

## HST-3000

### Option for DSL Services



#### Key Features

- All-in-one DSL tester
- Complete copper testing including DVOM, TDR, Wideband TIMS and Resistive Fault Location
- ADSL over POTS, ADSL over ISDN and G.SHDSL support with xTU-C/-R modem emulation
- All layer testing of the network including DSL, ATM, PPP and IP
- Built-in 10/100BT Ethernet allows the HST-3000 to surf through the customer's modem, isolate the PC or CPE and isolate the customer's modem in Through mode
- On-board Internet browser and FTP-download feature
- Modular hardware and software architecture is flexible and easily upgraded, allowing for the testing of multiple services
- CE Marked

Network operators and service providers are faced with a variety of test challenges to install and maintain robust and cost-effective DSL services.

DSL has been developed to make full use of the existing, and typically poor quality, copper network. Physical layer problems including attenuation, crosstalk, the presence of bridge taps or load coils, and physical faults (shorts, grounds, opens, or wet sections) can have a detrimental impact on DSL service performance and quality. Therefore, it is essential that these problems are identified and rectified quickly.

Reliable operation of DSL service is not restricted to physical layer testing of the copper network. Connectivity of the service to the DSLAM in the local exchange must also be assured. Beyond the DSLAM, connectivity and routing, both to the ATM network and ultimately to the service provider, need to be verified to ensure that the customer's expected level of service is validated.

There is also the challenge of provisioning and maintaining different DSL variants simultaneously – ADSL over POTS, ADSL over ISDN and G.SHDSL – to meet the demands of both residential and business customers.

To complicate matters, all of these challenges must be achieved within an operating environment constrained by reduced budgets, smaller workforces, and tighter deadlines.

JDSU's HST-3000 provides an effective DSL test solution to meet all of these key challenges. The HST-3000 delivers comprehensive physical layer copper testing and service testing at the DSL, ATM, IP and PPP layers. It also supports multiple DSL variants. In addition, it is capable of delivering the process improvement features that are required to enhance productivity and efficiency.

### Test the Copper

The HST-3000 offers extended copper testing to pinpoint physical layer problems quickly and easily. Features include:

- DVOM measuring AC and DC voltage, current and resistance
- Opens measurement
- Noise, balance and power influence
- Cable fault location with the graphical TDR or RFL
- Load coil detection
- Wideband TIMS
- Caller ID (CLID) testing
- POTS calls

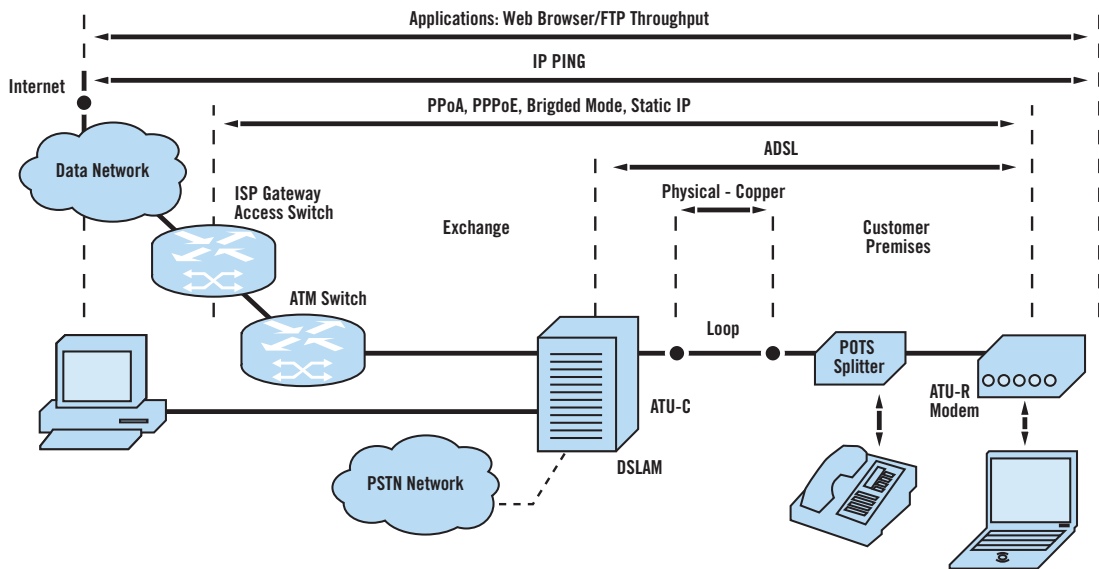


Figure 1 Complete physical and layer testing

### Test the Service

The HST-3000 can quickly confirm synchronization on the physical layer and measure link layer performance by emulating different DSL modems. Comprehensive performance statistics are provided including the actual DSL signal rate for the current connection. The connection's maximum possible rate is also determined. Additionally, SNR-per-tone and bits-per-tone are checked and displayed graphically to evaluate line quality.

xTU-R/-C modem emulation is provided by optional Service Interface Modules (SIMs). These modules are available for ADSL over POTS (AoP), ADSL over ISDN (AoI) and G.SHDSL.

ATM is the most common transport network for DSL networks. If there are problems at the ATM layer, the service will not work. It is important to identify the ATM layer as a source of any problems. ATM loopback analysis is provided. This ensures that any virtual circuit routing problem can be determined and correct end-to-end connectivity at the ATM layer can be established. Additionally, incorrect DSLAM and ATM mappings can be quickly identified and rectified to ensure customer connection to the network.

Routing connectivity across the network to an IP host or server can be verified using the IP PING mode. Packet loss rates and packet delay to and from the PING destination can be assessed to determine whether delays or slow service are due to provider error or CPE problems.

Authentication of PPPoE/PPPoA with PAP/CHAP is also included, making it possible to look past the DSLAM to verify correct mapping and connectivity to the ISP Gateway.

The HST-3000 has an optional on-board Internet browser allowing for the display of any Web page to demonstrate Internet access. Internet download testing is also available using the optional FTP-download feature, allowing for the determination of true download speeds as well as identifying delays.

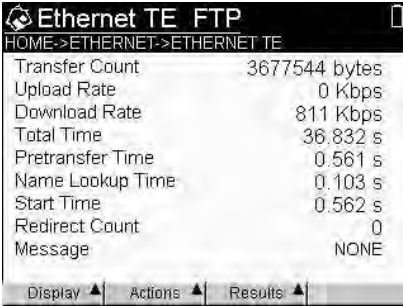


Figure 2 FTP-download analysis

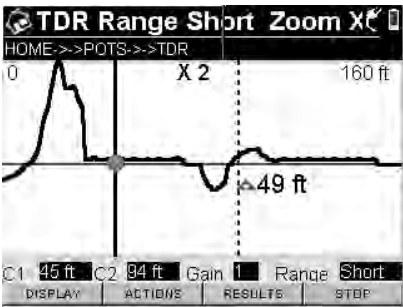


Figure 3 Time domain reflectometer

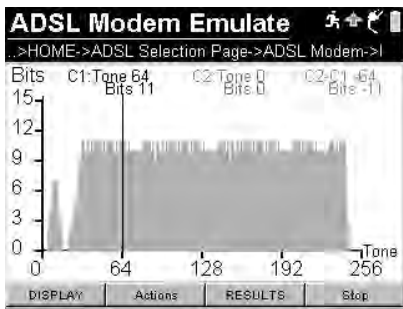


Figure 4 ADSL modem results



Figure 5 Web page

### Improve the Process

The HST-3000 provides a number of powerful features that can greatly improve the DSL installation and maintenance process, reducing costs and improving productivity and efficiency.

With one instrument to support physical copper testing, all layer service testing and multiple DSL modems, the HST-3000 ensures that services are delivered rapidly, efficiently and accurately.

The HST-3000's straightforward graphical user interface (GUI) greatly simplifies the testing process, thus reducing the amount of training required for comprehensive testing.

One-button automatic testing combined with support for all phases of DSL service deployment, reduce the number of technicians required to provision and maintain service. This simplicity also makes it possible for non-experts to operate tests.

In addition, the HST-3000's preprogrammed tests and customized scripts ensure that all technicians follow the same procedures, speeding up service delivery and minimizing installation and testing errors.

Standard Ethernet, USB and serial connections offer flexibility to easily download software and offload stored test results for later analysis.

The HST-3000's modular design not only provides a scalable, all-in-one solution for DSL testing, it can easily be upgraded with new modules and software to test other services, such as VoIP.

## Specifications

**ADSL Specifications****Standard compliance, ADSL over POTS modem**

ITU-T G.992.1, Annex A (G.DMT)

ITU-T G.992.2 (G.lite)

ETSI ETR 328

ANSI T1.413-1998, Issue 2

**Standard compliance, ADSL over ISDN modem**

ITU-T G.992.1, Annex B

**Types of Service Interface Modules (SIMs)**

ATU-R modem for ADSL over POTS (Annex A)

ATU-R/C modem for ADSL over POTS (Annex A)

ATU-R modem for ADSL over ISDN (Annex B)

ATU-R/C modem for ADSL over ISDN (Annex B)

STU-R/C modem for G.SHDSL

**General settings**

Switchable settings for Auto Sync, Trellis Coding, and Echo

Cancellation

**Physical layer feature support**

Actual and maximum bit rates

Capacity (% of used bandwidth)

Noise margin

Attenuation

Connection method

Training time

Number of syncs

Interleave depths

Coding gain

Modem state

TX power

Far vendor ID, revision, name

Event log

Graphical display of BPT (bits-per-tone)

Graphical display of SNR (SNR-per-tone)

**ADSL errors**

LOS (loss of signal)

SEF (severely errored frames)

RS corrected bytes

CRC (cyclic redundancy check)

OCD (out-of-cell delineation)

HEC (header error correction)

NCD (no cell delineation)

Modem errors

**PPP/IP connectivity (IP option)**

PPPoA, PPPoE, IPoA Terminate, and Through modes

Bridged Ethernet Terminate, and Through modes

Routing functions

Ethernet TE

Encapsulation: LLC SNAP, LLC, VC-MUX, HDLC

Address Modes: DHCP, IPCP, PAP, CHAP

NAT, DNS

**Data features (IP option)**

IP statistics: RX/TX %, lost packets, packet delay

Single or multiple PING

Trace route analysis

ATM OAM analysis

**ATM statistics**

Total RX/TX cells

TX AAL 5 frames

RX AAL 5 frames

TX dropped cells

RX CRC errors

RX AAL5 length errors

RX AAL5 aborts

Last unknown VPI/VCI

**Ethernet statistics**

RX/TX bytes

RX/TX frames

RX/TX errors

RX/TX dropped

Collisions

**G.SHDSL Specifications****Standard compliance for G.SHDSL modem emulation**

ITU-T 991.2, Annex A and Annex B

ETSI TS101 524-1

ANSI T1E1 4/99-006R6

**Feature support**

Power back-off feature

Asymmetric power spectral density feature

Fixed and adaptive rate modes

Minimal start-up noise margin for the adaptive mode

**User EOC messages**

Discovery probe

Inventory request

System loopback request (initiate)

System loopback request (terminate)

Element loopback request (initiate)

Element loopback request (terminate)

Element loopback request up to eight elements

Status request

Full status request

**Expected performance levels**

Line Length (26 AWG/4 mm)	Payload Rate (kbps)
9,000 ft / 2743 m	2304
10,000 ft / 3048 m	2112
11,000 ft / 3352 m	1664
12,000 ft / 3657 m	1344
13,000 ft / 3962 m	1088
14,000 ft / 4267 m	832
15,000 ft / 4572 m	704
16,000 ft / 4876 m	512
17,000 ft / 5181 m	384
18,000 ft / 5486 m	256

**The following payload rates are supported (kbps)**

64, 72, 128, 136, 192, 200, 256, 264, 320, 328, 384, 392, 448, 456, 512, 520, 576, 584, 640, 648, 704, 712, 768, 776, 832, 840, 896, 904, 960, 968, 1024, 1032, 1088, 1096, 1152, 1160, 1216, 1224, 1280, 1288, 1344, 1352, 1408, 1416, 1472, 1480, 1536, 1544, 1600, 1608, 1664, 1672, 1728, 1736, 1792, 1800, 1856, 1864, 1920, 1928, 1984, 1992, 2048, 2056, 2112, 2120, 2176, 2184, 2240, 2248, 2304, 2312

**PPP/IP connectivity (IP option)**

PPPoA, PPPoE, IPoA Terminate and Through modes

Bridged Ethernet Terminate and Through modes

Routing functions

Ethernet TE

Encapsulations: LLC SNAP, LLC, VC-MUX, HDLC

Address Modes: DHCP, IPCP, PAP, CHAP

NAT, DNS PPPoA Terminate and Through modes

IP statistics: RX/TX %, lost packets, packet delay

**Copper Measurement Specifications****DVOM measurements**

AC Voltage 0 to 175 V RMS (1% ±0.5 V)

DC Voltage 0 to 250 V DC (1% ±0.5 V)

DC Current 0 to 90 mA (1% ±0.5 mA)

Resistance 0 to 99 MΩ

**Resistance accuracy**

0 to 9999Ω 1% ±5Ω

10 kΩ to 99.9 kΩ ±1%

100 kΩ to 999 kΩ ±3%

1 MΩ to 9.9 MΩ ±3%

Leakage (test voltage 110 V) 0 to 99 MΩ

Distant to short distance calculation based on resistance, temperature, or wire gauge

**Opens measurement**

Displays the line capacitance or the calculated distance based on selected cable parameters

Distance range 0 to 30 km (0 to 100 kft)

Accuracy 0 to 6 km (20 kft), ±2%

**Noise and balance**

Longitudinal balance 28 to 99 dB

Noise (voice band and C filter/psopho) 0 to 50 dBm (equivalent to -40 to -90 dBm)

Power (mains) influence 40 to 120 dBmC (equivalent to +30 to -50 dBm)

**Generator**

Frequency range 200 Hz to 5 kHz (resolution of 1 Hz)

Level range 0 to -20 dBm (resolution of 1 dB)

Level accuracy 0.5 dB

Termination impedance 600Ω or 900Ω

**Receiver**

Frequency range 200 Hz to 4 kHz (resolution of 1 Hz)

Level range +10 to -40 dBm (resolution of 0.1 dB)

Level accuracy 0.5 dB

Termination impedance 600Ω or 900Ω

## Specifications

### Miscellaneous

Load coil detection/ count	0 to 5 coils (< 9km/ 27 kft)
Caller ID	name, phone number, raw data
Phone feature	DTMF phone

### TDR (optional)

Short range TDR	0 to 700 m (2 kft)
Medium range TDR	150 to 3000 m (0.5 to 10 kft)
Long range TDR user-selectable pulse width	3000 to 6000 m (10 to 20 kft)

Vp range (velocity of propagation)	0.300 to 1.000
Gain	X axis and Y axis
Graphical display	dual trace display and cursor operation for comparison with stored traces

### Resistive Fault Location (optional)

Test methods	single pair and 2nd pair hookup
Fault identification	0 to 10 M $\Omega$
Fault location accuracy	0 to 99 $\Omega$ , +0.1% 99 to 999 $\Omega$ , $\pm$ 0.2% 999 to 7000 $\Omega$ , $\pm$ 0.25%

Results display	graphical strapping diagram
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### Wide Transmission Impairments (optional)

Generator frequency range	10 kHz to 1.6 MHz
Generator level range	+5 to -20 dBm
Receiver frequency range	10 kHz to 1.6 MHz
Receiver level range	+10 to -70 dBm
Termination impedance	100 $\Omega$ , 135 $\Omega$
Noise weighting filters	E, F, G, none (IEEE Std 743)
Wideband noise level	+10 to -70 dBm
Impulse noise counter	1 to 15 min or continuous
Impulse noise threshold	E filter: 35 to 100 dBm F filter: 40 to 100 dBm G filter: 45 to 100 dBm
Spectral measurements frequency	4KHz to 3.8MHz
Spectral measurements level	+10 to -70 dBm
On-screen display of PSD masks of common disturbers	

### Transmission Impairment (optional)

#### Return Loss

Frequency range	200 Hz to 5 kHz
Measurement range	0 to 50 dB
Accuracy	$\pm$ 1 dB at 1 kHz and 20 dB $\pm$ 2 dB from 200 Hz to 5 kHz, 5 to 40 dB
Reference impedance	600 $\Omega$
Wideband Frequency Range	10 kHz to 2000 kHz
Measurement range	0 to 50 dB
Accuracy	$\pm$ 2 dB at 1000 kHz and 20 dB $\pm$ 3 dB from 10 kHz to 2000 kHz, 5 to 40 dB
Reference impedance	100 or 135 $\Omega$

### Noise and Noise with Tone

Voiceband frequency range	200 Hz to 5 kHz
Measurement range	+10 to -60 dB
Accuracy	$\pm$ 1 dB at 1 kHz and -30 dB Nominally within $\pm$ 2 dB across range

Weighting filters	C message, Psophometric, channel, 820 Hz and 1020 Hz notch
Reference impedance	600 $\Omega$ and bridging
Wideband frequency range	10 kHz to 2000 kHz
Measurement range	+10 to -60 dB
Accuracy	$\pm$ 1 dB at 1 kHz and -30 dB; $\pm$ 2 dB nominal
Weighting filters	E, F, G ANSI and ETSI

### Impulsive Noise

Voiceband frequency range	200 Hz to 5 kHz
Measurement range	0 to 50 dB
Operation	Nominally as per 0.71
Accuracy	$\pm$ 1 dB at 1 kHz and 20 dB $\pm$ 2 dB from 200 Hz to 5 kHz, 5 to 40 dB
Wideband frequency range	10 kHz to 2000 kHz
Measurement range	0 to 50 dB
Accuracy	$\pm$ 1 dB at 100 kHz and 20 dB

### Signal to Noise

Voiceband frequency range	200 Hz to 5 kHz
Measurement range	0 to 50 dB
Accuracy	$\pm$ 2 dB within range 5 to 40 dB input signal >30 dBm
Weighting filters	C or Psophometric (820 Hz or 1020 Hz notch)
Wideband frequency range	10 kHz to 2000 kHz
Measurement range	0 to 50 dB
Accuracy	$\pm$ 2 dB within range 5 to 40 dB input signal >30 dBm
Weighting filters	None, E, F, G ANSI and ETSI

### NEXT

Frequency range	10 kHz to 2000 kHz
Measurement range	0 to 50 dB at 500 kHz
Accuracy	$\pm$ 2 dB at 1 MHz and 40 dB and +5 dBm launch level
Weighting filters	None, E, F, G ANSI and ETSI
Launch level	0 dBm, -10 dBm, +5 dBm

### FEXT

Frequency range	10 kHz to 2000 kHz
Measurement range	0 to 50 dB at 500 kHz
Accuracy	$\pm$ 2 dB at 1 MHz and 40 dB If launch level is +5 dBm and line loss <20 dB
Weighting filters	None, E, F, G ANSI and ETSI

### FTP-download Feature (optional)

#### On-board Internet Browser (optional)

## General Specifications

### Power Supply

Batteries	Lithium Ion, removable battery pack
Operating time	approximately 6 to 10 h of typical usage
Auto switch-off	1 to 15 min after last action, or off
Charging time, internal	7 h from empty to full charge
AC line operation via external adapter/charger	

### Permissible Ambient Temperature

Nominal range of use	-14°C to +50°C
Storage and transport	-25°C to +70°C
Operating humidity	10% to 80% relative humidity
Storage humidity	10% to 95% relative humidity

### Physical Specifications

Size (H x W x D)	240 x 114 x 70 mm
Weight, including batteries	1.23 kg
Display	1/4 VGA monochrome transfective, 9.6-cm diagonal (readable in direct sunlight)

### General Specifications

Ruggedness	Survives 0.9 m (3 ft) drop to concrete on all sides
Water-resistant, splash proof	May be used in heavy rain
Multi-language	English, German, French, Spanish, Italian
Keypad	12-button keyboard with cursor keys and soft keys
CE Marked	

## Specifications

### Ordering Information

#### Base Units

HST-3000C	HST-3000C base with copper testing Requires the purchase of a SIM, see separate listing for HST3000-CAR (Ethernet and serial ports included)
HST-3000	HST-3000 base without copper testing Requires the purchase of a SIM, see separate listing for HST-3000-AR (Ethernet and serial ports included)

#### SIMs (Modules)

HST3000-4WLL	4 wire local loop
HST3000-T1	Dual Tx/Rx bantam T1 interface and T1 software option
HST3000-CT1	Dual T/R/G interface for copper Testing and Dual Tx/Rx bantam T1
HST3000-T3	Dual Tx/Rx bantam T1 interface, and dual Rx, single Tx BNC DS3 interface and DS3 software option
HST3000-BRI	ISDN BRI option
HST-ARCE	ADSL (ATU-R) option
HST-CAR	Copper (ATU-R) option
HST-CU	Dual T/R/G Interface to copper test option
HST-GSH	G.SHDSL option
HST3000-CuCE	Cu only SIM, CE mark
HST3000-CARCE	Cu & ATU-R (Annex A) SIM, CE mark
HST3000-ARCA	ATU-R/C dual mode SIM, AoPOTS
HST3000-CARCA	Cu & ATU-R/C dual mode SIM, AoPOTS
HST3000-ARB	Annex B ATU-R SIM
HST3000-CARB	Annex B Cu/ATU-R SIM
HST3000-ARCB	ATU-R/C dual mode SIM, AoISDN
HST3000-CARCB	Cu & ATU-R/C dual mode SIM, AoISDN
HST3000-CSHCE	G.SHDSL & Cu SIM
HST3000-BLK	Blank SIM

#### Software Options

HST3000S-IP	Advanced IP suite – PING and through mode support
HST3000S-WEB	Web browser option
HST3000-WBTONES	WB TIMS option
HST3000-RFP	RFL option
HST3000S-VOIP	VoIP software
HST3000-FTP	FTP software option
HST3000-SCRIPT	Scripted test option
HST3000S-H.323	VoIP Signaling call controls for H.323
HST3000S-SCCP	VoIP Signaling option for Cisco SCCP
HST3000S-SIP	VoIP Signaling option for SIP call control
HST3000-PCMSIG	Signaling (PCM) software option
HST3000-PCMTIMS	TIMS (PCM) software option
HST3000-T1DDS	DDS-T1 software option
HST3000-PRI	ISDN PRI software option
HST3000-SPE	Spectral Noise software option
HST3000S-MOS	MOS (Mean Opinion Score) Analysis option

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**Test & Measurement Regional Sales**

<b>NORTH AMERICA</b> TEL: 1 866 228 3762 FAX: +1 301 353 9216	<b>LATIN AMERICA</b> TEL: +55 11 5503 3800 FAX: +55 11 5505 1598	<b>ASIA PACIFIC</b> TEL: +852 2892 0990 FAX: +852 2892 0770	<b>EMEA</b> TEL: +49 7121 86 2222 FAX: +49 7121 86 1222	<b>WEBSITE: <a href="http://www.jdsu.com">www.jdsu.com</a></b>
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