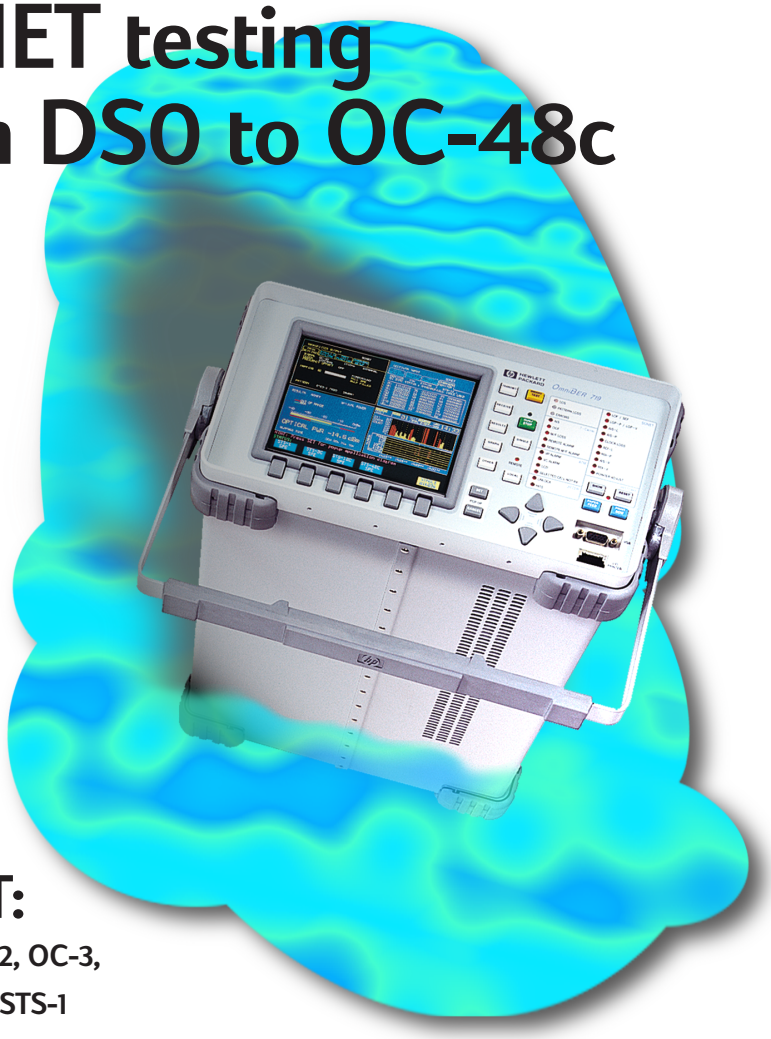
HEWLETT PACKARD

Specification

HP | OmniBER 719 | Communications Performance Analyzer

SONET testing from DS0 to OC-48c



SONET:

OC-48, OC-12, OC-3,
OC-1, STS-3, STS-1

T-carrier:

DS3, DS1, E1, E2, E3 (full mux/demux to DS0)

Contents

Introduction

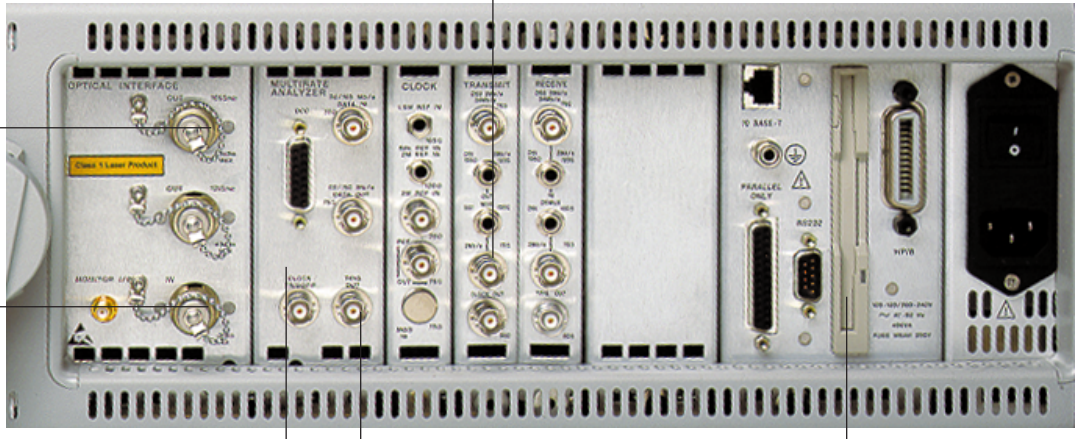
HP OmniBER 719

communications performance analyzer

The HP OmniBER 719 communications performance analyzer offers a single box field portable multi-rate SONET tester up to 2.5 Gb/s (OC-48). The analyzer is ideally suited to installation, maintenance, commissioning, system verification and manufacture of SONET transport networks and network equipment.

The latest enhancements to the HP OmniBER 719 analyzer include a choice of instrument variants for multi rate testing. This new choice allows you to buy the SONET test configuration you need today and upgrade in the future as your testing needs move to higher SONET rates.

Side view



Summary of capability

Model	SONET rates	Optional T-carrier/PDH
HP 37719A	OC-48, OC-12, OC3, OC-1 STS-3, STS-1	DS1, DS3, E1, E2, E3
HP 37719B	OC-12, OC3, OC-1 STS-3, STS-1	DS1, DS3, E1, E2, E3
HP 37719C	OC3, OC-1 STS-3, STS-1	DS1, DS3, E1, E2, E3
HP 37719C	STS-3, STS-1	DS1, DS3, E1, E2, E3

Other enhancements added to the latest HP OmniBER 719 include:

- Smartsetup autodiscover wizard simultaneously displays all J1 trace identifiers.
- Smartsetup lets you quickly and easily explore right down into the payload of selected SONET tributaries.
- A telephone jack socket enables talk/listen on DS0 channels carried in higher rate signals.
- SONET-only configurations available.
- Electrical-only configuration available for STS-3/STS-1 testing.
- E1 mapped into DS3.
- DS1 floating byte sync mapping.
- DS1 in-band and out-of-band loop code generation and monitor.
- New test patterns:
  Daly (55 octet), 1-in-8, 2-in-8.

Main features

Smartsetup

Not only is the HP OmniBER 719 analyzer rugged and portable, its easy-to-use **Smartsetup** and **Smart Tests** simplify and speed up the installation and maintenance of SONET networks.

The HP OmniBER 719 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. For SONET signals the analyzer also automatically displays all of the J1 trace identifiers, that is 48 J1 identifiers in an OC-48 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 HP OmniBER 719 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 HP OmniBER 719 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 HP OmniBER 719 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 (patent pending for DSn) is accurate to 50 µs with a resolution of 1 µs.

SONET ring testing

Configuring SONET rings and verifying their functionality is a complex and time-consuming process. Using the comprehensive thru mode capability of the HP OmniBER 719 analyzer can help to speed up the task and ensure that the advantages of the SONET ring configuration will be delivered when problems arise on the live network.

The three different thru modes of operation available are:

- **Transparent:** The SONET signal is monitored and normal measurements made. The line signal is passed through unaltered without recalculation of BIPs.
- **STS Payload overwrite:** Select an STS SPE channel and overwrite with an internally generated payload. BIPs are recalculated and all other SPEs are retransmitted unaltered. Standard transmit test functions are enabled so that it is possible to add errors, alarms, pointer adjustments etc.
- **VT payload overwrite:** Select a VT channel and overwrite with an internally generated payload. All other VTs 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 HP OmniBER 719 analyzer provides concatenated payload testing at all levels of a SONET signal. As well as providing concatenated payloads at the line rate e.g. OC-48c, the analyzer lets you test SONET structures containing concatenated payloads from lower levels of the SONET hierarchy e.g. STS-12c carried in OC-48. See Figure 1 for the full range of possibilities.

Remote control for manufacturing

Every HP OmniBER 719 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 (HP E4540A) allows control of an HP OmniBER 719 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 HP OmniBER 719 analyzer, download/ update results and disconnect. Disconnect and re-connect at any time without interrupting test progress.

T-carrier and En testing

The T-carrier test module provides comprehensive test capability for DS1, DS3, E1, E2 and E3 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 T-carrier test module also provides mapped payload testing capability for 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
- E1 add/drop from E2/E3
- DS1/DS3 and E1/E3 add/drop from SONET
- Telephone handset connector for talk/listen capability.

Testing of E1 mapped into DS3 is also available if required.

Other features of the HP OmniBER 719 analyzer

SONET

- Troublescan automatically scans for all possible error and alarm conditions
- Payload offset test
- SONET error and alarm generation/detection
- SONET tributary scan
- SONET pointer adjustments to GR-253
- Graphical pointer location graph
- Access to 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, 1.5 Mb/s (BITS), 10 MHz
- Performance analysis to ITU-T G.821, G.826, M.2101, M.2110, M.2120
- Graphical results storage.

T-Carrier

- Troublescan automatically scans for all possible error and alarm conditions
- Alarm scan
- Error and alarm generation/detection
- DS1/DS3 thru mode
- Choice of clock reference: Internal, recovered, external 64 kb/s, 1.5 Mb/s (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.

SONET

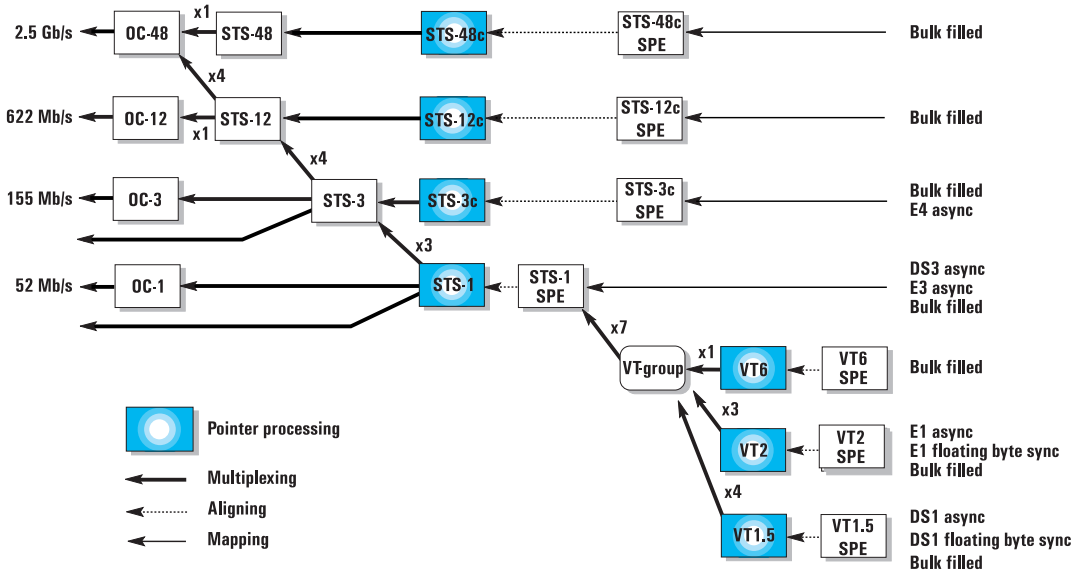


Figure 1: Bellcore GR-253 mapping structure (SONET payload mapping)

Optical interfaces

	HP 37719A	HP 37719B	HP 37719C
Wavelength Option 104 Option 105 Option 106	 1310 nm 1550 nm 1310/1550 nm	 1310 nm 1550 nm 1310/1550 nm	 1310 nm 1550 nm 1310/1550 nm
Rates	OC-48/12/3/1	OC-12/3/1	OC-3/1
Connectors	FC/PC (standard) SC (option 610) ST (option 611) ***Notes:*** *Optical interfaces on the HP 37719A use a customer exchangeable connector system. On HP 37719B and 37719C models, a fixed optical connector system is used (supports removal for cleaning).*		

Optical transmitters

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

	HP 37719A	HP 37719B and 37719C
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	0 to +3 dBm Typical: +1 dBm	–3 to +2 dBm Typical: 0 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 Bellcore GR-253-CORE and ITU-T G.957	
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

	HP 37719A	HP 37719B and 37719C
Line code	NRZ	NRZ
Wavelength	1280 to 1335 nm and 1500 to 1580 nm	1200 to 1600 nm
Sensitivity	OC-48: –28 dBm OC-12/3/1: –34 dBm	OC-12: –28 dBm OC-3/1: –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 +40 °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. *HP 37719A: 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	52 Mb/s, 155 Mb/s and 622 Mb/s (not available on HP 37719C). **Line code:** NRZ. **Level:** Nominal 1 V peak-to-peak into 50 ohms. **Connector:** SMA female.
Electrical line rates/interfaces	**STS-3 (CMI), STS-1 (B3ZS)** **Input mode:** Terminate or monitor mode. **Monitor gain:** 20 dB or 26 dB **Equalization:** STS-3: Automatic for cable loss up to 12 dB at half the bit rate. STS-1: Automatic covering range LO, x-connect and HI. **STS-1 operating level:** STS-1 HI: 1.1V peak nominal with cable equalization up to 450 ft. STS-1 900ft: As STS-1 HI with added cable equalization for 450ft to 900 ft. **Connector:** BNC, 75 ohm unbalanced. Option 620: WECO 560 connector replaces BNC.
Clock reference	**Internal:** ± 0.5 ppm; stability: ± 3 ppm; Ageing: ± 1 ppm. **Loop-timed:** Clock recovered from receiver's SONET input. **External reference:** BITS (1.5 Mb/s), 64 kb/s, 10 MHz. Connector: Bantam, 100 ohm balanced (BITS, 64 kb/s); BNC, 75 ohm unbalanced (10 MHz).
Clock trigger	51.840 MHz divided clock output. **Connector:** BNC, ECL to –2 V, ac coupled, 50 ohm.
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 ± 0.02 ppm Offsets the transmitted OC/STS-n line frequency relative to the selected clock reference.

SONET payload structure

See Figure 1 for details of SONET payload mapping.

The foreground STS-n test signal can be mapped into any select channel in the SONET line signal. Background channels can be set to the same as to the foreground or filled with an unequipped signal structure.

Notes:

1. *Option 013 (T-carrier testing) is required for DS1/DS3/E1/E3/E4 mappings.*
2. *OC-48 mappings only available on HP 37719A fitted with optical interface option (option 104, 105 or 106).*
3. *OC-12 mappings only available on HP 37719A or 37719B fitted with optical interface option (option 104, 105 or 106).*

Payload offset

± 100 ppm in 1 ppm steps, linearity 0.5 ppm.
The mapped DSn/En signal is offset with respect to the SPE in which it is carried.

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 013 (T-carrier testing).
DS3, DS1, E3, E1 dropped from and/or inserted into OC-N/STS-N line signal (supported for asynchronous mappings only).

SONET tributary scan

Automatically test BER on each SONET tributary for error free operation. Rx setup is used to determine tributary structure and test pattern. (At OC-48/OC-12 the foreground STS-3 will be scanned).
Alarms: Pattern loss.
User selectable BER threshold: Off, >0, $\geq 10^{-3}$,$\geq 10^{-6}$.

SONET error add

Data (whole frame)[1], frame (A1,A2)[1], CV-S (B1), CV-L (B2), REI-L (M0), REI-L (M1), CV-P (B3), REI-P (G1), STS IEC, CV-V (V5), REI-V (V5), 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].
N-in-T[3], where N is the number of errors transmitted in time T,
T = 10 ms to 10000s in decade steps.
N = 0 to 640 (STS-1), 1920 (STS-3), 7680 (STS-12), 30720 (STS-48).

1. *No "error all" selection available.*
2. *Max error rate depends on the error type.*
3. *CV-L (B2) errors only.*

SONET alarm generation

LOS, LOF, OOF, AIS-L, RDI-L, AIS-P, RDI-P, LOP-P, UNEQ-P, AIS-V, LOP-V, RDI-V, UNEQ-V, H4 LOM.
Control: On/off.

SONET pointer adjustments

Frequency offset: Offset the SPE/VT relative to the line rate. In the SPE/VT pointer mode the 87:3 sequence is generated. Frequency offset control (±100 ppm in 0.1 ppm steps).
Bellcore GR-253,ANSI T1.105.03 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. Periodic with added,
7. Periodic with cancelled.

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 (SPE). 1 to 5 adjustments (VT).
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. SPE/VT payload moves to the user programmed address immediately.

SONET overhead setup

TOH: All bytes user settable except B1 B2, H1, H2 and H3. The size bits in H1 are settable.
J0: User byte; 16 byte section trace message.
S1: Clear text setup of synchronization status message.
STS POH: All bytes user settable except B3.
J1: 64 or 16 byte path trace message.
C2: Clear text setup of signal label.
VT POH: V5, J2, Z6, Z7 user settable.
J2: User byte; 16 byte VT path trace message..
V5 (VT signal label): Clear text setup of VT path signal label.

SONET overhead monitor

SOH, LOH, STS POH, VT POH all bytes (hex/binary)
Text decodes provided for section trace (J0), synchronization status (S1),
ASP/MSP messages (K1K2), STS and VT path trace messages (J1, J2),
STS and VT signal labels (C2, V5).

APS messages

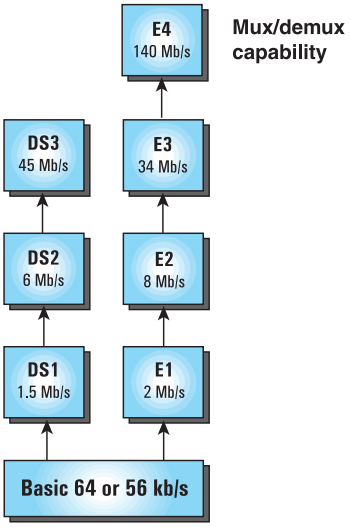
Clear text setup and decode of protection switching messages. Supports both linear (Bellcore GR-253) and ring (Bellcore GR-1230) messages.

SONET 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:** **SOH:** A1-A2 (6 bytes), D1-D3 (3 bytes), J0, Z0 ,E1, F1, media dependent bytes (row 2 col 2; row 2, col 3; row 3 col 2; row 3, col 3). **LOH:** D4-D12 (9 bytes), K1K2 (2 bytes), S1, M0, M1, Z1, Z2, E2. **POH:** J1, C2, G1, F2, H4, Z3, Z4, N1.
SONET overhead sequence capture	A selected overhead channel can be selected for capture. The capture can be triggered manually or on a user-defined receive value. The first 16 different receive values including the trigger are displayed along with the number of frames for which the value has persisted. **Overhead channel:** **SOH:** A1-A2 (6 bytes), D1-D3 (3 bytes), J0, Z0 , E1, F1, media dependent bytes (row 2 col 2; row 2, col 3; row 3 col 2; row 3, col 3). **LOH:** H1H2 (2bytes), D4-D12 (9 bytes), K1K2 (2 bytes), S1, M0, M1, Z1, Z2 E2 **POH:** J1, C2, G1, F2, H4, Z3, Z4, N1.
SONET 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:** **SOH:** D1-D3 (single byte), J0, Z0, E1, F1, media dependent bytes (row 2 col 2; row 2, col 3; row 3 col 2; row 3, col 3). **LOH:** D4-D12 (single byte), K1, K2, S1, M1, M0, E2. **POH:** J1, C2, G1, F2, H4, Z3, Z4, 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 – OC-1. 2 to 259 bytes – OC-3. 2 to 1042 bytes – OC-12. 2 to 4174 bytes – OC-48.
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).

SONET thru mode	**OC-48, OC-12, OC-3, OC-1, STS-3, STS-1 through mode:** **Transparent mode:** Signal passes through unaltered. BIPs are not recalculated. **Overhead overwrite:** The test features associated with the TOH/POH can be enabled to alter one single or multi-byte overhead channel (ie, errors and alarms, overhead sequences, stress test, APS/MSP messages, DCC insert, overhead BER) In this mode the parity bytes are recalculated. **STS payload overwrite:** Overwrite a selected STS SPE channel with an internally generated payload. All other SPEs are retransmitted unaltered. All standard transmit test functions are enabled (errors and alarms, pointer adjustments, overhead sequences, stress test, overhead BER). **VT payload overwrite:** Overwrite a selected VT with an internally generated payload. All other VTs and SPEs are retransmitted unaltered. All standard transmit test functions are enabled (errors and alarms; pointer adjustments).
SONET alarm detection	LOS, OOF, LOF, AIS-L, RDI-L, LOP-P, AIS-P, RDI-P, H4-LOM, LOP-V, AIS-V, RDI-V, pattern loss, clock loss, K1/K2 change, power loss, pointer adjust.
SONET error measurements	**Measurement control:** Manual, single, timed start. **Error:** Frame (A1,A2), CV-S(B1), CV-L(B2), CV-LFE(REI-L), CV-P(B3), CV-PFE(REI-P), CV IEC (STS path IEC), CV-V(V5), CV-VFE(REI-V), bit. **Basic results:** Error count, error ratio, alarm seconds. **Performance analysis:** G.826, G.821, M.2100. M2101, M.2110, M.2120.
Protection switch times ***Note:*** *Requires Option 013*	The 'service disruption' test measures protection switching time by measuring the duration of the error burst caused by a protection switching event (patent pending technique used with DSn signals). **Accuracy:** $< 50\mu s$. **Results:** Longest burst length, shortest burst length, last burst length. **Resolution:** $1\mu s$.
AlarmScan	Automatically identifies the payload structure then scans each STS/VT channel for alarms and BIP errors. Graphically displays the status of each STS/VT channel. **Alarms:** **STS-SPE:** LOP-P, AIS-P, RDI-P. **VT :** AIS-P, RDI-P, H4 LOM, LOP-V, AIS-V, RDI-V. **BIP errors:** B3 or V5 BIP-2 associated with each STS/VT channel.
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 STS SPE and VT pointer location. Up to four days of pointer location activity can be monitored. **Implied SPE/VT offset:** Calculated from the total +ve and –ve pointer movements since start of the measurement period.
Pointer results	SPE and VT Justifications (pointer value, positive count, positive seconds, negative count, negative seconds, NDF seconds, missing NDF seconds, implied SPE/VT offset).
Optical power measurement	**Accuracy:** ± 2 dB; Range: –10 dBm to –30 dBm. **Wavelength:** 1310 nm or 1550 nm. **Resolution:** 0.1 dBm.
Frequency measurement	**OC-48:** Frequency displayed in kHz with a 0.1 kHz resolution. Offset in ppm/kHz ≤ **OC-12:** 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:** 1sec, 1min, 15min, 60min **SONET bar graphs:** Frame (A1A2), CV-S (B1), CV-L (B2), CV-LFE (REI-L), CV-P (B3), CV-LFE (REI-P), CV-IEC (STS path IEC), CV-V (V5), CV-VFE (REI-V), bit. **SONET alarms:** LOS, LOF, OOF, LOP-P, NDF, missing NDF, AIS-L, RDI-L, K1K2 change, AIS-P, RDI-P, H4 LOM, LOP-V, VT NDF, VT missing NDF,AIS-V, RDI-V, pattern sync loss, power loss.

T-carrier testing (Option 013)



Adds T-carrier and En test capability. Testing can be performed directly at DSn/En physical interfaces or on SONET mapped payload signals.

Line rates

DS1, DS3, E1, E2, E3
Interfaces DS1: B8ZS/AMI; 100 ohm balanced (WECO Bantam).
DS3: B3ZS; 75 ohm unbalanced (BNC[1]).
E1: HDB3/AMI; 75 ohm unbalanced (BNC[1]), 120 ohm balanced (WECO Bantam).
E2: HDB3; 75 ohm unbalanced (BNC[1])
E3: HDB3; 75 ohm unbalanced (BNC[1]).
Input mode: Terminate or monitor mode.
Monitor gain:
DS1, E1/E2: 20, 26 dB or 30 dB.
DS3, E3: 20 or 26 dB.
Equalization:
DS1: DSX-1,DS1-LO 0-655ft (ANSI T1.102-1993).
DS3: DSX3, DS3-HI, DS3-900': 0-900ft (ANSI T1.102-1993).
E1/E2: 6 dB at f/2.
E3: 12 dB at f/2.
DS1 operating level: DSX-1, DS1-LO.
DS3 operating level: DS3-HI, DSX-3, DS3-900.
E1 output level: ITU-T G.703.
E2 output level: ITU-T G.703.
E3 output level: ITU-T G.703.

[1] Option 620 replaces BNC with WECO 560 connector.

Clock references

Internal: ± 0.5ppm @ 25C [± 4.5 ppm (includes ageing, stability, setting accuracy)].
DS1 only: ± 0.7ppm @ 25C [± 4.7 ppm (includes ageing, stability setting accuracy)].
Loop-timed: Clock recovered from receiver.
External reference: BITS (1.5 Mb/s), 64 kb/s, 10 MHz.
Connector: Bantam, 100 ohm balanced (BITS, 64 kb/s);
BNC, 75 ohm unbalanced (10 MHz).

Line rate offset

± 100 ppm in 1ppm steps.
Offsets the transmitted DSn/En line frequency relative to the selected clock reference.

Frame format

Framed, structured (mux/demux), unframed

	Framing	Channel structure
DS1	SF (D4), ESF, SLC-96 (ANSI T1-403-1989, TR-TSY-000499, ITU-T G.704)	56/64 kb/s, n × 56/64 kb/s
DS3	M13 (ANSI T1-107-1995), C-bit (ANSI T1-107a-1990)	DS1, 56/64 kb/s, n × 64 kb/s Option 014: E1 (ITU-T G.747)
E1	PCM30, PCM30CRC, PCM31, PCM31CRC (ITU-T G.703, G.732, G.706)	64 kb/s, n × 64 kb/s
E2	ITU-T G.742	2 Mb/s 64 kb/s, n × 64 kb/s
E3	ITU-T G.751	2/8 Mb/s, 64 kb/s, n × 64 kb/s
E4[1]	ITU-T G.751	2/8/34 Mb/s, 64 kb/s, n × 64 kb/s

[1] Supported as a mapped SONET payload (ie no physical E4 interfaces)

Test pattern

PRBS: 2^9-1, $2^{11}-1$, $2^{15}-1$, QRSS (14 zero limit – DS1 only), $2^{20}-1$, $2^{23}-1$.
Word: All 1s, all 0s, 1010, 1000, 16-bit word (frame aligned).
DS1 only: 3-in-24, 1-in 8, 2-in-8, Daly (55 octet).
Live traffic: Externally generated.
The test pattern can be inserted/measured at the line rate or at any level within the multiplexing structure, inlcuding in a selected 64/56 kb/s or n × 64/56 kb/s timeslot.

Error add

DS1: Bit, FAS (frame alignment signal), BPV/Code, CRC6, EXZ (excess zeros).
DS3: Bit, FAS, MFAS (multi-frame alignment signal), FAS+MFAS, BPV/Code, C-bit, P-bit, FEBE, EXZ.
E1: Bit, FAS, code, CRC4, REBE
E2/E3: Bit, FAS, code.
E4: Bit, FAS *(SONET payload – no interface provided)*.

Control:

Single	Selected error type transmitted when "single error" key is pressed.
Rate	1.0×10^{-3}, 1.1×10^{-3}, M.P $\times 10^{-n}$ n = 4 to 9; M.P = 1.0 to 9.9 in 0.1 steps)[1]
Burst	Single burst of n-errors. EXZ: n = 3 to 16. DS1 FAS: n = 1 to 6 DS3 FAS and MFAS: n = 1 to 4 En FAS: n = 1 to 4

[1] *Maximum error rate is 2.1 $\times$ 10^{-4} for:*
- *DS1 CRC6 errors*
- *DS3 FEBE, P-bit and C-bit errors*

Alarm generation

DS1: LOS, OOF, AIS, RAI (yellow).
DS3: LOS, OOF, AIS, Idle, RAI (X-bit), FEAC codes (Loopback and alarm/status codes).
E1: LOS, LOF, AIS, RAI, RAI (MF), CASMFL,minor alarm (via spare bits).
E2/E3: LOS, LOF, AIS, RAI.
E4: LOF, AIS, RAI *(SONET payload – no interface)*.
Control: On/off.

Spare bits generation

User-selected value transmitted in spare bits of En frame.
E4: FAS bits 14 to 16.
E3: FAS bit 12.
E2: FAS bit 12.
E1: Si bits (international bits): Timeslot 0 bit1 in both FAS and NFAS frames.
E1: E bits: CRC4 frames 13 and 15: timeslot bit 1.
E1: Sa bit (national bits): NFAS timeslot bits 4 to 8.
E1: Sa bit sequences: 8 bit sequence transmitted in any selected NFAS Sa bit.
E1: CAS multiframe: MFAS timeslot bits 5,7 and 8.

Signaling bits generation/monitor	**DS1:** Monitoring only. Displays signaling bits associated with all DS0 channels (ABCD format for ESF; AB format for SF (D4) and SLC-96). SLC-96 can display one of three states; 0,1 or alternating. **E1:** PCM30 and PCM30CRC frame formats. Transmit: User selected value transmitted in ABCD signal bits associated with all channels. Monitor: Simultaneously displays received ABCD signaling associated with all 30 channels.
FEAC codes	DS3 C-bit frame format. Transmits and monitors loopback and alarm/status codes as per ANSI T1.107-1995. **Transmit:** Use-selected loopback or alarm/status code tranmitted for controlled duration. Loopback codes: A single burst of N loopback codes and M messages transmitted (where N and M are selectable in the range 1 to 15). Alarm/status codes: Any ANSI T1.107-1995 message or any 0xxxxxx0 11111111 message may be transmitted, either in a single burst (selectable in the range 1 to 15) or continuously. **Monitor:** Displays in decoded form the two most recently received FEAC messages (current and previous messages.)
DS1 loopcodes	Transmits and monitors both in-band and out-of-band DS1 loopcodes. **In-band:** Line, payload, network, user (selectable in range 3 to 8 bits). Transmit: Selected code transmitted for 8 seconds (nominal). Monitor: Indicates the detection of a selected loop-up and loop-down code. Displays the last valid loopcode received. **Out-of-band:** Line, payload, network, universal user (11111111 0xxxxxx0). Transmit: Selected code transmitted either continuously or in a burst of n-messages (where n is selectable in range 1 to15). Monitor: Displays in decode form the two most recently received loopcodes (current and previous).
TroubleScan	Scans all possible error and alarm sources simultaneously. Non-zero error counts are displayed in large characters, up to a maximum of 4 different error counts.
PDH alarm scan	Continuously scans a received signal for alarms at the interface rate or within any sub-channel. Results presented graphically.

Error and alarm measurements	**Measurement control:** Manual, single, timed start. **Errors:** **DS1:** Bit, BPV/code, frame error, CRC6. **DS3:** Bit, BPV/code, frame error, P-bit, C-bit, FEBE. **E1:** Bit, code, frame error, CRC, REBE. **E2/E3:** Bit, code, frame error. **E4:** Bit, frame error *(SONET payload – no interface).* **Alarms:** **DS1:** LOS, pattern loss, AIS, OOF, multiframe loss, RAI (yellow), EXZ, idle. **DS3:** LOS, pattern loss, AIS, OOF, multiframe loss, RAI (x-bit), EXZ, idle. **E1:** LOS, pattern loss, AIS, LOF, RAI, RAI(MF), CASMFL. **E2/E3:** LOS, pattern loss, AIS, LOF, RAI. **E4:** LOS, pattern loss, AIS, LOF, RAI *(SONET payload – no interface)*. **Basic results:** Error count, error ratio, alarm seconds.
Performance analysis	ITU-T G.821 (bit), G.826, M.2100, M.2101, M.2110, M.2120.
Additional measurements	Line frequency (Hz and ppm offset), delay (En signals only).
Thru mode	DS1 and DS3 only. Received signal is retransmitted either unchanged or with a selected error rate injected across the entire DSn frame. All standard DSn received functions are available. **Error rate:** 1.1×10^{-3} to 1.0×10^{-9} (in 0.1 steps).
DS1/E1 add-drop	DS1 inserted and extracted from a DS3 signal. 100 ohm balanced (WECO Bantam). E1 inserted and extracted from a E2/E3/E4 signal. 75 ohm unbalanced (BNC). DS1, DS3, E1, E3 dropped from and/or inserted into an OC-N, STS-N line signal.
Handset connector	Supports adding and dropping of a selected DS0 voice channel (carried in a DSn or En signal) to an external handset. **Connector:** RJ411. **Coding:** μ-law (DSn), A-law (En).

Disk drive

Configurations	Save/recall of instrument configurations to/from floppy disk drive (in addition to the 5 internal stored settings).
Graphics	Save/recall of stored measurements graphics (SMG) to/from floppy disk drive. Extends internal event based storage from 10,000 events to 310,000 events.
Logging	Direction of logging output to floppy disk drive.
PC results format	Save SMG (stored measurement graphics) results in a CSV (comma separated variable) PC compatible format for importing to PC spreadsheets etc.
Screen dumps	Save screen dumps to disk in Windows-compatible .BMP format.
Disk management	Instrument provides the following disk drive features: Copying of instrument measurement graphics files to/from internal instrument storage to/from floppy disk drive. Copying of stored measurement graphics files from internal instrument storage to floppy disk drive. Deleting files or directories from floppy disk drive. Renaming of files. Labeling of floppy disks. Formatting of floppy disks.
Firmware upgrades	Allows the upgrading of instrument firmware from the floppy disk drive.

Graphics/logging

Max test result stores	10 internal SMG stores (stored graphics and data) (increases with floppy disk drive – number of stores limited only by free disk space).
Graphic display or printout	Bar chart (results versus time periods with up to 1 second resolution) for current or stored measurement period.
Storage capacity	10,000 events (increases to 310,000 events with floppy disk drive).
Bar resolution	1 second or 1, 15, 60 minutes.
DSn/En bar graphs	**En:** Bit, code, frame, CRC, REBE plus all En alarms. **DS1/DS3:** Bit, BPV, frame, CRC6, P-bit, C-bit, FEBE plus all DSn alarms.
SONET bar graphs	Frame errors (A1A2), CV-S (B1), CV-L (B2), CV-LFE (REI-L), CV-P (B3), CV-PFE (REI-P), CV-IEC (STS path IEC), CV-V (V5), CV-VFE (REI-V), bit plus all SONET alarms.
Printing/logging	Results, time, date and instrument control settings to internal/external printer or floppy disk drive. **Print/logging period:** 10 minutes, 1 hour, 24 hours, user-defined (10 to 99 minutes, or 1 to 99 hours).

Printers

		HP OmniBER 719 Option 602	External Printer
In-lid	80-column full-width graphics printer.	●	-
Results logging	Logging of instrument results to printer.	●	●
Graphics logging	Logging of instrument graphics results to printer.	●	●
Screen dump	Full-width printing of instrument screen to printer at press of a key.	●	-
Environmental	Printer operating temperature:	5 to 35°C	n/a
	Printer storage temperature:	–15 to +50°C	n/a
	Printer humidity range:	30% to 85% RH	n/a

Remote control/printer interface options

		601
Capability	RS-232-C printer/remote-control interface.	●
	HP-IB printer/remote-control interface.	●
	Parallel printer interface.	●
	LAN remote control interface.	●

General

Preset facility
Complete instrument configurations can be saved in non-volatile memory. Four independent configurations plus one factory default can be saved. Each store has a user-programmable name (disk drive increases storage – number of stores only limited by free disk space).

Supply
90 to 260 Vac nominal;
47 to 63 Hz, 450 VA nominal.

Dimensions
7.5 (H) × 13.40 (W) × 18.5 in (D) (× 20.10 in (D) with lid fitted).
190 (H) × 340 (W) × 470 mm (D) (× 510 mm (D) with lid fitted)

Weight
16 kg (typical); 35 lb.

Internal clock error
Basic accuracy: < 0.5 ppm at 77 °F (25 °C).
Temperature stability: < 3 ppm over operating temperature range.
Ageing rate: < 1 ppm per year.

Environmental
Operating temperature: 32 to 113°F (0 to 45 °C).
Storage temperature: 68 to 168 °F (–20 to + 70 °C).
Humidity range: 15% to 95% RH.

CE mark
ESD/Electrical fast transients/radiated susceptibility: Meets EN50082-1 (1992).
Radiation emissions/conducted emissions: Meets EN55011 (1991).

Regulatory standards

Product safety	EN 61010-1 (1993); IEC 1010-1 (1990) + A1 (1992) + A2 (1995); CSA C-22.2 No 1010.1-92.
EMC compatibility	**Immunity:** EN 50082-1 (1992); **Emmissions:** EN 55011 (1991), Group 1 Class A.
Laser safety standards	21 CFR CH.1 1040; EN 60825-1 (1994).

Accessories

Optical accessories	**HP E4545A:** 3 m fiber optic cable (FC/PC connectors) **HP E4546A:** FC/PC 15 dB attenuator.
Optical coupler	**HP 15744B:** In-lid optical coupler. **HP 15744C:** In-pouch optical coupler.
Carrying cases	**HP 15910B:** Soft, vinyl carrying case. **HP 15772C:** Hard, robust transit case.
Rack mount kit	**HP 15989A:** Rack mount kit. **HP 15990A:** Connector access panel (see publication number 5968-2793E).
Warranty	3-year warranty as standard.
Calibration certificate	**Option UK6:** Commercial calibration certificate with test data.
Graphics printer paper	**9270-1360:** Printer paper.
Telephone handset	**HP 15722A:** Telephone handset for option 013.

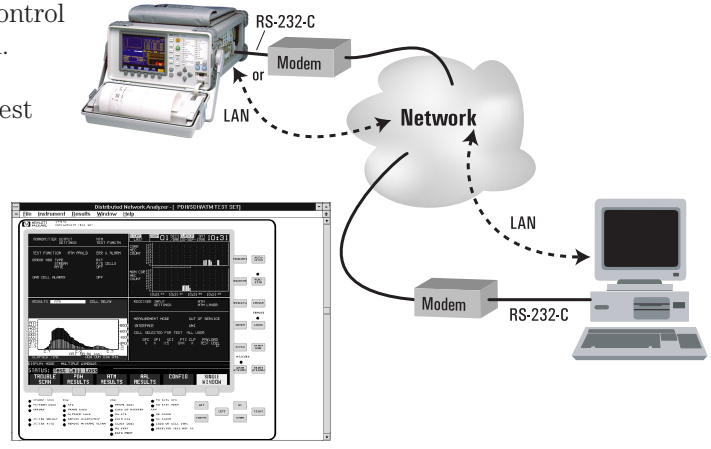
Distributed network analyzer (DNA) features

Use HP E4540A DNA software to pin-point elusive network faults and identify links with poor performance. The DNA software's long-term testing and automatic results logging capability let you easily monitor the quality of service you provide to key customers.

Monitor the network to identify performance and signal degradation. Interactively control analyzers for faster problem resolution.

Create and run your own customized test sequences effectively.

Transfer results to other Windows®-based applications and provide detailed quality-of-service information for managers and customers.



Distributed/remote testing

HP E4540A distributed network

PC/laptop/MS Windows®software (Windows 3.1, Windows NT or Windows 95) that allows control of the HP 377xx family of analyzers via a virtual instrument display. Allows remote user to store and recall instrument configurations, create and run test sequences, transfer test results to other Windows-based applications and provide quality-of-service information for managers and customers.

Option 0A9: License to use up to 10 copies.
Option UAT: License to use unlimited copies.

For full details of centralized testing using the HP OmniBER 719 analyzer and other telecom testers from HP, please ask your local HP representative for brochure 5964-2240E (distributed network analyzer software).

Also order an RS-232-C or LAN remote control interface (option 601).

Notes

Notes

HEWLETT® PACKARD

Full information on HP products is available at www.hp.com. You can also contact one of the following centers and ask for a test and measurement sales representative.

United States:
Hewlett-Packard Company
Test and Measurement Call Center
P.O. Box 4026
Englewood, CO 80155-4026
1 800 452 4844

Canada:
Hewlett-Packard Canada Ltd.
5150 Spectrum Way
Mississauga, Ontario
L4W 5G1
(905) 206 4725

Europe:
Hewlett-Packard
European Marketing Centre
P. O. Box 999
1180 AZ Amstelveen
The Netherlands
(31 20) 547 9900

Japan:
Hewlett-Packard Japan Ltd.
Measurement Assistance Center
9-1, Takakura-Cho, Hachioji-Shi
Tokyo 192-8510, Japan
Tel: (81) 426 56-7832
Fax: (81) 426 56-7840

Latin America:
Hewlett-Packard
Latin American Region Headquarters
5200 Blue Lagoon Drive
9th Floor
Miami, Florida 33126
USA
(305) 267 4245/4220
Fax: (305) 267-4288

Australia/New Zealand:
Hewlett-Packard Australia Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
Australia
Tel: 1 800 629 485 (Australia)
Tel: 0800 738 378 (New Zealand)
Fax: (61 3) 9210 5489

Asia Pacific:
Hewlett-Packard Asia Pacific Ltd.
17-21/F Shell Tower, Times Square
1 Matheson Street, Causeway Bay
Hong Kong
Tel: (852) 2599 7777
Fax: (852) 2506 9285

The information in this document is subject to change without notice

Printed in the UK
37719-90012 9/99

CE

HP OmniBER 719 is a Class 1 laser product EN60825-1: 1994

Class I laser product FDA 23 CER CH.1 1040.10 (1994)

MS Windows and Windows are US trademarks of Microsoft Corporation.

HP manufactures the HP OmniBER 719 analyzer under a quality system approved to the international standard ISO 9001 plus TickIT (BSI Registration Certificate No FM 10987).