

Sonet User Guide

OmniBER 719



Agilent Technologies

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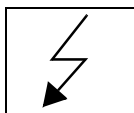
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WARNING

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.

OmniBER 719 SONET User Guide

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

Product Description

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 this instrument are:

- Multi-rate transmission testing from DS0 to OC-48.
- Concatenated payloads testing to OC-48c.
- T-carrier testing.
- Direct measurement of protection switching time.
- Powerful thru-mode testing for SONET ring turn-up.
- Comprehensive SONET overhead testing.
- Packet over SONET (POS) and ATM payloads up to 2.5 Gb/s.
- Fast access to key measurement tasks via Smart Test.
- Optical power and line frequency measurements.
- J0 section trace for DWDM testing.
- J1 and J2 path trace for network path testing.
- Optional integrated graphical printer.
- Transmit and Receive can be independently configured.

Conventions

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.

Connecting to the Network

Connecting to the Network

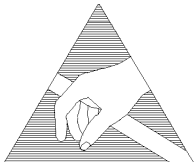
The network connectors are located on the modules at the side of the instrument. The connections available depend on the options fitted to your instrument.

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.

Connecting to the Network

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.

Connecting to the Network

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 power level of -3 dBm (-8 dBm for OmniBER 719A instruments). **NEVER EXCEED +3 dBm.**

Accepts SONET signals OC-1, OC-3, OC-12 and OC-48.

OPTICAL OUT

Provides optical signals OC-1, OC-3, OC-12 or OC-48 at wavelength 1280 to 1335nm (1280 to 1330nm for OmniBER 719A instruments), and/or 1480 to 1580 nm (1530 to 1570 for OmniBER 719A instruments).

Connecting to the Network

Cleaning Optical Connectors

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

| Description | 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 719.
- 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.

Connecting Accessories

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.

HANDSET Allows connection of a telephone handset for communication across the network.

Printer
HP-IB (GPIB),
RS232,
PARALLEL ONLY

The port selected for external printer use is not available for remote control. See "Connecting an Printer to a Parallel Port " page 256.

Remote Control
HP-IB (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, STP patch lead, RJ45 cable should be used to connect the LAN port on the processor module marked "10 Base-T".

Front Panel Soft Recovery (Cold Start)

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 719 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.

OmniBER 719 Option Guide

This guide explains the features offered with each OmniBER Mainframe and its associated options. There are three mainframes as follows:

- The 37719A
- The 37719B
- The 37719C

Mainframe test rate capability

| Mainframe | Test Rate Capability |
|-----------|--|
| 37719A | 2.5 Gb/s, 622 Mb/s, 155 Mb/s and 52 Mb/s |
| 37719B | 622 Mb/s, 155 Mb/s and 52 Mb/s |
| 37719C | 155 Mb/s and 52 Mb/s |

Note that STS-1 and STS-3 electrical testing is included in the base mainframe and that an optical option must be ordered if you wish to test at OC-48 and OC-12.

Tributary test options

| | Option |
|--|--------|
| PDH/T-carrier DS1, DS3, E1, E2, E3 | 013 |
| E1 into DS3 mapping (also requires option 013) | 014 |
| Replaces BNC connector with WECO 560 | 620 |

OmniBER 719 Option Guide

Optical interface

An optical interface must be ordered if a 37719A or 37719B is required.

| | Option |
|---------------------------------|---------------|
| 1310 nm only | 104 |
| 1550 nm only | 105 |
| Dual wavelength 1310 nm/1550 nm | 106 |
| Replaces FC/PC adapters with SC | 610 |
| Replaces FC/PC adapters with ST | 611 |

Jitter

| | Option |
|--------------------------|---------------|
| Adds jitter to all rates | 200 |

ATM/POS

| | Option |
|------------------------------------|---------------|
| ATM payloads (requires option 350) | 300 |
| POS payloads (requires option 350) | 310 |
| Advanced payload engine | 350 |

Please note that in earlier versions of the OmniBER the list of ATM options included options 300, 301 and 302. These options have now been merged into one ATM option 300 (as listed above). A new Advanced payload engine option 350 has been added which must be ordered with an ATM or POS option.

OmnIBER 719 Option Guide

Accessory options

| | Option |
|--|---------------|
| Remote HP Omnibook controller | 600 |
| RS-232-C, GPIB and LAN remote control interfaces | 601 |
| 80-column in-lid printer | 602 |

| | |
|---|---------|
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| “Using Smart Test” | page 40 |
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| “Setting Jitter Receive Interface” | page 47 |
| “Setting Extended Jitter Receive Interface” | page 48 |
| “Setting Wander Receive Interface” | page 49 |

Setting the Interfaces

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

Setting the Interfaces

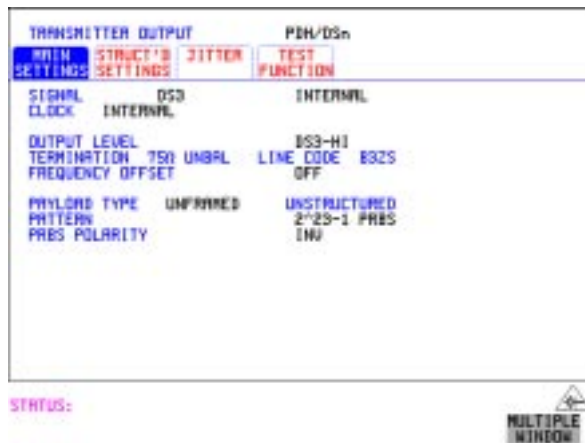
Setting PDH/DSn Transmit Interface (Option 013)

Description

DSn transmit interface settings should match network equipment settings of Rate, Termination and Line Code and determine the Payload to be tested.

TIP:

To set the Transmitter and Receiver to the same interface settings choose **OTHER SETTINGS CONTROL COUPLED**.



HOW TO:

- 1 Choose the required SIGNAL rate from 2 Mb/s, 8 Mb/s, 34 Mb/s Mb/s PDH, plus DS1, DS3 T-carrier interfaces.
- 2 Choose the required CLOCK SYNC source, internally generated, externally generated or recovered from the received PDH/DSn signal. If you select an external clock source, connect the external source to the appropriate port on the OmniBER clock module.
- 3 If DS1 or DS3 is chosen, choose the required OUTPUT LEVEL.
- 4 If you have chosen 2 Mb/s as the SIGNAL rate, choose the required TERMINATION. (At all other signal rates the impedance is fixed).

Setting the Interfaces

Setting PDH/DSn Transmit Interface (Option 013)

- 5 If you have chosen 8 Mb/s, 2 Mb/s or DS1 as the SIGNAL rate, choose the required LINE CODE. (At 34 Mb/s and DS3 coding is fixed).
- 6 If required, choose the FREQUENCY OFFSET value.
See “Adding Frequency Offset to the DSn Signal” page 64.
- 7 Choose the required PAYLOAD TYPE.
If **STRUCTURED** is required **FRAMED** must be chosen.
If **STRUCTURED** is chosen the DSn test signal must be set up. See “Setting Transmit Structured Payload/Test Signal” page 68.
If you have chosen 2 Mb/s, DS1 or DS3 as the DSn SIGNAL rate, the Framed choice is expanded to provide a menu of framing types.
- 8 Choose the PATTERN type and the PRBS POLARITY.

Additional Patterns at DS1

- 9 If you select a DS1 SIGNAL, two 8-bit patterns and a 55 Octet pattern are added to the list of available patterns. The 8-bit patterns are as follows:

Table 1 **8-Bit Patterns**

| Type | Pattern |
|--------|-----------|
| 1-in-8 | F01000000 |
| 2-in-8 | F01100000 |

Note 1: F indicates the position of the framing bit with respect to the 8-bit pattern when the framed data is generated

Note 2: Both 8-bit patterns and the 55 Octet pattern can only be selected as a payload for the whole DS1, i.e. they can not be selected as a pattern for an individual 64 kb/s channel.

Note 3: Bit errors can be added to both 8-Bit and 55 Octet test patterns as with the other available test patterns.

The 55 Octet pattern uses the Daly pattern as per ANSI T1.403

Setting the Interfaces

Setting DS_n THRU Mode

Setting DS_n THRU Mode

Description

THRU mode is used to non-intrusively monitor DS_n lines where no protected monitor points are available.

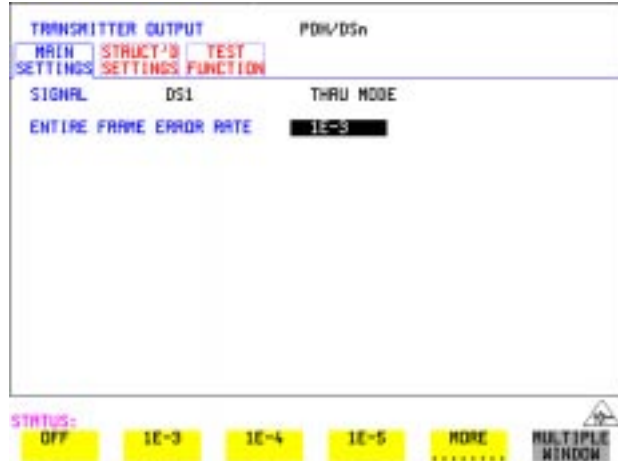
Note that since THRU mode locks some user settings, you must set SIGNAL RATE (DS1 or DS3), before selecting THRU mode.

Two modes of operation are possible:

Monitor Mode: This is when the Entire Frame Error Rate field is set to **OFF**. In this mode the received signal is passed through or transmitted unchanged, and the instrument monitors errors and alarms as normal DS1 operation.

Full Frame Overwrite Mode: In this mode any bit in the entire frame can be errored at a user defined rate. The bit that is errored can be any bit in the frame, including the frame bit (hence the title of “Full Frame Overwrite”). The error rates available are:

Data error rates: 1.0E-3, 1.0E-4, 1.0E-5, 1.0E-6, 1.0E-7 and user programmable in 0.1 steps from 1.1E-3 to 1.0E-9



HOW TO:

- 1 Make the required SIGNAL RATE choice on the PDH/DS_n **TRANSMIT** and **RECEIVE** displays.
- 2 Select THRU MODE as shown in the figure above.
- 3 Select an entire frame error rate from the choices given or use the USER softkey to program an error rate.

Setting SONET Transmit Interface

Payload Selection

One of the key features of the OmniBER 719 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. (STS-48c) 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 STS-48 (denoted STS-48c), the virtual container area is entirely filled by a single STS-48c SPE. This STS-48c SPE consists one Path Overhead and a single container capable of carrying a tributary signal operating at rates up to approximately 2.5 Gb/s. Once assembled a STS-48c 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 payload | STS-3c SPE payload |
| 10^{-14} | 48 days | >2 years |
| 10^{-13} | 4.8 days | 77 days |
| 10^{-12} | 11.6 hours | 7.7 days |
| 10^{-11} | 1.2 hour | 18.5 hour |
| 10^{-10} | 7 minutes | 1.9 hours |

Setting the Interfaces

Setting SONET Transmit Interface

Description

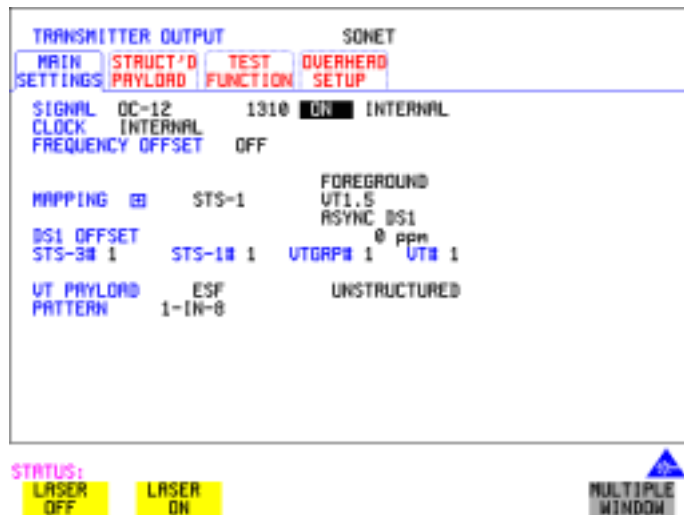
SONET transmit interface settings should match the network equipment settings of Rate, Wavelength and Mapping, determine the payload to be tested and set background conditions to prevent alarms while testing.

TIP:

If you wish to set the OmniBER 719 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.
If Option 106, Dual Wavelength optical module, is fitted and an optical rate is chosen, choose the required wavelength (1550 or 1310).
If STS-1 is chosen, choose the required interface level.
Choose **INTERNAL** unless **THRU MODE** is required. If **THRU MODE** is chosen, see "Setting SONET THRU Mode " page 37.
- 2 Make your choice of CLOCK synchronization 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

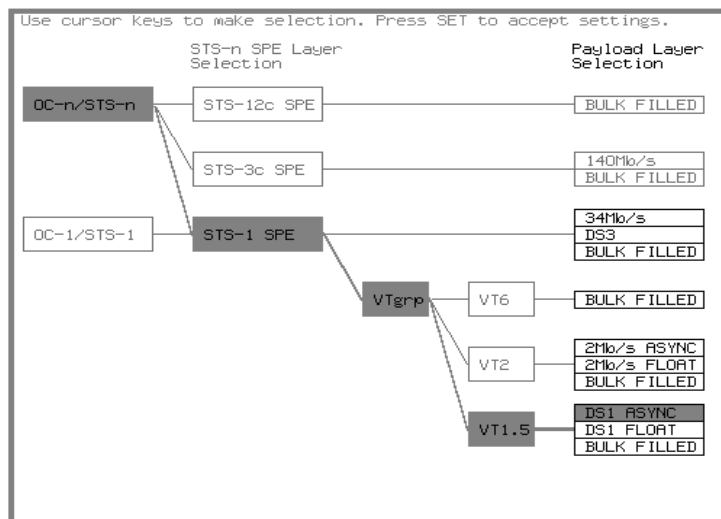
Setting the Interfaces

Setting SONET Transmit Interface

Offset to SONET Signal” page 62.

- 4 Choose the required **F/G MAPPING** and PAYLOAD TYPE, then **B/G MAPPING** and 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 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.

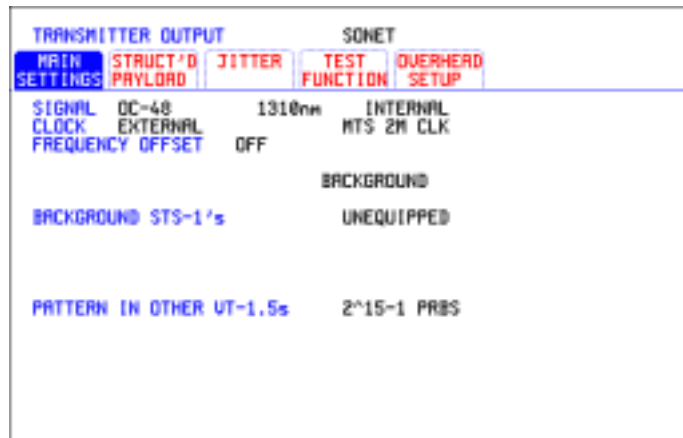
The BACKGROUND, PATTERN IN OTHER VT-6s is fixed at NUMBERED, that is, each VT-6 contains a unique number to allow identification in case of routing problems.

- 6 If required, choose DS1/2M/34M/DS3 OFFSET value. See “Adding Frequency Offset to SONET Signal” page 62

Setting the Interfaces

Setting SONET Transmit Interface

- 7 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.
- 8 Choose the payload framing under PAYLOAD TYPE or VT PAYLOAD.
If **STRUCTURED** is required **FRAMED** must be chosen.
If **STRUCTURED** is chosen, the Payload test signal must be set up. See “Setting Transmit Structured Payload/Test Signal” page 68.
If **INSERT** is chosen, see “Inserting an External DS_n Payload/Test Signal” page 74.
If you have chosen 2 Mb/s, DS1 or DS3 under Mapping, the Framed choice is expanded to provide a menu of framing types.
- 9 Choose the PATTERN type and PRBS polarity.



STATUS:

MULTIPLE WINDOW

- 10 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.
- 11 If VT mapping is chosen for the test STS, choose the PATTERN IN OTHER VT's.

NOTE

The definition of NORMAL and INVERTed polarity differs between ITU-T O.150 and common practice usage in the United States of America for 2¹⁵-1 and 2²³-1 PRBS patterns (see "PRBS Polarity Control " page 309.

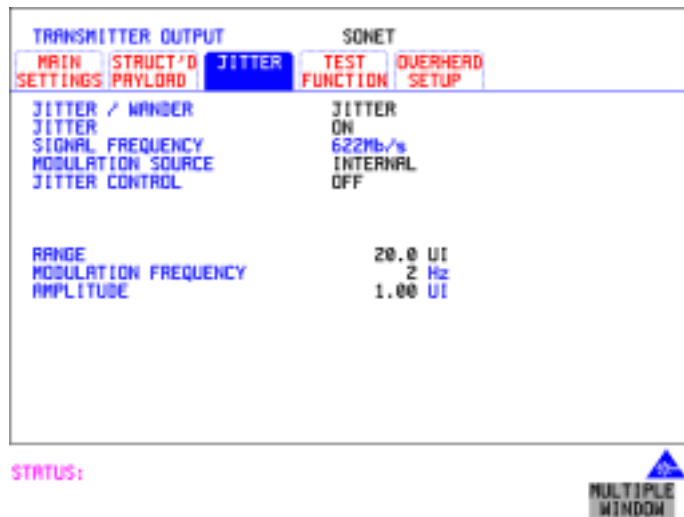
Setting the Interfaces

Setting Jitter Transmit Interface

Setting Jitter Transmit Interface

Description:
Option 200 required for jitter and option 013 for PDH/DSn.

You can add jitter to the transmitted DSn or SONET signal at DS1, DS3, 2 Mb/s, 34 Mb/s, STS-3, OC-3, OC-12, and OC-48. You can source the jitter modulation internally or from an external source. Jitter measurement up to 2.5 Gb/s is available when ATM or POS is selected as a payload.



HOW TO:

- 1 If you are adding jitter to the DSn signal, set up the DSn transmit interface. See Chapter “Setting PDH/DSn Transmit Interface (Option 013)”.
- 2 If you are adding jitter to the SONET signal, set up the SONET transmit interface. See “Setting SONET Transmit Interface” page 29.
- 3 Choose JITTER/WANDER **JITTER**.
If you wish to add wander to the DSn or SONET signal, See “Setting Wander Transmit Interface” page 35.
- 4 Choose JITTER **ON**.
If you wish to perform a Jitter Tolerance measurement, choose **AUTO TOLERANCE**. See “Measuring Jitter Tolerance” page 134.
If you wish to perform a Jitter Transfer measurement choose **TRANSFER FUNCTION**. See “Measuring Jitter Transfer” page 138.

Setting the Interfaces

Setting Jitter Transmit Interface

- 5 Choose the modulation source.

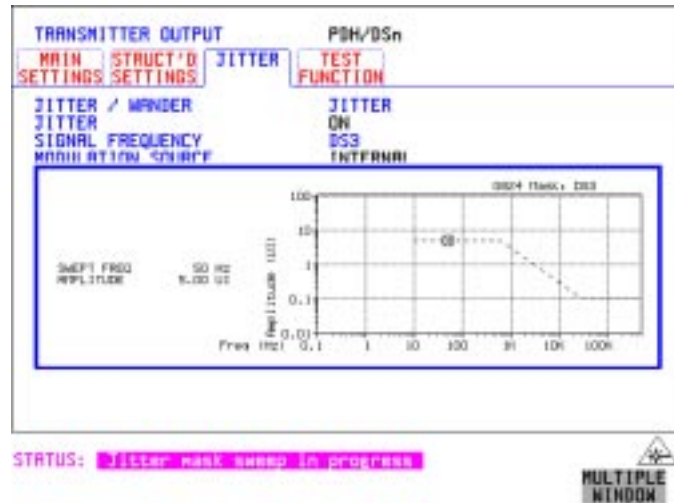
If adding jitter to the DS_n signal and **EXTERNAL** is chosen, connect the external source to the MOD IN port of the DS_n Jitter TX module. Up to 10 UI of external jitter modulation can be added at the MOD IN port.

If adding jitter to the SONET signal and **EXTERNAL** is chosen, connect the external source to the MOD IN port of the SONET Clock module. Up to 20 UI of external jitter modulation can be added at the MOD IN port.

- 6 If you have selected an **INTERNAL** Modulation Source, choose the JITTER CONTROL setting required.

You can choose the jitter range, jitter modulating frequency and jitter amplitude if **OFF** is chosen.

If you choose **SWEPT**, the OmniBER 719 will "sweep" through the ITU-T/ANSI jitter mask (G.823 for PDH, GR-499 or G.824 for DS_n, G.958, G.825 or GR-253 for SONET) adjusting the jitter amplitude according to the jitter frequency. With the **SWEPT** field selected, press SET on the instrument front panel for a display of the jitter mask sweep (an example is given below).



If you choose **SPOT**, you can choose the "spot" jitter frequency. The jitter amplitude is adjusted and controlled according to your jitter frequency choice.

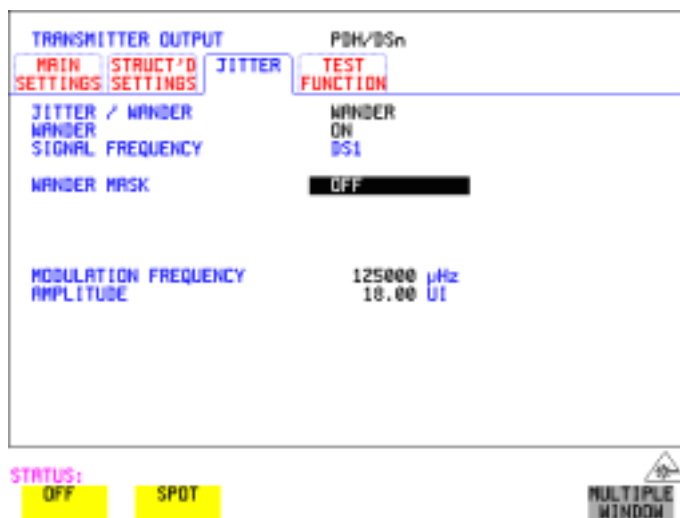
TIP:

If, when using the SWEPT MASK capability, a problem occurs around a certain frequency, this may require closer examination. Stop the sweep at that point by choosing **SPOT**. You can then control the "spot" jitter frequency to make closer examination of the problem.

Setting Wander Transmit Interface

Description:

You can add Wander to the DS1 signal and the STS-3, OC-3, OC-12 or OC-48 SONET signal. Wander is also available when you select an ATM or POS payload.



HOW TO:

DSn Wander (DS1)

- 1 Set up the PDH transmit interface, choose CLOCK and select the SOURCE required from the menu. If you select EXTERNAL connect the external source to the REF IN port on the CLOCK module. See “Setting PDH/DSn Transmit Interface (Option 013)” page 26.
- 2 Choose JITTER/WANDER **WANDER**.
If you wish to add jitter to the DSn signal, See “Setting Jitter Transmit Interface” page 33.
- 3 Choose WANDER **ON**.
- 4 Choose the WANDER MASK setting required.
You can choose the wander modulating frequency and wander amplitude if **OFF** is chosen.
If you choose **SPOT**, you can choose the "spot" wander frequency. The wander amplitude is adjusted and controlled according to your wander frequency choice.

Setting the Interfaces

Setting Wander Transmit Interface

SONET Wander (STS-3, OC-3, OC-12, OC-48)

- 5 Set up the SONET transmit interface. See "Setting SONET Transmit Interface" page 29.
- 6 Choose JITTER/WANDER **WANDER**.
If you wish to add jitter to the SONET signal, see "Setting Jitter Transmit Interface " page 33.
- 7 Choose WANDER **ON**.
- 8 Choose the WANDER MASK setting required.
You can choose the wander modulating frequency and wander amplitude if **OFF** is chosen.
If you choose **SPOT**, you can choose the "spot" wander frequency. The wander amplitude is adjusted and controlled according to your wander frequency choice.

Setting SONET THRU Mode

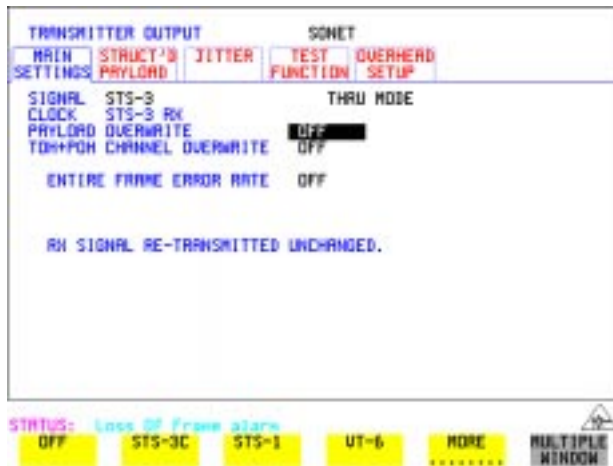
Description

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 errored 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.

Setting the Interfaces

Setting SONET THRU Mode

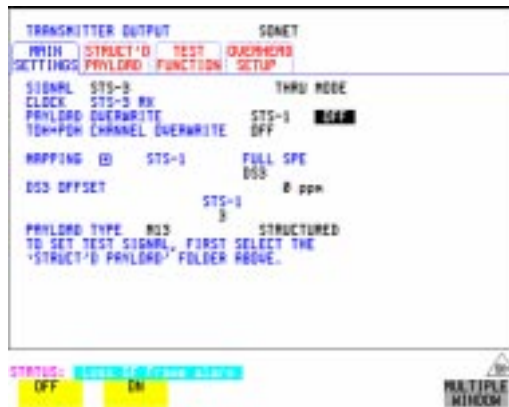
3. Payload Overwrite: In this mode you can overwrite the payload as explained in the following text. Any Path CV errors are recalculated before transmission. Use the **HOW TO** procedure to setup your instrument for THRU Mode operation.

OC-1/STS-1, OC-3/STS-3

You can substitute a new payload, Section and Line Overhead (TOH) and Path overhead (POH) in the received OC-1/STS-1 or OC-3/STS-3 signal for testing.

OC-12, OC-48

The overhead and payload may be overwritten for STS-3c SPE and STS-1. PAYLOAD OVERWRITE is not available for STS-12C or STS-48C. TOH+POH CHANNEL overwrite is available for STS-12C and STS-48C.



HOW TO:

- 1 Make the required SIGNAL RATE choice, and select THRU MODE on the SONET **TRANSMIT** display, See "Setting SONET Transmit Interface " page 29.
- 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 SONET Transmit Interface " page 29, steps 4 through 10.

Setting the Interfaces

Setting SONET THRU Mode

- 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.

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 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.

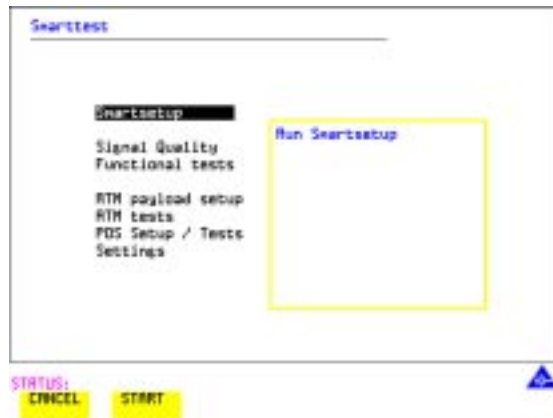
Smart Tests

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

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

HOW TO:

- 1 Connect the 37719A to the network and choose if necessary the required SONET **RECEIVE** interface on the 37719A (Smartsetup will select PDH or SONET).
- 2 Press **SMART TEST**.



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

Setting the Interfaces Using Smart Test

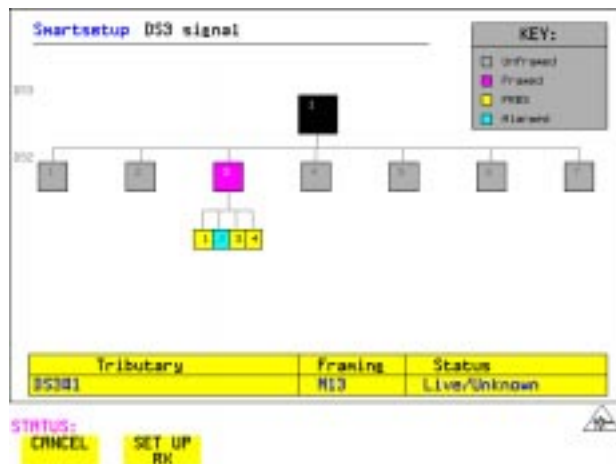
the receive signal. Or press **CANCEL** to exit Smart Tests.

An example of a typical display after choosing to RUN Smartsetup is shown below. **Note:** The Path Trace information displayed is the one obtained the last time a RESCAN was performed. If you have changed the input signal since the last Smartsetup you must perform a RESCAN now. If you have selected a PDH/DSn interface and a PDH/DSn signal is received, a tributary mapping display indicating the framing and status of each tributary is given, see below.

Smartsetup DC-12 (Optical)

| STS1# | Payload | Path trace |
|-------|------------|------------|
| 1 | STS-1 Uneq | |
| 2 | STS-1 Uneq | |
| 3 | STS-1 Uneq | |
| 4 | STS-1 Uneq | |
| 5 | STS-1 Uneq | |
| 6 | STS-1 Uneq | |
| 7 | STS-1 Uneq | |
| 8 | STS-1 Uneq | |
| 9 | STS-1 Uneq | |
| 10 | STS-1 Uneq | |
| 11 | STS-1 Uneq | |
| 12 | STS-1 Uneq | |

STATUS: CANCEL EXPLORE FURTHER RESCAN



Setting the Interfaces

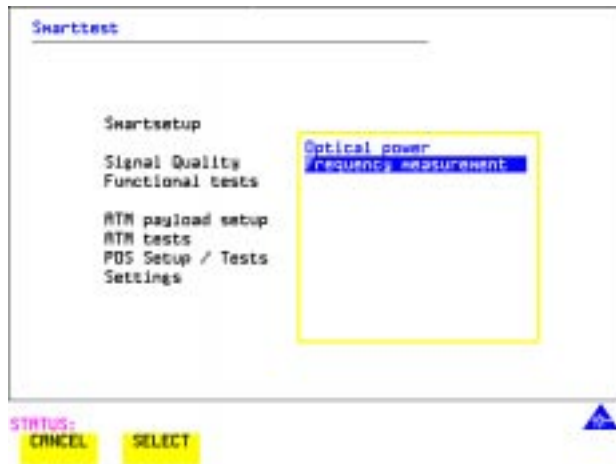
Using Smart Test

SET UP RX key

If you select an individual tributary using the cursor control keys, and then select **SET UP RX**, the instrument exits smartsetup and sets the receiver to the framing and status of the selected tributary.

To run a Smart Test (Signal Quality - Frequency Measurement):

- 1 Ensure a valid signal is connected to one of the instrument's Receive ports.
- 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.



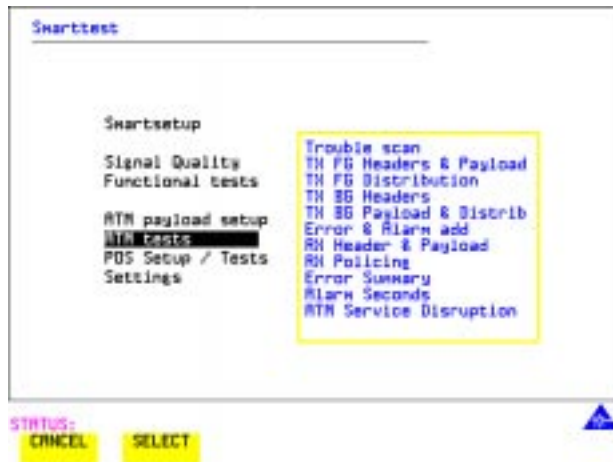
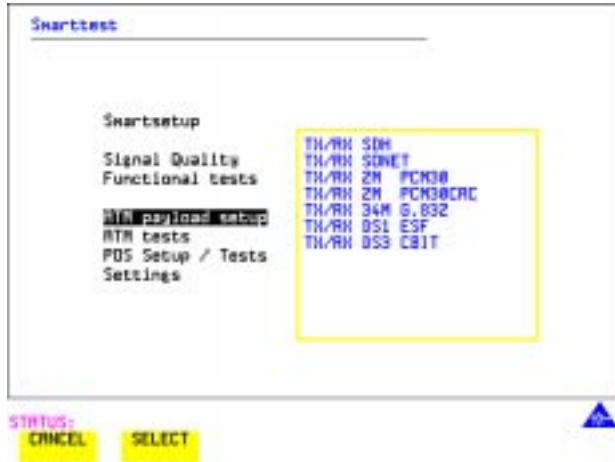
- 6 Press **SELECT** to display the frequency screen. Or press **CANCEL** to exit Smart Tests.

To run an ATM Smart Test

- 1 Ensure a valid signal is connected to one of the instrument's Receive ports.
- 2 Press **SMART TEST**.
- 3 Use the down cursor control key to select ATM payload setup or ATM tests.
- 4 Use the right cursor control key to access the setups/tests.

Setting the Interfaces Using Smart Test

- 5 Use the down cursor control key to select required setup/test.



Note: It is not possible for OmniBER to find ATM in a PDH payload in Smartsetup.

Setting the Interfaces

Setting PDH/DSn Receive Interface

Setting PDH/DSn Receive Interface

Description

DSn Receive interface settings should match the network equipment settings of Rate, Termination and Line Code and determine the Payload to be tested.

TIP:

To set the transmitter and receiver to the same interface settings choose **OTHER SETTINGS CONTROL** **COUPLED**.

| RECEIVER INPUT | | PDH/DSn |
|----------------|-------------------|----------------------|
| MAIN SETTINGS | STRUCT'D SETTINGS | JITTER TEST FUNCTION |
| SIGNAL | | DS3 |
| TERMINATION | | 75Ω UNBAL |
| LINE CODE | | B3Z5 |
| LEVEL | | TERMINATE |
| PAYLOAD TYPE | UNFRAMED | UNSTRUCTURED |
| PATTERN | | 2'23-1 PRES |
| PRES POLARITY | | INV |

STATUS: PDH/DSn SDH SONET

MULTIPLE WINDOW

HOW TO:

- 1 Choose the required SIGNAL rate.
- 2 If you have chosen 2 Mb/s as the SIGNAL rate, choose the required TERMINATION. (At all other rates the impedance is fixed.)
- 3 If you have chosen 8 Mb/s, 2 Mb/s or DS1 as the SIGNAL rate, choose the required LINE CODE. (At 34Mb/s and DS3 coding is fixed.)
- 4 If you are measuring at the network equipment monitor point, set the LEVEL field to **MONITOR**. In this case the received signal will be 20 to 30 dB below the normal level.
Choose the GAIN required to return the received signal to normal.
Choose EQUALIZATION **ON** to compensate for cable losses if required.
- 5 Choose the PAYLOAD TYPE.

Setting the Interfaces

Setting PDH/DSn Receive Interface

If **STRUCTURED** is required **FRAMED** must be chosen.

If **STRUCTURED** is chosen, the PDH/DSn test signal must be set up. See “Setting Transmit Structured Payload/Test Signal” page 68.

If you chose 2 Mb/s, DS1 or DS3 as the PDH/DSn SIGNAL rate, the FRAMED choice is expanded to provide a menu of framing types.

- 6 Choose the PATTERN type and the PRBS POLARITY required.

Additional Patterns at DS1

- 7 If you select a DS1 SIGNAL, two 8-bit patterns and a 55 Octet pattern are added to the list of available patterns. They are as follows:

Table 2 **8-Bit Patterns**

| Type | Pattern |
|--------|-----------|
| 1-in-8 | F01000000 |
| 2-in-8 | F01100000 |

Note 1: F indicates the position of the framing bit with respect to the 8-bit pattern when the framed data is generated

Note 2: Both 8-bit patterns and the 55 Octet pattern can only be selected as a payload for the whole DS1, i.e. they can not be selected as a pattern for an individual 64 kb/s channel.

The 55 Octet pattern uses Daly pattern as per ANSI T1.403.

Setting the Interfaces

Setting SONET Receive Interface

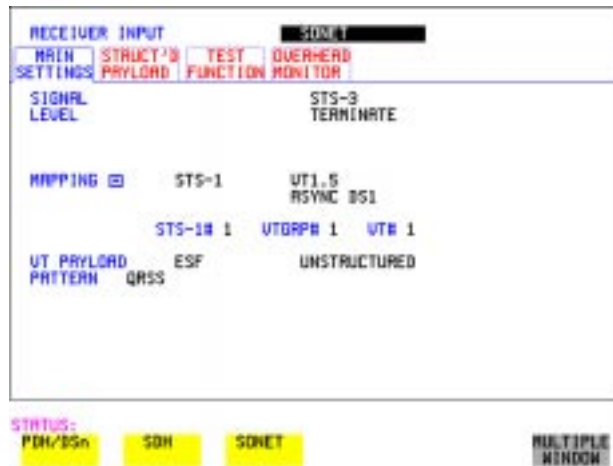
Setting SONET Receive Interface

Description

SONET 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 719 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 either electrical or optical.
If STS-1 or STS-3 is chosen, choose the required LEVEL.
If the LEVEL chosen is **MONITOR** choose the required GAIN.
- 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 payload framing under PAYLOAD TYPE or VT PAYLOAD.
If **STRUCTURED** is required **FRAMED** must be chosen.
If **STRUCTURED** is chosen the Payload test signal must be set up. See “Setting Receive Structured Payload/Test Signal” page 70.
If DROP is chosen, see “Dropping an External Payload/Test Signal” page 77.
- 5 Choose the PATTERN type and PRBS polarity (see page 309).

Setting the Interfaces

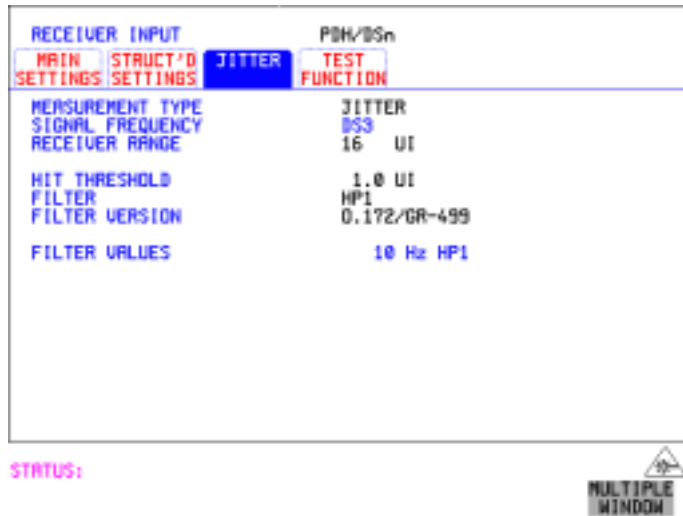
Setting Jitter Receive Interface

Setting Jitter Receive Interface

Description:
Option 200 required
for Jitter operation.

Jitter and error measurements are made simultaneously when a jitter option is fitted. Jitter measurement up to 2.5 Gb/s is also available when ATM or POS is selected as a payload. The jitter receive interface is selected with **RECEIVE PDH/DSn JITTER** or **RECEIVE SONET JITTER** MEASUREMENT TYPE **JITTER**.

The choices made on the jitter receive interface determine the jitter measurement range, the threshold level for determining a jitter hit and which filters are used in the jitter measurement.



HOW TO:

- 1 Choose the RECEIVER RANGE - the jitter measurement range.
- 2 Choose the HIT THRESHOLD level - if the received jitter exceeds the value chosen a jitter hit is recorded.
- 3 Choose the FILTER you wish to include in the peak to peak and RMS jitter measurement. The choices are:
OFF, LP, HP1, HP2, 12kHz HP, LP+HP1, LP+HP2, LP+12kHz HP
- 4 If you have selected a PDH/DSn Receive Interface you can also select FILTER VERSION, O.171 or O.172/GR-499. The selection is not available with a SONET Receive Interface.

Setting the Interfaces

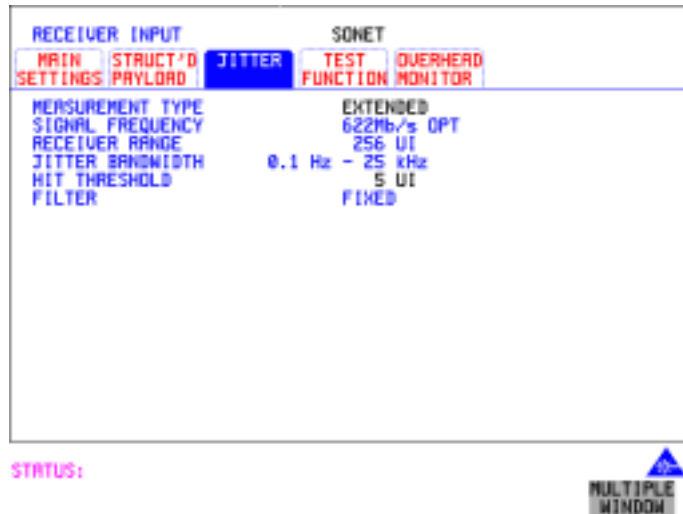
Setting Extended Jitter Receive Interface

Setting Extended Jitter Receive Interface

Description:

Extended Jitter measurements are made in a jitter bandwidth of 0.1 Hz to 25 kHz. These measurements are made at the upper end of the standard wander frequency range and the lower end of the standard jitter frequency range. The extended jitter receive interface is selected with **RECEIVE** **PDH/DSn** **JITTER** or **RECEIVE** **SONET** **JITTER** MEASUREMENT TYPE **EXTENDED**.

The choices made on the jitter receive interface determine the threshold level for determining a jitter hit. The measurement Range and the Filters are not selectable.



HOW TO:

- 1 Choose MEASUREMENT TYPE **EXTENDED**.
- 2 Choose the HIT THRESHOLD level - if the received jitter exceeds the value chosen a jitter hit is recorded.

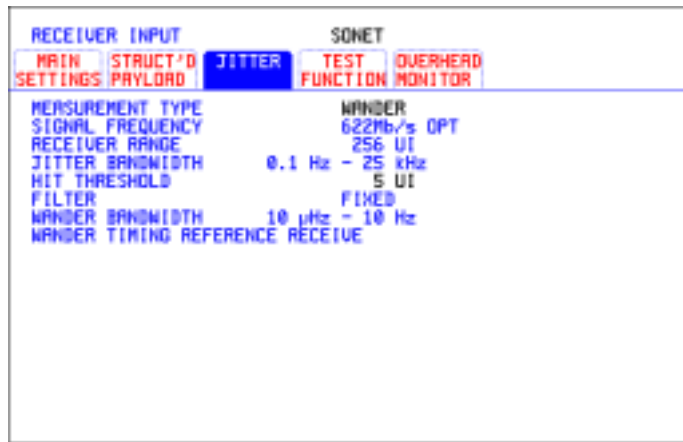
Setting the Interfaces

Setting Wander Receive Interface

Setting Wander Receive Interface

Description:

You can measure Wander at all DS_n and SONET rates. An external timing reference should be selected on the **TRANSMIT** **PDH/DS_n** or **SONET** **MAIN SETTINGS** display to ensure accurate Wander results.



STATUS:



HOW TO:

- 1 Choose an external timing reference on the **TRANSMIT** **SONET** **MAIN SETTINGS** display. See, "Setting SONET Transmit Interface" page 29.
- 2 If you intend to measure wander on a DS_n signal, set up the DS_n receive interface. See, "Setting PDH/DS_n Receive Interface" page 44.
- 3 If you intend to measure wander on a SONET signal, set up the SONET receive interface. See, "Setting SONET Receive Interface" page 46.
- 4 Choose MEASUREMENT TYPE **WANDER**.
- 5 Choose the wander HIT THRESHOLD - if the received wander exceeds the value chosen a wander hit is recorded.

Setting the Interfaces

Setting Wander Receive Interface

- “Using Transmit Overhead Setup” page 52
- “Using Receive Overhead Monitor” page 54
- “Setting Overhead Trace Messages” page 56
- “Setting Overhead Labels” page 57
- “Generating Overhead Sequences” page 58
- “Using Receive Overhead Capture” page 60
- “Adding Frequency Offset to SONET Signal” page 62
- “Adding Frequency Offset to the DS_n Signal” page 64
- “Setting up Signaling Bits” page 65
- “Setting Transmit Structured Payload/Test Signal” page 68
- “Setting Receive Structured Payload/Test Signal” page 70
- “Setting Transmit N x 64 kb/s/N x 56 kb/s Structured Payload/Test Signal” page 71
- “Setting Receive N x 64 kb/s/N x 56 kb/s Structured Payload/Test Signal” page 73
- “Inserting an External DS_n Payload/Test Signal” page 74
- “Dropping an External Payload/Test Signal” page 77
- “Adding Errors and Alarms at the SONET Interface” page 80
- “Adding Errors and Alarms to a DS_n Signal” page 81
- “Using FEAC Codes” page 82
- “Setting DS_n Spare Bits” page 84
- “Adding Pointer Adjustments” page 85
- “Using Pointer Graph Test Function” page 93
- “Stressing Optical Clock Recovery Circuits” page 95
- “Generating Automatic Protection Switch (APS) Messages” page 97
- “Inserting and Dropping the Data Communications Channel” page 102
- “Using DS₁ LOOP Codes” page 103

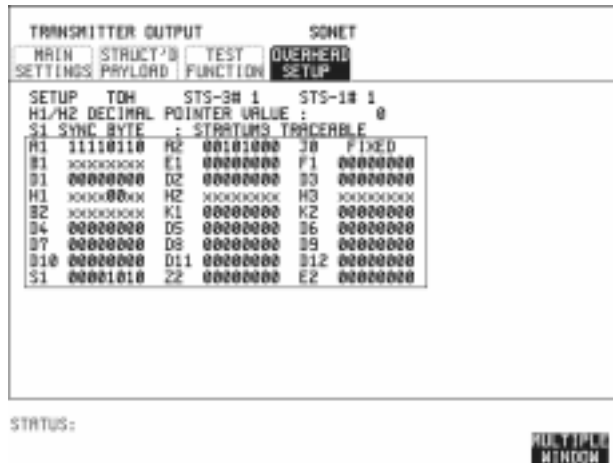
Selecting Test Features

Selecting Test Features

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 SONET Transmit Interface " page 29.
- 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 STS-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 **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.

Selecting Test Features

Using Transmit Overhead Setup

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-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).
H4 byte is transmitted as all zero's for 34 Mb/s and DS3.
- 4 If TRACE MESSAGES is chosen, see "Setting Overhead Trace Messages " page 56.

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.

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 243.

| RECEIVER INPUT | | SONET | |
|--------------------------------------|----------|----------|----------|
| MAIN | STRUCT'D | TEST | OVERHEAD |
| SETTINGS | PAYLOAD | FUNCTION | MONITOR |
| MONITOR TOH STS-3# 1 STS-1# 1 | | | |
| S1 SYNC STATUS : STARTING TRACEABLE | | | |
| A1 | 11110110 | A2 | 00101000 |
| B1 | 10111001 | E1 | 00000000 |
| D1 | 00000000 | D2 | 00000000 |
| H1 | 01100000 | H2 | 00000000 |
| B2 | 10100101 | K1 | 00000000 |
| D4 | 00000000 | D5 | 00000000 |
| D7 | 00000000 | D8 | 00000000 |
| D10 | 00000000 | D11 | 00000000 |
| S1 | 00001010 | Z2 | 00000000 |
| | | F0 | 00000001 |
| | | F1 | 00000000 |
| | | F2 | 00000000 |
| | | F3 | 00000000 |
| | | F4 | 00000000 |
| | | F5 | 00000000 |
| | | F6 | 00000000 |
| | | F7 | 00000000 |
| | | F8 | 00000000 |
| | | F9 | 00000000 |
| | | F10 | 00000000 |
| | | F11 | 00000000 |
| | | F12 | 00000000 |
| | | F13 | 00000000 |
| | | F14 | 00000000 |
| | | F15 | 00000000 |
| | | F16 | 00000000 |
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| | | F45 | 00000000 |
| | | F46 | 00000000 |
| | | F47 | 00000000 |
| | | F48 | 00000000 |
| | | F49 | 00000000 |
| | | F50 | 00000000 |
| | | F51 | 00000000 |
| | | F52 | 00000000 |
| | | F53 | 00000000 |
| | | F54 | 00000000 |
| | | F55 | 00000000 |
| | | F56 | 00000000 |
| | | F57 | 00000000 |
| | | F58 | 00000000 |
| | | F59 | 00000000 |
| | | F60 | 00000000 |
| | | F61 | 00000000 |
| | | F62 | 00000000 |
| | | F63 | 00000000 |
| | | F64 | 00000000 |
| | | F65 | 00000000 |
| | | F66 | 00000000 |
| | | F67 | 00000000 |
| | | F68 | 00000000 |
| | | F69 | 00000000 |
| | | F70 | 00000000 |
| | | F71 | 00000000 |
| | | F72 | 00000000 |
| | | F73 | 00000000 |
| | | F74 | 00000000 |
| | | F75 | 00000000 |
| | | F76 | 00000000 |
| | | F77 | 00000000 |
| | | F78 | 00000000 |
| | | F79 | 00000000 |
| | | F80 | 00000000 |
| | | F81 | 00000000 |

STATUS:

HOW TO:

- 1 Set up the receive SONET interface and payload as required. See "Setting SONET Receive Interface" page 46.
- 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.

Selecting Test Features

Using Receive Overhead Monitor

- 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 bytes 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, D4 - D12), 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 60.

Selecting Test Features

Setting Overhead Trace Messages

Setting Overhead Trace Messages

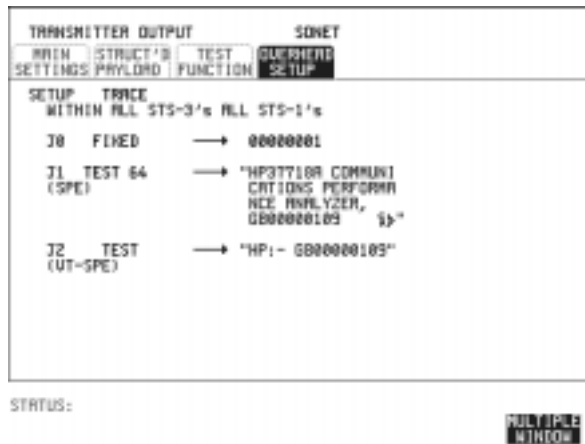
Description

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-3c SPE path connection.

J2 verifies the VT SPE path connection.





HOW TO:

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

How to Edit User Messages

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 alphanumeric 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 13) under the heading "Changing Instrument Settings".

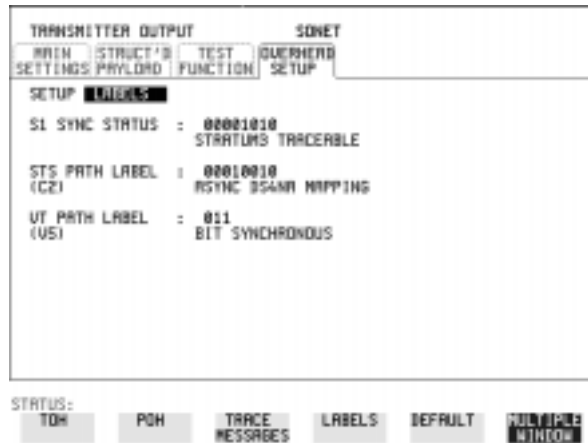
Selecting Test Features

Setting Overhead Labels

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 Edit User Defined Labels

There are two ways you can edit a label as follows;

- 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”.

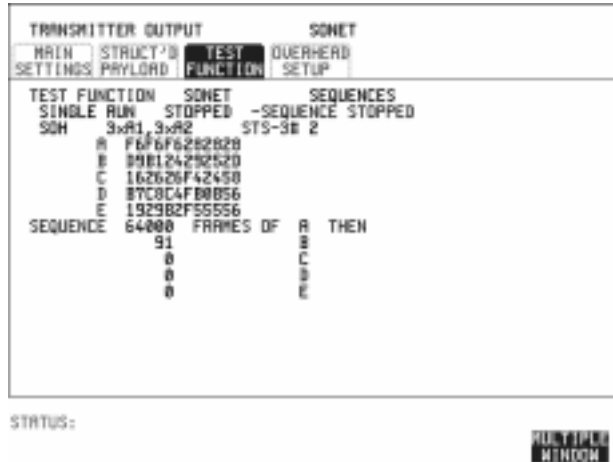
Selecting Test Features

Generating Overhead Sequences



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 SONYET transmit interface and payload required. See "Setting SONYET Transmit Interface" page 29.
- 2 Select **TEST FUNCTION**, SONYET, 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**  .

Selecting Test Features

Generating Overhead Sequences

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.

Selecting Test Features

Using Receive Overhead Capture

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 243.

| RECEIVER INPUT | | SONET | |
|----------------|-------------|--------------|-------------|
| MAIN | STRUCT'D | TEST | O/H CAPTURE |
| SETTINGS | PAYLOAD | FUNCTION | MONITOR |
| TEST FUNCTION | SONET | O/H CAPTURE | |
| SOH | 3xR1, 3xR2 | STS-3# 2 | |
| TRIGGER | ON NOT | F6F6F6282828 | |
| CAPTURE | STOPPED | | |
| DATA | FRAME COUNT | | |
| 09812429252D | 91 | | |
| F6F6F6282828 | 64000 | | |
| 09812429252D | 91 | | |
| F6F6F6282828 | 64000 | | |
| 09812429252D | 91 | | |
| F6F6F6282828 | 64000 | | |
| 09812429252D | 91 | | |
| F6F6F6282828 | 64000 | | |

STATUS:

MULTIPLE WINDOW

HOW TO:

- 1 Set up the receive SONYET interface and payload as required. See "Setting SONYET Receive Interface" page 46.
- 2 Select **TEST FUNCTION**, SONYET, 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.

Selecting Test Features

Using Receive Overhead Capture

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**.

Selecting Test Features

Adding Frequency Offset to SONET Signal

Adding Frequency Offset to SONET Signal

Description



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



HOW TO:

SONET Line Rate Offset

- 1 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. When Floating Byte 2 Mb/s is chosen, in conjunction with SONET line rate offset, the chosen tributary will be offset as the line rate is offset. (No pointer movements).

Selecting Test Features

Adding Frequency Offset to SONET Signal

Tributary Offset ± 100 ppm

- 1 Choose the amount of tributary offset required.

You can set the Offset in the range -100 ppm to +100 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.

Tributary offset affects the stuff rate but does not cause pointer movements and can be used to test mapping jitter. If the combined value of SONET line rate offset and tributary offset chosen is sufficient to cause the maximum stuff rate to be exceeded the payload is offset to prevent bit errors occurring and the maximum stuff rate is maintained.

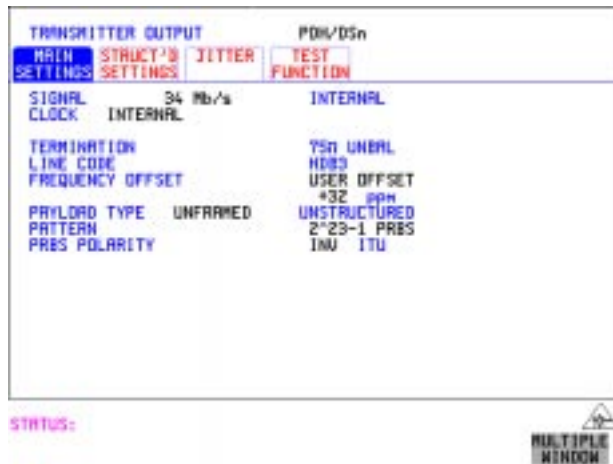
Adding Frequency Offset to the DS_n Signal

Description

Option 012 required.

You can add frequency offset to the interface DS_n SIGNAL at all rates. Frequency Offset can be added at preset ITU-T/ANSI values or as User defined values in the range ± 100 ppm. The preset values change with the SIGNAL rate chosen as shown:

| | | |
|--------------------|--------------|---------|
| DS-1 (1.544 Mb/s) | ± 32 ppm | -32 ppm |
| 2 Mb/s (E1) | ± 50 ppm | -50 ppm |
| 8 Mb/s | ± 30 ppm | -30 ppm |
| 34 Mb/s (E3) | ± 20 ppm | -20 ppm |
| DS-3 (44.736 Mb/s) | ± 20 ppm | -20 ppm |



HOW TO:

- 1 Choose the FREQUENCY OFFSET required.
- 2 If you choose USER OFFSET, you can set the frequency offset to be between -100 ppm and +100 ppm in 1 ppm steps. Select the field immediately below USER OFFSET and use **DECREASE DIGIT**, **INCREASE DIGIT**, **←** and **→** to set the frequency offset. (The amount of frequency offset can be varied while measurements are taking place.)

Selecting Test Features

Setting up Signaling Bits

Setting up Signaling Bits

Description

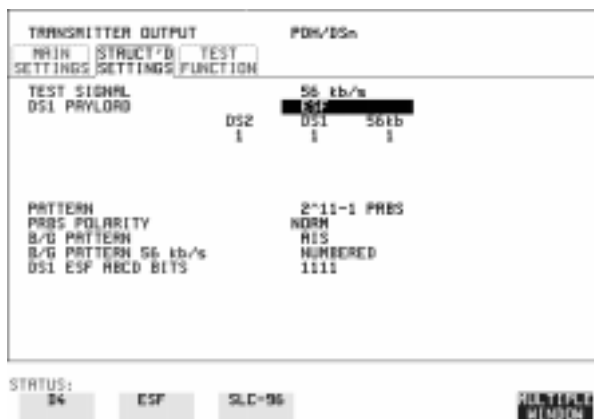
When transmitting 2.048 Mb/s signals with timeslot-16 CAS (PCM30 or PCM30CRC) multiframing the state of A,B,C,D signaling bits can be set. The signaling bits of all timeslots are set to the user-defined 4-bit value.

When transmitting a DS1 framed, structured signal the values of the A,B signaling bits for D4 and SLC-96 payloads, and A,B,C,D signaling bits for ESF payloads can be defined.

HOW TO

Transmit a DS1 payload signal with user-defined signaling bits

DSn Operation



- 1 Choose **PDH/DSn** on the **TRANSMIT** display.
Choose SIGNAL **DS1** or **DS3**, and PAYLOAD TYPE **STRUCTURED** on the **MAIN SETTINGS** display
- 2 Choose TEST SIGNAL **56 kb/s** or **Nx56 kb/s** on the **STRUCTURED SETTINGS** display.
- 3 Set the A,B bits (for D4 and SLC-96) and A,B,C,D bits (for ESF) as required.

SONET Operation

- 1 Choose **SONET** on the **TRANSMIT** display.
- 2 Set MAPPING to VT-1.5.
- 3 Choose MAPPING **FL BYTE DS1**, **ASYNC DS1** or **DS3** and VT

Selecting Test Features

Setting up Signaling Bits

PAYLOAD **STRUCTURED** on the **MAIN SETTINGS** display. If you choose **FL BYTE DS1** proceed to step 5.

- 4 Choose TEST SIGNAL **56 kb/s** or **Nx56 kb/s** on the **STRUCTURED SETTINGS** display .
- 5 Set the A,B bits (for D4 and SLC-96) and A,B,C,D bits (for ESF) as required.
- 6 **Floating Byte DS1 selection:** Set the ABCD bits for **NO-F-BIT** or **ESF** framing and/or the AB bits for **D4 VT PAYLOAD** framing as required.

HOW TO

Transmit a 2 Mb/s signal with user-defined signaling bits

DSn Operation



- 1 Choose **PDH/DSn** on the **TRANSMIT** display.
- 2 Choose SIGNAL **2 Mb/s** and PAYLOAD TYPE **PCM30** or **PCM30CRC** on the **MAIN SETTINGS** display.
- 3 If UNSTRUCTURED is chosen set the 2M CAS ABCD bits value on the **MAIN SETTINGS** display.
If STRUCTURED is chosen set the 2M CAS ABCD bits value on the **STRUCTURED SETTINGS** display.

Selecting Test Features

Setting up Signaling Bits

SONET Operation



- 1 Choose **SONET** on the **TRANSMIT** display.
- 2 Set MAPPING to VT-2.
- 3 Choose MAPPING **ASYNC 2Mb/s** or **FL BYTE 2Mb/s** and VT PAYLOAD **PCM30** or **PCM30CRC** on the **MAIN SETTINGS** display.
- 4 If UNSTRUCTURED is chosen set the 2M CAS ABCD bits value on the **MAIN SETTINGS** display.
If STRUCTURED is chosen set the 2M CAS ABCD bits value on the **STRUCTURED SETTINGS** display.

Setting Transmit Structured Payload/Test Signal

Description

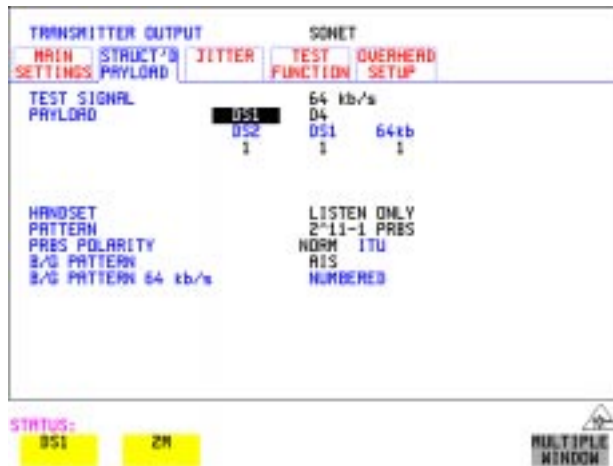
Structured DS_n Payload/Test Signal settings determine the payload or the DS_n test signal to be tested and set any background (non test) conditions to prevent alarms while testing.

TIP:

If you wish to set the OmniBER 719 transmitter and receiver to the same Payload settings, choose **OTHER SETTINGS CONTROL COUPLED**.

Interested in International Gateway Testing?

If your instrument has option 014 fitted you can map an E1 or 2Mb/s signal into DS3 as shown below:



HOW TO:

- 1 Choose the required TEST SIGNAL rate. If N x 64 kb/s or N X 56 kb/s is chosen, see "Setting Transmit N x 64 kb/s/N x 56 kb/s Structured Payload/Test Signal " page 71.
- 2 Choose the PAYLOAD framing pattern.
 If TEST SIGNAL 2Mb/s is chosen **INSERT 2 Mb/s** is added to the PAYLOAD menu. See "Inserting an External DS_n Payload/Test Signal " page 74.
 If TEST SIGNAL DS1 is chosen **INSERT DS1** is added to the menu. See "Inserting an External DS_n Payload/Test Signal " page 74.
- 3 Choose the test tributary in the structured payload, under 34Mb, 8Mb, 2Mb, 64 kb/s or DS2, DS1, 56 kb/s.

Selecting Test Features

Setting Transmit Structured Payload/Test Signal

- 4 Choose the PATTERN type and PRBS POLARITY.
- 5 Choose the B/G PATTERN. (background)
The B/G PATTERN in the non test 56/64 kb/s timeslots is fixed as NUMBERED, that is, each timeslot contains a unique number to allow identification in case of routing problems.

Signaling

- 6 If a 2 Mb/s PAYLOAD with PCM30 or PCM30CRC framing, or 56 kb/s or Nx56kb/s Test Signal is chosen. See, "Setting up Signaling Bits " page 65.

Selecting Test Features

Setting Receive Structured Payload/Test Signal

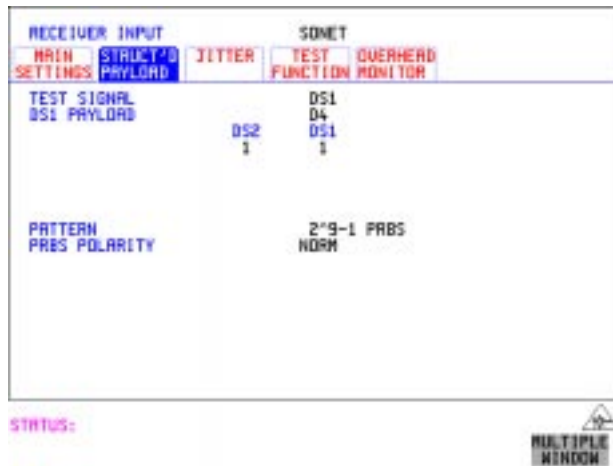
Setting Receive Structured Payload/Test Signal

Description

Structured DS_n Payload/Test Signal settings determine the payload or the DS_n test signal to be tested.

TIP:

If you wish to set the OmniBER 719 transmitter and receiver to the same Payload settings, choose **OTHER** **SETTINGS CONTROL** | **COUPLED** .



HOW TO:

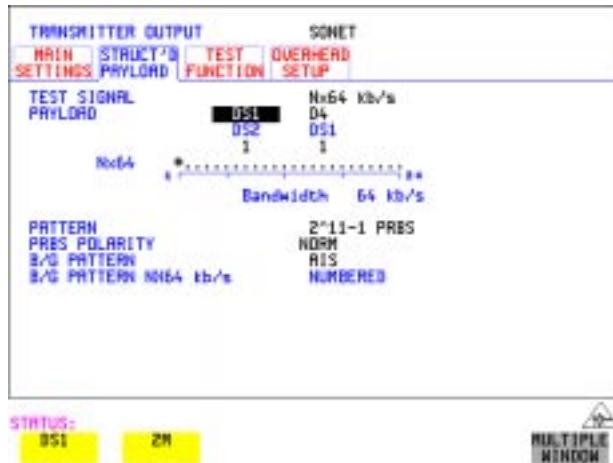
- 1 Choose the required Test Signal rate. If N x 64 kb/s or N x 56 kb/s is chosen, see "Setting Receive N x 64 kb/s/N x 56 kb/s Structured Payload/Test Signal " page 73.
- 2 Choose the Framing pattern of the PAYLOAD.
If TEST SIGNAL 2 Mb/s is chosen, **DROP 2 Mb/s** is added to the menu. See "Dropping an External Payload/Test Signal " page 77.
If TEST SIGNAL DS1 is chosen, **DROP DS1** is added to the menu.
See "Dropping an External Payload/Test Signal " page 77.
- 3 Choose the test tributary within the structured payload, under 34Mb, 8Mb, 2Mb, 64 kb or DS2, DS1, 56 kb/s.
- 4 Choose the PATTERN type and PRBS polarity.

Setting Transmit N x 64 kb/s/N x 56 kb/s Structured Payload/Test Signal

Description

Wideband services such as high speed data links and LAN interconnection require a bandwidth greater than 56/64 kb/s but less than DS1/2 Mb/s for example 112 kb/s or 336 kb/s. These wideband signals are sent in a DS1/2 Mb/s frame by sharing the signal across multiple timeslots.

N x 64kb/s/N x 56 kb/s structured payload allows a test pattern to be inserted across a number of timeslots even if the chosen timeslots are non-contiguous.



HOW TO:

- 1 Choose the required Test Signal rate.
- 2 If your instrument has option 014 fitted you can map an E1 or 2Mb/s signal into DS3. Select DS1 or 2M as shown in the figure above.
- 3 Choose the Framing pattern of the 2M or DS1 PAYLOAD.
- 4 Choose the test timeslots within the structured payload using **DESELECT ALL**, **DESELECT**, **SELECT**, **←** and **→** softkeys. As each timeslot is selected, an * marks the chosen timeslot.
- 5 Choose the PATTERN type and PRBS polarity.
- 6 Choose the B/G PATTERN.

Selecting Test Features

Setting Transmit N x 64 kb/s/N x 56 kb/s Structured Payload/Test Signal

- 7 The B/G PATTERN in the non-test 56/64 kb/s timeslots is fixed as NUMBERED, that is, each timeslot contains a unique identification number.

Signaling

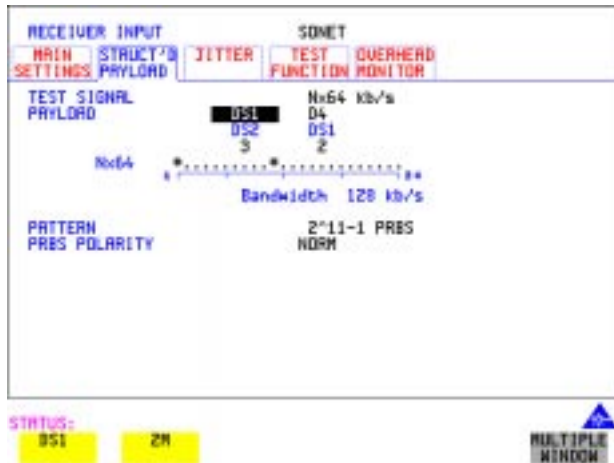
- 8 If a 2 Mb/s PAYLOAD with PCM30 or PCM30CRC framing, or 56 kb/s or Nx56kb/s Test Signal is chosen. See, "Setting up Signaling Bits " page 65.

Setting Receive N x 64 kb/s/N x 56 kb/s Structured Payload/Test Signal

Description

Wideband services such as high speed data links and LAN interconnection require a bandwidth greater than 56/64 kb/s but less than DS1/2 Mb/s e.g. 112 kb/s or 336 kb/s. These wideband signals are sent in a DS1/2 Mb/s frame by sharing the signal across multiple timeslots.

N x 64kb/s and N x 56 kb/s structured payload/test signal allows the test Timeslots to be chosen for error measurement even when the Timeslots are non contiguous.



HOW TO:

- 1 Choose the required Test Signal rate.
- 2 If your instrument has option 014 fitted you can map an E1 or 2Mb/s signal into DS3. Select DS1 or 2M as shown in the figure above.
- 3 Choose the Framing pattern of the 2M or DS1 PAYLOAD.
- 4 Choose the test timeslots within the structured payload using **DESELECT ALL** **DESELECT** **SELECT** **←** and **→** softkeys. As each timeslot is chosen an * marks the chosen timeslot. In the example above Timeslots 3, 5, 9, 21, 22, 23 are chosen for test.
- 5 Choose the PATTERN type and PRBS polarity.

Selecting Test Features

Inserting an External DS_n Payload/Test Signal

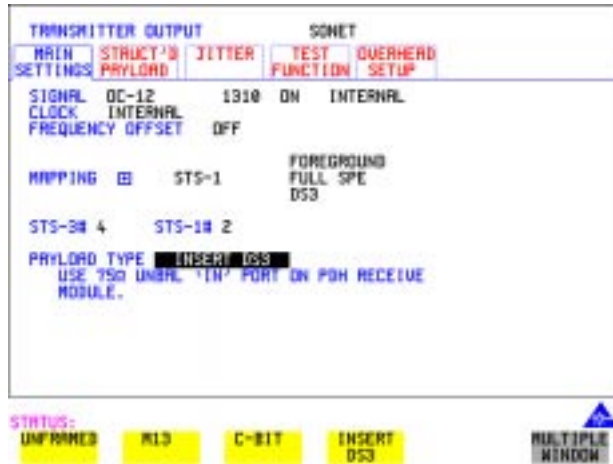
Inserting an External DS_n Payload/Test Signal

Description

You can insert 2 Mb/s or 34 Mb/s into an STS-*n* line signal when option 013 is fitted. DS3, DS1, E3 and E1 can be inserted when option 014 is fitted.

HOW TO:

Insert 34 Mb/s & DS3

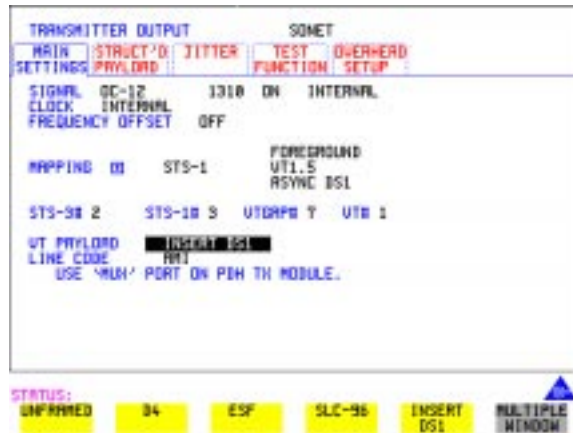


- 1 Press **TRANSMIT**, select **SONET** and the **MAIN SETTINGS** page.
- 2 Set up the required transmit Sonet interface, set appropriate MAPPING then choose VT PAYLOAD **INSERT 34 Mb/s**, or **INSERT DS3** as required. Connect your external source to the appropriate port as indicated on the instrument display (when you position the cursor on the PAYLOAD TYPE field and select INSERT).

Selecting Test Features

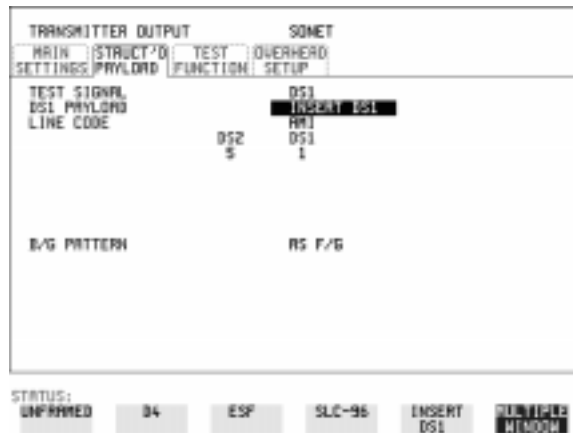
Inserting an External DSn Payload/Test Signal

Insert 2 Mb/s or DS1 (Unstructured SONET Payload)



- 1 Connect the external payload to the MUX port of the PDH/DSn Transmit module. If 2 Mb/s connect to 75 Ω MUX port. If DS1 connect to 100 Ω MUX port.
- 2 Set up the required transmit SONET interface, and choose VT-2 or VT-1.5 MAPPING and VT PAYLOAD **INSERT 2 Mb/s** or **INSERT DS1**.

Insert 2 Mb/s or DS1 (Structured SONET Payload or Structured DSn)



- 1 Connect the external payload to the MUX port of the DSn Transmit module. If 2 Mb/s connect to 75 Ω MUX port. If DS1 connect to 100 Ω MUX port.

Selecting Test Features

Inserting an External DS_n Payload/Test Signal

Structured SONET Payload

- 2 Set up the required transmit SONET interface. See "Setting SONET Transmit Interface " page 29.
- 3 Set up the SONET structured payload. See "Setting Transmit Structured Payload/Test Signal " page 68.
- 4 Choose 2M PAYLOAD/DS1 PAYLOAD **INSERT 2 Mb/s** or **INSERT DS1** .
- 5 Choose the LINE CODE.

Structured DS_n

- 6 Set up, the required transmit DS_n interface, See "Setting PDH/DS_n Transmit Interface (Option 013) " page 26.
- 7 Set up the DS_n Test Signal interface. See "Setting Transmit Structured Payload/Test Signal " page 68
- 8 Choose 2M PAYLOAD/DS1 PAYLOAD **INSERT 2 Mb/s** or **INSERT DS1** .
- 9 Choose the LINE CODE.

Selecting Test Features

Dropping an External Payload/Test Signal

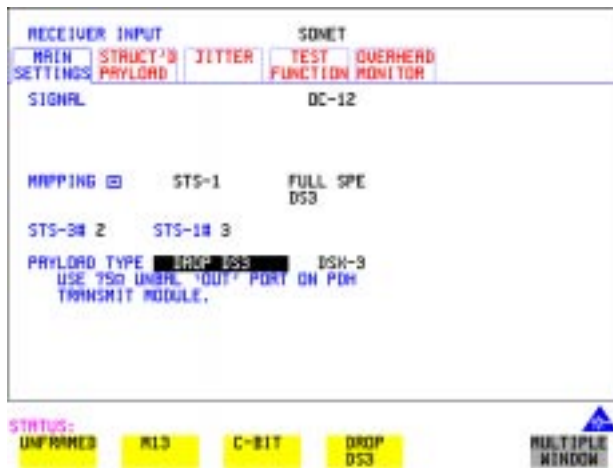
Dropping an External Payload/Test Signal

Description

You can drop 2Mb/s or 34 Mb/s from an STS-N line signal when option 013 is fitted. DS3, DS1, E3 and E1 can be dropped when option 014 is fitted

HOW TO:

Drop 34 Mb/s or DS3



- 1 Connect the 75Ω OUT port of the DS_n Transmit module to the external equipment.
- 2 Set up the receive SONYET interface, and choose PAYLOAD. **DROP 34 Mb/s** or **DROP DS3**, or as required.
If **DROP DS3** is chosen, choose the DS3 output level.

Selecting Test Features

Dropping an External Payload/Test Signal

Drop 2 Mb/s /DS1 (Unstructured SONET Payload)

| RECEIVER INPUT | | SONET | |
|-----------------------------------|------------------|-----------------------|-----------|
| MAIN SETTINGS | STRUCT'D PAYLOAD | TEST FUNCTION MONITOR | OVERHEAD |
| SIGNAL: DC-12 | | | |
| MAPPING ID | STS-1 | VT1.5 | ASYNC DS1 |
| STS-30 2 | STS-10 5 | UTDRPB 1 | UTB 1 |
| VT PAYLOAD | DROP DS1 | | |
| LINE CODE | FR1 | | |
| USE 'DEMUX' PORT ON PDR RN MODULE | | | |

STATUS: UNFORMED 34 ESP SLC-96 DROP DS1 MULTIPLE WINDOW

- 1 Connect the DEMUX port of the DS_n module to the external equipment.
- 2 Set up the required receive SONET interface, and choose VT-2 or VT-1.5 MAPPING and VT PAYLOAD **DROP 2 Mb/s** or **DROP DS1**.
- 3 Choose the required LINE CODE.

Drop 2 Mb/s/DS1 (Structured SONET Payload or Structured DS_n)

| RECEIVER INPUT | | SONET | |
|----------------|------------------|-----------------------|----------|
| MAIN SETTINGS | STRUCT'D PAYLOAD | TEST FUNCTION MONITOR | OVERHEAD |
| TEST SIGNAL | DS1 | | |
| DS1 PAYLOAD | DROP DS1 | | |
| LINE CODE | B8ZS | | |
| | DS2 7 | DS1 3 | |

STATUS: UNFORMED 34 ESP SLC-96 DROP DS1 MULTIPLE WINDOW

- 1 Connect the DEMUX port of the Receive DS_n module to the external equipment.
If 2 Mb/s connect to 75Ω DEMUX port. If DS1 connect to 100Ω DEMUX port.

Selecting Test Features

Dropping an External Payload/Test Signal

Structured SONET Payload

- 2 Set up the required receive SONET interface. See "Setting SONET Receive Interface " page 46.
- 3 Set up the SONET structured payload. See "Setting Receive Structured Payload/ Test Signal " page 70.
- 4 Choose 2M PAYLOAD **DROP 2 Mb/s** or DS1 PAYLOAD **DROP DS1** .
- 5 Choose the LINE CODE.

Structured DS_n

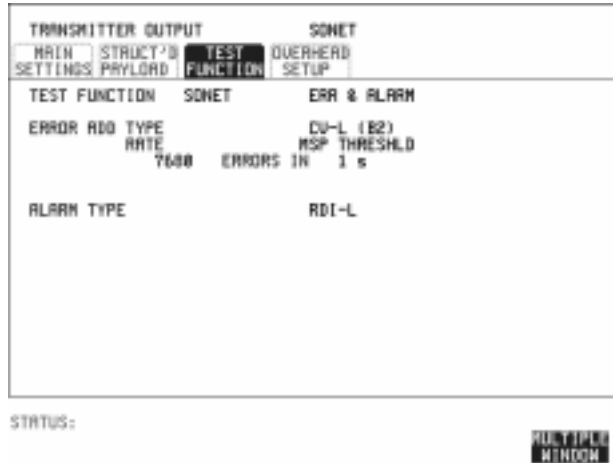
- 6 Set up, the required receive DS_n interface, See "Setting PDH/DS_n Receive Interface " page 44.
- 7 Set up the DS_n Test Signal interface. See "Setting Receive Structured Payload/ Test Signal " page 70
- 8 Choose 2M PAYLOAD **DROP 2 Mb/s** or DS1 PAYLOAD **DROP DS1** .
- 9 Choose the LINE CODE.

Selecting Test Features
Adding Errors and Alarms at the SONET Interface

Adding Errors and Alarms at the SONET Interface

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 SONET Transmit Interface " page 29.
- 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.

Selecting Test Features

Adding Errors and Alarms to a DS_n Signal

Adding Errors and Alarms to a DS_n Signal

Description

Errors and alarms can be added to a DS_n signal during testing.



HOW TO:

- 1 If SONET interface is chosen, set up the SONET transmit interface and payload required. See “Setting SONET Transmit Interface” page 29.
If DS_n interface is chosen, set up the DS_n interface and payload required. See “Setting PDH/DS_n Transmit Interface (Option 013)” page 26.
- 2 Select **TEST FUNCTION**, DS_n PAYLD, ERR & ALARM as shown above.
- 3 Choose the ERROR ADD TYPE and RATE on the Transmitter **TEST FUNCTION** display.
The RATE can be selected from a fixed value or is user programmable. If you select USER PROGRAM you can select the error rate before enabling the errors. This feature is useful for error threshold testing.
- 4 Choose the ALARM TYPE.
Errors and Alarms can be added at the same time.

Using FEAC Codes

Description

The third C-Bit in subframe 1 is used as a FEAC channel, where alarm or status information from the far-end terminal can be sent back to the near-end terminal. The channel is also used to initiate DS3 and DS1 line loopbacks at the far-end terminal from the near-end terminal.

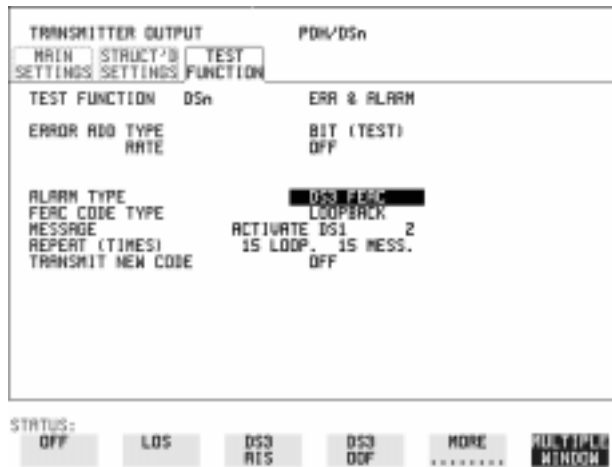
The codes are six digits long and are embedded in a 16 bit code word; the format is 0XXXXXX011111111.

There are two types of code, Loopback and Alarm Status.

Loopback provides a choice of two DS1 messages and two DS3 Messages. The DS1 Messages can be sent in ALL DS1 channels or in a SINGLE channel. The message can be repeated up to 15 times.

Alarm Status provides 13 preset codes and a USER programmable code function. These codes can be transmitted continuously or in bursts.

The new code is transmitted by choosing **BURST** or **ON**.



HOW TO:

Transmit an FEAC code

- 1 Choose SIGNAL **DS3** and PAYLOAD TYPE **CBIT** on the **TRANSMIT MAIN SETTINGS** display.
- 2 Choose **TRANSMIT TEST FUNCTION**, DSn PAYLD and ALARM TYPE **DS3 FEAC**. When a FEAC code is not being transmitted, an all ones pattern is transmitted.

Selecting Test Features

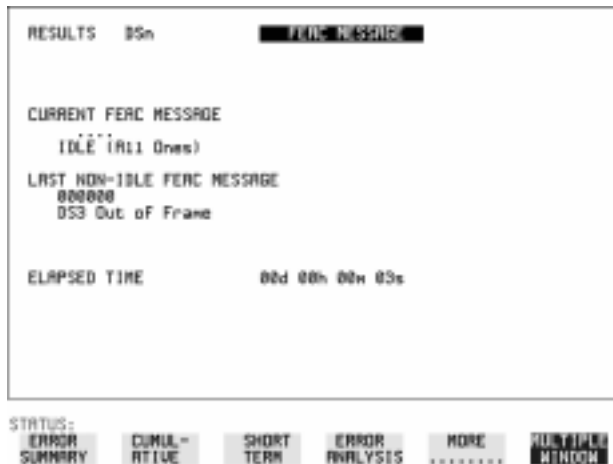
Using FEAC Codes

- 3 Choose the FEAC CODE TYPE.
- 4 Choose the MESSAGE from the choices displayed.
If you chose a DS1 message an additional field to the right of the DS1 MESSAGE is displayed. Position the cursor on this field and choose **ALL** or **SINGLE CHANNEL**.
If you choose **SINGLE CHANNEL** use the EDIT keys to select a channel from 1 to 28. Press **END EDIT** when finished.
- 5 If **LOOPBACK** is chosen, choose the REPEAT (TIMES) LOOP and MESS, in the range 1 to 15.
- 6 If **ALARM/ STATUS** is chosen, choose the BURST LENGTH (TIMES).
- 7 Choose TRANSMIT NEW CODE **BURST** or **ON** to transmit the selected FEAC message.

TIP:

To View FEAC Messages

The received FEAC message can be viewed on the **RESULTS** display.



```
RESULTS 05n          FEAC MESSAGE

CURRENT FEAC MESSAGE
  IDLE (All Ones)
LAST NON-IDLE FEAC MESSAGE
  000000
  DS3 Out of Frame

ELAPSED TIME          00d 00h 00m 03s

STATUS:
ERROR SUMMARY  CUMULATIVE  SHORT TERM  ERROR ANALYSIS  MORE .....  MULTIPLE WINDOW
```

Selecting Test Features

Setting DS_n Spare Bits

Setting DS_n Spare Bits


Description

Certain Spare Bits will cause the occurrence of a minor alarm when received as a logical "0".:

8 Mb/s & 34 Mb/s - FAS Bit 12

2 Mb/s - NFAS Timeslot (timeslot 0 of NFAS frame) Bit 0

| TRANSMITTER OUTPUT | | SONET |
|-----------------------------|-----------------------|------------------------------|
| MAIN SETTINGS | STRUCT'D PAYLOAD | TEST FUNCTION OVERHEAD SETUP |
| TEST FUNCTION | DS _n PAYLD | SPARE BITS |
| 2M: SL BIT (T/S-8 BIT 1) | | 1 |
| 56 BITS (NFAS T/S BITS 4-8) | | 11111 |
| CRS NFR T/S-16 BITS 5,7,8 | | 111 |

STATUS: 

HOW TO:

- 1 If SONET interface is chosen, set up the SONET transmit interface and payload required. See "Setting SONET Transmit Interface " page 29.
If DS_n interface is chosen, set up the DS_n transmit interface and payload required. See "Setting PDH/DS_n Transmit Interface (Option 013) " page 26.
- 2 Set the value of the spare bits required for testing.
If a BIT SEQUENCE is required, choose SEND SEQUENCE **ON** to transmit the sequence.

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 DS_n signal output from a SONET network element.

Jitter caused by Pointer Adjustments

Pointer adjustments are the mechanisms within SONET 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 defines a set of pointer sequences to be used when evaluating an NE's pointer adjustment jitter performance.

The OmniBER 719 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 719.

Selecting Test Features

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 SONET Transmit Interface " page 29.
- 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 us).

For VT, the minimum spacing between adjustments is 4 multiframes (2ms).

Choose ADJUST POINTER [ON] to add the chosen burst.

NEW POINTER -You can choose any pointer value in the defined range (0 to 782 For an STS-1 pointer) with or without a New Data Flag, and transmit. 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.

Selecting Test Features
Adding Pointer Adjustments

| 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 |

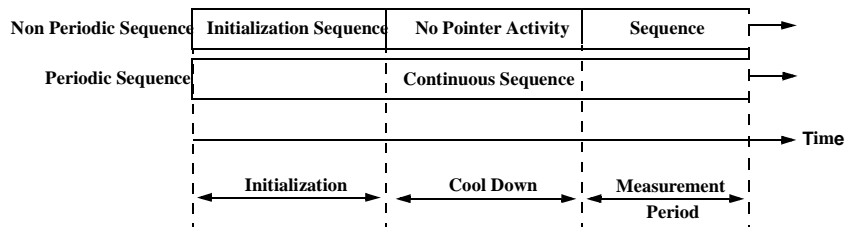
T1.105/GR-253 - Provides pointer movements according to T1.105 and GR-253:

- 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 G.783 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 719 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.

Selecting Test Features

Adding Pointer Adjustments

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

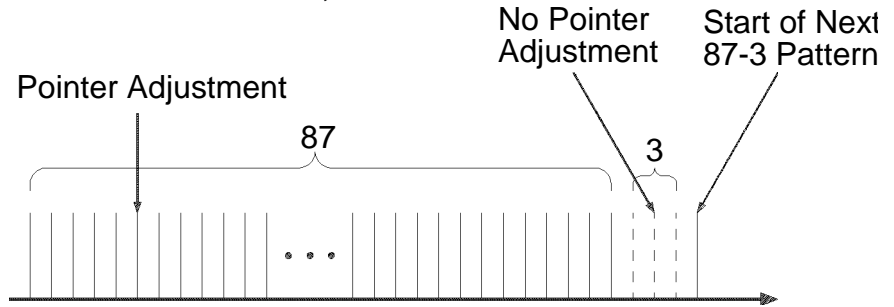
NOTE

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.

Selecting Test Features
Adding Pointer Adjustments

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). |

Selecting Test Features
Adding Pointer Adjustments

| 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. |

Selecting Test Features
Adding Pointer Adjustments

| 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.

Table 3 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) | √ | √ | √ |

Selecting Test Features
Adding Pointer Adjustments

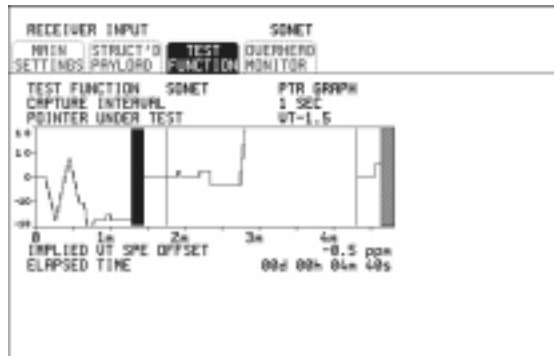
Table 3 **Pointer Sequences Available with Selected Mapping**

| POINTER SEQUENCE | MAPPING | | |
|------------------------------------|---------|----------|-------|
| | SPE | VT6, VT2 | VT1.5 |
| PERIODIC NORMAL (26-1) | | | √ |
| 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 | | | √ |

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 243.



STATUS:

RECEIVE
MINECON

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 SNET interface and payload as required. See "Setting SNET Receive Interface" page 46.
- 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, a short term measurement can be made at the identified time to gain more detail of the event.

Selecting Test Features

Using Pointer Graph Test Function

- 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.

Stressing Optical Clock Recovery Circuits

Description

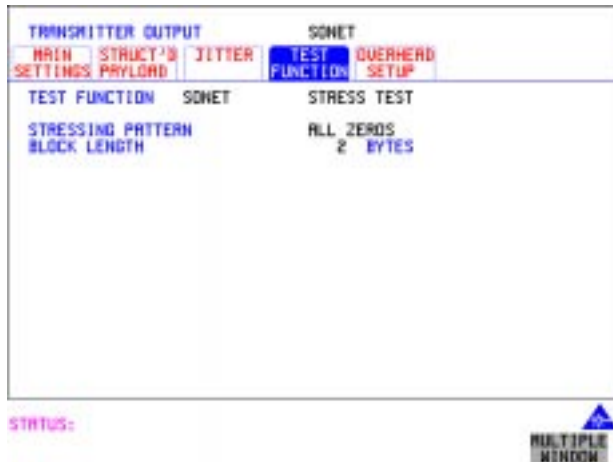
This test is essentially designed for testing optical clock recovery circuits in the presence of long runs of zero's or ones (after scrambling). The test function page allows control of the test pattern and the block length. The maximum block length is 2 bytes less than the width of the SPE.

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 SONET Transmit Interface " page 29.

Selecting Test Features

Stressing Optical Clock Recovery Circuits

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.

Generating Automatic Protection Switch (APS) Messages

Description

You can program the K1 and K2 bytes to exercise the APS functions for both LINEAR (GR-253) and RING (GR-1230) topologies.

The APS Message types are:-

- PASSIVE
- ACTIVE

The following table shows the APS message type availability.

| TX | RX | TOPOLOGY | APS Message Types |
|-----------|-----------|-----------------|--------------------------|
| SONET | PDH/DSn | LINEAR | PASSIVE |
| SONET | PDH/DSn | RING | PASSIVE |
| SONET | SDH | LINEAR | PASSIVE or ACTIVE |
| SONET | SDH | RING | PASSIVE |

**GENERAL
HOWTO:**

- 1** Set up the SONET transmit interface and payload required. See "Setting SONET Transmit Interface " page 29.
- 2** Choose the TOPOLOGY required.
- 3** Follow the appropriate HOWTO, listed in the following pages.

Selecting Test Features

Generating Automatic Protection Switch (APS) Messages

PASSIVE APS HOWTO:

The default APS message type is PASSIVE. The APS message is only transmitted when the **DOWNLOAD** key is pressed.



HOW TO:

- 1 Select PASSIVE APS message type.

NOTE

This step does not apply to RING TOPOLOGY.

- 2 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.
- 3 Choose **DOWNLOAD** to transmit the new K1/K2 values.

Selecting Test Features

Generating Automatic Protection Switch (APS) Messages



ACTIVE APS Message Type

This message type only applies to LINEAR topology.

The ACTIVE APS message type gives real-time response to provide switching keep-alive capability. The instrument will not initiate any changes, but will respond to change requests that appear on the input K1/K2 byte values.

The ACTIVE APS message type offers two modes:-

- UNIDIRECTIONAL
- BIDIRECTIONAL

The behavior for each mode is as shown in the following table.

| APS MODE | RX K1 (b5-b8)* | TX K1 (b1-b4)* | TX K1 (b5-b8)* | TX K2 (b1-b4)* | TX K2 (b5)* | TX K2 (b6-b8)* |
|----------------|-------------------|-------------------|-------------------|-------------------|----------------|-------------------|
| UNIDIRECTIONAL | xxxx | 0000 | 0000 | xxxx | user | 100 |
| BIDIRECTIONAL | 0000 | 0000 | 0000 | 0000 | user | 101 |
| BIDIRECTIONAL | yyyy | 0010 | yyyy | yyyy | user | 101 |

* IGR bit numbering convention

where:

xxxx = any 4-bit binary value.

user = user programmable bit, corresponding to APS ARCHITECTURE.

Selecting Test Features

Generating Automatic Protection Switch (APS) Messages

yyyy = any non-zero 4-bit binary value.



HOW TO:

- 1 Select ACTIVE APS message type.
- 2 Select ACTIVE APS message mode.



Selecting Test Features

Generating Automatic Protection Switch (APS) Messages

- 3 Select the required APS ARCHITECTURE.
- 4 Choose **DOWNLOAD** to transmit the new K1/K2 values.



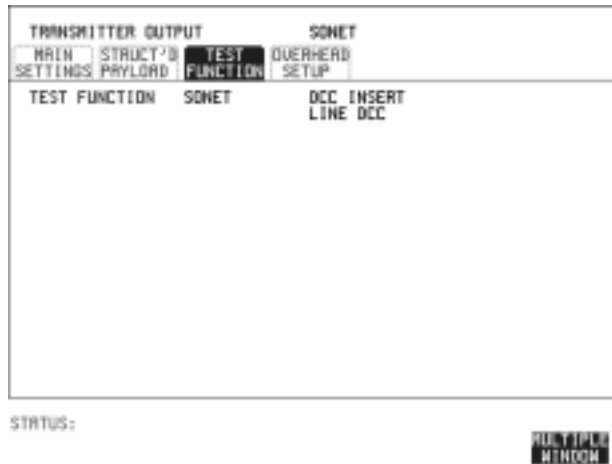
Inserting and Dropping the Data Communications Channel

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**, **SONET**, **TEST FUNCTION** display.

DCC DROP is available on the **RECEIVE**, **SONET**, **TEST FUNCTION** display.



HOW TO:

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

Using DS1 LOOP Codes

Description

A loopback code causes the far end equipment to return a signal to the sender, so that the sender can verify signal integrity. Loop codes are used by carriers of the T1 signal and users of the transport medium as a maintenance tool to aid in fault location. Loopback commands are in-band (that is they use the payload space), and out-band (they use an ESF data link).

The OmniBER 719 provides both In-band and Out-band loop codes as follows:

Out-band Loop Codes

Out-band codes are transmitted in an ESF data link, in addition to transmitting the in-band signal in the payload. They are only available when ESF framing is selected on the Transmitter Output **MAIN SETTINGS** page.

| Loop type | Activate | Deactivate |
|-----------|-------------------|-------------------|
| Line | 11111111 01110000 | 1111111100011100 |
| Payload | 11111111 00101111 | 11111111 01001100 |
| Network | 11111111 01001000 | n/a |
| Universal | n/a | 11111111 00100100 |
| User Code | 111111110xxxxxx0 | |

Note that when switching from an idle message to a loop-back message, the loop-back message will start following the idle message and not part way through it.

Note that the left most bit is transmitted first, and that when a loop code is not being sent, the idle data link sequence is sent. This is a continuous repetition of the pattern 01111110

In-band Loop Codes

With in-band codes, the transmitted signal comprises the entire payload of the signal, overwriting whatever signal was there before. The signal may be framed or unframed. When framed the framing bits overwrite the loopback code (see “In-Band DS1 Loopcode 156MTS Compatibility” on next page).

Note the user word can be set to any length, between 3 and 8 bits. The left most bit is transmitted first.

Selecting Test Features

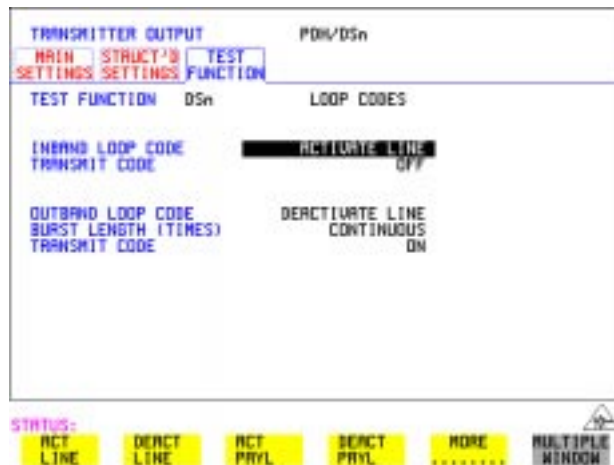
Using DS1 LOOP Codes

The following in-band codes can be selected .

| Loop type | Activate | Deactivate |
|-----------|----------------------|------------|
| Line | 00001 | 001 |
| Payload | 1100 | 1110 |
| Network | 11111111 01001000 | n/a |
| User Code | xxxxxxxx | xxxxxxxx |

In-Band DS1 Loopcode 156MTS Compatibility

Normal operation is such that DS1 framing bit overwrites the DS1 Loopcode pattern. A selection on the **OTHER MISCELLANEOUS** page enables you to change operation such that DS1 Loopcode is gapped in order to prevent the DS1 framing bit overwriting the DS1 Loopcode pattern. See page 294 In-Band DS1 Loopcode 156MTS Compatibility.



HOW TO:

Transmit an In-band loop code

- 1 Choose SIGNAL **DS1** and set LINE CODE and PAYLOAD TYPE as required on the **TRANSMIT MAIN SETTINGS** display.
- 2 Choose **TRANSMIT TEST FUNCTION** and set the TEST FUNCTION field to **DSn** and **LOOP CODES**.

Selecting Test Features Using DS1 LOOP Codes

- Choose the INBAND LOOP CODE from the choices given.
- To transmit a code select the TRANSMIT CODE field on the **TRANSMIT TEST FUNCTION**, **DSn**, **LOOP CODES** display and select **BURST**. The code is sent for nominally eight seconds.

HOW TO:

Monitor/view received loop codes

- Choose SIGNAL **DS1** on the **RECEIVE MAIN SETTINGS** display. Also set the LINE CODE to match the setting on the Transmitter display.
- Choose **DSn RESULTS** and **LOOP CODES** on the **RESULTS** display.
- Set the INBAND LOOPUP and LOOPDOWN fields to the required codes. Note the instrument receiver only detects the codes you have chosen. It does not detect other codes in the background. If you wish to view other codes, then you must select them in the appropriate fields.
- View the results in the RESULTS window.



HOW TO:

Transmit an Out-band loop code

- Choose SIGNAL **DS1** and set LINE CODE as required, and PAYLOAD TYPE to **ESF** on the **TRANSMIT MAIN SETTINGS** display.
- Choose **TRANSMIT TEST FUNCTION** and set the TEST FUNCTION field to **DSn** and **LOOP CODES**.

Selecting Test Features

Using DS1 LOOP Codes

- 3 Choose the OUTBAND LOOP CODE from the choices given.
- 4 Set the BURST LENGTH to **CONTINUOUS** or **BURST**. The BURST length can be set from 1 to 15 times.
- 5 To transmit the code set the TRANSMIT CODE field on the **TRANSMIT TEST FUNCTION** field to **ON** or **BURST** as required.

HOW TO:

Monitor/view received loop codes

- 6 Choose SIGNAL **DS1** and PAYLOAD TYPE **ESF** on the **RECEIVE MAIN SETTINGS** display. Also set the LINE CODE to match the setting on the Transmitter display.
- 7 Choose **DSn RESULTS** and **LOOP CODES** on the **RESULTS** display.
- 8 View the CURRENT CODE and LAST CODE results in the RESULTS window.

| | |
|---|----------|
| “Using Overhead BER Test Function” | page 108 |
| “Performing a Trouble Scan” | page 109 |
| “Test Timing” | page 111 |
| “Making SONET Analysis Measurements” | page 112 |
| “Making DS _n Analysis Measurements” | page 113 |
| “Measuring Frequency” | page 114 |
| “Measuring Optical Power” | page 115 |
| “Measuring Round Trip Delay” | page 116 |
| “Monitoring Signaling Bits” | page 118 |
| “Measuring Service Disruption Time” | page 119 |
| “Performing a SONET Tributary Scan” | page 122 |
| “Performing a SONET Alarm Scan” | page 125 |
| “Performing a DS _n Alarm Scan” | page 126 |
| “Measuring Jitter” | page 127 |
| “Measuring Extended Jitter” | page 129 |
| “Measuring Wander” | page 131 |
| “Measuring Jitter Tolerance” | page 134 |
| “Measuring Jitter Transfer” | page 138 |
| “Measuring Pointer Adjustment (Tributary) Jitter” | page 145 |

Making Measurements

Making Measurements

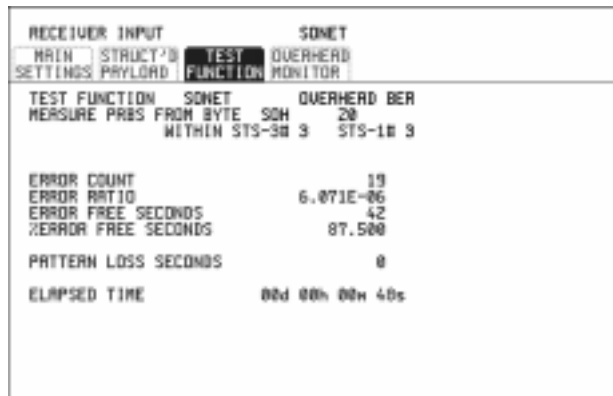
Using Overhead BER Test Function

Using Overhead BER Test Function

Description

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

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



STATUS:

RECEIVER WINDOW

HOW TO:

- 1 Set up the SONET transmit interface and payload required. See "Setting SONET Transmit Interface " page 29.
- 2 Set up the receive SONET interface and payload as required. See "Setting SONET Receive Interface " page 46.
- 3 Choose the overhead byte to be tested on the **RECEIVE SONET TEST FUNCTION** display.
- 4 Choose the overhead byte to be tested on the **TRANSMIT SONET TEST FUNCTION** display.
- 5 Press **RUN/STOP** to start the test.
- 6 The PRBS pattern can be errored by pressing **SINGLE**.

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 719 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 LEDs 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.

Error Count Priority - see the Table on the following page for a list of error count priority.

Making Measurements
Performing a Trouble Scan

Error Count Priority

| DSn | SONET | ATM | POS |
|--|---|--|---|
| CRC CODE DS3FR (DS1FR) P-BIT C-BIT FEBE BIT | CV-S CV-L CV-P CV-V FRAME CRC DS3FR (DS1FR, FAS2) REI-L REI-P REI-V P-BIT C-BIT REBE (FEBE) BIT | Corrected HEC Non corrected HEC Received Cells CLP0 Received Cells CLP1 Received Cells CLP0+1 Errored Cells Lost Cells Misinserted Cells Bit Error Non-conforming cells | FCS Errors IP Header Errors IP Payload Errors |

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.

Making Measurements

Making SONET Analysis Measurements

Making SONET Analysis Measurements

Description

G.826, M.2101, M.2110 and M.2120 analysis results are provided for all relevant 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

| RESULTS | SONET | ERROR ANALYSIS | |
|---------|--------|----------------|--------|
| G.826 | M.2101 | M.2110 | M.2120 |

| ERROR TYPE CU-L(B2) | | | |
|---------------------------|--------|------|----|
| CU-L(B2) ANALYSIS (G.826) | | | |
| EB | 426612 | ES | 0 |
| SES | 0 | URS | 57 |
| PLRS | 57 | BBE | 0 |
| ESR | 0 | SESR | 0 |
| BBER | 0 | | |

ELAPSED TIME 00d 00h 03m 20s

STATUS: RUN/STOP

HOW TO:

- 1 Set up the receive SONET interface and payload required. See "Setting SONET Receive Interface " page 46.
- 2 If required set up the SONET transmit interface and payload. See "Setting SONET Transmit Interface " page 29.
- 3 Press RUN/STOP to start the measurement.
- 4 You can view the analysis results on the RESULTS SONET ANALYSIS display.

TIP:

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

Making Measurements

Making DSn Analysis Measurements

Making DSn Analysis Measurements


Description

G.821, G.826, M.2100, M.2110 and M.2120 analysis results are provided for all relevant DSn and DSn Payload error sources.

In addition the following results are provided:

- Cumulative error count and error ratio
- Short Term error count and error ratio
- Alarm Seconds
- SIG/BIT Monitor. See "Monitoring Signaling Bits " page 118.

| RESULTS | DSn | ERROR ANALYSIS | | |
|--------------|-----------------|----------------|--------|-----------|
| G.821 | G.826 | M.2100 | M.2110 | M.2120 |
| BIT | | | | |
| EC | 126 | And | ES | 2.32240% |
| ES | 11 | | | 6.81853% |
| EPS | 172 | | | 33.38387% |
| SES | 0 | | | 0.00000% |
| UFRU | 21 | | | 18.25412% |
| BEG MIN | 1 | | | 25.00000% |
| BPV ES | 5 | | | |
| ELAPSED TIME | 00d 00h 03m 24s | | | |

STATUS: 

HOW TO:

- 1 If SONET is chosen as the interface, set up the Receive Interface and Payload required. See "Setting SONET Receive Interface " page 46. If required set up the Transmit Interface and Payload. See "Setting SONET Transmit Interface " page 29.
- 2 If DSn is chosen as the interface, set up the DSn receive interface. See "Setting PDH/DSn Receive Interface " page 44. If required set up the DSn transmit interface. See "Setting PDH/DSn Transmit Interface (Option 013) " page 26.
- 3 Press **RUN/STOP** to start the measurement.
- 4 If SONET is chosen as the interface, you can view the analysis results on the **RESULTS DSn PAYLOAD ERROR ANALYSIS** display
If DSn is chosen as the interface, you can view the analysis results on the **RESULTS DSn ERROR ANALYSIS** display.

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 DSN Receive module or the IN port of the Multirate Analyzer module (SONET electrical) or the IN port of the Optical Interface module (SONET optical).
- 2 Choose the required SIGNAL rate and LEVEL on the **PDH/DSn** **RECEIVE** **MAIN SETTINGS** or **SONET** **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.

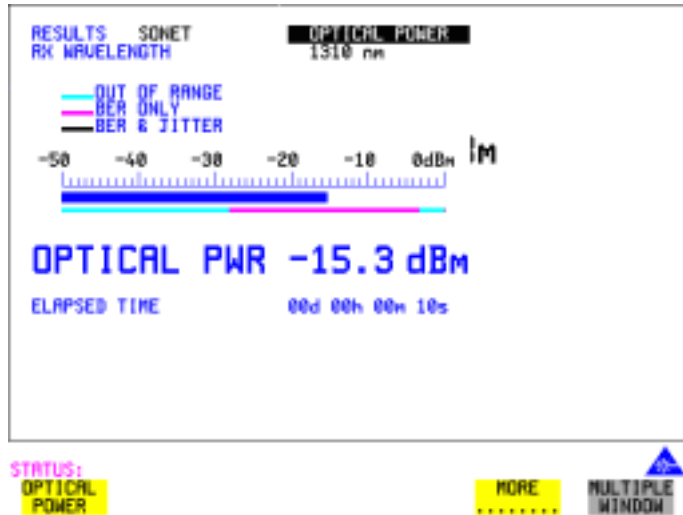
Making Measurements

Measuring Optical Power

Measuring Optical Power

Description

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



HOW TO:

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

NOTE

1. Optical power measurement is always available even if test timing is off.
 2. The white portion of the colored bar shows the power range for accurate jitter measurement (only displayed if a jitter option is fitted). The green portion of the colored bar shows the power range for accurate BER measurement.
-

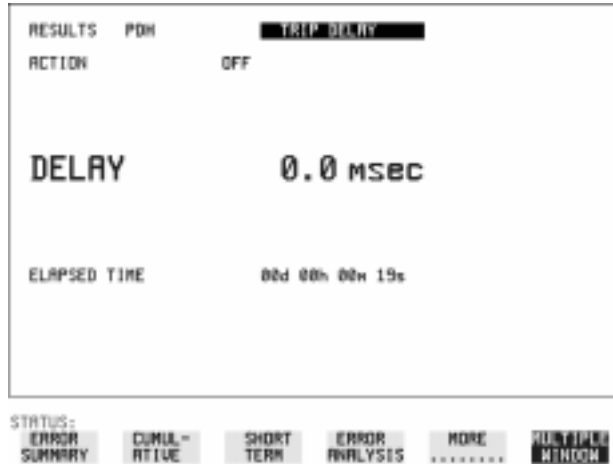
Making Measurements

Measuring Round Trip Delay

Measuring Round Trip Delay

Description:

The time taken for voice traffic to pass through the network is very important. Excessive delay can make speech difficult to understand. The Round Trip Delay feature of the OmniBER 719 measures the delay in a 64 kb/s timeslot. A test pattern is transmitted in the 64 kb/s timeslot and a timer is set running. A loopback is applied to the network equipment to return the test signal. The received pattern stops the timer and the Round Trip Delay is calculated.



NOTE

You can only measure Round Trip Delay on a 64 kb/s test signal obtained from a 34 Mb/s, 8Mb/s or 2 Mb/s DS_n interface or DS_n payload signal.

HOW TO:

- 1 If measuring on an SONET interface, set up the SONET transmit and receive interfaces and payloads required. See "Setting SONET Transmit Interface " page 29 and "Setting SONET Receive Interface" page 46.
- 2 If measuring on a DS_n interface, set up the DS_n transmit and receive interfaces and payloads required. See "Setting PDH/DS_n Transmit Interface (Option 013)" page 26 and "Setting PDH/DS_n Receive Interface" page 44.
- 3 Connect a loopback to the network equipment.
- 4 Choose ACTION **ON** to start the measurement.
If measuring on an SONET interface, the results are available on the **RESULTS**

Making Measurements

Measuring Round Trip Delay

DSn PAYLOAD display.

If measuring on a DSn interface, the results are available on the **RESULTS**

DSn display.

The Round Trip delay measurement range is up to 2 seconds. The resolution varies with the received interface signal rate:

| | |
|--------------|------------------|
| 2 Mb/s | 1 microsecond |
| 8, 34 Mb/s | 110 microseconds |
| STS-1, STS-3 | 0.5 milliseconds |
| OC-12, OC-48 | 0.5 milliseconds |

Monitoring Signaling Bits

Description

The OmniBER 719 receiver can be used to monitor the state of signaling bits in received 2 Mb/s signals with timeslot-16 CAS multiframing (PCM30 or PCM30CRC) and DS1 structured signals.

2.048 Mb/s Results

For 2 Mb/s signals with timeslot-16 CAS multiframing a table showing the values of A,B,C,D signaling bits in all 30 channels is given.

DS1 Results

D4 and SLC-96 payloads

A table simultaneously showing the state of the A and B signaling bits in the 6th and 12th frames of a superframe is given. Each frame contains 24 timeslots. In SLC-96 mode A and B choices are 0, 1 or alternating. If you set bit A or B to alternate, the displayed bit changes to an A, to indicate that the bit is alternating from 1 to 0. The same signaling is transmitted in all channels.

ESF Payloads

A table simultaneously showing the state of the A, B, C and D signaling bits in the 6th, 12th, 18th and 24th frames of a superframe is given. Each frame contains 24 timeslots.

RESULTS DS1 PAYLOAD SIGNAL MONITOR

DS1 ESF ABCD BITS

| TS | ABCD | TS | ABCD | TS | ABCD | TS | ABCD |
|----|------|----|------|----|------|----|------|
| 1 | 1100 | 7 | 1111 | 13 | 1111 | 19 | 1111 |
| 2 | 1111 | 8 | 1111 | 14 | 1111 | 20 | 1111 |
| 3 | 1111 | 9 | 1111 | 15 | 1111 | 21 | 1111 |
| 4 | 1111 | 10 | 1111 | 16 | 1111 | 22 | 1111 |
| 5 | 1111 | 11 | 1111 | 17 | 1111 | 23 | 1111 |
| 6 | 1111 | 12 | 1111 | 18 | 1111 | 24 | 1111 |

STATUS: ERROR SUMMARY CUMULATIVE SHORT TERM ERROR ANALYSIS MORE TERMINATE WINDOW

Measuring Service Disruption Time

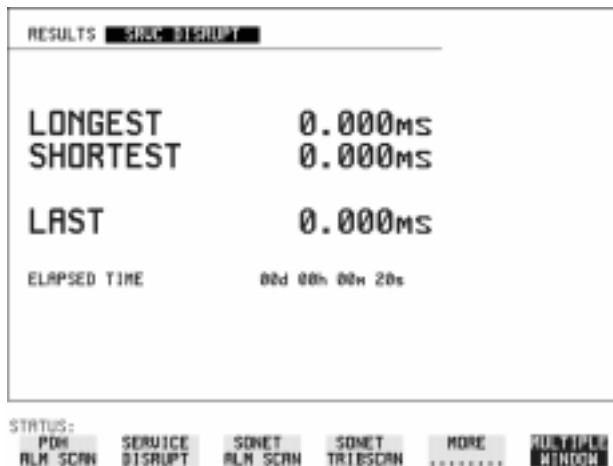
Description:

Protection switching ensures that data integrity is maintained and revenue protected when equipment failure occurs. The speed of operation of the protection switch can be measured.

The sequence of events involved in measuring the switching time is:

- Pattern Synchronization (no errors) is achieved.
- The protection switch is invoked - Pattern Synchronization is lost.
- The standby line is in place - Pattern Synchronization is regained.

The time interval between pattern sync loss and pattern sync gain is a measure of the disruption of service due to protection switching. For information on measuring service disruption on ATM refer to "ATM Service Disruption" page 178 and for POS operation refer to "POS Service Disruption" page 213.



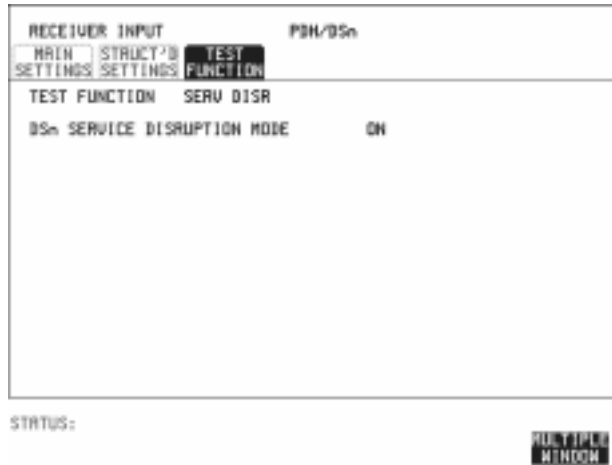
Service Disruption is chosen on the **RESULTS** page except for the following configuration:

- If you choose a DS_n or SONET interface and an ANSI (DS1, DS3) framed, unstructured payload you must select Service Disruption on the Transmitter and

Making Measurements

Measuring Service Disruption Time

Receiver **TEST FUNCTION** display.



NOTE

At DS1 and DS3 Service Disruption results are only available for Unstructured payloads.

Error Burst Definition

Error bursts start and finish with an error. Bursts of less than 10 us are ignored. Bursts are assumed to have completed when >2000ms elapses without any errors being received.

The longest burst detected is 2 seconds.

Accuracy: <= 50us for bulk filled PDH/T-Carrier tributary test signals.

NOTE

Note To measure Service Disruption your instrument must have a PDH/DSn module fitted as the measurement takes place within the PDH/DSn module.

HOW TO:

- 1 If interfacing at SONET set up the SONET transmit and receive interfaces and payloads required. See "Setting SONET Transmit Interface " page 29 and "Setting SONET Receive Interface " page 46.
- 2 If interfacing at DSn set up the DSn transmit and receive interfaces and payloads as required. See "Setting PDH/DSn Transmit Interface (Option 013) " page 26 and "Setting PDH/DSn Receive Interface " page 44.

Making Measurements

Measuring Service Disruption Time

- 3 If you choose a DS1 or DS3 framed unstructured payload, choose **SERVICE DISRUPT** on the **TRANSMIT** and **RECEIVE TEST FUNCTION** displays.
- 4 Press **RUN/STOP** to start the measurement.
- 5 Invoke the protection switch.
- 6 View the results on the **RESULTS** **SRVC DISRUPT** display.

Results Displayed

LONGEST - Longest burst of errors during measurement.

SHORTEST - Shortest burst of errors during measurement.

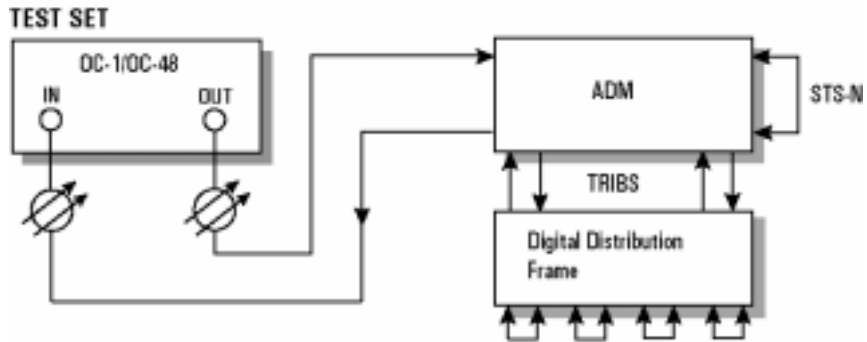
LAST - Length of last burst of errors detected during measurement.

Performing a SONET Tributary Scan

Description

Verifying an ADM Installation

The OmniBER 718'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.



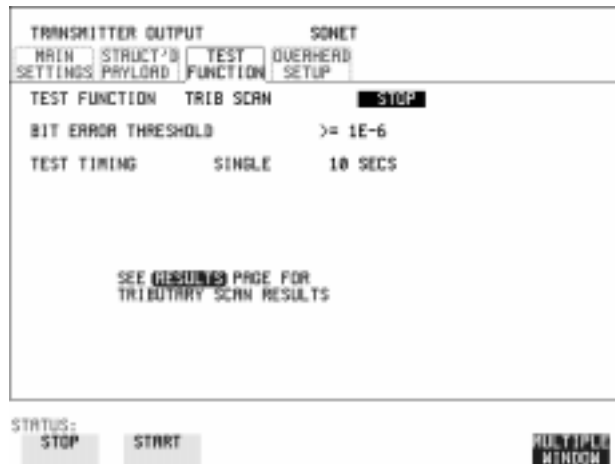
Tributary Scan tests each tributary for error free operation and no occurrence of Pattern Loss. A failure is indicated by highlighting the tributary in which the failure occurred. The **TRANSMIT** **SONET** **MAIN SETTINGS** mapping setup determines the tributary structure. The OmniBER 719 will configure the Transmitter to the Receiver and the PATTERN is forced to the payload it will fill.

TIP:

The SONET Tributary Scan display can be logged to the chosen logging device. See "Logging on Demand " page 243.

Making Measurements

Performing a SONET Tributary Scan



HOW TO:

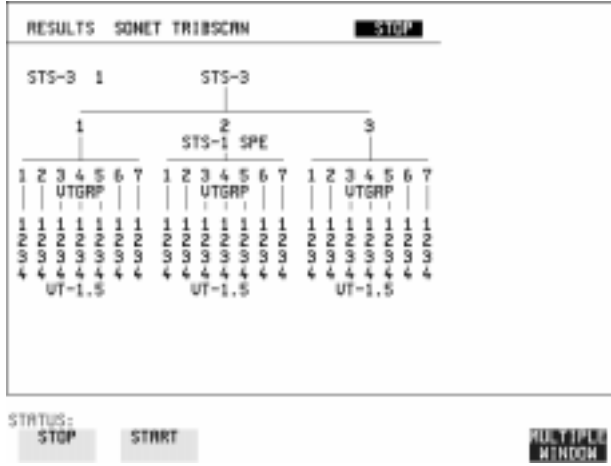
- 1 Set up the transmit and receive SONET interfaces and payload as required. See "Setting SONET Transmit Interface " page 29 and "Setting SONET Receive Interface " page 46.
- 2 Choose the required BIT ERROR THRESHOLD.
This determines the error rate above which a failure is declared.
- 3 Choose the required 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 (see following page).
The Scan can be started on the **TRANSMIT** **SONET** **TEST FUNCTION** display or the **RESULTS** display by choosing START.
If the Scan is started on the **TRANSMIT** **SONET** **TEST FUNCTION** display, the OmniBER 719 changes to the **RESULTS** display.
If a full-bandwidth concatenated payload is selected (e.g. an STS-48c within an OC-48), then Tributary Scan is disabled.

Making Measurements

Performing a SONET Tributary Scan

NOTE

The keyboard is locked during tributary scan.



Making Measurements

Performing a SONET Alarm Scan

Performing a SONET Alarm Scan

Description

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.

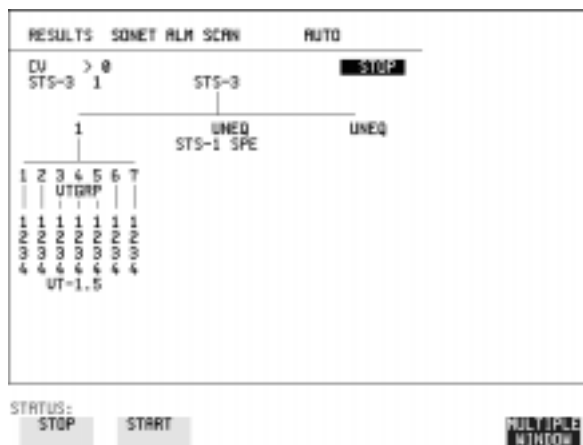
The channel in which an alarm occurred is highlighted if any of the following alarms occur:

STS SPE: LOP-P, RDI-P, AIS-P,

VT-1.5: LOP-P, AIS-P, RDI-P, H4 LOM, 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 243.



HOW TO:

- 1 Set up the receive SONET interface and payload as required. See "Setting SONET Receive Interface" page 46.
- 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.
- 5 Choose **START** to start the Alarm Scan.

Making Measurements
Performing a DS_n Alarm Scan

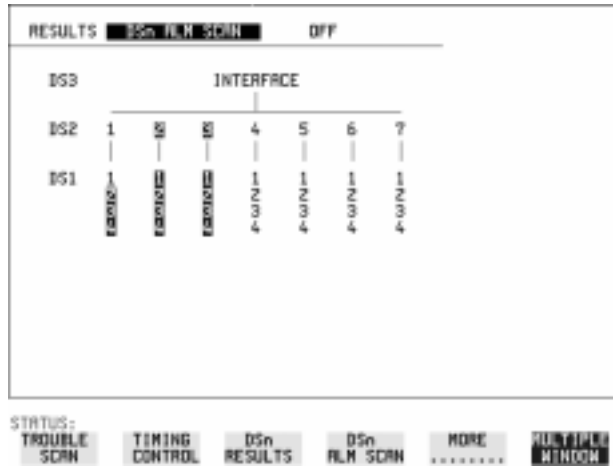
Performing a DS_n Alarm Scan

Description

DS_n Alarm Scan tests each channel for the following alarms:

- Frame Loss
- RAI
- AIS

The channel in which an alarm occurs is highlighted.



HOW TO:

- 1 Set up the receive DS_n interface as required. See “Setting PDH/DS_n Receive Interface” page 44.
- 2 Choose **ON** to start the Alarm Scan.

Measuring Jitter

Description:
Option 200 is required for Jitter operation.

Jitter Measurement Filters

Jitter and error measurements are made simultaneously when a jitter option is fitted.

Cumulative and Short Term results of Jitter Amplitude and Jitter Hits are provided on the **RESULTS JITTER** display.

Graph and Text results for Jitter Transfer and Jitter Tolerance are also provided.

LP, HP1 and HP2 filters to ITU-T O.171 and O.172/BELLCORE GR-499.

| Bit Rate (kb/s) | HP1 (Hz) | HP2 (kHz) | LP (kHz) | HP rms (kHz) |
|-----------------|----------|-----------|----------|--------------|
| 1.544 | 10 | 8 | 40 | 12 |
| 2048 | 20 | 18 | 100 | 12 |
| 8448 | 20 | 80 | 400 | 12 |
| 34368 | 100 | 10 | 800 | 12 |
| 44736 | 10 | 30 | 400 | 12 |
| 51840 | 100 | 20 | 400 | 12 |
| 155520 | 500 | 65 | 1300 | 12 |
| 622080 | 1000 | 250 | 5000 | 12 |
| 2488320 | 5000 | 1000 | 20000 | 12 |

Please note that the instrument measurement bandwidth varies depending on the Receiver Range selected (i.e. the bandwidth is reduced when not on the 1.6 UI range). If you change the Receiver Range selection check the Filter Values displayed at the bottom right of the display meet your measurement requirements.

Rms jitter measurements settling time

If you select a PDH/DSn receiver interface and choose a O.172 /GR-499 Filter on the Receiver Input, Jitter page; please allow approximately 20 seconds settling time before performing a measurement.

Making Measurements

Measuring Jitter

NOTE

To obtain optimum performance while measuring jitter on optical signals ensure the signal optical power level is within the measurement window. See “Measuring Optical Power” page 115.

| RESULTS | JITTER | CUMULATIVE |
|--------------|-----------|-----------------|
| HITS | AMPLITUDE | |
| +VE PEAK | | 0.074UI |
| -VE PEAK | | 0.044UI |
| PEAK-PEAK | | 0.118UI |
| RMS | | 0.009UI |
| FILTERS | | HP2 |
| ELAPSED TIME | | 00d 00h 01m 14s |

STATUS: MULTIPLE WINDOW

HOW TO:

- 1 If measuring Jitter on a DS_n signal, set up the receive DS_n interface and the receive Jitter interface. See “Setting PDH/DS_n Receive Interface” page 44 and “Setting Jitter Receive Interface” page 47.
- 2 If measuring jitter on a SONET Optical signal, check on the **RESULTS** **SONET RESULTS** **OPTICAL POWER** display that the measured optical power level falls within the white portion of the coloured bar. This ensures the accuracy of the Jitter results
- 3 If measuring Jitter on a SONET signal, set up the receive SONET interface and the receive Jitter interface. See “Setting SONET Receive Interface” page 46 and “Setting Jitter Receive Interface” page 47
- 4 If performing a Jitter Tolerance measurement, See “Measuring Jitter Tolerance” page 134. If performing a Jitter Transfer measurement, See “Measuring Jitter Transfer” page 138.
- 5 Press **RUN/STOP** to start the measurement.
- 6 You can view the Jitter hits and Amplitude results on the **RESULTS** **JITTER** display.

Measuring Extended Jitter

Description:
Option 200 required
for Jitter
measurements.

Extended Jitter measurements are made at the upper end of the standard wander frequency range and the lower end of the standard jitter frequency range.

When **EXTENDED** is chosen (on the Receiver Input Jitter page) Jitter results are provided. Cumulative and Short Term results of Jitter Amplitude and Jitter Hits are provided on the **RESULTS** **JITTER** display. The following Table gives the Extended range receiver measurement bandwidth.

| Bit Rate (kb/s) | Range U.I. | Jitter measurement bandwidth* | | | |
|-----------------|------------|---------------------------------------|-----------------------|------------------------|--------------------------------------|
| | | F _L (Hz) lower 3dB point** | F _{MIN} (Hz) | F _{MAX} (kHz) | F _U (kHz) upper 3dB point |
| 1544 | 256 | 0.15 | 1 | 0.2 | 0.25 |
| 2048 | 256 | 0.15 | 1 | 0.2 | 0.25 |
| 8448 | 256 | 0.15 | 1 | 0.2 | 0.625 |
| 34368 | 256 | 0.15 | 1 | 2 | 2.5 |
| 44736 | 256 | 0.15 | 1 | 5 | 6.25 |
| 51840 | 64 | 0.15 | 1 | 20 | 25 |
| 155520 | 64 | 0.15 | 1 | 20 | 25 |
| 622080 | 256 | 0.15 | 1 | 20 | 25 |
| 2488320 | 1024 | 0.15 | 1 | 20 | 20 |

* The measurement accuracy is specified between F_{MIN} and F_{MAX} only.

** Nominal value.

Making Measurements

Measuring Extended Jitter

| RESULTS | JITTER | CUMULATIVE |
|--------------|-----------|-----------------|
| HITS | AMPLITUDE | |
| +VE PEAK | | 0.074UI |
| -VE PEAK | | 0.044UI |
| PEAK-PEAK | | 0.118UI |
| RMS | | 0.009UI |
| FILTERS | | HP2 |
| ELAPSED TIME | | 00d 00h 01m 14s |

STATUS: MULTIPLE WINDOW

HOW TO:

- 1 If measuring Extended Jitter on a DS_n signal, set up the receive DS_n interface and the receive Jitter interface. See "Setting PDH/DS_n Receive Interface" page 44 and "Setting Extended Jitter Receive Interface " page 48.
- 2 If measuring Extended jitter on an SONET Optical signal, check on the **RESULTS** **SONET RESULTS** **OPTICAL POWER** display that the measured optical power level falls within the white portion of the coloured bar. This ensures the accuracy of the Jitter results.
- 3 If measuring Extended Jitter on an SONET signal, set up the receive SONET interface and the receive Jitter interface. See "Setting SONET Receive Interface" page 46 and "Setting Extended Jitter Receive Interface " page 48.
- 4 Press **RUN/STOP** to start the measurement.

Measuring Wander

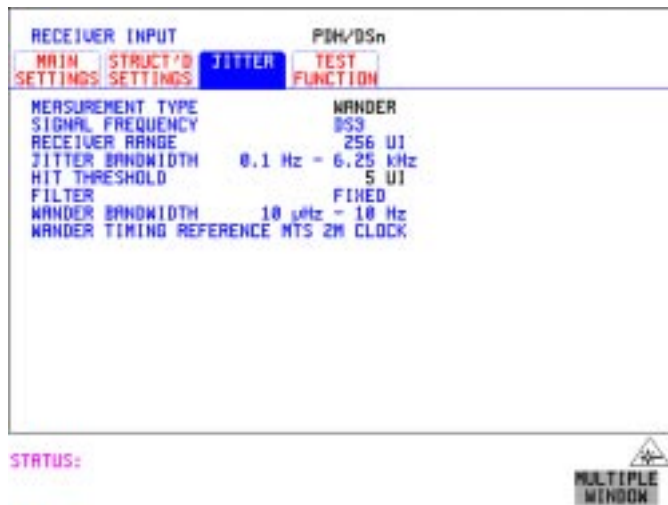
Description:

Wander is defined as the long- term variations of the significant instants of a digital signal from their ideal positions in time, where long-term implies phase oscillations of frequency less than or equal to a demarcation point that is specified for each interface rate. Refer to ANSI T1.102 for the demarcation frequencies for each digital signal.

Accurate Wander measurements require a Wander reference derived from a master timing external source. Connect your external timing source to the appropriate port on the instrument clock module. Wander results are displayed in UI or nanoseconds. Jitter Amplitude and Jitter Hits results are also available.

Problems may arise due to wrongly configured equipment running on internal clocks or at the junction of different operator's network equipment. Since the timing sources may operate at slightly different frequencies and exhibit long term frequency drift, phase difference (Wander) may occur between the incoming data and the network equipment. This causes "Bit Slips" in the network equipment buffers and results in frames being repeated or deleted thus reducing the efficiency of data transfer.

When wander is measured at DS1 or 2 Mb/s, Estimated Bit and Frame slips are calculated and a Bar Graph shows the cumulative Wander over the measurement period.



Making Measurements

Measuring Wander

HOW TO:

Make the Measurement

1 PDH/DSn Operation Wander Reference:

Select the **TRANSMIT** **PDH/DSn** **MAIN SETTINGS** display, and set the CLOCK field to **EXTERNAL**. Choose the CLOCK SOURCE required from the menu provided (i.e. MTS 2M CLOCK/DATA, MTS 64k CLOCK, BITS 1.5Mb/s and 10MHz REF). Connect your external timing source to the appropriate port on the instrument clock module. See “Setting PDH/DSn Transmit Interface (Option 013)” page 26.

2 SONET Operation Wander Reference

Select the **TRANSMIT** **SONET** **MAIN SETTINGS** display. and set the CLOCK field to **EXTERNAL**. Choose the CLOCK SOURCE required from the menu provided (i.e. MTS 2M CLOCK/DATA, MTS 64k CLOCK, BITS 1.5Mb/s and 10MHz REF). Connect your external timing source to the appropriate port on the instrument clock module. See, “Setting SONET Transmit Interface” page 29.

3 If measuring wander at a DS_n rate set up the DS_n receive interface. See, “Setting PDH/DS_n Receive Interface” page 44.

4 If measuring wander on an SONET Optical signal, check on the **RESULTS** **SONET RESULTS** **OPTICAL POWER** display that the measured optical power level falls within the white portion of the coloured bar. This ensures the accuracy of the Wander results.

5 If measuring wander at a SONET rate set up the SONET receive interface. See, “Setting SONET Receive Interface” page 46.

6 Choose MEASUREMENT TYPE **WANDER**.

7 Choose the WANDER HIT THRESHOLD level - if the received wander exceeds the value chosen a wander hit is recorded.

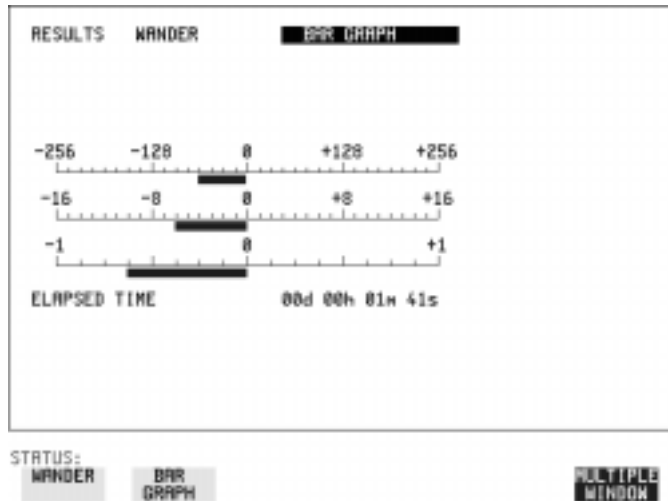
8 Press **RUN/STOP** to start the measurement.

Making Measurements

Measuring Wander

HOW TO:

View the Results



- 1 Choose **WANDER** on the **RESULTS** display and choose the display units required:
 - TIME displays the wander results in nanoseconds.
 - UI displays the wander results in Unit Intervals
 - If you are measuring wander at 2 Mb/s Estimated Bit slips and Estimated Frame slip results are provided and a **GRAPH** choice is added to the menu.
 - If **GRAPH** is chosen the cumulative wander results are displayed in graphical form. The Graphs are additive and in the example shown above the Wander is -76.5 BITS. Graph is only available when a DS1 or 2Mb/s signal is selected.

NOTE

Estimated Bit Slips signify the slippage from the start of the measurement.
One Estimated Frame Slip corresponds to 256 Bit Slips.
Implied Frequency Offset is calculated from the Wander results.

Measuring Jitter Tolerance

Description:
Option 200 is required for Jitter measurement and 013 for PDH/DSn operation.

The jitter auto tolerance feature provides jitter tolerance measurements within the relevant DS1 and DS3 masks taken from BELLCORE GR.499, Category 1 and Category 2 equipment and ITU-T G.824.

SONET masks are taken from BELLCORE GR-253-CORE.

G.823 low and high Q systems are provided for PDH (2, 8, 34 Mb/s) are.

PDH/DSn User Selectable Masks

| Line Rate | GR.499 CAT 1 | GR.499 CAT 2 | G.823 | G.823 High Q | G.823 Low Q | G.824 |
|-----------|--------------|--------------|-------|--------------|-------------|-------|
| 2 Mb/s | | | | √ | √ | |
| 8 Mb/s | | | | √ | √ | |
| 34 Mb/s | | | √ | | | |
| DS1 | √ | √ | | | | √ |
| DS3 | √ | √ | | | | √ |

SONET User Selectable Masks

| Line Rate | GR-253 | G.825 | G.958 Type A | G.958 Type B |
|-----------|--------|-------|--------------|--------------|
| STS-1 | √ | | | |
| STS-3 | √ | √ | √ | √ |
| STS-12 | √ | √ | √ | √ |
| STS-48 | √ | √ | √ | √ |

Jitter is generated at a range of frequencies within the mask and an error measurement is made. If no errors occur (PASS), the jitter amplitude at that frequency point is increased until errors occur (FAIL) or the maximum jitter amplitude is reached. The highest jitter amplitude at which PASS occurs is plotted on the graph as the Jitter Tolerance for that jitter frequency.

Making Measurements

Measuring Jitter Tolerance

User-Programmable Masks

There are 5 user programmable masks provided allowing you to create, edit and title up to 5 jitter masks. Please refer to “To Generate a New Jitter Mask” on page 301 and “To change the parameters of a User Defined Jitter Mask” on page 303 for instructions on how to generate or edit a user programmable mask.

TIP:

The transmitter and receiver can be set to different rates to allow testing across multiplexers, for example transmitter set to STS-3 with embedded DS-3 and receiver set to DS-3.



HOW TO:

Make the Measurement

PDH/DSn Interface

- 1 If you are performing jitter tolerance on the DS_n signal, set up the DS_n transmit and receive interfaces, including the test PATTERN. See “Setting PDH/DS_n Transmit Interface (Option 013)” page 26 and “Setting PDH/DS_n Receive Interface” page 44.
- 2 If you have chosen a PDH/DS_n interface now select the JITTER page and select AUTO TOLERANCE and a MASK (see display above). Proceed to step 6.

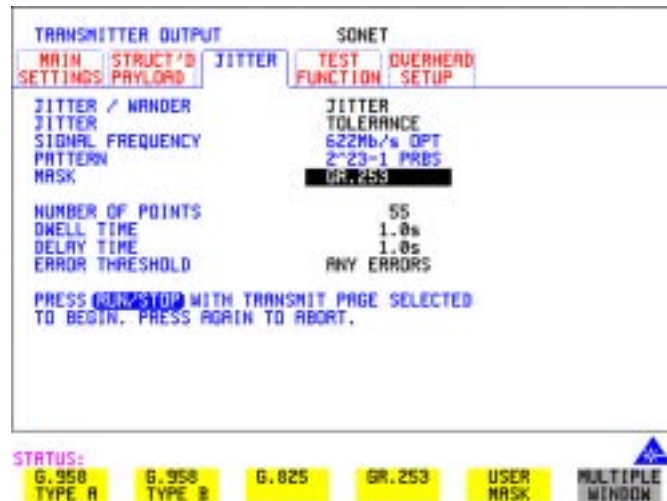
SONET Interface

- 3 If you are performing jitter tolerance on an SONET Optical signal, check on the **RESULTS** **SONET RESULTS** **OPTICAL POWER** display that the measured optical power level falls within the white portion of the coloured bar. This ensures the accuracy of the Jitter results.

Making Measurements

Measuring Jitter Tolerance

- 4 If you are performing jitter tolerance on the SONET signal, set up the SONET transmit and receive interfaces, including the required test PATTERN. See “Setting SONET Transmit Interface” page 29 and “Setting SONET Receive Interface” page 46.



- 5 If you have chosen a SONET interface now select the JITTER page and select AUTO TOLERANCE and a MASK (see display above).

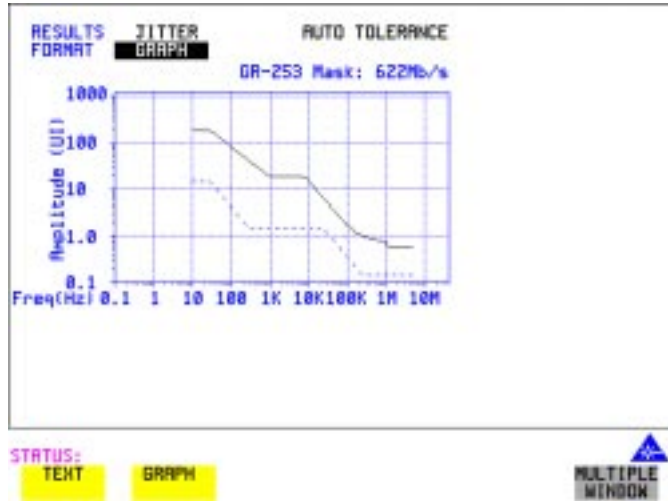
Steps common to PDH/DSn and SONET operation

- 6 Choose the NUMBER OF POINTS at which jitter is transmitted (3 to 55)
- 7 Choose the DWELL TIME - the time jitter is generated at each jitter frequency point (0.1 to 99.9 seconds).
- 8 Choose the DELAY TIME - the time delay between the jitter frequency/ amplitude being applied and the error measurement being made. This allows the network equipment to settle as jitter frequency is changed. (0.1 to 99.9 seconds).
- 9 Choose the ERROR THRESHOLD.
If ANY ERRORS is chosen, any BIP or BIT error will result in a FAIL.
If BIT ERRORS is chosen, choose a value between 1 and 1,000,000 to determine the bit error threshold for the jitter tolerance PASS/FAIL decision.
BER>= shows the bit error ratio calculated from the bit error threshold choice and the dwell time choice.
- 10 Press **RUN/STOP** to start the jitter auto tolerance measurement.

Making Measurements

Measuring Jitter Tolerance

The measurements progress can be monitored on the **TRANSMIT** display. At the end of the test the results can be viewed on the **TRANSMIT** or **RESULTS** displays. The **TRANSMIT** display is cleared when **TRANSMIT** is pressed but the results remain on the **RESULTS** display until the next jitter tolerance measurement is made.



HOW TO:

View the Results

- 1 Choose the results FORMAT.

If **GRAPH** is chosen, a plot of the jitter tolerance results against the ITU-T mask is displayed.

If **TEXT** is chosen, the results from which the graph is constructed are displayed, Point number, Frequency, Mask amplitude, Tolerance, Result.

If applicable, points 13 through 55 can be viewed on pages 2 through 5.

If you wish to log the jitter tolerance results to a printer, See “Logging Jitter Tolerance Results” page 247.

Measuring Jitter Transfer

Description:

Perform vital jitter transfer (gain) measurements using the OmniBER 719. With the OmniBER 719 you can perform Jitter transfer measurements at DS1, DS3 and each of the PDH rates 2, 8 and 34 Mb/s, and also STS-1, STS-3, OC-1, OC-3, OC-12 and OC-48.

Jitter transfer defines the ratio of output jitter amplitude to input jitter amplitude versus jitter frequency for a given bit rate. In network equipment some of the jitter present at the input port of a regenerator will be transmitted to the output port. On networks with cascaded equipment on long trunk routes it is important to limit jitter transfer.

The jitter generator provides the stimulus for the jitter transfer measurement. Narrow band filtering is used in the jitter receiver thus allowing selection and measurement of the relevant jitter components to provide accurate and repeatable results.

The jitter transfer results are presented in graphical and tabular form. Graphical results are plotted as Gain V Frequency. The relevant Pass Mask for PDH/DSn or SONET is also displayed on the graph. Please refer to the OmniBER 719 Specifications book provided with your instrument for detailed information on Jitter Transfer input and pass masks.

NOTE

1. The Transmitter and Receiver must be set to the same interface rate.

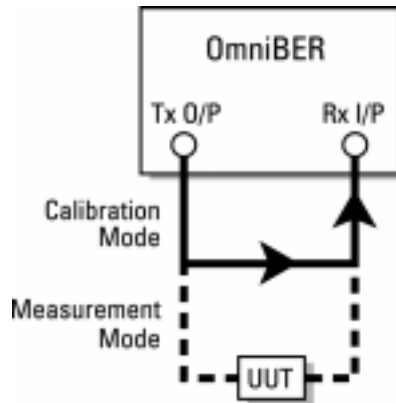
HOW TO:

Achieve the required accuracy:

- 1 The OmniBER 718 must be connected back to back in order to perform a calibration cycle before making a Jitter Transfer measurement (see figure on next page). Use an optical attenuator to keep optical power at optimum level if you are performing tests on optical signals.

Making Measurements

Measuring Jitter Transfer



- 2 The OmniBER 719 must have been switched on for 1 hour before starting a calibration cycle.
- 3 The climatic conditions must remain stable from switch-on to end of measurement.
- 4 The Jitter Transfer measurement must be started within 10 minutes of completion of the Calibration.
- 5 If maximum Delay time, maximum Dwell time and maximum number of Points is selected, the accuracy specification cannot be guaranteed as the time from start of calibration to end of measurement (test period) will be approximately two hours. It is recommended that the maximum test period does not exceed 90 minutes.

The total Test Period is equal to the Calibration period plus the Measurement period. Both Calibration and Measurement periods are identical and are equal to the following: (Delay Time + Dwell Time + 5 Seconds) X Number of Points.

The Test Period is therefore (Delay Time + Dwell Time + 5 Seconds) X Number of Points X 2.

Making Measurements

Measuring Jitter Transfer

NOTE

For best results, a Dwell Time of 20 seconds and a Delay Time of 10 seconds, are recommended.



HOW TO:

Perform Jitter Transfer Calibration

NOTE

If a PDH/DSn interface is selected the CALIBRATION should always be carried out with LEVEL **TERMINATE** selected on the **RECEIVE MAIN SETTINGS** display.

- 1 If DSn Jitter Transfer is required, set up the DSn transmit and receive interfaces, the receive jitter interface and connect DSn IN to DSn OUT. See “Setting PDH/DSn Transmit Interface (Option 013)” page 26, “Setting PDH/DSn Receive Interface” page 44 and “Setting Jitter Receive Interface” page 47.
- 2 If you are performing jitter transfer on an SONET Optical signal, check on the **RESULTS SONET RESULTS OPTICAL POWER** display that the measured optical power level falls within the white portion of the coloured bar. This ensures the accuracy of the Jitter results.
- 3 If OC-3, OC-12 or OC-48 Optical Jitter Transfer is required, set up the SONET transmit and receive interfaces, the receive jitter interface and connect the OUT port of the Optical module to the IN port of the Optical module. See “Setting SONET Transmit Interface” page 29, “Setting SONET Receive Interface” page 46 and “Setting Jitter Receive Interface” page 47.

Making Measurements

Measuring Jitter Transfer

CAUTION

If OC-3/12/48 SONET Jitter Transfer is required, a 15 dB attenuator must be connected between the IN and OUT ports of the Optical module.

4 If you wish to measure STS-1 or STS-3 electrical jitter transfer, set up the SONET transmit/ receive interfaces and the receive jitter interface and connect IN port to OUT port on the SDH module. See “Setting SONET Transmit Interface” page 29, “Setting SONET Receive Interface” page 46 and “Setting Jitter Receive Interface” page 47.

5 Choose JITTER **TRANSFER FUNCTION** on the **TRANSMIT** **JITTER** display.

6 Choose the INPUT MASK.

SONET operation

If measuring SONET jitter transfer, the BELLCORE GR-253 mask can be High or Low. You can also select from 1 of 5 user programmable jitter masks see (**USER**) paragraph below.

GR-253 Low masks cover the lower frequency band.

GR-253 High masks cover the upper frequency band.

PDH/DSn operation

At DS1 and DS3, G.824 and GR.499 Cat1 and GR.499 Cat2 are provided.

If measuring PDH jitter transfer at 2 Mb/s or 8 Mb/s a Q Factor choice is provided (G.823, High Q and G.823 Low Q). Your Q Factor choice should match the network equipment regenerator Q Factor.

At 34 Mb/s a G.823 jitter transfer input mask is offered.

If **USER** is chosen, choose the mask jitter frequencies, F1, F2, F3 and F4, and mask jitter amplitudes A1 and A2, see “To change the parameters of a User-defined jitter mask” page 303 for instructions on how to change the parameters of a user mask and “To Generate a New Jitter Mask” on page 301.

7 Choose the NUMBER OF POINTS at which jitter is transmitted (1 to 55)

8 Choose the DELAY TIME - the time delay between the jitter frequency/ amplitude being applied and the error measurement being made. This allows the network equipment to settle as jitter frequency is changed (5 to 30 seconds).

9 Choose the DWELL TIME - the Dwell Time is the test period spent at each amplitude/frequency point (5 to 30 seconds). The result recorded is the maximum peak-to-peak jitter detected during the Dwell Time test period.

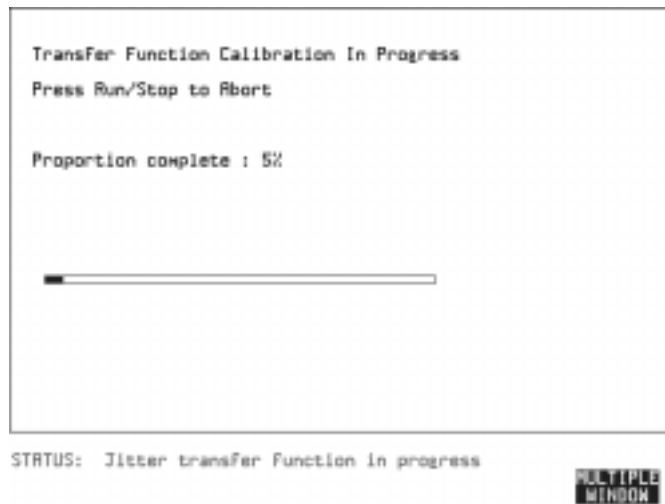
10 Select a PASS MASK if a choice is given.

Making Measurements

Measuring Jitter Transfer

Pass Mask Offset

- 11 An offset in the range -2.00 dB to +2.00 dB in steps of 0.01 dB can be added to the selected Pass Mask. Select PASS MASK OFFSET and use the edit keys to select an offset. Select **END EDIT** when finished selecting an offset.
- 12 With MODE set to **CALIB** press **RUN/STOP** to start the calibration. The Jitter Transfer display is replaced by an information display for the duration of the Calibration.
A bar graph showing the progress of the calibration will appear on the display. When the Calibration is complete, the display will revert to the **TRANSMIT JITTER** display.



HOW TO:

Start the Jitter Transfer Measurement

NOTE

The Jitter Transfer measurement must be started within 10 minutes of the completion of calibration.

- 1 After the CALIBRATION is completed, remove the back to back connection from the DS_n or SONET or optical interfaces and connect to the system under test.
If the measurement is to be made at a network equipment monitor point, choose **MONITOR** on the DS_n or SONET **RECEIVE MAIN SETTINGS** display before making the jitter transfer measurement.

Making Measurements

Measuring Jitter Transfer

- Choose MODE **MEASURE** on the **TRANSMIT** **JITTER** display and press **RUN/STOP**.
The measurement's progress can be monitored on the **TRANSMIT** display.

HOW TO:

View the Results

- Select **RESULTS**, **JITTER** and **TRANSFER FN**, then choose the results FORMAT.
If **GRAPH** is chosen, a plot of the jitter transfer results against the ITU-T mask is displayed.
If **TEXT** is chosen, the results from which the graph is constructed are displayed:
Point number, Frequency, Mask amplitude (dB), Jitter Gain (dB), Result.
If applicable, points 13 through 55 can be viewed on pages 2 through 5.

| Pt | Frequency | Ampl | Mask(dB) | Gain(dB) | Result |
|----|-----------|------|----------|----------|--------|
| 34 | 6491 | 0.46 | -36.15 | 0.00 | FAIL |
| 35 | 7899 | 0.38 | -37.05 | 0.00 | FAIL |
| 36 | 9612 | 0.31 | -39.55 | 0.01 | FAIL |
| 37 | 11696 | 0.26 | -41.25 | 0.00 | FAIL |
| 38 | 14291 | 0.21 | -42.94 | 0.00 | FAIL |
| 39 | 17317 | 0.17 | N/A | 0.01 | PASS |
| 40 | 21072 | 0.14 | N/A | 0.02 | PASS |
| 41 | 25640 | 0.12 | N/A | 0.01 | PASS |
| 42 | 31200 | 0.10 | N/A | 0.01 | PASS |
| 43 | 37964 | 0.10 | N/A | 0.00 | PASS |
| 44 | 46195 | 0.10 | N/A | 0.00 | PASS |
| 45 | 56211 | 0.10 | N/A | 0.00 | PASS |

- If **GRAPH** is chosen, choose the SCALE required.
WIDE provides a vertical axis range of +5 to -60 dB and is recommended for viewing the high frequency portion of the graph. This allows a clearer view of the difference between the actual result and the ITU-T pass mask.
NARROW provides a vertical axis range of +3 to -3 dB and is recommended for viewing the low frequency portion of the graph. This allows a clearer view of the difference between the actual result and the ITU-T pass mask.

Making Measurements

Measuring Jitter Transfer



- 3 If you wish to log the jitter tolerance results to a printer, See “Logging Jitter Transfer Results” page 249.

Measuring Pointer Adjustment (Tributary) Jitter

Introduction

During the transition from a DS_n network to mixed DS_n/SONET networks new sources of jitter emerge, caused by the mapping process and network synchronization problems. This new jitter may result in pointer adjustments which in turn cause tributary jitter at the DS_n output ports of the network element.

Pointer Adjustment Jitter

Jitter resulting from pointer adjustments is transient in nature, relatively high in amplitude, and most of the energy is contained in low frequency components.

GR.253 CORE recommendations define a set of pointer sequences when evaluating NE's pointer adjustment jitter performance. These sequences are designed to emulate the pointer activity that results from incorrect synchronization within a network element.

The OmniBER Transmitter can generate the test sequences recommended by ANSI T1.105.03, BELLCORE GR-253-CORE and ITU-T G.783. Use these sequences to stress the system under test for correct levels of tributary jitter.

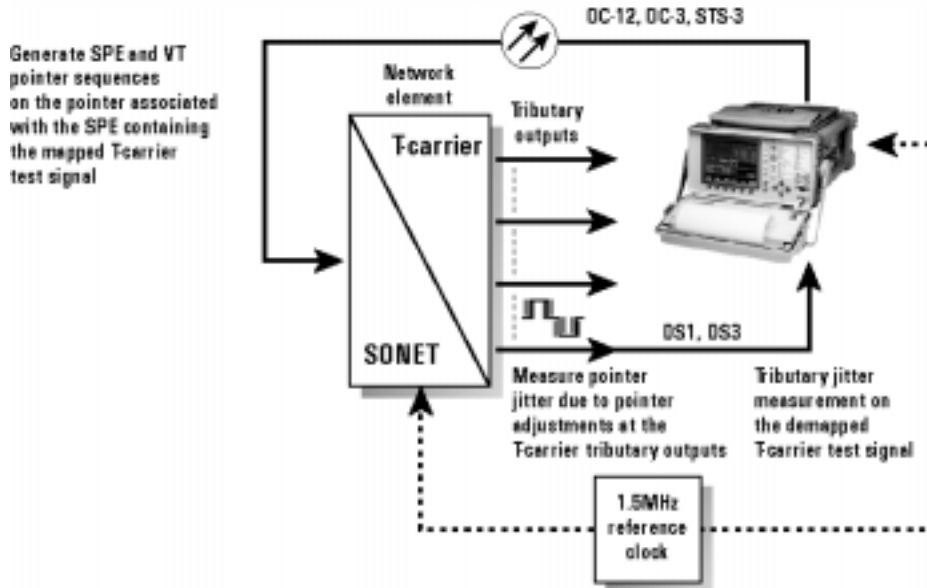
Refer to "Adding Pointer Adjustments" on page 85 for instructions on how to add pointer adjustments and detailed explanations of the pointer sequences provided by the OmniBER.

Making Measurements
Measuring Pointer Adjustment (Tributary) Jitter

I BELLCORE GR-253/T1.105.03 Jitter Specification

| Payload | Pointer | Sequence | Measurement bandwidth | Max. Jitter (UI p-p) |
|----------|-----------|----------------------------|--|----------------------|
| 1.5 Mb/s | VT 1.5 | E, F | 0.01 to 40 kHz* | 1.5 |
| 2 Mb/s | VT 2 | A, B, C A, B, C | 0.02 to 100 kHz * 18 to 100 kHz ** | 0.4 0.075 |
| 34 Mb/s | STS-1 SPE | A, B, C D A, B, C, D | 0.1 to 800 kHz * 0.1 to 800 kHz * 10 to 800 kHz ** | 0.4 0.75 0.075 |
| 45 Mb/s | STS-1 SPE | E, F, G, H | Note 1. | Note 1. |

*denotes LP + HP1 filters. ** Denotes LP + HP2 filters;
 Note 1 These values are for further study by ITU-T.



Typical tributary jitter test setup

HOW TO:

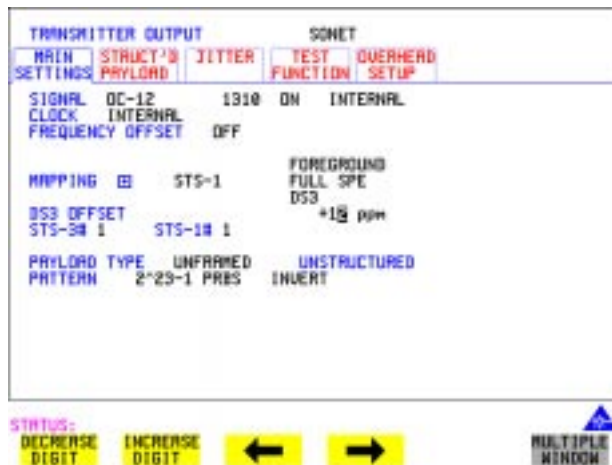
- 1 Connect the OmniBER to the Network Element as shown in the previous Figure. Ensure the OmniBER and the NE are synchronized.
- 2 Select the **OTHER SETTINGS CONTROL** page and choose TRANSMITTER

Making Measurements

Measuring Pointer Adjustment (Tributary) Jitter

AND RECEIVER **INDEPENDENT**.

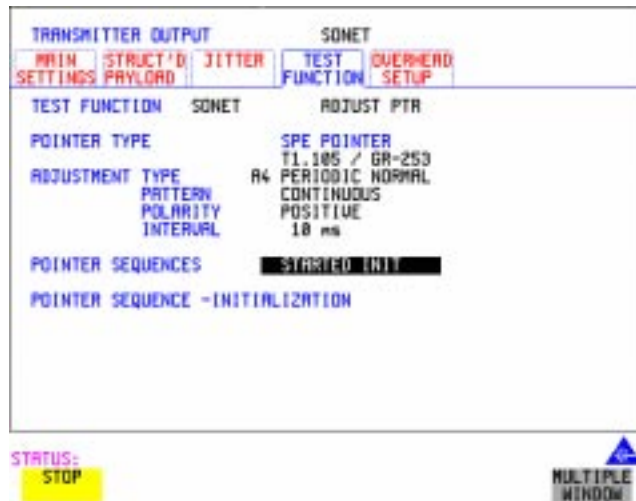
- 3 Select **RECEIVE**, **MAIN SETTINGS**, **PDH/DSn** and select a PDH/DSn SIGNAL rate (DS1, DS3, 34, 8 or 2 Mb/s).
- 4 On the same page set the required test pattern from the PATTERN field.
- 5 On the **TRANSMIT**, **SONET**, **MAIN SETTINGS** page select a SIGNAL rate (the rates available depend on the options fitted to your instrument). In this example we have selected OC-48.
- 6 On the same page, now set the Transmitter DSn payload offset (DS3 OFFSET field in figure below) to any in-range value.



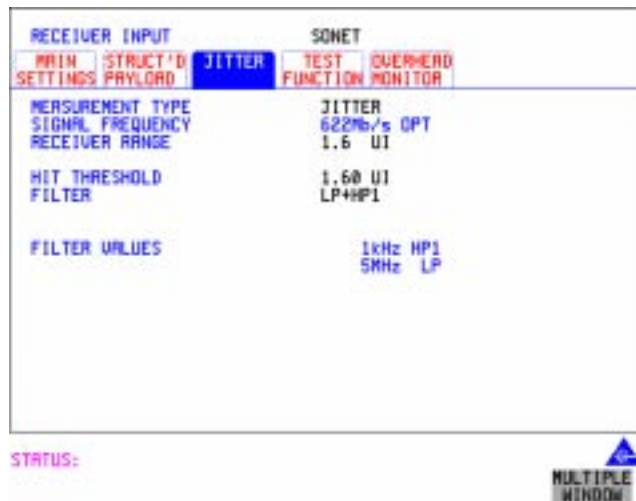
- 7 Select **TRANSMIT**, **SONET**, **TEST FUNCTION**, then select **SONET ADJUST PTR**.
- 8 Setup and run pointer sequence A (see page 85 for information on the pointer sequences available). When the pointer sequence initialization and cool-down periods are finished and the display indicates "POINTER SEQUENCE - IN PROGRESS" proceed to step 9.

Making Measurements

Measuring Pointer Adjustment (Tributary) Jitter



- 9 Select **RESULTS**, **TIMING CONTROL** and set TEST TIMING to **SINGLE** and a period of 20 seconds.
- 10 Set the jitter measurement range to 1.6 UI and measurement filter to LP+HP1, as shown below.
- 11 Press **RUN/STOP** to start the measurement.



- 12 Verify that no alarms or errors are detected by the OmniBER receiver.

Making Measurements

Measuring Pointer Adjustment (Tributary) Jitter

- 13** Set the **RESULTS**, **JITTER** page to **CUMULATIVE** and AMPLITUDE.
- 14** Measure and record peak-to-peak jitter from ten consecutive measurement periods.
- 15** Change the filter setting to LP+HP2, and repeat step 13.
- 16** Repeat the above procedure for pointer sequences B, C, D, E, F and G as required.

Making Measurements

Measuring Pointer Adjustment (Tributary) Jitter

| | |
|--|----------|
| "Setting up the Transmitter for ATM Payloads " | page 152 |
| "Setting up the Convergence Sublayer " | page 155 |
| "Setting Foreground Traffic " | page 157 |
| "Transmitting ATM Alarms " | page 163 |
| "Adding ATM Errors " | page 165 |
| "Viewing ATM Results " | page 167 |
| "Setting up the Receiver for ATM Payloads " | page 168 |
| "Setting up the Receiver ATM signal " | page 170 |
| "Policing ATM Traffic " | page 172 |
| "Measuring ATM Delay Performance " | page 174 |
| "Measuring ATM Alarms " | page 177 |
| "ATM Service Disruption " | page 178 |

ATM Operation

For ATM operation you must have option 300, 301 or 302 installed. Option 300 offers ATM up to 2.5 Gb/s, option 301 ATM to 622 Mb/s and option 302 ATM to 155 Mb/s. Note that ATM option rates are not linked to maximum rate of instrument, for example, option 302 155 Mb/s can be ordered for a 2.5Gb/s instrument.

ATM Operation

Setting up the Transmitter for ATM Payloads

Setting up the Transmitter for ATM Payloads

Description

The transmitter rate and mapping can be set up to match the requirements of the ATM network under test. Select a SONET rate from STS-1 to OC-48 or a DS_n rate of DS-3 or DS-1.

TIP

To set the Transmitter and Receiver to the same interface settings choose **OTHER SETTINGS CONTROL COUPLED**.

NOTE

For ATM in PDH/DS_n you must select ATM in the Receiver before it can be selected in the Transmitter (unless the instrument is coupled).

Note ATM Mappings are performed using ITU-T Recommendation G.707 and G.804 and ATM Forum physical layer specifications.



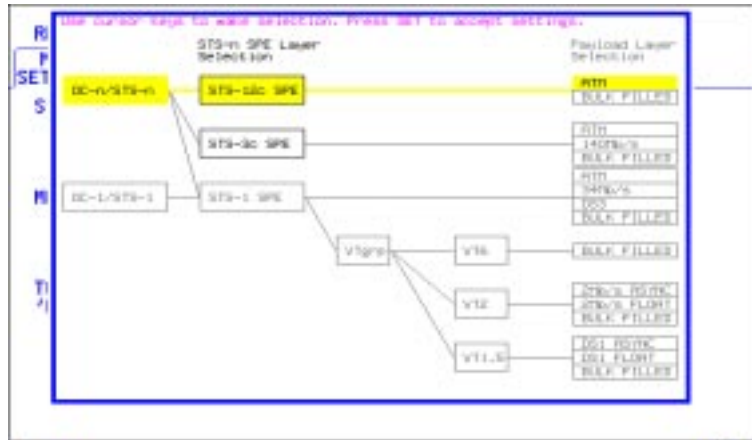
How to

- 1 On the **TRANSMIT** page select from **PDH/DS_n** or **SONET**.
- 2 Select the SIGNAL rate. (If you selected a PDH/DS_n interface and have not coupled the Transmitter and Receiver, have you selected ATM in the Receiver first?).
- 3 Select required MAPPING and then select **ATM**.

ATM Operation

Setting up the Transmitter for ATM Payloads

Use **SET** to bring up the popup application diagram (only applies to SONET mapping). This allows an alternative way of selecting the appropriate mapping.



ATM Operation
Setting up the Transmitter for ATM Payloads

Table 4

ATM availability with PDH/DSn and SONET Signal Rates and Framing

| Signal Rate | Framing Type | Is ATM available? |
|--------------------|--|--------------------------|
| DS3 | CBIT M13 | yes no |
| DS1 | ESF D4 SLC96 | yes no no |
| 2 Mb/s | PCM30 PCM30CRC PCM31 PCM31CRC | yes yes no no |
| 8Mb/s | ----- | no |
| 34 Mb/s | G.832 Framed | yes no |
| SONET | ATM is available into all SPE mappings, but not into a VT structure. | |

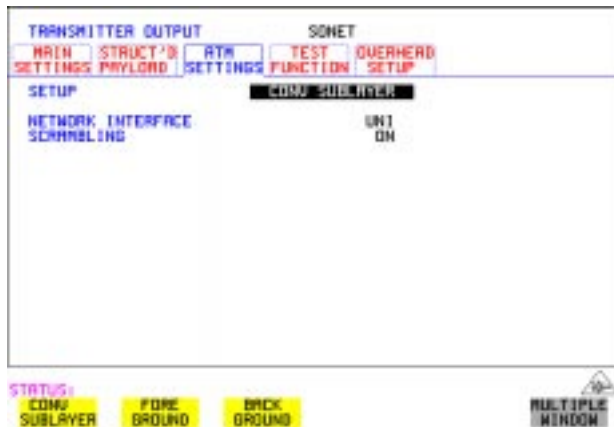
Setting up the Convergence Sublayer

Description

Setting up the Convergence Sublayer allows the test signal to be set to suit the ATM network under test.

How to

- 1 Set up the Transmitter for ATM in the MAIN SETTINGS folder (See "Setting up the Transmitter for ATM Payloads " page 152").
- 2 Select the **ATM SETTINGS** folder.



- 3 Select SETUP as required.
- 4 If **CONV SUBLAYER** is selected then the NETWORK INTERFACE can be selected as **UNI** or **NNI** and the SCRAMBLING can be turned on or off. For most applications ATM scrambling should be left on. If a DS3 interface and CBIT framing is selected an additional field CONVERGENCE SUBLAYER can be set to **DIRECT** or **PLCP**.

Network Interface

The cell header format used at the User Network Interface (UNI) and Network Node Interface (NNI) differs. The UNI has a Generic Flow Control field which can be used for Media Access Control (MAC) functions to transmit cells over shared media systems, while the NNI uses these four extra bits for extra path addressing.

ATM Operation
Setting up the Convergence Sublayer

Cell Header at UNI

| Bits | | | | | | | | |
|------|---|---|---|-----|---|-----|---|-------|
| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | Bytes |
| GFC | | | | VPI | | | | 1 |
| VPI | | | | VCI | | | | 2 |
| VCI | | | | | | | | 3 |
| VCI | | | | PTI | | CLP | | 4 |
| HEC | | | | | | | | 5 |

Cell Header at NNI

| Bits | | | | | | | | |
|------|---|---|---|-----|---|-----|---|-------|
| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | Bytes |
| VPI | | | | | | | | 1 |
| VPI | | | | VCI | | | | 2 |
| VCI | | | | | | | | 3 |
| VCI | | | | PTI | | CLP | | 4 |
| HEC | | | | | | | | 5 |

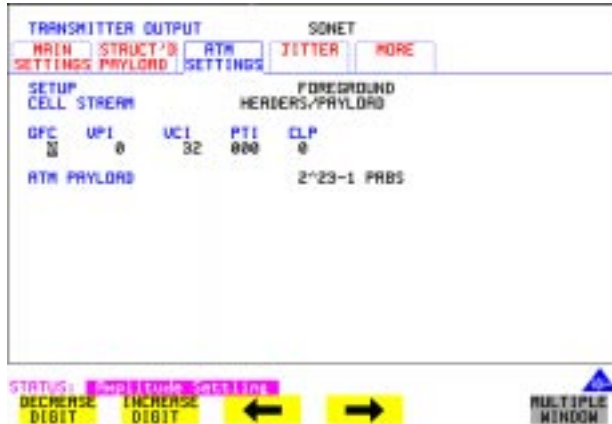
GFC - Generic Flow Control
VPI - Virtual Path Identifier
VCI - Virtual Channel Identifier
PTI - Payload Type
CLP - Cell Loss Priority
HEC - Header Error Control

Setting Foreground Traffic

Description

There are one foreground and seven background ATM channels available for testing. The backgrounds are used to simulate real traffic which can be routed differently to the foreground channel. The foreground is the test channel you use to stress the system under test.

Refer to page 159 for a description of how to set up background traffic. The relative distribution of background and foreground is described on page 160.



How To

Foreground Setup

- 1 Set up the Transmitter for ATM in the MAIN SETTINGS folder (See "Setting up the Transmitter for ATM Payloads " page 152").
- 2 Select **TRANSMIT** and the **ATM SETTINGS** folder as shown above, and set the SETUP field to **FOREGROUND**. Set the ATM header as required using the cursor keys.
- 3 Select an ATM Payload from the choices offered.
To make a range of error measurements on your connection, select **TEST CELL** as the payload in the transmitter and the receiver. This allows the measurement of cell errors, cell loss, cell misinsertion and cell delay simultaneously. For a simple BER measurement you can select **PRBS** or **USER** byte. When making a jitter tolerance measurement, select **PRBS**.

ATM Operation
Setting Foreground Traffic

What is a test cell? Simultaneous measurement of all ATM performance parameters can be made using a special-purpose test cell. The test cell is described in ITU 0.191. The cell payload consists of a 4-byte sequence number (SN) which is used to detect lost or misinserted cells, a 4-byte timestamp (TS) which is used for cell delay and CDV measurements, a 1-byte test cell payload type (TCPT) and a 2-byte CRC-16 which is used for error detection and protection of the sequence number and timestamp.

An example of the test cell is given below.

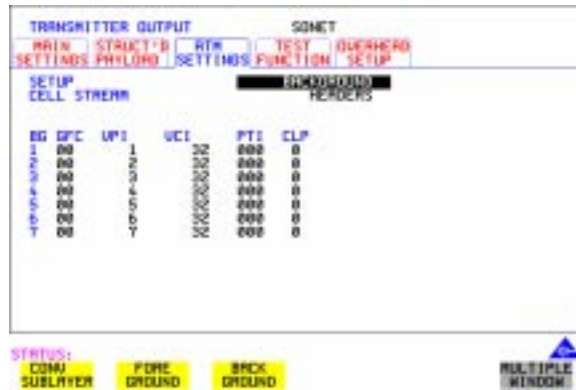
Test Cell

| | | | | | |
|-------------------|---------------|---------------|--------------------|----------------|-------------------|
| header 5 bytes | SN 4 bytes | TS 4 bytes | Unused 37 bytes | TCPT 1 byte | CRC-16 2 bytes |
|-------------------|---------------|---------------|--------------------|----------------|-------------------|

Setting Background Traffic

Description

You can select up to seven background channels which can be used to represent typical ATM traffic. The background channels are non-test channels and are used to fully load the element under test.



How To

- 1 Set the SETUP field to **BACKGROUND**.
- 2 Set CELL STREAM to **HEADERS** and set up the Background Headers as required, using the cursor keys to navigate through the header fields.

Setting Foreground and Background Distributions

Description

The ATM Forum has defined the following Service Categories:

- Constant Bit Rate (CBR)
- Variable Bit rate (VBR)
- Unspecified Bit Rate (UBR)
- Available Bit Rate (ABR)

Data carried within each of these Service Categories will be policed within the network to ensure that the traffic does not exceed the bandwidth negotiated. This ensures that the quality of service can be met and that other traffic is not degraded.

In the OmniBER the distribution of the ATM cells in the data stream can be set up to give CBR, VBR and single burst to simulate typical ATM traffic. Note that Background distributions are CBR. You can select the transmit cell rate in steps of 1 cell per second up to the maximum cell rate, giving you precise and accurate cell rates for performance tests and verifying ATM policing functions.

Because UBR is policed in a similar manner to CBR, a CBR signal can be used to represent UBR data. In ABR, dynamic control of the signal bandwidth is provided by resource management cells. However, a limited error performance test may be performed using a fixed bandwidth CBR signal.



ATM Operation

Setting Foreground and Background Distributions

Setting up foreground

How to

- 1 Set up the Transmitter for ATM (See "Setting up the Transmitter for ATM Payloads " page 152).
- 2 In the **ATM SETTINGS** folder select SETUP as **FOREGROUND**, CELL STREAM as **DISTRIBUTION** and then the traffic parameters for the Virtual Channel (VC) under test can be set up.
- 3 **Service Selections:**
For Constant Bit Rate (CBR) traffic, select the PEAK CELL RATE and CDV tolerance.
For Variable Bit Rate (VBR) traffic, select the SUSTAINABLE CELL RATE, PEAK CELL RATE, MAXIMUM BURST SIZE and CDV tolerance. The OmniBER then automatically generates worst case user traffic for the VC under test using the 0.191 enhanced traffic generator algorithm.
For error performance measurement, set the CDV tolerance value to its minimum value.
Select SINGLE BURST to transmit a burst of cells at the selected cell rate.

NOTE

The CDV tolerance value cannot be set to zero. The minimum value reflects the inherent CDV that is generated due to the segmentation and mapping of the ATM cell stream into the physical interface.

To fully stress the policing functions of the VC under test, the CDV tolerance can be set to the value used in the policing function.

Peak Cell Rate

For CBR, the peak cell rate is the average rate at which cells will be transmitted. Because the selected cell rate is implemented by a series of discrete cell events, for arithmetical reasons there will be some unavoidable deviation from ideal periodic timing. This effect is small.

Cell Delay Variation Tolerance (CDVT)

The transmitter will generate a signal which has a cell delay variation as set by the user in order to test a receiver's cell delay variation tolerance.

Sustainable Cell Rate

For VBR, this is the long term average cell rate being transmitted.

ATM Operation

Setting Foreground and Background Distributions

Burst Size

This is the number of cells transmitted at the peak cell rate, a value which may vary from the number chosen due to cell delay variation.

Setting up background

How To

- 1 Selecting the SETUP as **BACKGROUND** and CELL STREAM as **PAYLOAD/DISTRIBUTION** allows the 7 backgrounds to be set up. The payload can be set up as an 8-bit user-selectable pattern for each background. The number of cells per second on each background can also be set. This is limited by the bandwidth which is occupied by the foreground. Setting a unique value in the payload byte for each background can help you to trace and identify cell streams later.

| BACKGROUND | CELL STREAM | PAYLOAD | CELLS/PS | KBITS/PS |
|------------|-------------|---------|----------|----------|
| 1 | 00000001 | | 0 | 0 |
| 2 | 00000010 | | 0 | 0 |
| 3 | 00000011 | | 0 | 0 |
| 4 | 00000100 | | 0 | 0 |
| 5 | 00000101 | | 0 | 0 |
| 6 | 00000110 | | 0 | 0 |
| 7 | 00000111 | | 0 | 0 |
| FILL | IDLE | | ZIN | 0.1 |

Note

If there is any extra bandwidth left over after the foreground and background are filled with FILL CELLS, you can select between IDLE or UNASSIGNED Cells to fill the remaining cells.

Transmitting ATM Alarms

Description

You can generate VP and VC AIS and RDI alarms to verify the response of the ATM Network under test, and also generate VP and VC Continuity check cells to keep the circuit alive during bursty traffic conditions.

Types of alarms available are: VP-AIS, VP-RDI, VP-CC, VC-AIS, VC-RDI and VC-CC. The following tables show the expected responses of ATM VP and VC switches to input conditions.

Downstream Alarms

| Stimulus | Response: VP switch | Response: VC switch |
|------------------|---------------------|---------------------|
| LOS, LOF, LOP | VP-AIS | VC-AIS |
| MS-AIS, Path AIS | VP-AIS | VC-AIS |
| LCD | VP-AIS | VC-AIS |
| VP-LOC | VP-AIS | VC-AIS |
| VP-AIS | VP-AIS | VC-AIS |
| VC-LOC | none | VC-AIS |
| VC-AIS | none | VC-AIS |

Upstream Alarms

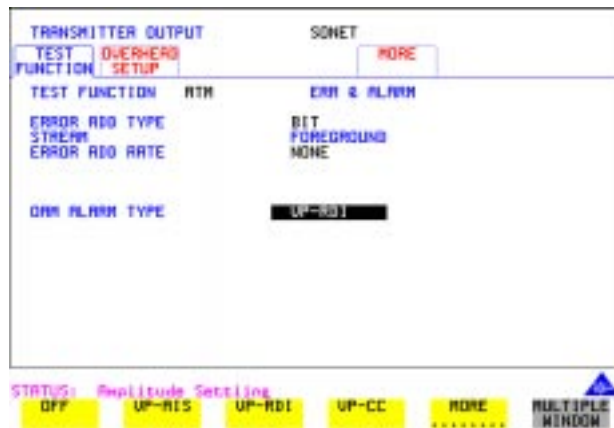
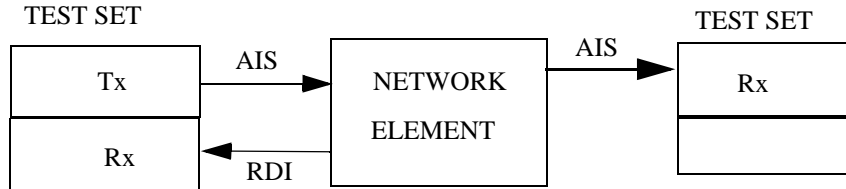
| Stimulus | Response: VP switch | Response: VC switch | Response: VC end point |
|------------------|---------------------|---------------------|------------------------|
| LOS, LOF, LOP | MS-RDI | MS-RDI | MS-RDI |
| MS-AIS, Path AIS | Path RDI | Path RDI | Path RDI |
| LCD | Path RDI | Path RDI | Path RDI |
| VP-LOC | none | VP-RDI | VP-RDI |
| VP-AIS | none | VP-RDI | VP-RDI |
| VC-LOC | none | none | VC-RDI |
| VC-AIS | none | none | VC-RDI |

ATM Operation

Transmitting ATM Alarms

The following figure illustrates an example where the ability of a network element to recognize and respond to AIS and RDI alarms is tested.

AIS/RDI Alarm Testing



How to

- 1 Set up the Transmitter for ATM (See "Setting up the Transmitter for ATM Payloads " page 152).
- 2 Select the Transmitter **TEST FUNCTION** folder, and select TEST FUNCTION as **ATM** .
- 3 Move the down cursor to OAM ALARM TYPE and select the alarm you require to test your network element.

OAM cells are transmitted when the OAM ALARM TYPE has an alarm selected. For VP or VC AIS, any channel with the same VP or VC is suspended and the OAM cell is transmitted once per second. For VP or VC RDI the OAM cell is interspersed with the foreground channel.

Adding ATM Errors

Description

Errors can be added to the ATM payload and to the cell headers. To stress ATM header alignment, you can add bursts of single or double header errors. To simulate ATM impairments, you can add bit errors, cell loss, cell misinsertion or cell errors.

Cell loss may be caused by transmission errors on the ATM header or more importantly may arise due to congestion in ATM switches. *Cell misinsertion* may also be caused by transmission errors on the ATM overhead. If errors cause the VP/VC to be changed to another valid value, this will cause a cell to be misinserted into another channel. Also, faults within the routing tables or management system of an ATM switch may cause cells to be routed to the wrong output port, appearing as misinserted cell. *Cell errors* caused by transmission impairments or faults within Network Equipment need to be measured in a different way from bit errors to ensure that lost or misinserted cells do not corrupt the measurement.

In order to make the necessary ATM measurements a different kind of test signal than that traditionally used to measure BER is required. This test signal is known as the *test cell* and has been designed and endorsed by the ATM Forum and standardized in the ITU-T in Recommendation 0.191. OmniBER uses the test cell to make simultaneous ATM error measurements.



How to

- 1 Set up the **TRANSMIT** page for ATM (See "Setting up the Transmitter for ATM Payloads " page 152).
- 2 Move to the **TEST FUNCTION** folder and select TEST FUNCTION to be

ATM Operation

Adding ATM Errors

ATM

- 3 Move the down cursor to ERROR ADD TYPE and select the Error Type you require.

Note

When you select **ALL** in the STREAM field an additional field appears which allows you to introduce a burst of errors.

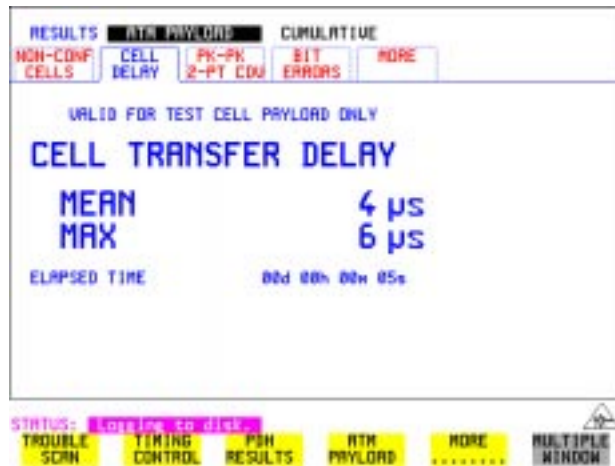
To Verify HEC Function

- 1 Add SINGLE HEC errors and verify that the Network Element corrects these errors
- 2 Add DOUBLE HEC errors and verify that a lost cell is recorded for each Double HEC error. (To measure lost cells, select TESTCELL as the payload.)
- 3 Add a burst of 2 SINGLE HEC errors and verify that one lost cell is recorded. The first error is corrected; the second is not.
- 4 Add a burst of 7 DOUBLE HEC errors and verify that LCD occurs in the Network Element.

Viewing ATM Results

Description

The ATM results can be viewed in a variety of ways on the RESULTS page.



How to

- 1 Press the **RESULTS** key.
- 2 Select **ATM PAYLOAD** in the RESULTS field.
- 3 Move the right cursor to select the different types of errors and alarms.
- 4 **ERROR SUMMARY** gives a summary of all possible ATM errors and can be set up to be read as counts (total in measurement interval) or ratios/rates.
- 5 **CUMULATIVE** errors give the number of errors which have occurred in total since the last time **RUN/STOP** was pressed. **SHORT TERM** errors give the number of errors 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.
- 6 **ALARM SECONDS** is used to look at ATM alarms.

ATM Operation

Setting up the Receiver for ATM Payloads

Setting up the Receiver for ATM Payloads

Description

The receiver rate and mapping can be set up to match the requirements of the ATM network under test. Select a SONET rate from STS-1 to OC-48 or a DS_n rate of DS-3 or DS-1.

TIP

To set the Transmitter and Receiver to the same interface settings choose **OTHER SETTINGS CONTROL**, **COUPLED**.



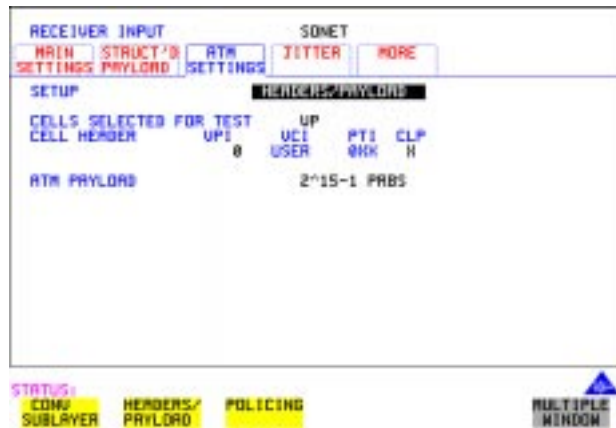
How to

- 1 Press **RECEIVE** and select from **PDH/DS_n** or **SONET**.
- 2 Select the SIGNAL rate.
- 3 Select required MAPPING with ATM as a payload.
Use **SET** to bring up the popup application diagram (only applies to SONET mapping). This allows an alternative way of selecting the appropriate mapping. Use the cursor keys to navigate through the popup application diagram (see next page).

Setting up the Receiver ATM signal

Description

The setup of the ATM settings allow the user to tailor the test signal to suit the network under test.



How to

- 1 Select the Receive rate and mapping. (See "Setting up the Receiver for ATM Payloads " page 168).
- 2 Select the **ATM SETTINGS** folder.
- 3 Select SETUP as **CONV SUBLAYER**, **HEADERS/PAYLOAD** or **POLICING** (See "Policing ATM Traffic " page 172).
- 4 If **CONV SUBLAYER** is selected then the network interface can be selected as UNI or NNI (see diagram on next page) and the SCRAMBLING can be turned on or off. For most applications, ATM scrambling should be left on. The HEC CORRECTION can be enabled/disabled at this point. Header error correction (HEC) allows the correction of a single header error. To simulate a typical ATM receiver it should be switched ON.
- 5 If **HEADERS/PAYLOAD** is selected the CELLS SELECTED FOR TEST can be set up. To test a Virtual Path, select **VP** and set the VPI value. To test a VC, select **VC** and set the VPI and VCI. For specialist applications, you can select **EXPERT** mode to give complete flexibility in setting up the receiver. **ALL USER** cells is used to give a quick indicator of the total cells bandwidth being used.

ATM Operation

Setting up the Receiver ATM signal

NOTE

Select VP or VC for most test applications. ATM alarms are only monitored if VP or VC is selected.

- 6 To measure error or delay performance of the ATM connection, select **TEST CELL** as the payload in the transmitter and the receiver. This allows the measurement of cell errors, cell loss, cell misinsertion and cell delay simultaneously. For a simple BER measurement you can select **PRBS** or **USER BYTE**. When making a jitter tolerance measurement, select **PRBS**.

Network Interface

The cell header format used at the User Network Interface (UNI) and Network Node Interface (NNI) differs. The UNI has a Generic Flow Control field which can be used for Media Access Control (MAC) functions to transmit cells over shared media systems, while the NNI uses these four extra bits for extra path addressing.

Cell Header at UNI

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | Bit/ Byte |
|-----|---|---|---|-----|---|-----|---|--------------|
| GFC | | | | VPI | | | | 1 |
| VPI | | | | VCI | | | | 2 |
| VCI | | | | | | | | 3 |
| VCI | | | | PTI | | CLP | | 4 |
| HEC | | | | | | | | 5 |

Cell Header at NNI

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | Bit/ Bytes |
|-----|---|---|---|-----|---|-----|---|---------------|
| VPI | | | | | | | | 1 |
| VPI | | | | VCI | | | | 2 |
| VCI | | | | | | | | 3 |
| VCI | | | | PTI | | CLP | | 4 |
| HEC | | | | | | | | 5 |

GFC - Generic Flow Control, VPI - Virtual Path Identifier

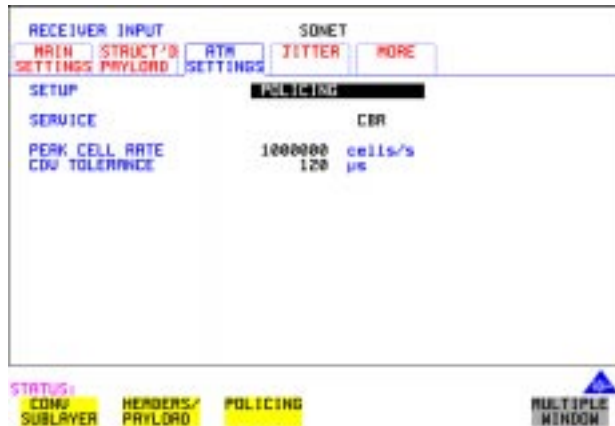
VCI - Virtual Channel Identifier, PTI - Payload Type

CLP - Cell Loss Priority, HEC - Header Error Control

Policing ATM Traffic

Description

Policing ATM traffic allows the user to check whether the incoming ATM service complies with the traffic contract.



How to

- 1 Set up the Transmitter for ATM (See "Setting up the Transmitter for ATM Payloads " page 152).
- 2 Set up the Receiver for ATM (See "Setting up the Receiver ATM signal " page 170).
- 3 Select the **ATM SETTINGS** folder.
- 4 Select SETUP as **POLICING** .
- 5 To test a Continuous Bit Rate (CBR) service select the service **CBR** . Then set up the PEAK CELL RATE and CDVT. Any incoming signal which violates the peak cell rate or cell delay variation will result in NON-CONFORMING CELLS error. Because UBR traffic is policed in a similar manner to CBR, you can select CBR to police UBR traffic. In ABR dynamic control of the signal bandwidth is provided by resource management cells. However ABR is policed in a similar manner to CBR and so you can select CBR to police ABR traffic that is not changing.
- 6 To test a Variable Bit Rate (VBR) service select **VBR** . Then set up the SUSTAINABLE CELL RATE, the PEAK CELL RATE, the MAXIMUM BURST SIZE and the CDV TOLERANCE (See page 161 for definitions).
- 7 If the received cell stream does not conform to the policing parameters set up,

ATM Operation
Policing ATM Traffic

non-conforming cells are recorded. To view these cells, see "Viewing ATM Results " page 167.

Measuring ATM Delay Performance

Description

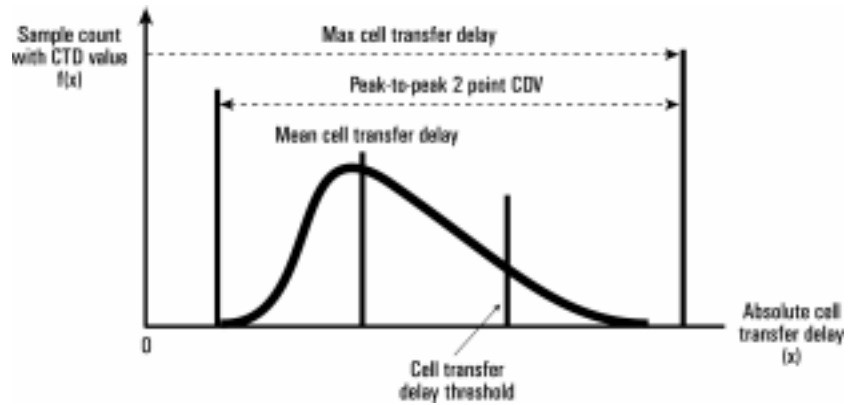
Cell delay can be a problem in any two-way communication system, for example in voice communications, conversation becomes increasingly difficult as path delays increase. In a similar manner, data communications throughput is decreased if significant delay (or latency) slows down the speed that messages can be acknowledged by the receiving terminal.

Cell delay variation (CDV) is caused by dynamic changes in the delay characteristic of an ATM connection. CDV causes problems in buffer underflow and overflow in play-out buffers used to recreate a CBR service. (This results in cell loss and the corresponding corruption of the data being carried. If the clock used to generate the CBR data is derived from the incoming data (adaptive clock method), excessive CDV may cause the PLL to lose lock). CDV may also be a problem for data carried on rt-VBR connections, like VBR video, where accurate timing recovery is critical to the observed quality of the decoded video signal (accumulation of CDV can increase the probability of cell loss due to switch congestion).

During design and verification, it may be necessary to test the delay and CDV of an ATM Network Element under load conditions to ensure that delay performance parameters can be guaranteed.

ATM Operation

Measuring ATM Delay Performance



Cell Delay

ATM delay measurements

Each cell transmitted may experience a different delay through the ATM network. The delay calculated for each cell can be analyzed over a period of time to produce delay measurements. The following ATM cell delay measurements have been standardized by the ATM Forum and also in ITU-T Recommendation O.191.

- Mean cell transfer delay: the average of the delays calculated for each cell over the measurement time.
- Maximum cell transfer delay: the maximum value of delay calculated over the measurement time.
- Peak to peak two point CDV: the difference between the maximum delay and the minimum delay calculated over the measurement time.

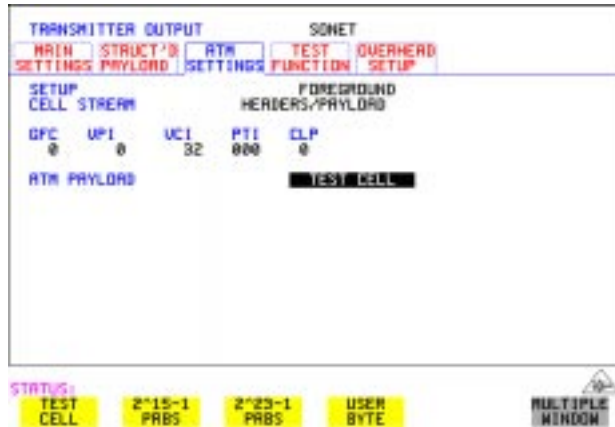
These measurements are made using the timestamp field within the O.191 test cell.

ATM Operation

Measuring ATM Delay Performance

How to

- 1 Set up the **TRANSMIT** page for ATM see "Setting up the Transmitter for ATM Payloads " page 152.



- 2 Select TEST CELL as the transmit and receive payload as shown above.
- 3 Select RESULTS and view the Delay and CDV results, an example is given below.



Note: Delay measurements such as mean cell transfer delay are only valid if you perform a round trip measurement, that is, when a transmitter and receiver are in the same instrument. You can perform a CDV measurement end to end, that is, using two separate instruments to transmit and receive.

Measuring ATM Alarms

Description

You can generate VP and VC AIS and RDI alarms to verify the response of the ATM Network under test, and also generate VP and VC Continuity check cells to keep the circuit alive during bursty traffic conditions. Set up the OmniBER to generate AIS or RDI alarms and check the ability of your network element to recognize and respond to alarms.



How To

- 1 Set up the **TRANSMIT** page for ATM (see "Setting up the Transmitter for ATM Payloads " page 152).
- 2 Set up the Transmitter to generate ATM alarms (see "Transmitting ATM Alarms " page 163).

NOTE

VP Alarms will only be detected if the CELL SELECTED FOR TEST is VP or VC.
 VC Alarms will only be detected if the CELL SELECTED FOR TEST is VC.

- 3 Check that the appropriate LED illuminates on the instrument front panel when alarms are generated.
- 4 On the **RESULTS** page select RESULTS as **ATM PAYLOAD, ALARM SECONDS**.

ATM Service Disruption

Description

The ATM service disruption test measures the time that cells are lost or errored while they pass through a network element. There are a number of reasons for such a disruption, from a break in the line which may activate a protection switch to an ESD discharge causing a temporary interruption to the ATM service.

To make valid Quality of Service measurements the actual time that traffic is lost must be measured. To do this the OmniBER uses the test cell as a payload. The test cell is a special cell, defined in ITU-T Recommendation 0.191, which allows the detection of lost, mis-inserted and errored cells simultaneously. These key parameters are input to the ATM service disruption measurement. The measurement time starts at the last good cell before the disruption and finishes whenever the first good cell arrives following a disruption. To ensure that the disruption has completely finished, 200ms of error free cells are required before the measurement is recorded. For maximum accuracy ensure the gap between cells does not exceed one second.



How To

To perform a service disruption measurement, set up the OmniBER as follows:

- 1 Set up the Transmitter for ATM, select the highest cell rate possible to ensure maximum accuracy (See "Setting up the Transmitter for ATM Payloads " page 152).
- 2 In the ATM SETTINGS folder set up the required service and traffic

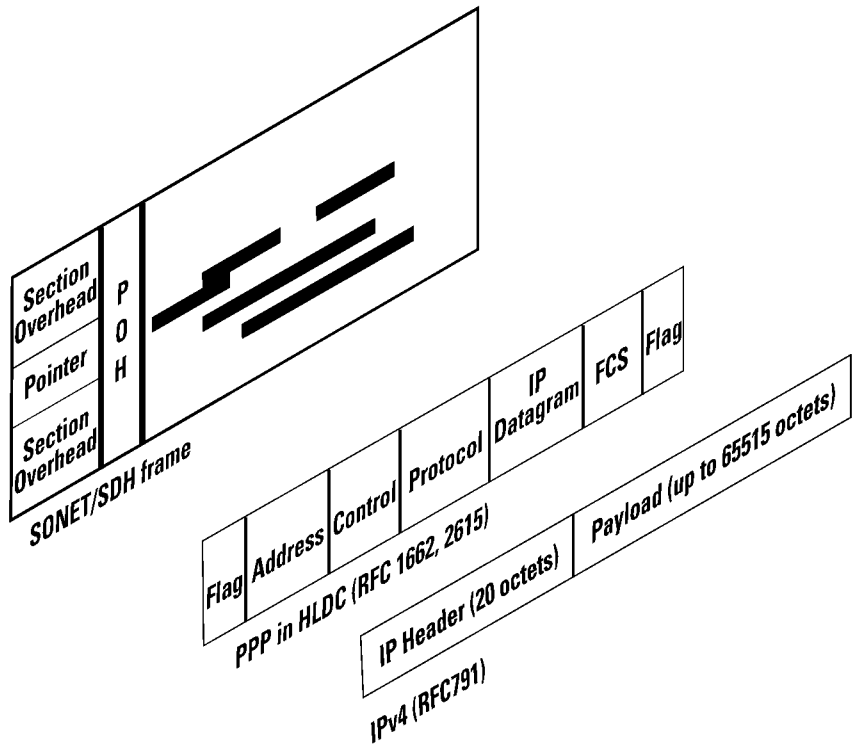
ATM Operation

ATM Service Disruption

distributions. (See "Setting Foreground Traffic " page 157, "Setting Background Traffic " page 159 & "Setting Foreground and Background Distributions " page 160).

- 3 Set up the Receiver for ATM. (See "Setting up the Receiver for ATM Payloads " page 168).
- 4 In the Receiver ATM SETTINGS folder set up the service and filter required.
- 5 Verify that no errors/alarms are received (no red LEDs and the RESULTS page is clear of errors).
- 6 In the system under test, activate the protection switch or generate some kind of temporary system failure.
- 7 Go to the RESULTS page. In the first RESULTS field select **SRVC DISRUPT** and note the duration of the service disruption. Available measurements are LONGEST burst, SHORTEST burst and LAST burst.

ATM Operation
ATM Service Disruption



Packet over SONET (POS)

For POS operation you must have option 310 installed. Option 310 offers POS up to 2.5 Gb/s with a 37718A Mainframe, up to 622 Mb/s with a 37718B mainframe and up to 155 Mb/s with a 37718C mainframe.

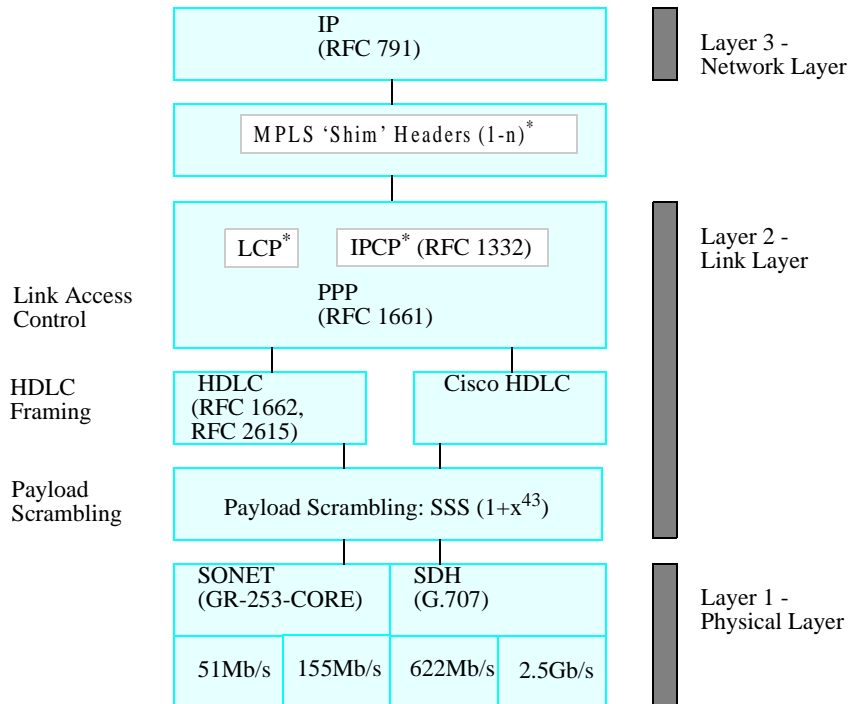
Further information on POS technology/applications is supplied on the CD-ROM shipped with your instrument.

POS Protocol Stack

POS technology can be found in the line cards of high speed routers. It is a layer 2 protocol that maps IP packets into the SONET/SDH frame. Data is first of all segmented into an IP datagram that includes the 20-byte header. This datagram is encapsulated via PPP packets and framing information is added with HDLC-like framing. Gaps between frames are filled with flags (7E). The resulting data is scrambled, and mapped octet synchronously into the SONET/SDH frame.

POS is described by the Internet Engineering Task Force (IETF) in the following 'Request for Comment' (RFC) documents:

RFC-1661 (Point-to-Point Protocol), RFC-1662 (PPP in HDLC-like framing) and RFC-2615 (PPP over SONET/SDH).



*MPLS supported on Rx but not on Tx

*LCP, IPCP not supported

Packet over SONET (POS) Setting up the Transmitter for POS Payloads

Setting up the Transmitter for POS Payloads

Description

The transmitter rate and mapping can be set up to match the requirements of the equipment under test. At SONET, select a rate from OC-1 to OC-48.

CAUTION

Laser On/Off selection. Always switch off the laser before connecting or disconnecting optical cables.

TIP

To set the 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 Press the **TRANSMIT** key and select **SONET**.
- 2 Select the SIGNAL rate.
- 3 If Option 106, Dual Wavelength optical module, is fitted and an optical rate is chosen, choose the required wavelength (1550 or 1310).
If STS-1 is chosen, choose the required interface level (CROSS-CONNECT, HIGH or LOW).
Choose **INTERNAL** unless **THRU MODE** is required. If **THRU MODE** is chosen, see "Setting SONET THRU Mode " page 37.

Packet over SONET (POS)

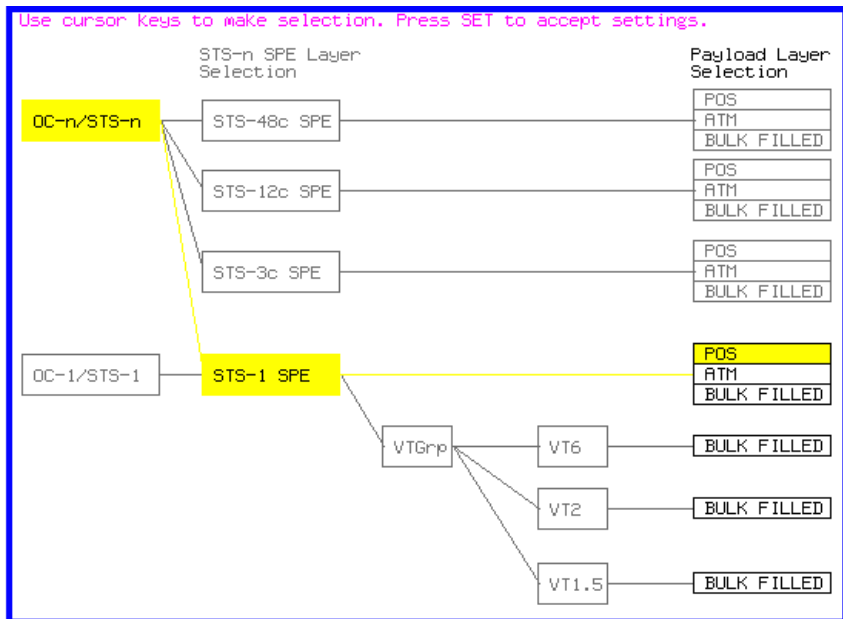
Setting up the Transmitter for POS Payloads

- 4 Make your choice of CLOCK synchronization 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).
- 5 If required choose the FREQUENCY OFFSET value. See “Adding Frequency Offset to SONET Signal” page 62.

Payload Mappings

The payload mappings available for POS in SONET are: STS-48c SPE, STS-12c SPE, STS-3c SPE and STS-1 SPE.

- 6 Select required MAPPING and then select **POS**.
Alternatively, use **SET** to bring up the popup application diagram:



Use **→** and **←** to move between STS Layer Selection and Payload Layer Selection. Use **↑** and **↓** to set the mapping and **SET** to set your selection.

- 7 Select the STS-n channel under test.
- 8 Select the **POS SETTINGS** page and set up as described in the following pages:

Setting HDLC Framing, Scrambling and HDLC Frame Check Sequence

Description

PPP in HDLC-like framing

PPP encapsulated packets are mapped into frames. HDLC-like framing is used to delineate the packet boundaries so that the receiver can extract them from the SONET/SDH frame. Gaps between packets are filled with standard HDLC flags of 7E.

Two framing formats are provided.

- PPP in HDLC framing - as per RFC 1662.
- CISCO HDLC - Cisco's proprietary frame structure.

The HDLC-like frame includes address, control, and protocol fields followed by the IP datagram.

The frame structure is common to both formats, with values shown below.

Table 5 Frame Structure for PPP in HDLC and Cisco HDLC

| Flag | Address | Control | Protocol | IP datagram | FCS | Flag |
|--------|---------|---------|----------|-------------|------------|--------|
| 8 bits | 8 bits | 8 bits | 16 bits | variable | 16/32 bits | 8 bits |

| | | | | | | | |
|-------------|------|------|------|--------|--|--|------|
| PPP in HDLC | 0x7E | 0xFF | 0x03 | 0x0021 | | | 0x7E |
| Cisco HDLC | 0x7E | 0x0F | 0x00 | 0x0800 | | | 0x7E |

Packet over SONET (POS)

Setting HDLC Framing, Scrambling and HDLC Frame Check Sequence

Scrambling

The purpose of POS scrambling is to ensure that malicious users cannot bring down a network by transmitting patterns which disrupt/confuse SONET/SDH synchronization or framing. See Packet over SONET/SDH white paper (on your OmniBER CD-ROM) for more details.

The addition of payload scrambling occurs when inserting the HDLC-like framed PPP packets into the SONET/SDH frame

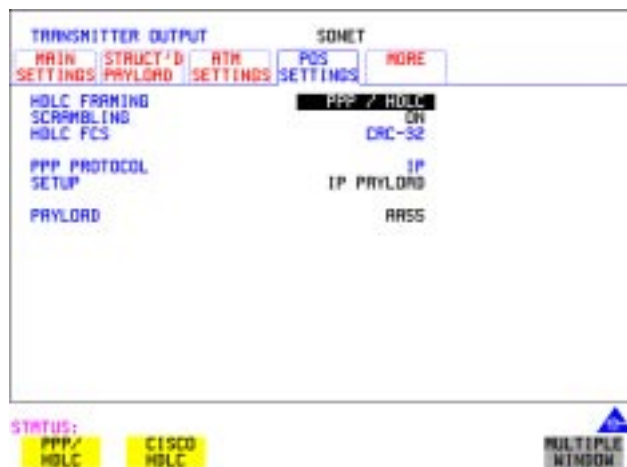
Frame Check Sequence

The FCS (Frame Check Sequence) is a CRC checksum and is used to protect the entire frame and give an indication of traffic integrity.

The FCS value is calculated over all bits of the address, control, protocol, datagram and padding fields. It does not include the flag fields or the FCS field itself.

How To

- 1 This procedure assumes you have already selected a POS payload on the MAIN SETTING page, see “Setting up the Transmitter for POS Payloads” page 183.
- 2 Select the **POS SETTINGS** folder as shown below:



- 3 Set the HDLC FRAMING field to **PPP/HDLC** or **CISCO HDLC** as required.

Packet over SONET (POS)

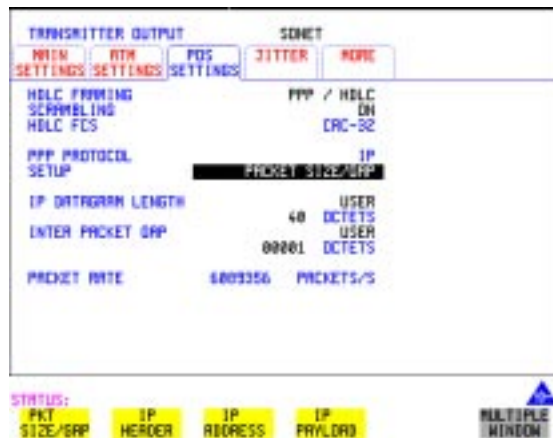
Setting HDLC Framing, Scrambling and HDLC Frame Check Sequence

- 4 Set SCRAMBLING to **ON** or **OFF** as required.
If you select **ON** then scrambling is performed during insertion into the SONET using an $x^{43} + 1$ polynomial.
Note that the Scrambling OFF/ON selection affects the value of the C2 Overhead Byte as follows:
 - Path Signal Label C2 set to 0x16 to indicate PPP when Scrambling set ON.
 - Path Signal Label C2 set to 0xCF to indicate PPP when Scrambling set OFF.
- 5 Set the HDLC FCS (Frame Check Sequence) field to **CRC-16** or **CRC-32** as required. Note that **CRC-16** is not available for STS-48c at 2.5Gb/s. CRC-32 is usually the recommended selection.

Setting IP Packet (Datagram) Length and Inter-Packet Gap

Description

Both the IP datagram length and the Inter-packet gap are settable



How To

- 1 This procedure assumes you have already selected a POS payload on the MAIN SETTING page, see “Setting up the Transmitter for POS Payloads” page 183.
- 2 Select the **POS SETTINGS** folder as shown above.
- 3 Set the SETUP field to **PACKET SIZE/GAP** .

Setting IP Datagram Length

- 4 Select the IP DATAGRAM LENGTH field.
- 5 Choose the IP DATAGRAM LENGTH. There is a choice of: **USER** , **RANDOM** | or **7:4:1** .

Note: The IP datagram length is the value placed in the IP header ‘Total Length’ field. No padding is implemented: the datagram is immediately followed by the end of the HDLC frame (FCS and closing flag).

User Length:

Settable between 20 and 65535 octets. Step size 1 octet. This is the size of the entire datagram, including the 20 octet header, before any HDLC octet stuffing. When the size is set to 20 only a header is transmitted.

Packet over SONET (POS)

Setting IP Packet (Datagram) Length and Inter-Packet Gap

Random Lengths: The IP datagram size is varied randomly between minimum & maximum limits.

The minimum datagram size is settable between 20 and 63 octets.

The maximum datagram size can be set to one of the following values:

- 127
- 511
- 1023
- 8191
- 65535

7,4,1 Lengths: Emulates real traffic patterns by sending a repeating sequence of 12 packets in which 7 have size 40 octets, 4 have size 552 octets, and 1 has size 1500 octets.

Setting Inter-Packet Gap

6 Choose the INTER PACKET GAP required, you can select either **USER** or **RANDOM**.

USER: Settable between 1 to $2^{30} - 1$ octets. Step size: 1 octet.

RANDOM: The Inter-packet gap is varied randomly between minimum & maximum limits.

The minimum Inter-packet gap size is fixed at 1.

The maximum Inter-packet gap size can be set to one of the following values:

- 4
- 32
- 1024
- 2^{20}
- $2^{30} - 1$

Packet Rate

The PACKET RATE displayed at the bottom of the display is the number of packets per second and is determined by the following:

- Channel Bandwidth (OC-1/OC-3/OC-12/OC-48).
- Packet (datagram) size.
- HDLC byte stuffing.
- Inter - packet gap

Please refer to “What determines the packet rate?” page 207 for a detailed description on how Packet Rate is calculated.

Setting IP Header

Description

Note that the IP Header is sent in every packet.

How To

- 1 This procedure assumes you have already selected a POS payload on the MAIN SETTING page, see “Setting up the Transmitter for POS Payloads” page 183.
- 2 Select the **POS SETTINGS** folder as shown below:
- 3 Set the SETUP field to **IP HEADER**.



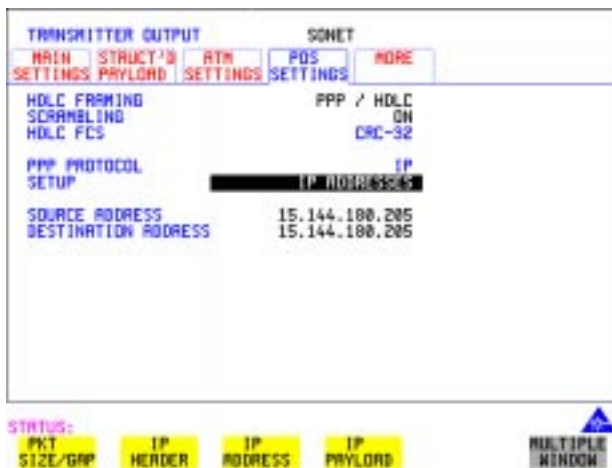
- 4 Select the TYPE OF SERVICE (TOS) field and set up the 8 bits as required. This field is used to specify the service precedence of datagrams during their transmission through the internet system.
- 5 Select the FLAGS field to control fragmentation of packets and using the edit keys set each flag to 0 or 1.
- 6 Select the TIME TO LIVE (TTL) field and select a value from 0 to 255 (instrument default value is 64). Each Router will decrement the TTL value as it passes through. When it reaches zero the packet is destroyed.
- 7 Select the PROTOCOL field and choose from the following preset values: ICMP (1), IP (4), TCP (6), UDP (17), ICMP or program the USER PROGRAM value (0 to 255). The instrument default choice is TCP. This field indicates the next level protocol used in the data portion of the internet datagram (the value in brackets indicates the value of the byte in decimal (i.e. (6) indicates binary 00000110).

Setting IP Addresses

Setting IP Addresses

How To

- 1 This procedure assumes you have already selected a POS payload on the MAIN SETTING page, see “Setting up the Transmitter for POS Payloads” page 183.
- 2 Select the **POS SETTINGS** folder as shown below:



- 3 Set the SETUP field to **IP ADDRESS** and set up the Source and Destination Addresses.

Setting IP Payload

How To

- 1 This procedure assumes you have already selected a POS payload on the MAIN SETTING page, see “Setting up the Transmitter for POS Payloads” page 183.
- 2 Select the **POS SETTINGS** folder as shown below.



- 3 Set the SETUP field to **IP PAYLOAD**.

The IP Payload selections offered are:

- $2^{23}-1$ PRBS. (The PRBS can be non-inverted or inverted.)
 - All Ones.
 - All Zeros.
 - 0xAA55 pattern
 - 16-bit or 32 bit (BIN or HEX) user selectable word.
- 4 Set the PAYLOAD FIELD as required. Note that your choice of payload can affect the stability of the Packet Rate value (due to HDLC stuffing). To eliminate any uncertainty due to stuffing you should choose carefully the IP header and payload so that no stuffing takes place. Selecting a fixed word instead of a PRBS is recommended.

Adding POS Alarms

Adding POS Alarms

Description

In the OmniBER receiver the front panel HDLC LOSS LED illuminates whenever there are no valid HDLC frames and no HDLC flags. The HDLC LINK LOSS alarm provided here allows you to simulate the condition when no valid HDLC frames/flags are present.

How To

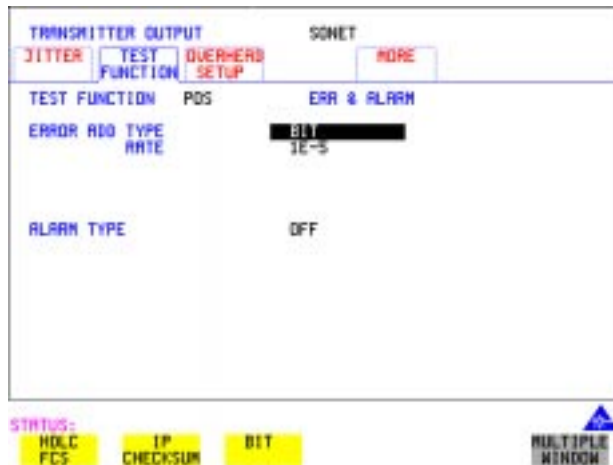
- 1 This procedure assumes you have already selected a POS payload on the MAIN SETTING page, see “Setting up the Transmitter for POS Payloads” page 183.
- 2 Press the **TRANSMIT** key and select **SONET**.
- 3 Select the **TEST FUNCTION** folder as shown.
- 4 Set the TEST FUNCTION field to POS.
- 5 Set the ALARM TYPE field to **OFF** or **LINK LOSS**.
Selecting **LINK LOSS** logically inverts the 7E hex flag by transmitting the value 0x81 in all octets.



Adding POS Errors

How To

- 1 This procedure assumes you have already selected a POS payload on the MAIN SETTING page, see “Setting up the Transmitter for POS Payloads” page 183.
- 2 Press the **TRANSMIT** key and select **SONET**.
- 3 Select the **TEST FUNCTION** folder as shown:
- 4 Set the TEST FUNCTION field to **POS**.



- 5 Select the ERROR ADD TYPE field and choose an Error Type, also select the Error Rate. The Error Add Types and Rates available are as follows:
 - HDLC FCS (CRC-16/CRC-32) errors.
Mode: Single (via front panel SINGLE key) or Rate (1E-3).
 - IP Header CHECKSUM Errors.
Mode: Single or Rate (1E-3).
 - BIT (IP Data) Errors
Mode:- Single or Rate
Rate = 1E-n where n= 3 to 9
Note: BIT is disabled when IP datagram length is set to 20 octets (Header only).

Packet over SONET (POS) Setting up the Receiver for POS Operation

Setting up the Receiver for POS Operation

Description

The receiver rate and mapping can be set up to match the requirements of the equipment under test. For SONET, select a rate from STS-1/OC-1 to OC-48 Optical.

TIP

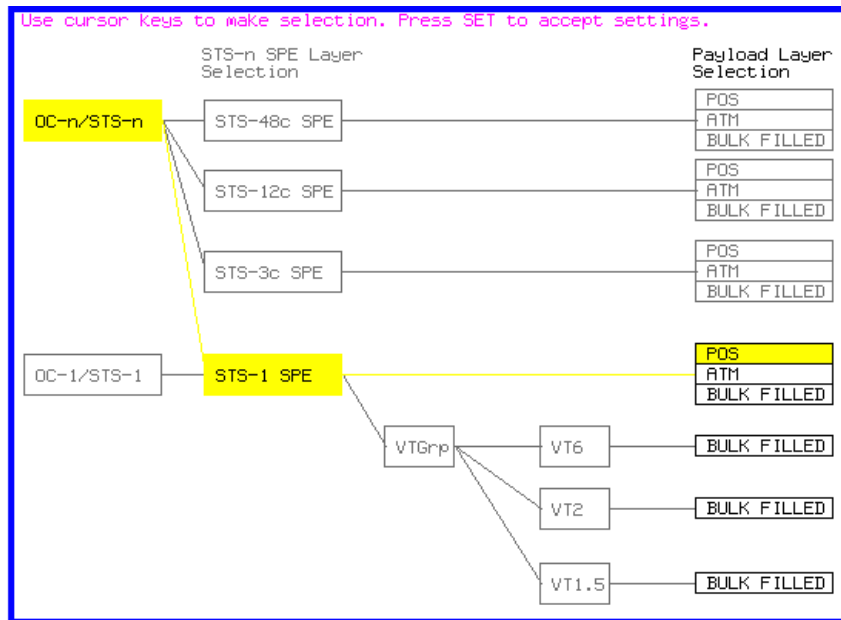
To set the Transmitter and Receiver to the same interface settings choose **OTHER SETTINGS CONTROL COUPLED**. This causes the receiver to be configured to the same settings as the transmitter.



How To

- 1 Press **RECEIVE** and select **SONET**.
- 2 Select the **MAIN SETTINGS** folder.
- 3 Select the SIGNAL rate.
- 4 Select required MAPPING with POS as a payload.
As an alternative, use **SET** to bring up the popup application diagram. Use the cursor keys to navigate through the popup application diagram (see next page).

Packet over SONET (POS)
Setting up the Receiver for POS Operation



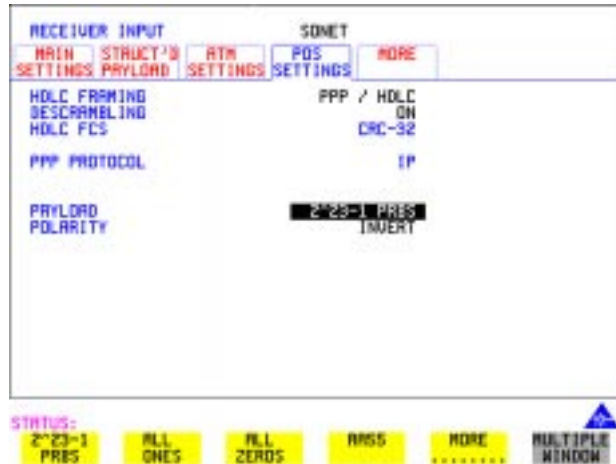
- 5 Continue to the next task “Setting up the Receiver POS signal” page 197 for advice on setting up the receiver POS signal.

Packet over SONET (POS)
Setting up the Receiver POS signal

Setting up the Receiver POS signal

Description

You can set up the POS receiver signal to suit the equipment under test.



How To

- 1 Select the Receive rate and mapping, see "Setting up the Receiver for POS Operation " page 195.
- 2 Select the **POS SETTINGS** folder.
- 3 Set HDLC FRAMING to **PPP/HDLC** or **CISCO HDLC** as required.
- 4 Set DESCRAMBLING to **ON** or **OFF**.
- 5 Set HDLC FCS field to **CRC-16** or **CRC-32**.
- 6 Set the PAYLOAD field to one of the following:
 - **2^23-1 PRBS**
 - **ALL ONES**
 - **ALL ZEROS**
 - **AA55**
 - **USER WORD**
 - **LIVE TRAFFIC**

Viewing POS Results

Description

The POS results can be viewed in a variety of ways on the RESULTS page.

| RESULT TYPE | COUNTS |
|------------------|-----------|
| HDLC FRAMES | 7.551E+07 |
| HDLC FCS ERRORS | 0 |
| IP DATAGRAMS | 7.551E+07 |
| IP HEADER ERRORS | 0 |
| BIT ERRORS | 120013 |

ELAPSED TIME 00d 00h 00m 12s

STATUS: TROUBLE SCRN TIMING CONTROL SONET RESULTS POS PAYLOAD MORE MULTIPLE WINDOW

How To

- 1 Press the **RESULTS** key.
- 2 Select **POS PAYLOAD** in the RESULTS field.
- 3 **RESULT SUMMARY** gives a summary of all possible POS measurements and errors/counts and can be set up to be read as counts (total in measurement interval) or ratios/rates.
- 4 **CUMULATIVE** gives the number of errors and counts which have occurred in total since the last time **RUN/STOP** was pressed.
- 5 **SHORT TERM** 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.
- 6 **ALARM SECONDS** is used to look at POS and Power Loss alarms.

POS Applications

The following pages give typical test applications.

Channelized Testing

Description

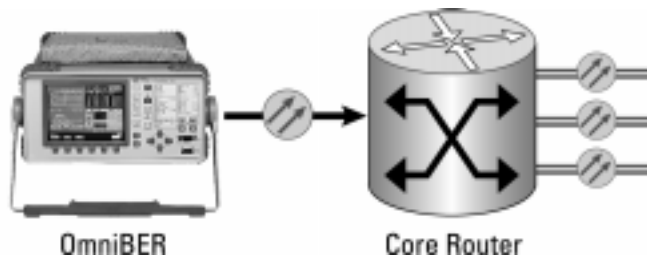
Channelized testing is the ability to perform tests on individual channels within SONET.

Many L1/L2 chipsets and line cards support SONET channelization. Typical configurations are:

- 3 STS-1 channels in an OC-3
- 4 STS-3c channels in an OC-12
- 4 STS-12c channels in an OC-48
- 16 STS-3c channels in an OC-48.

An important feature of the OmniBER is the ability to perform channelized testing using a POS payload.

With the OmniBER you can perform tests either in a single channel (with the other channels filled with a background payload) or over the full SDH bandwidth (concatenated mode).



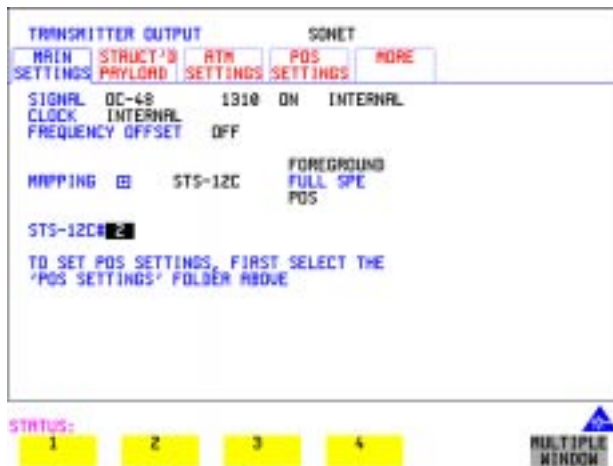
How to

- 1 Set the Transmitter and Receiver to the same interface settings by choosing **OTHER SETTINGS CONTROL COUPLED**. This causes the receiver to be configured to the same settings as the transmitter.
- 2 Press the **TRANSMIT** key and select **SONET**.
- 3 Select the **MAIN SETTINGS** folder.
- 4 Select the SIGNAL rate, CLOCK and FREQUENCY OFFSET as required.

Packet over SONET (POS)

Channelized Testing

- 5 Select required MAPPING with POS as a payload.
Use **SET** to bring up the popup application diagram. This allows an alternative way of selecting the appropriate mapping. Use the cursor keys to navigate through the popup application diagram.
- 6 Select the channel under test.
The figure below gives an example where the channel under test is STS-12c (2) in an OC-48 signal.



Fully Exercising POS Hardware Architecture

Description

POS hardware operating at high speeds uses wide bus architectures (that is, internal buses which are several bytes wide). To ensure correct operation the hardware needs to be fully exercised (stressed) so that all ‘corner cases’ are caught. This is done by generating traffic with varying packet and gap sizes, sending the smallest packets at highest speed, longest packets, scrambling and exercise of the octet stuffing and destuffing. It may also include sending packet sizes rarely encountered in live networks (such as packet sizes which are not rounded to 4-byte boundaries).

With the OmniBER 719 you generate traffic profiles to successfully exercise POS hardware using the methods described. The following figure illustrates the traffic profiles offered in the OmniBER 719.

Fixed packet size and gap

If you select a fixed packet and gap you can check different phases of the wide-bus architecture. For example selecting gap sizes of 1, 2, 3 and 4 will test all 4 byte phases of a 4-byte architecture.

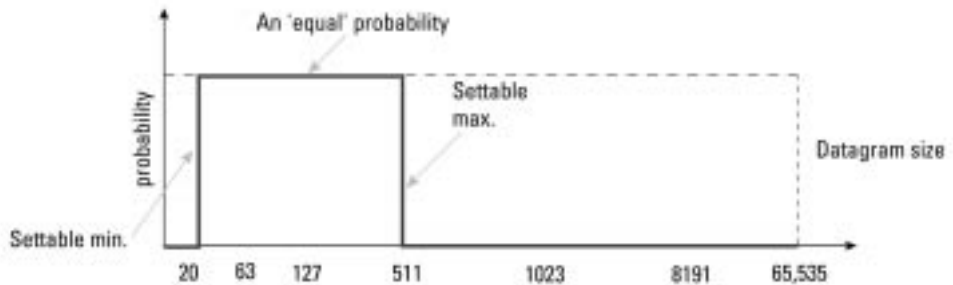
Random packet size

With random packet sizes, the maximum and minimum size can be set.

Packet over SONET (POS) Fully Exercising POS Hardware Architecture

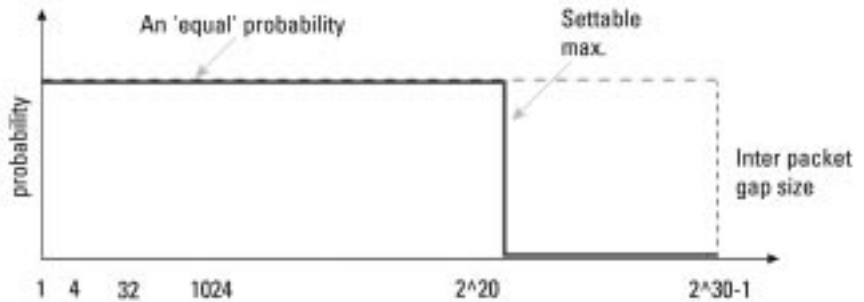
Minimum sizes are particularly important for stress testing hardware. This minimum size can be set equal to the minimum allowed by the hardware.

The probability of a packet with a particular size (between max and min.) is roughly equal for all packet sizes (see following figure).



Random packet gap

Random packet gaps can be generated with roughly equal probability between 1 octet and maximum. Setting a lower maximum value will increase the average packet rate.



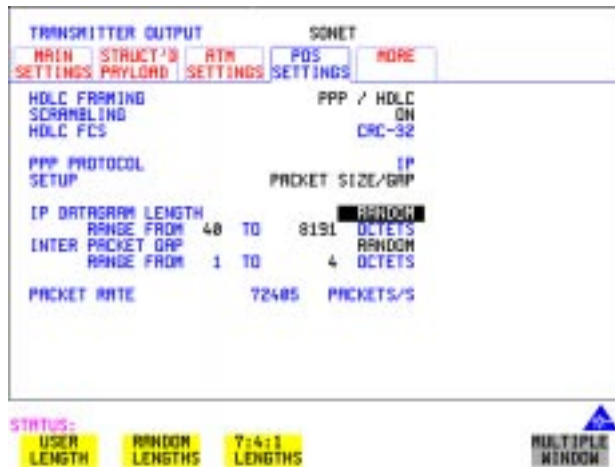
Packet over SONET (POS) Fully Exercising POS Hardware Architecture

Transmit an IP packet that generates maximum stress on the circuit under test.

An ideal way to generate the maximum stress on circuits under test is to transmit an IP packet which has both a random packet size and gap. You can do this with the OmniBER, and an example is given below.

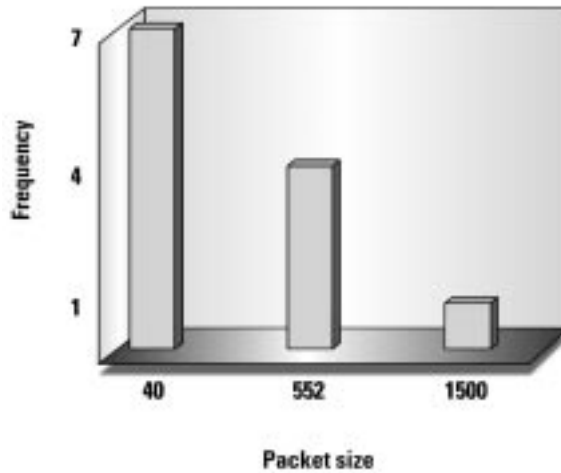
How To

- 1 This procedure assumes you have already selected a POS payload on the MAIN SETTING page, see “Setting up the Transmitter for POS Payloads” page 183.
- 2 Select the **POS SETTINGS** folder.
- 3 Set up the POS SETTINGS page, an example is given below.



Packet over SONET (POS)
Fully Exercising POS Hardware Architecture

Transmit IP data that more closely resembles real traffic (7:4:1 distribution)



With internet traffic any of the definable packet sizes (and gaps) may be transmitted. In practise it is more common to see fewer variations in the packet size the more packets there are transmitted. The OmniBER 719 provides a packet stream that closely approximates to this type of distribution, there are three packet sizes; they are 1500, 552 and 40 octets (see Figure above). The distribution is 7 small packets (40), 4 medium sized packets (552) and 1 big packet (1500) in every group of 12.



Throughput Testing

Description

Packet over SONET chipsets and line cards will have performance limits imposed by the hardware architecture and by the size and management of buffers. To test these components it will be necessary to check that IP packets can be passed at the following:

- Minimum packet size and/or
- Maximum packet rate.

Using the OmniBER you can generate a continuous stream of packets of any size, and with any inter-packet gap.

In the following example the OmniBER is set up to generate a packet stream of 75-byte IP packets with a 17-byte gap between packets. The instrument displays (at the bottom of the screen) the actual transmitted packet rate in packets/s (2995200). To obtain the desired packet rate it is necessary to understand the factors determining packet rate, this is explained in the following text.



Packet over SONET (POS)

Throughput Testing

What determines the packet rate?

- Channel bandwidth (STS-1 SPE, STS-3c SPE, STS-12c SPE or STS-48c SPE).
- Packet size.
- HDLC byte stuffing.
- Inter packet gap.

Available bandwidth

The available bandwidth (in bytes/second) for packet transmission for each channel is as follows:

- STS-1 SPE 6048000
- STS-3c SPE 18720000
- STS-12c 74880000
- STS-48c SPE 299520000

Packet Size

For IP, the packet size is specified in terms of the IP datagram size including the 20 byte IP header. The actual packet size transmitted includes 4 bytes of PPP/HDLC overhead plus the FCS (HDLC Frame Check Sum) which is 2 bytes for FCS16 or 4 bytes for FCS32. Hence, for a 75 byte IP datagram with FCS32 the actual packet size is $75 + 4 + 4 = 83$ bytes.

The packet size may be further modified by HDLC stuffing. This will add one extra byte every time the flag (7E) or escape (7D) octet appears in the packet.

The actual transmitted packet rate (in packets/second) will then be:

channel bandwidth \div (packet size (including overhead and stuffing) + gap size).

For our example (see display on previous page), ignoring the effect of HDLC byte stuffing, we would expect a packet rate of $299520000 \div (83 + 17) = 2995200$ pkts/sec. However, due to the effects of HDLC stuffing, this figure may be slightly reduced. To eliminate the uncertainty due to stuffing, it is possible to choose carefully the IP header and payload so that no stuffing takes place. The procedure given on the next page shows how this can be done:

Packet over SONET (POS)

Throughput Testing

To Transmit a packet rate of 2995200 packets/second

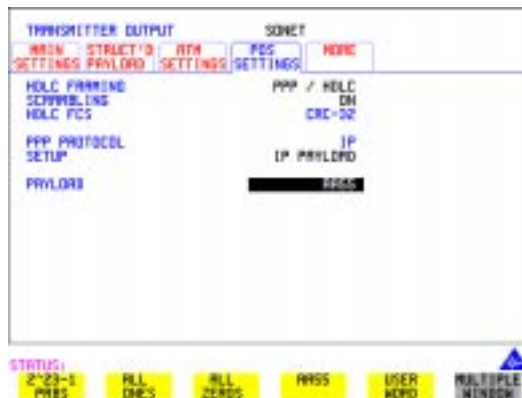
The following procedure shows how to set up the OmniBER to generate a packet stream of 75-byte IP packets with a 17-byte gap between packets and with a packet rate of 2995200 packets/s.

How To

- 1 Press the **TRANSMIT** key and select **SONET**.
- 2 Select the **MAIN SETTINGS** folder and set up the page as shown below, with a POS payload selected.



- 3 Select the **POS SETTINGS** folder.
- 4 Set the SETUP field to **IP PAYLOAD**.
- 5 Select a fixed word pattern as the payload (AA55 for this example).



Packet over SONET (POS)

Throughput Testing

- 6 Set the SETUP field to **PACKET SIZE/GAP**.
- 7 Set the IP datagram length and inter packet gap as shown below.



Note the PACKETS/S rate displayed is what we expected (2995200).

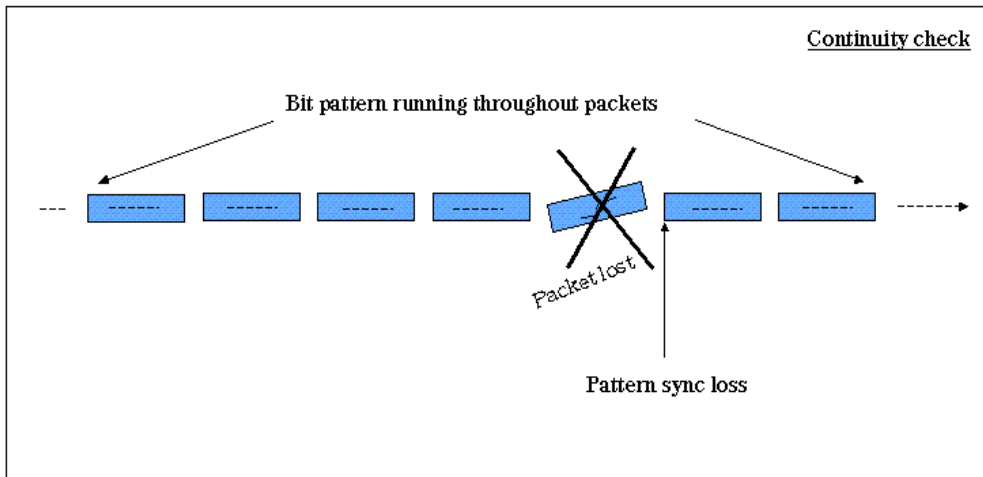
If however you are setting up the transmitter to transmit a different packet rate and the value displayed is not what you expect, you may need to vary the word pattern (IP payload) and/or the IP datagram header bytes until the expected packet rate is displayed.

Continuity Test

Description

A continuity check is a simple and effective way of checking for missing packets or corrupted packets that are dropped. The method used is to transmit a PRBS in the POS payload part of all the IP packets and check that the PRBS arrives at the receiving port error free. A lost or corrupted packet will result in a burst of errors at the OmniBER receiver.

The figure below illustrates a packet stream with a bit pattern running through the packets and shows that when a packet is lost pattern sync loss occurs. Pattern sync loss will result in errors which can be measured in the OmniBER.



Setting up the OmniBER to perform a Continuity Test

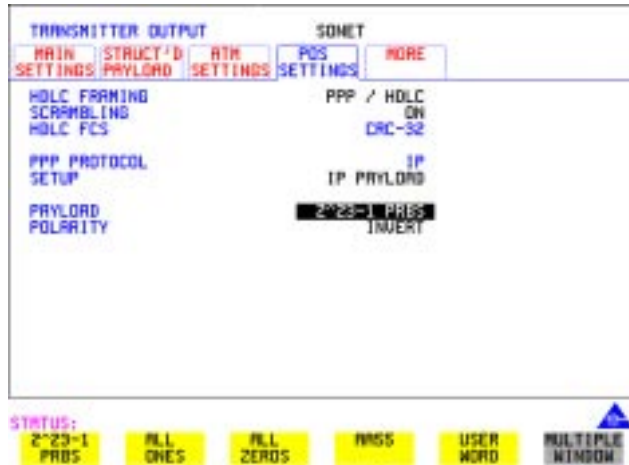
How To

- 1 Set the Transmitter and Receiver to the same interface settings by choosing **OTHER**, **SETTINGS CONTROL**, **COUPLED**.
- 2 Press the **TRANSMIT** key and select **SONET**.
- 3 Select a POS payload on the **MAIN SETTINGS** page, see "Setting up the Transmitter for POS Payloads" page 183

Packet over SONET (POS)

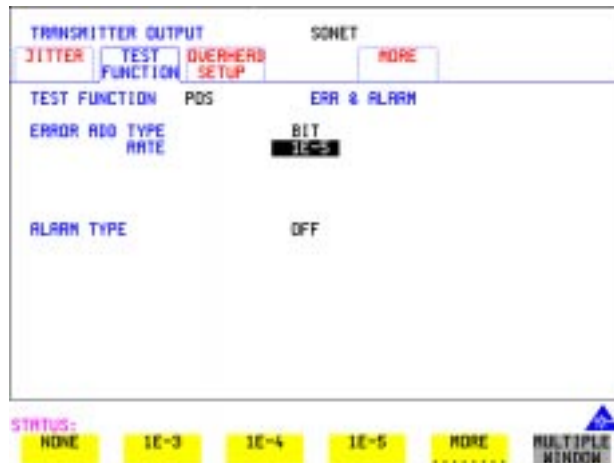
Continuity Test

- 4 Select the **POS SETTINGS** folder.
- 5 Set the SETUP field to **IP PAYLOAD** and select a suitable payload, for this example we have chosen a 2²³-1 PRBS as shown below.



Check continuity by adding POS errors and verifying that the correct alarms and errors are received by the OmniBER.

- 6 Select the **TEST FUNCTION** folder and set up as shown below.



Packet over SONET (POS)

Continuity Test

- 7 Press **RUN/STOP** to start the measurement.
- 8 View the results on the **RESULTS**, **POS PAYLOAD** page. An example is given below.



In our example we introduced POS bit errors at 1E-5, this is reflected in the Results page shown in the display above.

POS Service Disruption

Description

A common feature of modern secure networks is the ability to switch the user traffic to a backup path when the main path fails, or under administrative control. This can happen at the SONET layer, or at higher protocol layers (for example MPLS). The switching will usually only disrupt the traffic briefly, and the OmniBER can measure this disruption using the method described below.

Service disruption can be measured on a POS signal on the disrupted path or virtual path.

Measurement method

The measurement is made by sending and receiving a PRBS pattern at the IP layer. The detection of a service disruption is based on the detection of bit errors on the received PRBS. The disruption period is the time from the end of a received error-free packet to the occurrence of the next error-free word (32-bits) after any bit errors have been detected. The measurement is recorded only if 200ms of no bit errors occur after the disruption period.

POS Service Disruption measurement is only available when PRBS is chosen as the payload.

Measurement accuracy

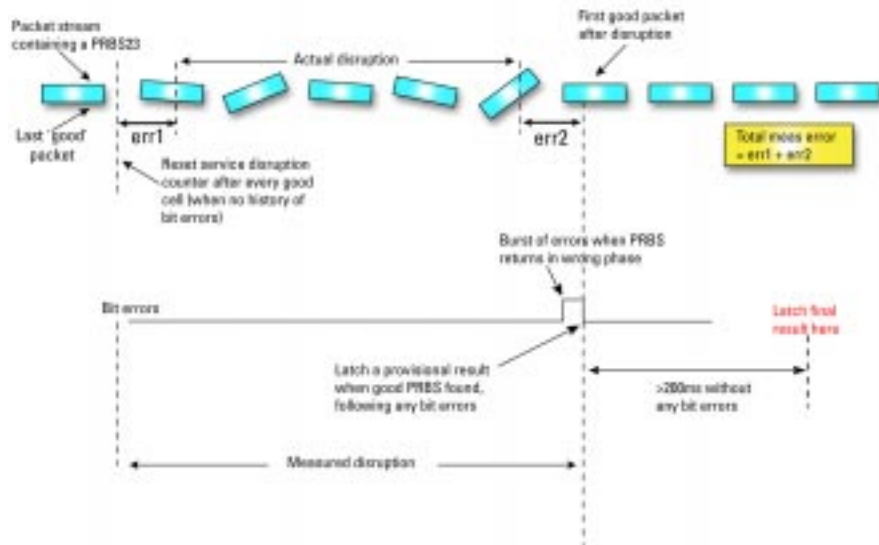
Measurement accuracy is proportional to the packet rate. The packet rate in turn is dependent on 4 factors: packet size, inter-packet gap, stuffing ratio and bandwidth (see “What determines the packet rate?” page 207).

To maximize the accuracy of this measurement, the inter-packet gap should be kept to a minimum and the packets should be kept small. However, the resulting packet rate should not exceed the specification of the system under test. The measurement accuracy is typically $\pm 2 \times (1 \div \text{packet rate})$. For example a packet rate of 10,000 packets/s gives an accuracy of typically ± 0.2 milliseconds, which is accurate enough to measure typical disruptions of many milliseconds

Hence it is only practical to approximate the accuracy. For best results, the smallest possible inter-packet gap should be chosen along with the smallest possible packet size.

The figure on the next page illustrates the measurement technique and also shows how the packet size and rate affects the measurement accuracy.

Packet over SONET (POS) POS Service Disruption



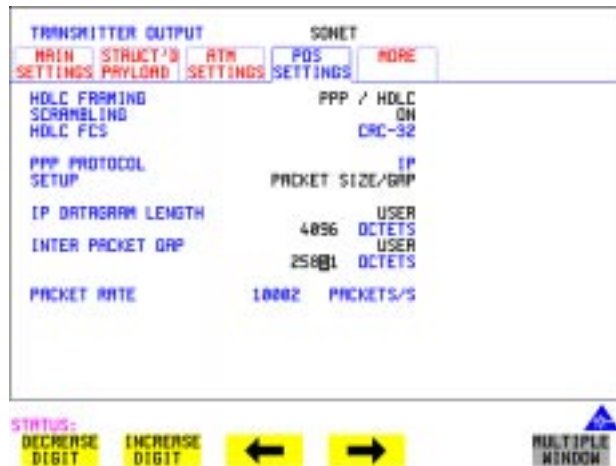
Set up the OmniBer to measure service disruption

How To

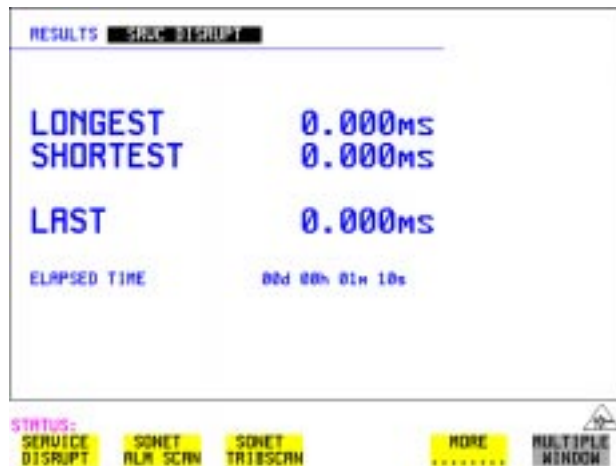
- 1 Set the Transmitter and Receiver to the same interface settings by choosing **OTHER SETTINGS CONTROL COUPLED**.
- 2 Set up the OmniBER to transmit a POS payload (see “Setting up the Transmitter for POS Payloads” page 183).
- 3 Select the **POS SETTINGS** folder.
- 4 Set the SETUP field to **IP PAYLOAD** and select **2^23-1 PRBS**.
- 5 Set the SETUP field to **PACKET SIZE/GAP** and set the IP datagram length and inter packet gap to suit your equipment under test. In the following example (on next page) we have set the datagram length and inter packet gap to give a packet rate of approximately 10,000 packets per second.

Packet over SONET (POS)

POS Service Disruption



- 6 Press **RUN/STOP** to start the measurement.
- 7 Invoke the protection switch.
- 8 View the results on the **RESULTS**, **SERVICE DISRUPT** display.



HDLC Frame Stuffing

Description

Each HDLC-like frame begins and ends with a flag sequence, which is the binary sequence 011111110 (hexadecimal 7E).

The IP data is examined on an octet by octet basis for the value 7E. If it occurs an escape sequence is used to replace any 7E octet with 7D-5E.

The 7D character is considered to be the 'escape' character so it needs to be replaced. 7D is converted to 7D-5D. The entire process is reversed at the receiver

Checking HDLC byte stuffing

To fully exercise the HDLC byte stuffing, patterns can be generated which deliberately contain a lot of stuff bytes. The IP payload can be set to a repeating 16-bit or 32-bit word pattern. Any byte of this word can be set to 7E (to emulate the flag sequence) or 7D (to emulate the escape sequence). OmniBer will 'escape' these bytes wherever they occur. For example, setting the user word pattern to 7E FF 7D FF will result in two extra escape bytes being stuffed into every 4-byte sequence during the payload.

A pattern such as 7E 7D 7D 7E will exercise the worst case stuffing rate.

Setting up the OmniBER to exercise HDLC byte stuffing

In the following example we set the PACKET SIZE/GAP to the instrument default settings (with 40 octet datagram length and 1 octet gap) and then select a User Word to create maximum stuffing, and note the change in Packet Rate due to stuffing.

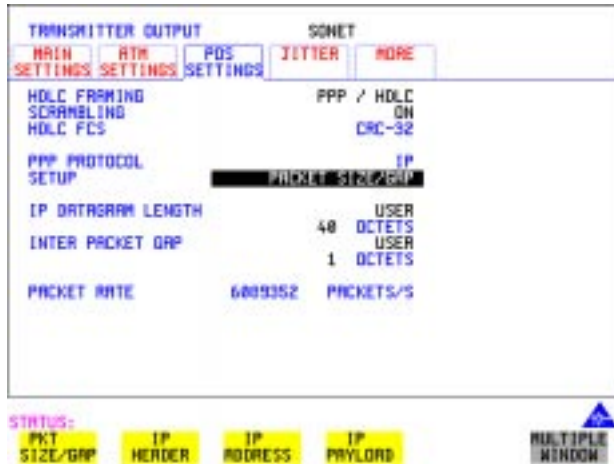
How To

- 1 Set the Transmitter and Receiver to the same interface settings by choosing **OTHER** **SETTINGS CONTROL** **COUPLED**.
- 2 Set up the OmniBER to transmit a POS payload (see "Setting up the Transmitter for POS Payloads" page 183).
- 3 Select the **POS SETTINGS** folder.
- 4 Set the SETUP field to **IP PAYLOAD** and select **2^23-1 PRBS**.

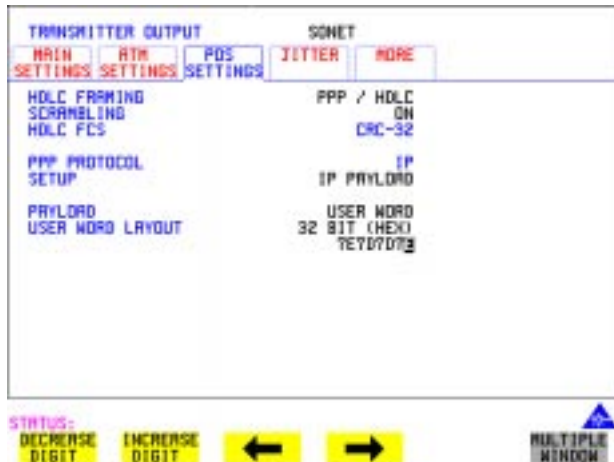
Packet over SONET (POS)

HDLC Frame Stuffing

- Set the SETUP field to **PACKET SIZE/GAP** and set the IP datagram length and inter packet gap to suit your equipment under test. In the following example we have set the datagram length and inter packet gap to the instrument default settings (see figure below).



- Set the SETUP field to **IP PAYLOAD** and select **USER WORD**. Set the User Word to 32 BIT (HEX) 7E7D7D7E as shown below.



Packet over SONET (POS)

HDLC Frame Stuffing

- 7 Set the SETUP field to **PACKET SIZE/GAP** and note that the PACKET/S rate has dropped due to stuffing caused by the selection of the User Word 7E7D7E7D.

TRANSMITTER OUTPUT SONET

MAIN SETTINGS ATM SETTINGS POS SETTINGS JITTER MORE

HDLC FRAMING PPP / HDLC
SCRAMBLING ON
HDLC FCS CRC-32

PPP PROTOCOL IP
SETUP **PACKET SIZE/GAP**

IP DATAGRAM LENGTH 48 USER
ENTER PACKET GAP 1 USER
PACKET RATE 4348970 PACKETS/S

STATUS: PKT SIZE/GAP IP HEADER IP ADDRESS IP PAYLOAD MULTIPLE WINDOW

Jitter Tolerance Testing of POS Equipment

Jitter is present to a certain extent in all telecommunication networks, and can be defined simply as the movement in time of parts of a clock or data stream relative to where we expect to find them. Bit errors or data loss will occur in a digital signal if jitter at the input port of a network element exceeds a threshold value. It is important therefore that the network element be designed to tolerate a sufficient level of jitter, that is, does not introduce errors when certain values of jitter are present. The

ITU-T specifies the lower limit of maximum tolerable input jitter (MTIJ) in the form of an ITU-T jitter tolerance mask. The OmniBER provides a number of ITU-T masks for Jitter Tolerance testing, see “Measuring Jitter Tolerance” page 134.

Use the Jitter generation and measurement features of the OmniBER to verify the jitter tolerance of POS line cards.

Jitter/Wander Generation and Jitter Tolerance and Jitter Transfer tests are available at all SONET rates when a POS payload is selected.

Automatic Jitter Tolerance measurement is only available with a POS payload when the payload selected is 2²³-1PRBS.

Only a Jitter Tolerance example is given here, for information on Jitter Transfer and Wander measurements refer to “Measuring Jitter Transfer” page 138 and “Measuring Wander” page 131.

Jitter Tolerance method

Jitter is generated at a range of frequencies within the mask and an error measurement is made. If no errors occur (PASS), the jitter amplitude at that frequency point is increased until errors occur (FAIL) or the maximum jitter amplitude is reached. The highest jitter amplitude at which PASS occurs is plotted on the graph as the Jitter Tolerance for that jitter frequency.

User-Programmable Masks

There are 5 user programmable masks provided allowing you to create, edit and title up to 5 jitter masks. Please refer to “To Generate a New Jitter Mask” on page 301 and “To change the parameters of a User Defined Jitter Mask” on page 303 for instructions on how to generate or edit a user programmable mask.

Packet over SONET (POS) Jitter Tolerance Testing of POS Equipment

How To

Perform a Jitter Tolerance Measurement

- 1 Set up the transmitter and select a POS payload with a fixed 2²³-1 PRBS (see "Setting up the Transmitter for POS Payloads " page 183) and "Setting IP Payload" page 192.
- 2 Select the **POS SETTINGS** folder as shown below.



- 3 Set the SETUP field to **PACKET SIZE/GAP** and select a size as large as practical for the system under test (this gives better coverage for error detection). For this example we selected a length of 4096 and a gap of 1.
- 4 Select the IP DATAGRAM LENGTH field as required.
- 5 Set the INTER PACKET GAP as required (the smaller the better for increased coverage).
- 6 If you are performing jitter tolerance on a SONET Optical signal, check on the **RESULTS** **SONET RESULTS** **OPTICAL POWER** display that the measured optical power level falls within the white portion of the coloured bar. This ensures the accuracy of the Jitter results.
- 7 Set up the receiver for POS operation, see "Setting up the Receiver for POS Operation" page 195 and "Setting up the Receiver POS signal" page 197. Set the receiver payload to 2²³-1PRBS

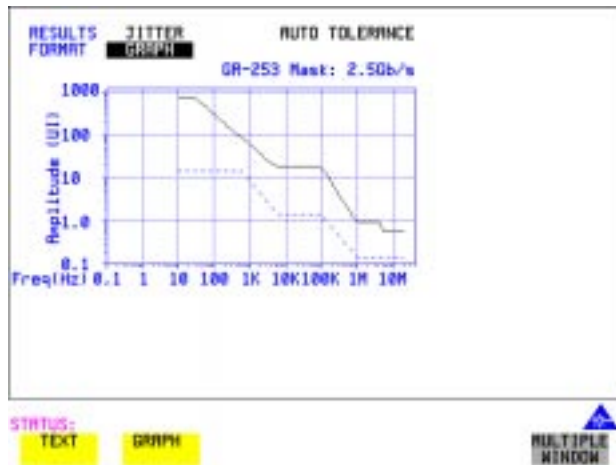
Packet over SONET (POS)

Jitter Tolerance Testing of POS Equipment



- 8 Select the **JITTER** folder and select AUTO TOLERANCE and a MASK (see display above).
- 9 Choose the NUMBER OF POINTS at which jitter is transmitted (3 to 55)
- 10 Choose the DWELL TIME - the time jitter is generated at each jitter frequency point (0.1 to 99.9 seconds).
- 11 Choose the DELAY TIME - the time delay between the jitter frequency/amplitude being applied and the error measurement being made. This allows the network equipment to settle as jitter frequency is changed. (0.1 to 99.9 seconds).
- 12 Set the ERROR THRESHOLD field to ANY ERRORS. Any BIT, BIP, FCS or header errors will result in a FAIL.
- 13 Press **[RUN/STOP]** to start the jitter auto tolerance measurement. The measurements progress can be monitored on the **[TRANSMIT]** display. At the end of the test the results can be viewed on the **[TRANSMIT]** or **[RESULTS]** displays. The **[TRANSMIT]** display is cleared when **[TRANSMIT]** is pressed but the results remain on the **[RESULTS]** display until the next jitter tolerance measurement is made.

Packet over SONET (POS)
Jitter Tolerance Testing of POS Equipment



View the Results

14 Choose the results FORMAT.

If **GRAPH** is chosen, a plot of the jitter tolerance results against the ITU-T mask is displayed.

If **TEXT** is chosen, the results from which the graph is constructed are displayed, Point number, Frequency, Mask amplitude, Tolerance, Result.

If applicable, points 13 through 55 can be viewed on pages 2 through 5.

If you wish to log the jitter tolerance results to a printer, See “Logging Jitter Tolerance Results” page 247.

- “Saving Graphics Results to Instrument Store” page 224
- “Recalling Stored Graph Results” page 225
- “Viewing the Bar Graph Display” page 227
- “Viewing the Graphic Error and Alarm Summaries” page 229
- “Logging Graph Displays” page 231
- “Logging Results” page 233
- “Logging on Demand” page 243
- “Logging Jitter Tolerance Results” page 247
- “Logging Jitter Transfer Results” page 249
- “Logging Results to Parallel (Centronics) Printer” page 251
- “Logging Results to GP-IB Printer” page 252
- “Logging Results to Internal Printer” page 253
- “Logging Results to RS-232-C Printer” page 254
- “Printing Results from Disk” page 255
- “Connecting an Printer to a Parallel Port” page 256
- “Changing Internal Printer Paper” page 257
- “Cleaning Internal Printer Print Head” page 260

Storing, Logging and Printing

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 276.
- 2 Press **RUN/STOP** to start the measurement. Graphical results will be stored in the chosen location.

Recalling Stored Graph Results

Description

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

| STORED | STORED DATE | STORED TIME | TEST DURATION | STORED USED |
|-------------------------|-------------|-------------|---------------|-------------|
| DISK | | | | |
| -9 | | | | |
| -8 | | | | |
| -7 | | | | |
| -6 | | | | |
| -5 | | | | |
| -4 | | | | |
| -3 | | | | |
| -2 | 10-JUL-1997 | 15:28 | 16h 28m 34s | 22 |
| -1 | 11-JUL-1997 | 07:58 | 00h 01m 04s | <12 |
| LAST | 12-JUL-1997 | 07:51 | 00h 01m 19s | NULL |
| STORAGE 1 SEC | | | TOTAL USED | 22 |
| RESOL 'N COMPRESSED | | | RAM FREE | 982 |
| FREE STORE 19626 EVENTS | | | | |

STATUS:
GRAPH RESULTS TEXT RESULTS DELETE STORE DELETE ALL **CONFIRM WINDOW**



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 281.
- 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.

Storing, Logging and Printing

Recalling Stored Graph Results

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. |

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 225.
- 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 225. |
| Zoom | The width, in minutes, of each "bar" in the bar graph, controlled |

Storing, Logging and Printing
Viewing the Bar Graph Display

by **ZOOM IN** / **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.

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.

| STORE | START | 14:28 | STOP | 14:48 |
|-------------------|----------------|--------|----------------|-----------|
| -1 | TUE 8-SEP-1998 | | TUE 8-SEP-1998 | |
| DSn ERROR SUMMARY | | | | |
| | | COUNT | | RATIO |
| BIT | | 261865 | | 1.429E-04 |
| 8PU | | 202187 | | 3.715E-06 |
| DS3 FRAME | | 838 | | 2.369E-06 |
| DS1 FRAME | | 12 | | 1.877E-06 |
| P-BIT | | 224151 | | 4.197E-06 |
| C-BIT | | 50271 | | 3.424E-07 |
| FEBE | | 16981 | | 3.202E-07 |
| CRC | | N/A | | N/A |

STATUS:
 STORE STATUS GRAPH RESULTS PRINT NEXT SUMMARY ALARM SUMMARY FULL SCREEN WINDOW

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 225.
- 3 To view the Alarms which have occurred during the measurement, select **ALARM SUMMARY**. Use **NEXT SUMMARY** to view the PDH/DSn; and SONET Alarm Summaries in turn if applicable.
- 4 To view the Errors which have occurred during the measurement select **ERROR SUMMARY**. Use **NEXT SUMMARY** to view the PDH/DSn; and SONET Error Summaries in turn if applicable.

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 225.

Storing, Logging and Printing

Viewing the Graphic Error and Alarm Summaries

| | |
|--------------|---|
| 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. |

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 a Printer**

- 1 Choose the logging DEVICE.

The logging device can be selected on the **OTHER LOGGING** display when SETUP is set to **LOGGING DEVICE**. For more details on the choice of devices and how to setup the instrument to interface with them please refer to the following sections:

- RS232: “Logging Results to RS-232-C Printer” page 254.
- GPIB: “Logging Results to GP-IB Printer” page 252
- PARALLEL: “Logging Results to Parallel (Centronics) Printer” page 251.
- INTERNAL (only if Option 602, Internal Printer, is fitted): “Logging Results to

Storing, Logging and Printing

Logging Graph Displays

Internal Printer" page 253.

- 2 Press **GRAPH** to view the bar graph display. To log the Error and Alarm summaries, the displayed Bar graphs and the Alarm graph to the printer, choose **PRINT** on the bar graph display.
- 3 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**.
- 4 To log the selected Error and Alarm summaries to the printer, choose **PRINT** on the Text Results display.

HOW TO:

Log to the Internal 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 "Saving Data Logging to Disk " page 276.
- 3 Press **GRAPH** to view the bar graph display. 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.

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 over a user defined test period. If required, results can be logged at regular intervals during this test period but, regardless of whether or not Periodic Logging is selected, the results will be logged at the end of the test period. An instant summary of the results can also be demanded by pressing **PRINT NOW**. This will not affect any test period in progress.

The user can choose to log all available results or else a subset of the available results (e.g. Errors, Jitter, G.826, M.2100 etc.). This means the logging output can be tailored to contain only the results that are of particular interest.

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 an error event is logged.

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

Logging Output

The results can be logged to the following devices:

- Optional Internal printer fitted into the instrument front cover (Option 602)
- External GP-IB printer (option 601)
- External RS-232-C printer (option 601)
- External Parallel Port printer (option 601)
- Internal Disk Drive

HOW TO:

Selecting Logging Device

The logging device can be selected on the **OTHER LOGGING** display when SETUP is set to **LOGGING DEVICE**. For more details on the choice of devices

Storing, Logging and Printing

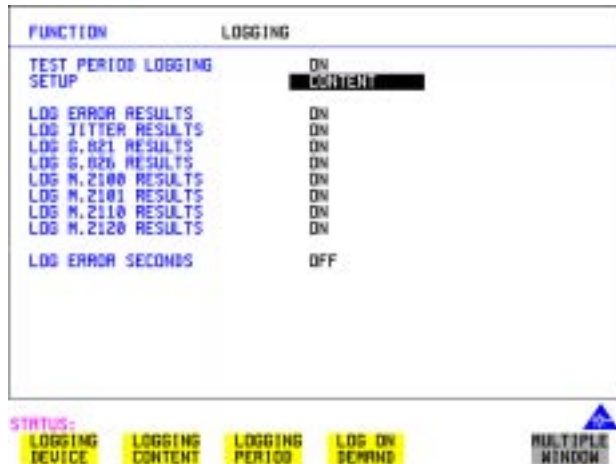
Logging Results

and how to setup the instrument to interface with them please refer to the following sections:

- RS232: “Logging Results to RS-232-C Printer” page 254.
- GPIB: “Logging Results to GP-IB Printer” page 252
- PARALLEL: “Logging Results to Parallel (Centronics) Printer” page 251.
- DISK: “Saving Data Logging to Disk” page 276.
- INTERNAL (only if Option 602, Internal Printer, is fitted): “Logging Results to Internal Printer” page 253.

Enabling Test Period Logging

To enable Test Period Logging first select the **OTHER LOGGING** display and then set TEST PERIOD LOGGING to be **ON**. For more information on setting up the actual Test Period (i.e. Gating Period) please refer to the “Test Timing” page 111 Section.



Selecting Logging Content

The SETUP **LOGGING CONTENT** selection on the **OTHER LOGGING** display allows the user to choose which type of results they wish to log. For example if they only wished to log the G.821 and G.826 Analysis Results then they would simply set LOG G.821 RESULTS and LOG G.826 RESULTS to be **ON** while setting all the other selections to be **OFF**. There is no restriction as to what

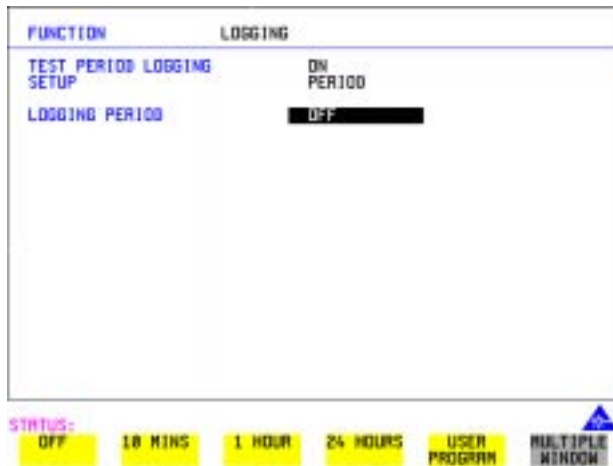
Storing, Logging and Printing

Logging Results

result selection is made but please note that the selections all default to be **ON** so that all results are logged by default.

When TEST PERIOD LOGGING is set to **ON** then there is a LOG ERROR SECONDS selection on the SETUP **LOGGING CONTENT** display. Setting LOG ERROR SECONDS to be **ON** means that, if errors are detected during the Test Period, then a timed and dated message is logged each time an error second occurs. The message will contain the type of error detected and the number of errors of that type which were received in the error second. Note that if there are excessive occurrences of error seconds during a Test Period then having this selection switched **ON** will result in heavy use of printer paper.

Selecting Logging Period



As well as logging results at the end of the Test Period, the user can also select a logging period. The logging period is setup via SETUP **LOGGING PERIOD** on the **OTHER LOGGING** display. At the end of each of these logging periods results will be logged. Note that this selection is only offered when TEST PERIOD LOGGING is set to **ON**.

The length of the logging period is setup using the LOGGING PERIOD selection. This offers a number of preset intervals along with a USER PROGRAM choice which provides a choice of 10 minutes to 99 hours. The actual logging period chosen by the user should be of a shorter duration than the test period in order that results can be logged periodically within the test period.

Storing, Logging and Printing

Logging Results

When a logging period is selected, then the user can choose whether **ALL** results are to be logged at the end of each period or a **SELECTED** subset. Note that this selection is in addition to that already made on the SETUP **LOGGING CONTENT** page.

The WHEN selection allows the user to have results logged **ALWAYS** at the end of each logging period or only when the error count for the logging period is greater than 0 i.e. **PERIOD EC>0** . If the error count is 0 then the message NO BIT ERRORS is displayed.

The TYPE selection allows the user to choose whether the results logged at the end of each period are the Cumulative Results, Period Results or both. The definitions for these two result types are as follows:

Period Results: The Results obtained over a set period of time during the test i.e. the logging period.

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

Logging Results Examples

There are four phases of results logging:

- Start of measurement - Header is logged
- During the measurement - Alarm events and if enabled error events
- End of logging period - Complete set of period and cumulative results
- End of measurement - Complete set of cumulative results.

Logging Header

When the measurement is started the logging header provides a record of the instrument configuration that produced the results.

Storing, Logging and Printing

Logging Results

```
=====|
|                               OmniBER 37719                               |
|                               Instrument Configuration                       |
|-----|
| Receive Signal   : OC-48                STS-3 under test   : 1         |
| Mapping         : STS-1   VT2          ASYNC 2Mb/s        |
| Selected STS-1  : STS-1[1]              |
| Selected VT     : VTGRP[1] VT[1]         |
| Payload (Struct): PCM30CRC              |
| Test Signal     : 64kb/s                 |
| Tributaries     :                               64kb [ 1] |
| Pattern        : 2^11-1                   Polarity       : NORMAL   |
| Range          : 64 UI                     Filter         : HP1       |
| Hit Threshold  : 1.0 UI                   |
|
| MEASUREMENT STARTED 07 Sep 00 10:01:17      Print Period OFF |
|-----|
```

Logging During Measurement

During the measurement a timed and dated message is logged each time an alarm occurs, and 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).

```
| 10:03:35 CV-S (B1)           500 |
| 10:03:36 CV-S (B1)           900 |
| 10:03:38 CV-L (B2)           300 |
| 10:03:39 CV-L (B2)           600 |
| 10:03:41 CV-P (B3)           900 |
| 10:03:42 CV-P (B3)          1000 |
| 10:03:44 CV-P (B3)           300 |
| 10:03:45 A1A2 FRAME          700 |
| 10:03:46 A1A2 FRAME          100 |
| 10:03:48 REI-L               100 |
| 10:03:50 REI-L              1000 |
| 10:03:51 REI-L              1000 |
| 10:03:53 REI-P               300 |
| 10:03:54 REI-P              1000 |
| 10:03:56 REI-P               700 |
| 10:04:00 CV-V               1000 |
```

Storing, Logging and Printing Logging Results

```

| 10:04:01 CV-V          1000          |
| 10:04:03 CV-V          200          |
| 10:04:07 RDI-V         SET          |
| 10:04:09 RDI-P         SET          |
| 10:04:10 Pattern Loss  SET          |
| 10:04:11 SEF           SET          |
| 10:04:17 RDI-V         CLEAR        |
| 10:04:19 RDI-P         CLEAR        |
| 10:04:21 Pattern Loss  CLEAR        |
| 10:04:22 SEF           CLEAR        |
| 10:04:22              ALL ALARMS CLEAR |

```

Logging at the End of Measurement

At the end of the measurement a complete set of cumulative results are logged. At the end of each LOGGING PERIOD a complete set of Period results and a full set of cumulative results are logged.

```

=====
| MEASUREMENT COMPLETE 07 Sep 00 10:05:57      Elapsed Time 00d 00h 00m 01s |
=====
|
|                          Cumulative Results
|
| Error Results :
|
|          A1A2 FRAME  CV-S (B1)  CV-L (B2)      REI-L  CV-P (B3) |
| Error Count          0          0          0          0          0 |
| Error Ratio          0          0          0          0          0 |
|
|          REI-P      CV-V      REI-V
| Error Count          0          0          0
| Error Ratio          0          0          0
|
|
|          FAS 140M  FAS 34M  FAS 8M  FAS 2M
| Error Count          N/A      N/A      N/A      0
| Error Ratio          N/A      N/A      N/A      0
|
|          BIT      CODE      CRC      REBE
| Error Count          0      N/A      0      0
| Error Ratio          0      N/A      0      0
|

```

Storing, Logging and Printing Logging Results

| JITTER | | | | |
|----------------------------|-----------|-----------|-------|-----------|
| Hit Count | | | | 0 |
| Hit Seconds | | | | 0 |
| Hit Free Seconds | | | | 1 |
| Positive Peak | | | | 0.010 |
| Negative Peak | | | | 0.010 |
| Peak-to-Peak | | | | 0.020 |
| RMS | | | | 0.006 |
| Analysis Results : | | | | |
| G.826 ANALYSIS | | | | |
| | CV-S (B1) | CV-L (B2) | REI-L | CV-P (B3) |
| Errored Blocks | 0 | 0 | 0 | 0 |
| Errored Seconds | 0 | 0 | 0 | 0 |
| Severely Errored Seconds | 0 | 0 | 0 | 0 |
| Unavailable Seconds | 0 | 0 | 0 | 0 |
| Path Unavailable Seconds | N/A | 0 | 0 | 0 |
| Background Block Errors | 0 | 0 | 0 | 0 |
| Errored Second Ratio | 0 | 0 | 0 | 0 |
| Severely Errored Sec Ratio | 0 | 0 | 0 | 0 |
| Background Block Err Ratio | 0 | 0 | 0 | 0 |
| | REI-P | CV-V | REI-V | |
| Errored Blocks | 0 | 0 | 0 | |
| Errored Seconds | 0 | 0 | 0 | |
| Severely Errored Seconds | 0 | 0 | 0 | |
| Unavailable Seconds | 0 | 0 | 0 | |
| Path Unavailable Seconds | 0 | 0 | 0 | |
| Background Block Errors | 0 | 0 | 0 | |
| Errored Second Ratio | 0 | 0 | 0 | |
| Severely Errored Sec Ratio | 0 | 0 | 0 | |
| Background Block Err Ratio | 0 | 0 | 0 | |

Storing, Logging and Printing Logging Results

| M.2101 ANALYSIS | | | | | |
|--------------------------|----------------|----------|-----------------|---------|---------|
| | Section | | High Order Path | | |
| | Rx | Tx | Rx | Tx | |
| Errored Seconds | 0 | 0 | 0 | 0 | |
| Severely Errored Seconds | 0 | 0 | 0 | 0 | |
| Unavailable Seconds | 0 | 0 | 0 | 0 | |
| | | | | | |
| | Low Order Path | | Rx | Tx | |
| Errored Seconds | 0 | 0 | | | |
| Severely Errored Seconds | 0 | 0 | | | |
| Unavailable Seconds | 0 | 0 | | | |
| | | | | | |
| G.821 ANALYSIS | | | | | |
| | BIT | FAS 140M | FAS 34M | FAS 8M | FAS 2M |
| Errored Sec | 0 | N/A | N/A | N/A | 0 |
| %Errored Sec | 0.00000 | N/A | N/A | N/A | 0.00000 |
| %ES (Annex D) | 0.00000 | N/A | N/A | N/A | N/A |
| Error Free Sec | 1 | N/A | N/A | N/A | 1 |
| %Error Free Sec | 100 | N/A | N/A | N/A | 100 |
| Severely Err Sec | 0 | N/A | N/A | N/A | 0 |
| %Severely Err Sec | 0.00000 | N/A | N/A | N/A | 0.00000 |
| Degraded Minutes | 0 | N/A | N/A | N/A | 0 |
| %Degraded Minutes | 0.00000 | N/A | N/A | N/A | 0.00000 |
| Unavailable Sec | 0 | N/A | N/A | N/A | 0 |
| %Unavailable Sec | 0.00000 | N/A | N/A | N/A | 0.00000 |
| | | | | | |
| | | | CODE | CRC4 | REBE |
| Errored Sec | | | N/A | 0 | 0 |
| %Errored Sec | | | N/A | 0.00000 | 0.00000 |
| Error Free Sec | | | N/A | 1 | 1 |
| %Error Free Sec | | | N/A | 100 | 100 |
| Severely Err Sec | | | N/A | 0 | 0 |
| %Severely Err Sec | | | N/A | 0.00000 | 0.00000 |
| Degraded Minutes | | | N/A | 0 | 0 |
| %Degraded Minutes | | | N/A | 0.00000 | 0.00000 |
| Unavailable Sec | | | N/A | 0 | 0 |
| %Unavailable Sec | | | N/A | 0.00000 | 0.00000 |

Storing, Logging and Printing Logging Results

| G.826 ANALYSIS | | | | | | |
|----------------------------|--------|-------|------|-------|-------|-----|
| | Near | 8Mb/s | Far | Near | 2Mb/s | Far |
| Errored Blocks | N/A | | N/A | 0 | | 0 |
| Errored Seconds | N/A | | N/A | 0 | | 0 |
| Severely Errored Seconds | N/A | | N/A | 0 | | 0 |
| Unavailable Seconds | N/A | | N/A | 0 | | 0 |
| Path Unavailable Seconds | N/A | | N/A | 0 | | 0 |
| Background Block Errors | N/A | | N/A | 0 | | 0 |
| Errored Second Ratio | N/A | | N/A | 0 | | 0 |
| Severely Errored Sec Ratio | N/A | | N/A | 0 | | 0 |
| Background Block Err Ratio | N/A | | N/A | 0 | | 0 |
| BIT Errors | | | | | | |
| Errored Blocks | | 0 | | | | |
| Errored Seconds | | 0 | | | | |
| Severely Errored Seconds | | 0 | | | | |
| Unavailable Seconds | | 0 | | | | |
| Background Block Errors | | 0 | | | | |
| Errored Second Ratio | | 0 | | | | |
| Severely Errored Sec Ratio | | 0 | | | | |
| Background Block Err Ratio | | 0 | | | | |
| M.2100 ANALYSIS | | | | | | |
| | Rx | 8Mb/s | Tx | Rx | 2Mb/s | Tx |
| Errored Seconds | N/A | | N/A | 0 | | 0 |
| Severely Errored Seconds | N/A | | N/A | 0 | | 0 |
| Unavailable Seconds | N/A | | N/A | 0 | | 0 |
| 64k Rx | | | | | | |
| Errored Seconds | | 0 | | | | |
| Severely Errored Seconds | | 0 | | | | |
| Unavailable Seconds | | 0 | | | | |
| M.2110 ANALYSIS | | | | | | |
| | 15-min | 1-hr | 2-hr | 24-hr | 7-day | |
| BIS Results | WAIT | WAIT | WAIT | WAIT | WAIT | |

Storing, Logging and Printing Logging Results

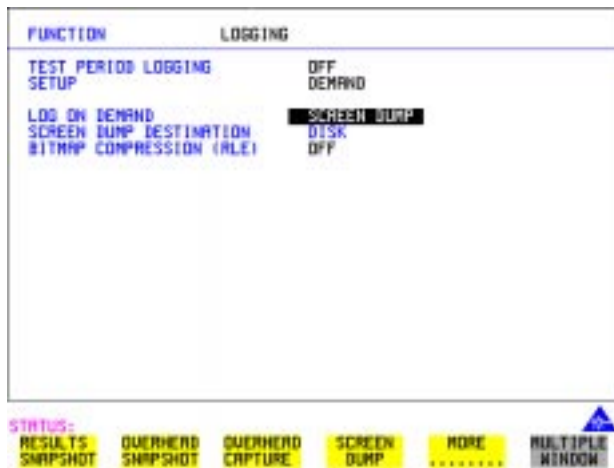
```
|
|
| Frequency :      0.0 kHz      Offset :      O/R kHz      Offset :      O/Rppm |
| Power Level :   -13.9 dBm    STM-16o OPTICAL |
|
| Pointer Results :                SPE POINTER                VT POINTER |
|                               Count      Seconds           Count      Seconds |
| NDF                               0                               0 |
| Missing NDF                       0                               0 |
| +ve Pointer Adjustments            0              0              0 |
| -ve Pointer Adjustments            0              0              0 |
| Implied VC Offset                   0.0              0.0 |
| Pointer Value                        0              664 |
|=====|
```

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
- SCREEN DUMP - Allows logging of the chosen display



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.
The logging device can be selected on the **OTHER LOGGING** display when SETUP is set to **LOGGING DEVICE**. For more details on the choice of devices and how to setup the instrument to interface with them please refer to the following sections:
 - RS232: “Logging Results to RS-232-C Printer” page 254.

Storing, Logging and Printing

Logging on Demand

```

| C2 | 00  J1 Path Trace:          | Z6 | 00  J2 Path Trace:          |
| G1 | 00  "~~~~~"                 | Z7 | 00  "~~~~~"                 |
| F2 | 00  "          "             |    |    E.164 CRC NOT FOUND      |
| H4 | 00  "          U          "   |    |                               |
| Z3 | 00  "          "             |    |                               |
| Z4 | 00  "          "             |    |                               |
| N1 | 00  "          "             |    |                               |

```

Results Snapshot

Results Snapshot provides a Header listing the instrument settings that produced the results and the last recorded, complete set of cumulative measurement results.

```

=====
| 10:08:20 PRINT DEMANDED- RESULTS SNAPSHOT      Elapsed Time  00d 00h 00m 01s |
=====
|
|                               Cumulative Results                               |
|
| Error Results :
|
|           A1A2 FRAME  CV-S (B1)  CV-L (B2)      REI-L  CV-P (B3) |
| Error Count           0           0           0           0           0 |
| Error Ratio           0           0           0           0           0 |
|
|           REI-P        CV-V        REI-V
| Error Count           0           0           0
| Error Ratio           0           0           0
|
|
|           FAS 140M    FAS 34M    FAS 8M    FAS 2M |
| Error Count           N/A        N/A        N/A        0 |
| Error Ratio           N/A        N/A        N/A        0 |
|
|           BIT        CODE        CRC        REBE |
| Error Count           0           N/A        0           0 |
| Error Ratio           0           N/A        0           0 |
|
|
| Frequency :           0.0 kHz      Offset :      O/R kHz      Offset :      O/Rppm |
| Power Level :      -13.9 dBm      STM-16o OPTICAL
|

```

Storing, Logging and Printing

Logging on Demand

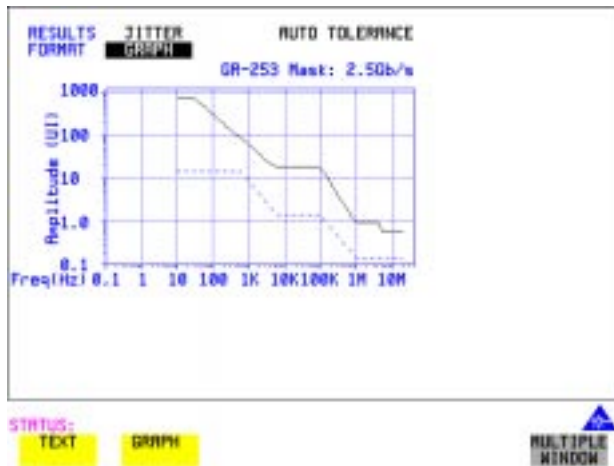
| Pointer Results : | SPE POINTER | | VT POINTER | |
|-------------------------|-------------|---------|------------|---------|
| | Count | Seconds | Count | Seconds |
| NDF | | 0 | | 0 |
| Missing NDF | | 0 | | 0 |
| +ve Pointer Adjustments | 0 | 0 | 0 | 0 |
| -ve Pointer Adjustments | 0 | 0 | 0 | 0 |
| Implied VC Offset | 0.0 | | 0.0 | |
| Pointer Value | 0 | | 664 | |
| ===== | | | | |

Logging Jitter Tolerance Results

Description

The jitter auto tolerance feature provides jitter tolerance measurements within the relevant mask, BELLCORE GR-253 and GR-499 for SONET.

You can log the jitter auto tolerance results to a printer for record keeping purposes. The **GRAPH** version or the **TEXT** version of the jitter tolerance results can be logged to an external printer.



HOW TO:

- 1 Choose the logging DEVICE.
The logging device can be selected on the **OTHER LOGGING** display when SETUP is set to **LOGGING DEVICE**. For more details on the choice of devices and how to setup the instrument to interface with them please refer to the following sections:
 - RS232: "Logging Results to RS-232-C Printer" page 254.
 - GPIB: "Logging Results to GP-IB Printer" page 252
 - PARALLEL: "Logging Results to Parallel (Centronics) Printer" page 251.
 - INTERNAL (only if Option 602, Internal Printer, is fitted): "Logging Results to Internal Printer" page 253.

Storing, Logging and Printing

Logging Jitter Tolerance Results

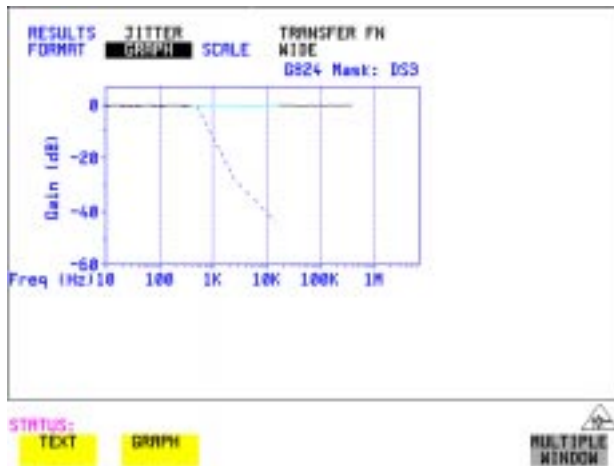
- 2 Choose **GRAPH** on the **RESULTS** **AUTO TOLER** display or choose **TEXT** on the **RESULTS** **AUTO TOLER** display, if you wish to log the graph and text results to the printer.
- 3 Press **PRINT NOW** to log the chosen results to the printer.

Logging Jitter Transfer Results

Description

The jitter transfer feature provides jitter transfer measurements within the relevant ITU-T mask, GR-499/G.824 for DS_n and GR.253 for SONET.

You can log the jitter transfer results to a printer for record keeping purposes. The **GRAPH** version or the **TEXT** version of the jitter transfer results can be logged to an external printer.



HOW TO:

- 1 Choose the logging DEVICE.

The logging device can be selected on the **OTHER LOGGING** display when SETUP is set to **LOGGING DEVICE**. For more details on the choice of devices and how to setup the instrument to interface with them please refer to the following sections:

- RS232: “Logging Results to RS-232-C Printer” page 254.
- GPIB: “Logging Results to GP-IB Printer” page 252
- PARALLEL: “Logging Results to Parallel (Centronics) Printer” page 251.
- INTERNAL (only if Option 602, Internal Printer, is fitted): “Logging Results to Internal Printer” page 253.

Storing, Logging and Printing

Logging Jitter Transfer Results

- 2 Choose **GRAPH** on the **RESULTS** **JITTER** **TN FUNCTION** display or choose **TEXT** on the **RESULTS** **JITTER** **TN FUNCTION** display if you wish to log the graph and text results to the printer.
- 3 Press **PRINT NOW** to log the chosen results to the printer.

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 Printer to a Parallel Port " page 256.
- 2 If a non HP printer is connected then set PRINTER TYPE to be **ALT. PRINTER**. Set MODE to be **NORMAL** (80 character column width) or **COMPRESS** (40 character column width) according to the capabilities of your printer.
- 3 See "Logging Results " page 233 or "Logging on Demand " page 243 for more details on selecting the type of Results you wish to log.
- 4

Logging Results to GP-IB Printer

Description

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



HOW TO:

- 1 Connect an GP-IB printer to the GPIB port.

NOTE

Choosing GP-IB external printer for logging prevents the use of GP-IB remote control.

- 2 See "Logging Results " page 233 or "Logging on Demand " page 243 for more details on selecting the type of Results you wish to log.

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.

| FUNCTION | LOGGING |
|---------------------|----------|
| LOGGING SETUP | DEVICE |
| LOGGING PORT | INTERNAL |
| REMOTE CONTROL PORT | HP1B |

STATUS:

| | | | | | |
|----------|-------|------|------|----------|-----------------|
| INTERNAL | RS232 | HP1B | DISK | PARALLEL | MULTIPLE WINDOW |
|----------|-------|------|------|----------|-----------------|

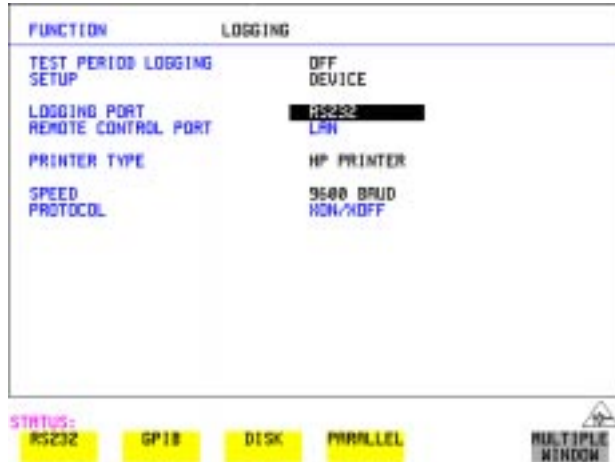
HOW TO:

- 1 See "Logging Results " page 233 or "Logging on Demand " page 243 for more details on selecting the type of Results you wish to log.

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 then set PRINTER TYPE to be **ALT. PRINTER**. Set MODE to be **NORMAL** (80 character column width) or **COMPRESS** (40 character column width) according to the capabilities of your printer.
- 3 Set SPEED to match the Baud Rate chosen on your printer.
- 4 Set PROTOCOL to match that required by your printer.
- 5 See "Logging Results " page 233 or "Logging on Demand " page 243 for more details on selecting the type of Results you wish to log.

Printing Results from Disk

Description

If you have inserted a disk into the internal disk drive and saved data to disk, you can print the contents of the disk using a PC and Printer as follows:

Remove the Disk from the OmniBER 718 and insert 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>

Connecting an Printer to a Parallel Port

Description

If Remote Control Option, 601, is fitted, the OmniBER 719 has the capability of interfacing with an printer via the PARALLEL port.

CAUTION

Do not connect a serial printer e.g. RS-232-C or GPIB to the OmniBER 719 Parallel port as this will damage the interface.

HOW TO:

- 1 Connect the OmniBER 719 Parallel port to your Printer Parallel port using printer cable HP 24542D.

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

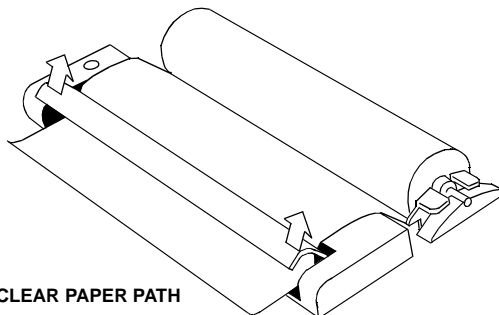
Suitable rolls of paper are available from Hewlett Packard, Part Number 9270-1360.

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 printer paper from the front (in the normal direction of operation).



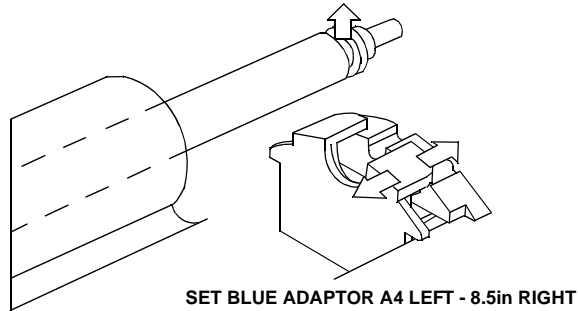
- 3 Lift out the spindle. Adjust the paper width adaptor to the width of the paper being used.
- 4 Put the paper roll on the spindle such that the sensitive side (slightly shiny) will be on the underside of the print mechanism. Ensure that the relocation of the spindle locks the blue width adaptor in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

Storing, Logging and Printing

Changing Internal Printer Paper

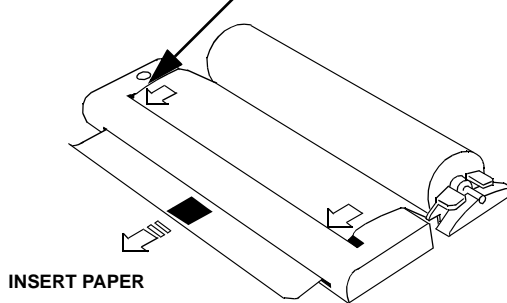
NOTE

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 HP 9270-1360 paper which has the sensitive side on the outside of the roll.



- 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.

Align paper with the leftmost edge of the printer mechanism slot

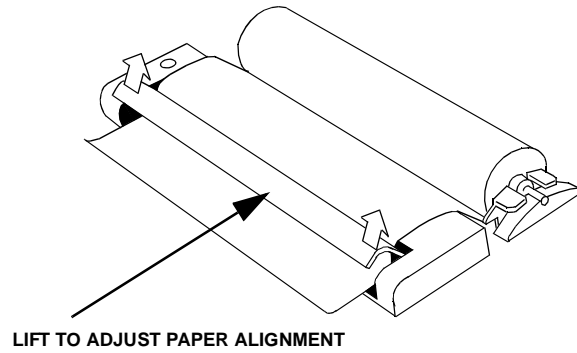


CAUTION

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

Storing, Logging and Printing
Changing Internal Printer Paper

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



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 257.
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 257.

NOTE

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

- “Storing Configurations in Instrument Store” page 262
- “Titling Configuration in Instrument Store” page 263
- “Recalling Configurations from Instrument Store” page 264
- “Formatting a Disk” page 265
- “Labeling a Disk” page 266
- “Managing Files and Directories on Disk” page 267
- “Saving a Screen Dump to Disk ” page 274
- “Saving Graphical Results to Disk” page 276
- “Saving Data Logging to Disk” page 278
- “Saving Configurations to Disk” page 279
- “Recalling Configuration from Disk” page 280
- “Recalling Graphics Results from Disk” page 281
- “Copying Configuration from Instrument Store to Disk” page 282
- “Copying Configuration from Disk to Instrument Store” page 284
- “Copying Graphics Results from Instrument Store to Disk” page 286

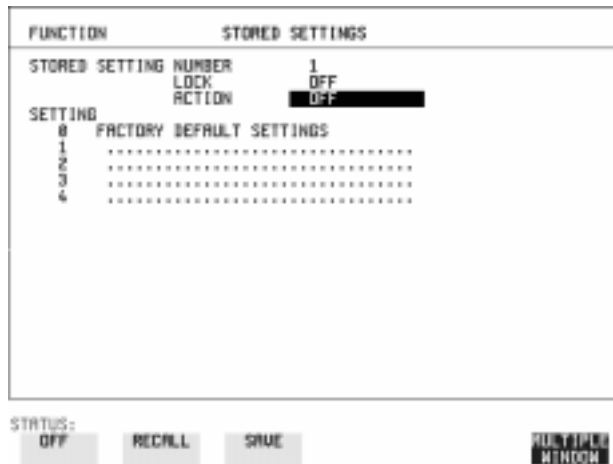
Using Instrument and Disk Storage

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.



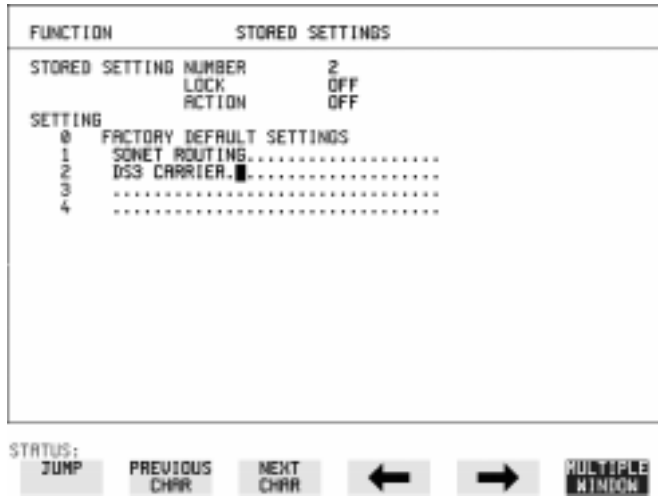
HOW TO:

- 1 Set the OmniBER 719 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 263.

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.

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.

Formatting a Disk

Formatting a Disk

Description

Only 1.44M, MS-DOS compatible disks can be used in the OmniBER 719. Any other format or capacity will result in a disk access error being displayed.



NOTE

Disks can be formatted in an IBM compatible PC but it is recommended that the disk is formatted in the OmniBER 719 as this will ensure full compatibility with the Floppy Disk power fail recovery included in the OmniBER 719.

HOW TO:

- 1 Choose DISK OPERATION **DISK FORMAT**.
- 2 Insert the Disk into the Disk drive.
- 3 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.

Labeling a Disk

Description

You can label your disks for ease of identification.

| FUNCTION | FLOPPY DISK |
|--------------------------------|------------------------------|
| DISK OPERATION LABEL | DISK LABEL MY DISK |
| Select OK to perform operation | <input type="checkbox"/> OFF |
| A:\ LABEL: MY DISK | FREE: Bytes |

STATUS:

OFF

OK

MULTIPLE WINDOW

HOW TO:

- 1 Choose DISK OPERATION **DISK LABEL**.
- 2 Label the Disk using **PREVIOUS CHAR** **NEXT CHAR** **→** **←** or press **SET** and use the pop-up keypad.
- 3 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.

Managing Files and Directories on Disk

Description

File and Directory structures can be important in speeding 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

| | | |
|--------------------------------|--------------------------|-------|
| FUNCTION | FLOPPY DISK | |
| DISK OPERATION | FILE CREATE DIRECTORY | |
| NAME | SONET | |
| Select OK to perform operation | OFF | |
| A:\ LABEL: | FREE: | Bytes |

STATUS:
OFF OK MULTIPLE WINDOW

HOW TO:

- 1 Choose DISK OPERATION **FILE** | **CREATE DIRECTORY** on the **OTHER** | **FLOPPY DISK** display.
- 2 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.
- 3 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.

Using Instrument and Disk Storage

Managing Files and Directories on Disk

NOTE

Title Bar - File types displayed and current directory. (cannot be highlighted).

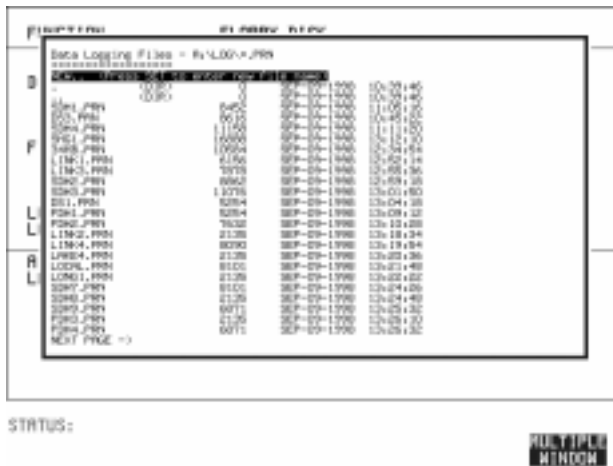
. <**DIR**> - Current Directory.

.. <**DIR**> - Parent directory. Move highlighted cursor to this line and press **SET** to move to parent directory.

SONET1.PRN - File (with named extension) in current directory. Move highlighted cursor to this line and press **SET** to select the file. The display will return to the **SAVE** display and the selected file name will appear in the FILE NAME field.

NEXT - Move highlighted cursor to this line and press **SET** to access the next page of file names.

PREV - Move highlighted cursor to this line and press **SET** to access the previous page of file names.



7 **NEW.** - Allows entry of new file name using pop-up keypad. Press **SET** to obtain the pop-up keypad display. Enter the new filename, Choose **END** and press **SET** to return to the file manager display.

8 Press **CANCEL** to return to the **SAVE** display.
The filename entered via the keypad appears on the **SAVE** display.
The file extension is added automatically.
The Directory name and the disk Label appear at the bottom of the display.

Using Instrument and Disk Storage

Managing Files and Directories on Disk

Renaming a File on Disk

Description

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

| FUNCTION | FLOPPY DISK |
|--------------------------------|------------------------------|
| DISK OPERATION | FILE RENAME |
| FROM:NAME | FILENAME.CNF |
| TO: DIRECTORY NAME | A:\ FILENAME.CNF |
| Select OK to perform operation | <input type="checkbox"/> OFF |
| A:\ LABEL: | FREE: Bytes |

STATUS:
 OFF OK

MULTIPLE
WINDOW

HOW TO:

- 1 Choose DISK OPERATION **FILE RENAME**.
- 2 Enter the FROM filename using **PREVIOUS CHAR** **||** **NEXT CHAR** **→** **←** or
Choose the directory which contains the file to be renamed. See "Accessing
Directories and Files " page 268. 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.
- 3 Choose the directory in which to locate the renamed file (it will appear on the
display). See "Accessing Directories and Files " page 268.
- 4 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.
- 5 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.

Using Instrument and Disk Storage

Managing Files and Directories on Disk

Deleting a File on Disk

Description

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

| FUNCTION | FLOPPY DISK |
|--------------------------------|-------------------------------|
| DISK OPERATION | FILE DELETE DELETE FILE |
| NAME | FILENAME.EXT |
| Select OK to perform operation | <input type="checkbox"/> OFF |
| A:\ LABEL: | FREE: Bytes |

STATUS:

OFF

OK

MULTIPLE
WINDOW

HOW TO:

- 1 Choose DISK OPERATION **FILE** **DELETE** **DELETE FILE**.
- 2 Choose the directory containing the file to be deleted. See "Accessing Directories and Files " page 268.
- 3 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.
- 4 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.

Using Instrument and Disk Storage

Managing Files and Directories on Disk

Deleting a Directory on Disk

Description

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

| FUNCTION | FLOPPY DISK |
|--------------------------------|------------------------------------|
| DISK OPERATION | FILE DELETE DELETE DIRECTORY |
| Select OK to perform operation | <input type="checkbox"/> OFF |
| A:\ LABEL: | FREE: Bytes |

STATUS:
 OFF OK

MULTIPLE WINDOW

NOTE

A directory cannot be deleted until all the files within the directory have been deleted. See "Deleting a File on Disk " page 271.

HOW TO:

- 1 Choose the directory you wish to delete (it will appear on the display). See "Accessing Directories and Files " page 268.
- 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 271.

Using Instrument and Disk Storage

Managing Files and Directories on Disk

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.

| FUNCTION | FLOPPY DISK |
|------------------------------------|------------------------|
| DISK OPERATION | FILE PROPERTIES |
| DISPLAY OPTION | FILE DESCRIPTOR |
| FILE NAME | FILENAME.CNF |
| DESCRIPTOR | |
| Press SET to select filename popup | |
| Select OK to perform operation | OFF |
| A:\ LABEL: | FREE: Bytes |

STATUS:

**TIME
& DATE**

**FILE
DESC**

**MULTIPLE
WINDOW**

HOW TO:

- 1 Choose the directory containing the file you wish to add the descriptor to. See "Accessing Directories and Files " page 268.
- 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.

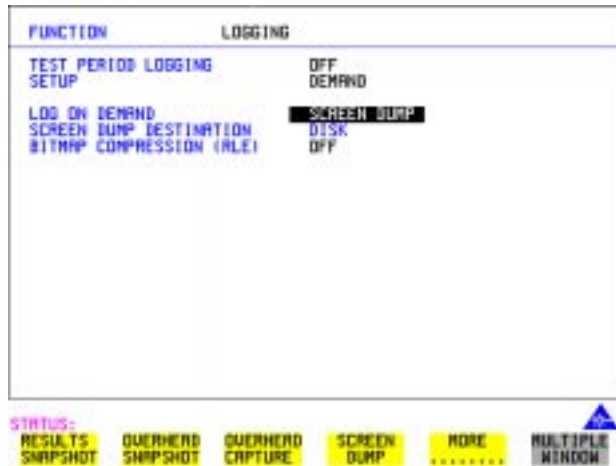
NOTE

This slows down the updating of the display.

Saving a Screen Dump to Disk

Description

The chosen display may be stored on disk in bitmap format using the Screen Dump feature of the OmniBER. 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 Select the **OTHER** **LOGGING** display, and choose SETUP **LOGGING DEVICE** and LOGGING PORT **DISK** .
- 2 Now set SETUP to **LOG ON DEMAND** and LOG ON DEMAND to **SCREEN DUMP** .
- 3 If compression is required to save disk space, select BITMAP COMPRESSION (RLE) **ON** .

Using Instrument and Disk Storage

Saving a Screen Dump to Disk

4

| | |
|------------------------|-----------------------------|
| FUNCTION | FLOPPY DISK |
| DISK OPERATION | SAVE |
| FILE TYPE NAME | SCREEN DUMP FILENAME.BMP |
| BMP DIR : A:\ | |
| BMP FILE: SDUMP029.BMP | |
| A:\ | |
| LABEL: no label | FREE: unknown Bytes |

STATUS: STORED SETTINGS FLOPPY LOGGING MORE **PRINT NOW**

- 5 Choose the directory in which to save the Screen Dump. See "Accessing Directories and Files " page 268.
- 6 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 filename. 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.

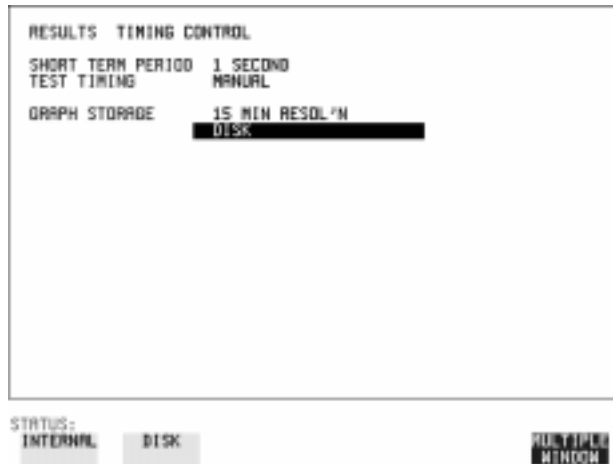
- 7 Move the highlighted cursor to NAME and enter the filename using **PREVIOUS CHAR** **NEXT CHAR** **→** **←** or press **SET** twice and use the pop-up keypad.
- 8 Choose the display you want to store on disk and press **PRINT NOW**. After a few second the message "SAVING SCREEN DUMP . . . (XX% COMPLETE)" is displayed.

Saving Graphical Results to Disk

Description

Graphical results can be saved to a file on disk. Two methods of naming the file, which is created when the measurement is started, are available:

- Automatic** A filename in the form meas001 is created automatically without any action from you.
- Your Choice** You can input a filename of your choice which will override the automatically generated filename. This must be entered before the measurement is started. If the filename you enter already exists, graphics results will be saved to the automatically generated filename. This prevents existing files from being overwritten each time the measurement is started.



HOW TO:

- 1 Choose GRAPH STORAGE **DISK** and the Graph Storage resolution required on the **RESULTS** display. See “Saving Graphics Results to Instrument Store” page 224.
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.

Using Instrument and Disk Storage

Saving Graphical Results to Disk

| FUNCTION | FLOPPY DISK | |
|----------------|-----------------|-------|
| DISK OPERATION | SAVE | |
| FILE TYPE | GRAPHICS | |
| NAME | FILENAME.SMG | |
| A:\ LABEL: | FREE: | Bytes |

STATUS:

CONFIG-
URATION

GRAPHICS

DATA
LOGGING

MULTIPLE
WINDOW

- Choose the directory in which to save the graphics results. See "Accessing Directories and Files " page 268.
- If you wish to enter your own choice of filename, choose DISK OPERATION **SAVE** FILE TYPE **GRAPHICS**.
- 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.

Saving Data Logging to Disk

Description

Data Logging can be saved to a file on disk. The disk can be transferred to a personal computer (PC) and the logging investigated at a later date.

| | | |
|-------------------|--|-------|
| FUNCTION | FLOPPY DISK | |
| DISK OPERATION | SAVE | |
| FILE TYPE NAME | DATA LOGGING FILENAME.PRN APPEND TO FILE | |
| A:\ LABEL: | FREE: | Bytes |

STATUS:

OVER-
WRITE

APPEND
TO FILE

MULTIPLE
WINDOW

HOW TO:

- 1 Choose the directory in which to save the logging results. See "Accessing Directories and Files" page 268.
- 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 wish to add the data logging to a file which already exists, choose **APPEND TO FILE**. The data logging is added to the named file on Disk in the available free space.
If you wish to overwrite the contents of the named file with the data logging, choose **OVERWRITE**.
- 4 Set up the **OTHER** **LOGGING** display. See "Logging Results" page 233.
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.

Saving Configurations to Disk

Description

You can store a large number of measurement settings which are used regularly and recall them when required.

Configurations can be stored to a file on the floppy disk. The floppy disk can be used in other instruments which have the same option structure.

| FUNCTION | FLOPPY DISK |
|---|------------------------------|
| DISK OPERATION | SAVE |
| FILE TYPE NAME | CONFIGURATION S00001L.CNF |
| Select OK to perform operation | OFF |
| A:\ LABEL: no label FREE: 1148928 Bytes | |

STATUS: CONFIGURATION GRAPHICS DATA LOGGING SCREEN DUMP **HIDDEN WINDOW**

HOW TO:

- 1 Set the OmniBER 719 to the configuration you wish to store.
- 2 Choose the directory in which you wish to save the OmniBER 719 configuration. See "Accessing Directories and Files " page 268.
- 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 Files " page 268.

Recalling Configuration from Disk

Description

If a configuration has been stored on disk, you will need to recall it at some time in the future to configure the instrument.

| | | |
|--------------------------------|-------------------------------|-------|
| FUNCTION | FLOPPY DISK | |
| DISK OPERATION | RECALL | |
| FILE TYPE NAME | CONFIGURATION FILENAME.CNF | |
| Select OK to perform operation | OFF | |
| A:\ LABEL: | FREE: | Bytes |

STATUS:
CONFIG-
URATION GRAPHICS

MULTIPLE
WINDOW

HOW TO:

- 1 Choose the directory that contains the configuration file to be recalled. See "Accessing Directories and Files " page 268.
- 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.

Recalling Graphics Results from Disk

Description

If graphic results have been stored on disk, you will need to recall them in able to view the results on the **(GRAPH)** display.

| | | |
|--------------------------------|------------------------------|-------|
| FUNCTION | FLOPPY DISK | |
| DISK OPERATION | RECALL | |
| FILE TYPE NAME | GRAPHICS FILENAME.SMG | |
| Select OK to perform operation | <input type="checkbox"/> OFF | |
| A:\ LABEL: | FREE: | Bytes |

STATUS:

OFF

OK

MULTIPLE
WINDOW

HOW TO:

- 1 Choose the directory that contains the graphics file to be recalled. See "Accessing Directories and Files " page 268.
- 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 225.

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 719 with the same options as the original instrument.

| FUNCTION | FLOPPY DISK |
|--------------------------------|------------------------------|
| DISK OPERATION | FILE COPY CONFIGURATION |
| FROM: 1 ATM27..... | |
| TO: NAME | FILENAME.CNF |
| Select OK to perform operation | <input type="checkbox"/> OFF |
| A:\ LABEL: | FREE: Bytes |

STATUS:
 OFF OK

MULTIPLE WINDOW

HOW TO:

- 1 Choose the directory to receive the configuration file. See "Accessing Directories and Files " page 268.
- 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.

Using Instrument and Disk Storage

Copying Configuration from Instrument Store to Disk

- 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.

Copying Configuration from Disk to Instrument Store

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 another OmniBER 719 with the same options as the original instrument.

| FUNCTION | FLOPPY DISK |
|--------------------------------|------------------------------|
| DISK OPERATION | FILE COPY CONFIGURATION |
| TO: | 4 ATMTEST..... |
| FROM: | NAME FILENAME.CNF |
| Select OK to perform operation | <input type="checkbox"/> OFF |
| A:\ LABEL: | FREE: Bytes |

STATUS:
 OFF OK

MULTIPLE WINDOW

HOW TO:

- 1 Choose the directory containing the configuration file. See "Accessing Directories and Files " page 268.
- 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.

Using Instrument and Disk Storage

Copying Configuration from Disk to Instrument Store

- 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.

Using Instrument and Disk Storage

Copying Graphics Results from Instrument Store to Disk

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.

| FUNCTION | FLOPPY DISK |
|--------------------------------|------------------------------|
| DISK OPERATION | FILE COPY GRAPHICS |
| FROM: STORE | -9 |
| TO: NAME FORMAT | FILENAME.SMG NORMAL |
| Select OK to perform operation | <input type="checkbox"/> OFF |
| A:\ LABEL: | FREE: Bytes |

STATUS:
 OFF

OK

MULTIPLE WINDOW

HOW TO:

- 1 Choose the directory to receive the graphics file. See "Accessing Directories and Files" page 268.
- 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.

Using Instrument and Disk Storage

Copying Graphics Results from Instrument Store to Disk

- 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 719, 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.

Using Instrument and Disk Storage

Copying Graphics Results from Instrument Store to Disk

- “Coupling Transmit and Receive Settings” page 290
- “Setting Time & Date” page 291
- “Enabling Keyboard Lock” page 292
- “Enabling Beep on Received Error” page 293
- “In-Band DS1 Loopcode 156MTS Compatibility” page 294
- “Suspending Test on Signal Loss” page 295
- “REI-L Result/Enable” page 296
- “Graph Storage Resolution” page 298
- “Setting Error Threshold Indication” page 299
- “Setting Screen Brightness and Color” page 300
- “To Generate a New Jitter Mask” page 301
- “To change the parameters of a User-defined jitter mask” page 303
- “Running Self Test” page 305
- “PRBS Polarity Control ” page 309

Selecting and Using "Other" Features

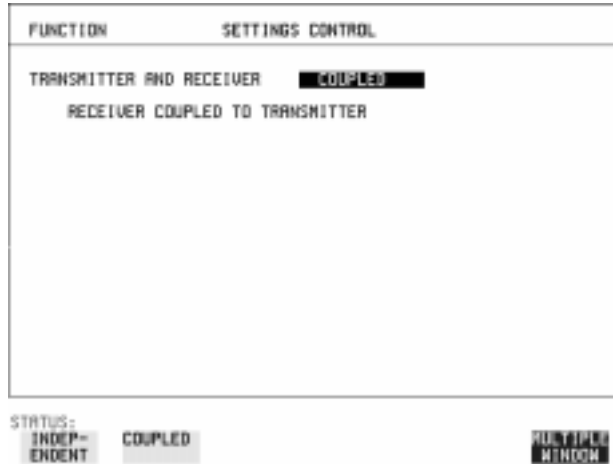
Selecting and Using "Other" Features
Coupling Transmit and Receive Settings

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:

- 1 Choose TRANSMITTER AND RECEIVER **COUPLED**.

Setting Time & Date

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.

Enabling Keyboard Lock

Enabling Keyboard Lock

Description

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

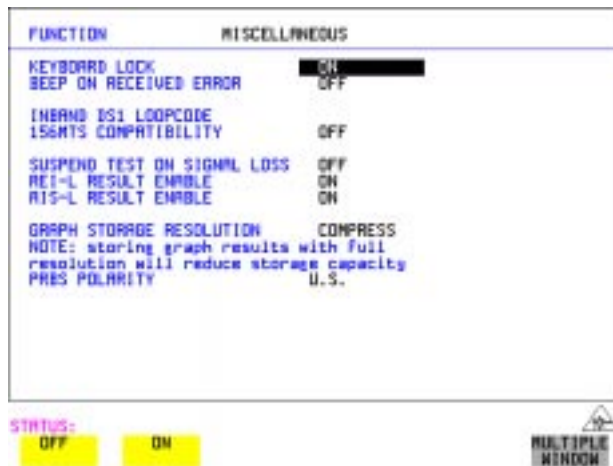
This function is provided in the OmniBER on the **OTHER** **MISCELLANEOUS** display.

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:

- 1 Choose KEYBOARD LOCK **ON**.

Selecting and Using "Other" Features

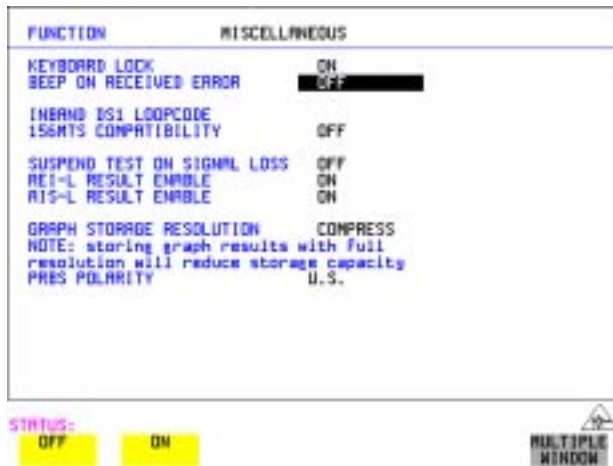
Enabling Beep on Received Error

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 719 on the **OTHER** **MISCELLANEOUS** display.



HOW TO: 1 Choose BEEP ON RECEIVED ERROR **ON**.

Selecting and Using "Other" Features
In-Band DS1 Loopcode 156MTS Compatibility

In-Band DS1 Loopcode 156MTS Compatibility

Description

The instrument default state is with the INBAND DS1 LOOPCODE 156MTS COMPATIBILITY field set to **OFF**. In this mode the instrument operates as per the T1.403.CORE standard which states that the DS1 framing bit should overwrite the DS1 Loopcode pattern. When **ON** is selected the instrument operation changes such that DS1 Loopcode is gapped in order to prevent the DS1 framing bit overwriting the DS1 Loopcode pattern. This is compatible with Hewlett-Packard's 156MTS T-Carrier and SONET tester.

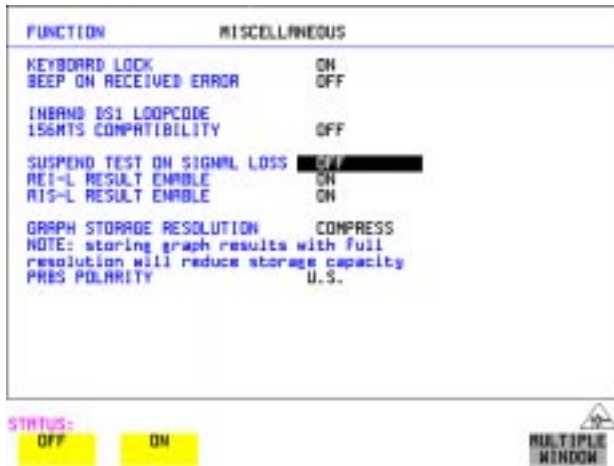


Selecting and Using "Other" Features Suspending Test on Signal Loss

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:

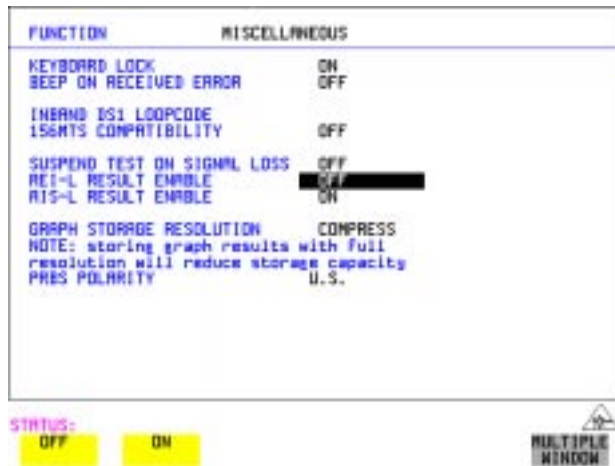
- 1 Choose SUSPEND TEST ON SIGNAL LOSS **ON**.

REI-L Result/Enable

Description

Before running a test, you can choose to enable or disable the SONET measurement of REI-L.

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



HOW TO:

- 1 Choose REI-L ENABLE **ON** or **OFF** as required.

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

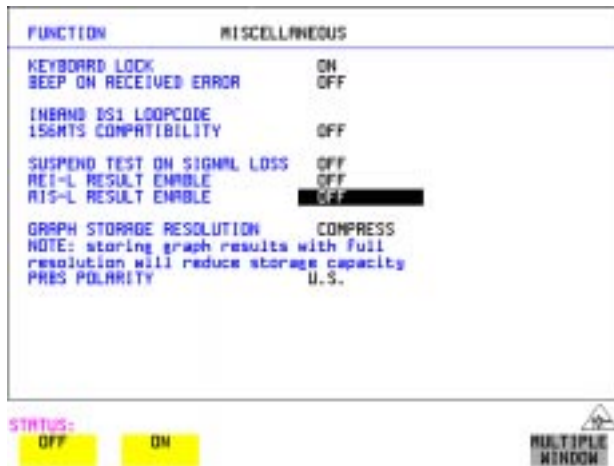
AIS-L Result/Enable

AIS-L Result/Enable

Description

Before running a test, you can choose to enable or disable the SONET measurement of AIS-L.

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



HOW TO:

- 1 Choose AIS-L ENABLE **ON** or **OFF** as required.

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

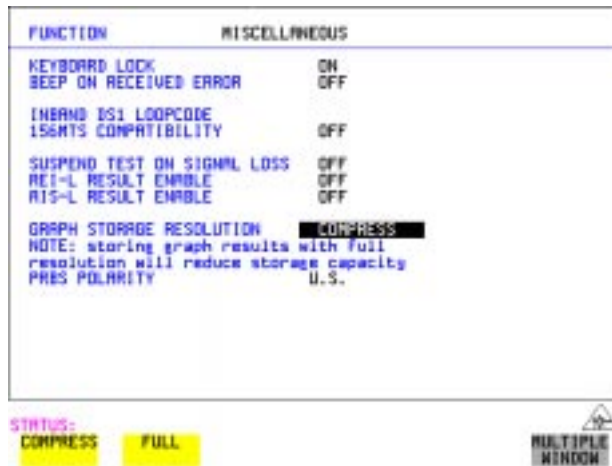
Selecting and Using "Other" Features

Graph Storage Resolution

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.



Setting Error Threshold Indication

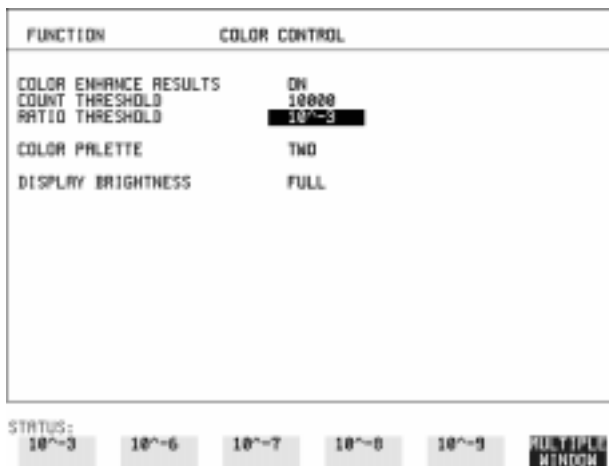
Setting Error Threshold Indication

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 719 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.

Setting Screen Brightness and Color

Description

The OmniBER 719 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.

| FUNCTION | COLOR CONTROL |
|-----------------------|------------------|
| COLOR ENHANCE RESULTS | ON |
| COUNT THRESHOLD | 10000 |
| RATIO THRESHOLD | 10 ⁻³ |
| COLOR PALETTE | TWO |
| DISPLAY BRIGHTNESS | FULL |

STATUS:
HALF **FULL** **RESTORED WINDOW**

HOW TO:

- 1 Choose the DISPLAY BRIGHTNESS to suit the operating environment.

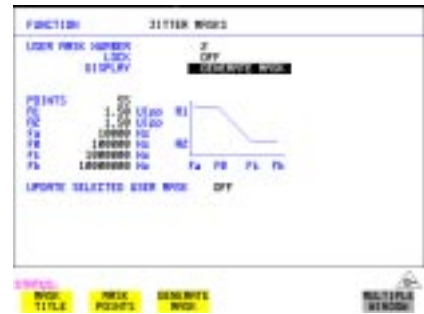
Selecting and Using "Other" Features To Generate a New Jitter Mask

To Generate a New Jitter Mask

This feature enables the user to quickly generate a new mask, without having to set each point in the mask. The procedure is as follows:

- 1 Select **OTHER**, **JITTER MASKS**, you will have to select **MORE** to access the JITTER MASKS key.
- 2 Check the mask LOCK is set to **OFF**, then select a USER MASK NUMBER (from 1 to 5). Note that it is not possible to edit a User Mask when there is a User Mask currently in use (i.e. when running a measurement). When this occurs the LOCK field displays "ON (IN USE)".

- 3 Position the cursor on DISPLAY and select **GENERATE MASK**.
- 4 Position the cursor on POINTS and set the required number of points in the mask.



- 5 Using the **↑**, **↓** and edit keys setup the amplitude and frequency of the user-selectable points given on the display (i.e. A1, A2 fa, f0, ft, fb).
- 6 Position the cursor on the UPDATE SELECTED USER MASK field and select **GENERATE**.



NOTE

A status message "Illegal mask parameters" will occur if the specified frequency and amplitude points are invalid. Check that the frequency points are in ascending order and that the A1 and A2 amplitudes are valid for the specified frequencies.

Selecting and Using "Other" Features To Generate a New Jitter Mask

7 Select DISPLAY **MASK POINTS**.

Note that the GENERATE action has resulted in a new mask being calculated and placed into the frequency and amplitude fields. Further editing can now take place as required, using the edit keys.

For example, selecting NUMBER OF POINTS will allow you to change the number of points in the mask, while selecting PAGE enables you to select pages 1 to 5 and edit the frequency and amplitude of each point on the mask.

The screenshot shows a terminal window titled "JITTER MASKS". At the top, it lists "FUNCTION" and "JITTER MASKS". Below this, several settings are displayed: "USER MASK NUMBER" is 1, "LOCK" is OFF, "DISPLAY" is MASK POINTS (highlighted), "NUMBER OF POINTS" is 50, and "PAGE" is 1. A table of mask points follows, with columns for "FREQ(Hz)" and "AMP(U)" repeated twice. The table contains 12 rows of data. At the bottom, there is a "STATUS:" section with three buttons: "MASK TITLE", "MASK POINTS", and "GENERATE MASK". To the right of these buttons is a "MULTIPLE WINDOW" icon.

| FREQ(Hz) | | AMP(U) | | FREQ(Hz) | | AMP(U) | |
|----------|-------|--------|----|----------|------|--------|--|
| 01 | 9999 | 1.30 | 07 | 23277 | 1.30 | | |
| 02 | 11502 | 1.30 | 08 | 26802 | 1.30 | | |
| 03 | 13243 | 1.30 | 09 | 30860 | 1.30 | | |
| 04 | 15248 | 1.30 | 10 | 35533 | 1.30 | | |
| 05 | 17557 | 1.30 | 11 | 40913 | 1.30 | | |
| 06 | 20216 | 1.30 | 12 | 47100 | 1.30 | | |

8 The new edits are automatically saved into the mask selected, there is no need to generate a new mask.

Locking the Mask

To prevent accidental changes to the masks when finished set the LOCK to **ON**.

To change the parameters of a User-defined jitter mask

- 1 Select **OTHER**, and set FUNCTION to **JITTER MASKS**; you will have to select **MORE** to access the JITTER MASKS key.

To Edit a User Mask Title



- 2 Check the mask LOCK is set to **OFF**, then select USER MASK NUMBER, and select the appropriate user mask (1 to 5).
- 3 Position the cursor on DISPLAY, then select **MASK TITLE**.
- 4 Position the cursor on the MASK (1 to 5) to be edited, and enter a new title using the edit keys.



Selecting and Using "Other" Features

To change the parameters of a User-defined jitter mask

To Edit Mask Points

- 1 Position the cursor on DISPLAY and select **MASK POINTS**.
- 2 Select NUMBER OF POINTS and using the ,  keys, and edit keys (INCREASE/DECREASE DIGIT) select the number of points in the mask (maximum 55) and the frequency and amplitude at each point. Use the PAGE field to switch between pages to access all 55 points in the mask.



The screenshot shows the 'JITTER MASKS' menu. At the top, 'FUNCTION' is listed. Below it, 'USER MASK NUMBER' is 2, 'LOCK' is OFF, and 'DISPLAY' is MASK POINTS. 'NUMBER OF POINTS' is 55 and 'PAGE' is 1. A table of mask points follows, with columns for point number, frequency (Hz), and amplitude (UI). The table is split into two columns of 6 points each. At the bottom, there are three yellow buttons: 'MASK TITLE', 'MASK POINTS', and 'GENERATE MASK'. A 'MULTIPLE WINDOW' icon is also present.

| FREQ(Hz) | | AMP(UI) | | | |
|----------|-----|---------|----|------|------|
| 01 | 200 | 1.50 | 07 | 592 | 1.27 |
| 02 | 240 | 1.50 | 08 | 710 | 1.06 |
| 03 | 287 | 1.50 | 09 | 850 | 0.89 |
| 04 | 344 | 1.50 | 10 | 1019 | 0.75 |
| 05 | 412 | 1.50 | 11 | 1221 | 0.63 |
| 06 | 494 | 1.50 | 12 | 1463 | 0.52 |

- 3 Note that it is not possible to edit a user mask when a user mask is currently in use (i.e. a measurement is running). When this occurs the LOCK field displays "ON (IN USE)".
- 4 The new edits are automatically saved into the mask selected, there is no need to generate a new mask.

Running Self Test

Running Self Test

Description

Before using the OmniBER 719 to make measurements, you can run Self Test ALL TESTS to ascertain the integrity of the OmniBER 719. These tests take between at least 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 Make the loopback connections listed below:
 - Connect Transmit module 75Ω OUT to Receive module 75Ω IN
 - Connect Transmit module 100/120Ω OUT to Receive module 100/120Ω IN
 - Connect Transmit module 75Ω MUX to Receive module 75Ω DEMUX
 - Connect Transmit module 100/120Ω MUX to Receive module 100/120Ω DEMUX
 - Connect Multirate Analyzer IN to OUT
 - Connect Optical OUT to Optical IN via a 15 dB attenuator.

NOTE

If any or all of these connections are not made the OmniBER 719 will FAIL Self Test.

Selecting and Using "Other" Features

Running 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 719 is functioning correctly, after a time of at least 1 hour, TEST STATUS PASSED is displayed.

If TEST STATUS [FAIL nnn] is displayed, the OmniBER 719 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 Make the loopback connections listed below:
Connect Transmit module 75Ω OUT to Receive module 75Ω IN
Connect Transmit module 100/120Ω OUT to Receive module 100/120Ω IN
Connect Transmit module 75Ω MUX to Receive module 75Ω DEMUX
Connect Transmit module 100/120Ω MUX to Receive module 100/120Ω DEMUX
Connect Multirate Analyzer IN to OUT
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.

Selecting and Using "Other" Features

Running Self Test

If the OmniBER 719 is functioning correctly, after a time of 2 to 3minutes, TEST STATUS PASSED is displayed.

If TEST STATUS [FAIL nnn] is displayed, the OmniBER 719 should be returned to a service office for repair.

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.



STATUS:

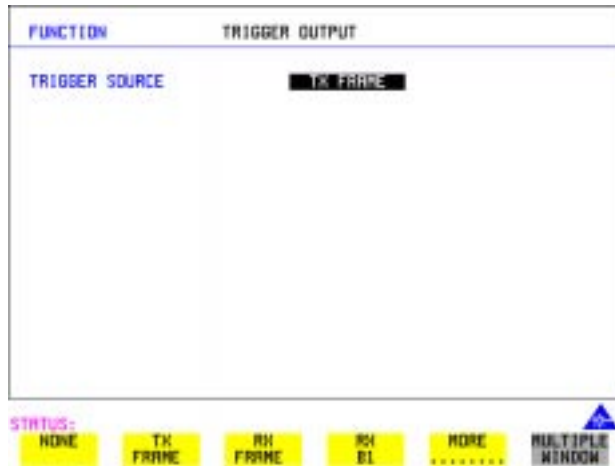


Trigger Output

Trigger Output

Description

Use the pulse output from the TRIG OUT port on the OmniBER Multirate Analyzer module to trigger external equipment. A pulse is output whenever the condition selected in the TRIGGER SOURCE field occurs.



How To

- 1 Select **OTHER**, and set FUNCTION to **TRIGGER OUTPUT**.
- 2 Set the TRIGGER SOURCE field as required from the following:

NONE
TX FRAME
RX FRAME
RX B1
RX B2 and
RX B3

Pulse Format

TTL Levels. Termination can be 75 ohm or 10 k ilohms.

RZ with active high pulse of 60usec (Nominal). Note that a single pulse is generated if a frame contains one or more errors giving a maximum frequency of 8kHz.

Connector

BNC.

PRBS Polarity Control

PRBS Polarity Control

Description

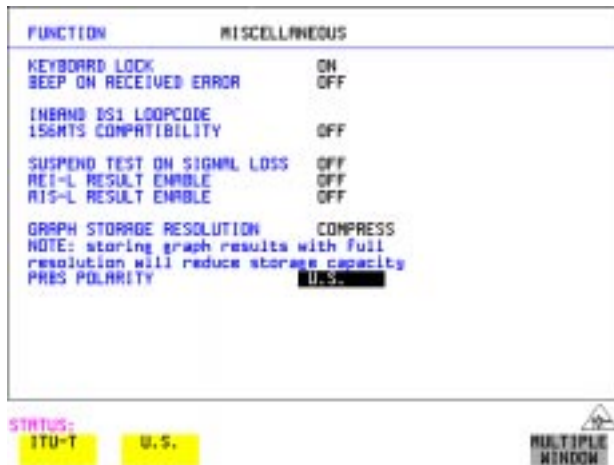
You can select PRBS patterns with NORMAL or INVERTed polarity from the TRANSMITTER and RECEIVER windows.

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-1 consecutive 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.



Selecting and Using "Other" Features

PRBS Polarity Control

Appendix A

STS-1 SPE Background Patterns

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

STS-1 SPE Background Patterns

Table 6 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). |
| VT-2 (2 Mb/s) Framed | VT-2 structure, framed with 2E15-1, 2E9-1 PRBS, NUMBERED or 1100 word pattern. In Numbered mode, each timeslot contains the pattern 0NNNNNNX where NNNNNN is the binary number of the TU. The least significant digit (X) is alternated between 0 and 1 in successive frames. | VT-2, VT-1.5 Mapping or SPE Word (8 bit user programmable word). |
| 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). |

Table 6 STS-1 SPE Background Patterns, continued

| Foreground | Background choice in Foreground TUG-3 | Background choice in other AU-3 |
|------------------------|---|--|
| VT-1.5 (DS1) Framed | VT-1.5 structure, DS1, D4 framed with 2E15-1, 2E9-1 PRBS, NUMBERED or 1100 word pattern in other TU-11s. In Numbered mode, each timeslot contains the pattern 1NNNNNN1 where NNNNNN is the binary number of the TU. Framing type will be the same as the foreground except when SLC96 is selected. In this case, D4 framing is inserted in the background | VT-2, VT-1.5 Mapping or SPE Word (8 bit user programmable word). |

STS-1 SPE Background Patterns

Appendix B

ETSI/ANSI Terminology

A table of ETSI terms with their ANSI equivalents.

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.

Table 7 **ETSI / ANSI Terminology**

| 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 |

ETSI/ANSI Terminology
ETSI/ANSI Conversion and Equivalent Terms

Table 7 **ETSI / ANSI Terminology , continued**

| ETSI Term | ANSI Term |
|------------------------------|---|
| MS-RDI | Line FERF / RDI-L |
| Multiplexer Section Overhead | Line Overhead |
| 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 $m = n \div 3$ for $m \geq 1$) |
| 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) |

Table 7 **ETSI / ANSI Terminology , continued**

| ETSI Term | ANSI Term |
|------------------------|------------------------------------|
| TU | VT |
| TU-11 | VT 1.5 |
| TU-12 | VT 2 |
| TU-2 | VT 6 |
| 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) |

NOTE: VC is an ETSI abbreviation for Virtual Container and an ETSI / ANSI abbreviation for (ATM) Virtual Channel. The context of VC must therefore be taken into account when converting between standards.

Appendix C

Glossary of Terms

A brief explanation of terms and abbreviations used in the OmniBER 719.

Glossary of Terms

Glossary

| | | | |
|----------|--|----------|--|
| A | | BPV | Bipolar Violation |
| AAL | ATM Adaptation Layer | C | |
| ABR | Available Bit Rate | CAS | Channel Associated Signaling |
| ADDF | Automatic Digital Distribution Frame | CBR | Constant Bit Rate |
| ADM | Add Drop Multiplexer | CCITT | Consultative Committee on International Telegraphy and Telephony |
| ADPCM | Adaptive Differential Pulse Coded Modulation | CCS | Common Channel Signaling |
| AIM | ATM Inverse Multiplexer | CDT | Cell Delay Tolerance |
| AIS | Alarm Indication Signal | CDV | Cell Delay Variation |
| AMI | Alternate Mark Inversion | CEPT | Committee of European PTTs |
| ANSI | American National Standards Institute | CMI | Coded Mark Inversion |
| APS | Automatic Protection Switching | CO | Central Office |
| ASCII | American Standard Code for Information Interchange | CPE | Customer Premises Equipment |
| ATM | Asynchronous Transfer Mode | CRC | Cyclic Redundancy Check |
| AU | Administrative Unit | CSES | Consecutive Severely Errored Seconds |
| AU-AIS | AU Pointer Justification Event | D | |
| AU-LOP | Loss of AU Pointer | D/I | Drop and Insert |
| AU-NDP | AU Pointer New Data Flag | DACS | Digital Access and Cross-connect Switches |
| B | | dB | Decibel |
| BBER | Background Block Error Ratio | DCC | Data Communications Channel |
| BC | Background Channel | DCS | Digital Cross-connect Switches |
| BCD | Binary Coded Decimal | DDF | Digital Distribution Frame |
| BER | Bit Error Rate | DDN | Digital Data Network |
| BERT | Bit Error Rate Testing | DTMF | Dual Tone Multi frequency Signaling |
| BIP | Bit Interleaved Parity | | |
| BPS | Bits Per Second | | |

Glossary of Terms

| | | | |
|-------------|---|----------|--|
| DWDM | Dense Wave Division Multiplexing | HO PTE | High Order Path Terminating Equipment |
| DXC | Digital Cross Connect | HO | High Order |
| E | | HP-IB | Hewlett-Packard Interface Bus (IEEE 488) |
| EB | Error Block | HP-PLM | High Path Payload Label Mismatch |
| EOW | Engineering Orderwire | HP-RDI | High Path Remote Defect Indication |
| ES | Error Seconds | HP-REI | High Path Remote Error Indication |
| ESF | Extended Superframe Format | HP-TIM | High Path Trace Identifier Mismatch |
| ESR | Errored Second Ratio | HP-UNEQ | High Path Unequipped |
| ETSI | European Telecommunications Standards Institute | Hz | Hertz (cycles per second) |
| F | | | |
| FAS | Frame Alignment Signal | I | |
| FC | Foreground Channel | IP | Internet Protocol (layer 3) |
| FCS | Frame Check Sequence | ISDN | Integrated Services Digital Network |
| FDDI | Fiber Distributed Data Interface | ISO | International Standards Organization |
| FEAC | Far End Alarm Channel | ITU | International Telecommunications Union |
| FEBE | Far End Block Error | | |
| FEC | Forward Error Connection | L | |
| FERF | Far End Receive Failure | LAN | Local Area Network |
| G | | LCP | Link Control Protocol |
| GUI | Graphical User Interface | LO | Low Order |
| H | | LOF | Loss of Frame |
| HDB3 | High Density Bipolar 3 | LOP | Loss of Path |
| HDLC | High-level Data Link Control (layer 2) | LOS | Loss of Signal |
| HEC | Header Error Control | LP-PLM | Low Path Payload Label Mismatch |
| HO Path RAI | High Order Path Remote Alarm Indication | LP-RDI | Low Path Remote Defect Indication |
| | | LP-REI | Low Path Remote Error Indication |

Glossary of Terms

| | | | |
|----------|--|----------|---|
| LP-RFI | Low Path Remote Failure Indication | OS | Operations System |
| LP-TIM | Low Path Trace Identifier Mismatch | P | |
| LP-UNEQ | Low Path Unequipped | P/AR | Peak-to-Average Ratio |
| LSB | Least Significant Bit | PBX | Private Branch Exchange |
| LTE | Line Terminal Equipment | PC | Personal Computer |
| LTM | Line Terminal Multiplexer | PCM | Pulse Code Modulation |
| | | PCN | Personal Communications Network |
| M | | PCR | Peak Cell Rate |
| MS | Multiplex Section | PDH | Plesiochronous Digital Hierarchy |
| MS-AIS | Multiplex Section AIS | PES | Percentage Error Second |
| MSOH | Multiplex Section Overhead | POH | Path Overhead |
| MS-RDI | Multiplex Section Remote Defect Indication | POS | Packet Over SONET/SDH |
| MS-REI | Multiplex Section Remote Error Indication | POTS | Plain Old Telephone Service |
| MTBF | Mean Time Between Failures | PPP | Point-to-Point Protocol (for transmission of multiprotocol datagrams over point-to-point links) |
| MTIJ | Maximum Tolerance Input Jitter | PRBS | Pseudo Random Binary Sequence |
| MUX | Multiplexer | PSN | Packet Switched Network |
| N | | PSTN | Public Switched Telephone Network |
| NDF | New Data Flag | PT | Payload Type |
| NE | Network Element | PTT | Public Telephone and Telegraph |
| NFAS | Non Frame Alignment Signal | PTE | Path Terminating Equipment |
| O | | PU | Physical Unit |
| OAM | Operations, Administration and Maintenance | Q | |
| OC | Optical Carrier | QoS | Quality of Service |
| OH | Overhead | | |
| OLTU | Optical Line Terminal Unit | | |
| OOF | Out of Frame | | |

Glossary of Terms

| | | | |
|----------|--|----------|---------------------------------------|
| R | | STE | Section Terminating Equipment |
| RAI | Remote Alarm Indication | STM | Synchronous Transport Module |
| RDI | Remote Defect Indication | STS | Synchronous Transport Signal |
| REBE | Remote End Block Error | SUT | System Under Test |
| REI | Remote Error Indication | T | |
| RF | Radio Frequency | TDM | Time Division Multiplexing |
| RS | Regenerator Section | TDMA | Time Division Multiple Access |
| RSOH | Regenerator Section Overhead | TE | Terminal Equipment |
| RSTE | Regenerator Section Terminating Equipment | TMN | Telecommunications Management Network |
| RS-TIM | Regenerator Section Trace Identifier Mismatch | TOH | Transport Overhead |
| RX | Receiver | TU | Tributary Unit |
| S | | TU-AIS | TU Alarm Indication Signal |
| S/N | Signal to Noise Ratio | TUG | Tributary Unit Group |
| SCPI | Standard Commands for Programmable Instrumentation | TU-LOM | TU Loss of Multiframe |
| SDH | Synchronous Digital Hierarchy | TU-LOP | Loss of TU Pointer |
| SDXC | Synchronous Digital Cross Connect | TU-NDF | TU Pointer New Data Flag |
| SEF | Severely Errored Frame | TX | Transmitter |
| SES | Severely Errored Second | U | |
| SESR | Severely Errored Seconds Ratio | UI | Unit Interval |
| SF | Super Frame | V | |
| SOH | Section Overhead | VBR | Variable Bit Rate |
| SONET | Synchronous Optical Network | VC | Virtual Channel |
| SPE | Synchronous Payload Envelope | VC-n | Virtual Container |
| | | VP | Virtual Path |
| | | VT | Virtual Tributary |
| | | VXI | VMEbus Extensions for Instrumentation |

Glossary of Terms

W

| | |
|-----|---------------------------------|
| WAN | Wide Area Network |
| WDM | Wave Division Multi- plexing |

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About This Edition

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