Agilent Part No. 37718-90217

Printed in U.K. September 2000.

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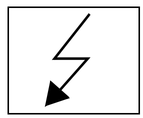
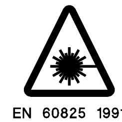
WARNING

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.

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OmniBER 718 SDH 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.

1 Introduction

2 Setting the Interfaces

3 Selecting Test Features

4 Making Measurements

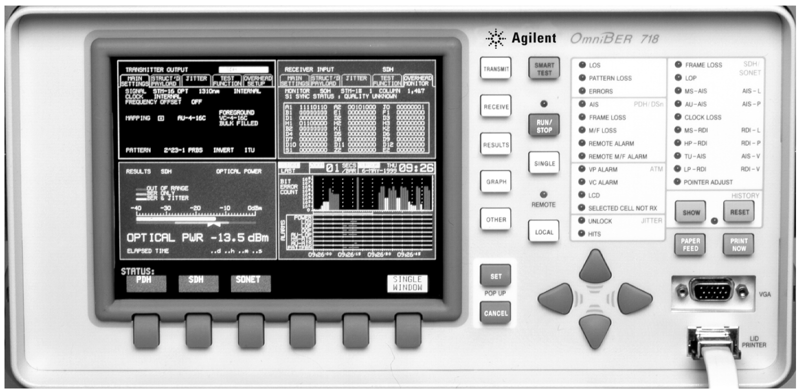
5 ATM Operation

1

Introduction

Product Description

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



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

- Multi-rate BER and jitter testing from 64 kb/s to 2.5 Gb/s (STM-16/OC-48).
- Concatenated payloads testing to STM-16c.
- Full PDH/T-carrier testing.
- Direct measurement of protection switching time.
- Powerful thru-mode testing for SDH/SONET ring turn-up.
- Comprehensive SDH/SONET overhead testing.
- Packet over SONET/SDH (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
- Line frequency offset
- Transmit and Receive can be independently configured.

Conventions

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

TRANSMIT

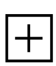
This is an example of a hardkey. Hardkeys (located to the right of the display) are used to give access to different sets of instrument settings, or select dedicated instrument functions. The key shown here displays the transmit settings.

PARALLEL

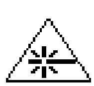
This is an example of a softkey. Softkeys (located below the display) are used to select instrument settings. The values associated with softkeys change as you move the display cursor from one instrument setting to another.

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 menu 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 is switched on.

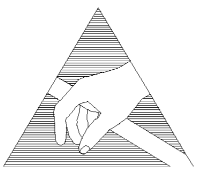
Connecting to the Network

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.

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 Installation/Verification manual for further information.

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.

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 -8 dBm (37718A 2.5 Gb/s) or -3 dBm (37718B/C).
NEVER EXCEED +3 dBm.

Accepts STM-0, STM-1, STM-4 and STM-16. Also accepts SONET signals OC-1, OC-3, OC-12, and OC-48 depending on the model and options fitted.

OPTICAL OUT

Provides an STM-0, STM-1, STM-4 or STM-16 optical signal (OC-1, OC-3, OC-12 or OC-48 SONET signals) at wavelength 1280 to 1335nm, and/or 1480 to 1580 nm, at a nominal power level of +1 dBm depending on model and options.

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 718.
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

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

External printer connection details are given in Chapter 6.
The port selected for external printer use is not available for remote control.

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)

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 718 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 718 Option Guide

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

- The 37718A
- The 37718B
- The 37718C

The instrument test interfaces are:

2.5 Gb/s, 622 Mb/s, 155 Mb/s, 52 Mb/s, DS1 (1.5 Mb/s), DS3 (45 Mb/s), E1 (2 Mb/s), E2 (8Mb/s), E3 (34 Mb/s).

Mainframe test rate capability

Mainframe	Test Rate Capability
37718A	2.5 Gb/s, 622 Mb/s, 155 Mb/s and 52 Mb/s
37718B	622 Mb/s, 155 Mb/s and 52 Mb/s
37718C	155 Mb/s and 52 Mb/s
Note that 52 Mb/s and 155 Mb/s electrical testing is included in the base mainframe.	

SDH/SONET Interface

Interface	Option
SDH only	001
Dual standard SDH/SONET	002

Tributary test options

	Option
PDH/T-carrier DS1, DS3, 2 Mb/s, 8 Mb/s, 34 Mb/s and 140 Mb/s	012
2 Mb/s into DS3 mapping (also requires option 012)	014
Replaces BNC connector with WECO 560	620

Optical interface

An optical interface must be ordered if an 37718A or 37718B 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.

Accessory options

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

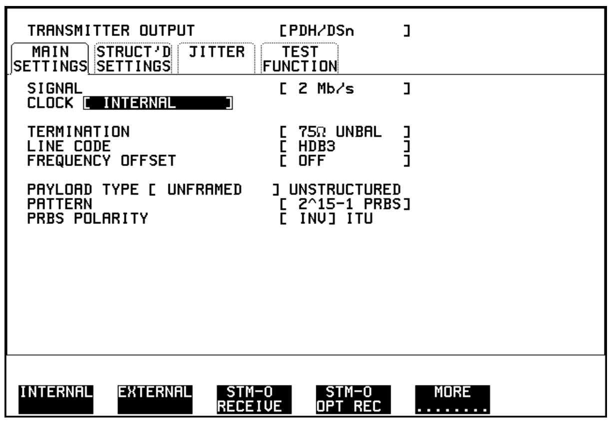
Setting the Interfaces

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

Setting PDH/DSn Transmit Interface (option 012)

Description PDH 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, 140 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 signal. If you select an external clock source, connect the external source to the appropriate port on the OmniBER clock module.
3. If a DS1 or DS3 SIGNAL 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).
5. If you have chosen 2 Mb/s, DS1 or 8 Mb/s as the SIGNAL rate, choose the required LINE CODE. (At 34 Mb/s, 140 Mb/s and DS3 coding is fixed.)
6. If required, choose the FREQUENCY OFFSET value see “Adding Frequency Offset to the PDH/DSn Signal” page 66.

7 Choose the required PAYLOAD TYPE.
If **STRUCTURED** is required **FRAMED** must be chosen .
If **STRUCTURED** is chosen the PDH test signal must be set up. See “Setting Transmit Structured Payload/Test Signal” page 70.
If you have chosen 2 Mb/s, DS1 or DS3 as the PDH/DSn signal rate, the Framed choice is expanded to provide a menu of framing types.
At 2 Mb/s if you select PCM30 or PCM30CRC framing a field is displayed enabling 2M CAS ABCD bits to be set. See “Setting up Signaling Bits” page 67

Choose the PATTERN type and the PRBS POLARITY.

Additional Patterns at DS1

8 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 DSn THRU Mode (option 012)

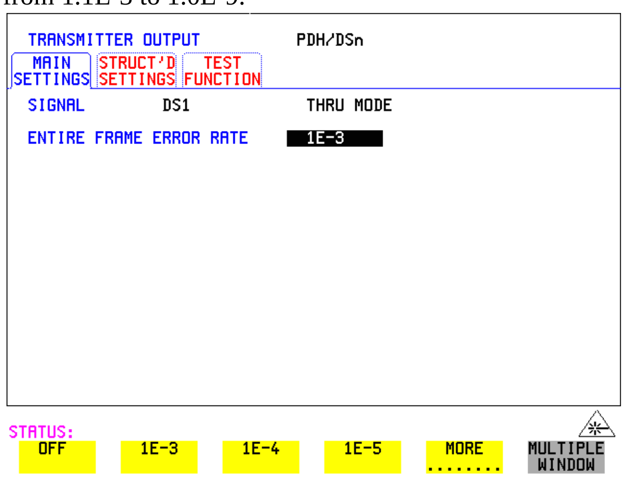
Description

THRU mode is used to non-intrusively monitor DSn 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 errorred 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, 1.0-E-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/DSn **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 SDH Transmit Interface

Payload Selection

One of the key features of the OmniBER 718 is the ability to test concatenated payloads, read the following for a brief description of concatenated payloads, and the benefits of using them.

Concatenated Payloads

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

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

Table 2 Test times using concatenated payloads

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

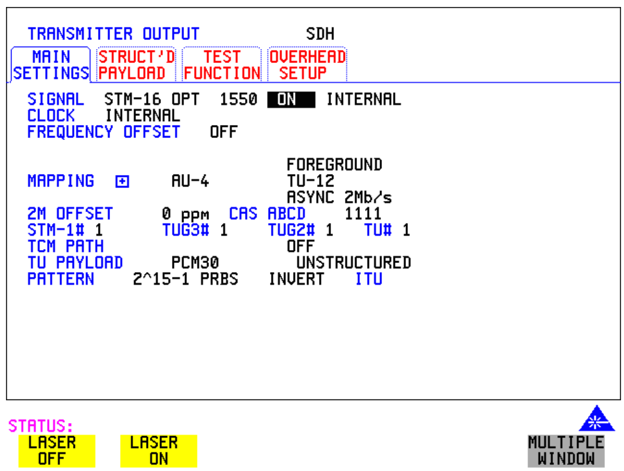
Description

SDH 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.

Laser On/Off selection (see display below)

Always switch off the laser before connecting or disconnecting optical cables.

TIP: If you wish to set the OmniBER 718 transmitter and receiver to the same interface settings choose **OTHER** **SETTINGS CONTROL** **COUPLED**.



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 STM-0 is chosen, choose the required interface level.
Choose **INTERNAL** unless **THRU MODE** is required. If **THRU MODE** is chosen, see "Setting SDH THRU Mode " page 38.

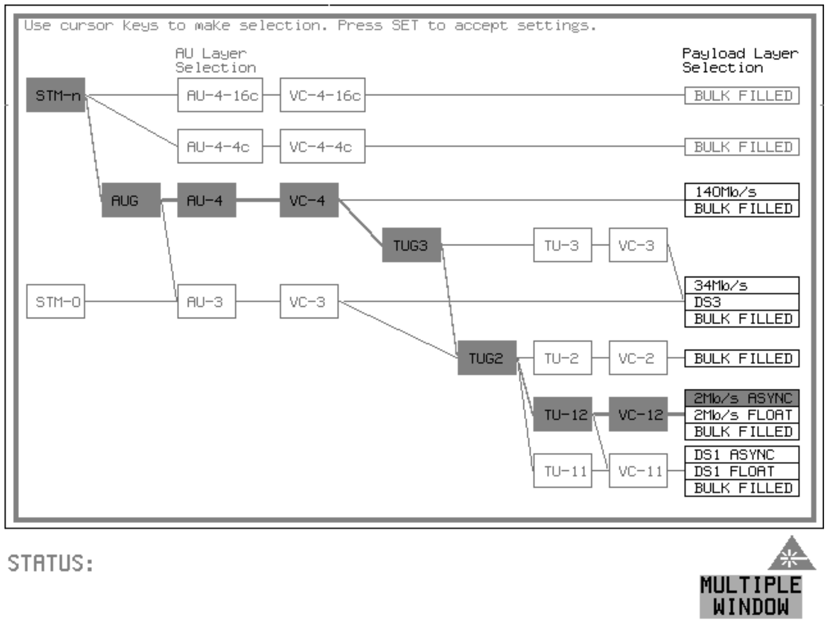
2 Make your choice of CLOCK synchronization source. The clock can be internally sourced from the instrument, recovered from the signal at the optical RECEIVE port or externally sourced from the CLOCK REF IN ports (MTS 64 kb/s, BITS 1.5 Mb/s or 10 MHz REF).

3 If required choose the FREQUENCY OFFSET value. See “Adding Frequency Offset to SDH Signal” page 64.

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 AU Layer Selection, TU Layer Selection and Payload Layer Selection. Use ⬆ and ⬇ to set the mapping and **SET** to set your selection.

5 If TU-2 mapping is chosen, TU CONCATENATION selection is enabled. Choose **OFF** or the tributary at which the concatenation begins (TU2-2C through TU2-6C).
The BACKGROUND, PATTERN IN OTHER TU2s is fixed at NUMBERED, that is, each TU-2 contains a unique number to allow identification in case of routing problems.

6 If required, choose DS1/2M/34M/DS3/140M OFFSET value. See “Adding Frequency Offset to SDH Signal” page 64

7 If TU-3, TU-2, TU-12 or TU-11 mapping is chosen, choose the test tributary , including the STM-1 for an STM-4/STM-16 signal.

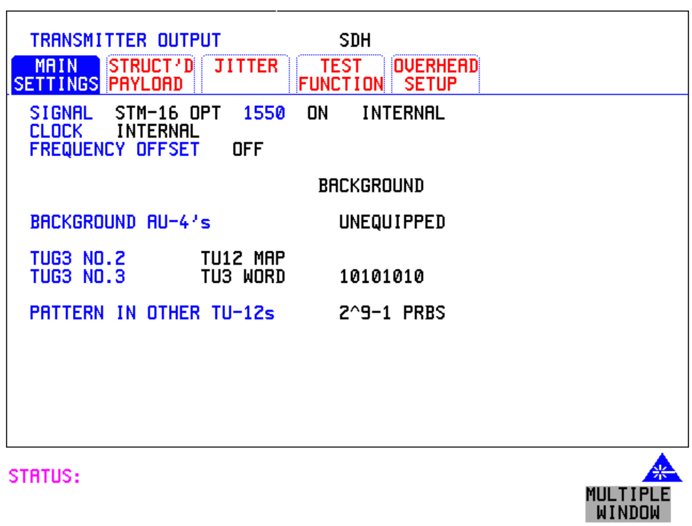
8 Choose the payload framing under PAYLOAD TYPE or TU PAYLOAD.
If **STRUCTURED** is required **FRAMED** must be chosen.
If **STRUCTURED** is chosen, the Payload test signal must be set up. See “Setting Transmit Structured Payload/Test Signal” page 70.
If **INSERT** is chosen, see “Inserting an External PDH/DSn Payload/Test Signal” page 76.
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 If 2 Mb/s framing **PCM30** or **PCM30CRC** is chosen, set the CAS ABCD bit values. See "Setting up Signaling Bits " page 67

10 Choose the PATTERN type and PRBS polarity. See Note below.

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

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



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 2^{15}-1 and 2^{23}-1 PRBS patterns.

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

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

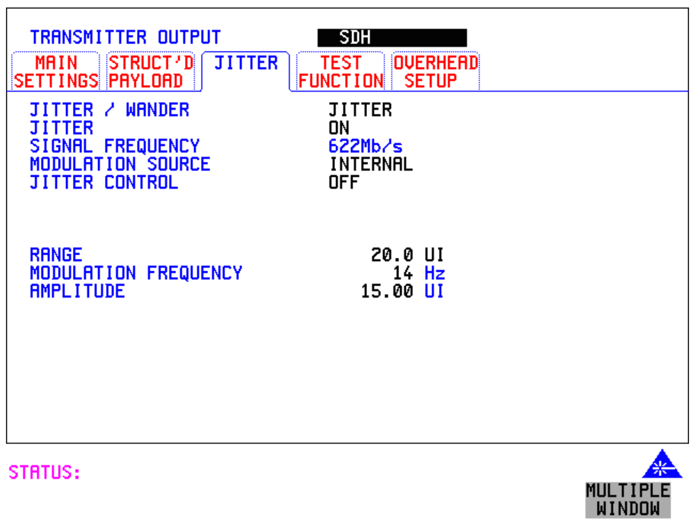
The ITU-T definition also applies in the US, except for 2^{15}-1 and 2^{23}-1 PRBS patterns. Through common practice, NORMAL indicates that the PRBS pattern is non-inverted. Therefore when the 'US' PRBS polarity control is enable and NORMAL is selected for these two patterns on the TRANSMITTER, a longest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

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.

Setting Jitter Transmit Interface

***Description:* Option 200 required for Jitter and option 012 for PDH.**

You can add jitter to the transmitted PDH/DSn or SDH signal at 2 Mb/s, 8 Mb/s, 34 Mb/s, 140 Mb/s, DS1, DS3, STM-0, STM-1, STM-4 and STM-16. Jitter modulation can be sourced internally or from an external source. Jitter measurement up to 2.5 Gb/s is also available when ATM is selected as a payload.



HOW TO:

1 If you are adding jitter to the PDH signal, set up the PDH transmit interface. See "Setting PDH/DSn Transmit Interface (option 012) " page 26.

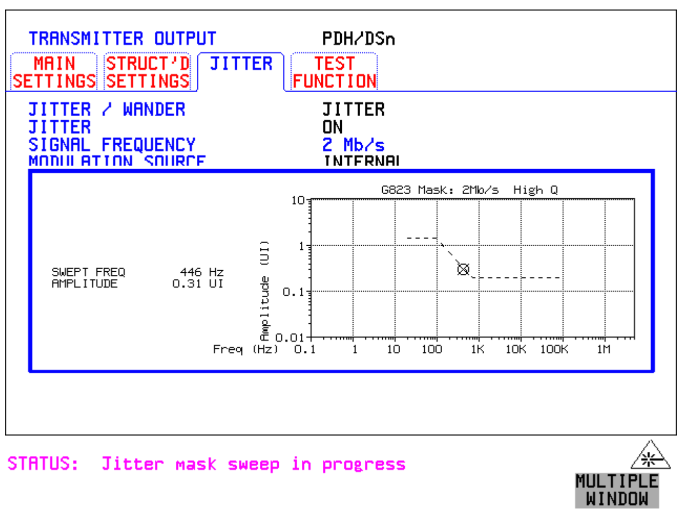
2 If you are adding jitter to the SDH signal, set up the SDH transmit interface. See "Setting SDH Transmit Interface " page 29.

3 Choose JITTER/WANDER **JITTER**.
If you wish to add wander to the PDH or SDH signal, see "Setting Wander Transmit Interface " page 36.

4 Choose JITTER **ON**.
If you wish to perform a Jitter Tolerance measurement, choose **AUTO TOLERANCE**. See “Measuring Jitter Tolerance” page 137.
If you wish to perform a Jitter Transfer measurement choose **TRANSFER FUNCTION**. See "Measuring Jitter Transfer " page 142.

5 Choose the modulation source.
If adding jitter to the PDH signal and **EXTERNAL** is chosen, connect the external source to the MOD IN port of the JITTER module. Up to 10 UI (20 UI for DS1/DS3) of external jitter modulation can be added at the MOD IN port.
If adding jitter to the SDH signal and **EXTERNAL** is chosen, connect the external source to the MOD IN port of the JITTER 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 718 will "sweep" through the ITU-T jitter mask (G.823 for PDH; GR.499 or G.824 for DSn; G.958, G.825 or GR.253 for SDH) 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).



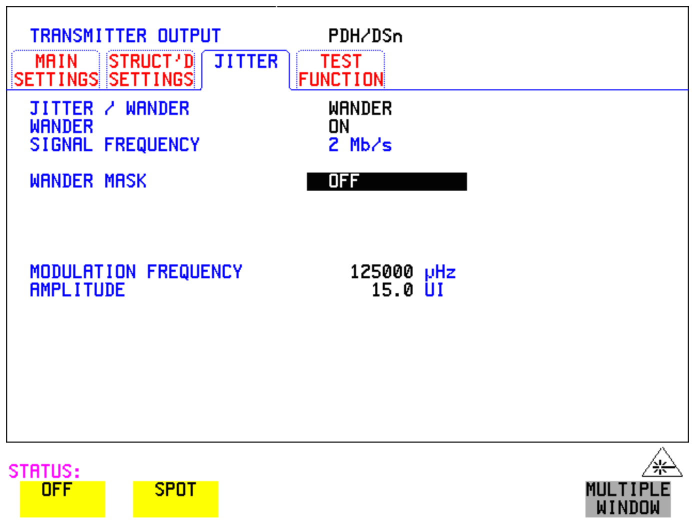
If you choose **SPOT**, you can choose the "spot" jitter frequency. The jitter amplitude is adjusted and controlled according to your jitter frequency choice.

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:
Option 200 required for Jitter and option 012 for PDH.

You can add Wander to a 2 Mb/s or DS1 PDH signal and also to STM-0, STM-1, STM-4 or STM-16 SDH signals



HOW TO:

PDH Wander (2 Mb/s)

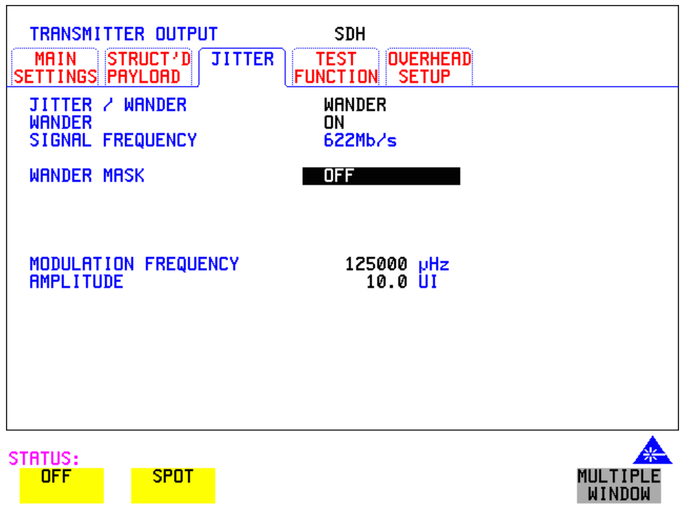
1 Set up the PDH transmit interface, choose CLOCK and select the SOURCE required from the menu. If you select EXTERNAL connect the external source to the REF IN port on the CLOCK module. See "Setting PDH/DSn Transmit Interface (option 012) " page 26.

2 Choose JITTER/WANDER **WANDER**.
If you wish to add jitter to the PDH signal see "Setting Jitter Transmit Interface " page 34.

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.

SDH Wander (STM-0, STM-1, STM-4, STM-16)



5 Set up the SDH transmit interface. See "Setting SDH Transmit Interface " page 29.

6 Choose JITTER/WANDER **WANDER**.
If you wish to add jitter to the SDH signal see "Setting Jitter Transmit Interface " page 34.

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 SDH THRU Mode

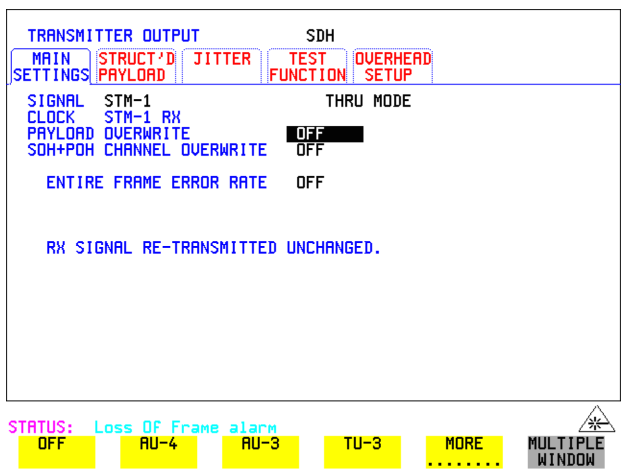
Description

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

The entire frame can be errored at a user defined rate if PAYLOAD OVERWRITE and SOH+POH CHANNEL OVERWRITE are both set to **OFF**. If either overwrite is enabled the ENTIRE FRAME ERROR RATE function is disabled. Jitter can be added to the STM-0, STM-1, STM-4 and STM-16 signal.

There are nominally three modes of operation as follows:

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



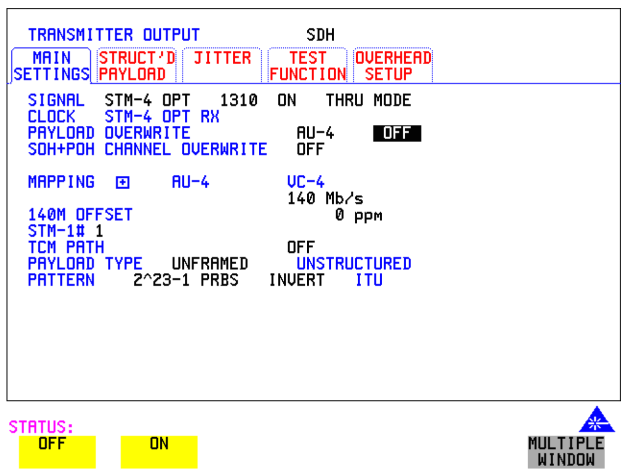
2. Hitless THRU Mode

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

3. Payload/Channel Overwrite: In this mode you can overwrite the payload as explained in the following text. Any Path B3 BIP errors are recalculated before transmission. Use the ***HOW TO*** procedure to setup your instrument for THRU Mode operation.

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

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



HOW TO:

1 Make the required SIGNAL RATE choice on the SDH **TRANSMIT** display. See "Setting SDH 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 AU-4, AU-3, TU-3, TU-2 or TU-12 is chosen, the B1, B2 and B3 BIPs are recalculated before transmission and the Mapping, Selected TU, TU Payload, Pattern, Tributary Offset and Pattern in other TU's settings are displayed. To choose the settings in these, See "Setting SDH Transmit Interface " page 29, steps 4 through 10.

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 SOH+POH OVERWRITE choice required.
The B1, B2 and B3 BIPs are recalculated before transmission.

5 If you wish to add jitter to the STM-0, STM-1, STM-4 or STM-16 signal, see "Setting Jitter Transmit Interface " page 34.

Using Smart Test

Smart Setup

The Smartsetup 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 718 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.

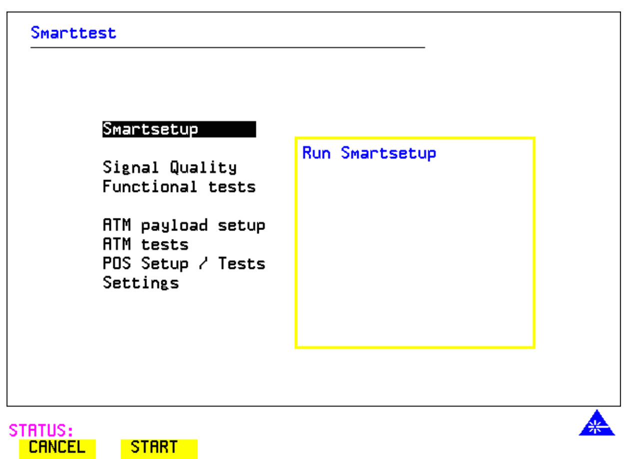
Smart Tests

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

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

HOW TO USE SMARTSETUP:

1. Connect the OmniBER 718 to the network and choose if necessary the required SDH **RECEIVE** interface on the OmniBER 718 (Smartsetup will select PDH or SDH/SONET, but can not select between SDH and SONET).
2. Press **SMART TEST**.



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

An example of a typical display after choosing to RUN Smartsetup is shown below. **Note:** The channel information displayed is the one obtained the last time a SCAN was performed (see Figure 1). 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 Figure 2).

Figure 1

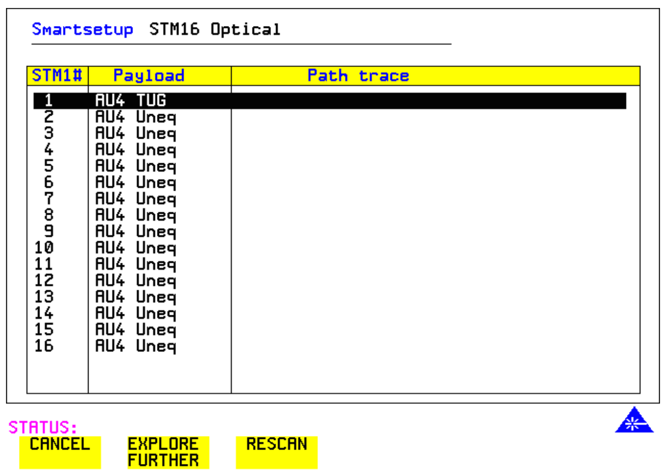
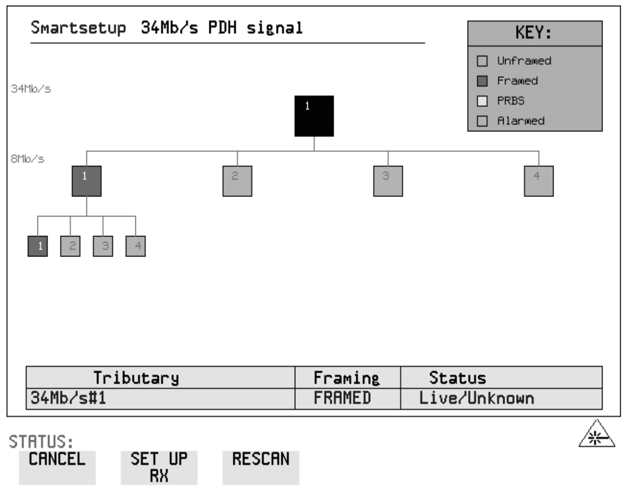


Figure 2

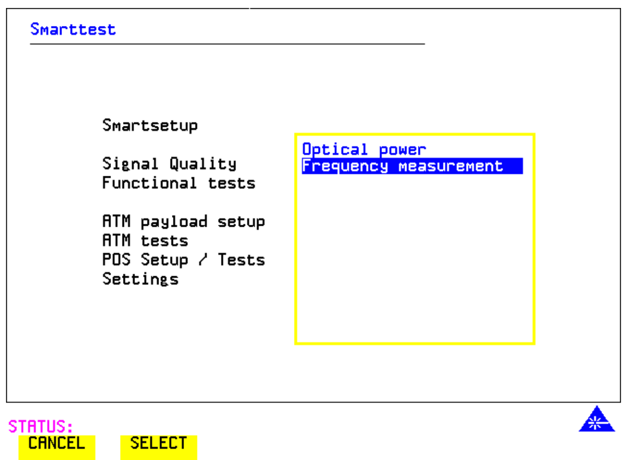


SET UP RX key

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

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

1. Ensure a valid signal is connected to the instrument’s Receive port.
2. Press **SMART TEST**.
3. Use the down cursor control key to select Signal quality.
4. Use the right cursor control key to access the tests.
5. Use the down cursor control key to select Frequency Measurement.

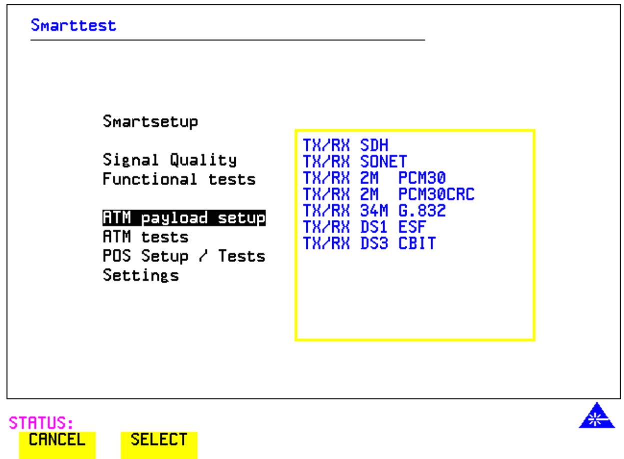


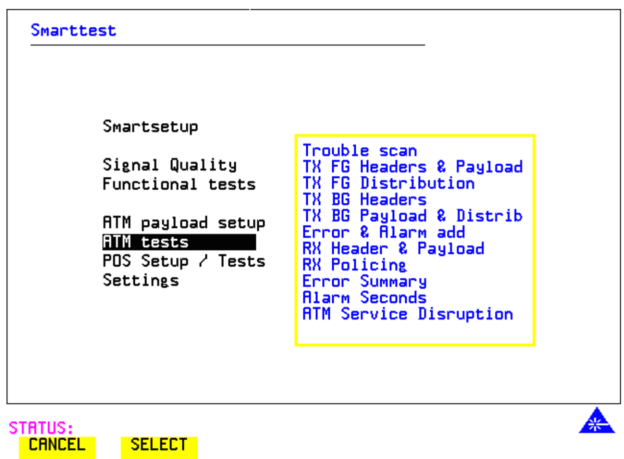
6. Press **SELECT** to display the frequency measurement screen. Or press **CANCEL** to exit Smart Tests.

To run an ATM Smart Test

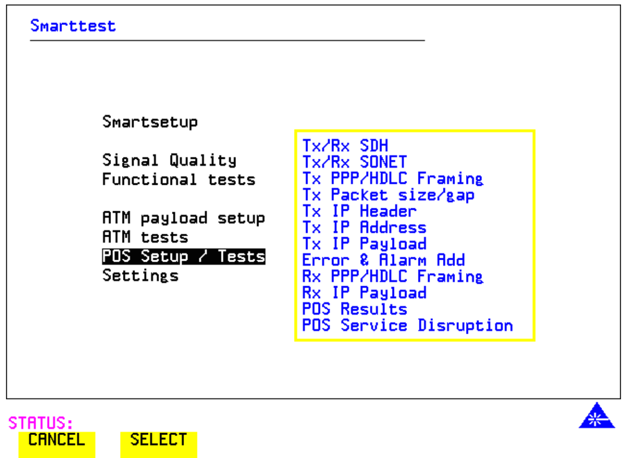
1. Ensure a valid signal is connected to one of the instrument’s Receive ports.
2. Press **SMART TEST**.
3. Use the down cursor control key to select ATM payload setup or ATM tests.
4. Use the right cursor control key to access the setups/tests.
5. Use the down cursor control key to select required setup/test.
6. Press **SELECT** to display the required measurement screen. Or press **CANCEL** to exit Smart Tests.

7





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



To run a POS 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 POS Setup/Tests.
4. Use the right cursor control key to access the setups/tests.
5. Use the down cursor control key to select required setup/test.
6. Press **SELECT** to display the required Setup screen. Or press **CANCEL** to exit Smart Tests.

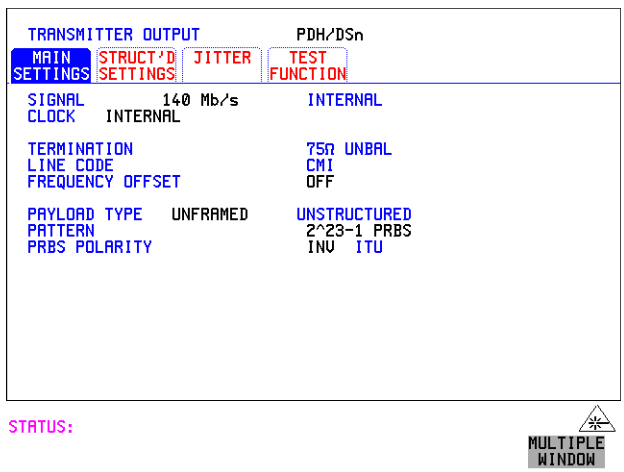
Setting PDH/DSn Receive Interface (Option 012)

Description

PDH 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**.



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 2 Mb/s, DS1 or 8 Mb/s as the SIGNAL rate, choose the required LINE CODE. (At 34Mb/s, 140 Mb/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.

Choose the PAYLOAD TYPE.
If **STRUCTURED** is required **FRAMED** must be chosen.
If **STRUCTURED** is chosen, the PDH test signal must be set up. See “Setting Transmit Structured Payload/Test Signal” page 70.
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.

5 Choose the PATTERN type and the PRBS POLARITY required.

Additional Patterns at DS1

6 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 3 8-Bit Patterns

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

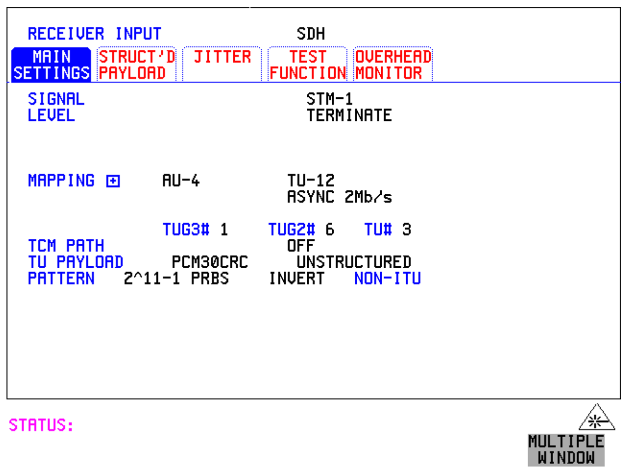
Note 1: F indicates the position of the framing bit with respect to the 8-bit pattern when the framed data is generated
Note 2: Both 8-bit patterns and the 55 Octet pattern can only be selected as a payload for the whole DS1, i.e. they can not be selected as a pattern for an individual 64 kb/s channel.

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

Setting SDH Receive Interface

Description SDH 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 718 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 STM-0 or STM-1 electrical 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 TU-2 mapping is chosen, and CONCATENATION is enabled, choose the tributary at which the concatenation begins.
If TU-2, TU-3, TU-12 or TU11 mapping is chosen, choose the test tributary, including the STM-1 for an STM-4/STM-16 signal.

4 Choose the payload framing under PAYLOAD TYPE or TU 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 72.
If DROP is chosen, see "Dropping an External Payload/Test Signal" page 79.

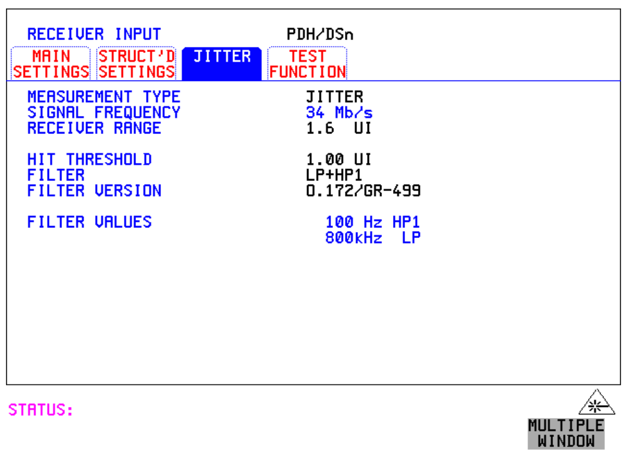
5 Choose the PATTERN type and PRBS polarity.

Setting Jitter Receive Interface

Description:
Option 200 required for Jitter.

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 is selected as a payload.
The jitter receive interface is selected with **RECEIVE** **PDH/DSn** **JITTER** or **RECEIVE** **SDH** **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:

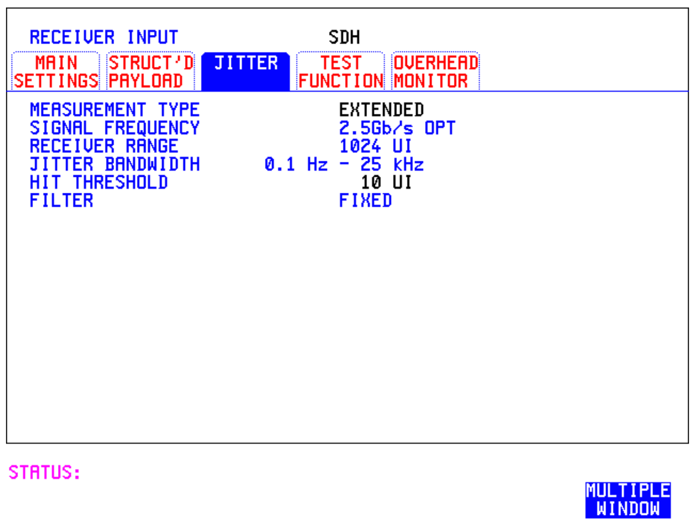
1. Choose the RECEIVER RANGE - the jitter measurement range.
2. Choose the HIT THRESHOLD level - if the received jitter exceeds the value chosen a jitter hit is recorded.
3. Choose the FILTER you wish to include in the peak to peak and RMS jitter measurement. The choices are:
   OFF, LP, HP1, HP2, 12kHz 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 an SDH Receive Interface.

Setting Extended Jitter Receive Interface

Description:
Option 200 required for Jitter.

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** **SDH** **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.



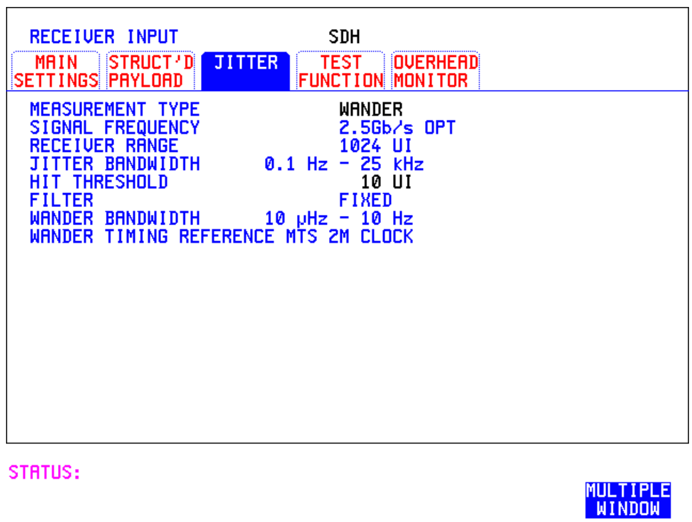
HOW TO:

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 Wander Receive Interface

Description:

You can measure Wander at all PDH and SDH rates. Select an external clock source on the TRANSMIT PDH/DSn or SDH MAIN SETTINGS display to ensure accurate Wander results.



HOW TO:

1. Choose a synchronization clock source on the TRANSMIT SDH or PDH/DSn MAIN SETTINGS display. See, "Setting SDH Transmit Interface" page 29.
2. If you intend to measure wander on a PDH signal, set up the PDH receive interface. See, "Setting PDH/DSn Receive Interface (Option 012)" page 47.
3. If you intend to measure wander on a SDH signal, set up the SDH receive interface. See, "Setting SDH Receive Interface" page 49.
4. Choose MEASUREMENT TYPE WANDER .
5. Choose the wander HIT THRESHOLD - if the received wander exceeds the value chosen a wander hit is recorded.

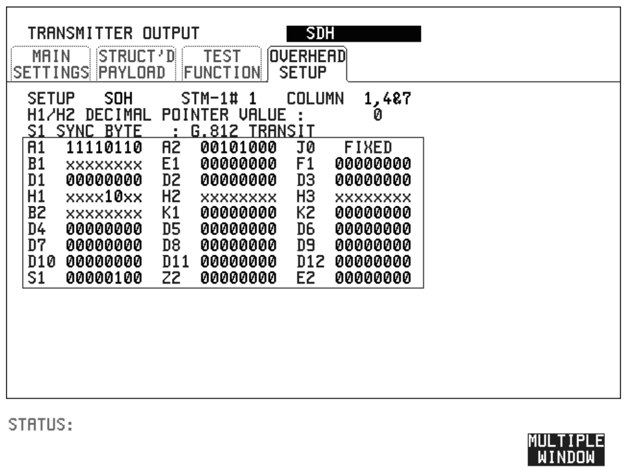
3

"Generating Automatic Protection Switch (APS) Messages" page 99

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. Section Overhead, Path Overhead, Trace Messages and Labels can be set using this feature.



HOW TO:

1 Set up the SDH transmit interface and payload required. See "Setting SDH Transmit Interface " page 29.

2 Choose the type of overhead to SETUP.
If STM-4 OPT or STM-16 OPT is chosen as the SDH interface, choose the STM-1 you wish to set up.
DEFAULT - Use to set all overhead bytes to the standard values defined by Bellcore/ANSI.
If a test function is active then the overhead byte value is determined by the choices made in the Test Function. For example if APS Messages is chosen, the K1K2 value is determined by the APS Messages setup.

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

turn). The value of the bytes can be set using **DECREASE DIGIT** **INCREASE DIGIT** ← →.
If BYTE NAMES is chosen, the labels for the ALL COLUMNS overhead bytes are displayed.

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

5 If TRACE MESSAGES is chosen, see "Setting Overhead Trace Messages " page 58.

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** .

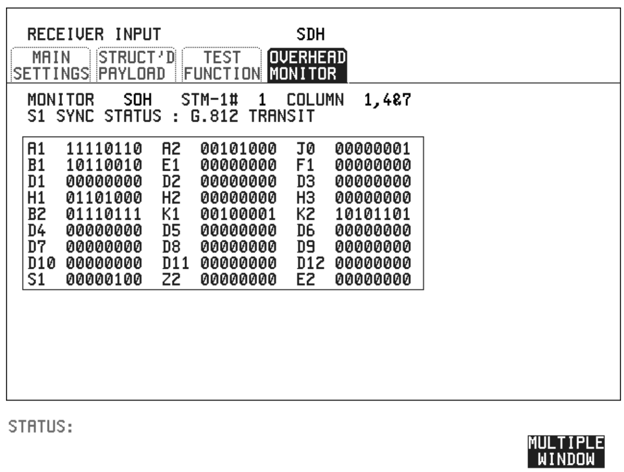
You can set all overhead bytes and test functions to the default state by recalling Stored Settings [0] on the **OTHER** display.

Using Receive Overhead Monitor

Description

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

A snapshot of the received overhead can be logged to the chosen logging device. See "Logging on Demand " page 261.



HOW TO:

1 Set up the receive SDH interface and payload as required. See “Setting SDH Receive Interface” page 49.

2 Choose the type of overhead to MONITOR.

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

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

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

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

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

7 If APS MESSAGES is chosen, choose the TOPOLOGY, **LINEAR** (G.783) or **RING** (G.841). The K1 and K2 bits are monitored.

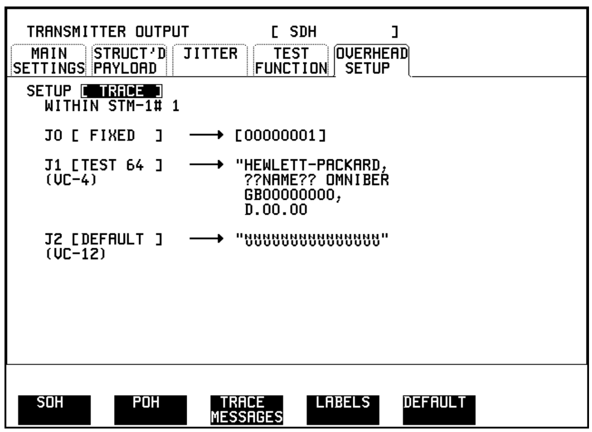
TIP: If any abnormal behavior is observed on a particular path or section overhead byte, or an associated group of bytes (3XA1,3XA2; D1 - D3), the **RECEIVE** **TEST FUNCTION** display of **OVERHEAD CAPTURE** can be used to "Zoom" in on the suspect byte or bytes on a frame by frame basis. See "Using Receive Overhead Capture " page 62.

Setting Overhead Trace Messages

Description

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

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



Choose the message for insertion in the chosen trace channel.

How to Edit User Messages

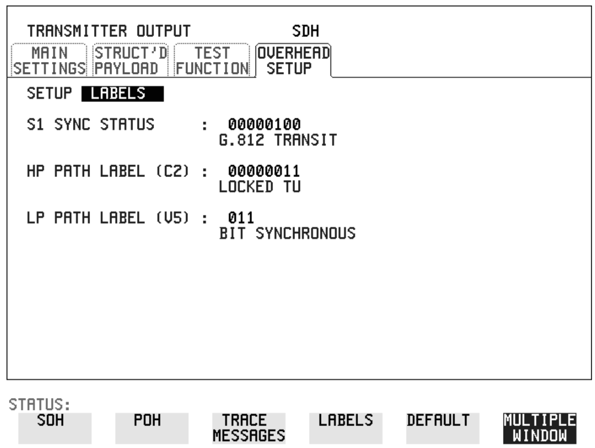
There are two ways you can edit a user message as follows;

- 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 alphanumerical keypad that is displayed when you press the front panel **SET** key. Detailed instructions on how to change instrument settings using the POP UP keypad is given in the Quick Start Guide (page 13) under the heading “Changing Instrument Settings”.

Setting Overhead Labels

Description

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



How to Edit User Defined Labels

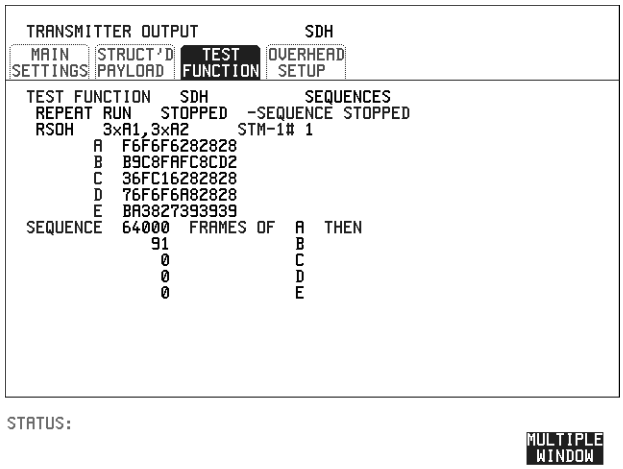
1 Choose the overhead label that you want to edit.

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".

Generating Overhead Sequences

Description

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



HOW TO:

1 Set up the SDH transmit interface and payload required. See “Setting SDH Transmit Interface” page 29.

2 Select **TEST FUNCTION** , SDH, SEQUENCES as shown above.

3 Choose the type of sequence required.
SINGLE RUN - runs the sequence once and then stops.
REPEAT RUN - runs the sequence repeatedly until STOPPED is chosen.

4 Choose the overhead type as required.
RSOH- Regenerator Section Overhead
MSOH- Multiplexer Section 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** ← →.

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

NOTE

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

A1A2 Boundary Function

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

STM-n

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

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

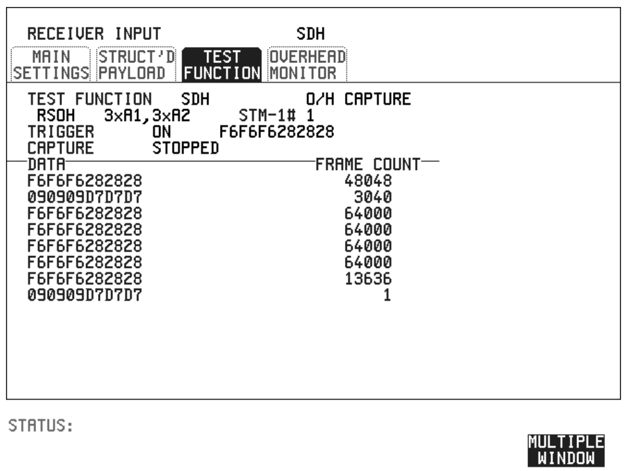
A network element will use three of these bytes (which ones are not defined in the standards, so will vary between manufacturers) to gain and maintain frame synchronization. The ability to stress test across the boundary is necessary to verify a correct synchronization algorithm within a network element.

Using Receive Overhead Capture

Description

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

The Overhead Capture display can be logged to the chosen logging device. See "Logging on Demand " page 261.



HOW TO:

1 Set up the receive SDH interface and payload as required. See “Setting SDH Receive Interface” page 49.

2 Select **TEST FUNCTION** , SDH, O/H CAPTURE as shown above

3 Choose the overhead type as required.
RSOH- Regenerator Section Overhead
MSOH- Multiplexer Section Overhead
POH- Path Overhead

4 Choose the Byte or bytes of overhead to be captured.

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

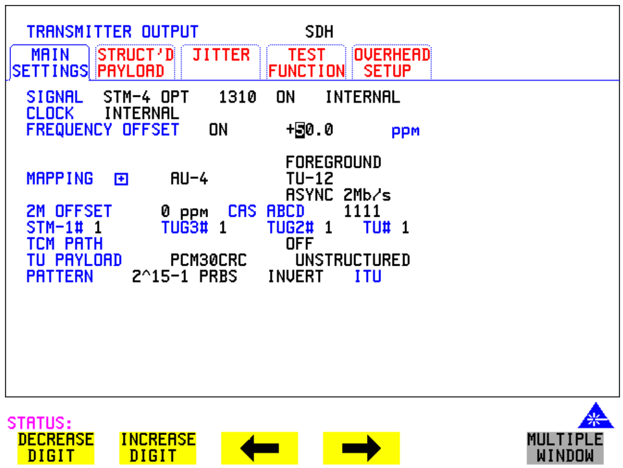
ON NOT - captures activity after the first occurrence of a deviation from your specified overhead state. Can be used for transient detection from a specified expected state.

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**.

Adding Frequency Offset to SDH Signal

Description

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



HOW TO:

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 SDH line rate offset chosen is sufficient to cause the maximum stuff rate to be exceeded, the asynchronous payload is offset to prevent bit errors occurring and the maximum stuff rate is maintained. When Floating Byte 2 Mb/s is chosen, in conjunction with SDH line rate offset, the chosen tributary will be offset as the line rate is offset. (No pointer movements).

Tributary Offset ±100 ppm

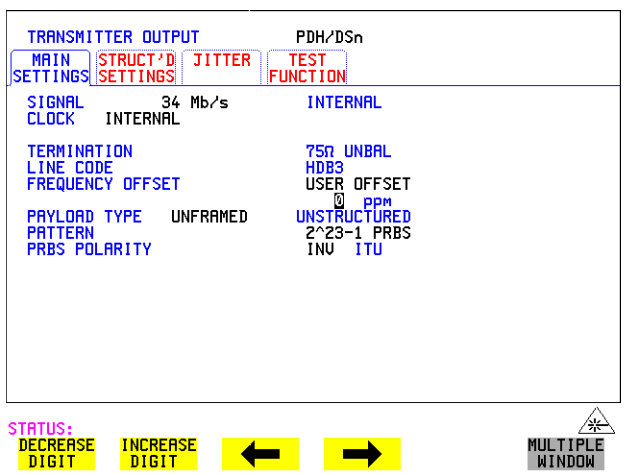
1 Choose the amount of tributary offset required.
You can set the Offset in the range -100 ppm to +100 ppm in 1 ppm steps using **DECREASE DIGIT** **INCREASE DIGIT** ← and → or press **SET** for a pop-up numerical keypad.
The amount of applied Frequency Offset can be varied while measurements are taking 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 SDH 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 PDH/DSn Signal

Description
Option 012 required for PDH operation.

You can add frequency offset to the interface PDH/DSn SIGNAL at all rates. Frequency Offset can be added at preset ITU-T 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 (E2)	+30 ppm	–30 ppm
34 Mb/s (E3)	+20 ppm	–20 ppm
DS-3 (44.736 Mb/s)	+20 ppm	–20 ppm
140 Mb/s (E4)	+15 ppm	–15 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.)

Setting up Signaling Bits

Description
Option 012 required for PDH operation.

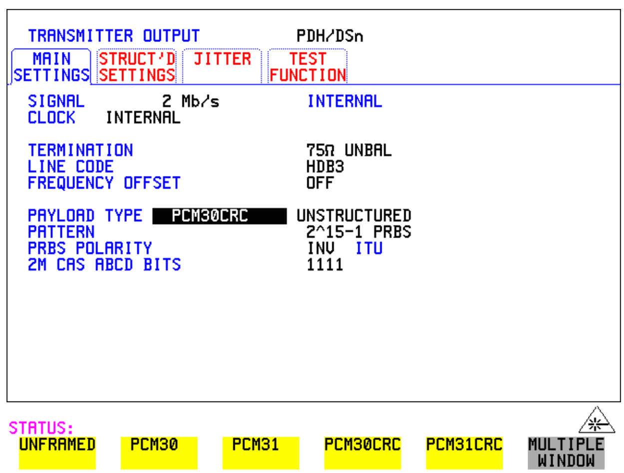
When transmitting 2.048 Mb/s signals with timeslot-16 CAS (PCM30 or PCM30CRC) multiframing the state of A,B,C,D signaling bits can be set. The signaling bits of all timeslots are set to the user-defined 4-bit value.

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 2 Mb/s signal with user-defined signaling bits

PDH Operation

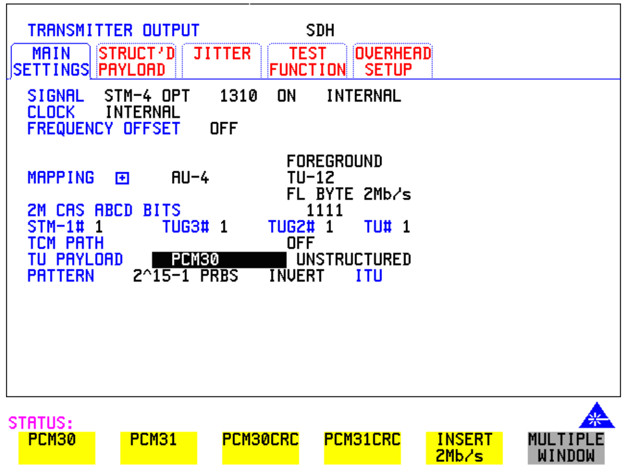


1 Choose **PDH/DSn** on the **TRANSMIT** display.

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.

SDH Operation



1 Choose **SDH** on the **TRANSMIT** display.

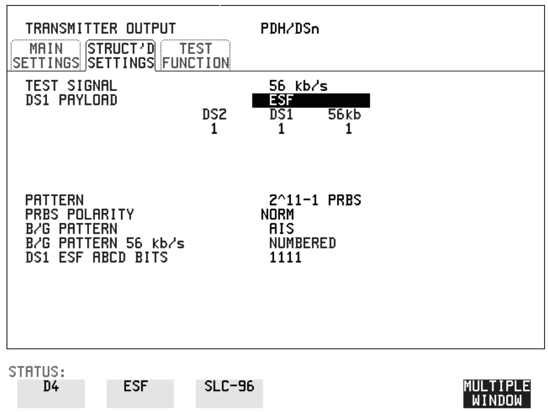
2 Set MAPPING to TU-12.

3 Choose MAPPING **ASYNC 2Mb/s** or **FL BYTE 2Mb/s** and TU PAYLOAD to **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.

HOW TO **Transmit a DS1 payload signal with user-defined signaling bits**

PDH Operation



1 Choose **PDH/DSn** on the **TRANSMIT** display.

2 Choose SIGNAL **DS1** or **DS3**, and PAYLOAD TYPE **STRUCTURED** on the **MAIN SETTINGS** display

3 Choose TEST SIGNAL **56 kb/s** or **Nx56 kb/s** on the **STRUCTURED SETTINGS** display.

4 Set the A,B bits (for D4 and SLC-96) and A,B,C,D bits (for ESF) as required.

SDH Operation

1 Choose **SDH** on the **TRANSMIT** display.

2 Set MAPPING to TU-12.

3 Choose MAPPING **FL BYTE DS1**, **ASYNC DS1** or **DS3** and TU 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 .

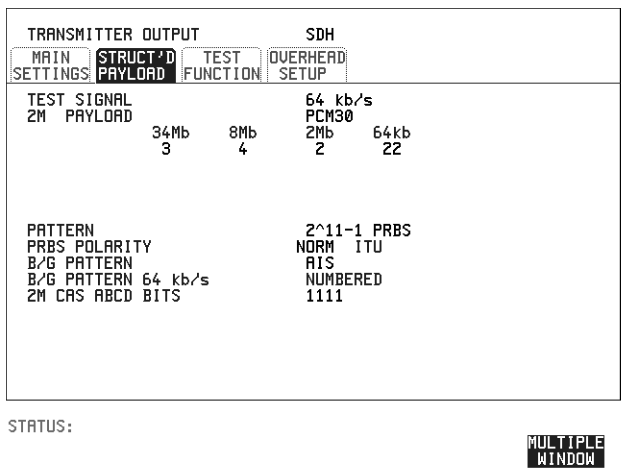
5 Set the A,B bits (for D4 and SLC-96) and A,B,C,D bits (for ESF) as required.

6 **Floating Byte DS1 selection:** Set the ABCD bits for **NO-F-BIT** or **ESF** framing and/or the AB bits for **D4** TU PAYLOAD framing as required.

Setting Transmit Structured Payload/Test Signal

Description Structured PDH Payload/Test Signal settings determine the SDH payload or the PDH 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 718 transmitter and receiver to the same Payload settings, choose **OTHER** **SETTINGS CONTROL** **COUPLED** .



HOW TO:

1. Choose the required TEST SIGNAL rate. If Nx64 kb/s is chosen, see "Setting Transmit N x 64 kb/s/N x 56 kb/s Structured Payload/Test Signal " page 73.
2. Choose the PAYLOAD framing pattern.
   If the TEST SIGNAL chosen was 2Mb/s, the **INSERT 2 Mb/s** choice is added to PAYLOAD menu. See "Inserting an External PDH/DSn Payload/Test Signal " page 76.
3. Choose the test tributary in the structured payload, under 34Mb, 8Mb, 2Mb, 64 kb/s or DS2, DS1.
4. Choose the PATTERN type and PRBS POLARITY.

5 Choose the B/G PATTERN (Background).
The B/G PATTERN in the non test 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

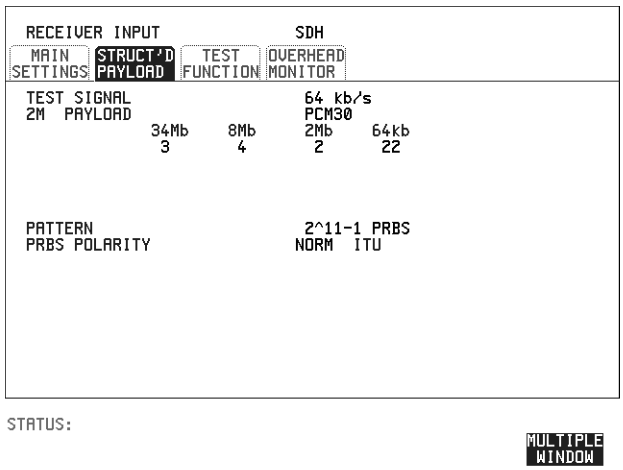
6 If a 2 Mb/s PAYLOAD with PCM30 or PCM30CRC framing, or 56 kb/s or Nx56kb/s Test Signal is chosen. See, "Setting up Signaling Bits " page 67.

Setting Receive Structured Payload/Test Signal

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

TIP: If you wish to set the OmniBER 718 transmitter and receiver to the same Payload settings, choose **OTHER** **SETTINGS CONTROL** **COUPLED**

.



HOW TO:

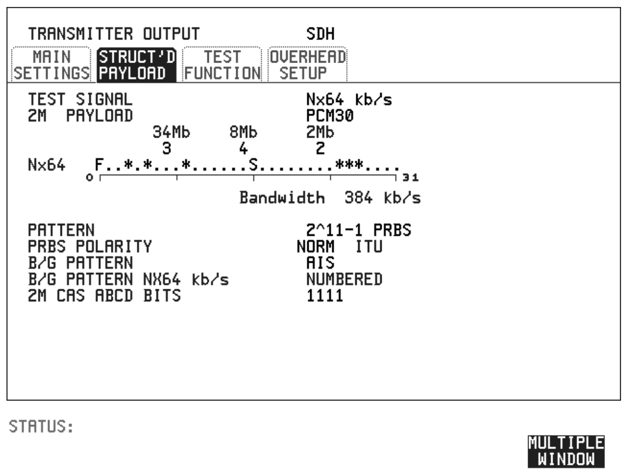
1. Choose the required Test Signal rate. If N x 64 kb/s or N x 56 kb/s is chosen, see "Setting Receive N x 64 kb/s/N x 56 kb/s Structured Payload/Test Signal " page 75.
2. Choose the Framing pattern of the PAYLOAD.
   If 2 Mb/s TEST SIGNAL is chosen, **DROP 2 Mb/s** is added to the menu. See "Dropping an External Payload/Test Signal " page 79.
3. Choose the test tributary within the structured payload, under 34Mb, 8Mb, 2Mb, 64 kb or DS2, DS1.
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 128 kb/s or 384 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 Choose the Framing pattern of the 2M or DS1 PAYLOAD.

3 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. In the example above Timeslots 3, 5, 9, 25, 26, 27 are selected for test.

4 Choose the PATTERN type and PRBS polarity.

5 Choose the B/G PATTERN.

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

Signaling

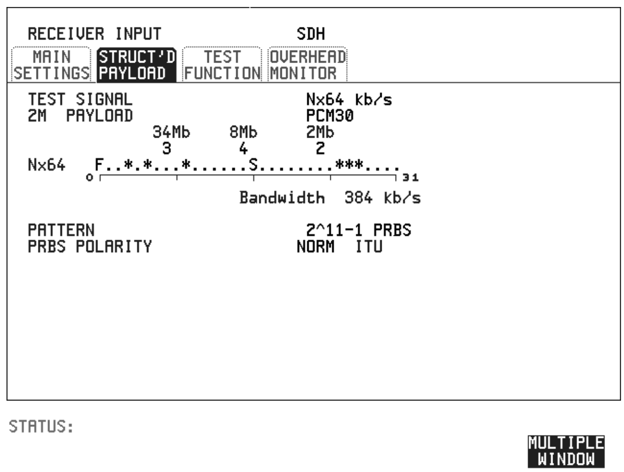
7 If a 2 Mb/s PAYLOAD with PCM30 or PCM30CRC framing, or 56 kb/s or Nx56kb/s Test Signal is chosen. See, "Setting up Signaling Bits " page 67.

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. 128 kb/s or 384 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 Choose the Framing pattern of the 2M or DS1 PAYLOAD.

3 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, 25, 26, 27 are chosen for test.

4 Choose the PATTERN type and PRBS polarity.

Inserting an External PDH/DSn Payload/Test Signal

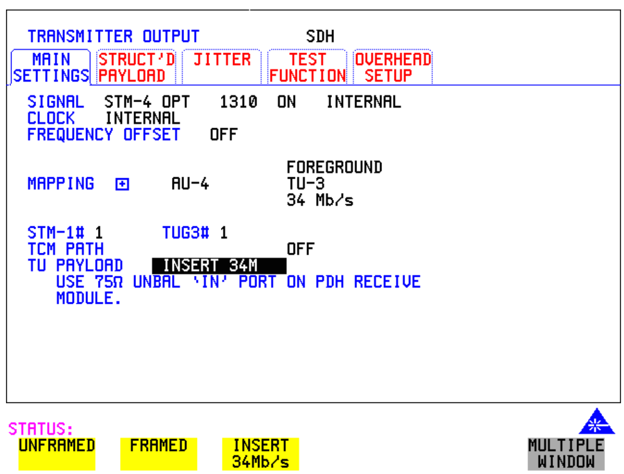
Description

You can insert 2 Mb/s, 34 Mb/s or 140 Mb/s into an STM-N line signal when option 012 is fitted. DS3, DS1, E3 and E1 can be inserted when option 014 is fitted.

RATE	Availability	Option
140 Mb/s	SDH Only	012
DS3	SDH & SONET	001, 012, 002
34Mb/s	SDH & SONET	001, 012,002
2Mb/s	PDH, SDH & SONET	001, 012, 002
DS1	DSn, SDH & SONET	001, 012, 002

HOW TO:

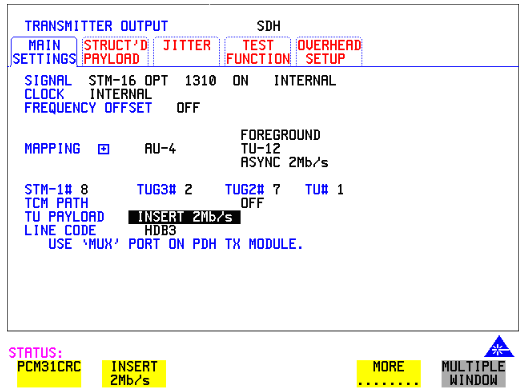
Insert 34 Mb/s, DS3 & 140 Mb/s



1 Press **TRANSMIT**, select **SDH** and the **MAIN SETTINGS** page.

2 Set up the required transmit SDH interface, set appropriate MAPPING then choose TU/VT PAYLOAD **INSERT 140 Mb/s**, **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).

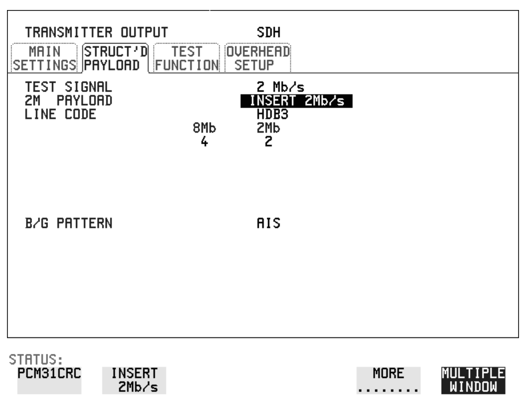
Insert 2 Mb/s or DS1 (Unstructured SDH/SONET Payload)



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

2 Set up the required transmit SDH interface, and choose TU12 MAPPING or TU11 MAPPING and TU PAYLOAD **INSERT 2 Mb/s** or **INSERT DS1**.

Insert 2 Mb/s or DS1 (Structured SDH Payload or Structured PDH)



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

Structured SDH Payload

2 Set up the required transmit SDH interface. See "Setting SDH Transmit Interface " page 29.

3 Set up the SDH structured payload. See "Setting Transmit Structured Payload/ Test Signal " page 70.

4 Choose 2M PAYLOAD/DS1 PAYLOAD **INSERT 2 Mb/s** or **INSERT DS1**.

5 Choose the LINE CODE.

Structured PDH

6 Set up, the required transmit PDH interface, See "Setting PDH/DSn Transmit Interface (option 012) " page 26.

7 Set up the PDH Test Signal interface. See "Setting Transmit Structured Payload/ Test Signal " page 70

8 Choose 2M PAYLOAD/DS1 PAYLOAD **INSERT 2 Mb/s** or **INSERT DS1**.

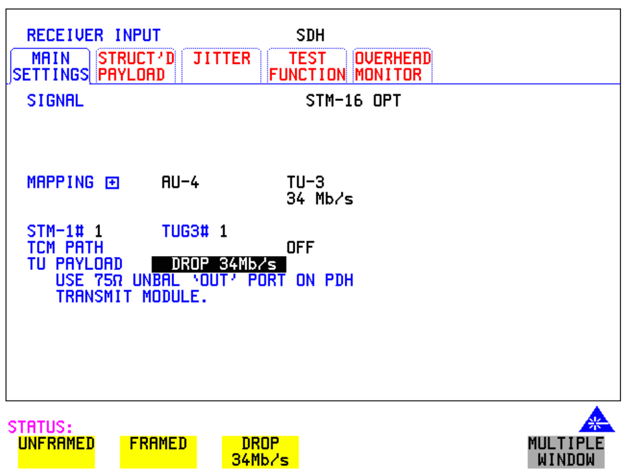
9 Choose the LINE CODE.

Dropping an External Payload/Test Signal

Description You can drop 2Mb/s, 34 Mb/s or 140 Mb/s from an STM-N line signal when option 012 is fitted. DS3, DS1, E3 and E1 can be dropped when option 014 is fitted

RATE	Availability	Option
140 Mb/s	SDH Only	012 Only
DS3	SDH & SONET	001, 012, 002
34Mb/s	SDH & SONET	001, 012, 002
2Mb/s	PDH, SDH & SONET	001, 012, 002
DS1	DSn, SDH & SONET	001, 012, 002

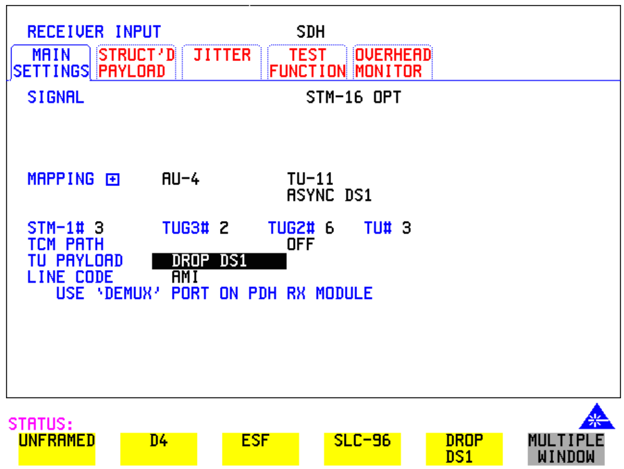
HOW TO: **Drop 34 Mb/s, DS3 & 140 Mb/s**



1 Connect the 75Ω OUT port of the PDH Tx module to the external equipment.

2 Set up the receive SDH interface, and choose TU PAYLOAD **DROP 140 Mb/s**, **DROP 34 Mb/s** or **DROP DS3**.
If **DROP DS3** is chosen, choose the DS3 output level.

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

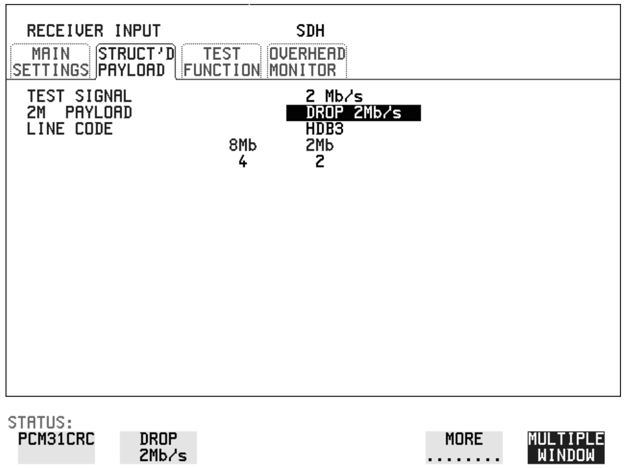


1 Connect the DEMUX port of the PDH module to the external equipment.

2 Set up the required receive SDH interface, and choose TU12 MAPPING or TU11 MAPPING and TU PAYLOAD **DROP 2 Mb/s** or **DROP DS1** .

3 Choose the required LINE CODE.

Drop 2 Mb/s/DS1 (Structured SDH Payload or Structured PDH



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

Structured SDH Payload

2 Set up the required receive SDH interface see "Setting SDH Receive Interface " page 49.

3 Set up the SDH structured payload, see "Setting Receive Structured Payload/Test Signal " page 72.

4 Choose 2M PAYLOAD/DS1 PAYLOAD **DROP 2 Mb/s** or **DROP DS1** .

5 Choose the LINE CODE.

Structured PDH

6 Set up, the required receive PDH interface, see "Setting PDH/DSn Receive Interface (Option 012) " page 47.

7 Set up the PDH Test Signal interface, see "Setting Receive Structured Payload/ Test Signal " page 72

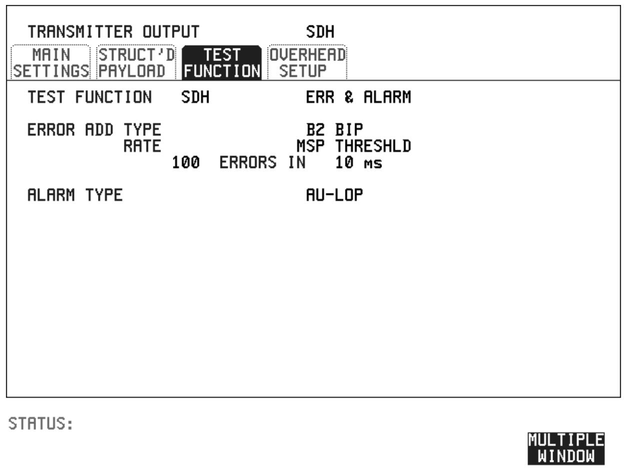
8 Choose 2M PAYLOAD/DS1 PAYLOAD **DROP 2 Mb/s** or **DROP DS1** .

9 Choose the LINE CODE.

Adding Errors & Alarms at the SDH Interface

Description

Errors and alarms can be added on the SDH signal during testing.



HOW TO:

1 Set up the SDH transmit interface and payload required. See "Setting SDH Transmit Interface " page 29.

2 Select **TEST FUNCTION** , SDH, ERR & ALARM as shown above.

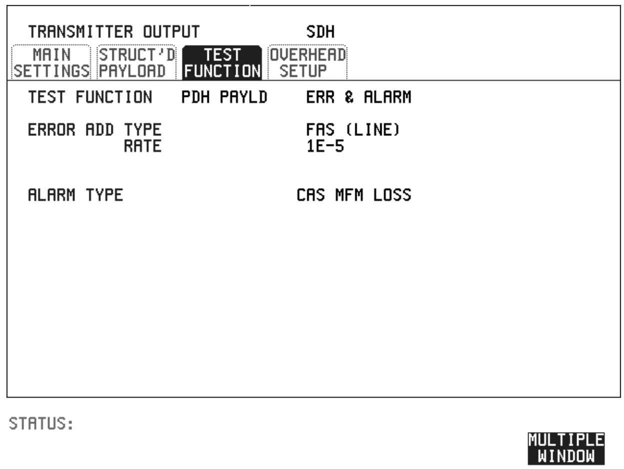
3 Choose the ERROR ADD TYPE and RATE required.
Errors can be added at preset rates and at USER programmable rate. With the exception of ENTIRE FRAME, A1A2 FRAME and BIT, errors can be added at ERROR ALL rate.
If B2 BIP errors are chosen errors can be added to trigger an MSP THRESHOLD. This takes the 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.

Adding Errors & Alarms to a PDH signal

Description
Option 012 is required for PDH operation.

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



HOW TO:

1 If SDH interface is chosen, set up the SDH transmit interface and payload required. See "Setting SDH Transmit Interface" page 29.
If PDH interface is chosen, set up the PDH interface and payload required. See "Setting PDH/DSn Transmit Interface (option 012)" page 26.

2 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.

3 Choose the ALARM TYPE.
Errors and Alarms can be added at the same time.

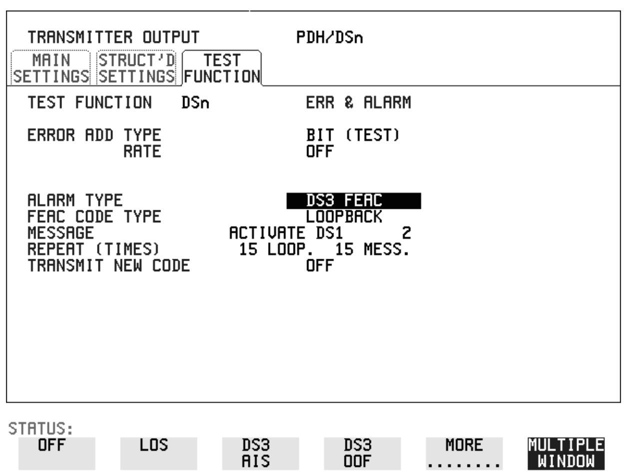
Using FEAC Codes

Description
Option 012 required

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 and ALARM TYPE **DS3 FEAC** . When a FEAC code is not being transmitted, an all ones pattern is transmitted.

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.

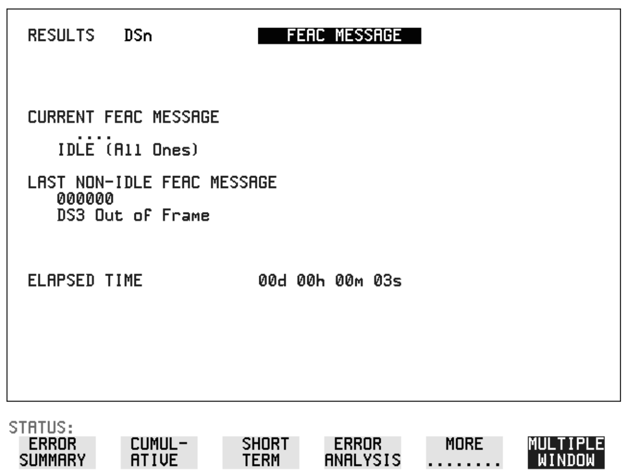
5 If **LOOPBACK** is chosen, choose the REPEAT (TIMES) LOOP and MESS, in the range 1 to 15.

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.

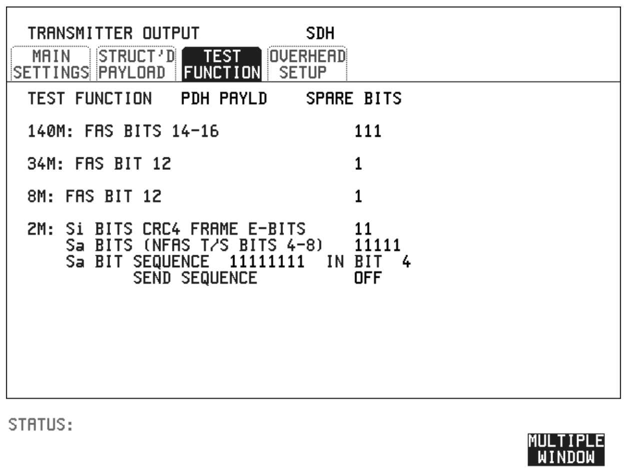


Setting PDH Spare Bits

Description

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

140 Mb/s - FAS Bit 14
34 Mb/s - FAS Bit 12
8 Mb.s - FAS Bit 12
2 Mb/s - NFAS Timeslot (timeslot 0 of NFAS frame) Bit 0



HOW TO:

1 If SDH interface is chosen, set up the SDH transmit interface and payload required. See "Setting SDH Transmit Interface " page 29.
If PDH interface is chosen, set up the PDH transmit interface and payload required. See "Setting PDH/DSn Transmit Interface (option 012) " 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 SDH network. They also enable individual payload channels to be inserted or extracted from a high speed STM-n line signal (for example the functionality provided by ADM’s).

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

Jitter caused by Pointer Adjustments

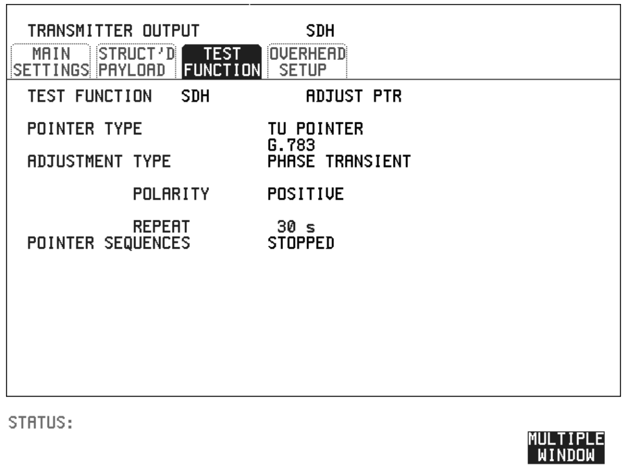
Pointer adjustments are the mechanisms within SDH used to compensate for frequency and phase differences between VCs and the outgoing SDH frames. These pointer adjustments are byte wide and since they can occur randomly, they may cause significant amounts of payload signal jitter. It is therefore necessary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

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

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

The OmniBER 718 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 718.

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



HOW TO:

1. Set up the SDH transmit interface and payload required. See "Setting SDH 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 AU and TU-3, the minimum spacing between adjustments is 500 us. For TU except TU-3, the minimum spacing between adjustments is 2 ms.
   Choose ADJUST POINTER [ON] to add the chosen burst.

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

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

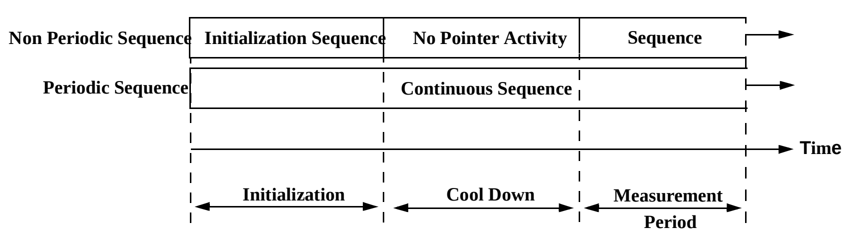
Pointer Type	Line Rate	AU Payload (VC) Rate	TU Payload (TU) Rate
AU	Constant	Offset	Tracks AU Payload
AU	Offset	Constant	Constant
TU	Constant	Constant	Offset
TU	Offset	Tracks Line Rate	Constant

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

G.783 Pointer Sequences Explained

In addition to the BURST, NEW POINTER and OFFSET pointer movements described, the OmniBER 718 can also generate pointer sequences (pointer movements) according to ITU-T G.783, T1.105.03 and GR-253. Note that T.105.03/ GR-253 sequences are explained in the SONET version of this User's Guide.

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



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

Initialization Period

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

Cool Down Period

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

Sequence (Measurement) Period

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

Periodic Test Sequences

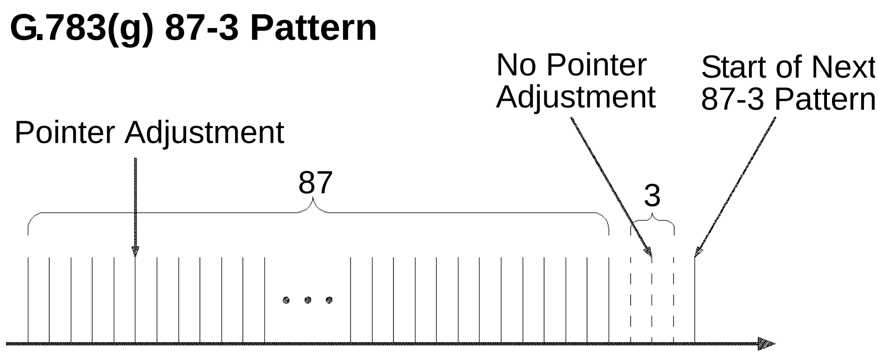
For periodic test sequences (for example “PERIODIC ADD g/h”) both the 60 second initialization and 30 second cool down periods consist of the same sequence as used for the subsequent measurement sequence. If the product of the period T and the selected optional background pattern (87+3 or 26+1) exceeds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

The OmniBER 718 displays a message indicating which phase (initialization, cool down or measurement) the transmitter is currently generating.

NOTE

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

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



An Example of a Pointer Sequence

Pointer Sequence	Description
G.783(a) PERIODIC SINGLE	Periodic Single adjustments, each with opposite polarity to the preceding adjustment. The interval between pointer adjustments is user selectable (see Note 1 page 93).
G.783 (b) PERIODIC ADD	Periodic Single adjustments, with selectable polarity and added adjustment (1 extra). The spacing between the added adjustment and the previous adjustment is set to the minimum, (see Note 2 page 93). The interval between pointer adjustments is user selectable (see Note 1). Added adjustments occur every 30 seconds.
G.783 (c) PERIODIC CANCEL	Periodic Single adjustments, with selectable polarity and cancelled adjustment (1 less). The interval between pointer adjustments is user selectable (see Note 1 page 93). Cancelled adjustments occur every 30 seconds.
G.783(d) PERIODIC DOUBLE	Periodic Double adjustments (pair of adjustments). The pair alternate in polarity. The spacing between pairs of adjustments, of like polarity is set to the minimum (see Note 2). The interval between pointer adjustments is user selectable (see Note 1).
G.783 (e) SINGLE	Periodic Single adjustments, all of the same polarity which is selectable. Separation between pointer adjustments is fixed at approximately 30 seconds.

Pointer Sequence	Description
G.783 (f) BURST	Periodic bursts of 3 adjustments, all of the same polarity which is selectable. The interval between bursts is fixed at approximately 30 seconds. The interval between adjustments within a burst is set to the minimum (see Note 2 page 93).
PHASE TRANSIENT	Phase transient pointer adjustment burst test sequence. All adjustments are of the same polarity, which is selectable. The interval between bursts is fixed at 30 seconds. Each burst consists of 7 pointer movement. The first 3 in each burst are 0.25 s apart, and the interval between the 3 and 4 movement, and each remaining movement 0.5 seconds.
G.783 (g) PERIODIC NORMAL (87-3 Pattern)	An 87-3 pattern is selected. The sequence pattern is 87 pointer movements followed by 3 missing pointer movements. Pointer polarity is selectable and the time interval between pointer adjustments settable (see Note 1 page 93).
G.783 (g) PERIODIC ADD (87-3 Pattern)	An 87-3 pattern is selected. The sequence pattern is 87 pointer movements followed by 3 missing pointer movements with an added pointer movement after the 43rd pointer. The spacing between the added adjustment and the previous adjustment is set to the minimum, (see Note 2 page 93). Pointer polarity is selectable. The time interval between pointer adjustments can be set (see Note 1). Added adjustments occur every 30 seconds or every repeat of the 87-3 pattern, whichever is longer.
G.783 (g) PERIODIC CANCEL (87-3 pattern)	An 87-3 pattern is selected. The sequence pattern is 87 pointer movements followed by 3 missing pointer movements with a cancelled pointer movement at the 87th pointer. Pointer polarity is selectable, and the time interval between pointer adjustments can be set (see Note 1). Cancelled adjustments occur every 30 seconds or every repeat of the 87-3 pattern, whichever is longer.
G.783 (h) PERIODIC NORMAL (Continuous Pattern)	Provides a continuous sequence of pointer adjustments. The polarity of the adjustments is selectable, and the time interval between adjustments can be set (see Note 1).
G.783 (h) PERIODIC ADD (Continuous Pattern)	Periodic Single adjustments, with selectable polarity and added adjustment (1 extra). The spacing between the added adjustment and the previous adjustment is set to the minimum, (see Note 2). The time interval between pointer adjustments can be set (see Note 1). Added adjustments occur every 30 seconds or every repeat of the 87-3 pattern, whichever is longer.

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

Pointer Sequence Notes

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

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

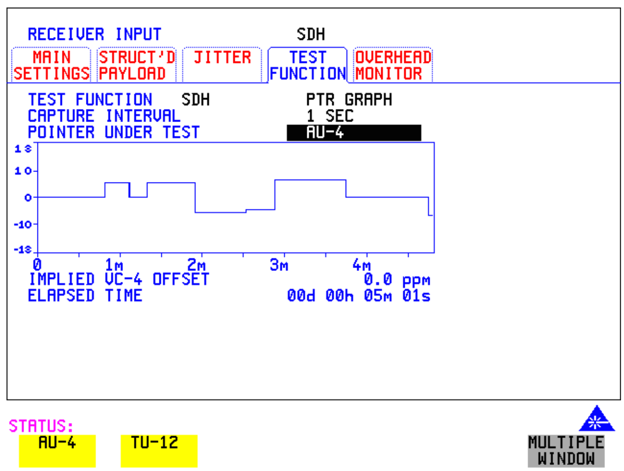
Table 4 O.172 - G.783 pointer test sequence description

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

Using Pointer Graph Test Function

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

The Pointer Graph display can be logged to the chosen logging device. See "Logging on Demand " page 261.



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

HOW TO:

1 Set up the receive SDH interface and payload as required. See “Setting SDH Receive Interface” page 49.

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

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

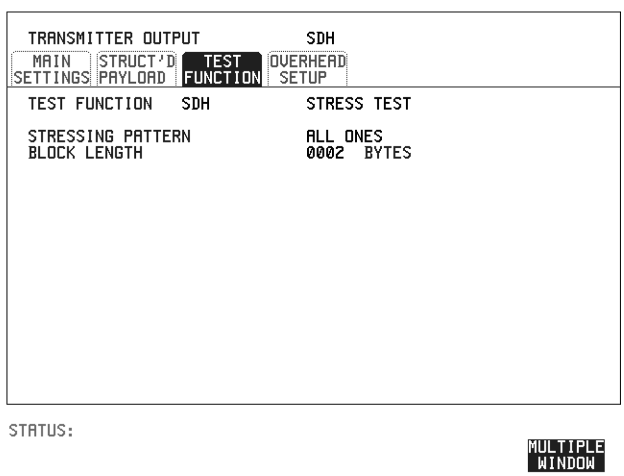
This test is essentially designed for testing optical clock recovery circuits in the presence of long runs of zero's or one's (after scrambling). The test function page allows control of the test pattern and the block length. The maximum block length is 2 bytes less than the width of the Virtual Container.

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

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

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

The stress test is available at all optical rates.



HOW TO:

1. Set up the SDH transmit interface and payload required. See "Setting SDH Transmit Interface " page 29.

   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 (IUT-T G.783) and RING (ITU-T G.841) topologies.

The APS Message types are:-

- PASSIVE
- ACTIVE

The following table shows the APS message type availability.

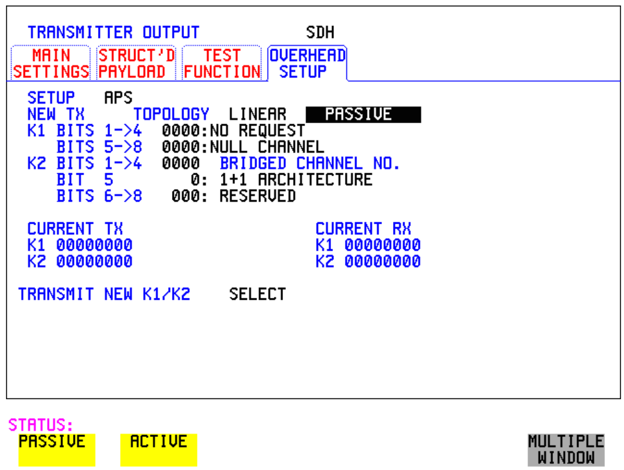
TX	RX	TOPOLOGY	APS Message Types
SDH	PDH/DSn	LINEAR	PASSIVE
SDH	PDH/DSn	RING	PASSIVE
SDH	SDH	LINEAR	PASSIVE or ACTIVE
SDH	SDH	RING	PASSIVE

GENERAL HOWTO:

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

PASSIVE APS HOWTO:

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



HOW TO:

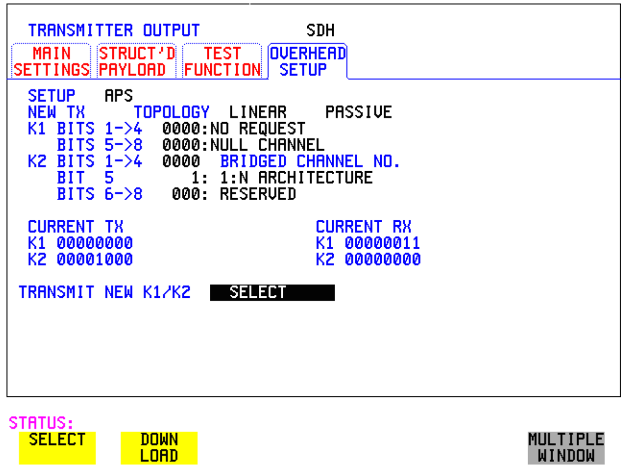
1 Select PASSIVE APS message type.

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.



ACTIVE APS Message Type

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

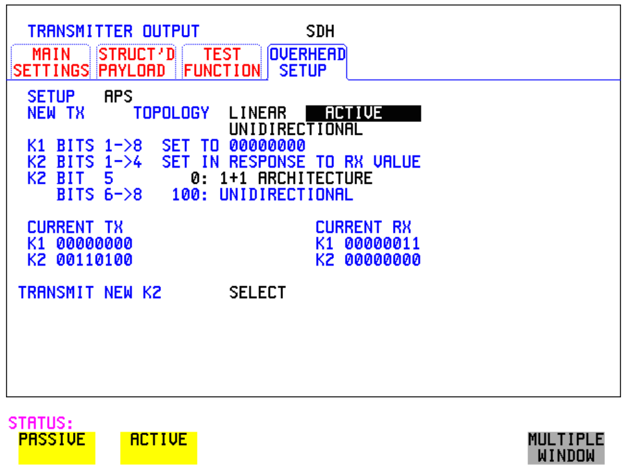
The behaviour for each mode is as shown in the following table.

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

* ITU bit numbering convention

where:

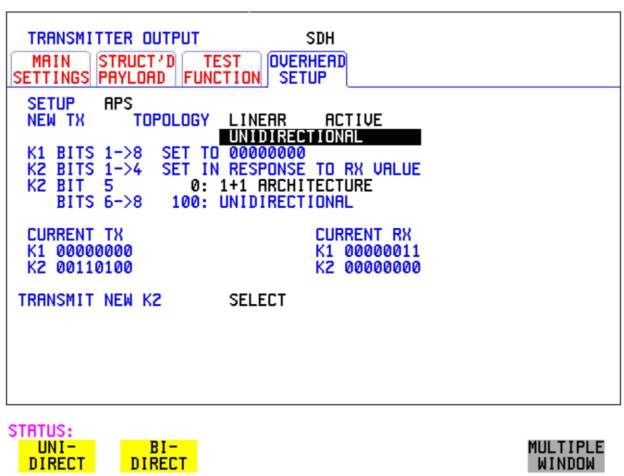
xxxx = any 4-bit binary value.
user = user programmable bit, corresponding to APS ARCHITECTURE.
yyyy = any non-zero 4-bit binary value.



HOW TO:

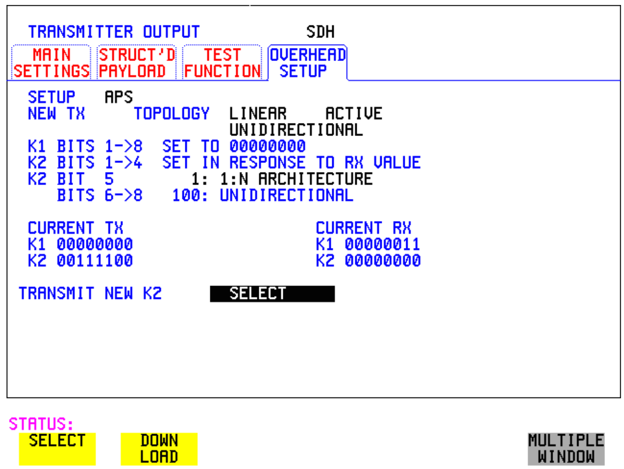
1 Select ACTIVE APS message type.

2 Select ACTIVE APS message mode.



3 Select the required APS ARCHITECTURE.

4 Choose **DOWNLOAD** to transmit the new K1/K2 values.



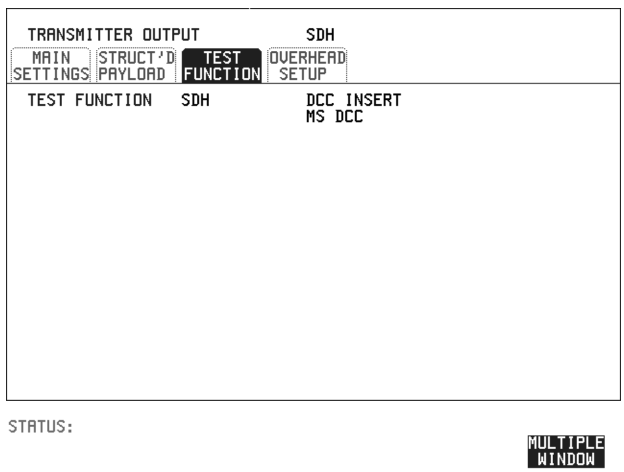
Inserting and Dropping the Data Communications Channel

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 SDH module.

DCC INSERT is available on the **TRANSMIT**, **SDH**, **TEST FUNCTION** display.

DCC DROP is available on the **RECEIVE** **SDH** **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 718 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).

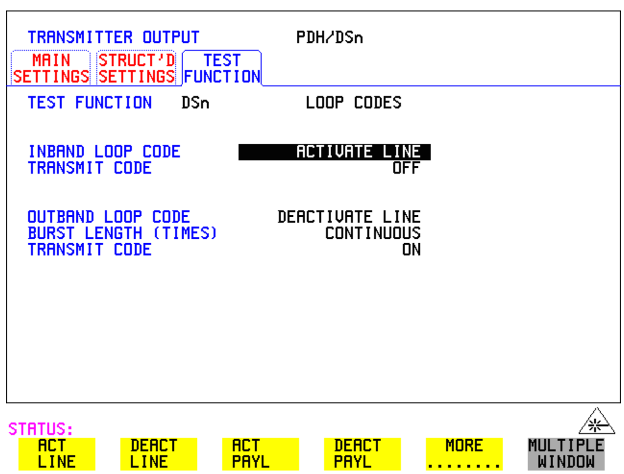
Note the user word can be set to any length, between 3 and 8 bits. The left most bit is transmitted first.

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 310 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**.

3 Choose the INBAND LOOP CODE from the choices given.

4 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.

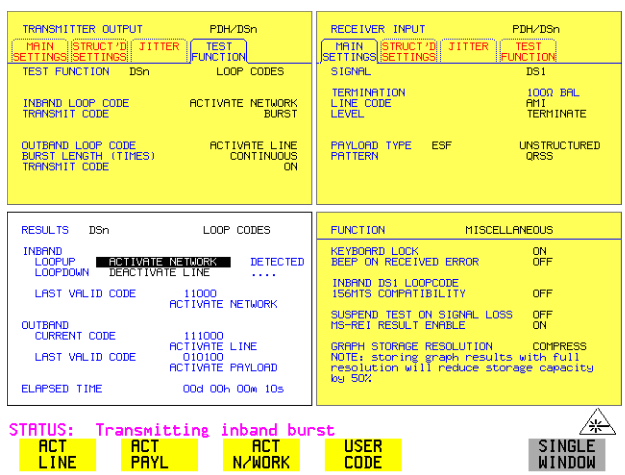
HOW TO: **Monitor/view received loop codes**

5 Choose SIGNAL **DS1** on the **RECEIVE** **MAIN SETTINGS** display. Also set the LINE CODE to match the setting on the Transmitter display.

6 Choose **DSn RESULTS** and **LOOP CODES** on the **RESULTS** display.

7 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.

8 View the results in the RESULTS window.



HOW TO: **Transmit an Out-band loop code**

1 Choose SIGNAL **DS1** and set LINE CODE as required, and PAYLOAD TYPE to **ESF** on the **TRANSMIT** **MAIN SETTINGS** display.

2 Choose **TRANSMIT** **TEST FUNCTION** and set the TEST FUNCTION field to **DSn** and **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.

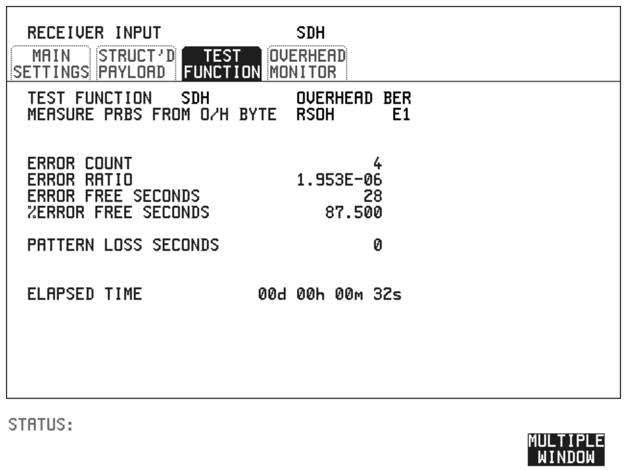
Making Measurements

Using Overhead BER Test Function

Description

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

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



HOW TO:

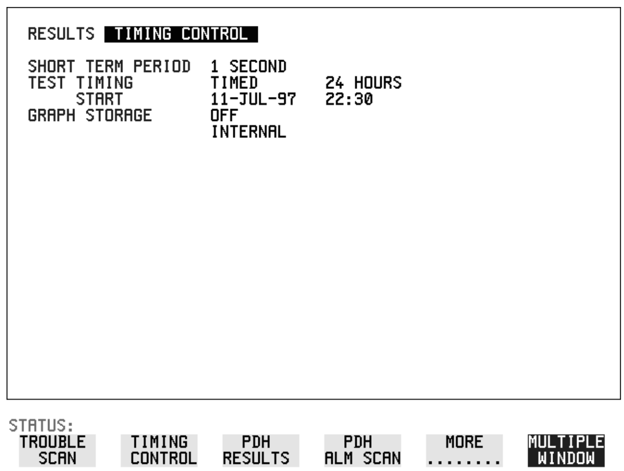
1. Set up the SDH transmit interface and payload required. See "Setting SDH Transmit Interface " page 29.
2. Set up the receive SDH interface and payload as required. See "Setting SDH Receive Interface " page 49.
3. Choose the overhead byte to be tested on the **RECEIVE** **SDH** **TEST FUNCTION** display.
4. Choose the overhead byte to be tested on the **TRANSMIT** **SDH** **TEST FUNCTION** display.
5. Press **RUN/STOP** to start the test.
6. The PRBS pattern can be errored by pressing **SINGLE**.

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.



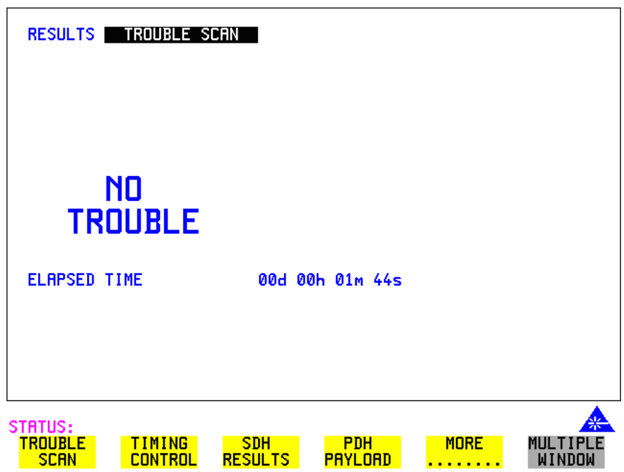
HOW TO:

1. Choose **TIMING CONTROL** on the **RESULTS** display.
2. Set the SHORT TERM PERIOD 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.

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 OmniBER this feature is provided by Trouble Scan.

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



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

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

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

Error Count Priority - see the Table on the following page for a list of error count priorities. The Table lists the error types in order of importance, most important at the top of table.

Error Count Priority

PDH	DSn	SDH	SONET	ATM
CRC CODE FAS 140M FAS 34M FAS 8M FAS 2M REBE BIT	CRC CODE DS3FR (DS1FR) P-BIT C-BIT FEBE BIT	B1 BIP B2 BIP B3 BIP TC-ERROR TU BIP FRAME CRC FAS2 (DS3FR, DS1FR) MS REI HP REI TC IEC OEI TC-REI LP REI BIT	CV-S CV-L CV-P CV-V FRAME CRC DS3FR (DS1FR, FAS2) REI-L REI-P REI-V 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

POS Errors Priority

POS errors are displayed with priority beneath physical layer trouble scan errors.

The order for display, in descending order is:

- FCS Errors
- IP Header Errors
- IP Payload Errors

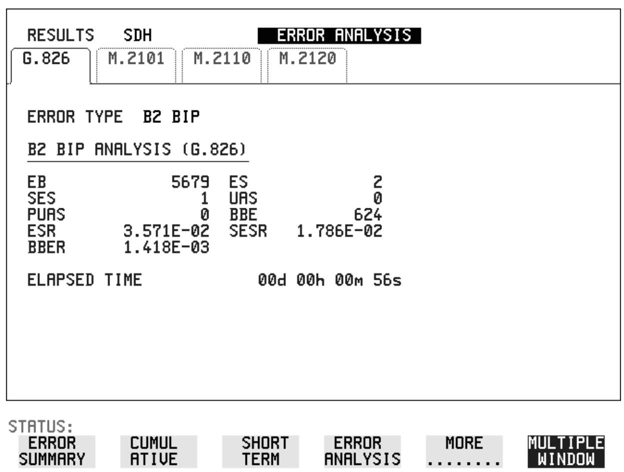
All POS alarms are monitored.

Making SDH Analysis Measurements

Description G.826, M.2101, M.2110 and M.2120 analysis results are provided for all relevant SDH 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. See, "Using Pointer Graph Test Function " page 95.



HOW TO:

1 Set up the receive SDH interface and payload required. See "Setting SDH Receive Interface " page 49.

2 If required set up the SDH transmit interface and payload. See "Setting SDH Transmit Interface " page 29.

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

4 You can view the analysis results on the **RESULTS** **SDH** **ANALYSIS** display.

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

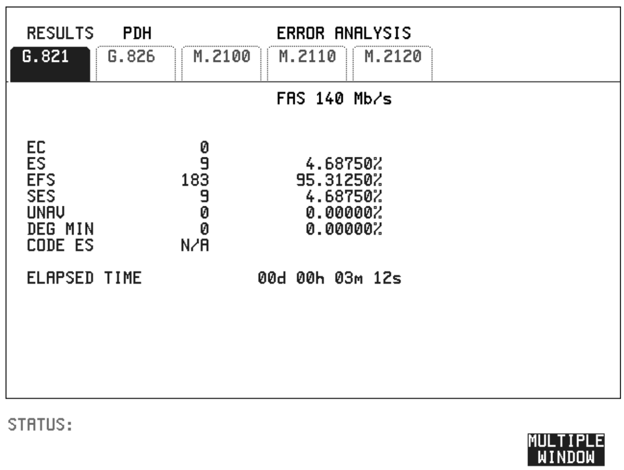
Making PDH Analysis Measurements

Description

Option 012 is required for PDH operation.

G.821, G.826, M.2100, M.2110 and M.2120 analysis results are provided for all relevant PDH and PDH 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 120.

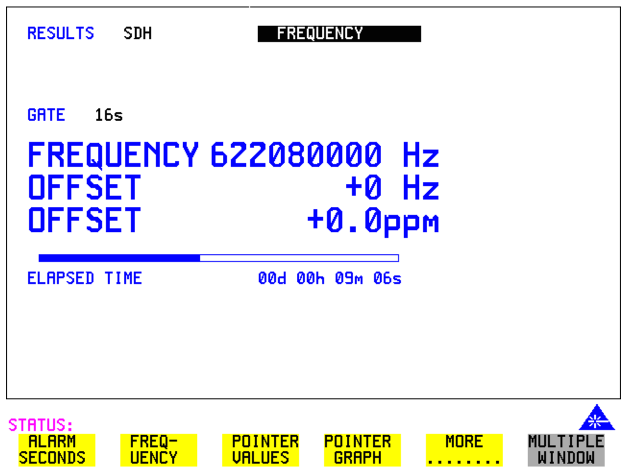


HOW TO:

1. If SDH is chosen as the interface, set up the Receive Interface and Payload required. See "Setting SDH Receive Interface " page 49. If required set up the Transmit Interface and Payload. See "Setting SDH Transmit Interface " page 29.
2. If PDH is chosen as the interface, set up the PDH receive interface. See "Setting PDH/DSn Receive Interface (Option 012) " page 47. If required set up the PDH transmit interface. See "Setting PDH/DSn Transmit Interface (option 012) " page 26.
3. Press **RUN/STOP** to start the measurement.
4. If SDH is chosen as the interface, you can view the analysis results on the **RESULTS** **PDH PAYLOAD** **ERROR ANALYSIS** display
   If PDH is chosen as the interface, you can view the analysis results on the **RESULTS** **PDH** **ERROR ANALYSIS** display.

Measuring Frequency

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



HOW TO:

1. Connect the signal to be measured to the IN port of the PDH/DSN RECEIVE module or the IN port of the Multirate Analyzer module (SDH electrical) or the IN port of the Optical Interface module (SDH optical).
2. Choose the required SIGNAL rate and LEVEL on the **PDH/DSN** **RECEIVE** **MAIN SETTINGS** or **SDH** **RECEIVE** **MAIN SETTINGS** display.

NOTE

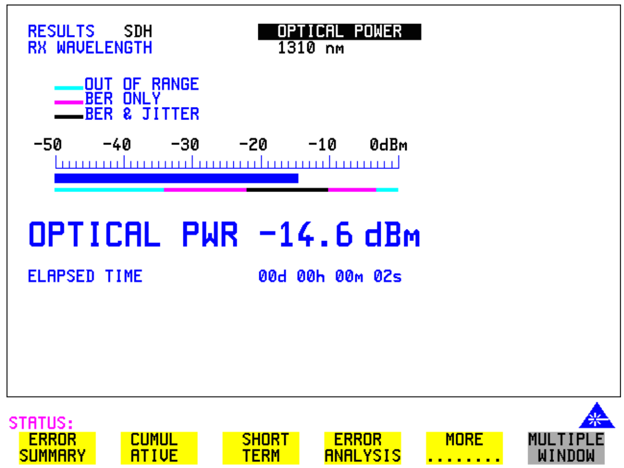
1. Frequency measurement is always available even if test timing is off.
2. The result is only valid if a complete sweep of the highlighted bar has occurred since the input was applied.

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.

Measuring Optical Power

Description Optical power measurement can be performed on the SDH signal connected to the IN port of the Optical Interface module.



HOW TO:

1. Connect the SDH optical signal to the IN port of the Optical Interface module.
2. Choose the received input signal rate on the **RECEIVE** **SDH** display.
3. To view Optical Power results select **RESULTS** **SDH RESULTS**, press **MORE** twice then select **OPTICAL POWER**.

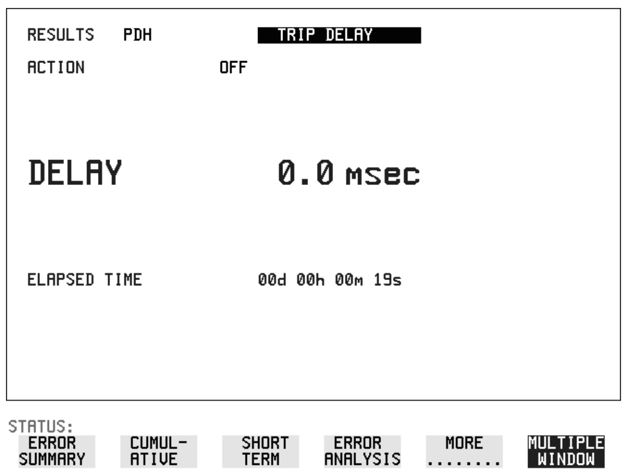
NOTE

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

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 718 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 140 Mb/s, 34 Mb/s, 8 Mb/s or 2 Mb/s PDH/DSn interface or PDH/DSn payload signal.

HOW TO:

1 If measuring on an SDH interface, set up the SDH transmit and receive interfaces and payloads required. See "Setting SDH Transmit Interface " page 29 and “Setting SDH Receive Interface” page 49.

2 If measuring on a PDH interface, set up the PDH transmit and receive interfaces and payloads required. See “Setting PDH/DSn Transmit Interface (option 012)” page 26 and “Setting PDH/DSn Receive Interface (Option 012)” page 47.

3 Connect a loopback to the network equipment.

4 Choose ACTION **ON** to start the measurement.

If measuring on an SDH interface, the results are available on the RESULTS PDH PAYLOAD display.

If measuring on a PDH interface, the results are available on the RESULTS PDH 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, 140 Mb/s	10 microseconds
STM-0, STM-1	0.5 milliseconds
STM-4, STM-16	0.5 milliseconds

Monitoring Signaling Bits

Description The OmniBER 718 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.

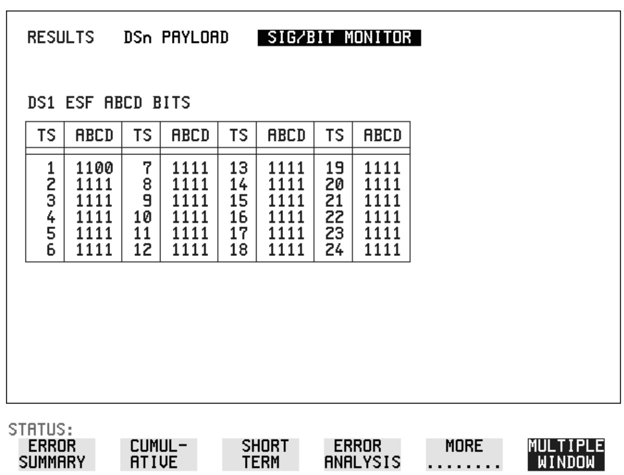
DS1 Results

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.



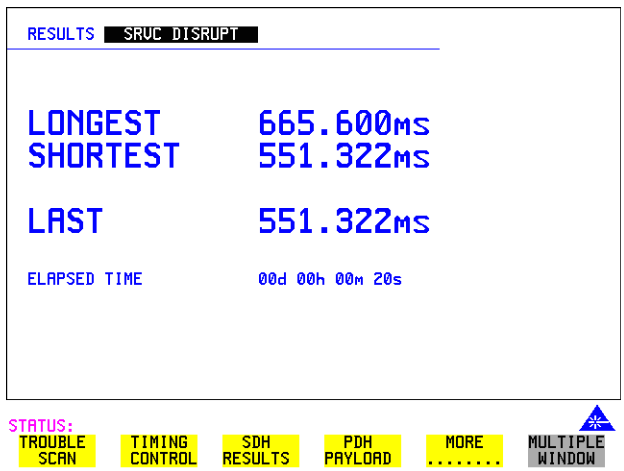
TS	ABCD	TS	ABCD	TS	ABCD	TS	ABCD
1	1100	7	1111	13	1111	19	1111
2	1111	8	1111	14	1111	20	1111
3	1111	9	1111	15	1111	21	1111
4	1111	10	1111	16	1111	22	1111
5	1111	11	1111	17	1111	23	1111
6	1111	12	1111	18	1111	24	1111

Measuring Service Disruption Time

Description:

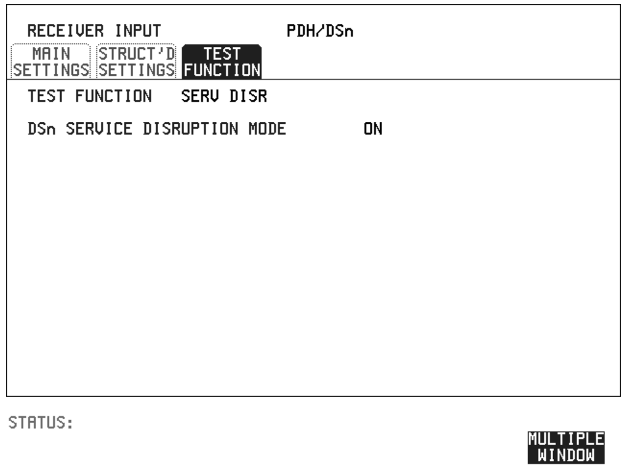
Protection switching ensures that data integrity is maintained and revenue protected when equipment failure occurs. The speed of operation of the protection switch can be measured.

The 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 180 and for POS refer to “POS Service Disruption” page 215.



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

- If you choose a PDH or SDH/SONET interface and an ANSI (DS1, DS3) framed, unstructured payload you must select Service Disruption on the **TRANSMIT** and **RECEIVE** **TEST FUNCTION** displays.



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 >200 ms 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 SDH set up the SDH transmit and receive interfaces and payloads required. See "Setting SDH Transmit Interface " page 29 and "Setting SDH Receive Interface " page 49.
2. If interfacing at PDH/DSn set up the PDH/DSn transmit and receive interfaces and payloads as required. See "Setting PDH/DSn Transmit Interface (option 012) " page 26 and "Setting PDH/DSn Receive Interface (Option 012) " page 47.

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.

Resolution: 1us

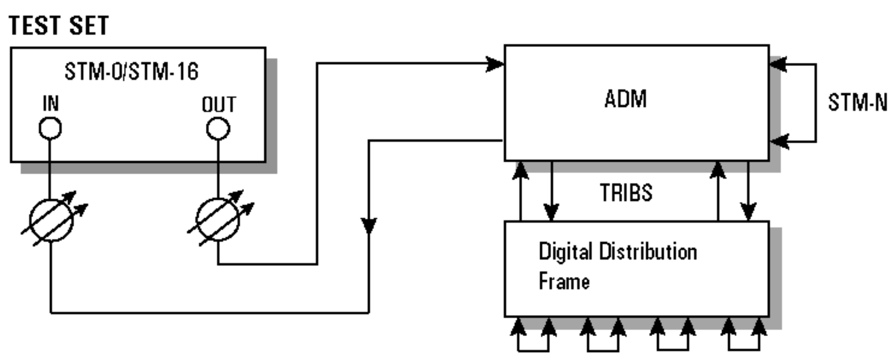
Performing an SDH Tributary Scan

Description

Verifying an ADM Installation

An important part of the ADM installation process is the verification of path routing through the ADM (or Digital Cross Connect). In order to verify the routing of VC-n paths which are terminated by the network element, the mapped payload, dropped to a PDH tributary port, must be looped back at the digital distribution frame and mapped into the VC-n at the PDH tributary insert port. VC-n paths which are not terminated must be looped back at the STM-n level. Since an STM-1 contains 63 VC-12's and a STM-4 contains 252 VC-12's, manually checking each path is time consuming and laborious.

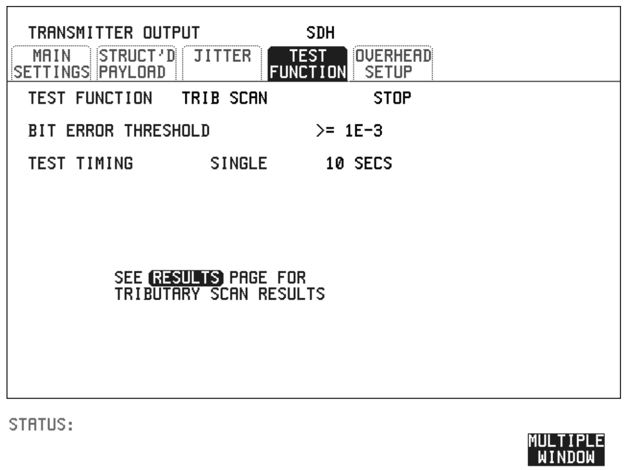
Using the OmniBER 718 Tributary Scan feature the installation of ADM's can be automated and any Bit errors or Pattern Loss flagged on the RESULTS display.



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** **SDH** **MAIN SETTINGS**, mapping setup determines the tributary structure. The OmniBER 718 will configure the Transmitter to the Receiver and the PATTERN is forced to the payload it will fill.

The SDH Tributary Scan display can be logged to the chosen logging device. See "Logging on Demand " page 261

.



HOW TO:

1 Set up the transmit and receive SDH interfaces and payload as required. See "Setting SDH Transmit Interface " page 29 and "Setting SDH Receive Interface " page 49.

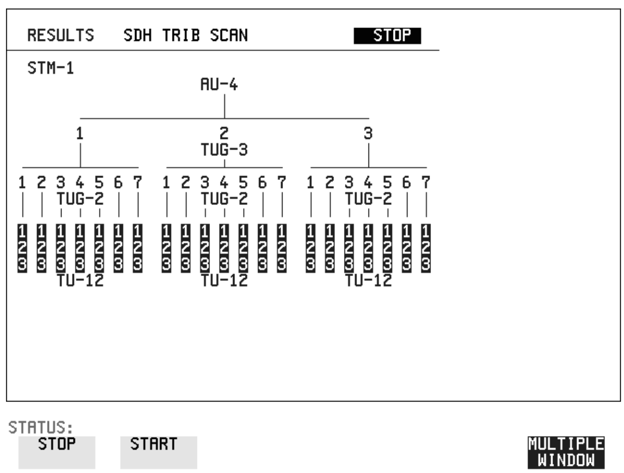
2 Choose the required BIT ERROR THRESHOLD.
This determines the error rate above which a failure is declared.

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, 63 TU-12 tributaries in an AU-4 - the time taken to complete the Tributary Scan will be 63 X TEST TIMING choice.

4 See next page.

5 The Tributary Scan results can be viewed on the **RESULTS** **SDH TRIBSCAN** display.
The Scan can be started on the **TRANSMIT** **SDH** **TEST FUNCTION** display or the **RESULTS** display by choosing START.
If the Scan is started on the **TRANSMIT** **SDH** **TEST FUNCTION** display, the OmniBER 718 changes to the **RESULTS** display.
If a full-bandwidth concatenated payload is selected (e.g. an VC-4-16c within an STM-16), then Tributary Scan is disabled.

NOTE The keyboard is locked during tributary scan.

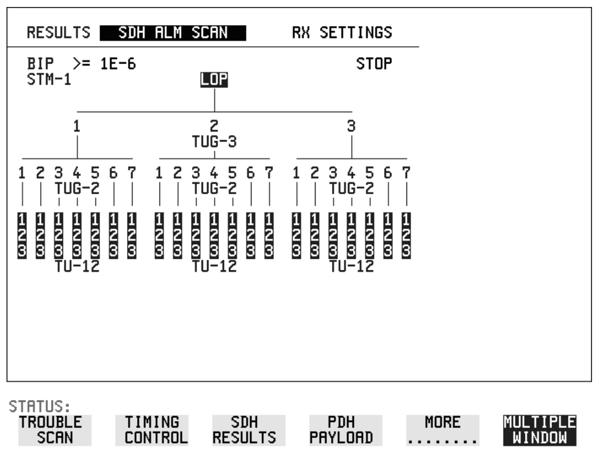


Performing an SDH Alarm Scan

Description

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

The SDH Alarm Scan display can be logged to the chosen logging device. See "Logging on Demand " page 261.



HOW TO:

1 Set up the receive SDH interface and payload as required. See “Setting SDH Receive Interface” page 49.

2 Choose **SDH ALM SCAN** on the **RESULTS** display.

3 Choose AUTO or RX SETTINGS.
RX SETTINGS: The scan checks the structure set on the **RECEIVE** **SDH** display.
AUTO: The scan checks the structure being received. This can be particularly useful when receiving mixed payloads.

4 Choose the BIP error threshold.

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

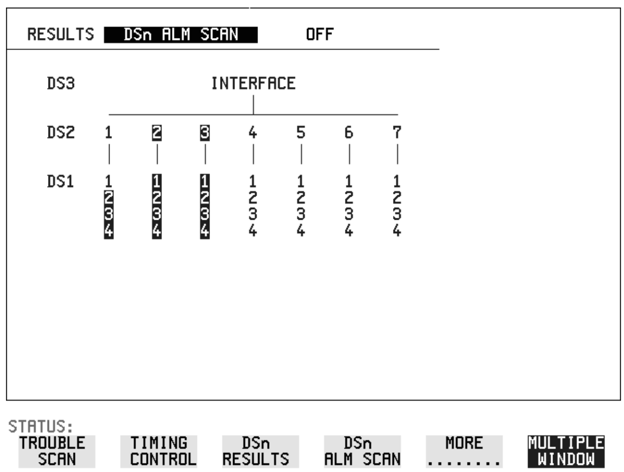
Performing a PDH/DSn Alarm Scan

Description

PDH 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 PDH interface as required. See “Setting PDH/DSn Receive Interface (Option 012)” page 47.

2 Choose **ON** to start the Alarm Scan.

Measuring Jitter

Description: Option 200 is required for Jitter measurements.

Jitter and error measurements are made simultaneously when a jitter option is fitted. Jitter measurements are also available when ATM is selected as a payload.

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.

Jitter Measurement Filters

LP, HP1 and HP2 filters to ITU-T O.171 (PDH) and O.172 (SDH).

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
139264	200	20	3500	12
155520	500	65	1300	12
622080	1000	250	5000	12
2488320	5000	1000	20000	12

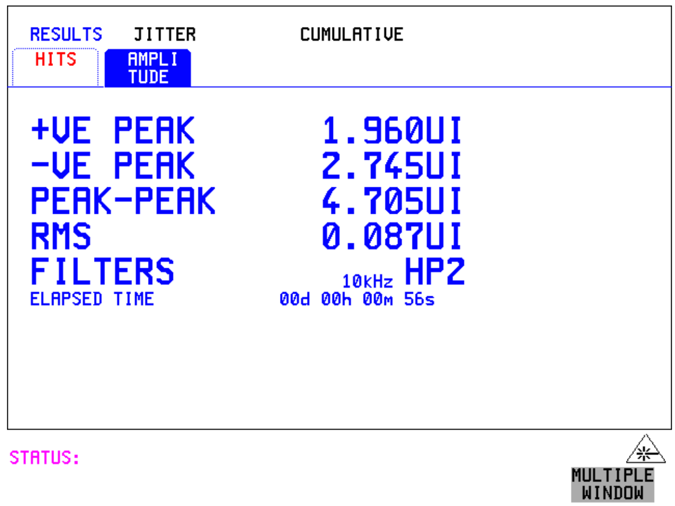
Please note that the instrument measurement bandwidth varies depending on the Receiver Range selected (i.e. the bandwidth is reduced when not on the 1.6 UI range). If you change the Receiver Range selection check the Filter Values displayed at the bottom right of the display meet you measurement requirements.

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.

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 117.



HOW TO:

1. If measuring Jitter on a PDH signal, set up the receive PDH interface and the receive Jitter interface. See “Setting PDH/DSn Receive Interface (Option 012)” page 47 and “Setting Jitter Receive Interface” page 50.
2. If measuring jitter on an SDH Optical signal, check on the **RESULTS** **SDH 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 an SDH signal, set up the receive SDH interface and the receive Jitter interface. See “Setting SDH Receive Interface” page 49 and “Setting Jitter Receive Interface” page 50.
4. If performing a Jitter Tolerance measurement, see "Measuring Jitter Tolerance " page 137.
   If performing a Jitter Transfer measurement, see "Measuring Jitter Transfer " page 142.
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 is required for Jitter measurements.

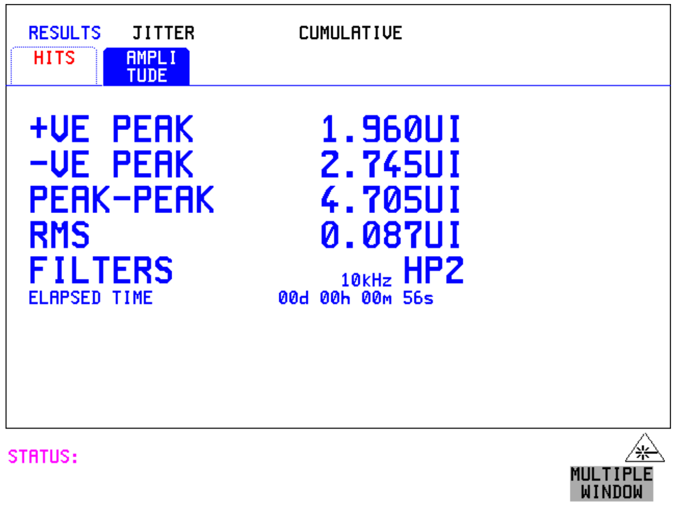
Extended Jitter measurements are made at the upper end of the standard wander frequency range and the lower end of the standard jitter frequency range.

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	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
139264	256	0.15	1	5	6.25
155520	64	0.15	1	20	25
622080	256	0.15	1	20	25
2488320	1024	0.15	1	20	25

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

** Nominal value.



HOW TO:

1 If measuring Extended jitter on a PDH signal, set up the receive PDH interface and the receive Jitter interface. See “Setting PDH/DSn Receive Interface (Option 012)” page 47 and “Setting Extended Jitter Receive Interface” page 51.

2 If measuring Extended jitter on an SDH Optical signal, check on the **RESULTS** **SDH 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 SDH signal, set up the receive SDH interface and the receive Jitter interface. See “Setting SDH Receive Interface” page 49 and “Setting Extended Jitter Receive Interface” page 51.

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

Measuring Wander

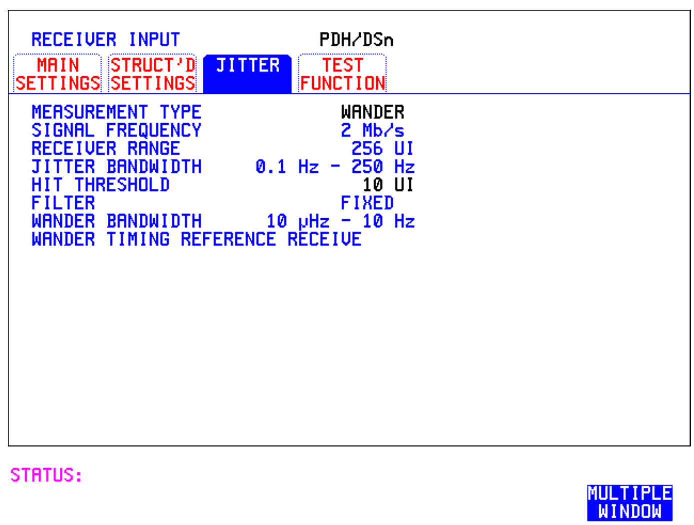
Description: Option 200 is required for Jitter measurement.

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



HOW TO:

Make the Measurement

1 **PDH 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 012) " page 26.

2 **SDH Operation Wander Reference**
Select the TRANSMIT SDH 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 SDH Transmit Interface” page 29.

3 If measuring wander at a PDH rate, set up the PDH receive interface. See, “Setting PDH/DSn Receive Interface (Option 012)” page 47.

4 If measuring wander on an SDH Optical signal, check on the RESULTS SDH 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.

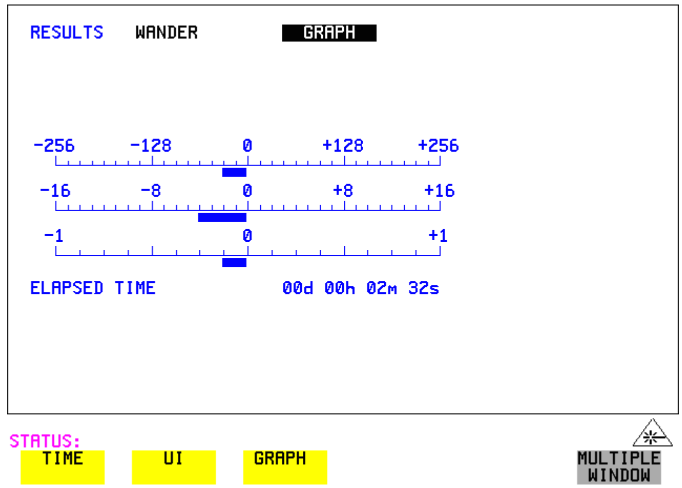
5 If measuring wander at an SDH rate set up the SDH receive interface. See, “Setting SDH Receive Interface” page 49.

6 Choose MEASUREMENT TYPE WANDER, as shown in the display on previous page.

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.

HOW TO: **View the Results**



9 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 or DS1 Estimated Bit slips and Estimated Frame slip results are provided and a **GRAPH** choice is added to the menu.

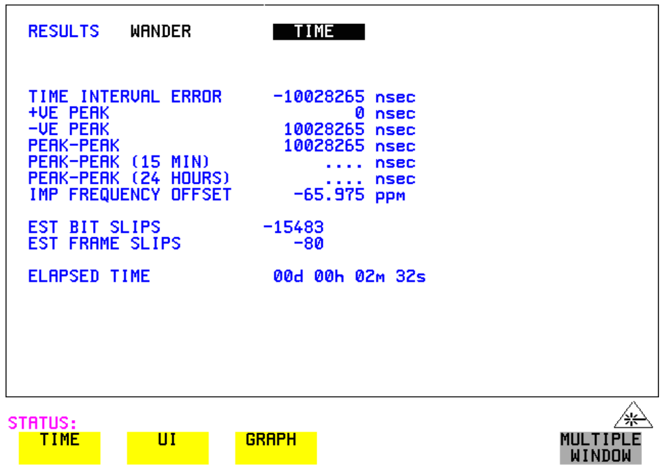
If **GRAPH** is chosen the cumulative wander results are displayed in graphical form. The Graphs are additive and in the example shown the Wander is -36.125 BITS. Graph is only available when a DS1 or 2 Mb/s signal is selected.

NOTE

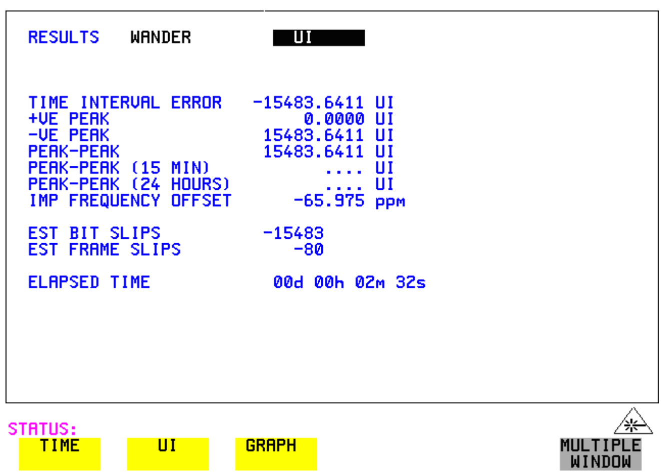
Estimated Bit Slips signify the slippage from the start of the measurement.
One Estimated Frame Slip corresponds to 256 Bit Slips.
Implied Frequency Offset is calculated from the Wander results.

Refer to the following page for displays giving examples of Time and UI wander results.

Wander Time Results



Wander UI Results



Measuring Jitter Tolerance

Description: Option 200 is required for Jitter measurement and 012 for PDH operation.

The jitter auto tolerance feature provides jitter tolerance measurements within the relevant ITU-T mask, G.823 low and high Q systems are provided for PDH (2, 8, 34, 140 Mb/s).
DS1 and DS3 masks are taken from ITU-T G.824 and Bellcore GR.499, Category 1 and Category 2 equipment.
For SDH the masks provided are those specified in ITU-T G.958, type A or B, and in ITU-T G.825. SONET masks are taken from GR-253. The jitter auto tolerance feature is also available when ATM is selected as a payload.

PDH User Selectable Masks

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

SDH/SONET User Selectable Masks

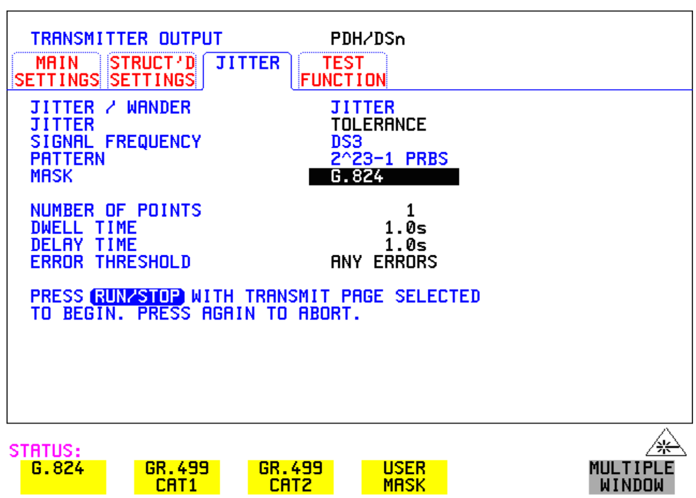
Line Rate	GR.253	G.825	G.958 Type A	G.958 Type B
STM-0	√			
STM-1	√	√	√	√
STM-4	√	√	√	√
STM-16	√	√	√	√

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 do 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 317 and “To change the parameters of a User Defined Jitter Mask” on page 319 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 STM-1 with embedded 34 Mb/s and receiver set to 34 Mb/s.



HOW TO:

Make the Measurement

PDH/DSn Interface

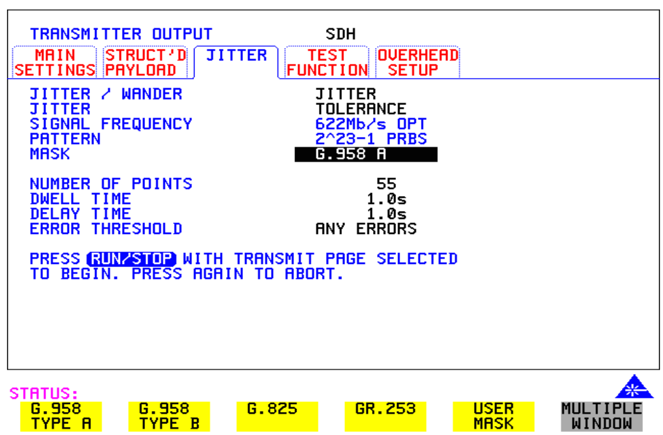
1 If you are performing jitter tolerance on a PDH/DSn signal, set up the PDH/DSn transmit and receive interfaces, including the required test PATTERN. See “Setting PDH/DSn Transmit Interface (option 012)” page 26 and “Setting PDH/DSn Receive Interface (Option 012)” page 47.

2 If you have chosen a PDH/DSn interface now select the JITTER page and select AUTO TOLERANCE and a MASK (see previous display). Proceed to step 6.

SDH Interface

3 If you are performing jitter tolerance on an SDH Optical signal, check on the **RESULTS** **SDH 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.

4 If you are performing jitter tolerance on the SDH signal, set up the SDH transmit and receive interfaces, including the required test PATTERN. See “Setting SDH Transmit Interface” page 29 and “Setting SDH Receive Interface” page 49.



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

Steps common to PDH/DSn and SDH operation

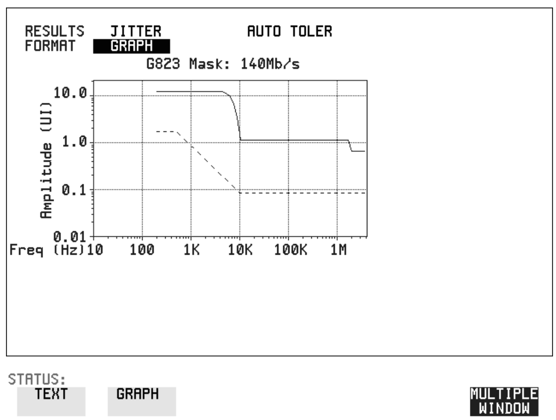
6 Choose the NUMBER OF POINTS at which jitter is transmitted (3 to 55)

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.

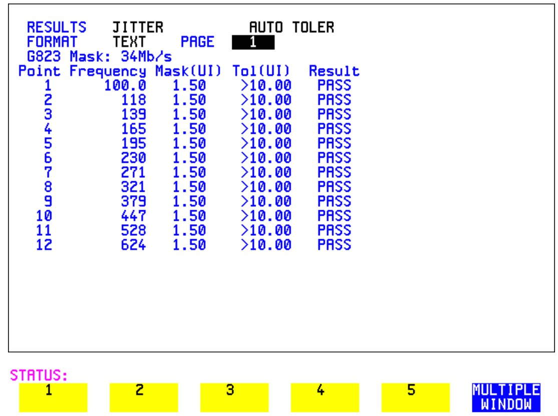
10 Press **RUN/STOP** to start the jitter auto tolerance measurement.
The measurements progress can be monitored on the **TRANSMIT** display. At the end of the test the results can be viewed on the **TRANSMIT** or **RESULTS** displays. The **TRANSMIT** display is cleared when **TRANSMIT** is pressed 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 264.

Measuring Jitter Transfer

***Description: Option 200 is required for Jitter measurement and 012 for PDH operation*.**

Perform vital jitter transfer (gain) measurements using the OmniBER 718.
With the OmniBER 718 you can perform Jitter transfer measurements at each of the four PDH rates 2, 8, 34, 140 Mb/s, plus DS1, DS3 and also STM-0, STM-1, STM-4 and STM-16. Jitter Transfer measurements are also available when ATM is selected as a payload.

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. Automatic band filtering is used in the jitter receiver this provides 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 or SDH is also displayed on the graph. Please refer to the OmniBER 718 Specifications book provided with your instrument for detailed information on Jitter Transfer input and pass masks.

The OmniBER is capable of generating input jitter frequencies up to 20MHz. For ITU-T G.958 Type B 'Jitter Transfer' testing at STM-4 and STM-16, we recommend that a maximum input frequency of 3MHz is used. This will ensures that the transfer measurement remains within the dynamic range of the receiver.

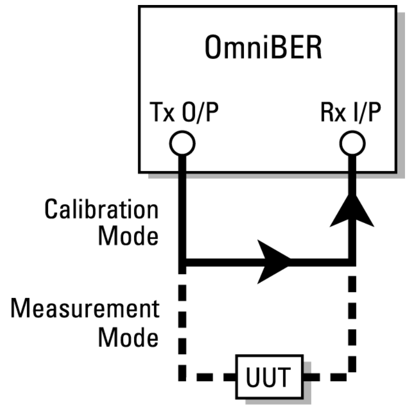
NOTE

1.The Transmitter and Receiver must be set to the same interface rate.
2. There is no ITU-T Pass Mask for 140 Mb/s.

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.



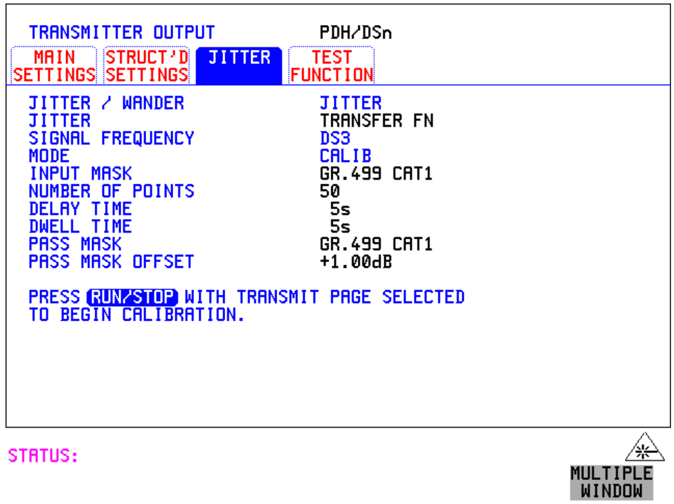
2 The OmniBER 718 must have been switched on for 1 hour before starting a calibration cycle.

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.
Test Period =(Delay Time + Dwell Time + 5 Seconds) X Number of Points X 2 (Calibration + Measurement).

NOTE For best results a Dwell Time of 20 seconds and 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 PDH Jitter Transfer is required, set up the PDH transmit and receive interfaces, the receive jitter interface and connect PDH IN to PDH OUT. See “Setting PDH/DSn Transmit Interface (option 012)” page 26, “Setting PDH/DSn Receive Interface (Option 012)” page 47 and “Setting Jitter Receive Interface” page 50.

2 If you are performing jitter transfer on an SDH Optical signal, check on the **RESULTS** **SDH 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 STM-0, STM-1, STM-4 or STM-16 Optical Jitter Transfer is required, set up the SDH 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 SDH Transmit Interface” page 29, “Setting SDH Receive Interface” page 49 and “Setting Jitter Receive Interface” page 50.

CAUTION If STM-0/1/4/16 SDH 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 STM-0 or STM-1 electrical jitter transfer, set up the SDH transmit/ receive interfaces and the receive jitter interface and connect IN port to OUT port on the SDH module. See “Setting SDH Transmit Interface” page 29, “Setting SDH Receive Interface” page 49 and “Setting Jitter Receive Interface” page 50.

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

6 Choose the INPUT MASK.
SDH operation
If measuring SDH jitter transfer, the ITU-T G.958 mask can be Type A or Type B and 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
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 and 140 Mb/s a G.823 jitter transfer input mask is offered while at DS1 and DS3 G.824 and GR.499 Cat1 and GR.499 Cat2 are provided.

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 319 for instructions on how to change the parameters of a user mask and “To Generate a New Jitter Mask” on page page 317.

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).

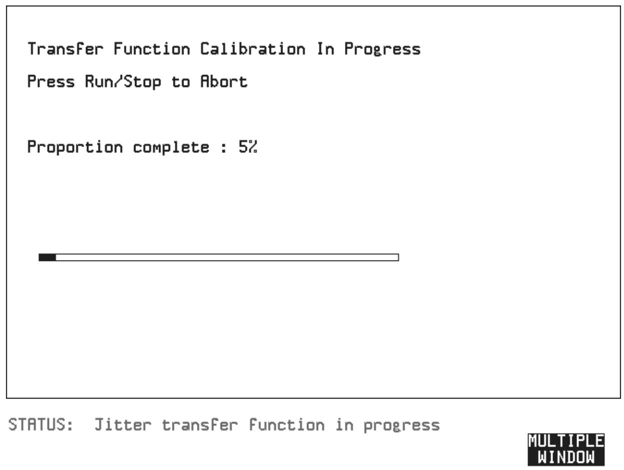
9 Choose the DWELL TIME - the Dwell Time is the test period spent at each amplitude/frequency point (5 to 30 seconds). The result recorded is the maximum peak-to-peak jitter detected during the Dwell Time test period.

10 Select a PASS MASK if a choice is given.

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.

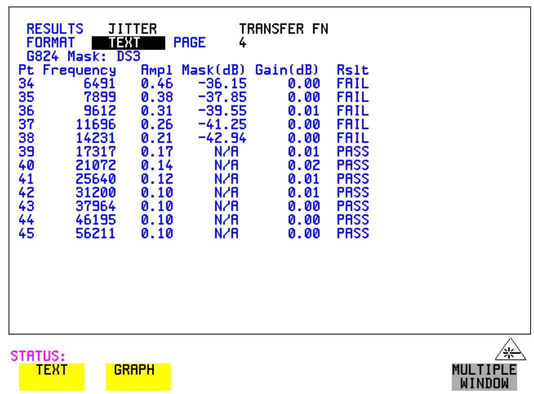
1 After the CALIBRATION is completed, remove the back to back connection from the PDH or SDH or optical interfaces.
If the measurement is to be made at a network equipment monitor point, choose **MONITOR** on the PDH **RECEIVE** **MAIN SETTINGS** display before making the jitter transfer measurement.

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

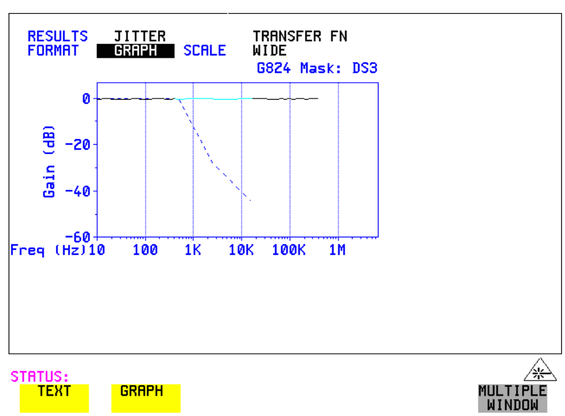
HOW TO: **View the Results**

1 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.



2 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.



3 If you wish to log the jitter tolerance results to a printer see “Logging Jitter Transfer Results” page 266.

Measuring Pointer Adjustment (Tributary) Jitter

Introduction

During the transition from a PDH network to mixed PDH/SDH 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 PDH 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.

ITU-T G.783 and ETSI TM-1015 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.

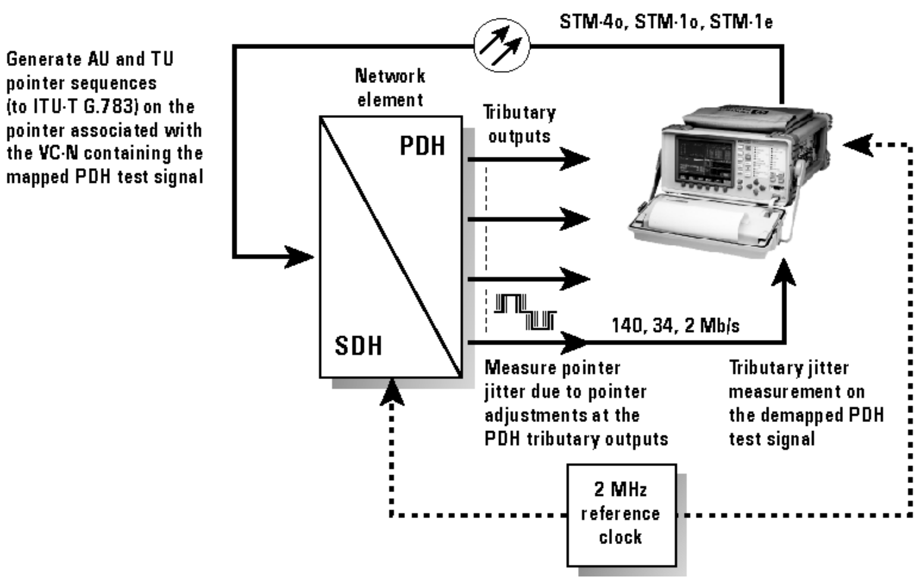
The OmniBER Transmitter can generate the test sequences recommended by ITU-T G.783/ETSI TM-1015. Use these sequences to stress the system under test for correct levels of tributary jitter.

Refer to “Adding Pointer Adjustments” on page 87 for instructions on how to add pointer adjustments and detailed explanations of the pointer sequences provided by the OmniBER.

ITU-T G.783 Jitter Specification

Payload	Pointer	Sequence	Measurement bandwidth	Max. Jitter (UI p-p)
1.5 Mb/s	TU-11	E, F	0.01 to 40 kHz*	1.5
2 Mb/s	TU-12	A, B, C A, B, C	0.02 to 100 kHz * 18 to 100 kHz **	0.4 0.075
34 Mb/s	TU-3	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	TU-3	E, F, G, H	Note 1.	Note 1.
140 Mb/s	AU-4	A, B, C D, G A, B, C, D, G	0.02 to 3500 kHz * 0.02 to 3500 kHz* 10 to 3500 kHz **	0.4 0.75 0.075

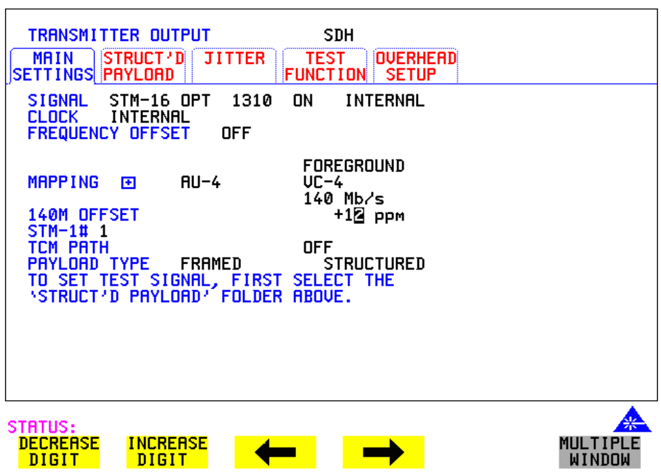
*denotes LP + HP1 filters. ** Denotes LP + HP2 filters;
Note 1 These values are for further study by ITU-T.



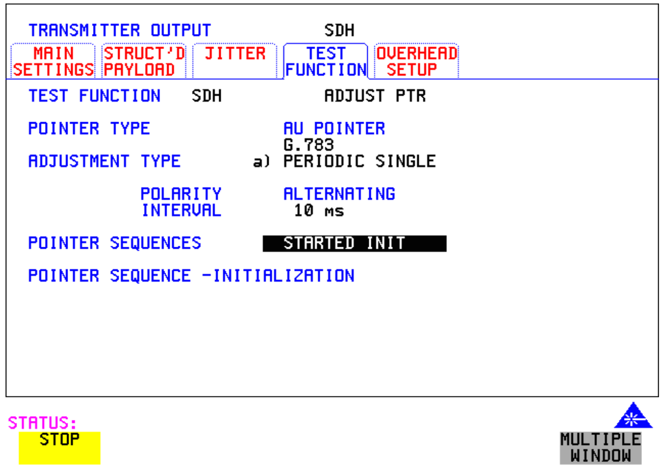
Typical tributary jitter test setup

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 AND RECEIVER **INDEPENDENT**.
3. Select **RECEIVE**, **MAIN SETTINGS**, **PDH/DSn** and select a PDH/DSn SIGNAL rate (140, 34, 8 or 2 Mb/s plus DS1 or DS3).
4. On the same page set the required test pattern from the PATTERN field.
5. On the **TRANSMIT**, **SDH**, **MAIN SETTINGS** page select a SIGNAL rate (the rates available depend on the options fitted to your instrument). In this example we have selected STM-16 OPT.
6. On the same page, now set the Transmitter PDH payload offset (140M OFFSET field in figure below) to any in-range value.



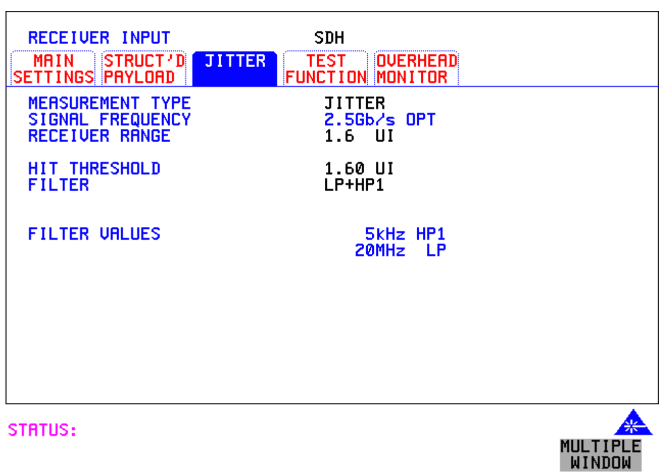
7. Select **TRANSMIT**, **SDH**, **TEST FUNCTION**, then select **SDH**, **ADJUST PTR**.
8. Setup and run pointer sequence A (see page 87 for information on the pointer sequences available). When the pointer sequence initialization and cool-down periods are finished and the display indicates “POINTER SEQUENCE - IN PROGRESS” proceed to step 9.



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.

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.

5

ATM Operation

For ATM operation you must have option 300 installed.

Option 300 offers ATM up to 2.5 Gb/s.

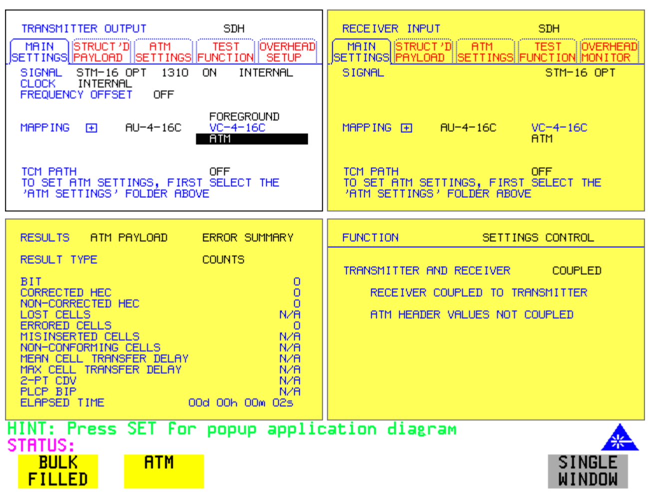
Setting up the Transmitter for ATM Payloads

Description The transmitter rate and mapping can be set up to match the requirements of the ATM network under test. At SDH, select a rate from STM-0 to STM-16 Optical or PDH/DSn rates of 34 Mb/s, 2 Mb/s, DS1 or DS3.

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

NOTE **For ATM in PDH/DSn 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/DSn** or **SDH**.
2. Select the SIGNAL rate. (If you selected a PDH/DSn 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**.

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

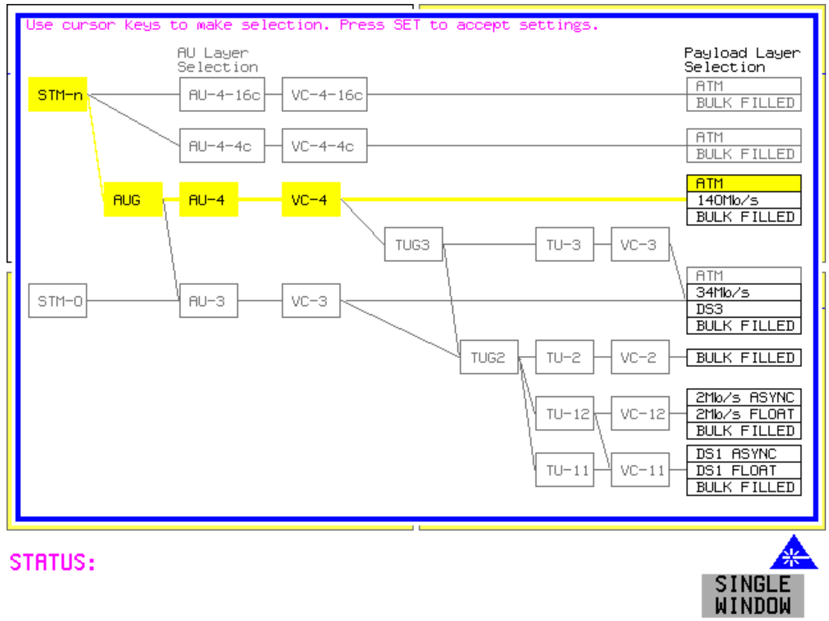


Table 5 **ATM availability with PDH/DSn and SDH Signal Rates and Framing**

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
140 Mb/s	------------	no
SDH	ATM is available into all VC mappings, but not into a TU structure.	

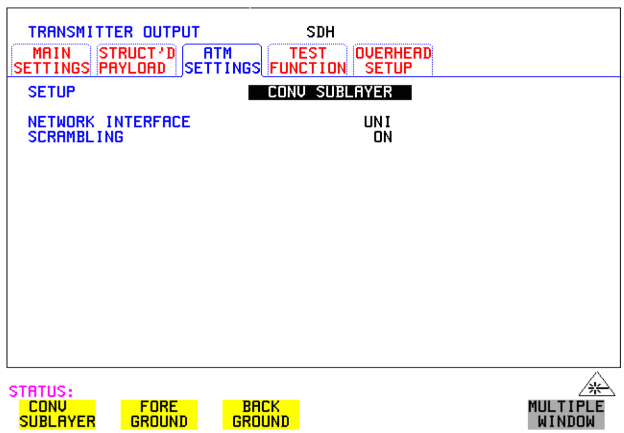
Setting up the Convergence Sublayer

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 154").

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.

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

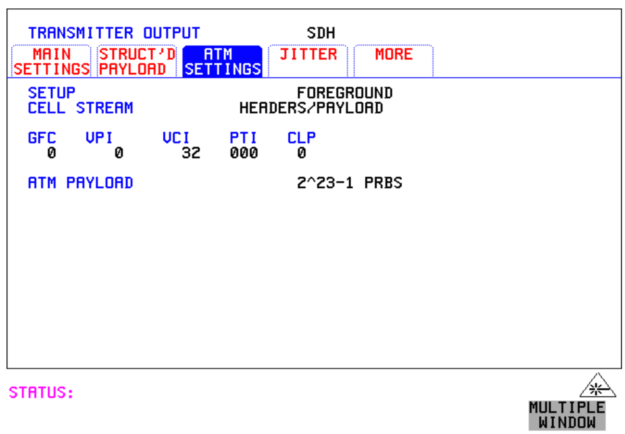
GFC - Generic Flow Control
VPI - Virtual Path Identifier
VCI - Virtual Channel Identifier
PTI - Payload Type
CLP - Cell Loss Priority
HEC - Header Error Control

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 161 for a description of how to set up background traffic. The relative distribution of background and foreground is described on page 162.



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 154").

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**.

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.

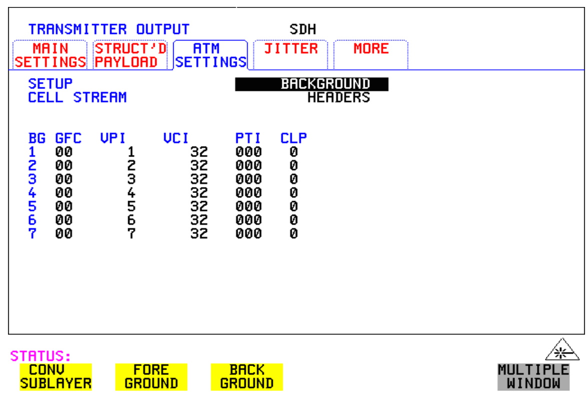
Test Cell

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

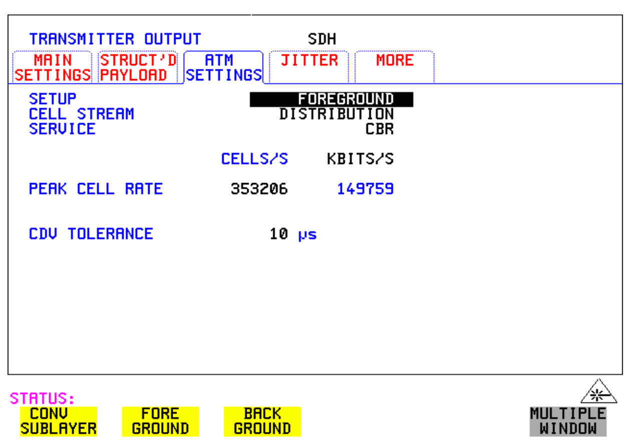
Description

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.



Setting up foreground

How to

1. Set up the Transmitter for ATM (See "Setting up the Transmitter for ATM Payloads " page 154).
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.

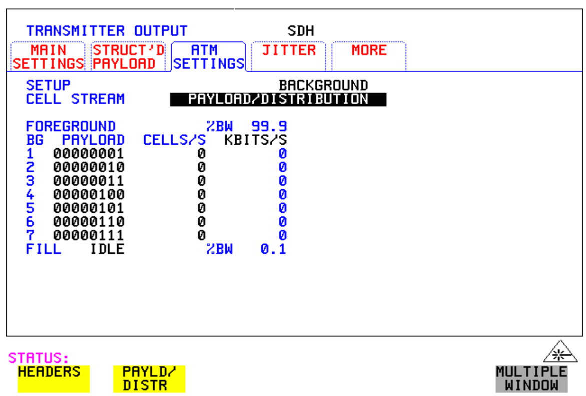
Burst Size

This is the number of cells transmitted at the peak cell rate, a value which may vary from the selected value 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.



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

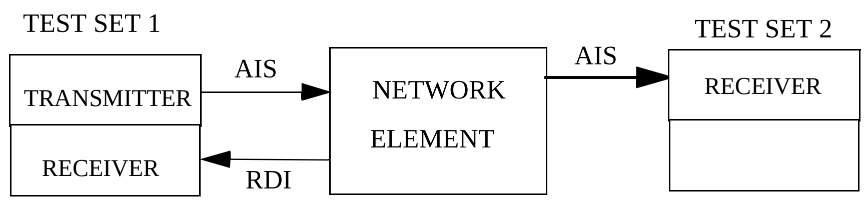
Stimulus	Response: VP switch	Response: VC switch
LOS, LOF, LOP	VP-AIS	VC-AIS
MS-AIS, Path AIS	VP-AIS	VC-AIS
LCD	VP-AIS	VC-AIS
VP-LOC	VP-AIS	VC-AIS
VP-AIS	VP-AIS	VC-AIS
VC-LOC	none	VC-AIS
VC-AIS	none	VC-AIS

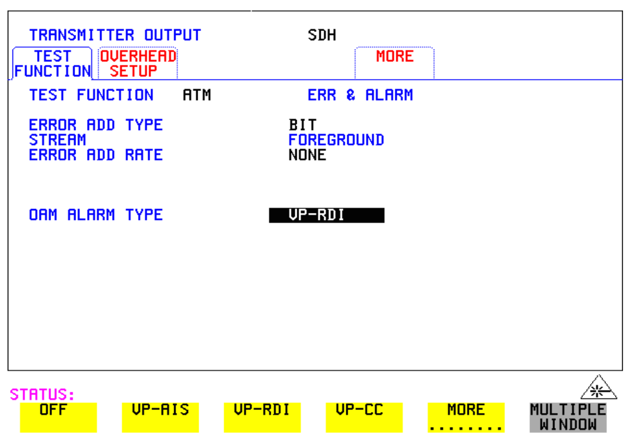
Upstream Alarms

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

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 154).

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.

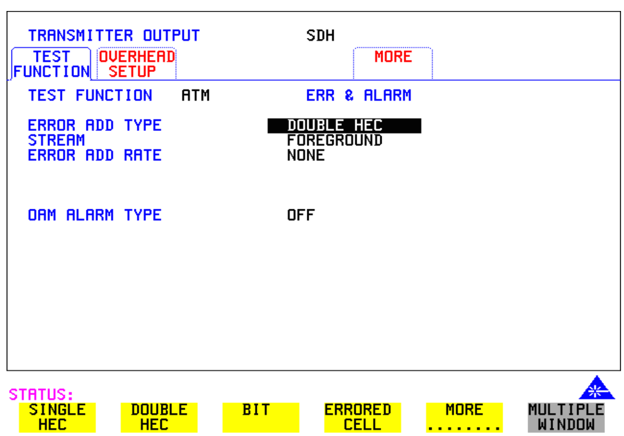
Adding ATM Errors

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 154).

2 Move to the **TEST FUNCTION** folder and select TEST FUNCTION to be **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

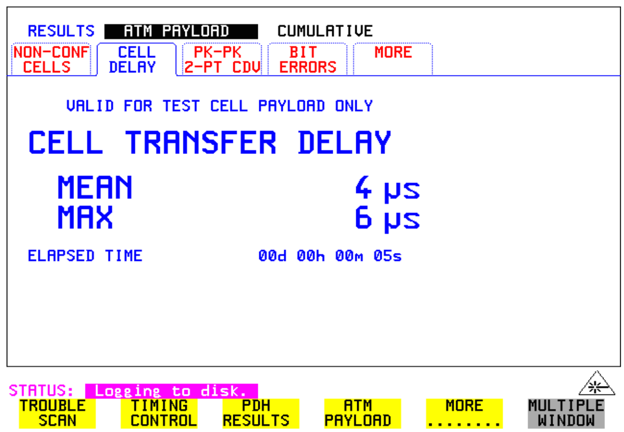
2 Add DOUBLE HEC errors and verify that a lost cell is recorded for each Double HEC error. (To measure lost cells, select TESTCELL as the payload).

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.

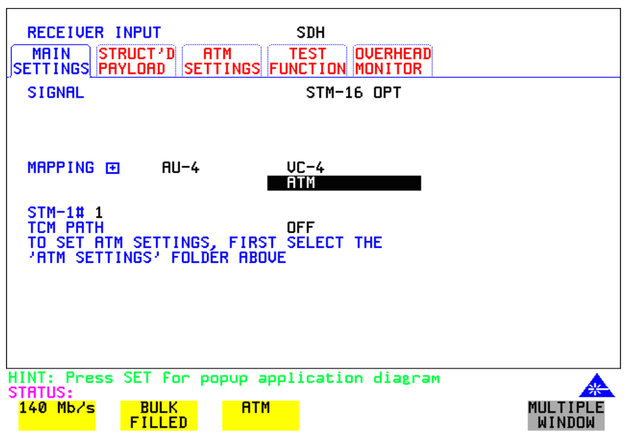
Setting up the Receiver for ATM Payloads

Description

The receiver rate and mapping can be set up to match the requirements of the ATM network under test. At SDH, select a rate from STM-0 to STM-16 Optical or PDH/DSn rates of 34 Mb/s, 2 Mb/s, DS3 or DS1.

TIP

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

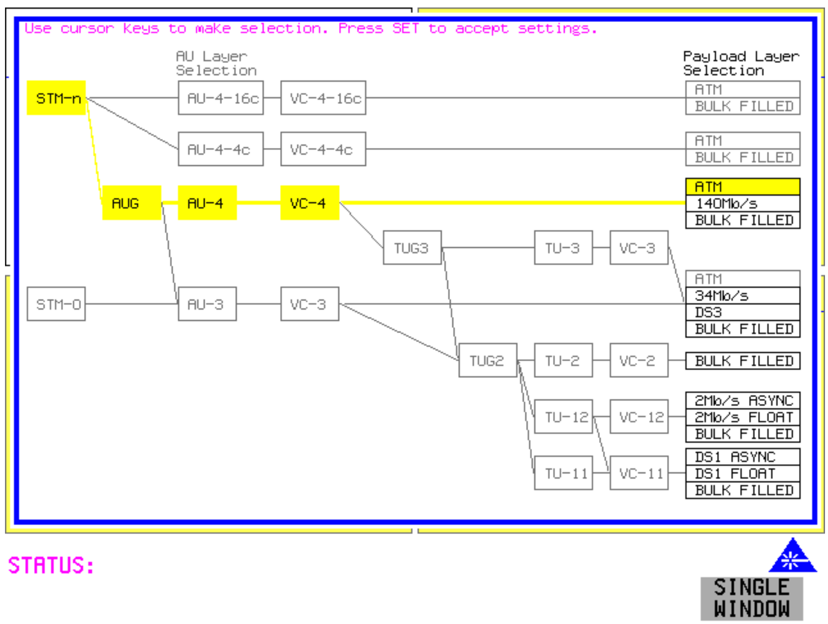


How to

1 Press **RECEIVE** and select from **PDH/DSn** or **SDH**.

2 Select the SIGNAL rate.

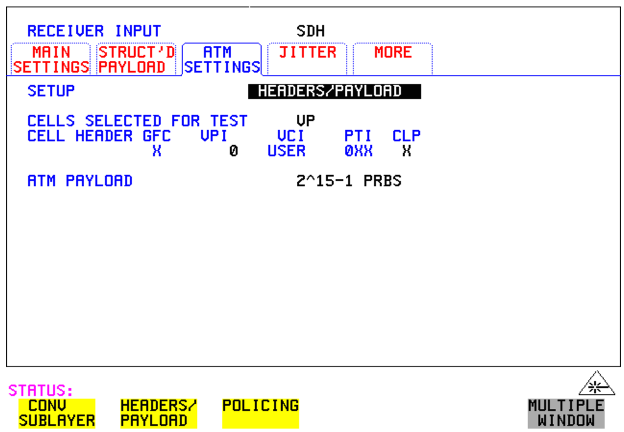
3 Select required MAPPING with ATM as a payload.
Use **SET** to bring up the popup application diagram (only applies to SDH mapping). This allows an alternative way of selecting the appropriate mapping. Use the cursor keys to navigate through the popup application diagram.



Setting up the Receiver ATM signal

Description

You can set up the ATM receiver 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 170).
2. Select the **ATM SETTINGS** folder.
3. Select SETUP as **CONV SUBLAYER**, **HEADERS/PAYLOAD** or **POLICING** (See "Policing ATM Traffic " page 174).
4. If **CONV SUBLAYER** is selected then the network interface can be selected as UNI or NNI (see diagrams 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.

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**.

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

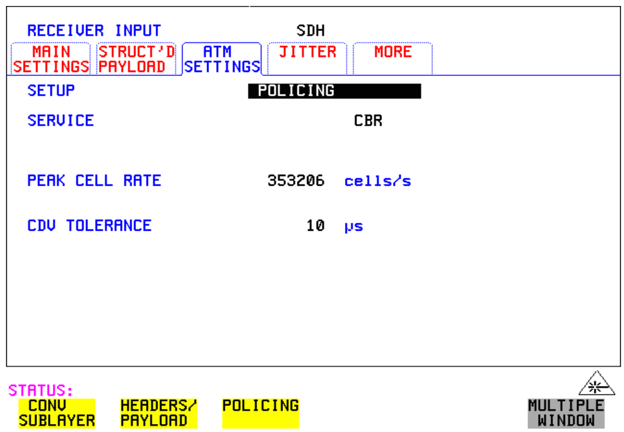
Bits								
8	7	6	5	4	3	2	1	Bytes
VPI								1
VPI				VCI				2
VCI								3
VCI				PTI			CLP	4
HEC								5

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

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 154).
2. Set up the Receiver for ATM (See "Setting up the Receiver ATM signal " page 172).
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 163 for definitions).
7. If the received cell stream does not conform to the policing parameters set up,

non-conforming cells are recorded. To view these cells, see "Viewing ATM Results " page 169.

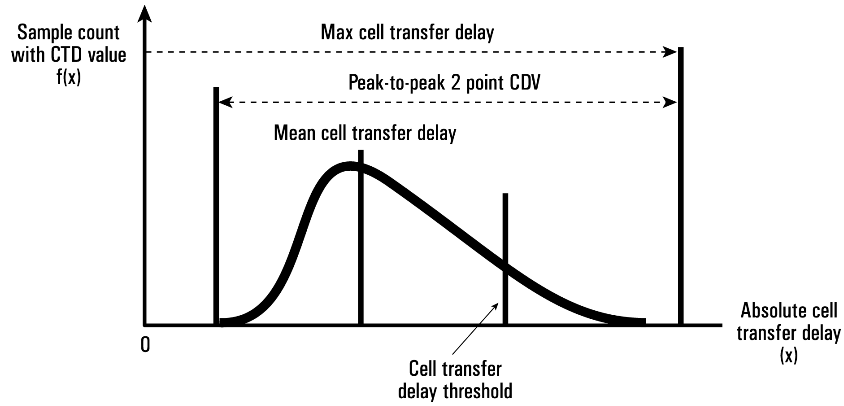
Measuring ATM Delay Performance

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.



Cell Delay

ATM delay measurements

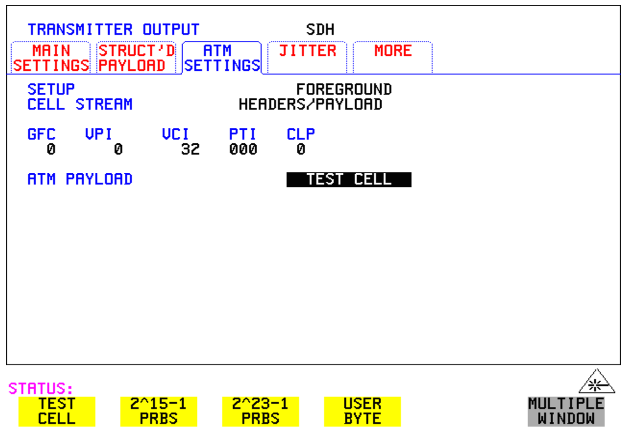
Each cell transmitted may experience a different delay through the ATM network. The delay calculated for each cell can be analyzed over a period of time to produce delay measurements. The following ATM cell delay measurements have been standardized by the ATM Forum and also in ITU-T Recommendation O.191.

- 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.

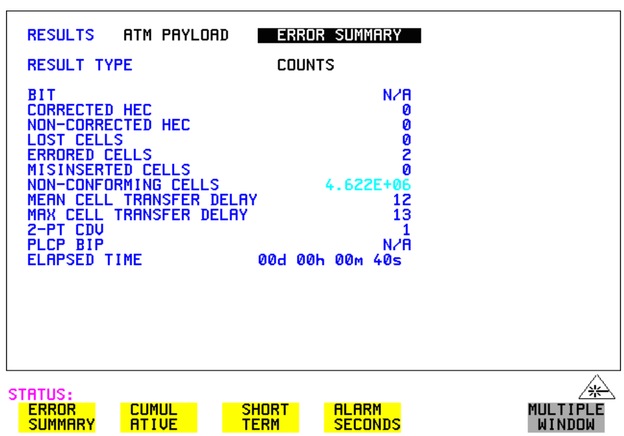
How to

1 Set up the **TRANSMIT** page for ATM see "Setting up the Transmitter for ATM Payloads " page 154.



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.

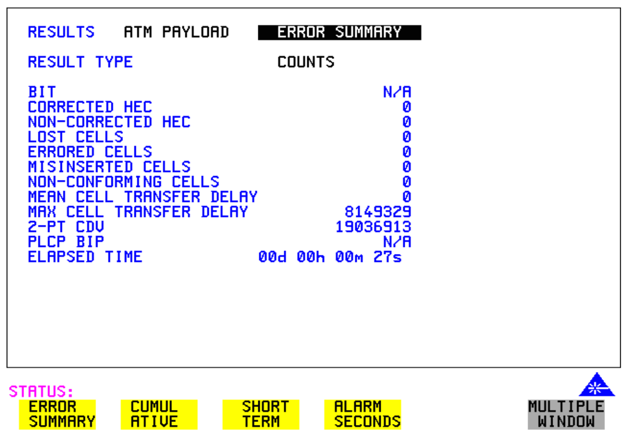


Note: Delay measurements such as mean cell transfer delay are only valid if you perform a round trip measurement, that is, when a transmitter and receiver are in the same instrument. You can perform a CDV measurement end to end, that is, using two separate instruments to transmit and receive.

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 154).

2 Set up the Transmitter to generate ATM alarms (see "Transmitting ATM Alarms " page 165).

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.

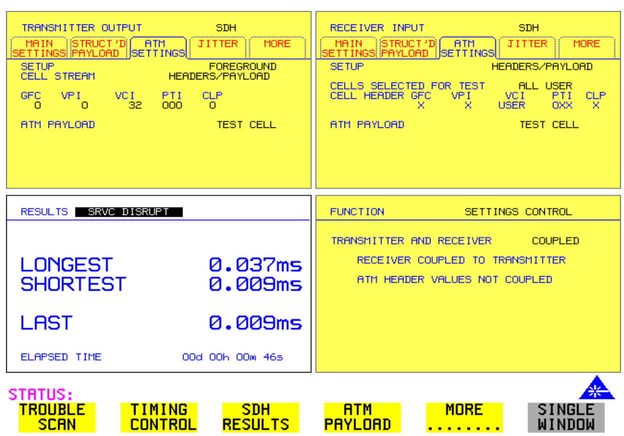
4 On the **RESULTS** page select RESULTS as **ATM PAYLOAD**, **ALARM SECONDS** .

ATM Service Disruption

Description

The ATM service disruption test measures the time during which 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 154).
2. In the ATM SETTINGS folder set up the required service and traffic distributions. (See "Setting Foreground Traffic " page 159, "Setting

Background Traffic " page 161 & "Setting Foreground and Background Distributions " page 162).

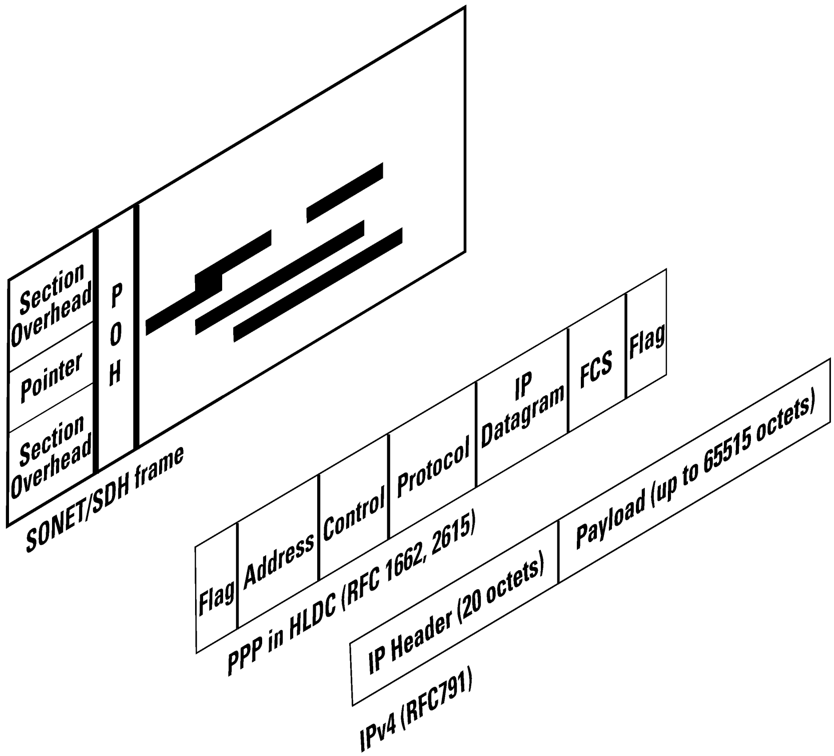
3 Set up the Receiver for ATM. (See "Setting up the Receiver for ATM Payloads " page 170).

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.



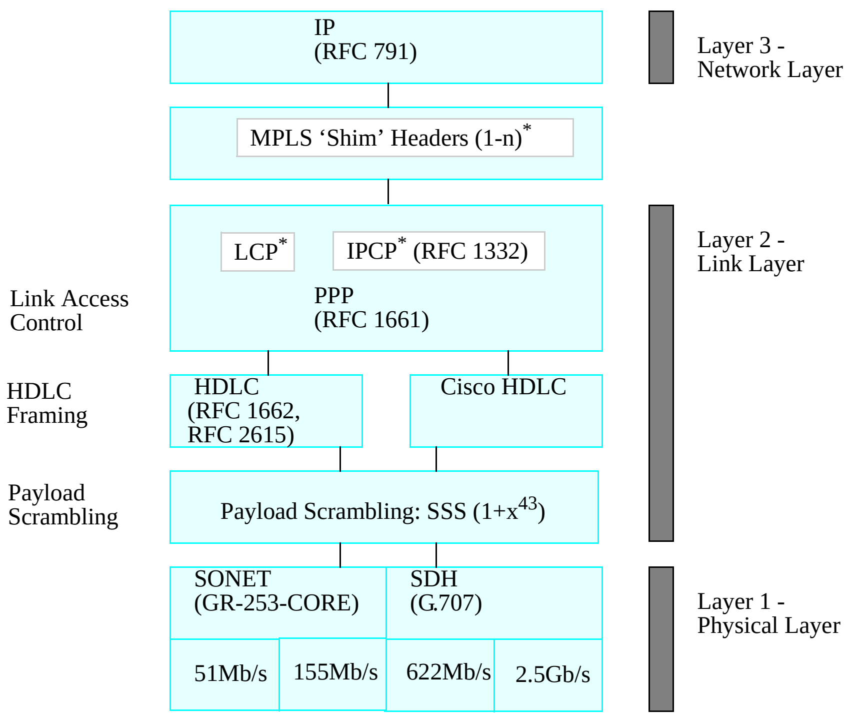
Packet over SDH (POS)

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

Setting up the Transmitter for POS Payloads

Description

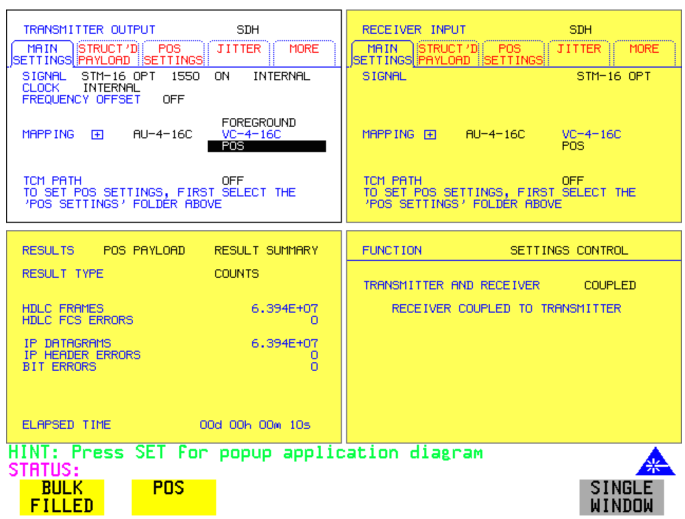
The transmitter rate and mapping can be set up to match the requirements of the equipment under test. At SDH, select a rate from STM-0 to STM-16 optical.

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 **SDH**.

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 STM-0 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 SDH THRU Mode " page 38.

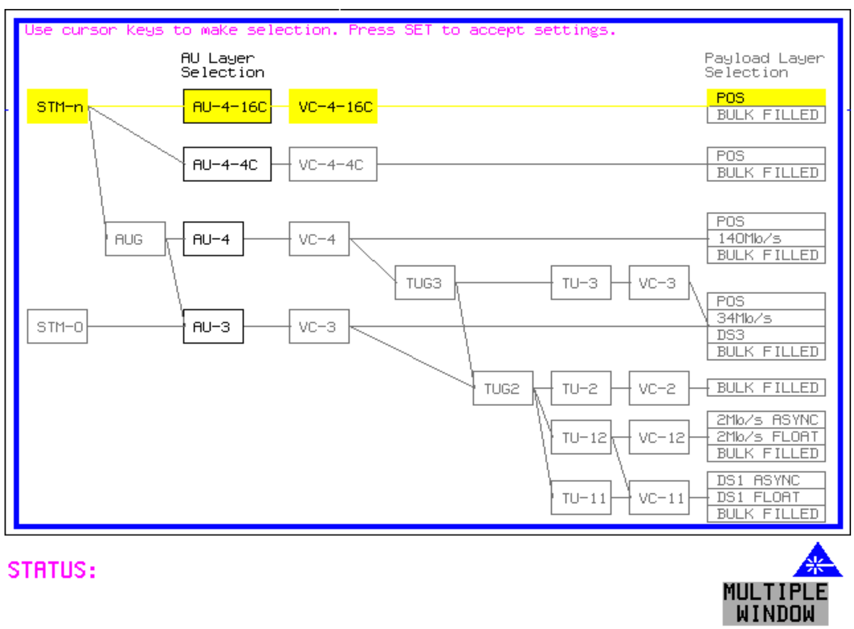
4 Make your choice of CLOCK synchronization source. The clock can be internally sourced from the instrument, recovered from the signal at the optical RECEIVE port or externally sourced from the CLOCK REF IN ports (MTS 64 kb/s, BITS 1.5 Mb/s or 10 MHz REF).

5 If required choose the FREQUENCY OFFSET value. See “Adding Frequency Offset to SDH Signal” page 64.

Payload Mappings

The payload mappings available for POS in SDH are: VC4-16c, VC4-4c, VC-4 and VC-3.

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



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

7 Select the STM-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 6 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

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.

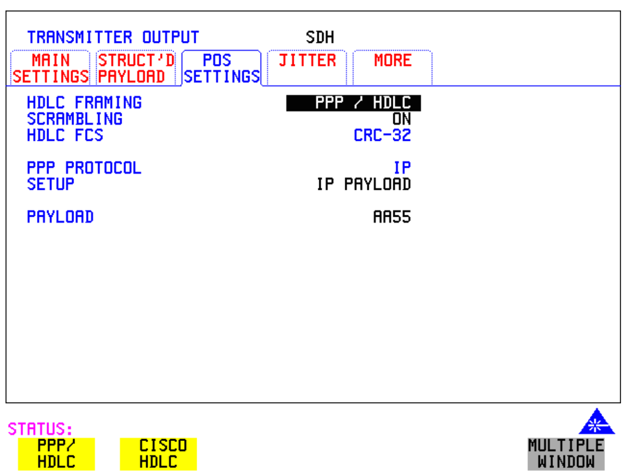
The addition of payload scrambling occurs when inserting the HDLC-like framed PPP packets into the SONET/SDH frame

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 185.
2. Select the **POS SETTINGS** folder as shown below:



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

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.

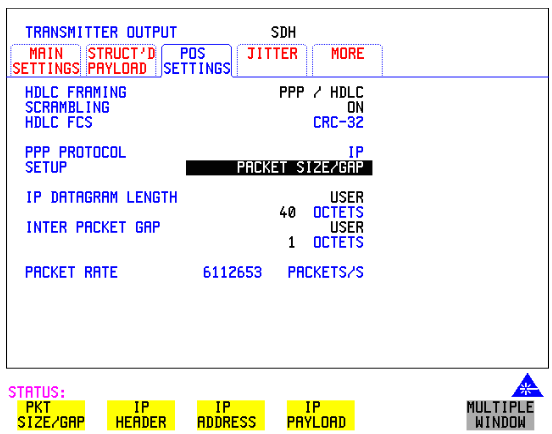
Note that the Scrambling OFF/ON selection affects the value of the C2 Overhead Byte as follows:

- 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 VC4-16c 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 185.

2 Select the **POS SETTINGS** folder as shown above.

3 Set the SETUP field to **PACKET SIZE/GAP** .

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.

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 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 (STM-0e/STM-1/STM-4/STM-16).
- Packet (datagram) size.
- HDLC byte stuffing.
- Inter - packet gap

Please refer to “What determines the packet rate?” page 209 for a detailed description on how Packet Rate is calculated.

Setting IP Header

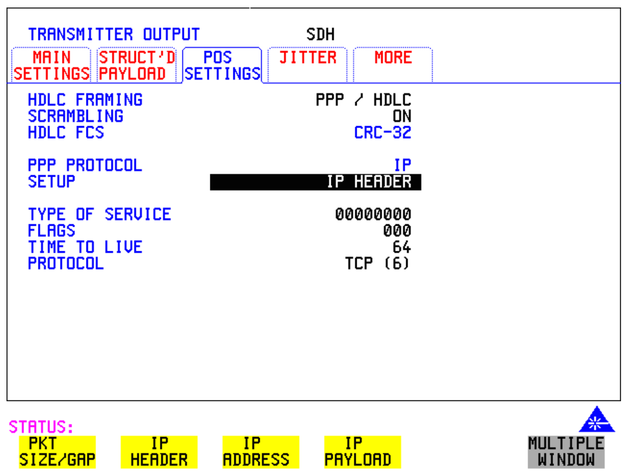
Description Note the IP Header is sent in every packet.

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 185.

2 Select the **POS SETTINGS** folder as shown below:

3 Set the SETUP field to **IP HEADER** .



4 Select the TYPE OF SERVICE 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 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:

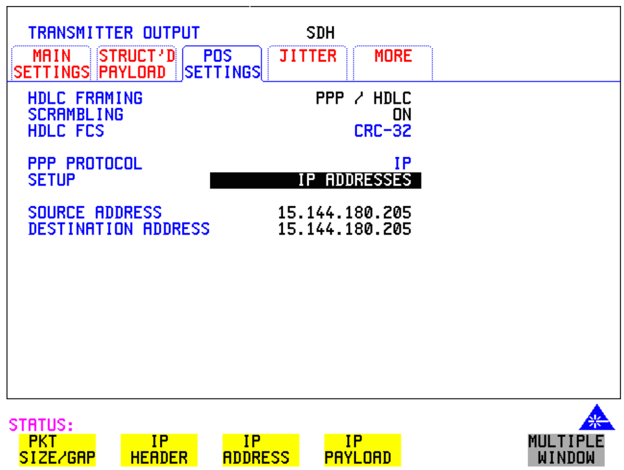
ICMP (1), IP (4), TCP (6), UDP (17), ICMP or program the USER PROGRAM value (0 to 255). The instrument default choice is TCP. This field indicates the next level protocol used in the data portion of the internet datagram (the value in brackets indicates the value of the byte in decimal (i.e. (6) indicates binary 00000110).

Setting IP Addresses

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 185.

2 Select the **POS SETTINGS** folder as shown below:

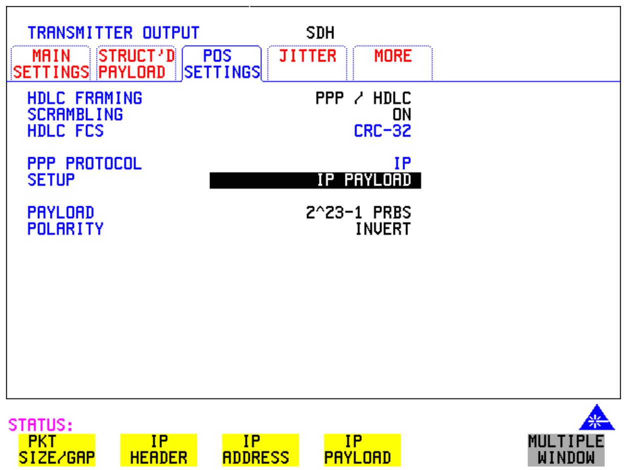


3 Set the SETUP field to **IP ADDRESS** and set up the Source and Destination Addresses.

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 185.
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.

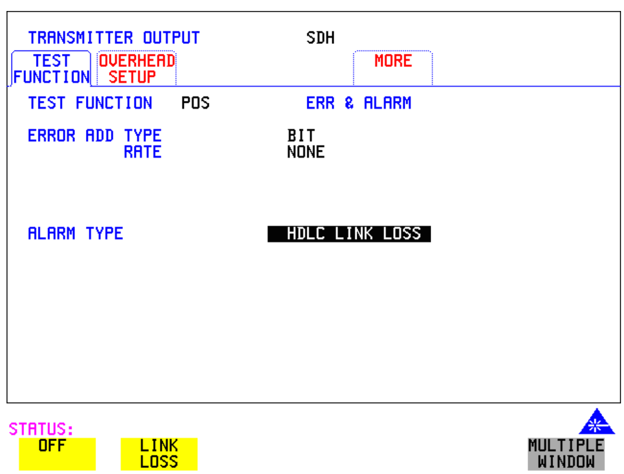
Adding POS Alarms

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 185
2. Press the **TRANSMIT** key and select **SDH**.
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

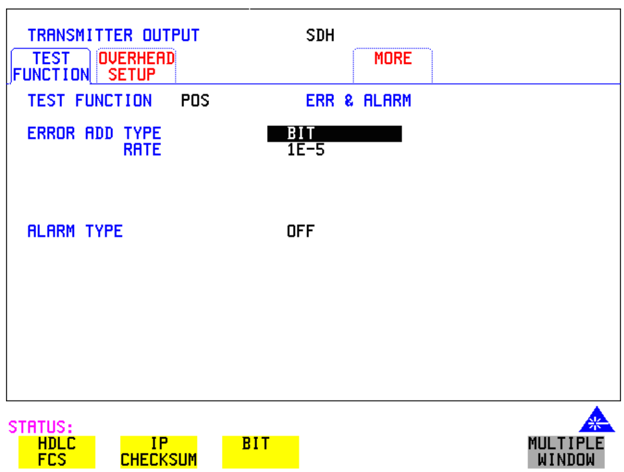
How To

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 185

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

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).

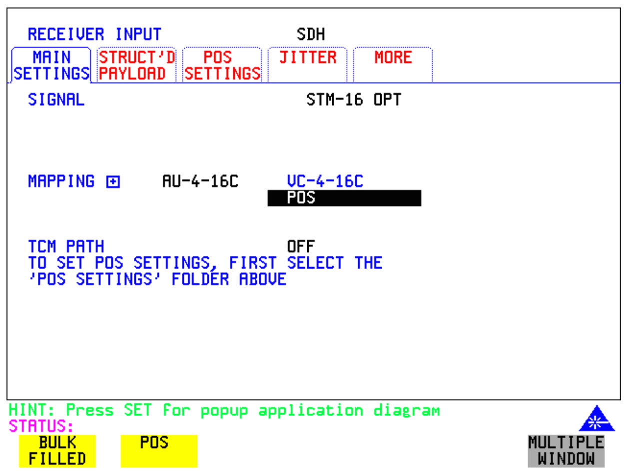
Setting up the Receiver for POS Operation

Description

The receiver rate and mapping can be set up to match the requirements of the equipment under test. For SDH, select a rate from STM-0 to STM-16 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.



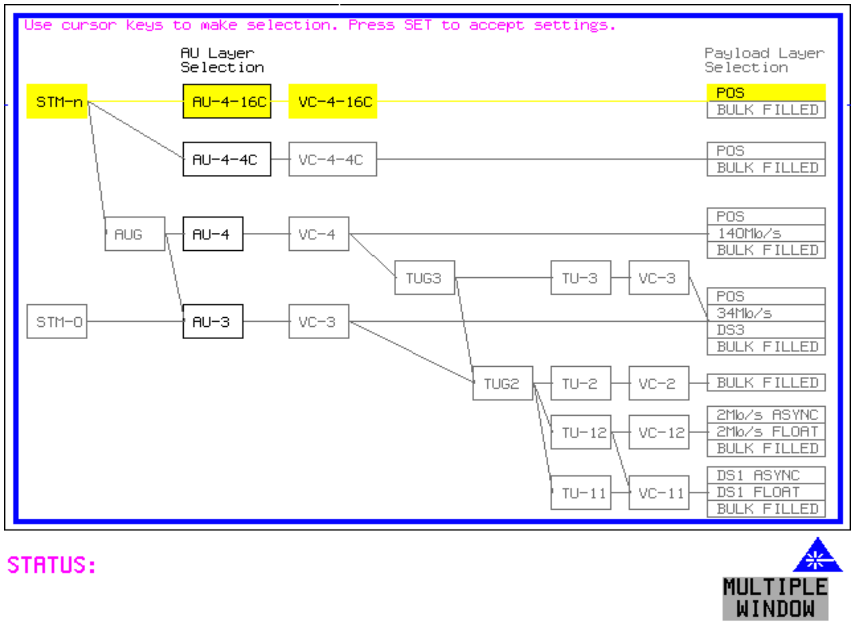
How To

1 Press **RECEIVE** and select **SDH** .

2 Select the **MAIN SETTINGS** folder.

3 Select the SIGNAL rate.

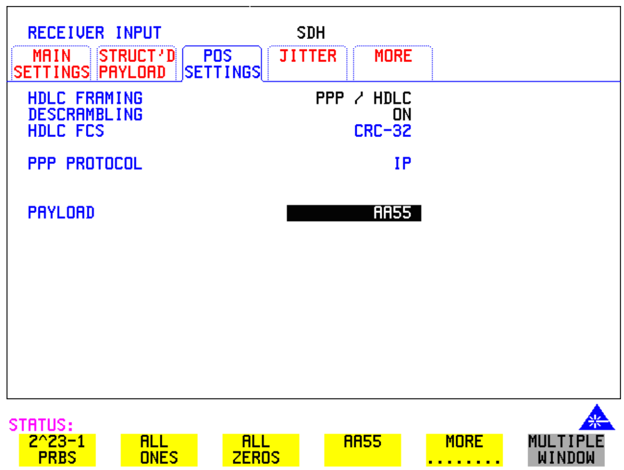
4 Select required MAPPING with POS as a payload.
As an alternative, use **SET** to bring up the popup application diagram. Use the cursor keys to navigate through the popup application diagram (see next page).



5 Continue to the next task “Setting up the Receiver POS signal” page 199 for advice on 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 197.

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**.

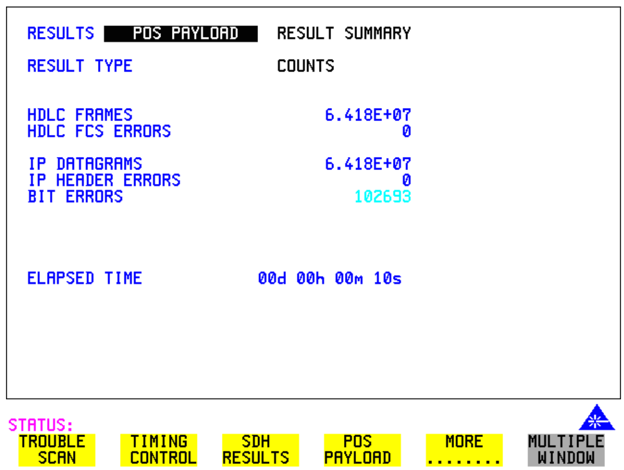
5 Set HDLC FCS field to **CRC-16** or **CRC-32**.

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.



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** errors give the number of errors and counts which have occurred in total since the last time **RUN/STOP** was pressed.
5. **SHORT TERM** errors give the number of errors and counts which have occurred in the last measurement interval. This measurement interval is set up on the results page when **TIMING CONTROL** has been selected in the RESULTS field.
6. **ALARM SECONDS** is used to look at POS alarms.

POS Applications

The following pages give typical test applications.

Channelized Testing

Description

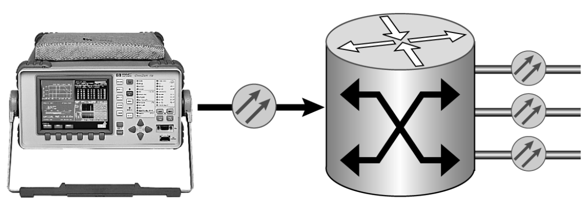
Channelized testing is the ability to perform tests on individual channels within SDH.

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

- 3 AU3 channels in an STM-1 OPT
- 4 AU-4 channels in an STM-4 OPT
- 4 AU-4-4c channels in an STM-16 OPT
- 16 AU-4 channels in an STM-16 OPT.

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).

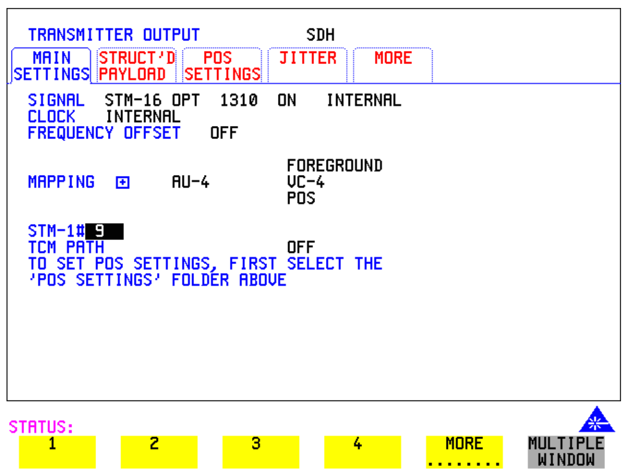


How to

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 **SDH**.
3. Select the **MAIN SETTINGS** folder.
4. Select the SIGNAL rate, CLOCK and FREQUENCY OFFSET as required.

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 STM-1(9) in an STM-16 signal.

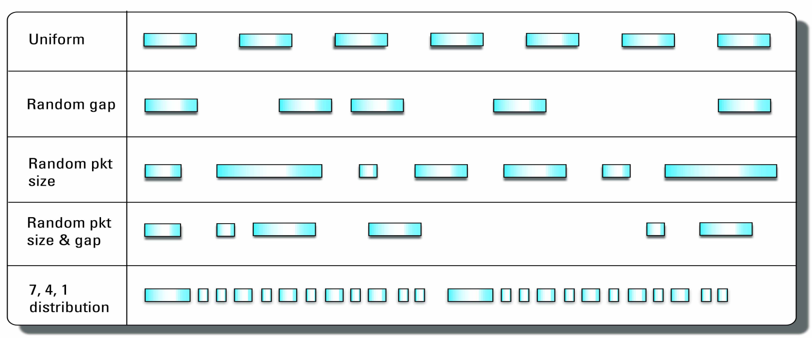


Fully Exercising POS Hardware Architecture

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 718 you generate traffic profiles to successfully exercise POS hardware using the methods described. The following figure illustrates the traffic profiles offered in the OmniBER 718.



Fixed packet size and gap

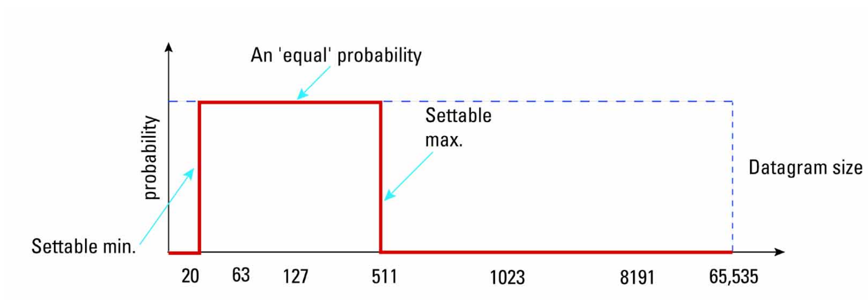
If you select a fixed packet and gap you can check different phases of the wide-bus architecture. For example selecting gap sizes of 1, 2, 3 and 4 will test all 4 byte phases of a 4-byte architecture.

Random packet size

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

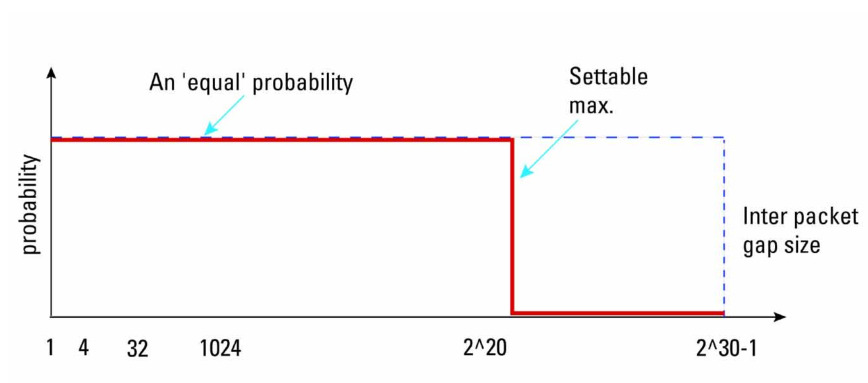
Minimum sizes are particularly important for stress testing hardware. This minimum size can be set equal to the minimum allowed by the hardware.

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

Ransom 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.

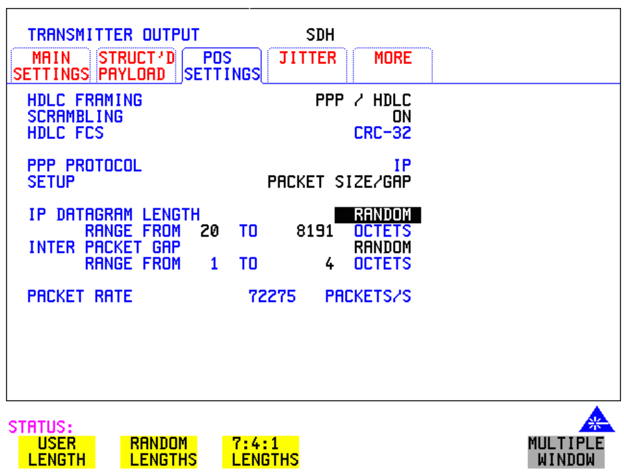


Transmit an IP packet that generates maximum stress on the circuit under test.

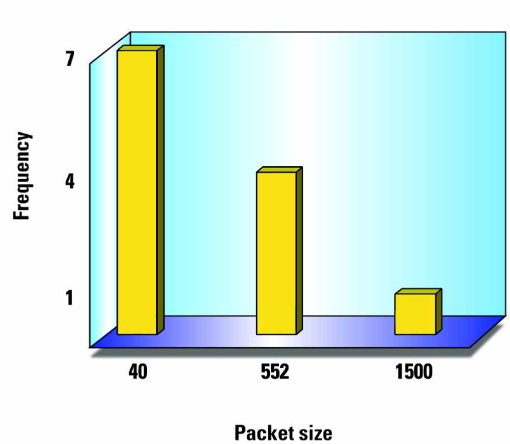
An ideal way to generate the maximum stress on circuits under test is to transmit an IP packet which has both a random packet size and gap. You can do this with the OmniBER, and an example is given below.

How To

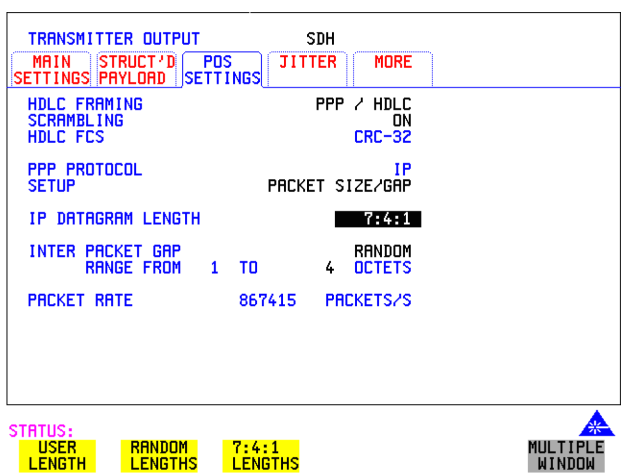
1. This procedure assumes you have already selected a POS payload on the MAIN SETTING page, see “Setting up the Transmitter for POS Payloads” page 185.
2. Select the **POS SETTINGS** folder.
3. Set up the POS SETTINGS page, an example is given below.



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 718 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

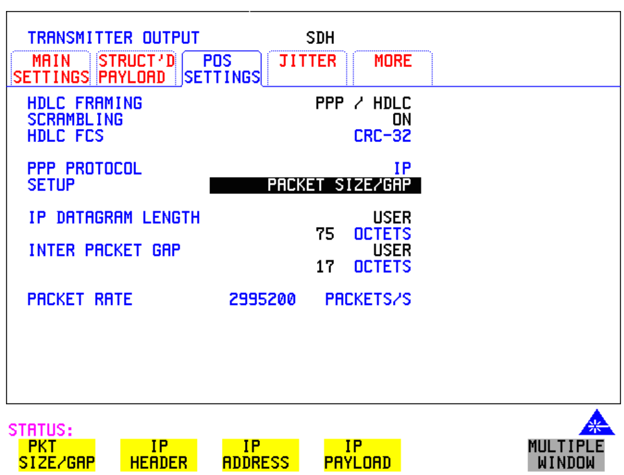
Description

Packet over SDH 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.



What determines the packet rate?

- Channel bandwidth (STM-0e/STM-1/STM-4/STM-16).
- 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:

- AU-3 6048000
- AU4 18720000
- AU-4-4C 74880000
- AU-4-16C 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 ÷ (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 ÷ (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:

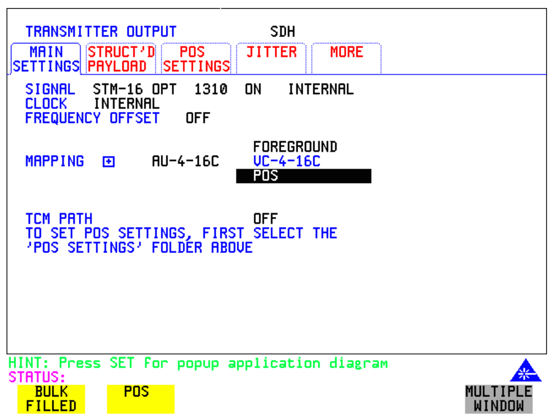
To Transmit a packet rate of 2995200 packets/second

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 **SDH**.

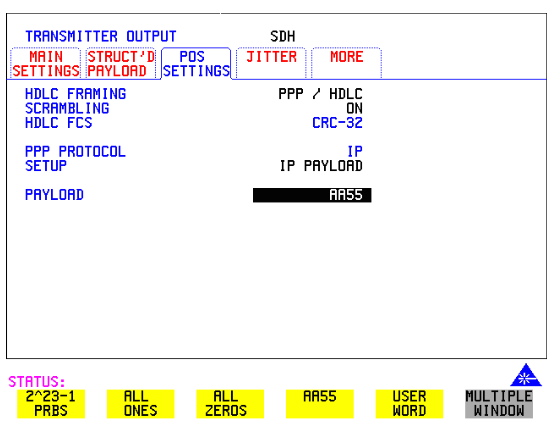
2 Select the **MAIN SETTINGS** folder and set up the page as shown below, with a POS payload selected.



3 Select the **POS SETTINGS** folder.

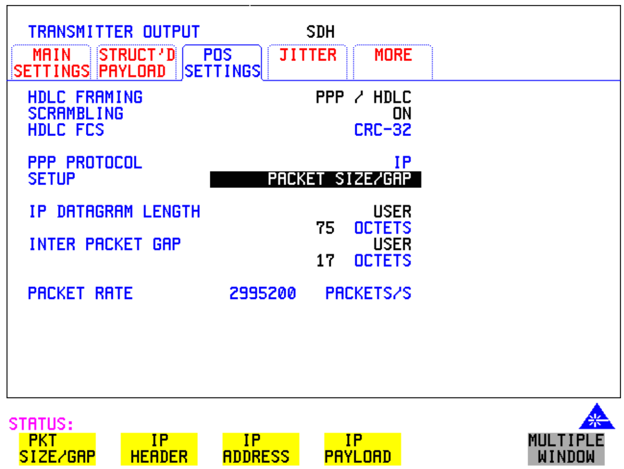
4 Set the SETUP field to **IP PAYLOAD**.

5 Select a fixed word pattern as the payload (AA55 for this example).



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).

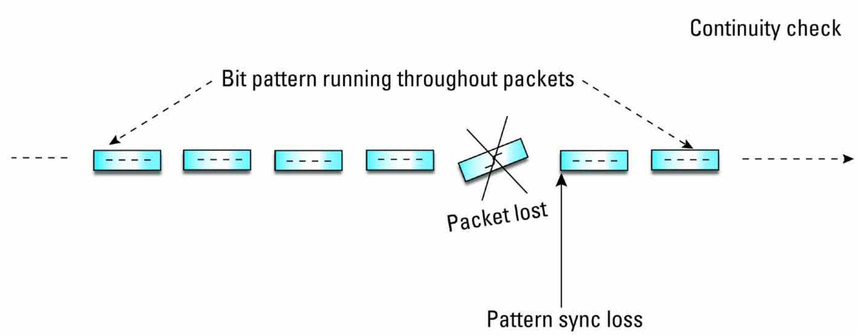
If however you are setting up the transmitter to transmit a different packet rate and the value displayed is not what you expect, you may need to vary the word pattern (IP payload) and/or the IPdatagram header bytes until the expected packet rate is displayed.

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

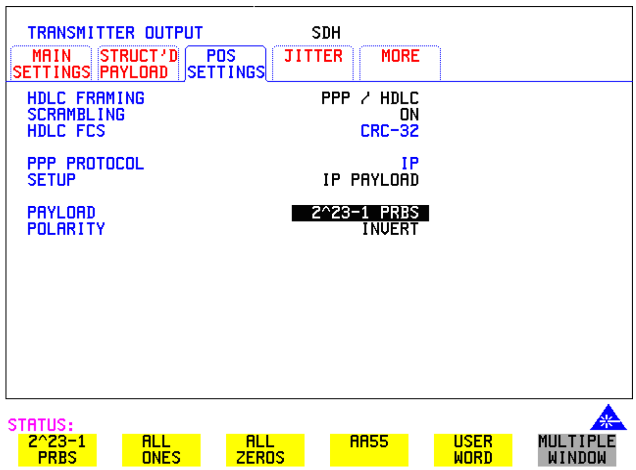
1 Set the Transmitter and Receiver to the same interface settings by choosing **OTHER**, **SETTINGS CONTROL**, **COUPLED**.

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

3 Select a POS payload on the **MAIN SETTINGS** page, see “Setting up the Transmitter for POS Payloads” page 185

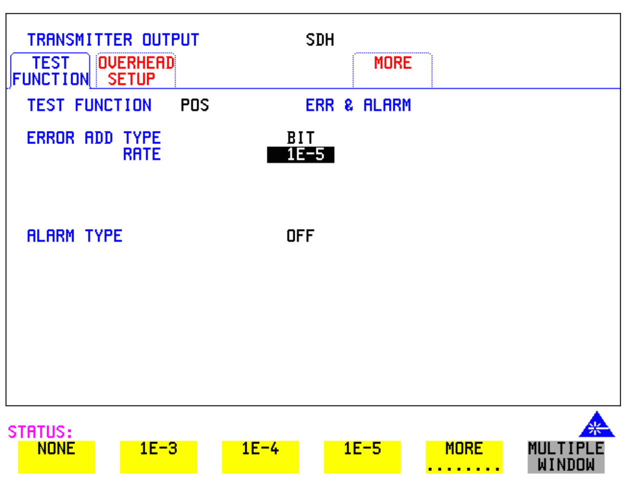
4 Select the **POS SETTINGS** folder.

5 Set the SETUP field to **IP PAYLOAD** and select a suitable payload, for this example we have chosen a 2^23-1 PRBS as shown below.



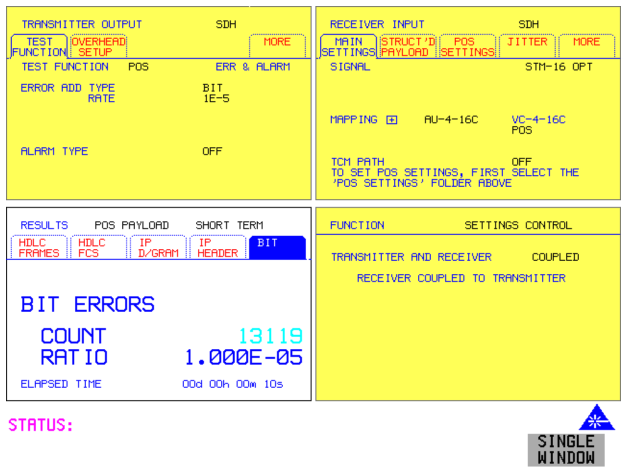
Check continuity by adding POS errors and verifying that the correct alarms and errors are received by the OmniBER.

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



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 SDH 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

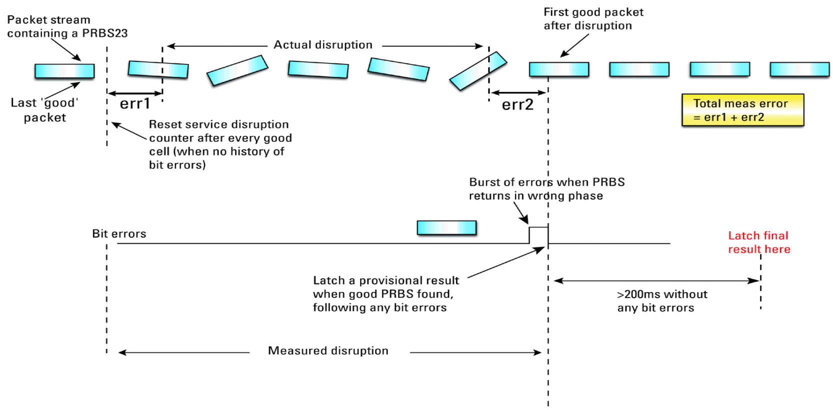
Measurement accuracy is proportional to the packet rate. The packet rate in turn is dependent on 4 factors: packet size, inter-packet gap, stuffing ratio and bandwidth (see “What determines the packet rate?” page 209).

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 ± 2 x (1÷ 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.

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.



Set up the OmniBer to measure service disruption

How To

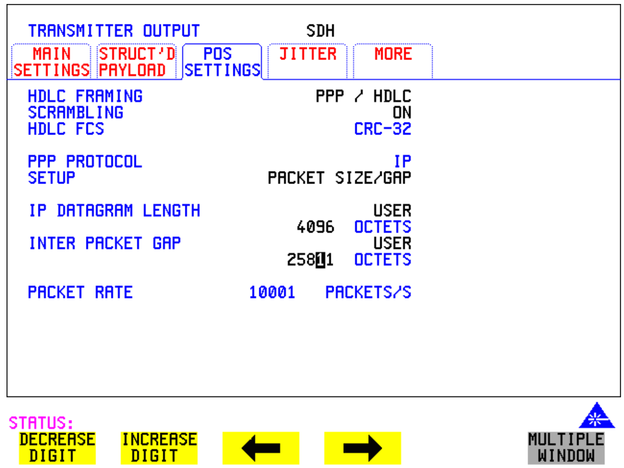
1 Set the Transmitter and Receiver to the same interface settings by choosing **OTHER** **SETTINGS CONTROL** **COUPLED**.

2 Set up the OmniBER to transmit a POS payload (see "Setting up the Transmitter for POS Payloads" page 185).

3 Select the **POS SETTINGS** folder.

4 Set the SETUP field to **IP PAYLOAD** and select **2^23-1 PRBS**.

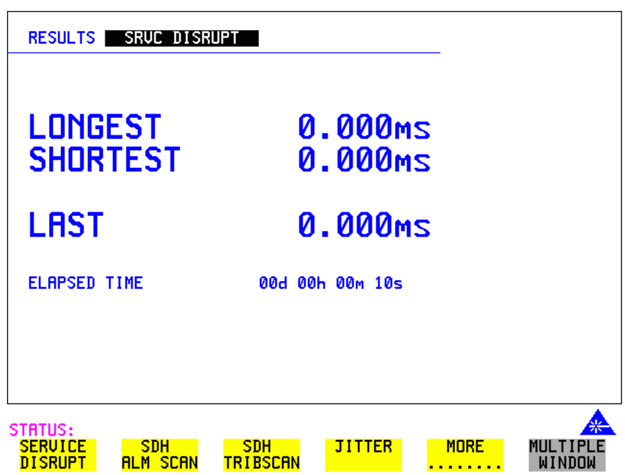
5 Set the SETUP field to **PACKET SIZE/GAP** and set the IP datagram length and inter packet gap to suit your equipment under test. In the following example (on next page) we have set the datagram length and inter packet gap to give a packet rate of approximately 10,000 packets per second.



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 to 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 (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

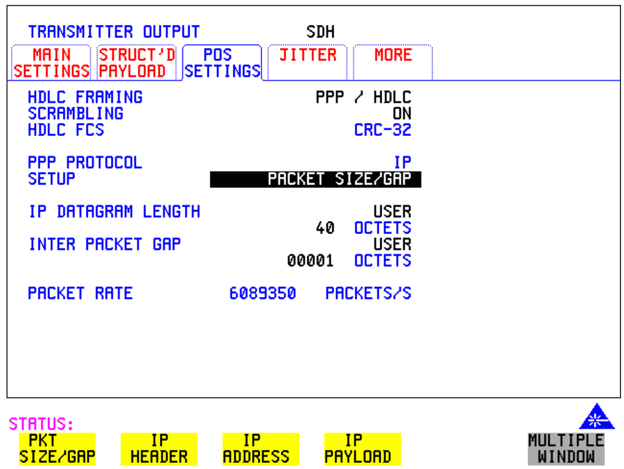
1 Set the Transmitter and Receiver to the same interface settings by choosing **OTHER** **SETTINGS CONTROL** **COUPLED**.

2 Set up the OmniBER to transmit a POS payload (see “Setting up the Transmitter for POS Payloads” page 185).

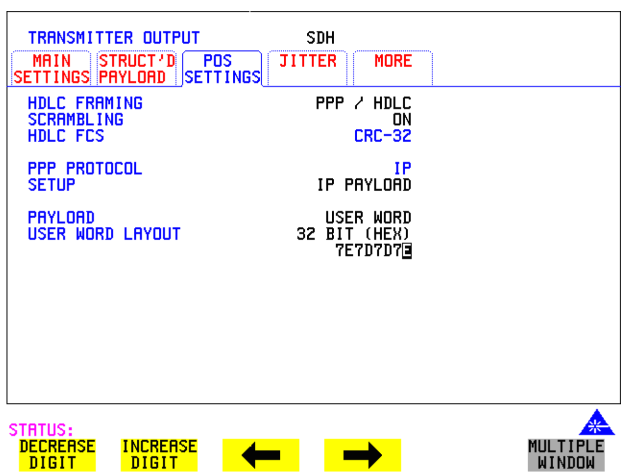
3 Select the **POS SETTINGS** folder.

4 Set the SETUP field to **IP PAYLOAD** and select **2^23-1 PRBS**.

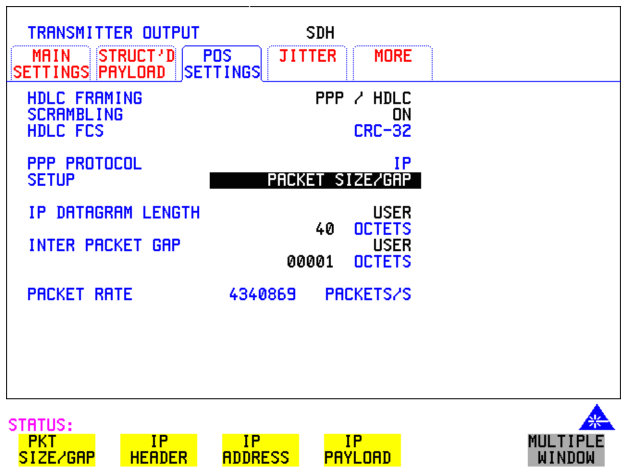
5 Set the SETUP field to **PACKET SIZE/GAP** and set the IP datagram length and inter packet gap to suit your equipment under test. In the following example we have set the datagram length and inter packet gap to the instrument default settings (see figure below).



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



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.



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 SDH rates when a POS payload is selected.
Automatic Jitter Tolerance measurement is only available with a POS payload when the payload selected is 2^23-1PRBS.

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

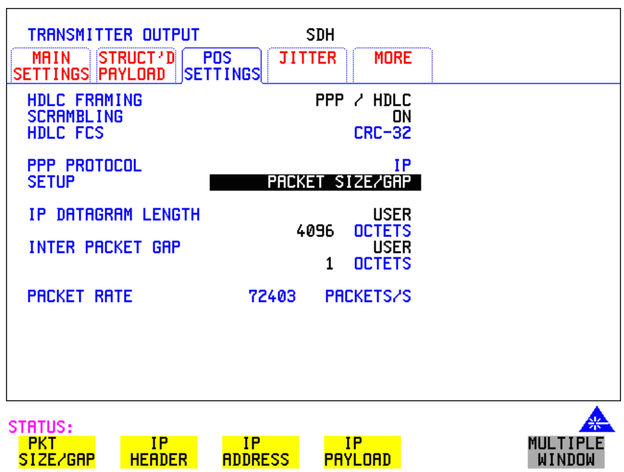
There are 5 user programmable masks provided allowing you to create, edit and title up to 5 jitter masks. Please refer to “To Generate a New Jitter Mask” on page 299 and “To change the parameters of a User Defined Jitter Mask” on page 301 for instructions on how to generate or edit a user programmable mask.

How To

Perform a Jitter Tolerance Measurement

1 Set up the transmitter and select a POS payload with a fixed 2^23-1 PRBS (see "Setting up the Transmitter for POS Payloads " page 185) and “Setting IP Payload” page 194.

2 Select the **POS SETTINGS** folder as shown below.



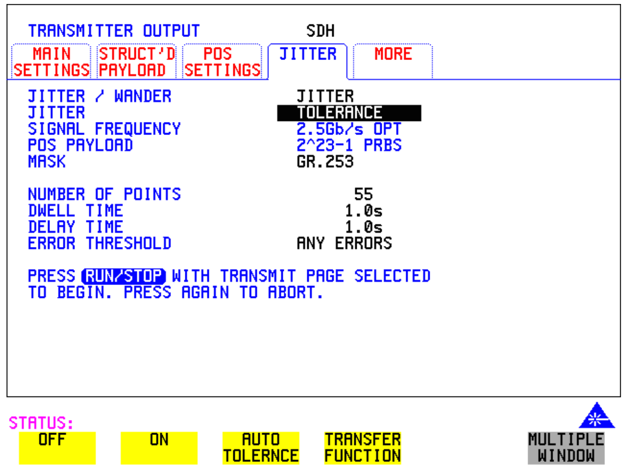
3 Set the SETUP field to **PACKET SIZE/GAP** and select a size as large as practical for the system under test (this gives better coverage for error detection). For this example we selected a length of 4096 and a gap of 1.

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 an SDH Optical signal, check on the **RESULTS** **SDH 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 197 and “Setting up the Receiver POS signal” page 199. Set the receiver payload to 2^23-1PRBS



8 Select the **JITTER** folder and select AUTO TOLERANCE and a MASK (see display above).

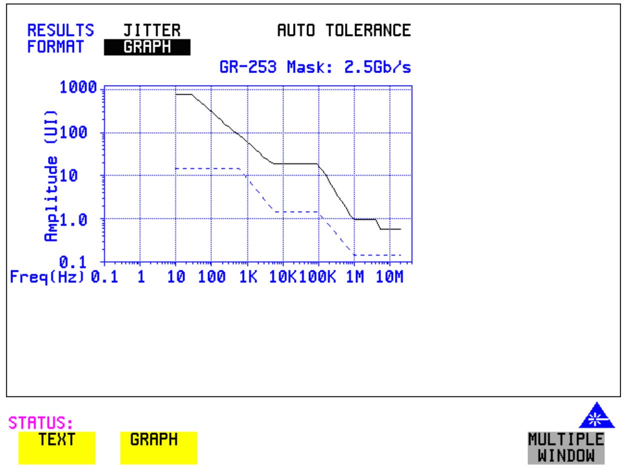
9 Choose the NUMBER OF POINTS at which jitter is transmitted (3 to 55)

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.



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 264.

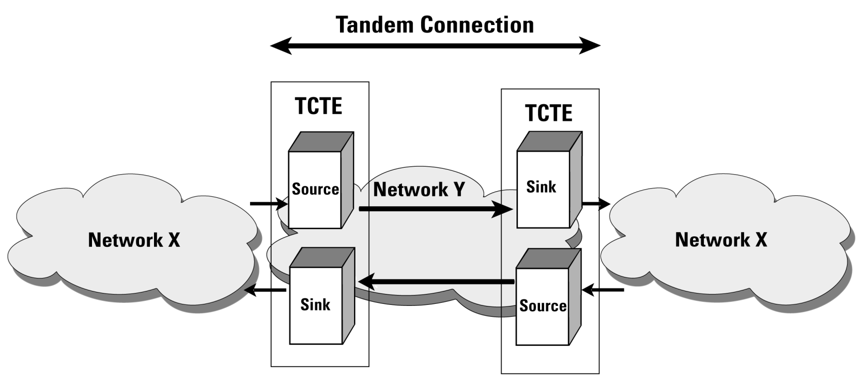
7

Tandem Connection Monitoring

Tandem Connection Monitoring (TCM)

What is a Tandem Connection?

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



TCM Test Capability in OmniBER

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

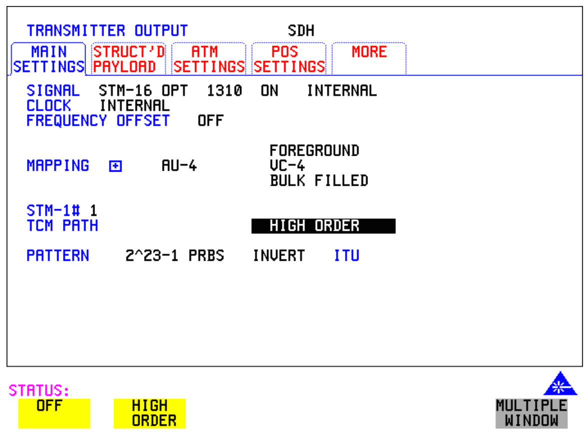
The functionality covers the requirements for both high order and low order paths.

High Order: VC4 →AU4 and VC3→AU3 use N1 byte.

Low Order: VC3→TU3 use N1 byte.

VC2→TU2, VC11→TU11 and VC→TU12 use N2 byte.

Setting up the Transmitter for TCM Operation



HOW TO

1. Press the **TRANSMIT** key and select **SDH**.
2. Select the **MAIN SETTINGS** folder.
3. Set up the Transmitter as required, see “Setting SDH Transmit Interface” page 29.
4. Set the TCM PATH field to **HIGH ORDER** or **LOW ORDER** as required. The LOW ORDER selection is enabled when a TU mapping is selected.

Setting up TCM Access Point Identifier (APId) messages

Description

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

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

The CRC is automatically calculated for all three message types.

HOWTO

1 Press the TRANSMIT key and select SDH.

2 Select the MAIN SETTINGS folder.

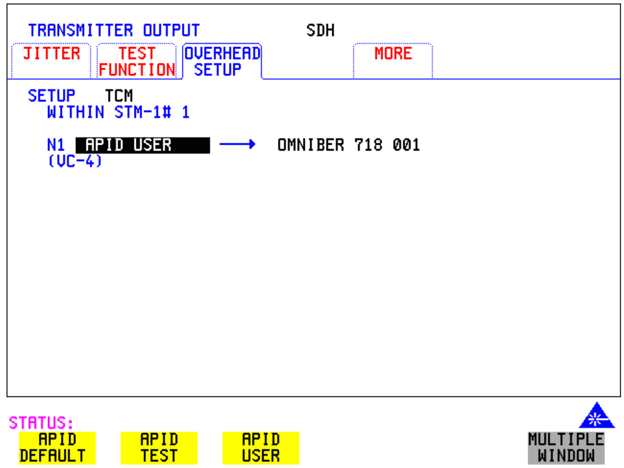
3 Set the TCM PATH field to HIGH ORDER or LOW ORDER as required.

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

Method 1:

5 Select the SETUP field and choose TCM MESSAGE.

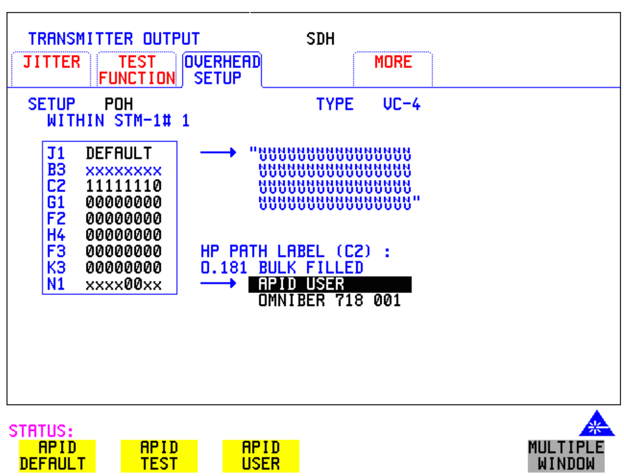
6 Set the N1 or N2 field as required from DEFAULT, TEST or USER. If you select USER, use the edit keys at the bottom of the screen to set up your message.



Method 2

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

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

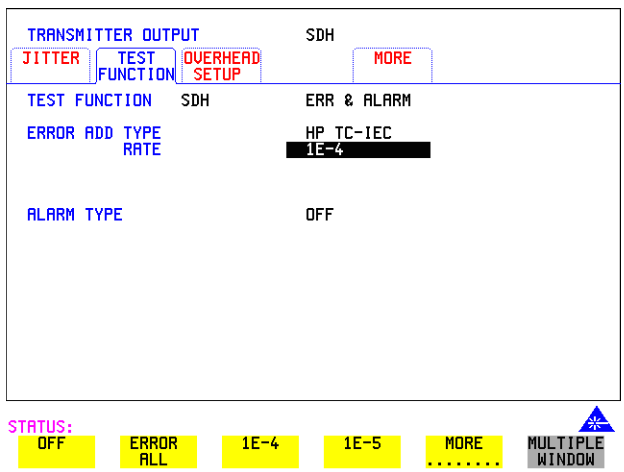


Adding TCM errors

Description

The following TCM errors can be generated in the OmniBER:

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



HOWTO

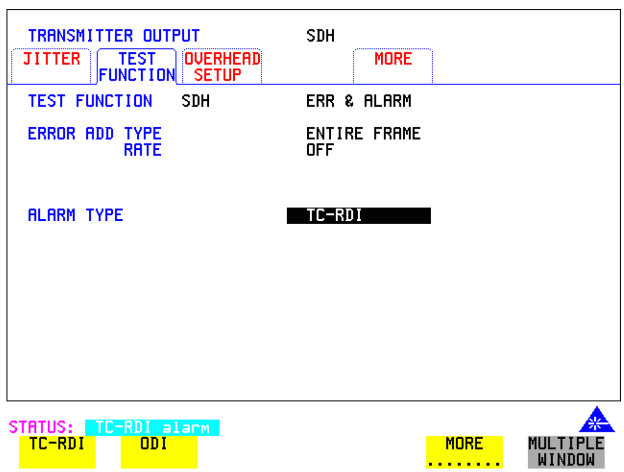
1. Press the **TRANSMIT** key and select **SDH**.
2. Select the **MAIN SETTINGS** folder.
3. Set the TCM PATH field to **HIGH ORDER** or **LOW ORDER** as required.
4. Select the **TEST FUNCTION** folder as shown above.
5. Set the TEST FUNCTION field to **SDH** and select **ERRORS & ALARMS**.
6. Select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

Adding TCM Alarms

Description

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

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



HOWTO

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

2 Select the **MAIN SETTINGS** folder.

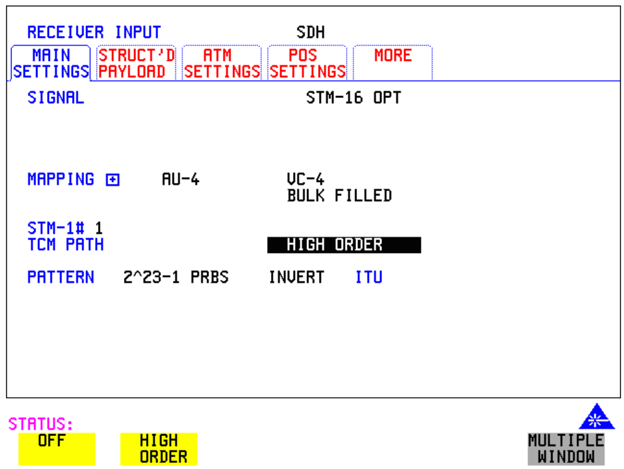
3 Set the TCM PATH field to **HIGH ORDER** or **LOW ORDER** as required.

4 Select the **TEST FUNCTION** folder as shown above.

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

6 Select the ALARM TYPE field and choose an Alarm Type.

Setting up the Receiver for TCM operation



HOWTO

1. Press **RECEIVE** and select **SDH** .
2. Select the **MAIN SETTINGS** folder.
3. Set up the Receiver as required, see “Setting SDH Receive Interface” page 49.
4. Set the TCM PATH field to **HIGH ORDER** or **LOW ORDER** as required. The LOW ORDER selection is enabled when a TU mapping is selected.

Detecting TCM APId messages

Description

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

HOWTO

1 Press **RECEIVE** and select **SDH** .

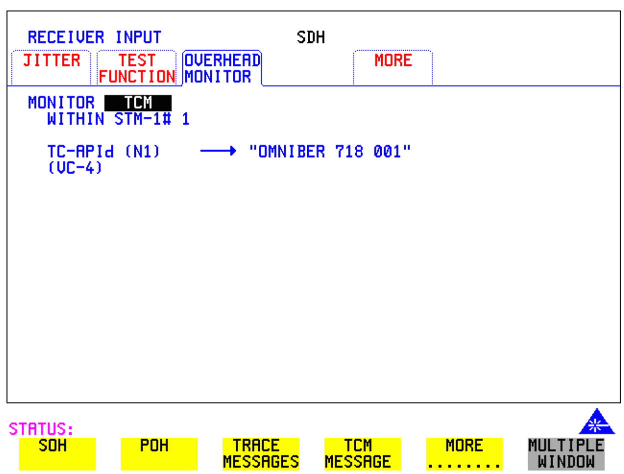
2 Select the **MAIN SETTINGS** folder.

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

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

Method 1

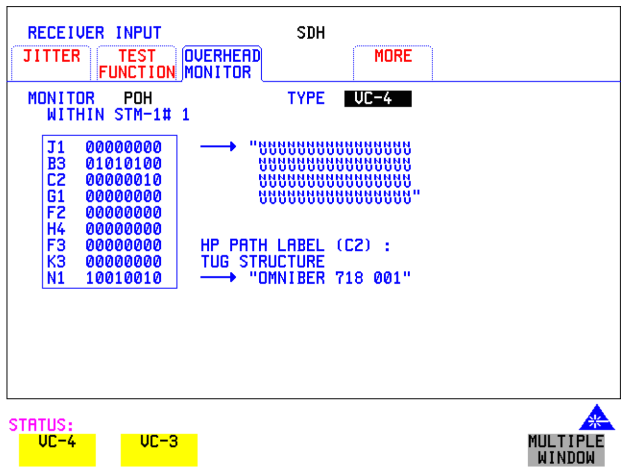
5 Select the MONITOR field and choose **TCM MESSAGE**, see following example display.



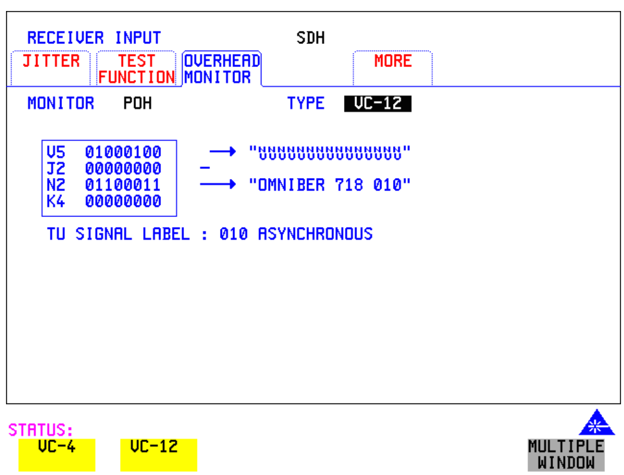
Method 2

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

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

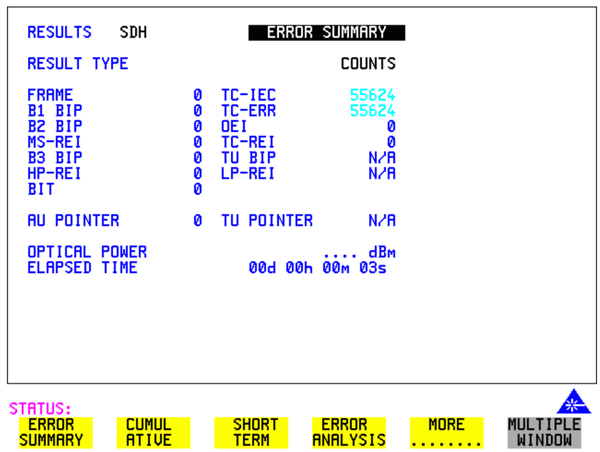


8 To view the N2 byte message select the TYPE field and set as required.



Viewing TCM Errors and Alarms

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

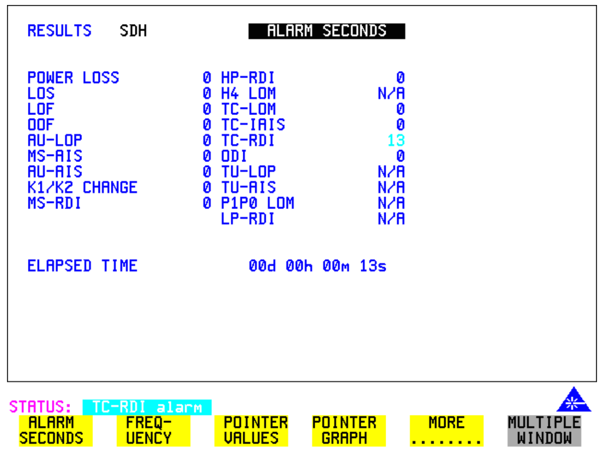


HOWTO

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

See next page for an example of the Alarms Results page

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

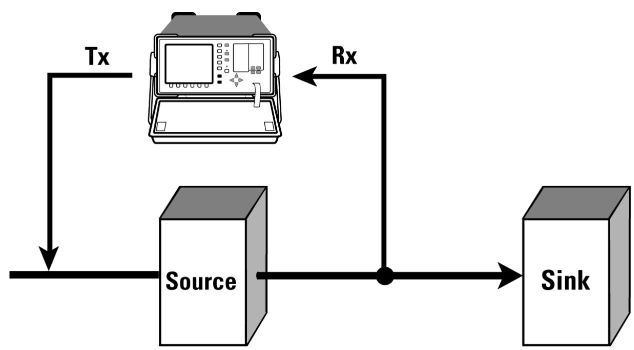


Tandem Connection Terminating Equipment (TCTE) Testing

TCTE Source Testing

Description

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



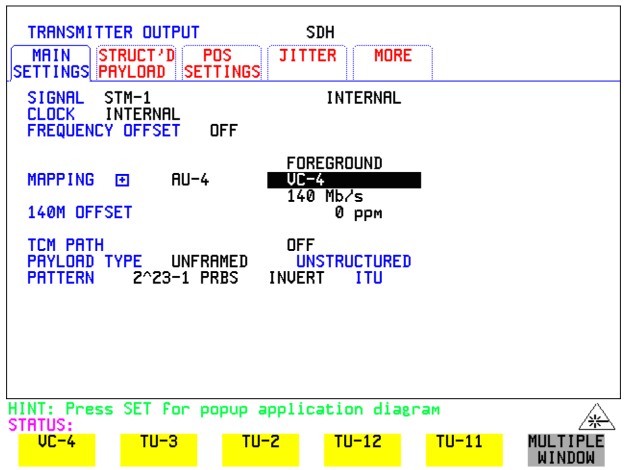
Introduction

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

HOWTO

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

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



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

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

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

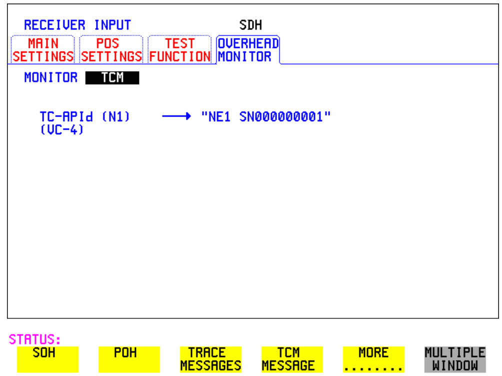
8 Select the **MAIN SETTINGS** folder.

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

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

11 Select the **OVERHEAD MONITOR** folder.

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



Error Monitoring Testing

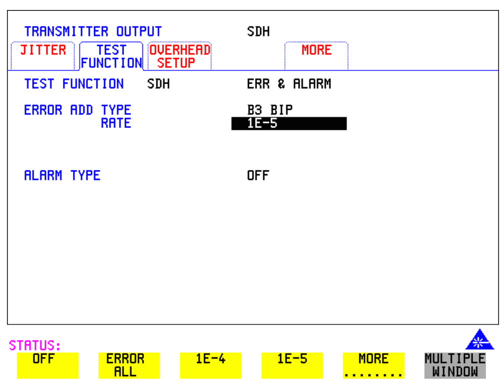
Method: Use the OmniBER Transmitter to generate errors in the system under test and verify on the Receiver that the correct error result is obtained.

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

14 Select the **TEST FUNCTION** folder.

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

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

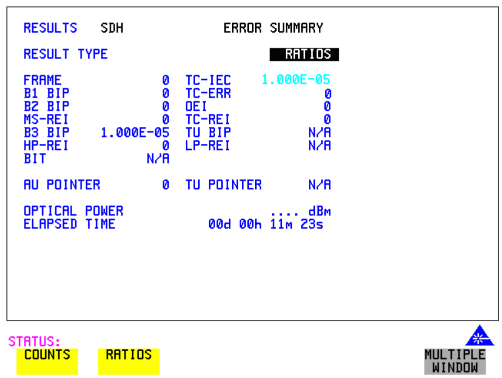


17 Press **RUN/STOP** to start the test. See “Test Timing” page 111 for advice on setting test periods.

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

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

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

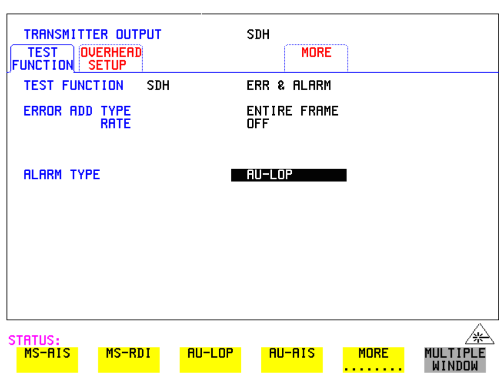


Alarms Testing

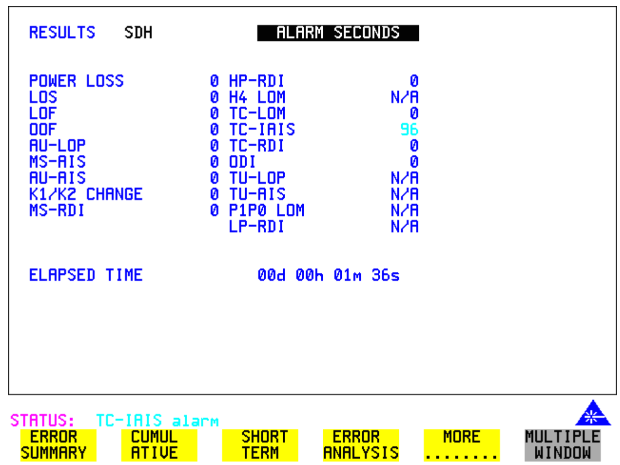
Method: Send an invalid VC-4 to the TCTE under test and check that the OmniBER Receiver registers an TC-IAIS alarm.

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

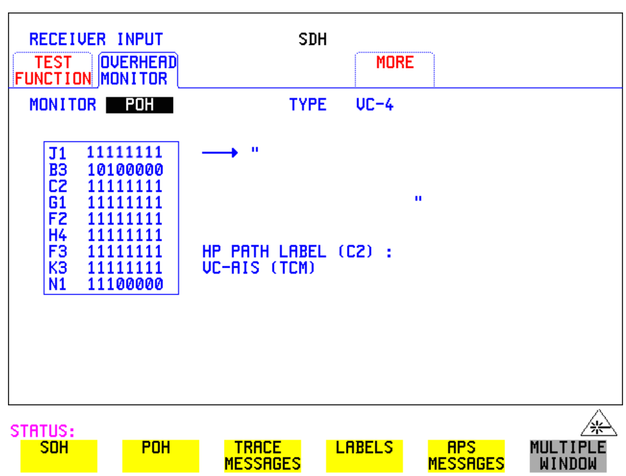
22 To generate an invalid VC-n in the OmniBER select the Transmitter TEST FUNCTION folder as shown below and select a AU-LOP, LOF or MS_AIS Alarm.



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



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

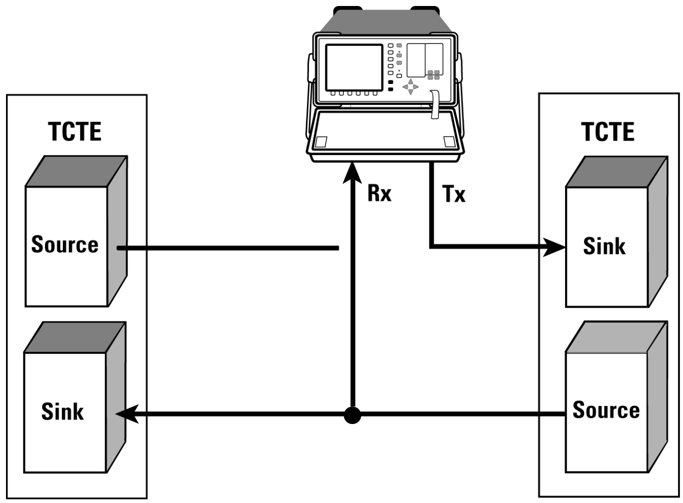


25 Press **RUN/STOP** to end the test.

TCTE Sink/Source Testing

Description

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



HOWTO

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

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

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

8

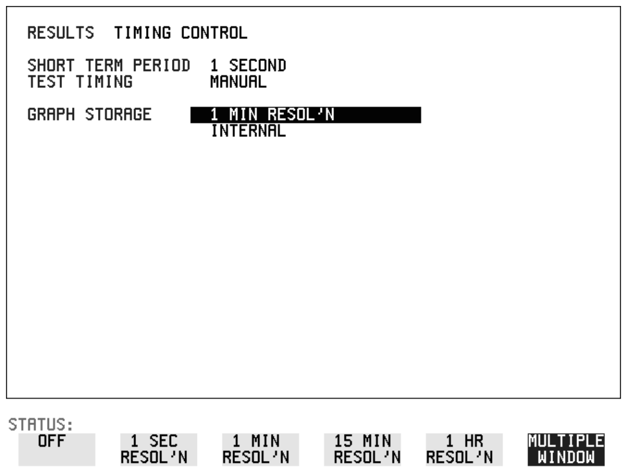
Storing, Logging and Printing

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:

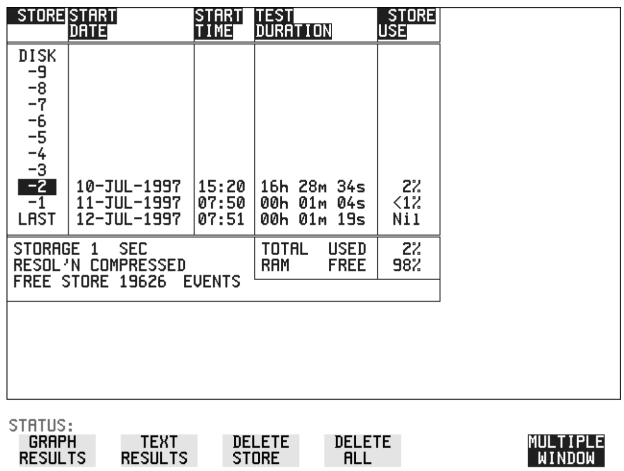
1. Before starting your measurement, choose the GRAPH STORAGE resolution and location.
   The resolution chosen affects the ZOOM capability when viewing the bar graphs. If 1 MIN is selected, 1 MIN/BAR, 15 MINS/BAR and 60 MINS/BAR are available. If 15 MINS is selected, 15 MINS/BAR and 60 MINS/BAR are 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 290.

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.



HOW TO:

1 Press **GRAPH** to view the bar graph display.

2 If currently viewing the bar graph display, select **TEXT RESULTS** then **STORE STATUS**. If currently viewing the error or alarm summary, select **STORE STATUS**.

3 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 297.

4 Choose **GRAPH RESULTS** if you wish to view the bar graphs.
The display will change to the bar graph display of the highlighted results.

5 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.

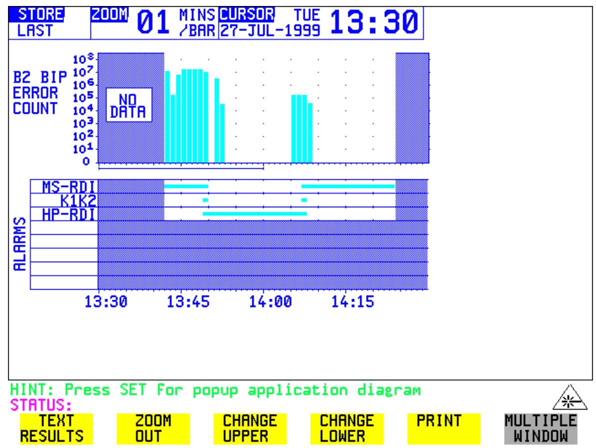
The top row of the display comprises five fields:

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.

2 To view previously stored graphs, see "Recalling Stored Graph Results " page 245.

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 245.

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

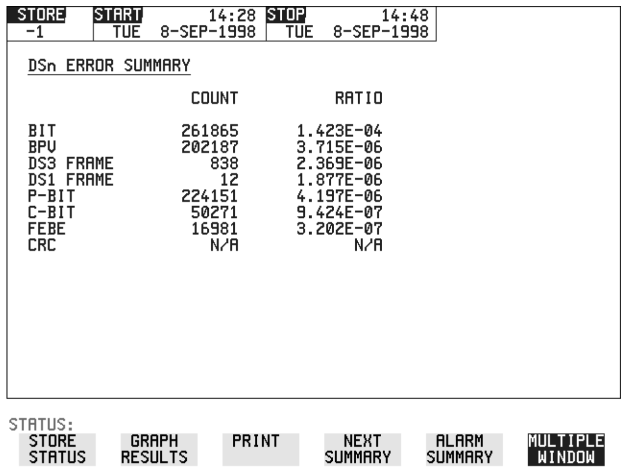
Cursor

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 Graphics Error and Alarm Summaries

Description

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



HOW TO:

1 To view the error or alarm summary associated with the current bar graphs, press **GRAPH** then **TEXT RESULTS**.

2 To view the error or alarm summary associated with previously stored bar graphs, see "Recalling Stored Graph Results " page 245.

3 To view the Alarms which have occurred during the measurement, select **ALARM SUMMARY**. Use **NEXT SUMMARY** to view the PDH/DSn; and SDH 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 SDH 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 245.

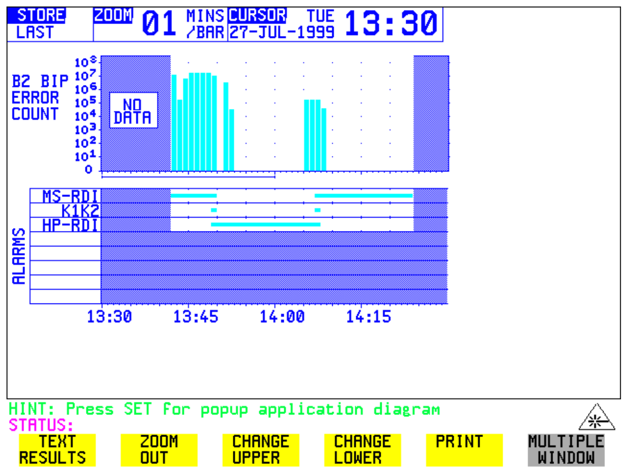
Start The start time and date of the test, that produced the displayed results.

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 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 270.
- GPIB: "Logging Results to GP-IB Printer" page 268
- PARALLEL: "Logging Results to Parallel (Centronics) Printer" page 267.
- INTERNAL (only if Option 602, Internal Printer, is fitted): "Logging Results to Internal Printer" page 269.

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 294.

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 (eg 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:

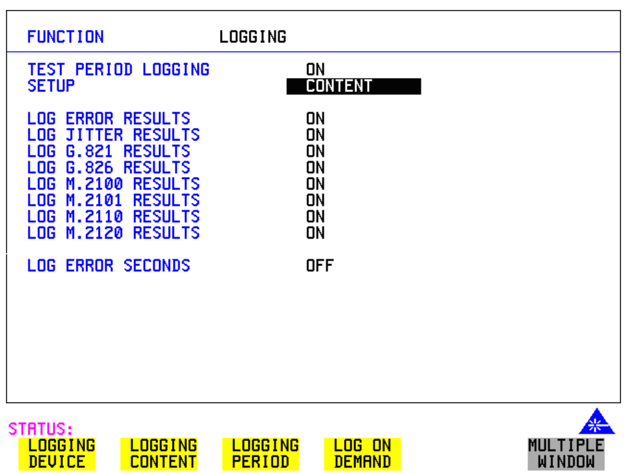
Selecting Logging Device

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 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 270.
- GPIB: “Logging Results to GP-IB Printer” page 268
- PARALLEL: “Logging Results to Parallel (Centronics) Printer” page 267.
- DISK: “Saving Data Logging to Disk” page 294.
- INTERNAL (only if Option 602, Internal Printer, is fitted): “Logging Results to Internal Printer” page 269.

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 (ie Gating Period) please refer to the “Test Timing” page 111 Section.

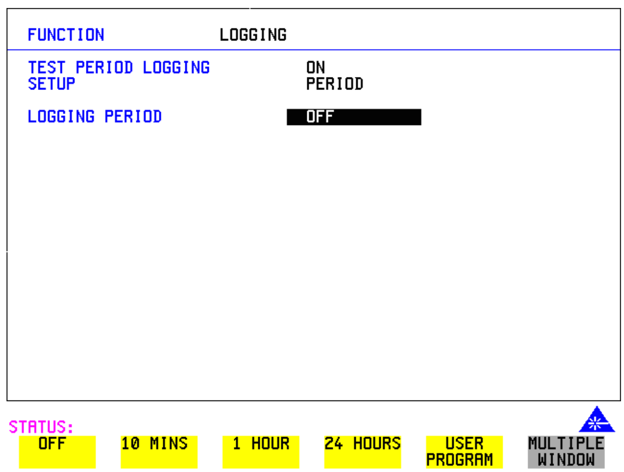


Selecting Logging Content

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 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 occurences 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.

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 ie **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 ie 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.

```
|==============================================================================|
|                               OmniBER 37718                                  |
|                           Instrument Configuration                           |
|------------------------------------------------------------------------------|
|   Receive Signal    : STM-16 OPTICAL      STM-1 under test   : 1             |
|   Mapping           : AU-4     TU-12    ASYNC 2Mb/s                          |
|   Selected TU       : TUG3[1] TUG2[1] TU[1]                                  |
|   TCM Path          : OFF                                                    |
|   Payload (Struct)  : PCM30CRC                                               |
|   Test Signal       : 64kb/s                                                 |
|   Tributaries       :                                           64kb [ 1]    |
|   Pattern           : 2^11-1             Polarity           : NORMAL         |
|                                                                              |
| MEASUREMENT STARTED   14 Jul 00  12:39:49         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).

```
| 12:41:38  B1 BIP             32252                                         |
| 12:41:38  B2 BIP            673688                                         |
| 12:41:38  B3 BIP             17419                                         |
| 12:41:38  HP-REI                77                                         |
| 12:41:38  TU BIP               820                                         |
| 12:41:38  LP-REI                 2                                         |
| 12:41:38  A1A2 FRAME          3445                                         |
| 12:41:38  MS-REI              1095                                         |
| 12:41:38  BIT                   36                                         |
| 12:41:38  FAS 2M                16                                         |
| 12:41:38  CRC                  490                                         |
| 12:41:57  LOF                  SET                                         |
| 12:41:57  OOF                  SET                                         |
| 12:41:57  AU-LOP               SET                                         |
| 12:41:57  H4 LOM               SET                                         |
| 12:41:57  TU-LOP               SET                                         |
| 12:41:57  Loss of Frame 2M     SET                                         |
| 12:41:57  MultiFrame Loss      SET                                         |
| 12:41:57  Pattern Loss         SET                                         |
| 12:42:06  LOF                CLEAR                                         |
| 12:42:06  OOF                CLEAR                                         |
| 12:42:06  AU-LOP             CLEAR                                         |
| 12:42:06  H4 LOM             CLEAR                                         |
| 12:42:06  TU-LOP             CLEAR                                         |
| 12:42:06  Loss of Frame 2M   CLEAR                                         |
| 12:42:06  Pattern Loss       CLEAR                                         |
| 12:42:06  MultiFrame Loss    CLEAR                                         |
| 12:42:07                     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.

Logging Results

```
|============================================================================|
| MEASUREMENT COMPLETE  14 Jul 00  12:44:41      Elapsed Time   00d 00h 03m 34s|
|============================================================================|
|                             Cumulative Results                             |
|                                                                            |
| Error Results :                                                            |
|                  A1A2 FRAME      B1 BIP      B2 BIP      MS-REI      B3 BIP |
| Error Count           16908      320131   3.305E+06        5769       85340 |
| Error Ratio       1.053E-02   6.410E-07   6.691E-06   1.168E-08   2.828E-06 |
|                                                                            |
|                      HP-REI      TC-IEC      TC-ERR         OEI      TC-REI |
| Error Count             361         N/A         N/A         N/A         N/A |
| Error Ratio       1.196E-08         N/A         N/A         N/A         N/A |
|                                                                            |
|                      TU BIP      LP-REI                                     |
| Error Count            4040           7                                     |
| Error Ratio       8.986E-06   1.557E-08                                     |
|                                                                            |
|                                                                            |
|                                FAS 140M     FAS 34M      FAS 8M      FAS 2M |
| Error Count                          N/A         N/A         N/A          79 |
| Error Ratio                          N/A         N/A         N/A   1.406E-05 |
|                                                                            |
|                                     BIT        CODE         CRC        REBE |
| Error Count                          187         N/A        2411           1 |
| Error Ratio                    1.456E-05         N/A   1.201E-02   4.983E-06 |
|                                                                            |
| Analysis Results :                                                         |
|                              G.826 ANALYSIS                                |
|                                  B1 BIP      B2 BIP      MS-REI      B3 BIP |
| Errored Blocks                    74564       22502         186       22398 |
| Errored Seconds                      18          10           4          10 |
| Severely Errored Seconds             16           9           0           9 |
| Unavailable Seconds                  10          10           0          10 |
| Path Unavailable Seconds            N/A          10          10          10 |
| Background Block Errors            3017        1914         186        1898 |
| Errored Second Ratio          8.824E-02   4.902E-02   2.020E-02   4.902E-02 |
| Severely Errored Sec Ratio    7.843E-02   4.412E-02           0   4.412E-02 |
| Background Block Err Ratio    2.006E-03   1.227E-03   1.174E-04   1.217E-03 |
|                                                                            |
|                                  HP-REI      TC-IEC      TC-ERR         OEI |
| Errored Blocks                       98         N/A         N/A         N/A |
| Errored Seconds                       4         N/A         N/A         N/A |
| Severely Errored Seconds              0         N/A         N/A         N/A |
| Unavailable Seconds                   0         N/A         N/A         N/A |
| Path Unavailable Seconds             10         N/A         N/A         N/A |
| Background Block Errors              98         N/A         N/A         N/A |
| Errored Second Ratio          2.020E-02         N/A         N/A         N/A |
| Severely Errored Sec Ratio            0         N/A         N/A         N/A |
| Background Block Err Ratio    6.187E-05         N/A         N/A         N/A |
```

```
|                                                                     |
|                                 TC-REI     TU-BIP     LP-REI       |
| Errored Blocks                    N/A       3341          7         |
| Errored Seconds                   N/A         10          2         |
| Severely Errored Seconds          N/A          9          0         |
| Unavailable Seconds               N/A         10          0         |
| Path Unavailable Seconds          N/A         10         10         |
| Background Block Errors           N/A        282          7         |
| Errored Second Ratio              N/A  4.902E-02  1.010E-02         |
| Severely Errored Sec Ratio        N/A  4.412E-02          0         |
| Background Block Err Ratio        N/A  7.231E-04  1.768E-05         |
|                                                                     |
|                                                                     |
|                                                                     |
|                             M.2101 ANALYSIS                         |
|                                       Section      High Order Path  |
|                                    Rx         Tx         Rx        Tx |
| Errored Seconds                   10          4         10         4 |
| Severely Errored Seconds          10          0         10         0 |
| Unavailable Seconds               10          0         10         0 |
|                                                                     |
|                    Low Order Path  Rx         Tx                    |
| Errored Seconds                   10          2                     |
| Severely Errored Seconds           9          0                     |
| Unavailable Seconds               10          0                     |
|                                                                     |
|                              G.821 ANALYSIS                         |
|                       BIT   FAS 140M    FAS 34M     FAS 8M    FAS 2M |
| Errored Sec           10        N/A        N/A        N/A        10 |
| %Errored Sec     4.90196        N/A        N/A        N/A   4.90196 |
| %ES (Annex D)    1.96078        N/A        N/A        N/A       N/A |
| Error Free Sec       194        N/A        N/A        N/A       194 |
| %Error Free Sec 95.09804        N/A        N/A        N/A  95.09804 |
| Severely Err Sec       8        N/A        N/A        N/A         7 |
| %Severely Err Sec 3.92157       N/A        N/A        N/A   3.43137 |
| Degraded Minutes       1        N/A        N/A        N/A         1 |
| %Degraded Minutes 25.00000      N/A        N/A        N/A  25.00000 |
| Unavailable Sec       10        N/A        N/A        N/A        10 |
| %Unavailable Sec 4.67290        N/A        N/A        N/A   4.67290 |
|                                                                     |
|                                             CODE       CRC4      REBE |
| Errored Sec                                  N/A         10         4 |
| %Errored Sec                                 N/A    4.90196   2.02020 |
| Error Free Sec                               N/A        194       194 |
| %Error Free Sec                              N/A   95.09804  97.97980 |
| Severely Err Sec                             N/A          8         4 |
| %Severely Err Sec                            N/A    3.92157   2.02020 |
| Degraded Minutes                             N/A          1         0 |
| %Degraded Minutes                            N/A   25.00000   0.00000 |
| Unavailable Sec                              N/A         10         0 |
| %Unavailable Sec                             N/A    4.67290   0.00000 |
```

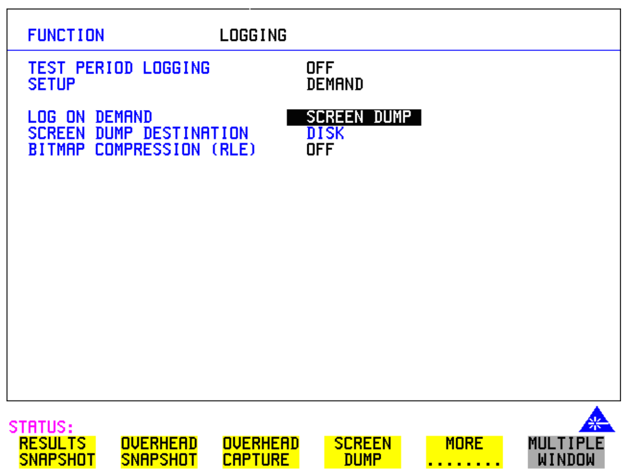
```
|                                                                              |
|                               G.826 ANALYSIS                                 |
|                                    Near  8Mb/s  Far        Near  2Mb/s  Far  |
| Errored Blocks                     N/A         N/A        2411           1  |
| Errored Seconds                    N/A         N/A          10           4  |
| Severely Errored Seconds           N/A         N/A           8           4  |
| Unavailable Seconds                N/A         N/A          10           0  |
| Path Unavailable Seconds           N/A         N/A          10          10  |
| Background Block Errors            N/A         N/A         694           0  |
| Errored Second Ratio               N/A         N/A   4.902E-02   2.020E-02  |
| Severely Errored Sec Ratio         N/A         N/A   3.922E-02   2.020E-02  |
| Background Block Err Ratio         N/A         N/A   3.541E-03           0  |
|                                                                              |
|                              BIT Errors                                      |
| Errored Blocks                     187                                      |
| Errored Seconds                     10                                      |
| Severely Errored Seconds             6                                      |
| Unavailable Seconds                 10                                      |
| Background Block Errors            187                                      |
| Errored Second Ratio         4.902E-02                                      |
| Severely Errored Sec Ratio   2.941E-02                                      |
| Background Block Err Ratio   1.181E-04                                      |
|                                                                              |
|                              M.2100 ANALYSIS                                 |
|                                      Rx   8Mb/s  Tx          Rx   2Mb/s  Tx  |
| Errored Seconds                    N/A         N/A          10           4  |
| Severely Errored Seconds           N/A         N/A           7           4  |
| Unavailable Seconds                N/A         N/A          10           0  |
|                                                                              |
|                                  64k Rx                                      |
| Errored Seconds                     10                                      |
| Severely Errored Seconds             8                                      |
| Unavailable Seconds                 10                                      |
|                                                                              |
|                              M.2110 ANALYSIS                                 |
|                        15-min       1-hr       2-hr       24-hr       7-day  |
| BIS Results            WAIT         WAIT       WAIT        WAIT        WAIT  |
|                                                                              |
|                                                                              |
|                                                                              |
| Frequency :  2488320.0 kHz      Offset :    +0.0 kHz    Offset :     +0.0ppm |
| Power Level :    -13.0 dBm     STM-16o OPTICAL                               |
|                                                                              |
| Pointer Results :                  AU POINTER                TU 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                          0                |
```

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 STM-N
OVERHEAD CAPTURE - Overhead Capture display
POINTER GRAPH - Pointer Graph display
SDH TRIBUTARY SCAN - SDH Tributary Scan display
SDH ALARM SCAN - SDH 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 270.

- GPIB: “Logging Results to GP-IB Printer” page 268.
- PARALLEL: “Logging Results to Parallel (Centronics) Printer” page 267.
- DISK: “Saving Data Logging to Disk” page 294. If SCREEN DUMP is chosen then please refer to “Saving a Screen Dump to Disk” page 292.
- INTERNAL (only if Option 602, Internal Printer, is fitted):“Logging Results to Internal Printer” page 269.

Log on Demand Examples

Overhead Capture, Pointer Graph, SDH Tributary Scan and SDH Alarm Scan logging are copies of the relevant display. Screen Dump logs a copy of the selected display (not Logging or Disk displays).

Overhead Snapshot

Overhead Snapshot provides the value of each byte of overhead in the STM-1 chosen for test.

```
|==============================================================================|
| 12:46:00  PRINT DEMANDED- O/H SNAPSHOT         Elapsed Time   00d 00h 03m 34s|
|==============================================================================|
|        | Setup : STM-16 OPTICAL                                              |
|------------------------------------------------------------------------------|
|    SOH (STM-1 #1 )                                     |                     |
|----+------------+----+------------+----+------------+                        |
| A1 | F6  F6  F6 | A2 | 28  28  28 | J0 | 01  AA  AA | J0 Path Trace:         |
| B1 | A2  00  00 | E1 | 00  00  00 | F1 | 00  00  00 |   “                “   |
| D1 | 00  00  00 | D2 | 00  00  00 | D3 | 00  00  00 |   E.164 CRC NOT FOUND  |
| H1 | 68  93  93 | H2 | 00  FF  FF | H3 | 00  00  00 | S1 Sync Status:        |
| B2 | 00  E0  3E | K1 | 00  00  00 | K2 | 00  00  00 | QUALITY UNKNOWN        |
| D4 | 00  00  00 | D5 | 00  00  00 | D6 | 00  00  00 |                        |
| D7 | 00  00  00 | D8 | 00  00  00 | D9 | 00  00  00 |                        |
| D10| 00  00  00 | D11| 00  00  00 | D12| 00  00  00 |                        |
| S1 | 00  00  00 | Z2 | 00  00  00 | E2 | 00  00  00 |                        |
|----+------------+----+------------+----+------------+------------------------|
|  High Order POH      TYPE VC-4    |  Low Order POH    TYPE  VC-12            |
|  WITHIN  STM-1   #1               |                                          |
|----+------------------------------+----+-------------------------------------|
|    |      HP Path Label (C2):     |    |      LP Path Label (V5):            |
| J1 | 00    “TUG STRUCTURE        “| V5 | 04     “010 ASYNCHRONOUS     “       |
| B3 | 07                           | J2 | 00                                  |
| C2 | 02   J1 Path Trace:          | N2 | 00   J2 Path Trace:                 |
| G1 | 00     “~~~~~~~~~~~~~~~~”    | K4 | 00     “~~~~~~~~~~~~~~~~”           |
| F2 | 00     “                “    |    |                                     |
| H4 | 25     “                “    |    |                                     |
| F3 | 00     “                “    |    |                                     |
| K3 | 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.

```
|==============================================================================|
| 12:48:02  PRINT DEMANDED- RESULTS SNAPSHOT     Elapsed Time   00d 00h 03m 34s|
|==============================================================================|
|                             Cumulative Results                               |
|                                                                              |
| Error Results :                                                              |
|                 A1A2 FRAME      B1 BIP      B2 BIP      MS-REI      B3 BIP |
| Error Count          16908      320131   3.305E+06        5769       85340 |
| Error Ratio      1.053E-02   6.410E-07   6.691E-06   1.168E-08   2.828E-06 |
|                                                                              |
|                     HP-REI      TC-IEC      TC-ERR         OEI      TC-REI |
| Error Count            361         N/A         N/A         N/A         N/A |
| Error Ratio      1.196E-08         N/A         N/A         N/A         N/A |
|                                                                              |
|                     TU BIP      LP-REI                                      |
| Error Count           4040           7                                      |
| Error Ratio      8.986E-06   1.557E-08                                      |
|                                                                              |
|                                                                              |
|                              FAS 140M     FAS 34M      FAS 8M      FAS 2M |
| Error Count                        N/A         N/A         N/A          79 |
| Error Ratio                        N/A         N/A         N/A   1.406E-05 |
|                                                                              |
|                                   BIT        CODE         CRC        REBE |
| Error Count                        187         N/A        2411           1 |
| Error Ratio                  1.456E-05         N/A   1.201E-02   4.983E-06 |
|                                                                              |
|                                                                              |
| Frequency :  2488320.0 kHz      Offset :    +0.0 kHz    Offset :     +0.0ppm |
| Power Level :    -12.9 dBm     STM-16o OPTICAL                               |
|                                                                              |
| Pointer Results :                  AU POINTER                TU 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                          0              |
|==============================================================================|
```

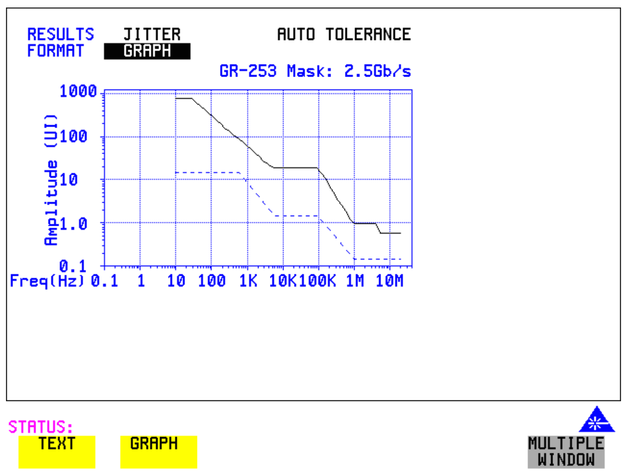
Logging Jitter Tolerance Results

Description

The jitter auto tolerance feature provides jitter tolerance measurements within the relevant ITU-T mask, G.823 for PDH, G.958 and G.825 for SDH.

You can log the jitter auto tolerance results to a printer for record keeping purposes. The **GRAPH** version and the **TEXT** version of the jitter tolerance results can be logged to a 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 270.
- GPIB: “Logging Results to GP-IB Printer” page 268
- PARALLEL: “Logging Results to Parallel (Centronics) Printer” page 267.
- INTERNAL (only if Option 602, Internal Printer, is fitted): “Logging Results to Internal Printer” page 269.

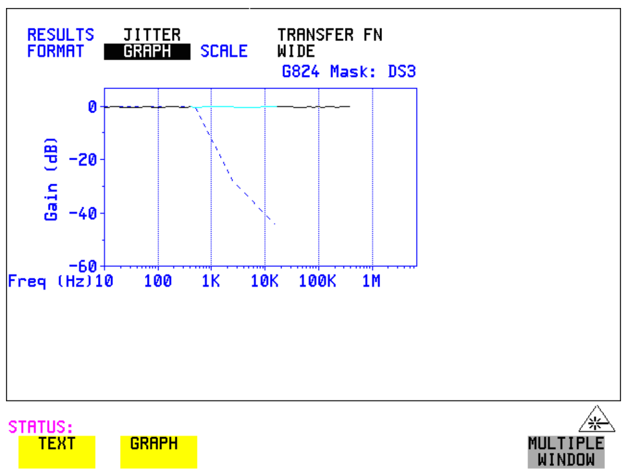
2 Choose **GRAPH** on the **RESULTS** **AUTO TOLER** display or choose **TEXT** on the **RESULTS** **AUTO TOLER** display, if you wish to log the graph and text results to the printer.

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, G.823 for PDH and G.958 for SDH.
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 a 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 270.
- GPIB: “Logging Results to GP-IB Printer” page 268
- PARALLEL: “Logging Results to Parallel (Centronics) Printer” page 267.
- INTERNAL (only if Option 602, Internal Printer, is fitted): “Logging Results to Internal Printer” page 269.

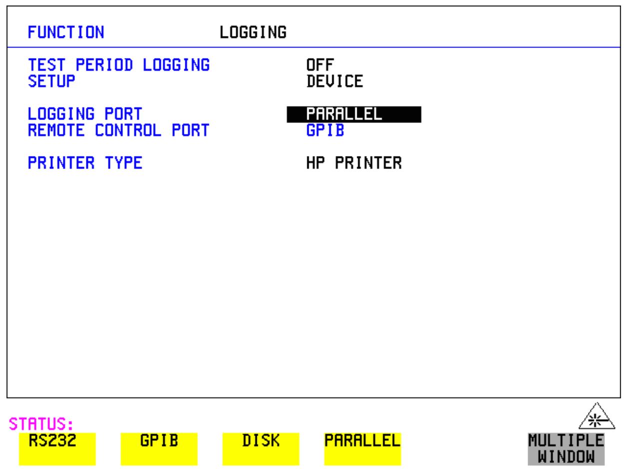
2 Choose **GRAPH** on the **RESULTS** **JITTER** **TN FUNCTION** display or choose TEXT on the **RESULTS** **JITTER** **TN FUNCTION** display if you wish to log the graph and text results to the printer.

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.

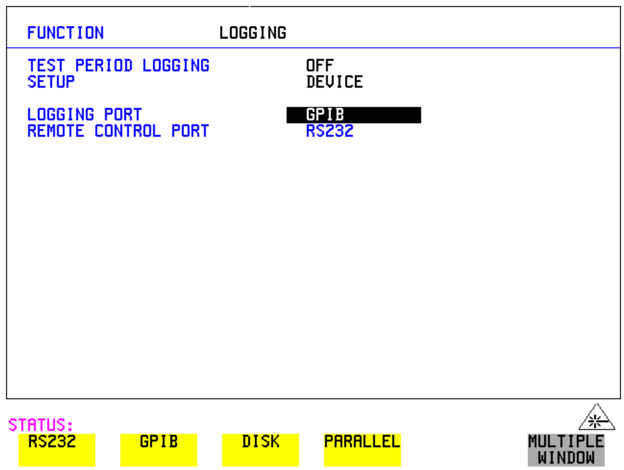
HOW TO:

1. Connect the Parallel printer to the PARALLEL port. See "Connecting a Printer to a Parallel Port " page 272.
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 253 or "Logging on Demand " page 261 for more details on selecting the type of Results you wish to log.

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

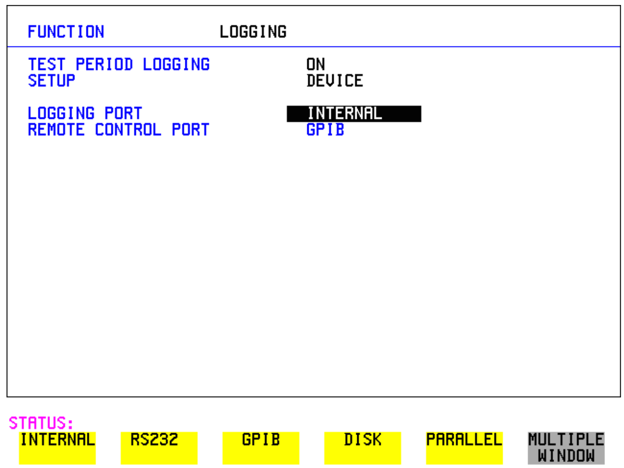
Choosing GP-IB external printer for logging prevents the use of GP-IB remote control.

2 See "Logging Results " page 225 or "Logging on Demand " page 233 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.



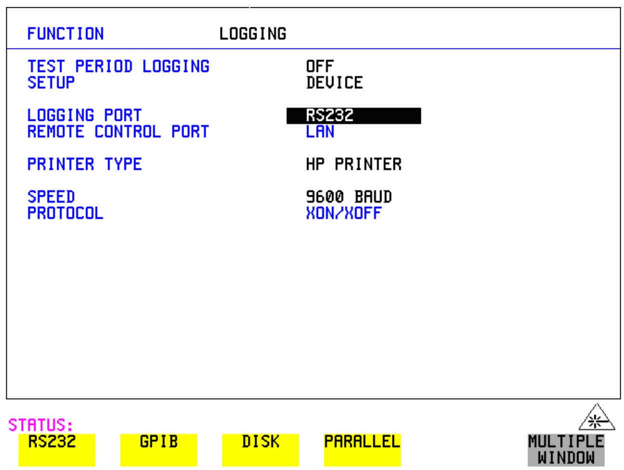
HOW TO:

1 See "Logging Results " page 225 or "Logging on Demand " page 233 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 225 or "Logging on Demand " page 233 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 a Printer to a Parallel Port

Description

If Remote Control Option, 601, is fitted, the OmniBER 718 has the capability of interfacing with a Printer, via the PARALLEL port.

CAUTION

Do not connect a serial printer e.g. RS-232-C or GPIB to the HP 37718A Parallel port as this will damage the interface.

HOW TO:

1. Connect the OmniBER 718 Parallel port to your Printer Parallel port using printer cable HP 24542D.

Changing Internal Printer Paper

Description Option 602 is required

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.

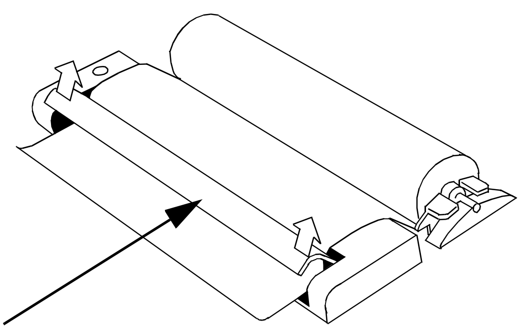
WARNING

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

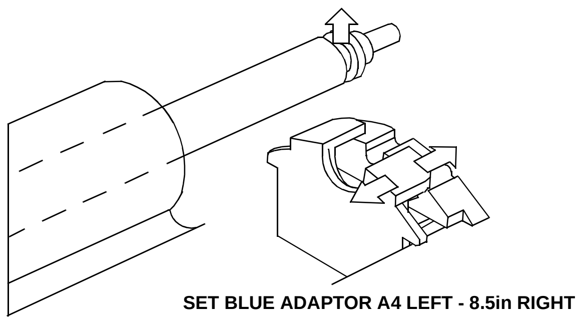


3 Lift out the spindle. Adjust the paper width adaptor to the width of the paper being used.

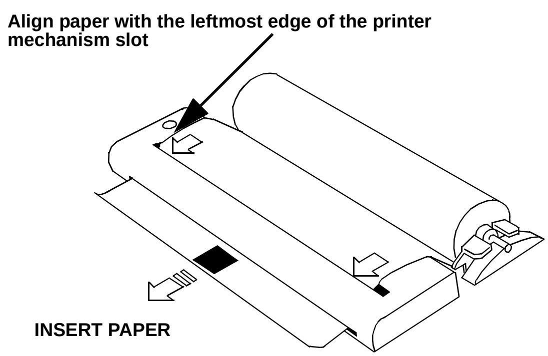
4 Put the paper roll on the spindle such that the sensitive side (slightly shiny) will be on the underside of the print mechanism. Ensure that the relocation of the spindle locks the blue width adaptor in position.

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.



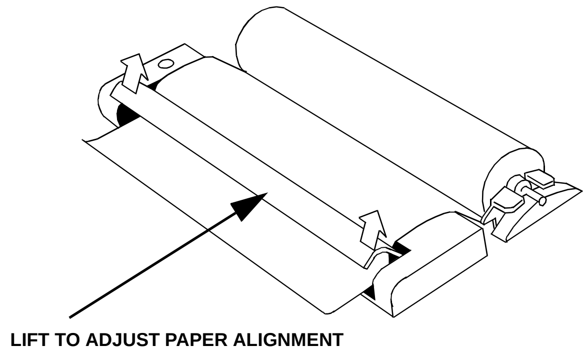
5 Feed the paper into the upper entry of the print mechanism. When the front cover of the print mechanism is closed, the printer should automatically feed the paper through until there is approximately 2.5 cm (1 in) clear at the front of the print mechanism.



CAUTION

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

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 273.
   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 273.

NOTE

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

9

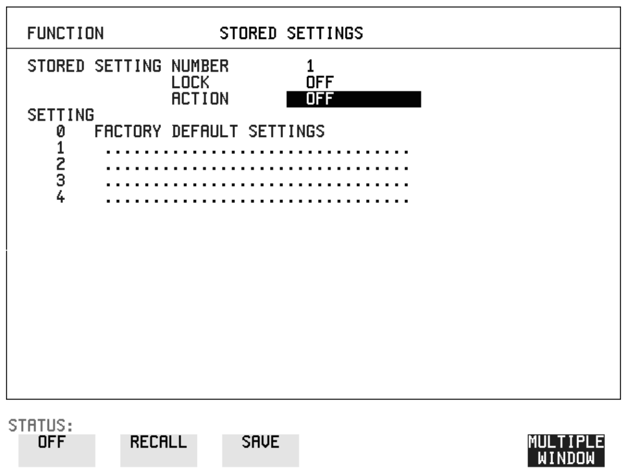
Using Instrument and Disk Storage

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.



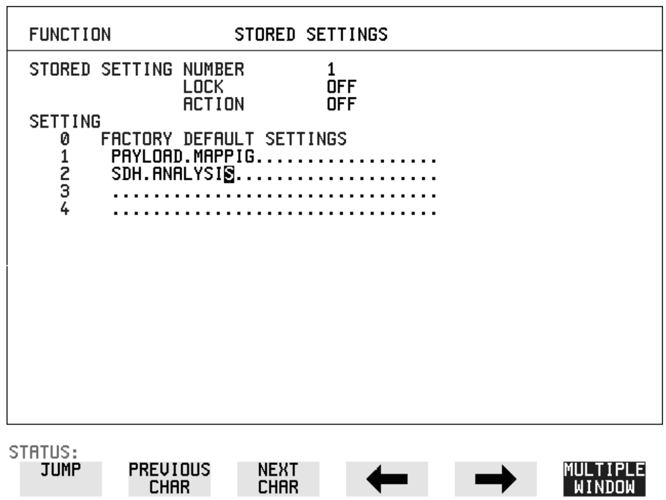
HOW TO:

1. Set the OmniBER 718 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 279.

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.

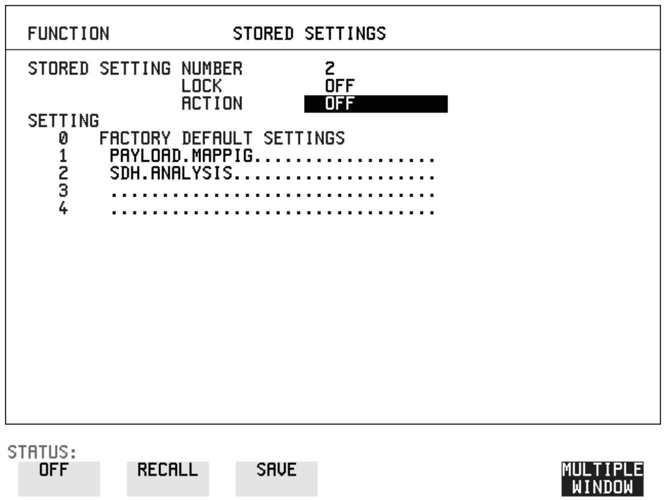
2 Choose LOCK **OFF** .

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.



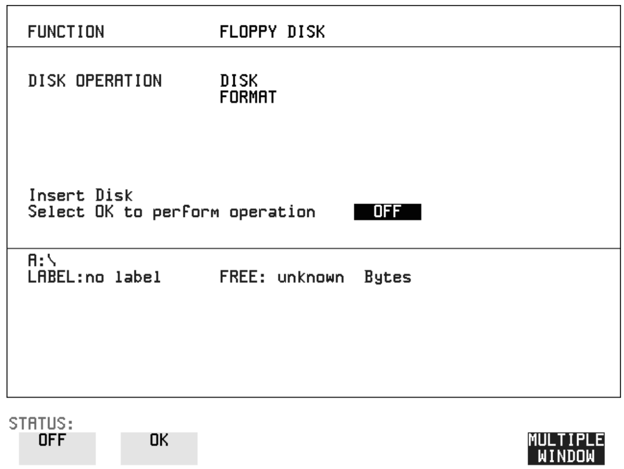
HOW TO:

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

Description Only 1.44M, MS-DOS compatible disks can be used in the OmniBER 718. 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 718 as this will ensure full compatibility with the Floppy Disk power fail recovery included in the OmniBER 718.

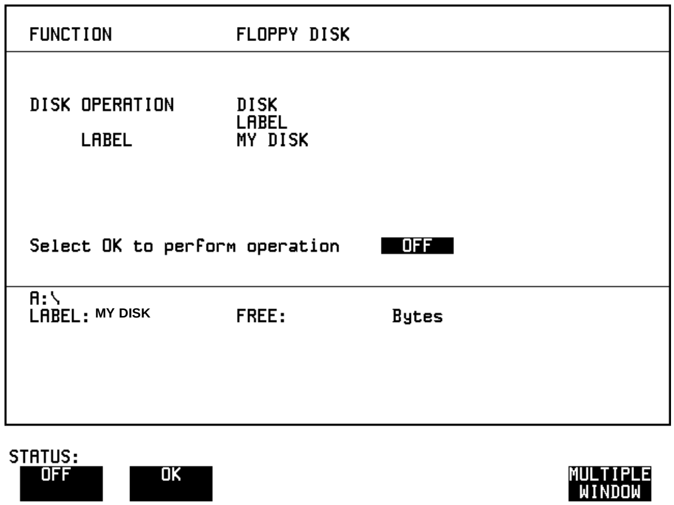
HOW TO:

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.



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.

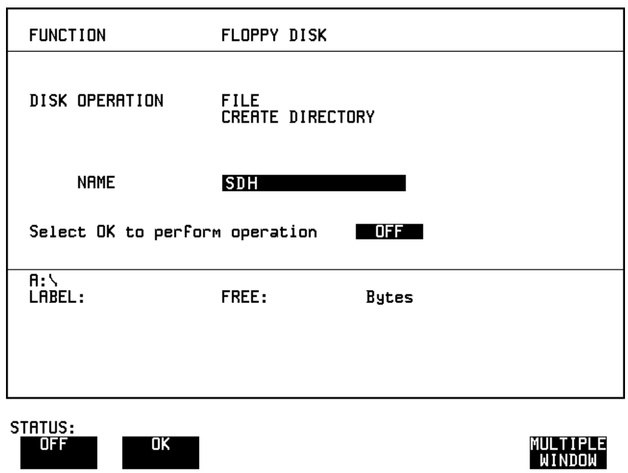
3 Choose **OK** to confirm the label is correct.
The label is displayed at the bottom of the display to confirm the operation has taken place.

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



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:\SDH will be created.

Accessing Directories and Files

1 Choose DISK OPERATION **SAVE**.

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

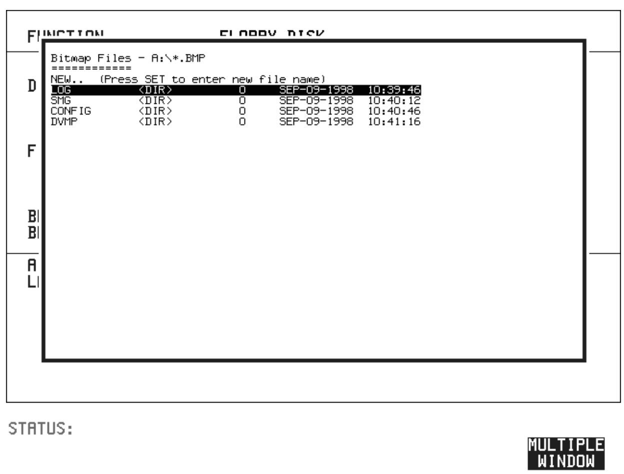
3 Move the highlighted cursor to the NAME field and press **SET**.

NOTE

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

4 Move the highlighted cursor to
. . **<DIR>** and press **SET** to move to parent directory.

5 Move the highlighted cursor to the directory required and press **SET** to move to that directory. (The directory name will appear on the display).
Only the files with the file extension chosen in FILE TYPE will be displayed.

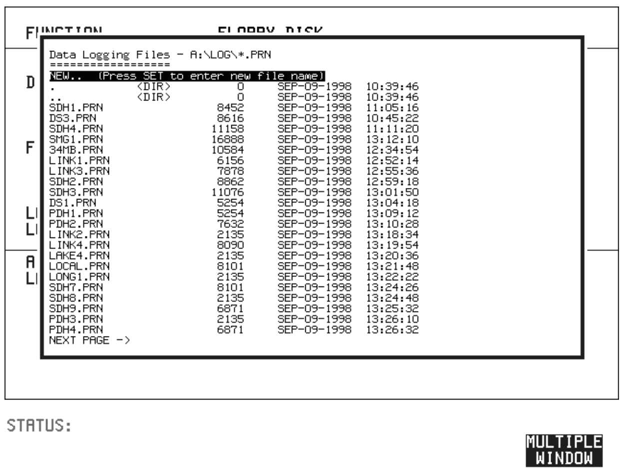


6 Move the highlighted cursor up and down the display using ⬆ and ⬇.

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.

SDH1.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.



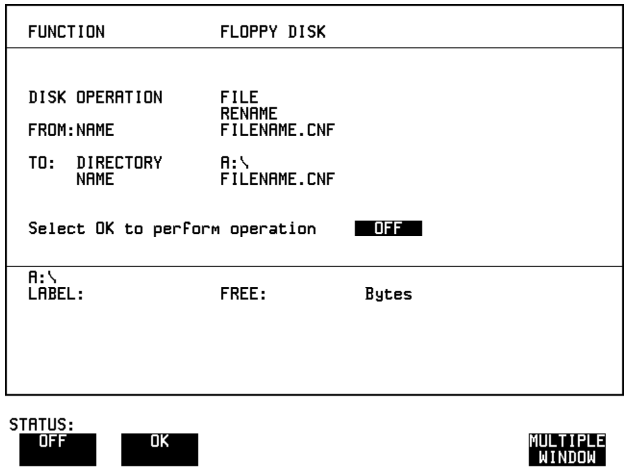
7 **NEW.** - Allows entry of new file name using pop-up keypad. Press **SET** to obtain the pop-up keypad display. Enter the new filename, Choose **END** and press **SET** to return to the file manager display.

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.

Renaming a File on Disk

Description

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



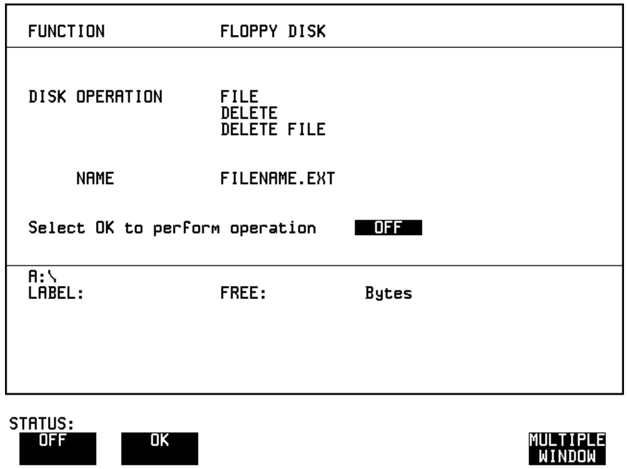
HOW TO:

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 284. 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 284.
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.

Deleting a File on Disk

Description

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



HOW TO:

1 Choose DISK OPERATION **FILE** **DELETE** **DELETE FILE**.

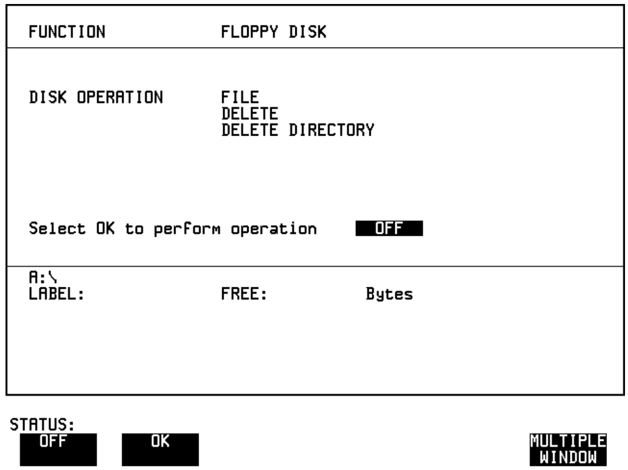
2 Choose the directory containing the file to be deleted. See "Accessing Directories and Files " page 284.

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.

Deleting a Directory on Disk

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



NOTE A directory cannot be deleted until all the files within the directory have been deleted. See "Deleting a File on Disk " page 287.

HOW TO:

1 Choose the directory you wish to delete (it will appear on the display). See "Accessing Directories and Files " page 284.

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.

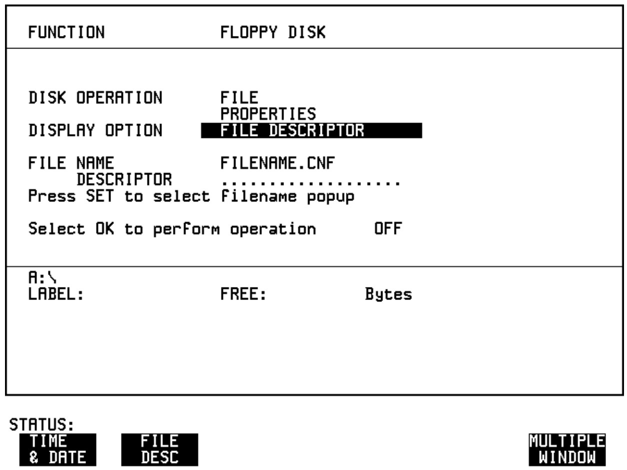
4 If files need to be deleted to prepare the directory for deletion. See "Deleting a File on Disk " page 287.

Adding Descriptors to Disk Files

Description

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

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



HOW TO:

1. Choose the directory containing the file you wish to add the descriptor to. See "Accessing Directories and Files " page 284.
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.

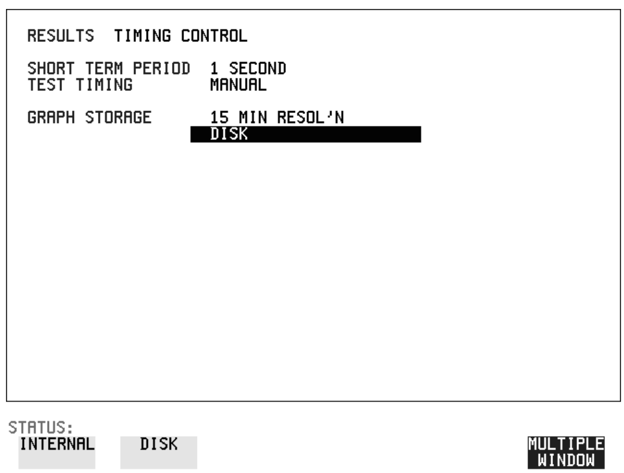
Saving Graphical Results to Disk

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:

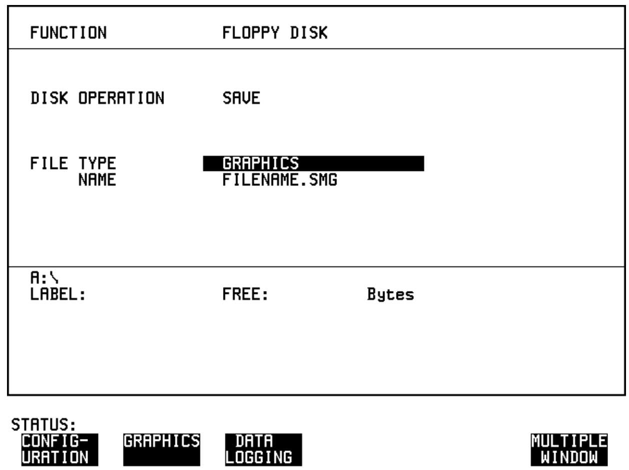
Automatic A filename in the form meas001 is created automatically without any action from you.

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 244.
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.



2 Choose the directory in which to save the graphics results. See "Accessing Directories and Files " page 284.

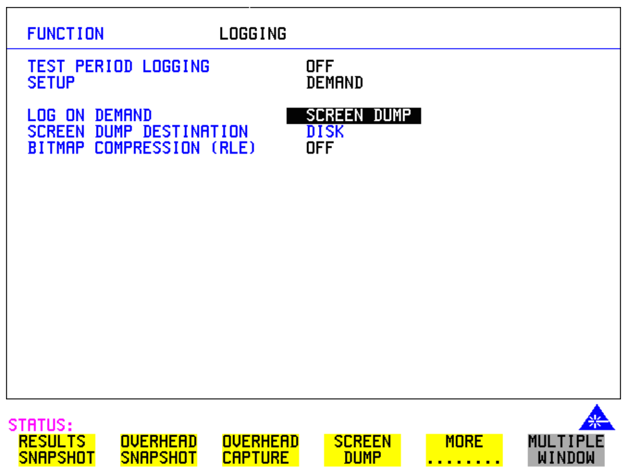
3 If you wish to enter your own choice of filename, choose DISK OPERATION **SAVE** FILE TYPE **GRAPHICS**.

4 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 a Screen Dump to Disk

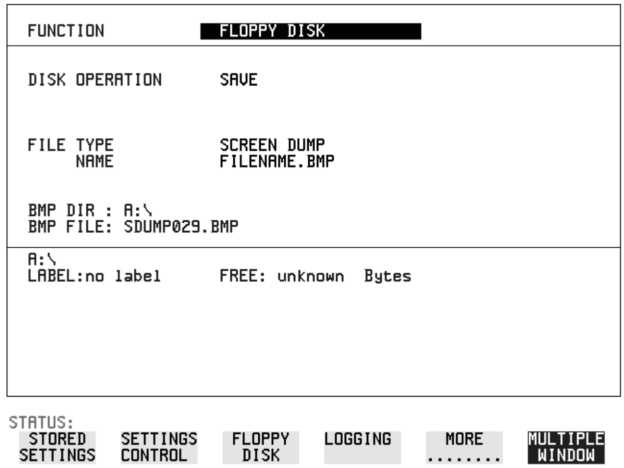
Description

The chosen display may be stored on disk in bitmap format using the Screen Dump feature of the 37718A. Logging and Floppy Disk displays must be set up for screen dump. See, "Logging on Demand " page 261. 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** .



4 Choose the directory in which to save the Screen Dump. See "Accessing Directories and Files " page 284.

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

NOTE

You have the option of an auto generated filename or entering your chosen 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.

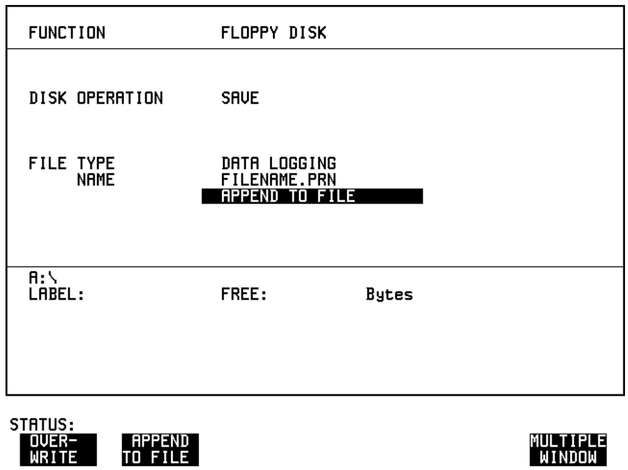
6 Move the highlighted cursor to NAME and enter the filename using **PREVIOUS CHAR** **NEXT CHAR** **⟶** **⟵** or press **SET** twice and use the pop-up keypad.

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

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.



HOW TO:

1 Choose the directory in which to save the logging results. See "Accessing Directories and Files " page 284.

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.

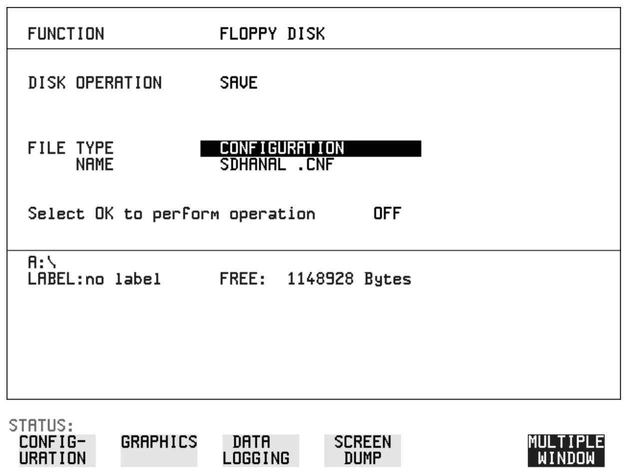
4 Set up the **OTHER** **LOGGING** display. See "Logging Results" page 253.
When the named file is opened, data logging is saved on the disk:
As each logging output occurs during the measurement or when **PRINT NOW** is pressed.

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.



HOW TO:

1 Set the OmniBER 718 to the configuration you wish to store.

2 Choose the directory in which you wish to save the OmniBER 718 configuration. See "Accessing Directories and Files " page 284.

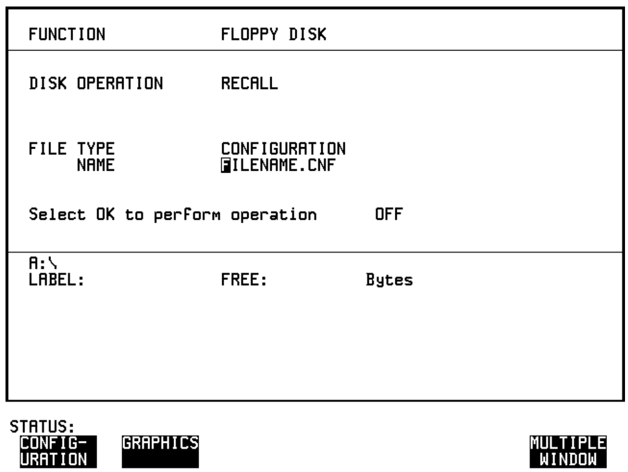
3 Choose DISK OPERATION **SAVE**, FILE TYPE **CONFIGURATION** and enter the filename using **PREVIOUS CHAR** **NEXT CHAR** **⟶** **⟵** or press **SET** twice and use the pop-up keypad.
The filename extension is fixed as .CNF.
The filename can contain up to 8 alphanumeric characters.

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 284.

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.



HOW TO:

1 Choose the directory that contains the configuration file to be recalled. See "Accessing Directories and Files " page 284.

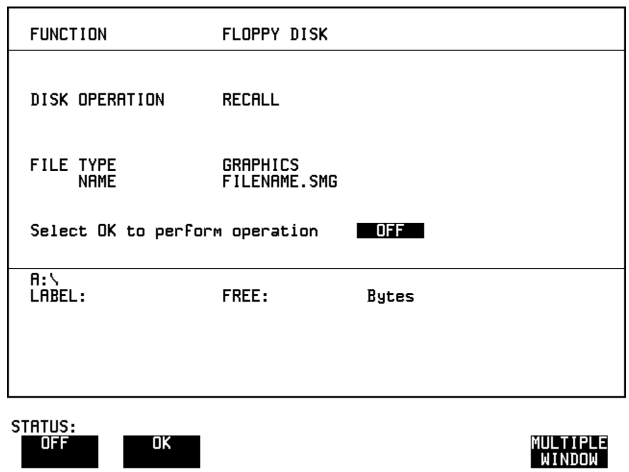
2 Choose DISK OPERATION **RECALL** FILE TYPE **CONFIGURATION** and enter your choice of filename using **PREVIOUS CHAR** **NEXT CHAR** **→** **←**.
The filename can contain up to 8 alphanumeric characters.
The filename extension is fixed as .CNF.

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.



HOW TO:

1 Choose the directory that contains the graphics file to be recalled. See "Accessing Directories and Files " page 284.

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.

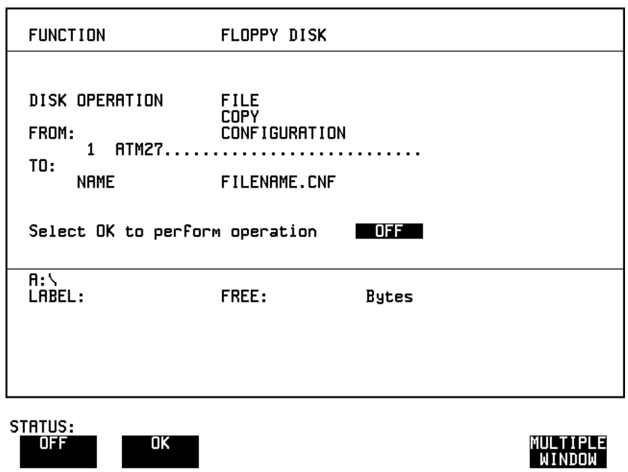
3 To recall the graphics results from disk to instrument, choose **OK** .

4 To view the graphics results, see "Recalling Stored Graph Results" page 245.

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 718 with the same options as the original instrument.



HOW TO:

1 Choose the directory to receive the configuration file. See "Accessing Directories and Files" page 284.

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.

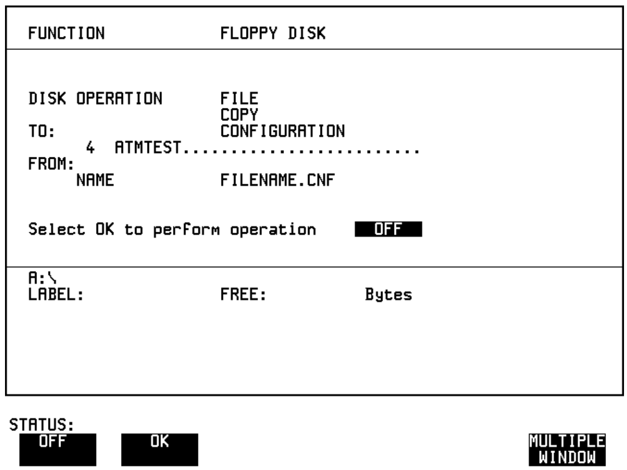
3 Enter the chosen filename using **PREVIOUS CHAR** **NEXT CHAR** **⟶** **⟵** or press **SET** twice and use the pop-up keypad.
The file name can contain up to 8 alphanumeric characters.
The filename extension is fixed as .CNF.

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 718 with the same options as the original instrument.



HOW TO:

1 Choose the directory containing the configuration file. See "Accessing Directories and Files " page 284.

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.

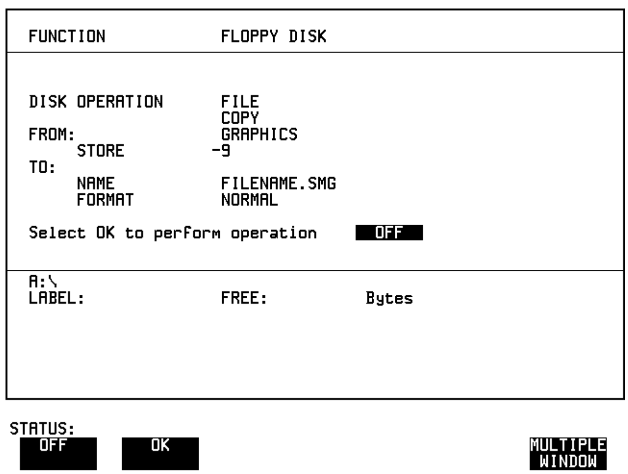
4 To copy the configuration from Disk to instrument, choose **OK**.
If you have entered a instrument store number which already contains a configuration, a warning "Are you sure you wish to continue" is displayed.
If YES is selected, the data in the instrument store will be overwritten.
If NO is selected,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

Copying Graphics Results from Instrument Store to Disk

Description

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

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



HOW TO:

1 Choose the directory to receive the graphics file. See "Accessing Directories and Files " page 284.

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.

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 718, 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.

10

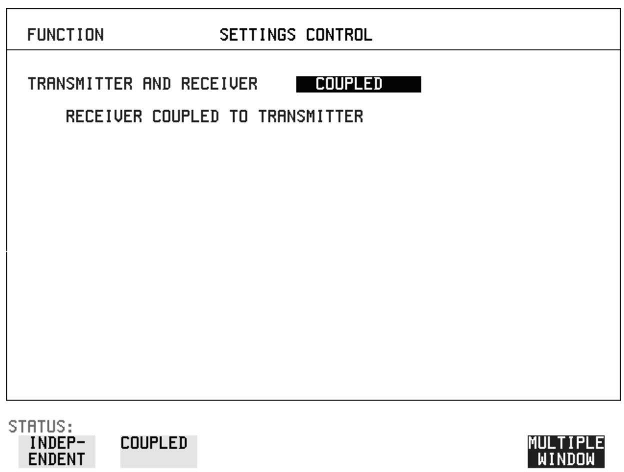
Selecting and Using "Other" Features

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.



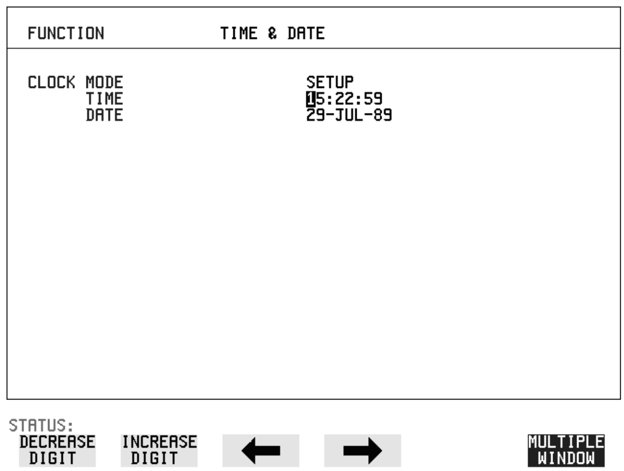
HOW TO:

1 Choose TRANSMITTER AND RECEIVER **COUPLED**.

Setting Time & Date

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

Description

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

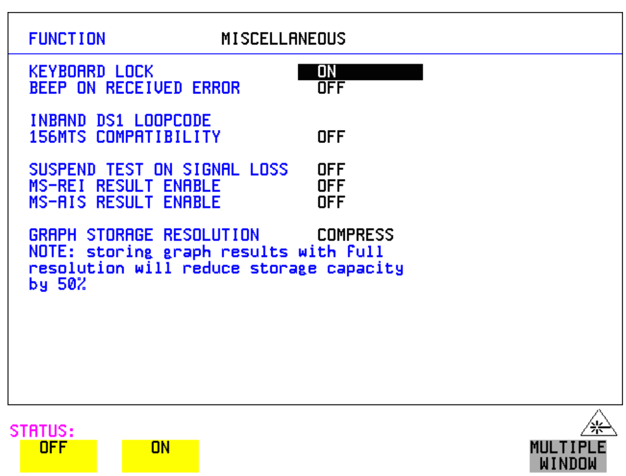
This function is provided in the OmniBER 718 on the **OTHER** **MISCELLANEOUS** display.

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



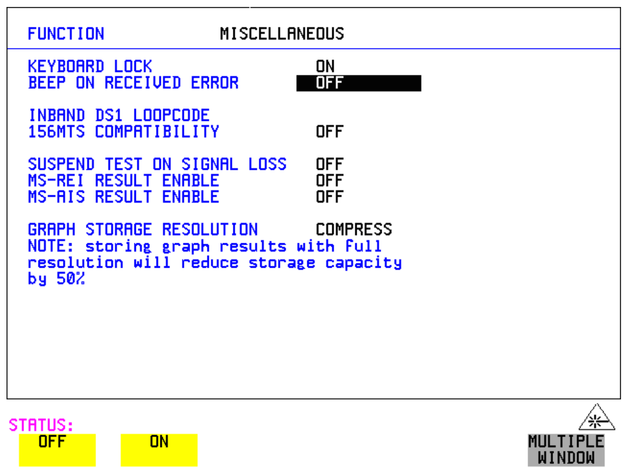
HOW TO:

1 Choose KEYBOARD LOCK **ON**.

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 718 on the **OTHER** **MISCELLANEOUS** display.



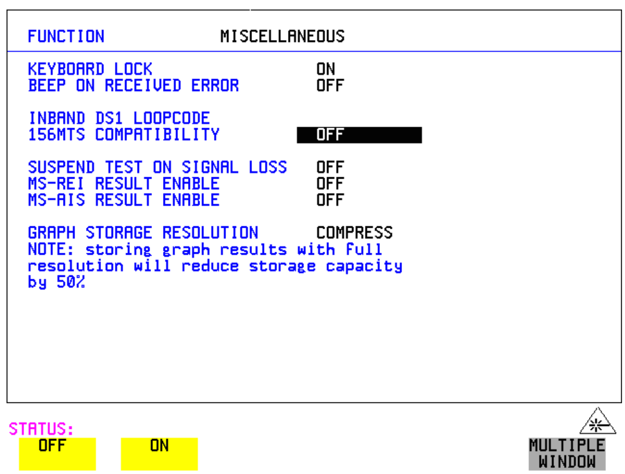
HOW TO:

1 Choose BEEP ON RECEIVED ERROR **ON**.

In-Band DS1 Loopcode 156MTS Compatibility

Description

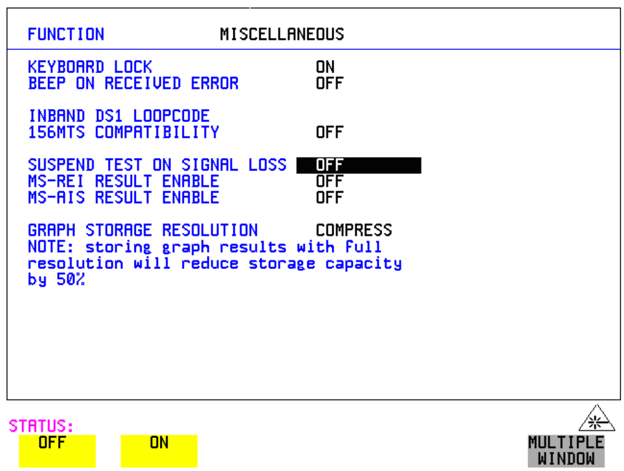
The instrument default state is with the INBAND DS1 LOOPCODE 156MTS COMPATIBILITY field set to **OFF** . In this mode the instrument operates as per the T1.403.CORE standard which states that the DS1 framing bit should overwrite the DS1 Loopcode pattern. When **ON** is selected the instrument operation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



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.



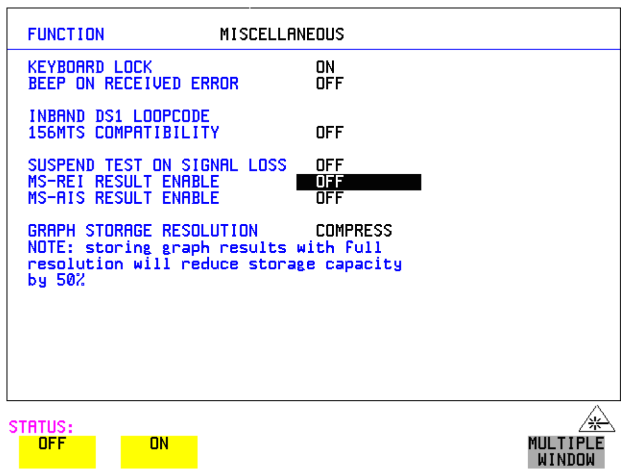
HOW TO:

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

MS-REI Result/Enable

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

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



HOW TO:

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

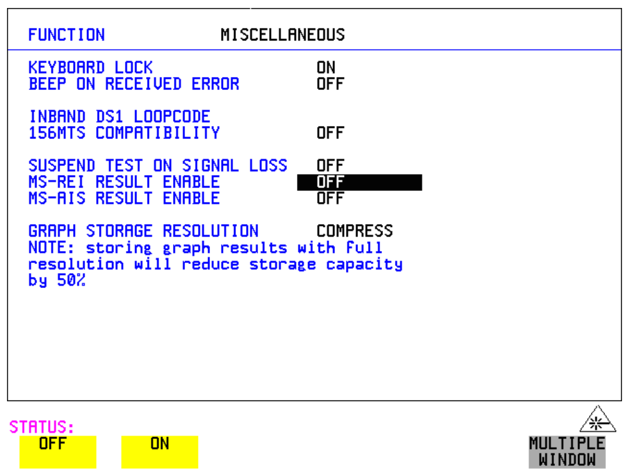
When set to **OFF**, the MS-REI and REI-L measurements are suppressed. Cumulative, Short Term and Analysis measurements are affected alike.

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

MS-AIS Result/Enable

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

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



HOW TO:

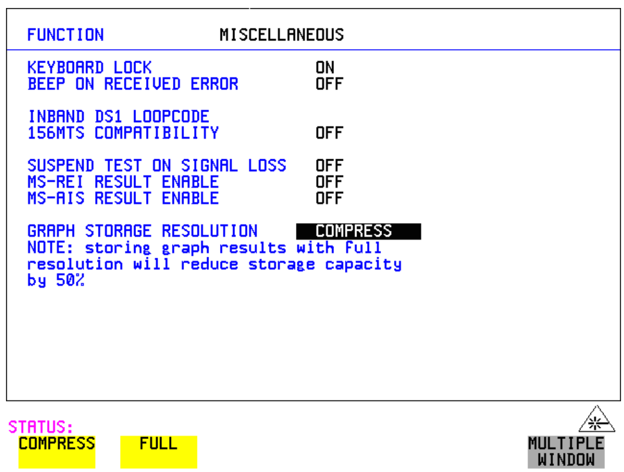
1 Choose MS-AIS ENABLE **ON** or **OFF** as required.

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

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.

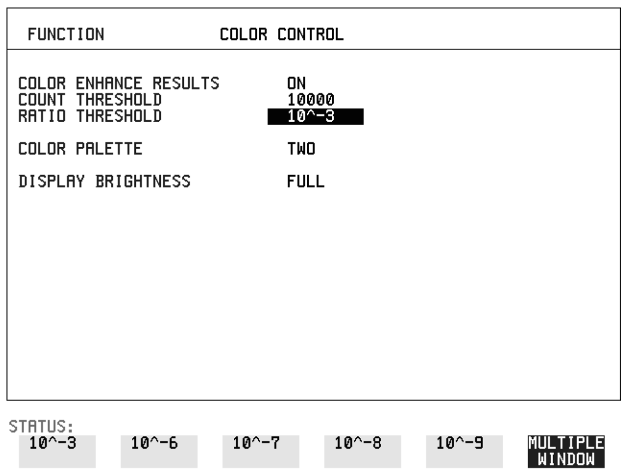


Setting Error Threshold Indication

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 718 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

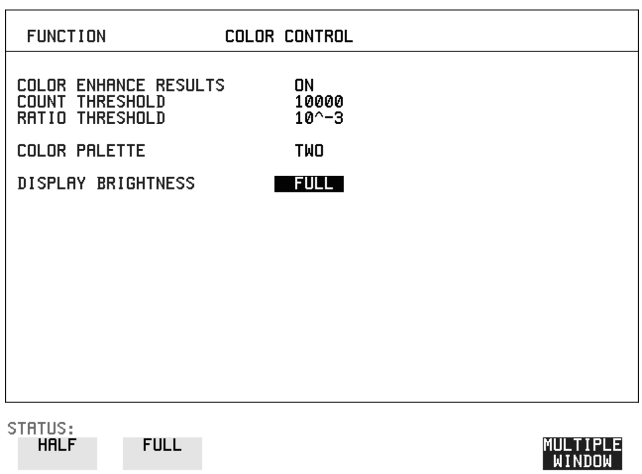
The OmniBER 718 screen can be set to single or two color using the COLOR PALETTE selection on the **OTHER**, **COLOR CONTROL** display.

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.

The function of the COUNT THRESHOLD and RATIO THRESHOLD fields is explained on the previous page.



HOW TO:

1 Choose the DISPLAY BRIGHTNESS to suit the operating environment.

To Generate a New Jitter Mask

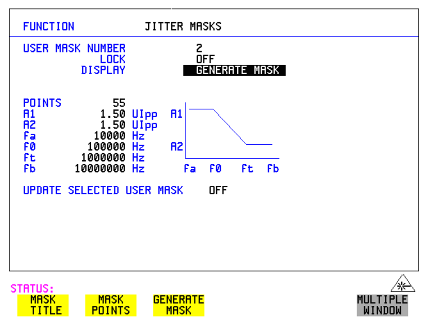
This feature enables the user to quickly generate a new mask, without having to set each point in the mask. The procedure is as follows:

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)”.

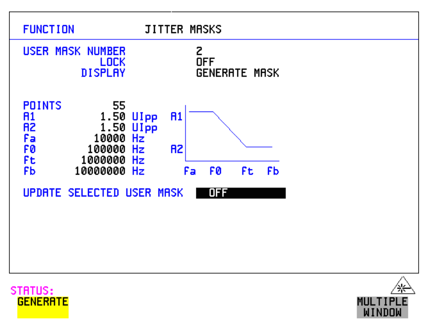
3 Position the cursor on DISPLAY and select **GENERATE MASK** .

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).

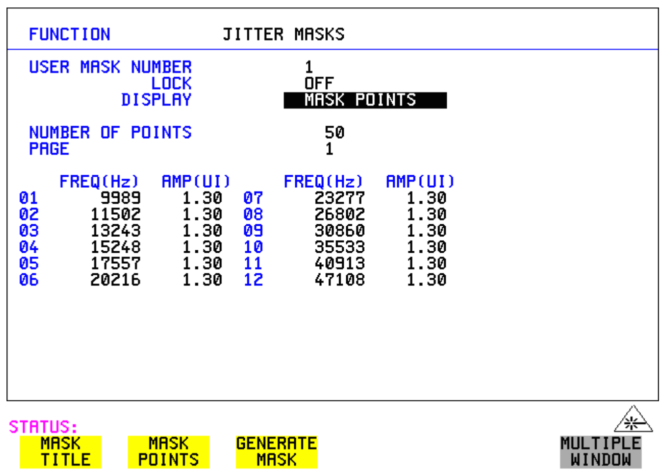
6 Position the cursor on the UPDATE SELECTED USER MASK field and select **GENERATE** .



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.

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.



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.

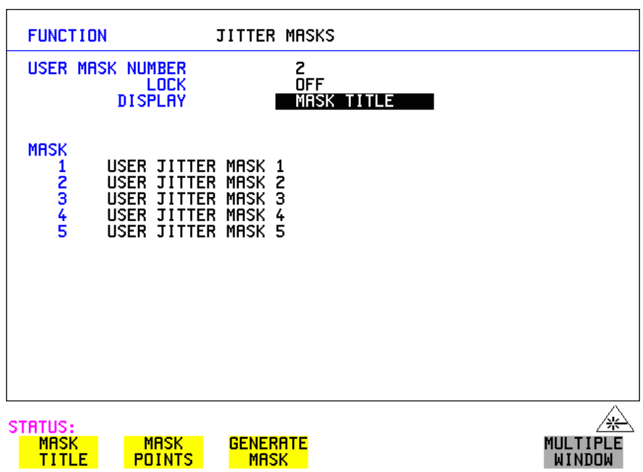
To Edit a User Mask Title

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.

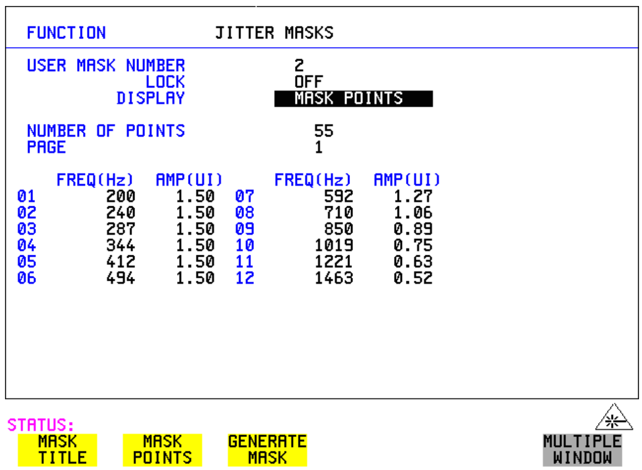
.



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.

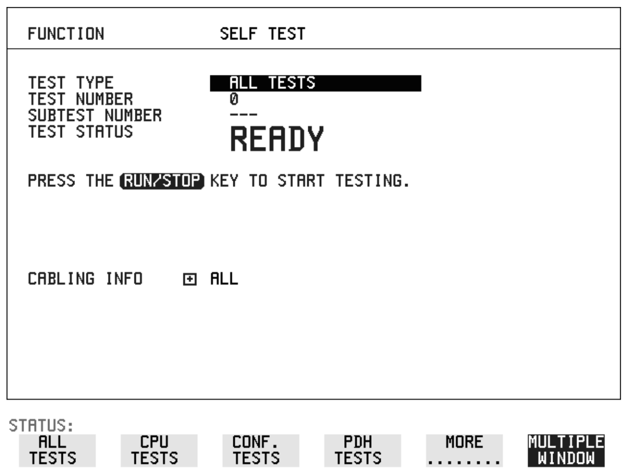


3 Note that it is not possible to edit a user mask when a user mask is currently in use (i.e. a measurement is running). When this occurs the LOCK field displays “ON (IN USE)”.

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

Running Self Test

Description Before using the OmniBER 718 to make measurements, you can run Self Test ALL TESTS to ascertain the integrity of the OmniBER 718. These tests take 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

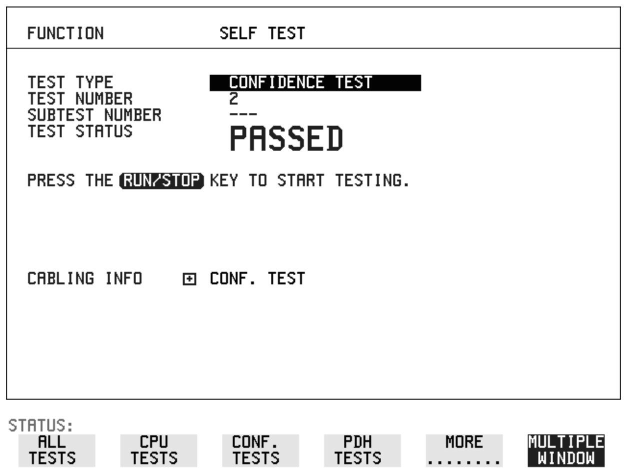
1 Choose TEST TYPE **ALL TESTS** on the **OTHER** **SELF TEST** display.

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 718 will FAIL Self Test.

4 Press **RUN/STOP** to activate the Self Test. TEST STATUS RUNNING will be displayed.
The information pertaining to TEST TYPE, TEST NUMBER and SUBTEST NUMBER will change as the Self Test progresses.
If the OmniBER 718 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 718 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.

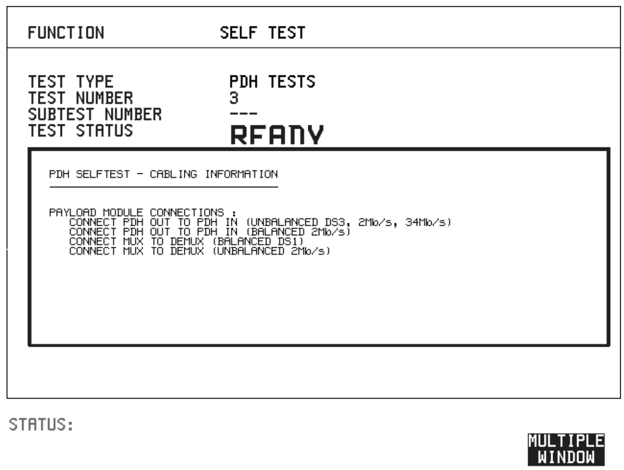
2 Insert a formatted disk into the instrument disk drive.

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.
If the OmniBER 718 is functioning correctly, after a time of 2 to 3minutes, TEST

STATUS PASSED is displayed.
If TEST STATUS [FAIL nnn] is displayed, the OmniBER 718 should be returned to a service office for repair.

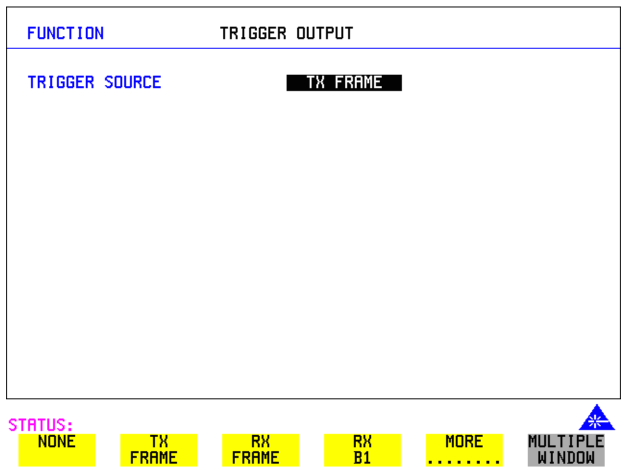
NOTE Each individual self test requires unique loopback connections. To obtain a list of the connections required move the highlighted cursor to CABLING INFO and press **SET**. The Loopbacks list will appear on the display.



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 filed as required from the following:

NONE
TX FRAME
RX FRAME
RX B1 (B1 error)
RX B2 (B2 error) or
RX B3 (B3 error)

Pulse Format

TTL Levels. Termination can be 75 ohm or 10 kohm.

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.

Appendix A

AU-3/TUG-3 Background Patterns

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

Table 7 **AU-3 Background Patterns**

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

Table 7 **AU-3 Background Patterns, continued**

Foreground	Background choice in Foreground AU-3	Background choice in other AU-3s
TU-11 (DS1) Framed	TU-11 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	TU-12, TU-11 Mapping or AU-3 Word (8 bit user programmable word).

Table 8 **TUG-3 Background Patterns**

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

Table 8 **TUG-3 Background Patterns**

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

Appendix B

ETSI/ANSI Terminology

A table of ETSI terms with their ANSI equivalents.

ETSI/ANSI Conversion and Equivalent Terms

Introduction

The terminology used on the instrument display can be ETSI (SDH) or ANSI (SONET) terminology. 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 9 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

Table 9 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÷ 3 for m ≥ 1
STM-0	STS-1
STM-1	OC3c / STS-3c
STM-4	OC-12 / STS-12
STM-16	OC-48 / STS-48
Tributary Unit (TU)	Virtual Tributary (VT)

Table 9 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	STS-3c
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 abbreviations used in the OmniBER 718.

Glossary

A

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

B

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

C

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

D

D/I	Drop and Insert
DACS	Digital Access and Cross-connect Switches
Datagram	Unit of data exchanged between a pair of internet modules.
dB	Decibel
DCC	Data Communications Channel
DCS	Digital Cross-connect Switches

DDF	Digital Distribution Frame
DDN	Digital Data Network
DTMF	Dual Tone Multifrequency Signaling
DF	The Don't fragment bit carried in the flags field
DWDM	Dense Wave Division Multiplexing
DXC	Digital Cross Connect

E

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

F

FAS	Frame Alignment Signal
FC	Foreground Channel
FCS	Frame Check sequence
FDDI	Fiber Distributed Data Interface
FEAC	Far End Alarm Channel
FEBE	Far End Block Error
FEC	Forward Error Connection
FERF	Far End Receive Failure
Flags	An internet header field carrying control flags.

G

GUI	Graphical User Interface

H

HDB3	High Density Bipolar 3
Header	Control information at the beginning of a message, datagram or block of data.
HDLC	High-level Data Link control protocol (layer2)
HEC	Header Error Control
HO Path RAI	High Order Path Remote Alarm Indication
HO PTE	High Order Path Terminating Equipment
HO	High Order
HP-IB	Hewlett-Packard Interface Bus (IEEE 488)
HP-PLM	High Path Payload Label Mismatch
HP-RDI	High Path Remote Defect Indication
HP-REI	High Path Remote Error Indication
HP-TIM	High Path Trace Identifier Mismatch
HP-UNEQ	High Path Unequipped
Hz	Hertz (cycles per second)

I

ICMP	Internet Control Message Protocol
IHL	The internet header field. Internet header length is the header length measured in 32 bit words.
IP	Internet Protocol
ISDN	Integrated Services Digital Network

ISO	International Standards Organization
ITU	International Telecommunications Union

L

LAN	Local Area Network
LCP	Link Control Protocol
LO	Low Order
LOF	Loss of Frame
LOP	Loss of Path
LOS	Loss of Signal
LP-PLM	Low Path Payload Label Mismatch
LP-RDI	Low Path Remote Defect Indication
LP-REI	Low Path Remote Error Indication
LP-RFI	Low Path Remote Failure Indication
LP-TIM	Low Path Trace Identifier Mismatch
LP-UNEQ	Low Path Unequipped
LSB	Least Significant Bit
LTE	Line Terminal Equipment
LTM	Line Terminal Multiplexer

M

MF	The more- fragments flag carried in the internet headers flag field.
MS	Multiplex Section
MS-AIS	Multiplex Section AIS
MSOH	Multiplex Section Overhead
MS-RDI	Multiplex Section Remote Defect Indication
MS-REI	Multiplex Section Remote Error Indication
MTBF	Mean Time Between Failures
MTIJ	Maximum Tolerance Input Jitter
MUX	Multiplexer

N

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

O

OAM	Operations, Administration and Maintenance
OC	Optical Carrier
Octet	An eight bit byte.
OH	Overhead
OLTU	Optical Line Terminal Unit
OOF	Out of Frame
OS	Operations System

P

P/AR	Peak-to-Average Ratio
PBX	Private Branch Exchange
PC	Personal Computer
PCM	Pulse Code Modulation
PCN	Personal Communications Network
PCR	Peak Cell Rate
PDH	Plesiochronous Digital Hierarchy
PES	Percentage Error Second
POH	Path Overhead

PPP	Point-to-Point Protocol
POS	Packet Over SONET/ SDH
POTS	Plain Old Telephone Service
PRBS	Pseudo Random Binary Sequence
PSN	Packet Switched Network
PSTN	Public Switched Telephone Network
PT	Payload Type
PTT	Public Telephone and Telegraph
PTE	Path Terminating Equipment
PU	Physical Unit

Q

QoS	Quality of Service

R

RAI	Remote Alarm Indication
RDI	Remote Defect Indication
REBE	Remote End Block Error
REI	Remote Error Indication
RF	Radio Frequency
RS	Regenerator Section
RSOH	Regenerator Section Overhead
RSTE	Regenerator Section Terminating Equipment
RS-TIM	Regenerator Section Trace Identifier Mismatch
RX	Receiver

S

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

T

TCP	Transmission Control Protocol.
TDM	Time Division Multiplexing
TDMA	Time Division Multiple Access
TE	Terminal Equipment

Time to Live	An internet header field which indicates the upper bound on how long a particular internet datagram may exist.
TMN	Telecommunications Management Network
TOH	Transport Overhead
TU	Tributary Unit
TU-AIS	TU Alarm Indication Signal
TUG	Tributary Unit Group
TU-LOM	TU Loss of Multiframe
TU-LOP	Loss of TU Pointer
TU-NDF	TU Pointer New Data Flag
TX	Transmitter

U

UI	Unit Interval

V

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

W

WAN	Wide Area Network
WDM	Wave Division Multiplexing

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About This Edition

This edition of the OmniBER 718 PDH/DSn/SDH/POS User Guide documents the product as of September 2000.

Sales and Service Offices

An up-to-date list of Agilent Offices is available through the Agilent Website at URL:
http://www.agilent.com.

Product Notes/White Papers on ATM/POS Operation

Refer to the Agilent Website at URL.
http://www.agilent.com.
for access to the following Product Notes.

- ATM error performance testing, 5968-9885E.
- Verifying the policing functions in the ATM network, 5968-9884E.
- Physical layer jitter testing in an ATM environment, 5968-9883E.
- Measuring service disruption times in high speed ATM networks, 5968-9137E.
- Packet Over SONET/SDH (White Paper), 5980-2027E.
- Packet Over SONET/SDH Functional Testing, 5980-2376E.
- Tandem Connection Monitoring, 5980-2907