Summary of capabilities

Model	SDH/SONET rates	Optional PDH/T-carrier
37718A	2.5 Gb/s, 622, 155, 52 Mb/s	2, 8, 34, 140 Mb/s DS1 (1.5 Mb/s), DS3 (45 Mb/s)
37718B	622, 155, 52 Mb/s	2, 8, 34, 140 Mb/s DS1 (1.5 Mb/s), DS3 (45 Mb/s)
37718C	155, 52 Mb/s	2, 8, 34, 140 Mb/s DS1 (1.5 Mb/s), DS3 (45 Mb/s)

Other enhancements added to the latest OmniBER 718 include:

- Smartsetup autodiscover wizard simultaneously displays all J1 trace identifiers.
- Smartsetup lets you quickly and easily explore right down into the payload of selected SDH/SONET tributaries.
- Full SDH and SONET jitter measurement and generation including DS1 and DS3.
- Real-time analysis of key performance indices MTIE, TDEV, MRTIE
- User-definable jitter tolerance and transfer masks.
- SDH-only or dual standard SONET/SDH configurations available.
- Electrical-only configuration available for 155/52 Mb/s testing.
- 2 Mb/s mapped into DS3.
- A telephone jack socket enables talk/listen on 64 kb/s channels carried in higher rate signals.
- ATM payloads available.
- POS payloads available.

Smartsetup

Not only is the OmniBER 718 analyzer rugged and portable, its easy-to-use **Smartsetup** and **Smart Tests** simplify and speed up the installation and maintenance of SDH/SONET/ATM networks.

The OmniBER 718 analyzer lets you start testing with just ***two key presses!*** With the analyzer connected to any signal, simply press the **Smart Test** key on the front panel, select **Smartsetup** and the instrument's autodiscover wizard automatically identifies the line rate and payload structure of the unknown input signal. The analyzer also automatically displays all of the J1 trace identifiers, that is 48 J1 identifiers in an OC-48 signal, or 16 in an STM-16 signal. With the signal structure now identified it's a simple process, using the cursor control keys, to select a channel of interest and to explore right down into the payload.

Smart Tests

The front panel Smart Test key offers a simple shortcut to the extensive capabilities of the OmniBER 718 analyzer. The Smart Tests are grouped together in functional blocks so you don't need to be an instrument 'expert' to get tests up and running quickly. Test capability that is accessed with only a couple of key presses include:

- Protection switch time measurement
- Optical power measurement
- Line frequency measurement
- Error and alarm summary results.

Large color display

The color VGA display on the OmniBER 718 analyzer operates in single- or multi-window mode. In multi-window mode, four windows are diplayed allowing simultaneous viewing of transmitter settings, receiver settings, graphical results and text results summary.

A VGA output is provided on the analyzer's front panel for connection to VGA projector for training purposes.

Protection switch time measurement

Service disruption measurement couldn't be simpler than with the OmniBER 718 analyzer. Using dedicated hardware, the analyzer measures the length of the error burst associated with a protection switch. Unlike the old method of correlating bit errors with time, the unique implementation in the analyzer is accurate to 50 µs with a resolution of 1 µs. Service disruption is also available on ATM signals.

SDH/SONET ring testing

Configuring SDH/SONET rings and verifying their functionality is a complex and time-consuming process. Using the comprehensive thru mode capability of the OmniBER 718 analyzer can help to speed up the task and ensure that the advantages of the SDH/SONET ring configuration will be delivered when problems arise on the live network.

The three different thru modes of operation available are:

- **Transparent:** The SDH/SONET signal is monitored and normal measurements made. The line signal is passed through unaltered without recalculation of BIPs.
- **AU-n/STS Payload overwrite:** Select an AU-n/STS SPE channel and overwrite with an internally generated payload. BIPs are recalculated and all other AU-n/STS SPEs are retransmitted unaltered. Standard transmit test functions are enabled so that it is possible to add errors, alarms, pointer adjustments etc.
- **TU-n/VT payload overwrite:** Select a TU-n/VT channel and overwrite with an internally generated payload. All other are retransmitted unaltered. Standard transmit test functions are enabled so that it is possible to add errors, alarms and pointer adjustments.

Concatenated payloads

Concatenated payloads are vital for the rapid and accurate testing of high bandwidth paths before they are brought into service. The OmniBER 718 analyzer provides concatenated payload testing at all levels of a SDH/SONET/ATM signal. As well as providing concatenated payloads at the line rate e.g. OC-48c, the analyzer lets you test SDH/SONET structures containing concatenated payloads from lower levels of the SDH/SONET hierarchy
e.g. STM-4c/STS-12c carried in STM-16/OC-48.

Remote control for manufacturing

Every OmniBER 718 analyzer is shipped with a set of Universal Instrument Drivers (UIDs) on CD-ROM. UIDs provide a suite of graphical function panels which make programming the analyzer easy and fast! There is no need to know about SCPI commands – the SCPI commands are generated automatically by setting switches on a graphical function panel.

UIDs are supported in the following environments:

- HP VEE
- Labview
- LabWindows/CVI
- Visual Basic
- C++

and on the following operating systems:

- Windows 95
- Windows NT
- HP-UX
- Sun Solaris.

Remote control for remote in-service monitoring

The Distributed Network Analyzer (DNA) software (E4540A) allows control of an OmniBER 718 analyzer from a remote PC via modem or LAN. Changes made on the virtual front panel on the PC are seen in real time at the remote site. Key presses made on the instrument at the remote site are seen in real time on the PC – ideal for remote troubleshooting by a centralized expert!

For long-term monitoring applications it is also possible to dial in to a remote OmniBER 718 analyzer, download/update results and disconnect. Disconnect and re-connect at any time without interrupting test progress.

PDH and T-carrier testing

The PDH/T-carrier test module provides comprehensive test capability for 2, 8, 34, 140 Mb/s, DS1(1.5 Mb/s) and DS3 (45 Mb/s) interfaces. For DS3 testing FEAC code generation and monitor capability is included. At DS1 both in-band and out-of-band loop code generation and monitor is also available.

The test module also provides mapped payload testing capability for SDH/SONET testing

Other supported functionality includes:

- Unframed, framed and structured (mux/demux) testing
- Error and alarm generation and measurement
- 56 kb/s, n × 56 kb/s, 64 kb/s and n × 64 kb/s testing
- DS1 add/drop from DS3 (requires option 002)
- 2 Mb/s add/drop from 8/34/140 Mb/s
- DS1/DS3 and 2/34 Mb/s add/drop from SDH/SONET
- Telephone handset connector for talk/listen capability.

Testing of 2 Mb/s mapped into DS3 is also available if required (option 014).

Jitter Testing

The OmniBER 718 can optionally perform jitter generation and measurement at all installed interface rates from 2.5 Gb/s to 1.5 Mb/s. The jitter capability in the OmniBER 718 lets you ensure that your network equipment complies with all relevant ITU-T and Bellcore jitter recommendations. Jitter test applications covered by the OmniBER 718 are:

- Output jitter measurement
- Auto jitter tolerance
- Auto jitter transfer
- Pointer jitter measurement
- Mapping jitter measurement

As well as the standard ITU-T and Bellcore masks, user definable jitter masks are included to let you specify the exact points you need to test your network equipment.

Wander analysis software

The wander analyzer software provides the real-time calculation of the MTIE, TDEV and MRTIE wander performance indices. The software is windows compatible.

What's more, the OmniBER 718 meets the latest ITU-T O.172 recommendation for test equipment.

Other features of the *OmniBER 718*

SDH/SONET

- Troublescan automatically scans for all possible error and alarm conditions
- Payload offset test
- SDH/SONET error and alarm generation/detection
- SDH/SONET tributary scan
- SDH/SONET pointer adjustments to ITU-T G.783/Bellcore GR-253-CORE
- Graphical pointer location graph
- Access to SDH/SONET overhead
- Overhead sequence generation and capture
- Text decode of APS messages for transmit and receive
- Optical stress test
- Drop/insert of DCC channels
- Optical power measurement
- Line frequency measurement
- Line frequency offset
- Choice of clock reference: Internal, recovered, external 64 kb/s, 2 M (MTS), 1.5 M (BITS), 10 MHz.
- Performance analysis to ITU-T G.821, G.826, M.2101, M.2110, M.2120
- Graphical results storage.
- Transmit and receive can be independently configured.

PDH/T-carrier (optional)

- Troublescan automatically scans for all possible error and alarm conditions
- Alarm scan
- Error and alarm generation/detection
- Choice of clock reference: Internal, recovered, external 64 kb/s, 2 M (MTS), 1.5 M (BITS), 10 MHz.
- Line frequency offset
- Signaling bits generation/detection
- Performance analysis to ITU-T G.821, G.826, M.2100, M.2110, M.2120
- Graphical results storage.
- Transmit and receive can be independently configured.

ATM (optional)

- ATM payloads up to 2.5 Gb/s.
- Comprehensive jitter test with ATM payloads.
- Fast, accurate measurements of protection switch times of ATM circuits.

POS (optional)

- POS payloads at all synchronous rates to 2.5 Gb/s.
- Channelized testing.
- PPP/HDLC and Cisco HDLC coverage.
- Verify HDLC stuffing.
- Continuity and throughput testing.
- Stress testing using traffic profiles - IP datagram size and inter-packet gap size fully configurable.
- Comprehensive jitter test with POS payloads.
- Service disruption measurement with POS payloads.

Optical transmitters

The following specifications cover both 1310 and 1550 nm transmitters unless otherwise stated.

	37718A	37718B and 37718C
Line code	NRZ	NRZ
Wavelength 1310 nm 1550 nm	 1280 to 1330 nm Typical: 1310 nm 1530 to 1570 nm Typical: 1550 nm	 1280 to 1335 nm Typical: 1310 nm 1480 to 1580 nm Typical: 1550 nm
Power	1 dBm ± 2 dB	–3 to +2 dBm
Spectral width	≤ 0.3 nm at –3 dB ≤ 1.0 nm at –20 dB	≤ 1.0 nm at –20 dB
Extinction ratio	> 10 dB	> 10 dB
Pulse mask	Meets ITU-T G.957 and Bellcore GR-253-CORE	
Fiber pigtail	Single mode	Single mode
Laser safety	Class 1 as defined by IEC825-1 and FDA 21 CFR, chapter 1, subchapter J.	

Optical receiver

	37718A	37718B and 37718C
Line code	NRZ	NRZ
Wavelength	1280 to 1335 nm and 1500 to 1580 nm	1200 to 1600 nm
Sensitivity	STM-16: –28 dBm STM-4/1/0: –28 dBm, typically –34 dBm	STM-4: –28 dBm STM-1/0: –28 dBm, typically –34 dBm
Max input power	–8 dBm	–3 dBm
Fiber pigtail	Multi-mode	Multi-mode

Notes:

1. *Sensitivity and maximum input power specifications are valid in the 0 to +45 °C temperature range.*
2. *Sensitivity and maximum input power specifications are measured at 10^{-10} error rate using a $2^{23} - 1$ test pattern.*
3. *37718A: The optical receiver operates over the range 1200 to 1600 nm. Sensitivity and maximum input power specifications are valid in defined wavelength ranges.*

Protected monitor point input (on optical modules)

52 Mb/s, 155 Mb/s and 622 Mb/s .
Line code: NRZ.
Level: Nominal 1 V peak-to-peak into 50 ohms.
Connector: SMA female.

Electrical line rates/interfaces

STM-1e (CMI) to ITU-T G.703, STM-0e (B3ZS).
Input mode: Terminate or monitor mode to ITU-T G.772.
Monitor gain: 20 dB or 26 dB
STM-1e equalization: Automatic for cable loss up to 12 dB at half the bit rate.
STM-0e operating level:
STM-0 HI: 1.1V peak nominal with cable equalization upto 450 ft.
STM-0 900ft: As STM-0 HI with added cable equalization for 450 ft to 900 ft.
Connector: BNC, 75 ohm nominal unbalanced.

Clock reference

Internal: ± 0.5 ppm; stability: ± 3 ppm; ageing: ± 1 ppm.
Loop-timed: Clock recovered from receiver's SDH input.
External reference: 2M (MTS), 1.5 M(BITS), 64 kb/s, 10 MHz.
Connector: BNC, 75 ohm nominal unbalanced, 3 pin Siemens 120 ohm balanced.

Clock trigger

Divided clock output (37718A)
51.840 MHz for STM-16/STM-4/STM-1
8.65 MHz for STM-0.
Divided clock output (37718B/C)
51.840 MHz for STM-16/STM-4/STM-1/STM-0
Connector: BNC, ECL to –2 V, ac coupled, 50 ohm.

Clock output

2 MHz reference clock output. 2.048 MHz ± 100 ppm (synchronized to clock reference).
Connector: BNC, 75 ohm nominal unbalanced.

Trigger/error output

60 µsec (nominal) pulse on B1, B2, B3 error, Tx/Rx frame (TTL level, termination can be 75 ohm or 10 kohm).
Connector: BNC, 75 ohm unbalanced.

Clock offset

± 999 ppm in 0.1 ppm steps.
Offset accuracy up to 100 ppm ± 0.02 ppm.
Offset accuracy 100 to 999 ppm ± 0.2 ppm.
Offsets the transmitted STM-n line frequency versus the selected clock reference.

SDH payload structure

See Figure 1 "SDH payload mapping" for details of payload mapping.

Verifies the payload mapping/demapping functions used to ensure a payload is carried through the SDH network, so that it is delivered correctly at its destination, as per the recommendations in ITU-T O.181.

SDH multiplexing structure (includes AU-4 and AU-3 mappings to ITU-T G.707).

STM-16: bulk filled VC-4-16c, VC-4-4c (concatenated payloads).
STM-4: bulk filled VC-4-4c (concatenated payloads).
140Mb/s:
VC-4→STM-N (bulk filled, unframed, framed, structured).
34Mb/s:
VC-3→TU-3→VC-4→ STM-N (bulk filled, unframed, framed, structured).

VC-3→AU-3→STM-N (bulk filled, unframed, framed, structured).
DS3:
VC-3→TU-3→VC-4→STM-N (bulk filled, unframed, framed, structured).
VC-3→AU-3→STM-N (bulk filled, unframed, framed, structured).
TU-2:
TU-2→TU-3→VC-4→STM-N (bulk filled TU-2-Nc concatenated payloads).
TU-2→VC-3→AU-3→STM-N (bulk filled TU-2-Nc concatenated payloads).
2 Mb/s (async/FI byte sync):
VC-12→TU-12→VC-4→STM-N (bulk filled, unframed, framed, structured).
VC-12→TU-12→VC-3→AU-3→STM-N (bulk filled, unframed, framed, structured).
DS1:
VC-11→TU-12→VC-4→STM-N (unframed, framed, structured).
VC-11→TU-11→VC-4→STM-N (unframed, framed, structured).
VC-11→TU-11→VC-3→AU-3→STM-N (unframed, framed, structured).

The foreground VC-4/VC-3 test signal can be mapped into any one or all channels. The background channels can be identical to the foreground or filled with a different structure.

Notes:
1. *Option 012 (PDH/T-carrier testing) is required for 2/34/140Mb/s/DS1/DS3 mappings.*
2. *STM-16 mappings only available on 37718A fitted with optical interface option (option 104, 105 or 106).*
3. *STM-4 mappings only available on 37718A or 37718B fitted with optical interface option (option 104, 105 or 106).*

Mixed payloads generation

With TU-3 or TU-11or TU-12 as foreground signal the background structure can be configured to be any valid combination of TU-3 or TU-11 or TU-12.

Payload offset

± 100 ppm in 1 ppm steps, linearity 0.5 ppm.
The line rate of the PDH signal, within the SDH container, is offset with respect to the container in which it is carried. Required for mapping jitter tests.

Payload test pattern

2^9-1, $2^{11}-1$, $2^{15}-1$, $2^{23}-1$ (inverted or non-inverted), all ones, all zeros, 1010, 1000, 16 bit user word.
DS1 only: QRSS ($2^{20}-1$; 14 zero limited), Daly (55-octet) 1-in-8, 2-in-8.

PDH/DSn drop/insert

Requires option 012 (T -carrier testing).
2/34/140 Mb/s, DS3 dropped and/or inserted into STM-n line signal (supported for asynchronous mappings only). In addition, DS1 drop/insert is available with option 002.

SDH tributary scan

Automatically test BER on each SDH tributary for error free operation. Rx setup is used to determine tributary structure and test pattern. (At STM-16/STM-4 the foreground STM-1 will be scanned).
Alarms: Pattern loss.
User selectable BER threshold: Off, >0, $\geq 10^{-3}$,$\geq 10^{-6}$.

SDH error add

Data (whole frame)[1], frame (A1,A2)[1], B1, B2, MS-REI, HP B3, HP-REI, AU4-IEC, LP BIP-2, LP-REI, bit[1].

Control: Single, error all, M.P x 10^{-n} (where M.P = 0.1 to 9.9 in 0.1 steps and n = 3 to 9[2]).

1. *No "Error All" selection available.*
2. *Max Error Rate depends on the Error Type*

SDH alarm generation

LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-RDI, HP-unequipped, TU-AIS, LP-RDI, TU-LOP, LP-unequipped, H4 LOM.
Control: On/off.

SDH pointer adjustments

Frequency offset: Offset the VC-n,TU-n relative to the line rate. In the AU pointer mode the 87:3 sequence is generated. Frequency offset control (±100 ppm in 0.1 ppm steps).
ITU-T G.783 sequences: Initialisation sequence and cool down period

1. Periodic Single,
2. Periodic Burst,
3. Periodic Phase Transient Burst,
4. Alternating Single,
5. Alternating Double,
6. Regular with Added,
7. Regular with Missing.

Programmable interval between regular adjustments.
Regular: Interval between regular adjustments can be programmed as follows:
10 ms < T <100 ms in 10 ms steps.
100 ms < T < 1 s in 100 ms steps.
1 s, 2 s, 5 s or 10 s.
Single burst: Incrementing burst, decrementing burst, alternating.
Burst size: 1 to 10 adjustments (AU and TU-3),1 to 5 adjustments (TU-2 and TU-12).
Adjustments within the burst are separated by the minimum legal limit (4 frames/multiframes).
New pointer: New pointer address transmitted with or without a NDF. VC-n payload moves to the user programmed address immediately.

SDH overhead setup

RSOH: All bytes (hex/binary) user settable except B1.
J0: 16 (15 +1 CRC) byte user defined or pre-defined trace identifier.
MSOH: All bytes (hex/binary) user settable except B2, H1, H2 and H3. (The SS bits in H1 col1 are settable), APS/MSP messages (K1K2) synchronization status messages (S1).
VC-4/VC-3 POH: All bytes (hex/binary) user settable except B3.
J1: 64 or 15 byte user defined or pre-defined trace identifier.
TU-2/TU-12/TU-11 POH: V5, J2, N2, K4 (hex/binary) user settable.
J2: 16 (15 + 1 CRC) byte user defined or pre- defined trace identifier.

SDH overhead monitor

RSOH, MSOH, VC-4/VC-3 POH, TU-2/TU-12/TU-11 LPOH all bytes (hex/binary). Text decodes provided for regenerator section trace identifier(J0), synchronization status (S1), ASP/MSP messages (K1K2), path trace identifiers (J1, J2), signal label (C2), low order path signal label (V5).

APS/MSP messages

Linear (ITU-T G.783) or ring architecture (ITU-T G.841) textual based protection switching messages can be transmitted and decoded.

For linear topologies APS messages can be active or passive. In passive, static messages can be generated and received. The active APS selection gives relative response to provide switch keep-alive capability by responding to change requests that appear on the K1/K2 byte values.

SDH overhead sequence generation

Sequence of up to 5 values transmitted in a selected overhead channel. The transmit duration for each value is user programmable in range 0 to 64000 frames.

Overhead channel:
RSOH: A1-A2 (6 bytes), D1-D3 (3 bytes), J0, Z0 ,E1, F1
MSOH: D4-D12 (9 bytes), K1K2 (2 bytes), S1, M1, Z1, Z2, E2
HPOH: J1, C2, G1, F2, H4, F3, K3, N1.

SDH overhead sequence capture

A single overhead channel can be selected to be captured. The display can be triggered manually or on a user-defined value. The first 16 values including the trigger are displayed along with the number of frames for which the pattern has persisted, each value being the width of the channel under test.
Overhead channel:
RSOH: A1-A2 (6 bytes), D1-D3 (3 bytes), J0, Z0 , E1, F1.
MSOH: H1H2 (2bytes), D4-D12 (9 bytes), K1K2 (2 bytes), S1, M0, M1, Z1, Z2, E2.
HPOH: J1, C2, G1, F2, H4, F3, K3, N1.

SDH overhead BER

2^9–1 PRBS transmitted and analyzed in a single 64 kb/s overhead channel. Single bit errors can be inserted in the transmitted test pattern.
Overhead channel:
RSOH: D1 to D3 (single byte), J0, E1, F1.
MSOH: D4 to D12 (single byte), K1, K2, S1, M1, M0, E2.
HPOH: J1, C2, G1, F2, H4, F3, K3, N1.
Results: Error count, error ratio, error free seconds, % error free seconds, pattern loss seconds

Optical stress test

Payload is overwritten with a block of zeros or ones after scrambling to stress timing recovery circuits.
Range:
2 to 85 bytes – STM-0.
2 to 259 bytes – STM-1.
2 to 1042 bytes – STM-4.
2 to 4174 bytes – STM-16.
CID test: Consecutive 1s digital test to ITU-T G,958 Appendix 1.

DCC add-drop

D1-D3 (192 kb/s), D4-D12 (576 kb/s)
Serial add-drop of DCC channels via RS-449 (15-pin D-type connector).

SDH thru mode

STM-16, STM-4, STM-1, STM-0 through mode
Transparent mode: Signal passes through unaltered. BIPs are not recalculated.
Overhead overwrite: The test features associated with the SOH/POH can be enabled to alter one single or multi-byte overhead channel ie, errors and alarms, overhead sequences, stress sest, APS/MSP messages, DCC insert, overhead BER. In this mode the B1,B2 BIPs are recalculated.
AU-4/AU-3 payload overwrite: Overwrite the complete selected AU-4/AU-3 with the internally generated payload. Enables the other AU-4/AU-3s to be looped while a new payload is inserted. The test features associated with the VC-4/VC-3 and/or the POH are enabled,
ie, errors and alarms, adjust pointer, overhead sequences, stress test, overhead BER.
TU-3/TU-12 payload overwrite: Overwrite the complete selected TU with the internally generated payload. Enables the other TUs to be looped while a new payload is inserted. The test features associated with the VC-n and/or the POH are enabled, ie, errors and alarms, adjust pointer.

SDH alarm detection

LOS, OOF, LOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-RDI, H4-LOM, TU-AIS, TU-LOP, TU-RDI, pattern loss, clock loss, K1/K2 change, power loss, pointer adjust.

SDH error measurements

Measurement control: Manual, single, timed start, power loss.
Error: Frame (A1A2), B1, B2, MS-REI, B3, HP-REI, HP-IEC, LP-REI, LP-BIP-2, bit.
Basic results: Error count, error ratio, elapsed time.
Performance analysis: ITU-T G.826, G.821, M.2101, M.2110, M.2120.

Service Disruption test
Note: *Requires Option 012*

Measures error burst length for measurement of service disruption during protection switching times to ITU-T G.783 (linear architecture)/G.841 (ring network topology).
Accuracy: 50 µs. for unframed signals
NOTE: It is recommended that unframed signals are used to measure service disruption as frame sync times will affect the measurement.
Results: longest burst length, shortest burst length, last burst length.
Resolution: 1 µs.

Start Condition: Any error.

Stop Condition: Error burst assumed complete when between 200 – 300ms have elapsed witout any errors being received.

Measurement Period: Elapsed time between the first bit error received and the last error received when the Start and Stop Conditions have been met.

NOTE: Option 350 is required for the following service disruption and AIS functionality.
OmniBER now provides timestamping of the first 10 service disruption events and the first 10 AIS duration measurements.

Service disruption has been extended to cover the following SDH and SONET tributaries.
- ❑ STS-48c
- ❑ STS-12c
- ❑ STS-3c
- ❑ STS-1

Service Disruption Measurement Parameters

Display Resolution: 1 µs

Measurement accuracy: 50 µs or better (for unframed signals)

Pattern: All current supported PRBS patterns (2^9-1, $2^{11}-1$, $2^{15}-1$, $2^{20}-1$, $2^{23}-1$) normal or inverted.
Bulk fitted.
POS
ATM (Using ITU-T 0.191 test cell)

Start Condition: Single PRBS bit error.

Stop Condition: Error burst assumed complete when >200ms has elapsed without any errors being received.

Measurement Period: The elapsed time between the first bit error received and the last error received once the start and stop conditions have been met.

AIS Duration Measurement Parameters	**Display Resolution:** 1 μs **Measurement accuracy:** 125 μs (1 frame) **Start Condition:** Detection of an all ones pattern in the H1 and H2 bytes, present for three consecutive super-frames (i.e. detection of AIS-P/AU-AIS). **Stop Condition:** The absence of all ones in the H1 and H2 bytes.
AlarmScan/ alarm & BIP scan	Automatically scans the SDH network hierarchy for alarms and BIP errors or alarms only with a graphical display of the network hierarchy's status including identification of unequipped channels. **Alarms:** LOP, HP AIS, HP RDI, H4 LOM, TU LOP, LP AIS,LP RDI **BIP Errors:** Lowest level BIP errors ie, B3 or BIP-2
TroubleScan	Scans all possible error and alarm sources simultaneously. Non-zero error counts are displayed in large characters, up to a maximum of four different error counts.
Pointer location graph	**Graphical display:** Shows the variation with time of the AU-n and TU-n pointer location. Up to four days of pointer location activity can be monitored. **Implied VC offset:** Calculated from the total +ve and –ve pointer movements since start of the measurement period.
Pointer results	AU and TU justifications (pointer value, positive count, positive seconds, negative count, negative seconds, NDF seconds, missing NDF seconds, implied AU-TUoffset).
Optical power measurement	**Accuracy:** ± 2 dB; Range: –10 dBm to –30 dBm. **Wavelength:** 1310 nm or 1550 nm. **Resolution:** 0.1 dBm.
Frequency measurement	**STM-16:** Frequency displayed in kHz with a 0.1 kHz resolution. Offset in ppm/kHz ≤ **STM-4:** Frequency displayed in Hz with a 1 Hz resolution. Offset in ppm/Hz. **Accuracy:** ± 1 Hz ± (internal clock error[1]) × frequency. [1] *See 'clock reference' for details on internal clock error.*
Stored measurement graphics	10 internal SMG stores (increases with floppy disc drive – number of stores limited only by free disc space). **Bar chart:** Results versus time periods with up to 1 second resolution. **Alarm chart:** Alarms versus time periods with up to 1 second resolution. **Resolution:** 1 sec, 1 min, 15 min, 60 min. **SDH bar graphs:** Frame (A1A2), B1, B2, MS REI, B3, HP REI, HP IEC, LP REI, LP BIP, bit. **SDH alarms:** LOS, LOF, OOF, AU LOP, AU NDF, AU missing NDF, MS AIS, MS RDI, K1K2 change, HP AIS, HP RDI, H4 LOM, TU LOP, TU NDF, TU missing NDF, LP AIS, LP RDI, pattern sync loss, power loss.
Tandem connection monitoring	**Selection:** High order (N1), low order (N2), OFF. **Alarm generation:** TC-LOM, TC-IAIS, TC-RDI, TC-ODI. **Error generation:** TC-REI, TC-IEC, OEI, TC-BIP **APID generation:** 16 byte (15 user byte + 1 CRC) user-definable message. **Alarm detection:** TC-LOM, TC-IAIS, TC-RDI, ODI. **Error detection:** TC-REI, TC-IEC, OEI, TC-BIP. **APID detection:** Access point identifier is captured and dis-layed in text.