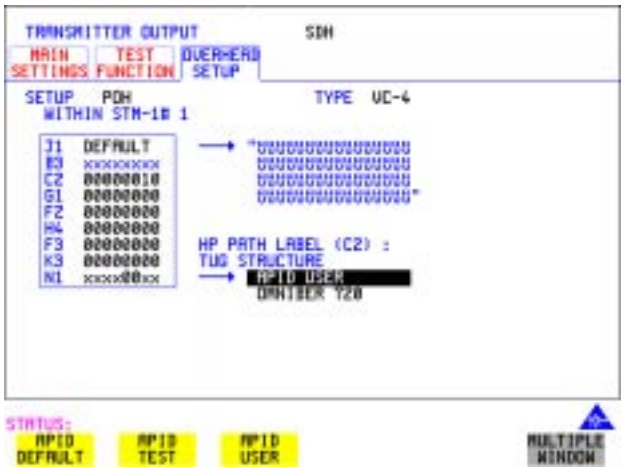
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Method 2

7 Select the SETUP field and choose **POH**.

8 Set the N1 or N2 field as required from DEFAULT, TEST or USER. If you select USER, use the edit keys at the bottom of the screen to set up your message.



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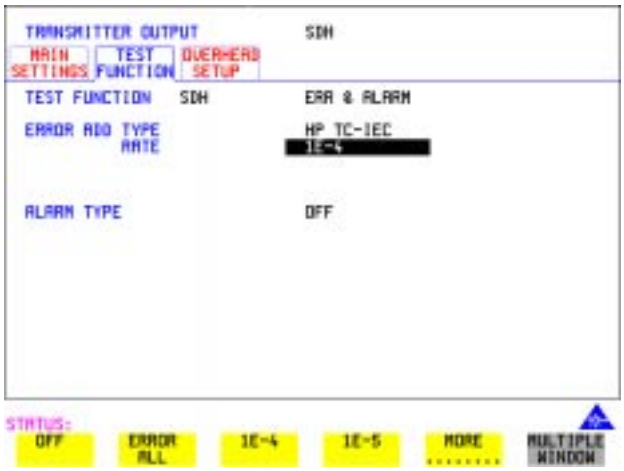
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Adding TCM errors

Description

The following TCM errors can be generated in the OmniBER:

TC-IEC	Incoming Error Count (on N1 only).
TC-REI	Remote Error Indication.
OEI	Outgoing Error Indication.
TC-BIP	TC-BIP Error (on N2 only)



HOWTO

1. Press the **TRANSMIT** key and select **SDH**.
2. Select the **MAIN SETTINGS** folder.
3. Set the TCM PATH field to **HIGH ORDER** or **LOW ORDER** as required.
4. Select the **TEST FUNCTION** folder as shown above.
5. Set the TEST FUNCTION field to **SDH** and select **ERRORS & ALARMS**.
6. Select the ERROR ADD TYPE field and choose an Error Type, also select the Error Rate.

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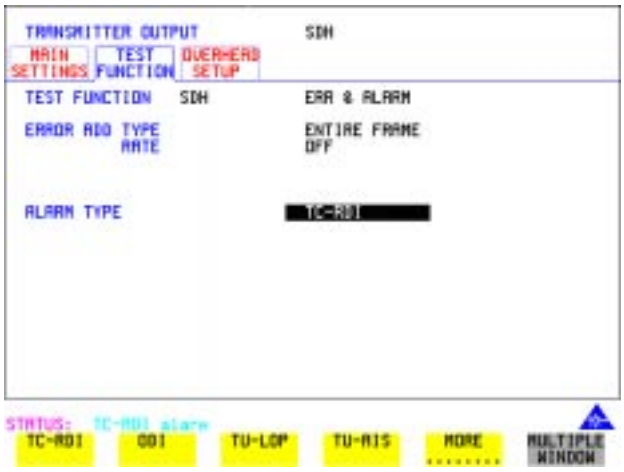
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Adding TCM Alarms

Description

There are four alarms that can be generated and detected in the OmniBER, they are:

TC- LOM	Tandem Connection Loss of Multiframe.
TC-RDI	Tandem Connection Remote Defect Indicator.
TC-IAIS	Incoming AIS.
ODI	Outgoing Defect Indicator.



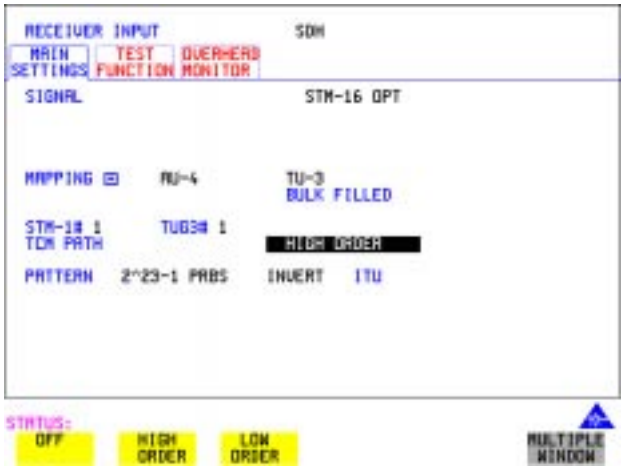
HOWTO

1. Press the **TRANSMIT** key and select **SDH**.
2. Select the **MAIN SETTINGS** folder.
3. Set the TCM PATH field to **HIGH ORDER** or **LOW ORDER** as required.
4. Select the **TEST FUNCTION** folder as shown above.
5. Set the TEST FUNCTION field to **SDH** and select **ERRORS & ALARMS**.
6. Select the ALARM TYPE field and choose an Alarm Type.

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Setting up the Receiver for TCM operation



HOWTO

1. Press **RECEIVE** and select **SDH**.
2. Select the **MAIN SETTINGS** folder.
3. Set up the Receiver as required, see “Setting Receive Interface” page 70.
4. Set the TCM PATH field to **HIGH ORDER** or **LOW ORDER** as required. The LOW ORDER selection is enabled when a TU mapping is selected.

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Detecting TCM APId messages

Description

TCM Access Point Identifier messages are detected and displayed on the Receiver OVERHEAD MONITOR page in two places, as described below.

HOWTO

1 Press RECEIVE and select SDH.

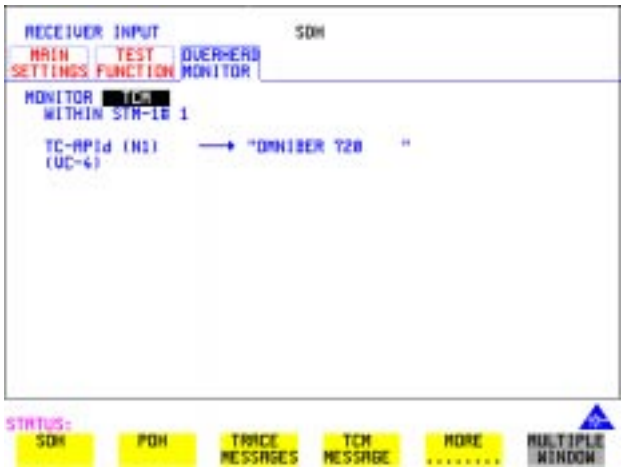
2 Select the MAIN SETTINGS folder.

3 Set the TCM PATH field to HIGH ORDER or LOW ORDER as required.

4 Select the OVERHEAD MONITOR folder and set up the APId messages using one of the following two methods:

Method 1

5 Select the MONITOR field and choose TCM MESSAGE, see following example display.

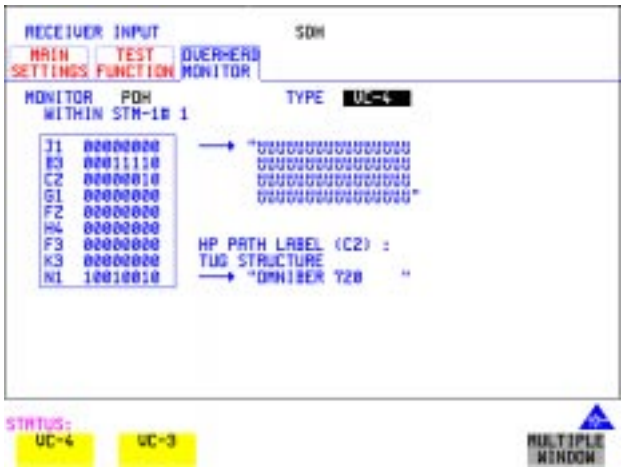


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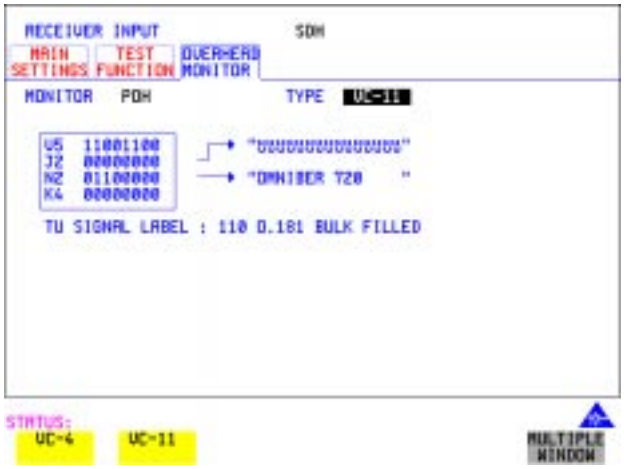
Method 2

6 Select the MONITOR field and choose **POH** .

7 To view the the N1 byte message set the TYPE field to **VC-4** or **VC-3** as required.



8 To view the N2 byte message select the TYPE field and set as required.



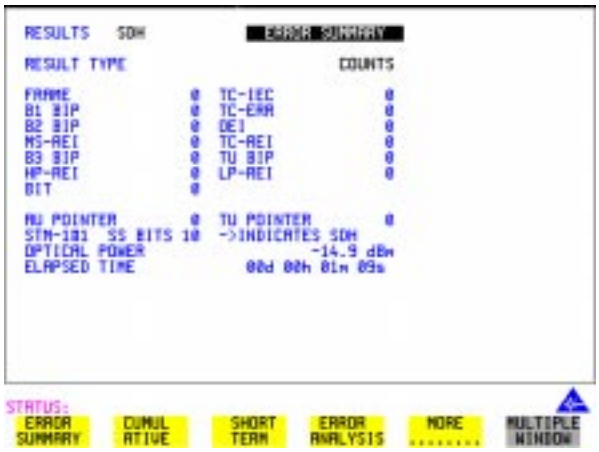
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Viewing TCM Errors and Alarms

Description

TCM error and alarm results can be viewed on the RESULTS page.



HOWTO

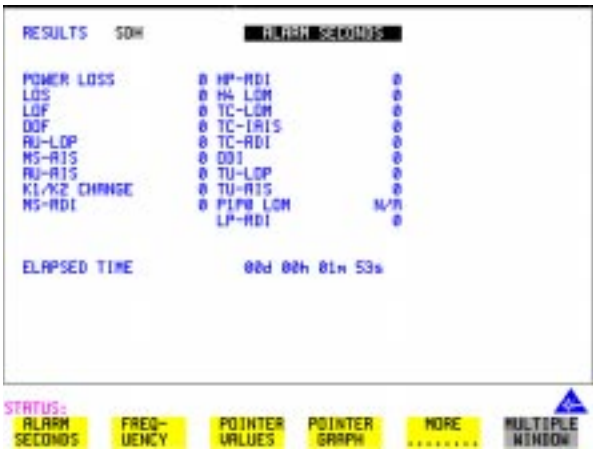
1. Press the **RESULTS** key.
2. Select **SDH RESULTS** in the RESULTS field.
3. **ERROR SUMMARY** gives a summary of all possible SDH/TCM measurements and errors/counts and can be set up to be read as counts (total in measurement interval) or ratios/rates.
4. **CUMULATIVE** errors give the number of errors and counts which have occurred in total since the last time **RUN/STOP** was pressed.
5. **SHORT TERM** errors give the number of errors and counts which have occurred in the last measurement interval. This measurement interval is set up on the results page when **TIMING CONTROL** has been selected in the RESULTS field.

See next page for an example of the Alarms Results page

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6 Select **ALARM SECONDS** to view alarms (see below).



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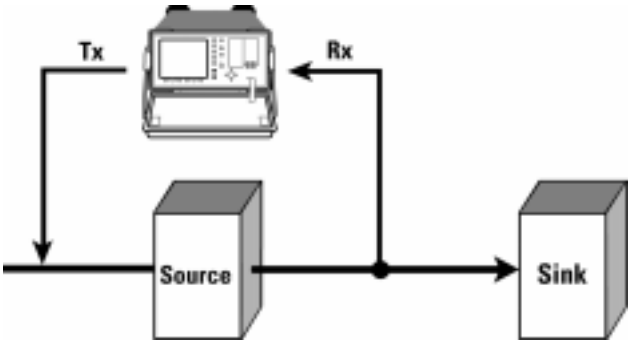
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Tandem Connection Terminating Equipment (TCTE) Testing

TCTE Source Testing

Description

Verify that the system responds correctly when a valid SDH signal is sent, and then add errors and alarms and check again that the system responds correctly to this new stimulus. The following figure illustrates the test setup for TCTE Source testing.



Introduction

The following procedure gives an example of testing a TCTE source which originates a VC-4 link over STM-1. In the procedure a valid SDH signal is sent from the OmniBER to the TCTE Source and the output of the Source is monitored in the OmniBER Receiver for correct TC-APId (access point identifier) and absence of alarms.

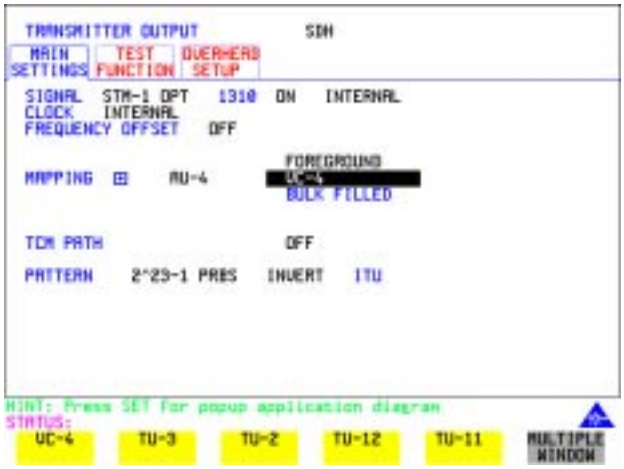
HOWTO

1. Connect the System under test to the OmniBER as shown above.
2. Press the TRANSMIT key and select SDH.
3. Select the MAIN SETTINGS folder.

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4 Configure the OmniBER to send a valid VC-n to the TCTE Source. For this example we have selected VC-4 mapping over STM-1.



5 Check that there are no alarms indicated on the OmniBER front panel. If TCM is not enabled on the TCTE then the instrument STATUS line (at bottom of the display) will indicate “TCM Loss of Multiframe (TC-LOM)”, and the Alarm Seconds results on the Results page will indicate TC-LOM alarms . The absence of errors confirms that TCM is configured correctly.

6 Check for correct TC-APId (access point identifier) as follows:

7 Press **RECEIVE** and select **SDH**.

8 Select the **MAIN SETTINGS** folder.

9 Set the Receiver settings to match those of your system.

10 Set the TCM PATH field to **HIGH ORDER** or **LOW ORDER** . The LOW ORDER selection is enabled when a TU mapping is selected.

11 Select the **OVERHEAD MONITOR** folder.

12 Select the MONITOR field and choose **TCM MESSAGE**, check on the display that the TC-APId matches the APId as expected from the TCTE, an example is given on the following page.

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Error Monitoring Testing

Method: Use the OmniBER Transmitter to generate errors in the system under test and verify on the Receiver that the correct error result is obtained.

13 Press the **TRANSMIT** key and select **SDH**.

14 Select the **TEST FUNCTION** folder.

15 Set the TEST FUNCTION field to **SDH** and select **ERRORS & ALARMS**.

16 Select an ERROR ADD TYPE and RATE, for this example we have chosen to add B3 BIP errors at a rate of 1E-5, as shown below.



17 Press **RUN/STOP** to start the test. See "Test Timing " page 105 for advice on setting test periods.

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18 Check that the OmniBER Receiver detects and displays a B3 BIP and TC-IEC error ratio of 1.000E-05 (for this example), see figure below.
This verifies that the Network Element has correctly copied the B3 count into bits 1-4 of the N1 byte and that B3 is correctly compensated.

19 To view results select **RESULTS** **SDH RESULTS** and **ERROR SUMMARY**.

20 Set the RESULT TYPE field to **RATIOS** .



Alarms Testing

Method: Send an invalid VC-4 to the TCTE under test and check that the OmniBER Receiver registers an TC-IAIS alarm.

21 Press the **TRANSMIT** key and select **SDH**.

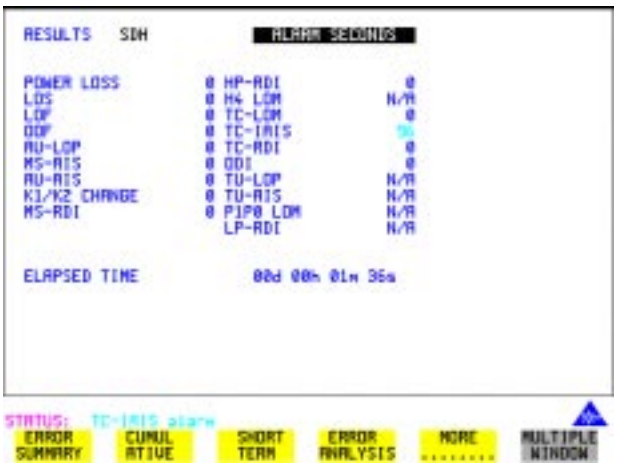
22 To generate an invalid VC-n in the OmniBER select the Transmitter TEST FUNCTION folder as shown below and select a AU-LOP, LOF or MS_AIS Alarm.



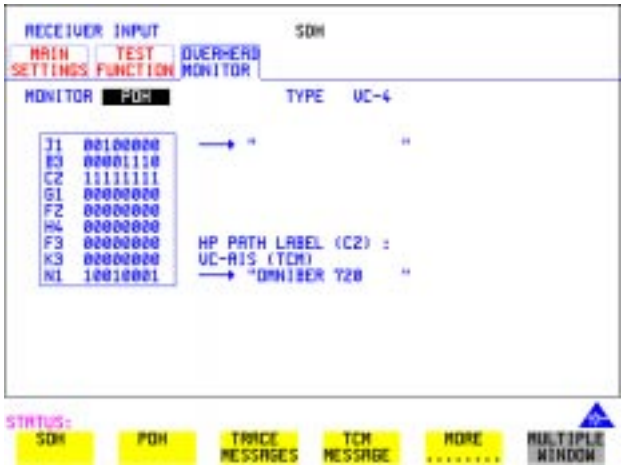
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23 View alarms on the RESULTS folder, an example is given below:



24 Verify that the signal label (in C2 or V5) is set to all-ones, which indicates a VC-AIS.



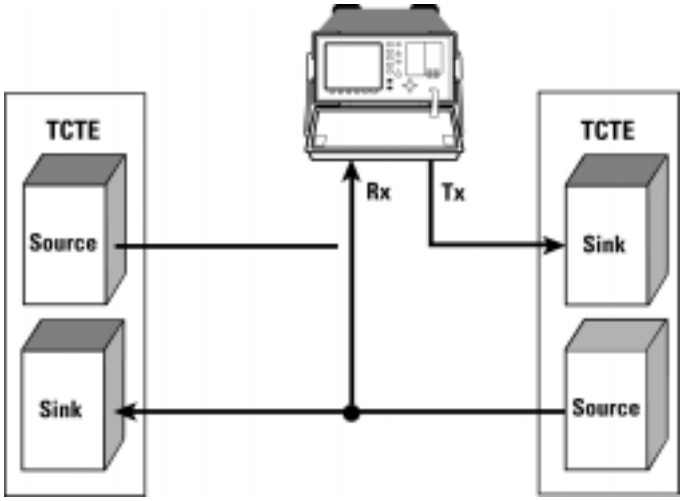
25 Press **RUN/STOP** to end the test.

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TCTE Sink/Source Testing

Description

Connect the OmniBER to the system under test as shown below, stress the system by adding alarms and errors, and check for the correct response from the network element.



HOWTO

1 Add the following alarms/errors to the signal input to the TCTE Sink input and check on the OmniBER RESULTS page for the correct response.

Alarm/Errors Transmitted	Response on OmniBER Rx
No signal, loss of frame, loss of pointer.	TC-RDI and ODI alarms.
TC-APId mismatch.	TC-RDI and ODI alarms.
TC-IAIS	ODI alarm.
BIP errors at 1E-5	OEI errors at 1E-5
BIP or IEC errors at 1E-5	TC-REI errors at 1E-5*

*Sending BIP errors without IEC errors, or IEC errors without BIP errors, gives rise to a non-zero result when the TCTE calculates B3-IEC. These errors are counted as TC errors (that is errors occurring on the TCM link) which in turn are reported on TC-REI.

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8

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"Recalling Stored Graph Results" page 135
"Viewing the Bar Graph Display" page 137
"Viewing the Graphic Error and Alarm Summaries" page 139
"Logging Graph Displays" page 141
"Logging Results" page 143
"Logging on Demand" page 146
"Logging Results to Parallel (Centronics) Printer" page 148
"Logging Results to GPIB Printer" page 149
"Logging Results to Internal Printer" page 150
"Logging Results to RS-232-C Printer" page 151
"Logging Data to Disk" page 152
"Printing Results from Disk" page 153
"Connecting an HP Printer to a Parallel Port" page 154
"Changing Internal Printer Paper" page 155
"Cleaning Internal Printer Print Head" page 158

Storing, Logging and Printing

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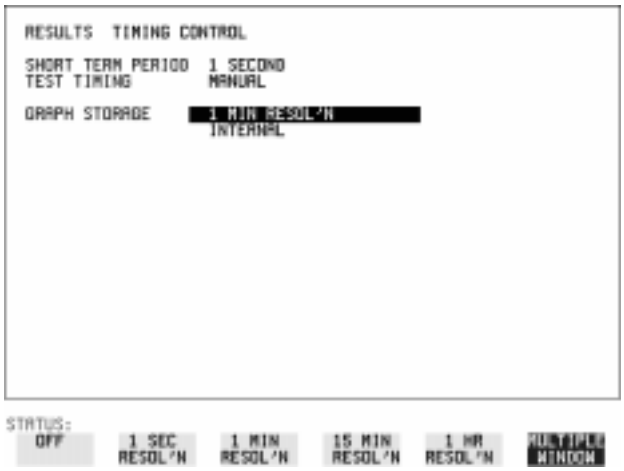
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Saving Graphics Results to Instrument Store

Description

Graphical representation of measurement results is very useful particularly during a long measurement period. It provides an overview of the results and can be printed for record keeping.

Graphics results can be stored in instrument graph storage or on floppy disk.



HOW TO:

1. Before starting your measurement, choose the GRAPH STORAGE resolution and location.
   The resolution chosen affects the ZOOM capability when viewing the bar graphs. If 1 MIN is selected, 1 MIN/BAR, 15 MINS/BAR and 60 MINS/BAR are available. If 15 MINS is selected, 15 MINS/BAR and 60 MINS/BAR are available. If 1 HOUR is selected, 60 MINS/BAR is available.
   The graphics results can be stored in the instrument - INTERNAL or stored on DISK. Storage to disk will use a default file name unless a file name is specified on the **OTHER** **FLOPPY DISK** display. See “Saving Graphical Results to Disk” page 168.
2. Press **RUN/STOP** to start the measurement. Graphical results will be stored in the chosen location.

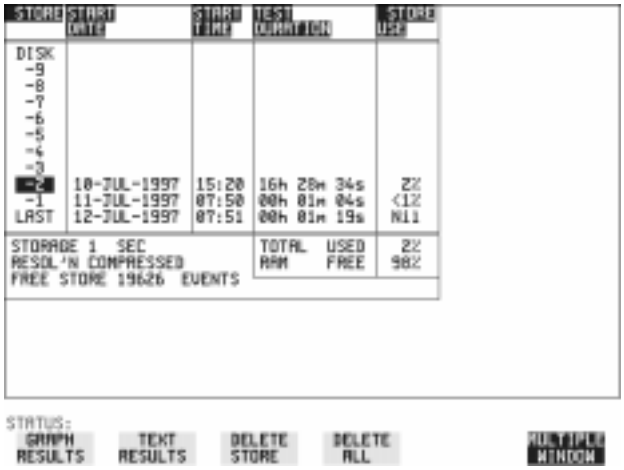
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Recalling Stored Graph Results

Description

Results stored from a previous measurement can be recalled to the graphics displays for viewing and printing.



HOW TO:

1. If currently viewing the bar graph display, select **TEXT RESULTS** then **STORE STATUS**. If currently viewing the error or alarm summary, select **STORE STATUS**.
2. Using ↑ and ↓, move the highlighted cursor to the store location which contains the required results.
   If the required results are stored on Disk, move the highlighted cursor to DISK and choose RECALL GRAPHICS on the FLOPPY DISK display. See “Recalling Graphics Results from Disk” page 170.
3. Choose **GRAPH RESULTS** if you wish to view the bar graphs.
   The display will change to the bar graph display of the highlighted results.
4. Choose **TEXT RESULTS** if you wish to view the error and alarm Summaries.
   The display will change to the text results display of the highlighted results.
   DELETE STORE deletes the results in the highlighted store.
   If **DELETE ALL** is chosen, a **CONFIRM DELETE**, **ABORT DELETE** choice prevents accidental deletion of all the stored results.

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The top row of the display comprises five fields:

Store	Memory location in which the displayed bar graph data is stored. Move the highlighted cursor, to the STORE location desired, using ↑ and ↓.
Start Date	The start date of the test, which produced the stored results.
Start Time	The start time of the test, which produced the stored results.
Test Duration	The duration of the test, which produced the stored results.
Store Use	The percentage (%) of the overall storage capacity occupied by each set of stored results. The TOTAL percentage used and the percentage still FREE is provided at the bottom of the STORE USE column.

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Viewing the Bar Graph Display

Description

All the graphic results obtained during the measurement are available for viewing. Identify a period of interest and zoom in for more detailed examination.



HOW TO:

1. To view the current bar graphs, press GRAPH and use **CHANGE UPPER** and **CHANGE LOWER** to obtain the bar graphs required. Press **SET** to obtain a choice of options.
2. To view previously stored graphs, see "Recalling Stored Graph Results " page 135.
3. For more detailed inspection of the bar graph, position the cursor centrally within the area of interest using ➡, ⬅ and select **ZOOM IN** to reduce the time axis to 15 MINS/BAR. This is only possible if the graphics results were stored with a STORAGE resolution of 1 SEC,1 MINS or 15 MINS.
   For further reduction of the time axis to 01 MINS/BAR or 01 SECS/BAR, position the cursor centrally within the area of interest and select **ZOOM IN** until the required time axis is obtained.
   The top row of the display comprises three fields:

Store Memory location in which the displayed bar graph data is stored. Store can only be changed when the status of stored results is displayed. See "Recalling Stored Graph Results " page 135.

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Zoom The width, in minutes, of each "bar" in the bar graph, controlled by **ZOOM IN** and **ZOOM OUT**.

Cursor The cursor position in terms of time and date, controlled by → and ←. The cursor position changes in steps of 1 second, 1 minute, 15 minutes or 60 minutes dependent upon the ZOOM setting. The cursor is physically located between the two graphs.

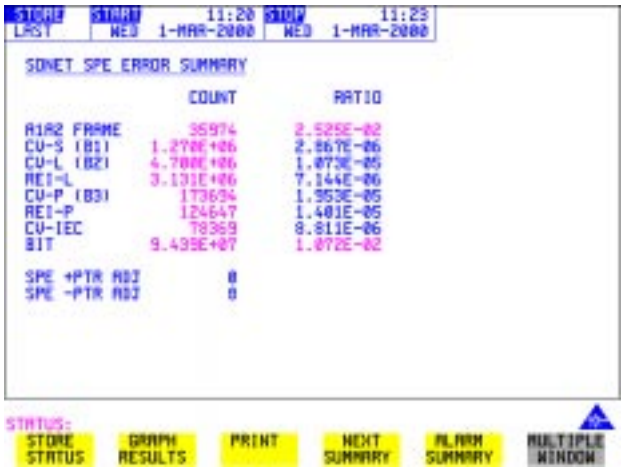
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Viewing the Graphic Error and Alarm Summaries

Description

The error and alarm summaries of the measurement chosen are displayed on the **TEXT RESULTS** display. The error summary or alarm summary can be viewed at any time.



HOW TO:

1. To view the error or alarm summary associated with the current bar graphs, press **GRAPH** then **TEXT RESULTS**.
2. To view the error or alarm summary associated with previously stored bar graphs, see "Recalling Stored Graph Results " page 135.
3. To view the Alarms which have occurred during the measurement, select **ALARM SUMMARY**.
4. To view the Errors which have occurred during the measurement select **ERROR SUMMARY**.

The top row of the display comprises three fields:

Store Memory location in which the bar graphs, error summary and alarm summary are stored.
Store can only be changed when the status of stored results is displayed. See "Recalling Stored Graph Results " page 135.

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Start	The start time and date of the test, that produced the displayed results.
Stop	The stop time and date of the test, that produced the displayed results.

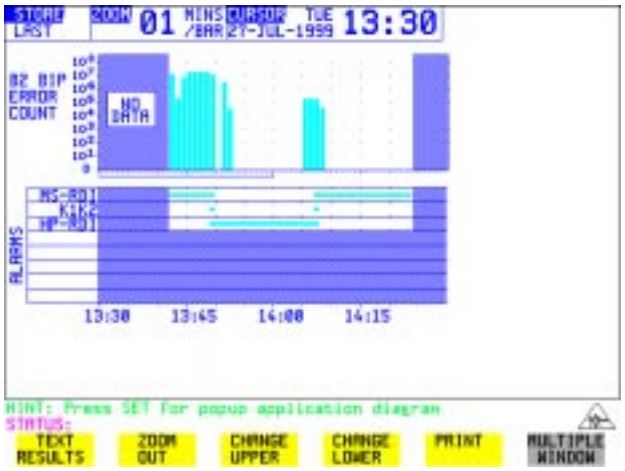
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Logging Graph Displays

Description

The bar graphs and error and alarm summaries can be logged to the disk for printing at a later date or logged to an internal printer if option 602 is fitted.
If Option 601, Remote Control, is fitted, the bar graphs and error and alarm summary can be logged to an external HP DeskJet printer at the end of the test period. If a printer is not immediately available, the graphics results remain in memory and can be logged at a later time when a printer becomes available. Suitable HP printers are the HP 660, HP 690C, HP 500 or HP 400.



HOW TO:

Log to an External Printer

1. Connect an external RS-232-C HP printer to the OmniBER 720 RS232 port. See "Logging Results to RS-232-C Printer " page 151 or connect an external GPIB HP printer to the OmniBER 720 GPIB port. See "Logging Results to GPIB Printer " page 149 or connect a Parallel DeskJet printer to the OmniBER 720 Parallel port. See "Logging Results to Parallel (Centronics) Printer " page 148.
2. Make the required selections on the **OTHER** **LOGGING** display: Set LOGGING SETUP to **DEVICE**, then set LOGGING PORT [GPIB] or [RS232] or [PARALLEL]. Now set the LOGGING SETUP field to **CONTROL** and set LOGGING to **ON**.
3. To log the Error and Alarm summarizes, the displayed Bar graphs and the Alarm

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graph to the printer, choose **PRINT** on the bar graph display.

4 Choose to confirm or abort the print.
To confirm the print and only print the portion of the graph displayed and the summaries choose **THIS SCREEN**.
To confirm the print and print the graph for the whole measurement period and the summaries choose **CURSOR TO END**.
To abort the print choose **ABORT**.

5 To log the selected Error and Alarm summaries to the printer, choose **PRINT** on the Text Results display.

HOW TO: **Log to the Disk Drive**

1 Insert a floppy disk in the disk drive.

2 Choose LOGGING PORT **DISK** on the **OTHER** **LOGGING** display.
Enter a filename on the **OTHER** **FLOPPY DISK** display. See "Logging Data to Disk " page 152.

3 To log the Error and Alarm summaries, the displayed Bar graphs and the Alarm graph to the disk, choose **PRINT** on the bar graph display.

4 Choose to confirm or abort the print.
To confirm the print and only print the portion of the graph displayed and the summaries choose **THIS SCREEN**.
To confirm the print and print the graph for the whole measurement period and the summaries choose **CURSOR TO END**.
To abort the print choose **ABORT**.

5 To log the selected Error and Alarm summaries to the disk, choose **PRINT** on the Text Results display.

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Logging Results

Description

Test Period Logging

If degradations in system performance can be observed at an early stage, then the appropriate remedial action can be taken to maximize circuit availability and avoid system crashes. Test period logging allows you to monitor the error performance of your circuit. At the end of the test period the selected results are logged. Results can be logged at regular intervals during the test period by selecting a LOGGING PERIOD of shorter duration than the test period. An instant summary of the results can be demanded by pressing **PRINT NOW** without affecting the test in progress.

Error Event Logging

Manual tracing of intermittent faults is time consuming. Error event logging allows you to carry out unattended long term monitoring of the circuit. Each occurrence of the selected error event is logged.

The results obtained during the test are retained in memory until they are overwritten by the next set of results. The results can be logged at any time during the test period and at the end of the test period. The results required are selected using **OTHER** **LOGGING** LOGGING SETUP **CONTROL**.

Any Alarm occurrence results in a timed and dated message being logged.

BER and Analysis results can be selected by the user.

Cumulative and Period versions of the results are calculated and can be selected by the user.

Period The results obtained over a set period of time during the test. The Period is defined by the LOGGING PERIOD selection.

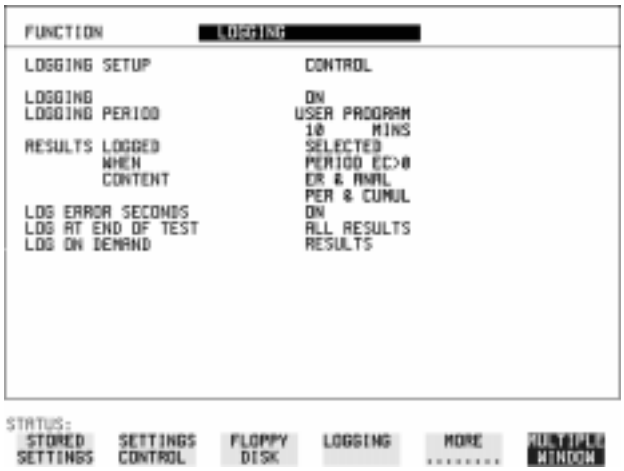
Cumulative The results obtained over the time elapsed since the start of the test.

The results can be logged to the following devices, selectable using **OTHER** **LOGGING** LOGGING SETUP **DEVICE**:

- Optional Internal printer fitted into the instrument front cover (Option 602)
- External GPIB printer (option 601)
- External RS-232-C printer (option 601)

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- External Parallel Port printer (option 601)
- Internal Disk Drive



HOW TO:

1. Choose LOGGING [ON] - enables the logging of results and alarms.
2. Choose LOGGING PERIOD - determines how regularly the results and alarms are logged.
   USER PROGRAM provides a choice of 10 minutes to 99 hours.
3. Choose RESULT LOGGED - allows you to log all results to or choose only those results you require.
4. Choose WHEN - allows you to choose to only log when the error count for the logging period is greater than 0. If the error count is 0 then the message NO BIT ERRORS is displayed.
5. Choose CONTENT - allows you a choice of error results to be logged.
   Error Results, Analysis or Error and Analysis (ER & ANAL)
   and
   Period, Cumulative or Period and Cumulative (PER & CUMUL).
6. If LOG ERROR SECONDS [ON] is chosen a timed and dated message is logged each time an error second occurs (excessive occurrences of error seconds during the logging period will result in heavy use of printer paper).
7. Choose the logging DEVICE.
   If RS232 is chosen, see "Logging Results to RS-232-C Printer " page 151.
   If GPIB is chosen, see "Logging Results to GPIB Printer " page 149.
   If PARALLEL is chosen, see "Logging Results to Parallel (Centronics) Printer " page 148.

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If DISK is chosen, see “Logging Data to Disk” page 152.
If Option 602, Internal Printer, is fitted and INTERNAL is chosen, see "Logging Results to Internal Printer " page 150.

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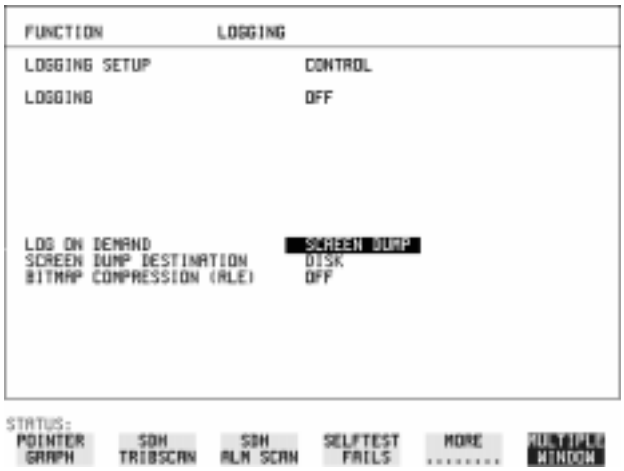
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Logging on Demand

Description

When PRINT NOW is pressed the chosen results are logged to the chosen logging device. The choice of results for logging is:

RESULTS SNAPSHOT - last recorded measurement results
OVERHEAD SNAPSHOT - last recorded overhead values of the chosen STS-3
OVERHEAD CAPTURE - Overhead Capture display
SCREEN DUMP - allows logging of the chosen display
POINTER GRAPH - Pointer Graph display
SONET TRIBUTARY SCAN - SONET Tributary Scan display
SONET ALARM SCAN - SONET Alarm Scan display
SELFTEST FAILS - Last recorded selftest failures



HOW TO:

1 Choose LOG ON DEMAND to determine results to be logged when PRINT NOW is pressed.
SCREEN DUMP allows you to log the selected display when PRINT NOW is pressed. (Logging or Disk displays cannot be logged using this feature).

2 Choose the logging DEVICE.
If RS232 is chosen, see "Logging Results to RS-232-C Printer " page 151.
If GPIB is chosen, see "Logging Results to GPIB Printer " page 149.

If PARALLEL is chosen, see "Logging Results to Parallel (Centronics) Printer " page 148.

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If DISK is chosen, see “Logging Data to Disk” page 152.
If Option 602, Internal Printer, is fitted and INTERNAL is chosen, see "Logging Results to Internal Printer " page 150.

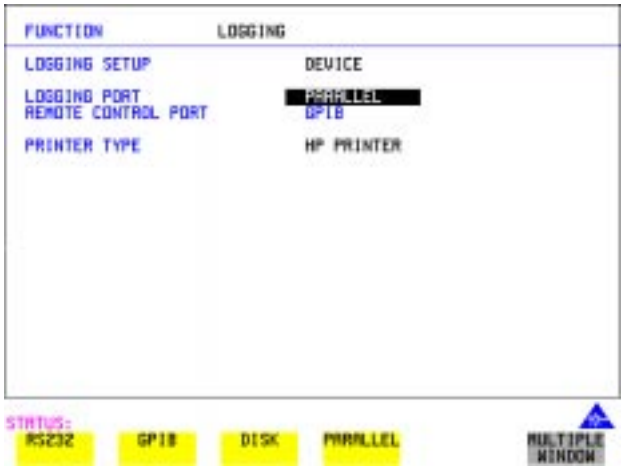
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Logging Results to Parallel (Centronics) Printer

Description

If Option 601, Remote Control Interface, is fitted, you can log the results and alarms to an external Parallel printer connected to the PARALLEL port. The Parallel port provides a standard IEEE 1284-A compatible interface.



CAUTION Damage to the instrument may result if a serial connection is made to this port.

HOW TO:

1. Connect the Parallel printer to the PARALLEL port. See "Connecting an HP Printer to a Parallel Port " page 154.
2. If a non HP printer is connected choose ALT PRINTER.
   Choose **NORMAL** 80 character column width or **COMPRESS** 40 character column width according to the capabilities of your printer.
3. Choose LOGGING SETUP **CONTROL** and set up the display as required. See "Logging Results " page 143 or "Logging on Demand " page 146.

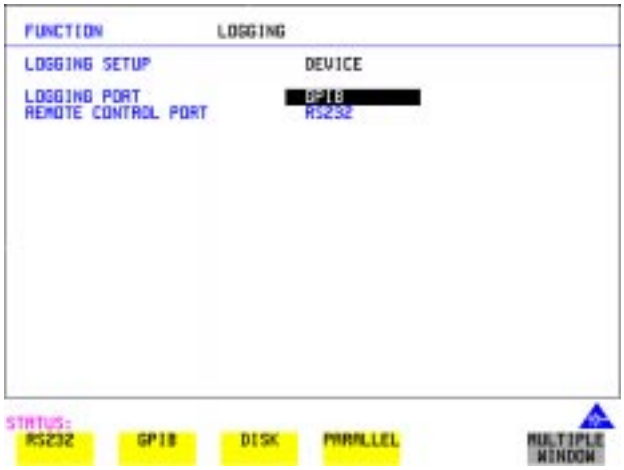
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Logging Results to GPIB Printer

Description

If Option 601, Remote Control Interface, is fitted, you can log the results and alarms to an external GPIB printer connected to the GPIB port.



HOW TO:

1 Connect an GPIB printer to the GPIB port.

NOTE

Choosing GPIB external printer for logging prevents the use of GPIB remote control.

2 Choose the LOGGING SETUP **CONTROL** and set up the display as required. See "Logging Results " page 143 or "Logging on Demand " page 146.

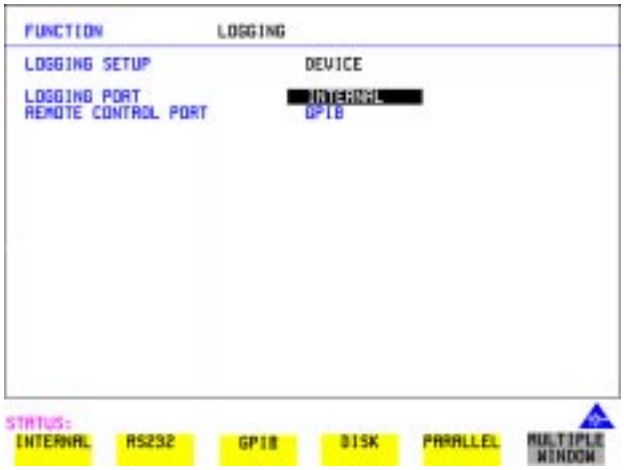
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Logging Results to Internal Printer

Description

If Option 602, Internal Printer is fitted, you can log the results and alarms to the in-lid printer.



HOW TO:

1 Choose the LOGGING SETUP **CONTROL** and set up the display as required. See "Logging Results " page 143.

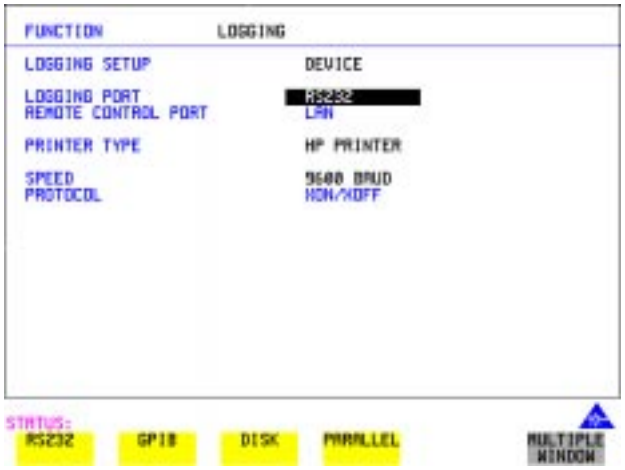
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Logging Results to RS-232-C Printer

Description

If Option 601, Remote Control Interface, is fitted, you can log the results and alarms to an external RS-232-C printer connected to the RS-232-C port.



HOW TO:

1 Connect an RS-232-C printer to the RS-232-C port.

NOTE

Choosing RS232 external printer for logging prevents the use of RS-232-C remote control.

2 If a non HP printer is connected choose ALT PRINTER. Choose **NORMAL** 80 character column width or **COMPRESS** 40 character column width according to the capabilities of your printer.

3 Choose the LOGGING SETUP **CONTROL** and set up the display as required. See "Logging Results " page 143 or "Logging on Demand " page 146.

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Logging Data to Disk

Description

You can log and save data to a new file, or to an existing file on disk. If you are logging to an existing file you can overwrite the contents of the file, or you can append new data to the file. The disk can then be transferred to a personal computer (PC) and the data investigated at a later date.



HOW TO:

1. Choose the directory in which to save the logging results. See "Accessing Directories and Selecting Files " page 165.
2. Choose DISK OPERATION **SAVE** FILE TYPE **DATA LOGGING** and enter your choice of filename using **PREVIOUS CHAR** **NEXT CHAR** → ← or press **SET** twice and use the pop-up keypad.
   The filename can contain up to 8 alphanumeric characters.
   The filename extension is fixed as .PRN.
3. If you want to log data to a new file, choose NONE.
   If you wish to add the data to a named file, choose APPEND TO FILE. The data is added to the file (in the available free space on the disk).
   If you wish to overwrite the contents of a named file, choose OVERWRITE.
4. Set up the **OTHER** **LOGGING** display. See “Logging Results” page 143.
   When the named file is opened, data logging is saved on the disk:
   As each logging output occurs during the measurement or when **PRINT NOW** is pressed.

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Printing Results from Disk

Description

The results and alarms you logged to Disk can be printed by removing the Disk from the OmniBER 720 and inserting it into a personal computer (PC).

PC Instructions

HOW TO:

Print from DOS Prompt

copy/b a:\<filename> <printer name>

HOW TO:

Print from Windows

1. Choose the required file from Filemanager.
2. Choose FILE - COPY FILE TO *<printer name>*

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Connecting an HP Printer to a Parallel Port

Description If Remote Control Option, 601, is fitted, the OmniBER 720 has the capability of interfacing with an printer or, an alternative suppliers printer, via the PARALLEL port.

CAUTION Do not connect a serial printer e.g. RS-232-C or GPIB to the OmniBER 720 Parallel port as this will damage the interface.

HOW TO: Connect the OmniBER 720 Parallel port to your Printer Parallel port using printer cable 24542D.

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Changing Internal Printer Paper

Description

The printer accepts rolls of thermal paper with the following dimensions:

Width:	216 mm (8.5 in) or 210 mm (8.27 in) (A4) tolerance +2.0 mm - 1.0 mm
Maximum Outside Diameter:	40 mm
Inside Core Diameter:	Between 12.5 mm and 13.2 mm

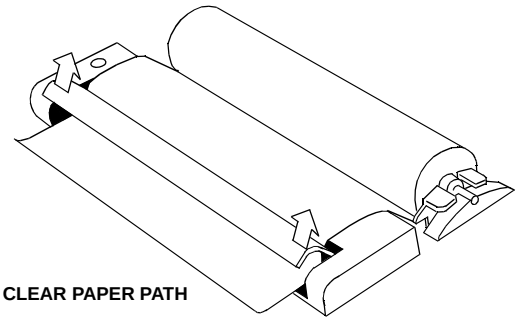
Suitable rolls of paper are available from Agilent, Part Number 9270-1360.

WARNING

The paper tear-off edge is SHARP. This edge is exposed when the printer cover is raised. Note the ⚠ CAUTION SHARP EDGE label on the cover.

HOW TO:

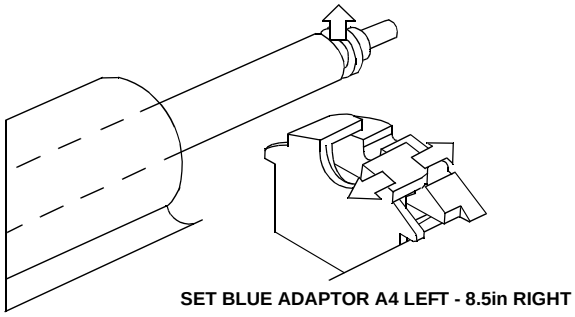
1. Raise the two locking tabs on the sides of the printer cover and then raise the cover.
2. Raise the printer mechanism front cover. This releases the paper drive. Remove any remaining paper from the front (in the normal direction of operation).



3. Lift out the spindle. Adjust the paper width adaptor to the width of the paper being used.
4. Put the paper roll on the spindle such that the sensitive side (slightly shiny) will be on the underside of the print mechanism. Ensure that the relocation of the spindle locks the blue width adaptor in position.

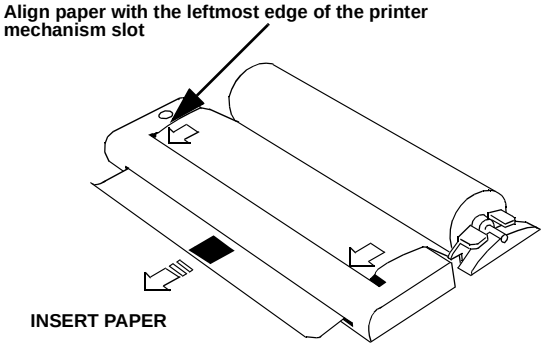
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NOTE The paper must be installed such that when it is in the print mechanism, the sensitive side (slightly shiny) is the underside.
The illustrations here show the correct fitting for 9270-1360 paper which has the sensitive side on the outside of the roll.



SET BLUE ADAPTOR A4 LEFT - 8.5in RIGHT

5 Feed the paper into the upper entry of the print mechanism. When the front cover of the print mechanism is closed, the printer should automatically feed the paper through until there is approximately 2.5 cm (1 in) clear at the front of the print mechanism.

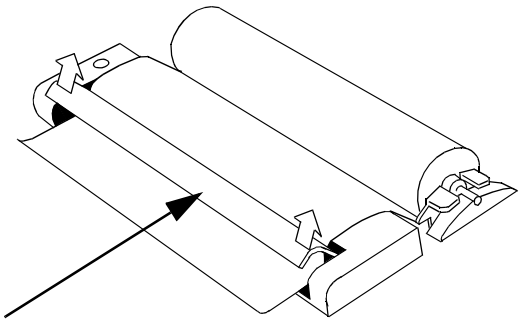


CAUTION Do not close the outer cover until the automatic paper feed is complete.

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6 If the printer paper is incorrectly aligned, raise the printer mechanism front cover to releases the paper drive and realign the paper.



LIFT TO ADJUST PAPER ALIGNMENT

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Cleaning Internal Printer Print Head

Description

The print head should be cleaned when broken or light characters occur in a vertical line on the page. To maintain a high quality print, clean the print head after 200 to 300 prints.
The print head is cleaned with a special cleaning paper which is supplied with the instrument.

WARNING

The paper tear-off edge is SHARP. This edge is exposed when the printer cover is raised. Note the ⚠ CAUTION SHARP EDGE label on the cover.

HOW TO:

1. Open the printer as for changing the paper. See "Changing Internal Printer Paper " page 155.
   If printer paper is fitted, remove it from the printer.
2. Feed the cleaning paper into the top entry of the print mechanism with the rough black side, which contains the cleaning material, towards the rear of the printer.
3. When the automatic feed is complete and the paper stops moving use the instrument front panel key **PAPER FEED** to move the cleaning paper through the print mechanism.
4. Remove the cleaning paper and replace the normal printer paper. See "Changing Internal Printer Paper " page 155.

NOTE

Retain the cleaning paper. It is designed to last for the life of the printer.

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Instrument Storage

"Storing Configurations in Instrument Store" page 160

"Titling Configuration in Instrument Store" page 161

"Recalling Configurations from Instrument Store" page 162

Disk Formatting and Labeling

"Formatting a Disk" page 163

"Labeling a Disk" page 164

Disk Storage

"Accessing Directories and Selecting Files" page 165

"Storing/Retrieving Data to/from Disk" page 167

Graphical Results - Saving, Copying and Recalling

"Saving Graphical Results to Disk" page 168

"Recalling Graphics Results from Disk" page 170

"Copying Graphics Results from Instrument Store to Disk" page 171

Configuration(s) - Saving, Copying and Recalling

"Saving Configurations to Disk" page 173

"Recalling Configuration from Disk" page 174

"Copying Configuration from Instrument Store to Disk" page 175

"Copying Configuration from Disk to Instrument Store" page 177

Files and Directories - Creating, Renaming, Deleting and Adding Discriptors

"Managing Files and Directories on Disk" page 179

Using Instrument and Disk Storage

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Storing Configurations in Instrument Store

Description

You can store measurement settings which are used regularly and recall them with a single operation.

One preset store is provided which cannot be overwritten, STORED SETTING NUMBER [0]. This store is used to set the instrument to a known state, the FACTORY DEFAULT SETTINGS.



HOW TO:

1. Set the OmniBER 720 to the configuration you wish to store.
2. Choose the STORED SETTING NUMBER to receive the configuration.
3. Choose LOCK **OFF**.
4. Choose ACTION **SAVE** to store the configuration in the chosen store.
5. To add a descriptive title see "Titling Configuration in Instrument Store " page 161.

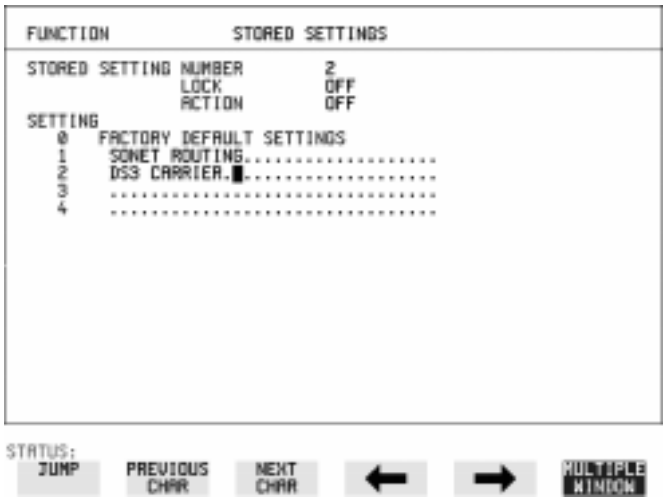
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Titling Configuration in Instrument Store

Description

When storing configurations, you can give them an easily remembered title for identification at a later date.



HOW TO:

1. Choose the STORED SETTING NUMBER which contains the stored configuration.
2. Choose LOCK **OFF**.
3. Use **JUMP**; **NEXT CHAR**; **PREVIOUS CHAR**; ⟶ and ⟵ to title the settings.

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Recalling Configurations from Instrument Store

Description

Having stored a configuration for future use, you must be able to recall that configuration in the future.



HOW TO:

1. Choose the STORED SETTING NUMBER which contains the stored configuration.
2. Choose ACTION **RECALL** to recall the stored configuration.
   The recall operation can be verified by checking the relevant display settings.

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Formatting a Disk

Description

Disks can be formatted in an IBM compatible PC or the OmniBER 720. It is recommended that you use the OmniBER 720 to format your disk as this will ensure full compatibility with the Floppy Disk power fail recovery included in the OmniBER 720.



NOTE

Only 1.44M, MS-DOS compatible disks can be used in the OmniBER 720. Any other format or capacity will result in a disk access error being displayed.

HOW TO:

1. Press **OTHER**, then select FLOPPY DISK.
2. Choose DISK OPERATION **DISK** **FORMAT**.
3. Insert the disk into the Disk drive.
4. Choose **OK** to Format the disk.
   A warning that this operation will erase all data is displayed and asks “do you wish to continue”.
   If YES is selected, all the data on the Disk will be erased and the disk will be formatted.
   If NO is selected, the operation is aborted. This allows you to view the data on the Disk and verify that it is no longer needed.

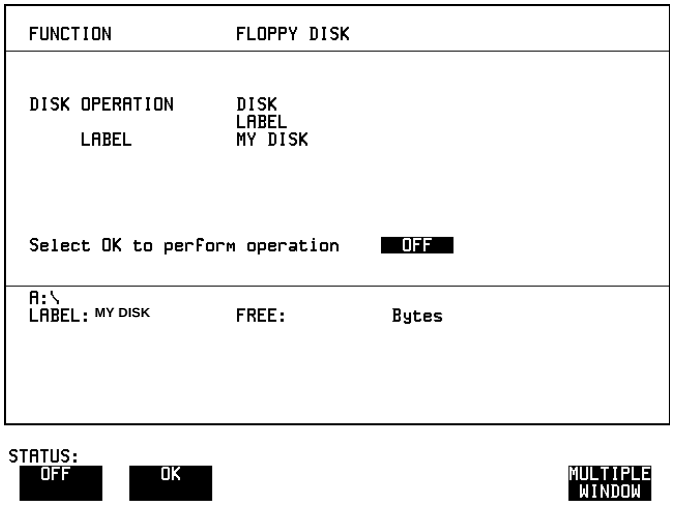
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Labeling a Disk

Description

You can use the OmniBER 720 to assign an identification label to your disk.



HOW TO:

1. Press **OTHER**, then select FLOPPY DISK.
2. Choose DISK OPERATION **DISK** **LABEL**.
3. Label the Disk using **PREVIOUS CHAR** **NEXT CHAR** → ← or press **SET** and use the pop-up keypad.
4. Choose **OK** to confirm the label is correct.
   The label is displayed at the bottom of the display to confirm the operation has taken place.

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Accessing Directories and Selecting Files

Description

Four differenct file types (*.CNF, *.SMG, *.PRN and * .BMP) can be stored on disk, but only one file type can be displayed at a time. The following procedure first shows you how to select the file type you want, then shows you how to access directories, and finally shows you how to select files. The "Files Pop-up Window Features" in step 3 below, also describes how you can create a new file.

HOW TO:

Select file type:

1 Press OTHER, then select FLOPPY DISK.

2 Choose DISK OPERATION SAVE.

3 Choose FILE TYPE you wish to view.
This acts as a filter on the filename extension:
CONFIGURATION - .CNF filter, GRAPHICS - .SMG filter,
DATA LOGGING - .PRN filter, SCREEN DUMP - .BMP filter.

Access directories:

4 Move the highlighted cursor to the NAME field and press SET.

Files Pop-up Window Features

Title Bar - Located on the top line of the window, it shows the current directory name and selected file types.

NEW . . . - To create a new file name, move the highlighted cursor to this line then press SET. Using the pop-up keypad to enter the new filename (use the cursor keys and SET to select each character), then choose ENTER when you have finished. Press SET to return to the file manager display.

. **<DIR>** - Denotes the Current Directory.
. . **<DIR>** - Denotes the Parent directory. To access the parent directory, move the highlighted cursor to this line and press SET.

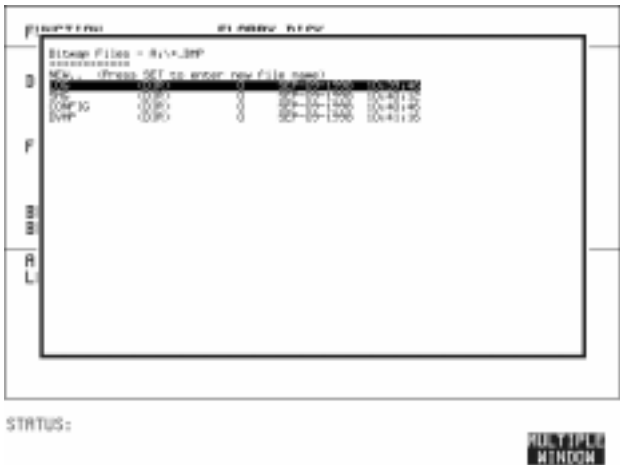
SON1.PRN - A file (with named extension) in current directory. To select this file, move the highlighted cursor to this line and press SET. The display will return to the SAVE display and the selected file name will appear in the FILE NAME field.

NEXT PAGE - To access the next page of file names, move the highlighted cursor to this line then press SET.

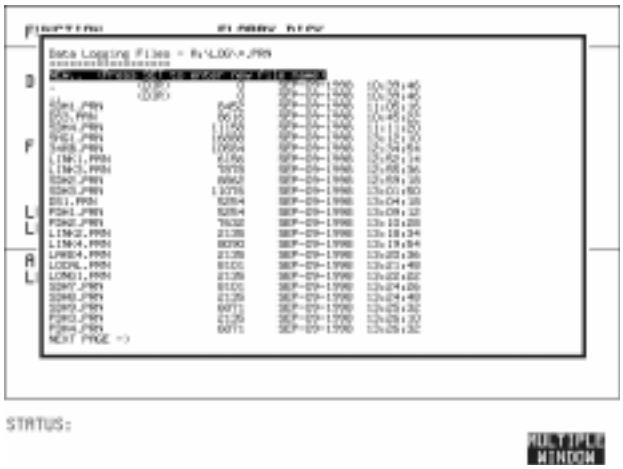
PREV PAGE - To access the previous page of file names, move the highlighted cursor to this line then press SET.

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5 Move the highlighted cursor to the **. . <DIR>** Parent Directory, then press SET.



6 Move the highlighted cursor to the directory required then press SET to move to the selected directory. Only the files with the file extension chosen in FILE TYPE (step 2) will be displayed.



Select a file:

7 Move the highlighted cursor up and down the display using ↑ and ↓ to select the required file or create a new file name (see the Files Pop-up Window Features bin step 3).

8 Press CANCEL to return to the SAVE display. The Directory name and the disk Label appear at the bottom of the display.

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Storing/Retrieving Data to/from Disk

You can store graphical result and instrument configuration files on disk. These files can then be recalled so that you can review graphical results at your convenience, or re-establish a specific instrument configuration.

If the instrument's own store has graphical results or configuration settings currently stored in it, these too can be copied to disk.

Finally, you can copy a configuration file from disk to the instrument's store.

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Saving Graphical Results to Disk

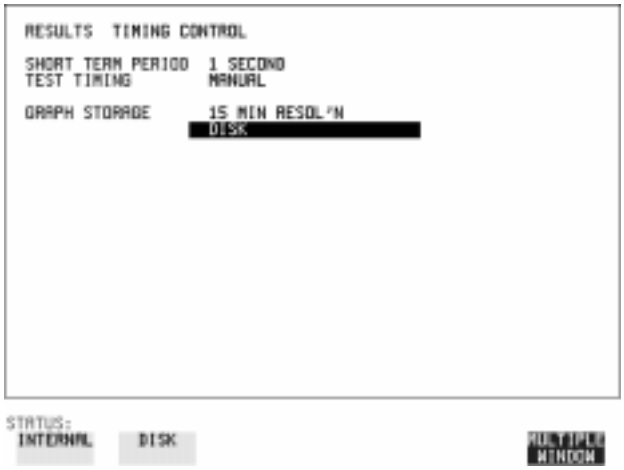
Description

When you start a measurement the graphical results can be saved to a file on disk. However, before you can gather graphical results you must first select an appropriate graphical resolution. See “Saving Graphics Results to Instrument Store” page 134. Also ensure that you have an appropriately formatted disk loaded into the disk drive.

There are two methods of assigning names to files:

Automatic If you do not enter a filename then the instrument automatically assigns a filename (in the form meas001).

Your Choice If you want to assign the filename, you must enter it before you start the measurement. Your choice of filename will override the automatically generated filename. If the filename you chose already exists, the graphics results will be saved to an automatically generated filename. This prevents existing files from being overwritten each time a measurement is started.



HOW TO:

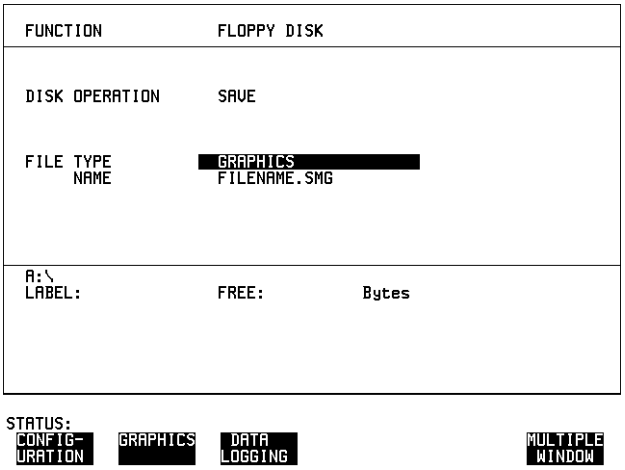
1 Press [RESULTS].

2 Choose GRAPH STORAGE DISK and the required Graph Storage resolution.

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3 Press **OTHER**.



4 Choose DISK OPERATION **SAVE** FILE TYPE **GRAPHICS**.

5 Choose the directory in which to save the graphics results. See "Accessing Directories and Selecting Files " page 165.

6 If you wish to use the automatically generated filename, no further action is required and the graphics results will be saved on Disk when the measurement is completed.

7 If you wish to enter your own choice of filename, move the highlighted cursor to NAME and enter the filename using **PREVIOUS CHAR** **NEXT CHAR** ⟶ ⟵ or press **SET** twice and use the pop-up keypad.
The filename can contain up to 8 alphanumeric characters.
The filename extension is fixed as .SMG.
The graphics results will be saved on Disk at the end of the measurement.

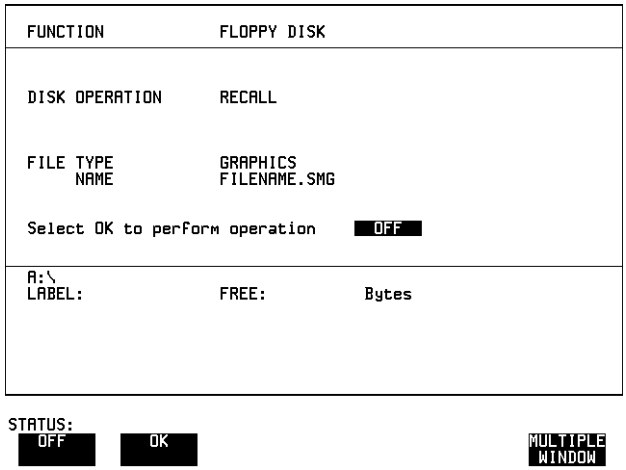
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Recalling Graphics Results from Disk

Description

The procedure below shows you how to recall graphical results from a graphics file stored on disk. You need to recall graphical results from disk before they can be viewed via the GRAPH display.



HOW TO:

1. Choose the directory that contains the graphics file to be recalled. See "Accessing Directories and Selecting Files " page 165.
2. Choose DISK OPERATION RECALL FILE TYPE GRAPHICS and enter your choice of filename using PREVIOUS CHAR NEXT CHAR → ←
   The filename can contain up to 8 alphanumeric characters.
   The filename extension is fixed as .SMG.
3. To recall the graphics results from disk to instrument, choose OK.
4. To view the graphics results, see “Recalling Stored Graph Results” page 135.

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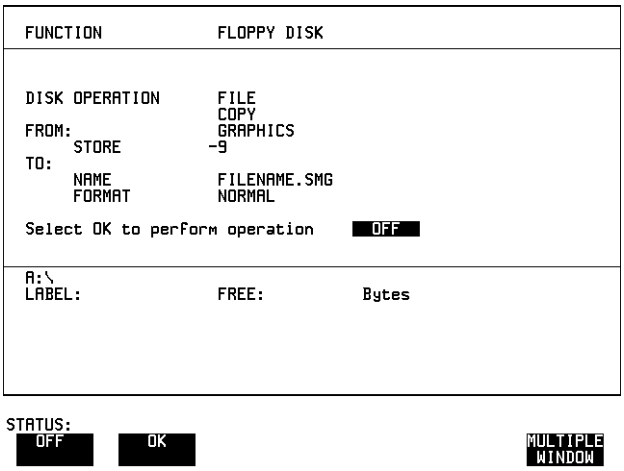
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Copying Graphics Results from Instrument Store to Disk

Description

You can copy Graphics Results from the instrument store to the Disk. This is useful under the following conditions:

- If you have graphics results stored in the instrument that you wish to prevent from being overwritten by a future measurement (only 10 store locations in the instrument)
- If you wish to retrieve the graphics results for viewing via a spreadsheet.



HOW TO:

1. Choose the directory to receive the graphics file. See "Accessing Directories and Selecting Files " page 165.
2. Choose DISK OPERATION **FILE** **COPY** **GRAPHICS** and enter the Instrument Store number using **DECREASE DIGIT** and **INCREASE DIGIT** or press **SET** and use the pop-up keypad.
3. Enter the filename the graphic results are to be copied to using **PREVIOUS CHAR** **NEXT CHAR** → ← or press **SET** twice and use the pop-up keypad.
   The file name can contain up to 8 alphanumeric characters.
   The filename extension is fixed as .SMG.

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4 If you wish to view the graphic results at a later date via a spreadsheet, choose FORMAT **CSV**. CSV is Comma Separated Variable.
If you wish to view the graphic results at a later date on an OmniBER 720, choose FORMAT **NORMAL**.

5 To copy the configuration from instrument to Disk, choose **OK**.
If you have entered a filename which already exists, a warning “File exists - are you sure you wish to continue” is displayed.
If YES is selected, the data on the Disk will be overwritten.
If NO is selected, the operation is aborted.
This allows you the opportunity to view the data on the Disk and verify that it is no longer needed.

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Saving Configurations to Disk

Description

A large number of measurement settings which are used regularly can be stored (as configuration files) on disk and recall when required.

Disk can be used in other instruments which have the same option structure.



HOW TO:

1. Set the OmniBER 720 to the configuration you wish to store.
2. Choose the directory in which you wish to save the OmniBER 720 configuration. See "Accessing Directories and Selecting Files " page 165.
3. Choose DISK OPERATION **SAVE**, FILE TYPE **CONFIGURATION** and enter the filename using **PREVIOUS CHAR** **NEXT CHAR** → ← or press **SET** twice and use the pop-up keypad.
   The filename extension is fixed as .CNF.
   The filename can contain up to 8 alphanumeric characters.
4. Choose **OK** to save the current configuration to disk.
   If you have entered a filename which already exists, a warning “File exists - are you sure you wish to continue” is displayed.
   If YES is selected, the configuration will be saved.
   To cancel, change OK to OFF and enter new filename. See "Accessing Directories and Selecting Files " page 165.

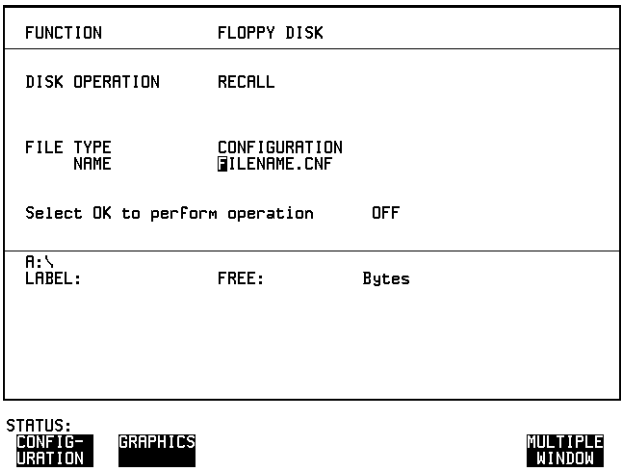
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Recalling Configuration from Disk

Description

The procedure below shows you how to recall mesurement settings from a configuration file stored on disk.



HOW TO:

1. Choose the directory that contains the configuration file to be recalled. See "Accessing Directories and Selecting Files " page 165.
2. Choose DISK OPERATION **RECALL** FILE TYPE **CONFIGURATION** and enter your choice of filename using **PREVIOUS CHAR** **NEXT CHAR** **→** **←**.
   The filename can contain up to 8 alphanumeric characters.
   The filename extension is fixed as .CNF.
3. To recall the configuration from disk to instrument, choose **OK**.
   The recall operation can be verified by checking the relevant display settings.

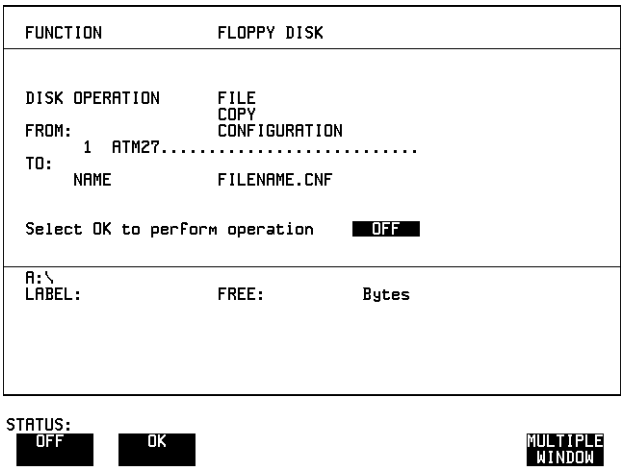
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Copying Configuration from Instrument Store to Disk

Description

If you have a configuration stored in the instrument store that you wish to use on another instrument, you can copy it to disk. The configuration can then be downloaded from the disk in to another OmniBER 720 with the same options as the original instrument.



HOW TO:

1. Choose the directory to receive the configuration file. See "Accessing Directories and Selecting Files " page 165.
2. Choose DISK OPERATION **FILE** **COPY** **CONFIGURATION** and enter the Instrument Store number using **DECREASE DIGIT** and **INCREASE DIGIT** or press **SET** and use the pop-up keypad.
   The Stored Settings description appears alongside the store number.
   If required the description can be modified using **JUMP** **NEXT CHAR** **PREVIOUS CHAR** ⟵ ⟶ or press **SET** and use the pop-up keypad.
   The description can contain up to 24 alphanumeric characters.
3. Enter the chosen filename using **PREVIOUS CHAR** **NEXT CHAR** ⟶ ⟵ or press **SET** twice and use the pop-up keypad.
   The file name can contain up to 8 alphanumeric characters.
   The filename extension is fixed as .CNF.

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4 To copy the configuration from instrument to Disk choose **OK** .
If you have entered a filename which already exists, a warning “File exists - are you sure you wish to continue” is displayed.
If YES is selected, the data on the Disk will be overwritten.
If NO is selected, the operation is aborted.

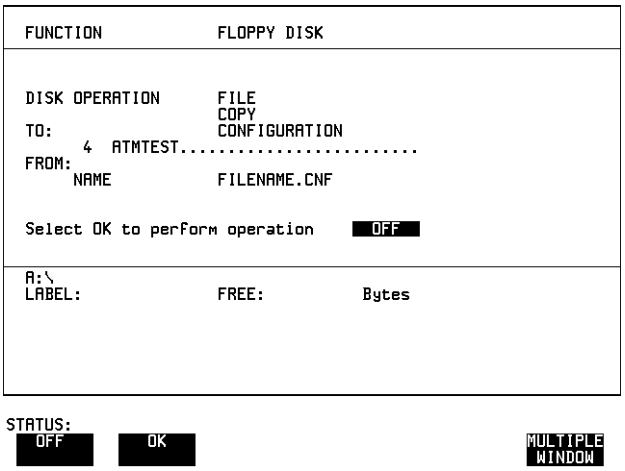
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Copying Configuration from Disk to Instrument Store

Description

If you have a configuration stored in the instrument store and you want to use it on another instrument, copy the configuration to disk. The configuration can then be downloaded from the disk to another OmniBER 720 with the same options as the original instrument.



HOW TO:

1. Choose the directory containing the configuration file. See "Accessing Directories and Selecting Files " page 165.
2. Choose DISK OPERATION **FILE** **COPY** **CONFIGURATION** and enter the Instrument Store number using **DECREASE DIGIT** and **INCREASE DIGIT** or press **SET** and use the pop-up keypad.
   Enter a description of the configuration using **PREVIOUS CHAR** **NEXT CHAR** → ← or press **SET** and use the pop-up keypad.
   The description can contain up to 24 alphanumeric characters.
3. Enter the filename the configuration is to be copied from using **PREVIOUS CHAR** **NEXT CHAR** → ← or press **SET**, highlight the file to be copied on the file manager display and press **SET**.
   The file name can contain up to 8 alphanumeric characters.
   The filename extension is fixed as .CNF.

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4 To copy the configuration from Disk to instrument, choose **OK**.
If you have entered a instrument store number which already contains a configuration, a warning “Are you sure you wish to continue” is displayed.
If YES is selected, the data in the instrument store will be overwritten.
If NO is selected, the operation is aborted.

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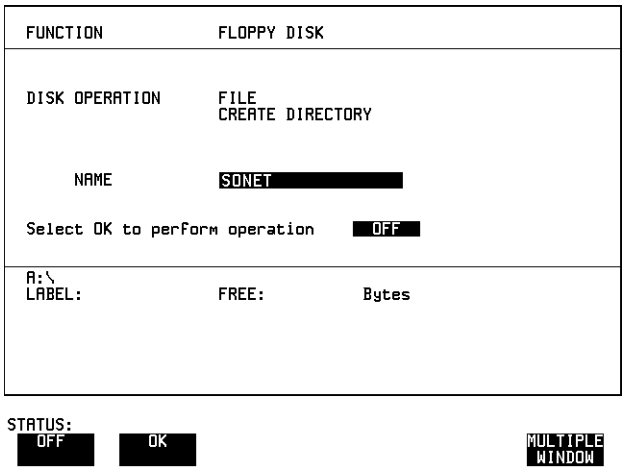
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Managing Files and Directories on Disk

Description

File and directory structures allow you to store information in an organized manner on disk - helps speed up the transfer of data between the instrument and the disk drive.
It is recommended that you create a directory structure as an aid to efficient file management particularly when the disk is moved to a PC.

Creating a Directory on Disk



HOW TO:

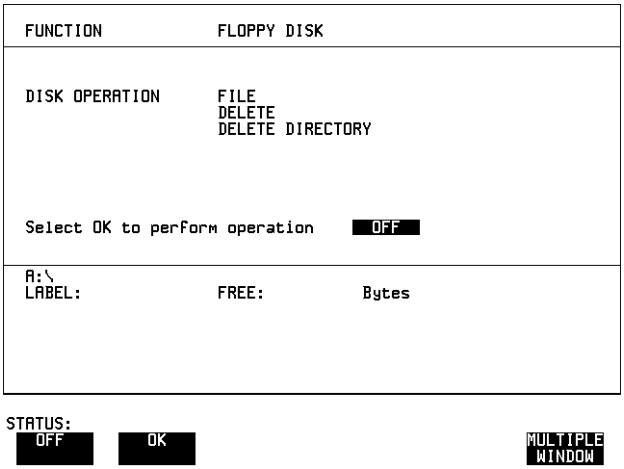
1. Press **OTHER**, then select FLOPPY DISK.
2. Choose DISK OPERATION **FILE** | **CREATE DIRECTORY**.
3. Enter the directory name using **PREVIOUS CHAR** **NEXT CHAR** | → ← or press **SET** and use the pop-up keypad.
   The directory name can contain up to 8 alphanumeric characters.
4. To create the directory choose **OK**.
   This will create a sub directory of the directory displayed at the bottom of the display. In this example A:\SONET will be created.

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Deleting a Directory on Disk

Description Obsolete Directories should be deleted as an aid to efficient file management.



NOTE A directory cannot be deleted until all the files within the directory have been deleted. See "Deleting a File on Disk " page 182.

HOW TO:

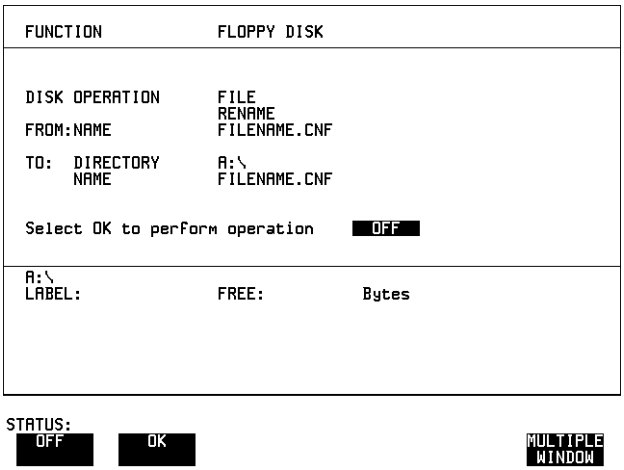
1. Choose the directory you wish to delete (it will appear on the display). See "Accessing Directories and Selecting Files " page 165.
2. Choose DISK OPERATION **FILE** **DELETE** **DELETE DIRECTORY**.
3. To delete the directory choose **OK**.
   A warning “Are you sure you wish to continue” is displayed.
   If YES is selected, the directory is deleted.
   If NO is selected, the operation is aborted.
   This prevents accidental deletion of a wanted directory.
   If the directory is not empty the messages “delete directory failed” “directory is not empty” are displayed.
4. If files need to be deleted to prepare the directory for deletion. See "Deleting a File on Disk " page 182.

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Renaming a File on Disk

Description Files can be renamed as an aid to efficient file management.



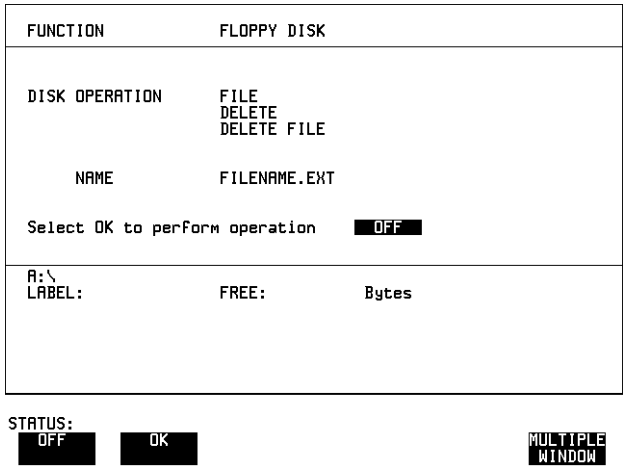
HOW TO:

1. Press OTHER, then select FLOPPY DISK.
2. Choose DISK OPERATION FILE RENAME.
3. Enter the FROM filename using PREVIOUS CHAR | NEXT CHAR → ← or Choose the directory which contains the file to be renamed. See "Accessing Directories and Selecting Files " page 165. Move the highlighted cursor to the file to be renamed and press SET to return to the FILE RENAME display. The filename, with extension, can contain up to 12 alphanumeric characters.
4. Choose the directory in which to locate the renamed file (it will appear on the display). See "Accessing Directories and Selecting Files " page 165.
5. Enter the TO filename using PREVIOUS CHAR | NEXT CHAR → ← or press SET twice and use the pop-up keypad.
   The filename can contain up to 8 alphanumeric characters.
   The file extension is fixed to the FROM filename extension.
6. To rename the file choose OK.
   If you have entered a filename which already exists, a warning “File exists - are you sure” you wish to continue is displayed.
   If YES is selected, the data in the file will be overwritten. If NO is selected, the operation is aborted.
   This allows you the opportunity to verify before renaming.

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Deleting a File on Disk

Description Obsolete files can be deleted as an aid to efficient file management.



HOW TO:

1. Press OTHER, then select FLOPPY DISK.
2. Choose DISK OPERATION **FILE** **DELETE** **DELETE FILE**.
3. Choose the directory containing the file to be deleted. See "Accessing Directories and Selecting Files " page 165.
4. Enter the filename to be deleted using **PREVIOUS CHAR** **NEXT CHAR** → ← or press SET, highlight the file to be deleted on the file manager display, and press SET.
   The file name can contain up to 12 alphanumeric characters, including the filename extension.
5. To delete the file choose **OK**.
   A warning “Are you sure you wish to continue” is displayed.
   If YES is selected, the file is deleted.
   If NO is selected, the operation is aborted.
   This prevents accidental deletion of a wanted file.

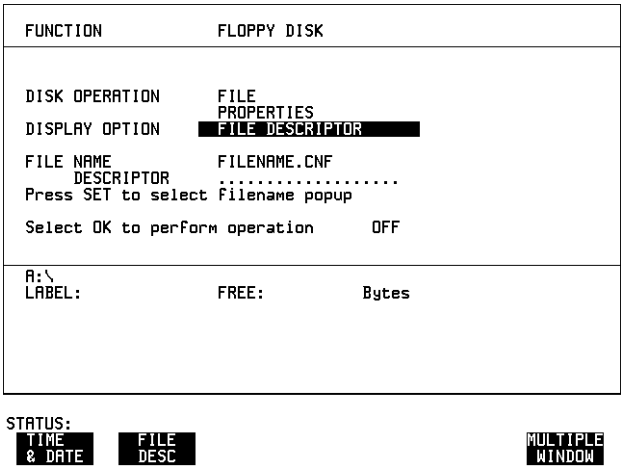
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Adding Descriptors to Disk Files

Description

When storing configurations or graphics on disk, you can give them an easily remembered descriptor for identification at a later date.

Descriptors can be added to .CNF and .SMG files.



HOW TO:

1. Choose the directory containing the file you wish to add the descriptor to. See "Accessing Directories and Selecting Files " page 165.
2. Choose DISK OPERATION **FILE** **PROPERTIES** and DISPLAY OPTION **FILE DESCRIPTOR**.
3. Move the highlighted cursor to the FILE NAME DESCRIPTOR field. Enter the file descriptor using **PREVIOUS CHAR** **NEXT CHAR** → ← or press **SET**, highlight the file required on the file manager display, and press **SET**.
4. Move the highlighted cursor to Select OK to perform operation and choose OK. The File List will show the descriptor instead of the TIME and DATE information as long as FILE DESCRIPTOR is selected.

NOTE This slows down the updating of the display.

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“Setting Time & Date” page 187
“Enabling Keyboard Lock” page 188
“Enabling Beep on Received Error” page 189
“Suspending Test on Signal Loss” page 190
“REI-L/MS-REI Result/Enable” page 191
“Graph Storage Resolution” page 192
“Setting Error Threshold Indication” page 194
“Setting Screen Brightness and Color” page 195
“Dumping Display to Disk” page 196
“Running Self Test” page 198

Selecting and Using "OTHER" Features

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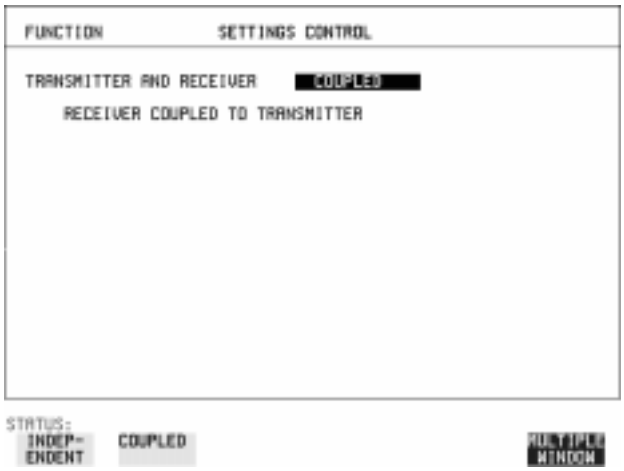
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Coupling Transmit and Receive Settings

Description

When generating and measuring at the same interface level, you can have the transmit and receive settings coupled together. Any settings change made on the transmit display will automatically occur on the receive display. Any settings change made on the receive display will automatically occur on the transmit display.

This function is available on the **OTHER** **SETTINGS CONTROL** display.



HOW TO:

Choose TRANSMITTER AND RECEIVER **COUPLED**.

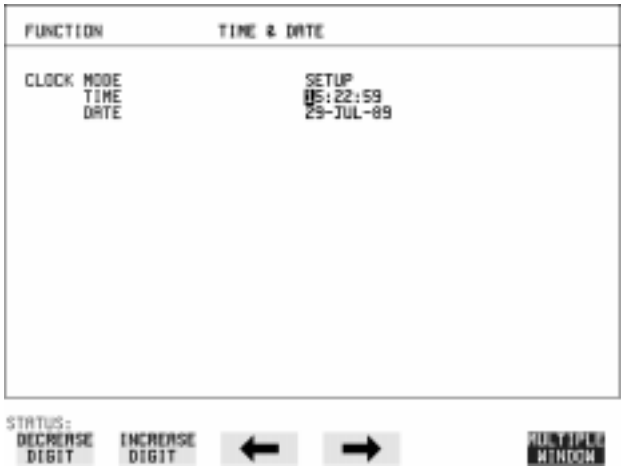
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Setting Time & Date

Description

When making Bit error measurements and recording results you can have certain events timed chronologically, for example, Alarms; Error Seconds.
The capability to set the Time and Date is provided on the OTHER TIME & DATE display.



HOW TO:

1. Choose CLOCK MODE **SETUP** and set the Time and Date using ↑; ↓; ←; →; **INCREASE DIGIT** and **DECREASE DIGIT**.
2. Choose CLOCK MODE **RUN** to complete the setting of Time and Date.

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Enabling Keyboard Lock

Description

You can protect the measurement settings from interference during a test.

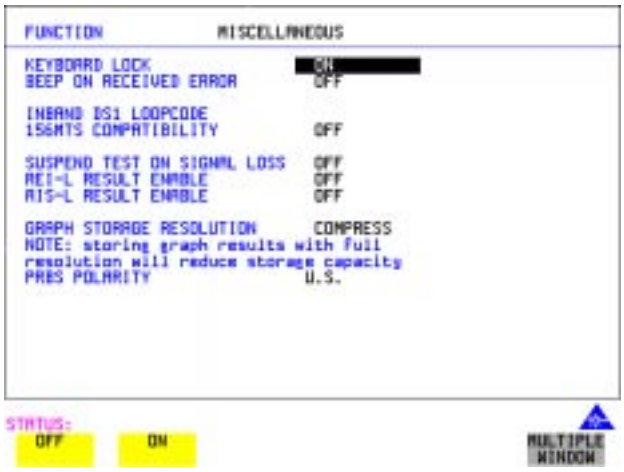
This function is provided in the OmniBER 720 on the **OTHER** **MISCELLANEOUS** display.

The following keys are not affected by Keyboard Lock:

- Display keys **TRANSMIT**; **RECEIVE**; **RESULTS**; **GRAPH**; **OTHER**
- cursor keys ← ↑ ↓ and →
- **SHOW** **PAPER FEED** **LOCAL** **SMART TEST**

The following display functions are not affected by Keyboard Lock:

- RESULTS type on the **RESULTS** display
- KEYBOARD LOCK on the **OTHER** display



HOW TO:

Choose KEYBOARD LOCK | **ON**.

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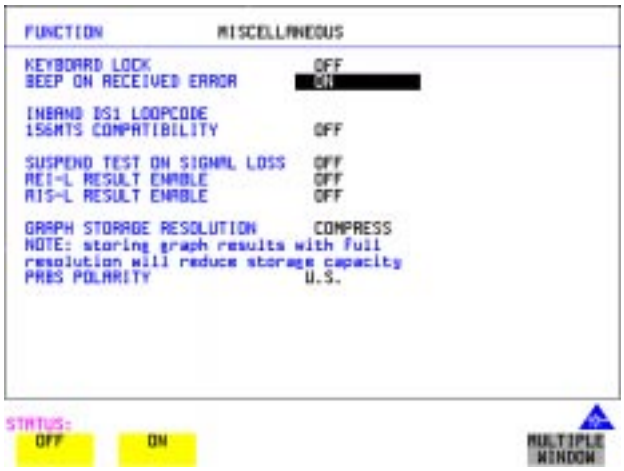
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Enabling Beep on Received Error

Description

You can have an audible indication of an error which is particularly useful when the display on the test set is hidden from view.

This function is provided in the OmniBER 720 on the **OTHER** **MISCELLANEOUS** display.



HOW TO:

Choose BEEP ON RECEIVED ERROR | **ON**.

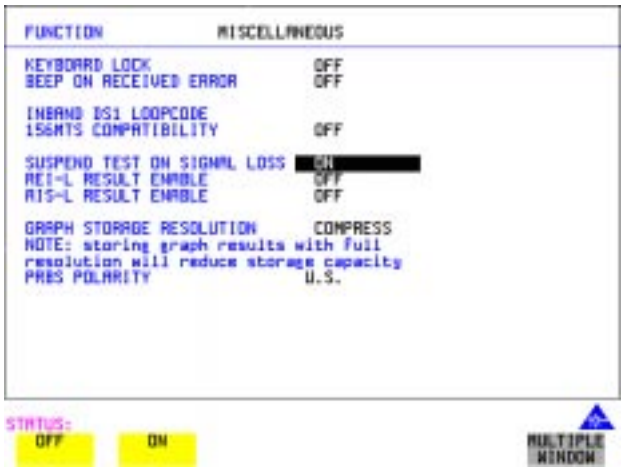
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Suspending Test on Signal Loss

When running a test, you can choose to suspend the test during periods of signal loss.

This function is available on the OTHER | MISCELLANEOUS display.



HOW TO: Choose SUSPEND TEST ON SIGNAL LOSS **ON**.

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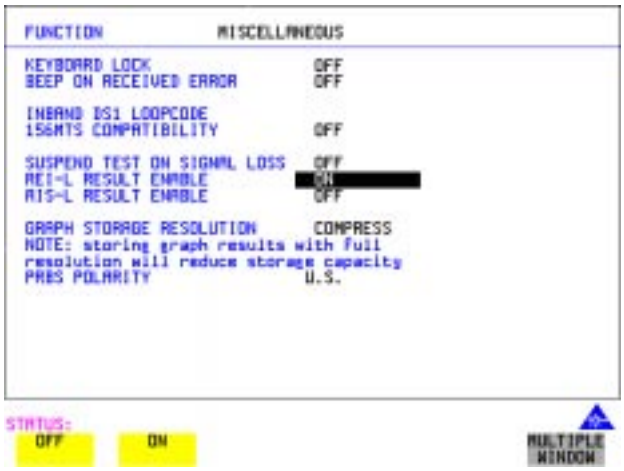
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REI-L/MS-REI Result/Enable

Description

Before running a test, you can choose to enable or disable the SDH measurements of MS-REI and MS-AIS or the equivalent SONET measurements of REI-L/AIS-L .

This function is available on the OTHER | MISCELLANEOUS | display.



HOW TO:

Choose MS-REI/MS-AIS or REI-L/AIS-L ENABLE ON or OFF as required.

When set to **OFF**, the MS-REI and REI-L measurements are suppressed. Cumulative, Short Term and Analysis measurements are affected alike.

The MS-REI measurement is twinned with B2-BIP with regard to the G.826 PUAS measurement. This results in the B2-BIP PUAS measurement showing **N/A** when MS-REI is set to **OFF.**

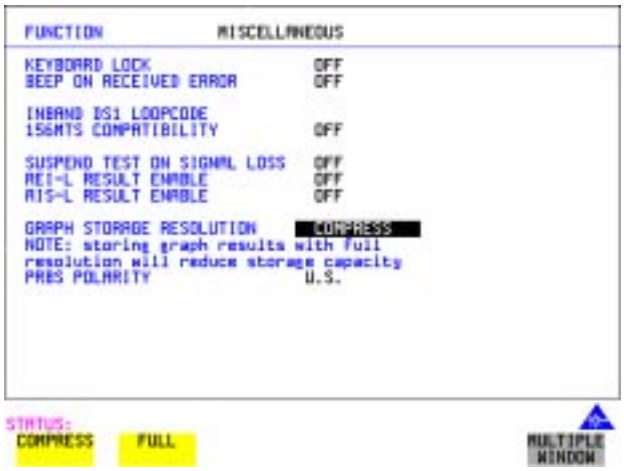
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Graph Storage Resolution

Description

The total graphics store capacity is normally 20.000 events. If GRAPH STORAGE RESOLUTION **FULL** is selected the capacity reduces to 10,000 events.



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PRBS Polarity Control (Option 003 only)

Description

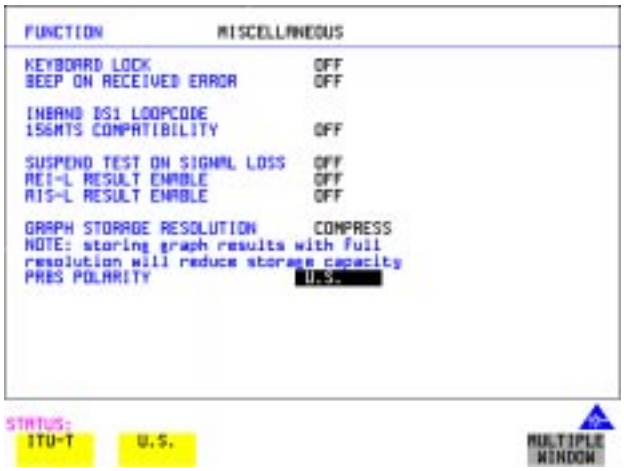
You can select PRBS patterns with NORMAL or INVERTed polarity from the TRANSMITTER and RECEIVER windows.

The definition of NORMAL and INVERTed differs between ITU-T O.150 and common practice usage in the United States of America for 2^{15}-1 and 2^{23}-1 PRBS patterns.

The PRBS polarity control allows the user to select which definition is used on the TRANSMITTER and RECEIVER windows.

The ITU-T O.150 standard specifies that the NORMAL or default for all PRBS patterns should be inverted. This will produce a longest string of n-1 consecutive zeros in a 2^n-1 PRBS pattern. Therefore selecting INVERT with an ITU-T pattern will produce a longest string of n-1consecutive ones in a 2^n-1 pattern.

The ITU-T definition also applies in the US, except for 2^{15}-1 and 2^{23}-1 PRBS patterns. Through common practice, NORMAL indicates that the PRBS pattern is non-inverted. Therefore when the 'US' PRBS polarity control is enable and NORMAL is selected for these two patterns on the TRANSMITTER, a longest string of n-1 consecutive ones is produced. The pattern has to be INVERTed in order to produce a longest string of n-1 consecutive zeros.



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Setting Error Threshold Indication

Description

When making error measurements, you can have an indication of when an error count or error ratio threshold has been exceeded. You can set the OmniBER 720 to indicate this by a color change, from yellow to red, of the bar on the **GRAPH** display and the result on the **RESULTS** display. You can choose the thresholds at which the color change occurs.
The Count and Ratio selections are independent.

This function is available on the **OTHER** **COLOR CONTROL** display.



HOW TO:

1. Choose COLOR ENHANCE RESULTS **ON**.
2. Choose the COUNT THRESHOLD and RATIO THRESHOLD.

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Setting Screen Brightness and Color

Description

The OmniBER 720 screen can be set to single or two color using the COLOR PALETTE selection on the OTHER, COLOR CONTROL display.

The screen brightness can be set to full or half brightness.
The half brightness setting is used when the room brightness is such that half brightness is desirable and will also prolong the life of the screen.

If the brightness is set to FULL and there have been no key presses in the last hour, then the screen automatically dims to the half brightness level and the status message “Display set to half brightness” is shown. Any key press will return the screen to full brightness.

This function is available on the OTHER COLOR CONTROL display.



HOW TO:

Choose the DISPLAY BRIGHTNESS to suit the operating environment.

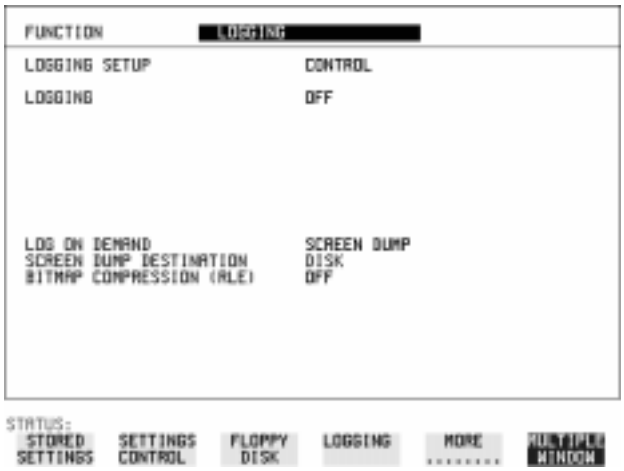
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Dumping Display to Disk

Description

The chosen display may be stored on disk in bitmap format using the Screen Dump feature of the OmniBER 720. Logging and Floppy Disk must be set up for screen dump. The current display is stored on disk when **PRINT NOW**. is pressed.



HOW TO:

1. Choose LOGGING SETUP **DEVICE** and LOGGING PORT **DISK** on the **OTHER**, **LOGGING** display.
2. Choose LOGGING SETUP **CONTROL** LOG ON DEMAND **SCREEN DUMP** on the **OTHER**, **LOGGING** display.
3. If compression is required to save disk space, select BITMAP COMPRESSION (RLE) **ON**.

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4 Choose the directory in which to save the Screen Dump. See "Accessing Directories and Selecting Files " page 165.

5 If you wish to enter your own choice of filename, choose DISK OPERATION **SAVE** FILE TYPE **SCREEN DUMP**.

NOTE

You have the option of an auto generated filename or entering your chosen filname.
The file name can have a maximum of 8 characters.
The file extension is fixed as .BMP.
The file name must satisfy DOS requirements, that is, there must be no spaces or other illegal characters.

6 Move the highlighted cursor to NAME and enter the filename using **PREVIOUS CHAR** **NEXT CHAR** → ← or press **SET** twice and use the pop-up keypad.

7 Choose the display you want to store on disk and press **PRINT NOW**.
After a few second the message “SAVING SCREEN DUMP . . . (XX% COMPLETE)” is displayed.

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Running Self Test

Description

Before using the OmniBER 720 to make measurements, you can run Self Test ALL TESTS to ascertain the integrity of the OmniBER 720. These tests take approximately 1 hour to complete depending on the options fitted.
Alternatively you can run Confidence Tests which only takes 2 to 3 minutes to complete. This is not a full verification but performs BER measurements with internal and external loopbacks fitted.



HOW TO:

Run ALL TESTS

1. Choose TEST TYPE **ALL TESTS** on the OTHER **SELF TEST** display.
2. Insert a formatted disk into the instrument disk drive.
3. Connect Optical OUT to Optical IN via a 15 dB attenuator.

NOTE

If any or all of these connections are not made the OmniBER 720 will FAIL Self Test.

4. Press RUN/STOP to activate the Self Test. TEST STATUS RUNNING will be displayed.
   The information pertaining to TEST TYPE, TEST NUMBER and SUBTEST NUMBER will change as the Self Test progresses.
   If the OmniBER 720 is functioning correctly, after a time of at least 1 hour, TEST STATUS PASSED is displayed.

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If TEST STATUS [FAIL nnn] is displayed, the OmniBER 720 should be returned to a service office for repair.



HOW TO: **Run Confidence TESTS**

1. Choose TEST TYPE **CONF. TESTS** on the **OTHER** **SELF TEST** display.
2. Insert a formatted disk into the instrument disk drive.
3. Connect Optical OUT to Optical IN via a 15 dB attenuator.
4. Press **RUN/STOP** to activate the Self Test. TEST STATUS RUNNING will be displayed.
   The information pertaining to TEST TYPE, TEST NUMBER and SUBTEST NUMBER will change as the Self Test progresses.
   If the OmniBER 720 is functioning correctly, after a time of 2 to 3 minutes, TEST STATUS PASSED is displayed.
   If TEST STATUS [FAIL nnn] is displayed, the OmniBER 720 should be returned to a service office for repair.

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NOTE Each individual self test requires unique loopback connections. To obtain a list of the connections required move the highlighted cursor to CABLING INFO and press **SET**. The Loopbacks list will appear on the display.



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Appendix A

Background Patterns

The following tables list the background patterns available when selecting specific foregrounds.

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SDH Operation

Table 3 AU-3 Background Patterns

Foreground	Background choice in Foreground AU-3	Background choice in other AU-3s
AU-3	---------	TU-11, TU-12 Mapping or AU-3 Word (8 bit user programmable word).
TU-2	Pattern in other TU-2s is numbered. They contain the word 11NNNNNx, where NNNNN is the binary number of the TU.	TU-11, TU-12 Mapping or AU-3 Word (8 bit user programmable word).
TU-12 (2 Mb/s) Unframed	TU-12 structure, unframed with 2E15-1, 2E9-1 PRBS or 1100 word pattern in all information bits.	TU-12, TU-11 Mapping or AU-3 Word (8 bit user programmable word).
TU-11 (DS1) Unframed	TU-11 structure, D4 framed with 2E15-1, 2E9-1 PRBS or 1100 Word pattern in other TU-11s.	TU-12, TU-11 Mapping or AU-3 Word (8 bit user programmable word).

Table 4 TUG-3 Background Patterns

Foreground	Background choice in Foreground TUG-3	Background choice in other TUG-3s
TUG-3	---------	TU-11, TU-12 Mapping or TU-3 Word (8 bit user programmable word).
TU-2	Pattern in other TU-2s is numbered. They contain the word 11NNNNNx, where NNNNN is the binary number of the TU.	

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Table 4 TUG-3 Background Patterns

Foreground	Background choice in Foreground TUG-3	Background choice in other TUG-3s
TU-12 (2 Mb/s) Unframed	TU-12 structure, unframed with 2E15-1, 2E9-1 PRBS or 1100 word pattern in all information bits.	TU-12, TU-11 Mapping or TU-3 Word (8 bit user programmable word).
TU-11 (DS1) Unframed	TU-11 structure, D4 framed DS1 with 2E15-1, 2E9-1 PRBS or 1100 Word pattern in other TU-11s.	TU-12, TU-11 Mapping or TU-3 Word (8 bit user programmable word).

SONET Operation

STS-1 SPE Background Patterns

Foreground	Background choice in Foreground TUG-3	Background choice in other AU-3
STS-1 SPE	---------	VT-1.5, VT-2 Mapping or SPE Word (8 bit user programmable word).
VT-6	Pattern in other VT-6s is numbered. They contain the word 11NNNNNx, where NNNNN is the binary number of the TU.	VT-1.5, VT-2 Mapping or SPE Word (8 bit user programmable word).
VT-2 (2 Mb/s) Unframed	VT-2 structure, unframed with 2E15-1, 2E9-1 PRBS or 1100 word pattern in all information bits.	VT-2, VT-1.5 Mapping or SPE Word (8 bit user programmable word).

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STS-1 SPE Background Patterns, continued

Foreground	Background choice in Foreground TUG-3	Background choice in other AU-3
VT-1.5 (DS1) Unframed	VT-1.5 structure, D4 framed with 2E15-1, 2E9-1 PRBS or 1100 Word pattern in other TU-11s.	VT-2, VT-1.5 Mapping or SPE Word (8 bit user programmable word).

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Appendix B

ETSI/ANSI Terminology

A table of ETSI terms with their ANSI equivalents.

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ETSI/ANSI Conversion and Equivalent Terms

Introduction

Refer to the table given in this appendix for an explanation of equivalent SDH/ SONET terms.

ETSI: European Telecommunications Standards Institute.

ANSI: American National Standards Institute.

ETSI Term	ANSI Term
AU-3	STS-1 SPE + H1, H2, H3
AU-4	STS-3c SPE + H1, H2, H3
BIP (Bit Interleaved parity)	CV (Code Violation)
High Order Path (HP / HO)	STS Path
I-n Intra Office, (n=STM-n level)	Intermediate Reach (IR)
L-n.1 or L-n.2 long haul	LR long reach
Low Order Path (LP / LO)	VT Path
LP-REI	REI-V
M.S.P	A.P.S
Multiplexer Section (MS)	Line
Multiplexer Section Protection	Automatic Protection Switching
MS-AIS	Line AIS / AIS-L
MS-BIP	Line CV / CV-L
MS-DCC	Line DCC / DCC-L
MS-REI	Line FEBE / REI-L
MS-RDI	Line FERF / RDI-L
Multiplexer Section Overhead	Line Overhead

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ETSI/ANSI Conversion and Equivalent Terms

ETSI Term	ANSI Term
Network Node Interface	Line Interface
OOF	SEF (severely errored frame defect)
Path AIS / AU-AIS	AIS-P
Path REI / HP REI	REI-P
Path FERF / HP RDI	RDI-P
Path IEC / AU-IEC	IEC-P
Path Overhead	Path Overhead
Regenerator	Repeater
Regenerator Section (RS)	Section
Regenerator Section Overhead	Section Overhead
Remote Alarm Indicator	RAI
RS-DCC	Section DCC (DCC-S)
Section Overhead (SOH)	Transport Overhead (TOH)
S-n.1 or S-n.2 short haul	Short Reach (SR)
SOH	TOH
STM-m	OC-n / STS-n (where m= n÷ 3 for m ≥ 1
STM-0	STS-1
STM-1	OC3c / STS-3c
STM-4	OC-12 / STS-12
STM-16	OC-48 / STS-48
Tributary Unit (TU)	Virtual Tributary (VT)
TU	VT
TU-11	VT 1.5
TU-12	VT 2
TU-2	VT 6

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ETSI/ANSI Conversion and Equivalent Terms

ETSI Term	ANSI Term
TU-3	NONE
TU BIP	VT BIP (CV-V)
TU RDI / LP-RDI	RDI-V
TUG	VT Group
TUG2	VT Group (12 columns)
TUG3	VT Group (86 columns)
TU multiframe	VT superframe
TU PATH AIS	VT AIS (AIS-V)
VC	SPE
VC4	STS3C SPE
Virtual Container (VC)	Synchronous Payload Envelope (SPE)

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Appendix C

Glossary of Terms

A brief explanation of terms and abbreviations used in the OmniBER 720.

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Glossary

A

AAL	ATM Adaptation Layer
ABR	Available Bit Rate
ADDF	Automatic Digital Distribution Frame
ADM	Add Drop Multiplexer
ADPCM	Adaptive Differential Pulse Coded Modulation
AIM	ATM Inverse Multiplexer
AIS	Alarm Indication Signal
AMI	Alternate Mark Inversion
ANSI	American National Standards Institute
APS	Automatic Protection Switching
ASCII	American Standard Code for Information Interchange
ATM	Asynchronous Transfer Mode
AU	Administrative Unit
AU-AIS	AU Pointer Justification Event
AU-LOP	Loss of AU Pointer
AU-NDF	AU Pointer New Data Flag

B

BBER	Background Block Error Ratio
BC	Background Channel
BCD	Binary Coded Decimal
BER	Bit Error Rate
BERT	Bit Error Rate Testing
BIP	Bit Interleaved Parity
BPS	Bits Per Second
BPV	Bipolar Violation

C

CAS	Channel Associated Signaling
CBR	Constant Bit Rate
CCITT	Consultative Committee on International Telegraphy and Telephony
CCS	Common Channel Signaling
CDT	Cell Delay Tolerance
CDV	Cell Delay Variation
CEPT	Committee of European PTTs
CMI	Coded Mark Inversion
CO	Central Office
CPE	Customer Premises Equipment
CRC	Cyclic Redundancy Check
CSES	Consecutive Severely Errored Seconds

D

D/I	Drop and Insert
DACS	Digital Access and Cross-connect Switches
dB	Decibel
DCC	Data Communications Channel
DCS	Digital Cross-connect Switches
DDF	Digital Distribution Frame
DDN	Digital Data Network

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Glossary

DTMF	Dual Tone Multi frequency Signaling
DWDM	Dense Wave Division Multiplexing
DXC	Digital Cross Connect

E

EB	Error Block
EOW	Engineering Orderwire
ES	Error Seconds
ESF	Extended Superframe Format
ESR	Errored Second Ratio
ETSI	European Telecommunications Standards Institute

F

FAS	Frame Alignment Signal
FC	Foreground Channel
FDDI	Fiber Distributed Data Interface
FEAC	Far End Alarm Channel
FEBE	Far End Block Error
FEC	Forward Error Connection
FERF	Far End Receive Failure

G

GUI	Graphical User Interface

H

HDB3	High Density Bipolar 3
HEC	Header Error Control
HO Path RAI	High Order Path Remote Alarm Indication
HO PTE	High Order Path Terminating Equipment
HO	High Order
HP-IB	Hewlett-Packard Interface Bus (IEEE 488)
HP-PLM	High Path Payload Label Mismatch
HP-RDI	High Path Remote Defect Indication
HP-REI	High Path Remote Error Indication
HP-TIM	High Path Trace Identifier Mismatch
HP-UNEQ	High Path Unequipped
Hz	Hertz (cycles per second)

I

ISDN	Integrated Services Digital Network
ISO	International Standards Organization
ITU	International Telecommunications Union

L

LAN	Local Area Network
LO	Low Order
LOF	Loss of Frame
LOP	Loss of Path
LOS	Loss of Signal
LP-PLM	Low Path Payload Label Mismatch
LP-RDI	Low Path Remote Defect Indication
LP-REI	Low Path Remote Error Indication
LP-RFI	Low Path Remote Failure Indication
LP-TIM	Low Path Trace Identifier Mismatch
LP-UNEQ	Low Path Unequipped
LSB	Least Significant Bit

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Glossary

LTE	Line Terminal Equipment
LTM	Line Terminal Multiplexer

M

MS	Multiplex Section
MS-AIS	Multiplex Section AIS
MSOH	Multiplex Section Overhead
MS-RDI	Multiplex Section Remote Defect Indication
MS-REI	Multiplex Section Remote Error Indication
MTBF	Mean Time Between Failures
MTIJ	Maximum Tolerance Input Jitter
MUX	Multiplexer

N

NDF	New Data Flag
NE	Network Element
NFAS	Non Frame Alignment Signal

O

OAM	Operations, Administration and Maintenance
OC	Optical Carrier
OH	Overhead
OLTU	Optical Line Terminal Unit
OOF	Out of Frame
OS	Operations System

P

P/AR	Peak-to-Average Ratio
PBX	Private Branch Exchange
PC	Personal Computer
PCM	Pulse Code Modulation
PCN	Personal Communications Network
PCR	Peak Cell Rate
PDH	Plesiochronous Digital Hierarchy
PES	Percentage Error Second
POH	Path Overhead
POTS	Plain Old Telephone Service
PRBS	Pseudo Random Binary Sequence
PSN	Packet Switched Network
PSTN	Public Switched Telephone Network
PT	Payload Type
PTT	Public Telephone and Telegraph
PTE	Path Terminating Equipment
PU	Physical Unit

Q

QoS	Quality of Service

R

RAI	Remote Alarm Indication
RDI	Remote Defect Indication
REBE	Remote End Block Error
REI	Remote Error Indication
RF	Radio Frequency
RS	Regenerator Section

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Glossary

RSOH	Regenerator Section Overhead
RSTE	Regenerator Section Terminating Equipment
RS-TIM	Regenerator Section Trace Identifier Mismatch
RX	Receiver

S

S/N	Signal to Noise Ratio
SCPI	Standard Commands for Programmable Instrumentation
SDH	Synchronous Digital Hierarchy
SDXC	Synchronous Digital Cross Connect
SEF	Severely Errored Frame
SES	Severely Errored Second
SESR	Severely Errored Seconds Ratio
SF	Super Frame
SOH	Section Overhead
SONET	Synchronous Optical Network
SPE	Synchronous Payload Envelope
STE	Section Terminating Equipment
STM	Synchronous Transport Module
STS	Synchronous Transport Signal
SUT	System Under Test

T

TCM	Tandem Connection Monitoring
TDM	Time Division Multiplexing
TDMA	Time Division Multiple Access
TE	Terminal Equipment
TMN	Telecommunications Management Network
TOH	Transport Overhead
TU	Tributary Unit
TU-AIS	TU Alarm Indication Signal
TUG	Tributary Unit Group
TU-LOM	TU Loss of Multiframe
TU-LOP	Loss of TU Pointer
TU-NDF	TU Pointer New Data Flag
TX	Transmitter

U

UI	Unit Interval

V

VBR	Variable Bit Rate
VC	Virtual Channel
VC-n	Virtual Container
VP	Virtual Path
VT	Virtual Tributary
VXI	VMEbus Extensions for Instrumentation

W

WAN	Wide Area Network
WDM	Wave Division Multiplexing

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