

Specifications

⚠ Warning

Under no circumstances is this product intended for direct connection to telephony inputs, systems, or equipment, including ISDN inputs. Doing so is a misapplication of this product, which could result in damage to the test tool and create a potential shock hazard to the user.

Under no circumstances should the CABLE TEST input be connected to LAN inputs, systems, or equipment. Doing so is a misapplication of this product, which could result in damage to the test tool and create a potential shock hazard to the user.

Calculated Measurement Accuracy

All Basic Link, Permanent Link, and Channel “Measurement Accuracy” specifications are calculated from the individual parameters using formulas defined in draft TIA guidelines. These TIA guidelines are currently in draft form, and future revisions may cause the calculated accuracies to change. This manual uses the TIA guidelines available at the time of printing for calculating Measurement Accuracy.

Traceable Calibration Period

One year.

Self-Calibration Period

To ensure maximum accuracy of test results, perform the self-calibration procedure, as described in “Calibrating the Test Tool” in Chapter 6, every 30 days.

Notes

All specifications for tests on twisted pair cabling apply to cable with 100 Ω of characteristic impedance. Contact Fluke Networks for information on measurement performance on cabling with characteristic impedance other than 100 Ω .

Compatibility with Remotes and Link Interface Adapters

The DSP-4100 and DSP-4300 test tools are compatible only with DSP-4100SR and DSP-4300SR remote units, respectively. The DSP-4100 and DSP-4300 remotes are not compatible with DSP-100, DSP-2000, or DSP-4000 test tools. The LIAs are not compatible with DSP-100 or DSP-2000 test tools.

The test tool can store calibration data for two different remotes.

Standard Link Interface Adapters

DSP-LIA011 Basic Link Adapter for Cat 5E

Plug type and life: shielded Cat 5E RJ45; >5000 insertions

Cable type: 100 Ω Cat 6 SsTP

Test supported: shielded and unshielded cable, TIA Cat 3, 4, 5, and 5E basic links, and ISO/IEC, EN50173 Class C and D permanent links

DSP-LIA012 Channel Adapter for Cat 6

Plug type and life: shielded RJ45; >5000 insertions

Tests supported: shielded and unshielded cable, TIA Cat 3, 4, 5, 5E, and 6 channels, and ISO/IEC Class C and D channels

DSP-LIA013 Channel/Traffic Adapter for Cat 6

Plug type and life: shielded RJ45; >5000 insertions

Tests supported: shielded and unshielded cable, TIA Cat 3, 4, 5, 5E, and 6 channels, ISO/IEC Class C and D channels

Also performs LAN traffic tests (see specifications for LAN traffic monitoring)

DSP-LIA101 Permanent Link Adapter for Cat 6

Personality module plug type and life: shielded Cat 6 RJ45; >5000 insertions

Test supported: shielded and unshielded cable, TIA Cat 3, 4, 5, 5E, and 6, and ISO/IEC, EN50173 Class C, D, and E permanent links

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Cable Types Tested

Shielded and unshielded twisted pair (STP and UTP) LAN cabling:

TIA Category 3, 4, 5, 5E, and 6 100 Ω

ISO/IEC Class C and D 100 Ω and 120 Ω

Foil-screened twisted pair cables (ScTP):

TIA Category 3, 4, 5, 5E, and 6 100 Ω

ISO/IEC Class C and D 100 Ω and 120 Ω

Shielded twisted pair cables (STP): 150 Ω

(IBM Type 1, 6, and 9; IBM interface adapter required).

Coaxial cables (connect with the RJ45 to BNC adapter):

Thicknet (10BASE5; adapter required)

Thinnet (10BASE2)

RG-58, RG-58 foam, RG-59, RG-59 foam, RG-8, RG-8A/U, and RG-62.

Note

For availability of additional adapters that allow testing to other performance standards, different cabling types, or fiber optic cabling, contact Fluke Networks.

Test Standards

Test Standard	Link Type
TIA Category 3 and 5E per Addendum #5 to TIA/EIA-568A	basic link or channel
TIA Category 5 (new) per TIA TSB-95	basic link or channel
TIA Category 6 per TIA Addendum #1 to TIA/EIA-568B (draft)	permanent link or channel
ISO/IEC-11801-2000 Class C and D (new)	permanent link or channel
ISO/IEC-11801-2000+ Class E (draft)	permanent link or channel
STP cabling, (IBM Type 1, 150 Ω) ANSI TP-PMD IEEE 802.3 10BASE5, 10BASE2	Ethernet with coaxial cabling
IEEE 802.3 10BASE-T, 100BASE-TX, 1000BASE-T	Ethernet with twisted pair cabling
IEEE 802.5	Token Ring, 4 Mb/s or 16 Mb/s

Additional test standards are available. Contact Fluke Networks for information.

Fiber optic test standards are supported when using the optional Fiber Test Adapters. See those products' manuals for more information.

Time for Autotest

Full 2-way Autotest of Category 5 UTP cable in approximately 10 seconds.

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Length

	Twisted Pair Cable		Coaxial Cable	
	Range	0 ft to 328 ft (0 m - 100 m)	328 ft to 2500 ft (100 m - 762 m)	0 ft to 328 ft (0 -100 m)
Resolution	1 ft or 0.1 m	1 ft or 0.1 m	1 ft or 0.1 m	1 ft or 0.1 m
Accuracy	\pm (1 ft (0.3 m) + 2 % of reading)	\pm (1 ft (0.3 m) + 4 % of reading)	\pm (1 ft (0.3 m) + 2 % of reading)	\pm (1 ft (0.3 m) + 4 % of reading)

Note

Specifications are relative to calibrated value using a representative reference cable. Variations occur because of variations in the cable manufacturing process.

Propagation Delay

	Twisted Pair Cable		Coaxial Cable	
	Range	0 ns to 500 ns	500 ns to 3800 ns	0 ns to 500 ns
Resolution	1 ns	1 ns	1 ns	1 ns
Accuracy	\pm (5 ns + 2 % of reading)	\pm (5 ns + 4 % of reading)	\pm (5 ns + 2 % of reading)	\pm (5 ns + 4 % of reading)

Delay Skew

	Twisted Pair Cable	
	Range	0 ns to 100 ns
Resolution	1 ns	
Accuracy	\pm 10 ns	

DC Loop Resistance Test

Range: 0 Ω to 400 Ω

Accuracy: \pm (2 Ω + 2 % of reading)

Resolution: 0.1 Ω

Overload recovery time: Less than 10 minutes to rated accuracy following an overvoltage. Self-calibration is required after repeated or prolonged overvoltage.

Measurement Accuracy as Specified in Relevant Standards

Accuracies computed from the parameters in Table 8-4 are shown in Figures 8-2 through 8-7.

Table 8-4. Performance Parameters

Parameter	Baseline Test Tool	Test Tool with DSP-LIA101 Permanent Link Adapter	Test Tool with Category 6/Class E Channel Adapter
Dynamic range	3 dB over test limit Pair-to-Pair NEXT and FEXT loss 65 dB Power Sum NEXT and FEXT loss 62 dB		
Amplitude resolution	0.1 dB		
Frequency range and resolution	1 MHz – 31.25 MHz: 100 kHz 31.25 MHz–100 MHz:200 kHz 100 MHz – 250 MHz: 500 kHz		
Dynamic Accuracy NEXT Attenuation (Insertion Loss)	± 0.75 dB ^{Note 1}		
Dynamic Accuracy ELFEXT	± 1.0 dB ^{Note 2}		
Source/load return loss	20 – 12.5 log (f / 100) 20 dB maximum	18 – 12.5 log (f / 100) 20 dB maximum	
Random Noise Floor	75 – 15 log (f / 100); 85 dB maximum		
Residual NEXT	65 – 20 log (f / 100) ^{Note 3}	54 – 20 log (f / 100) ^{Note 3}	
Residual FEXT	65 – 20 log (f / 100) ^{Note 3}	45 – 20 log (f / 100) ^{Note 3}	
Output Signal Balance	40 – 20 log (f / 100) ^{Note 4}	37 – 20 log (f / 100) ^{Note 4}	
Common Mode Rejection	40 – 20 log (f / 100) ^{Note 4}	37 – 20 log (f / 100) ^{Note 4}	
Tracking	± 0.5 dB		
Directivity	27 – 7 log (f / 100) ^{Note 5} 30 dB maximum	25 – 20 log (f / 100) 25 dB maximum	
Source Match	20 ^{Note 5}	20 – 20 log (f / 100) 20 dB maximum	
Return loss of Termination	20 – 15 log (f / 100) ^{Note 5} 25 dB maximum	16 – 15 log (f / 100) 25 dB maximum	

Notes for Table 8-4

1. Verification of dynamic accuracy is required up to the specified range for NEXT loss and FEXT loss.
2. The dynamic accuracy is based on dynamic accuracy performance for insertion loss (attenuation) and NEXT loss, and is assumed to combine the dynamic accuracy for ELFEXT as specified. The FEXT loss dynamic accuracy is tested to ± 0.75 dB.
3. Performance verification of residual NEXT and residual FEXT is up to 85 dB maximum, with an assumed frequency response change of 20 dB/decade.
4. Performance verification of Output Signal Balance and Common Mode Rejection is up to 60 dB maximum, with an assumed frequency response change of 20 dB/decade.
5. The performance requirements for tracking, directivity, and source match for the permanent link adapter apply after the permanent link adapters have been calibrated with the test tools they are attached to.

Typical Measurement Accuracies

The DSP-4000 Series test tools substantially exceed the measurement accuracy requirements of draft Level III TIA and IEC proposals. Typical measurement accuracy is determined as follows:

- For each performance parameter (for example, source/load return loss, residual NEXT, etc.) at every frequency, the **worst result for any wire pair or wire-pair combination** is obtained.
- The values of the **worst case wire pair or wire pair combinations** are substituted in the accuracy equation given by TIA and IEC guidelines.
- **Worst case** assumptions for **link performance** that affect measurement accuracy are used. These include the assumptions for link return loss, common-mode-to-differential-mode gain, and differential-to-common-mode gain.

Typical measurement accuracies are used to determine if test results are within the test tool's accuracy range. Results within the accuracy range are marked with an asterisk.

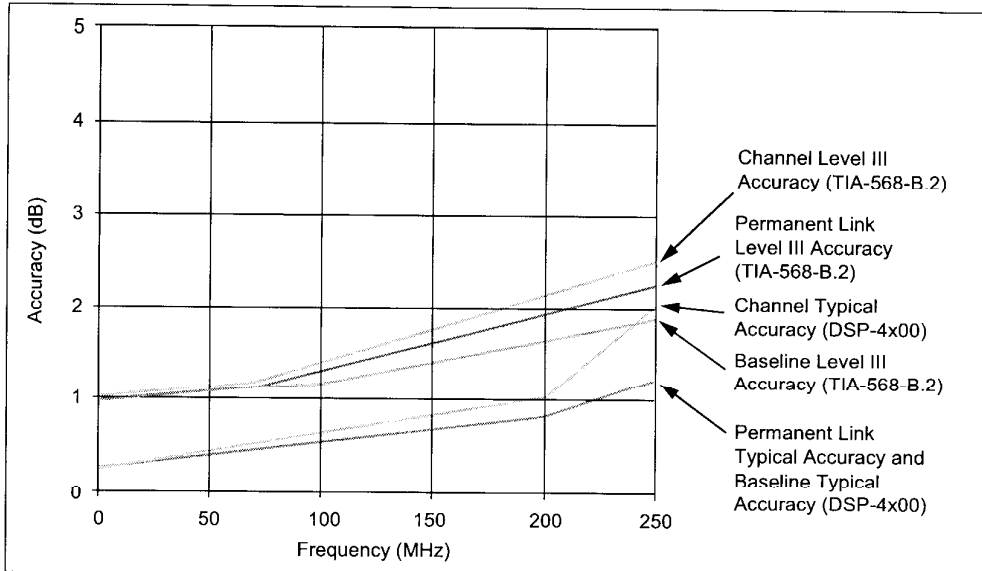


Figure 8-2. Attenuation (Insertion Loss) Measurement Accuracy for Channel

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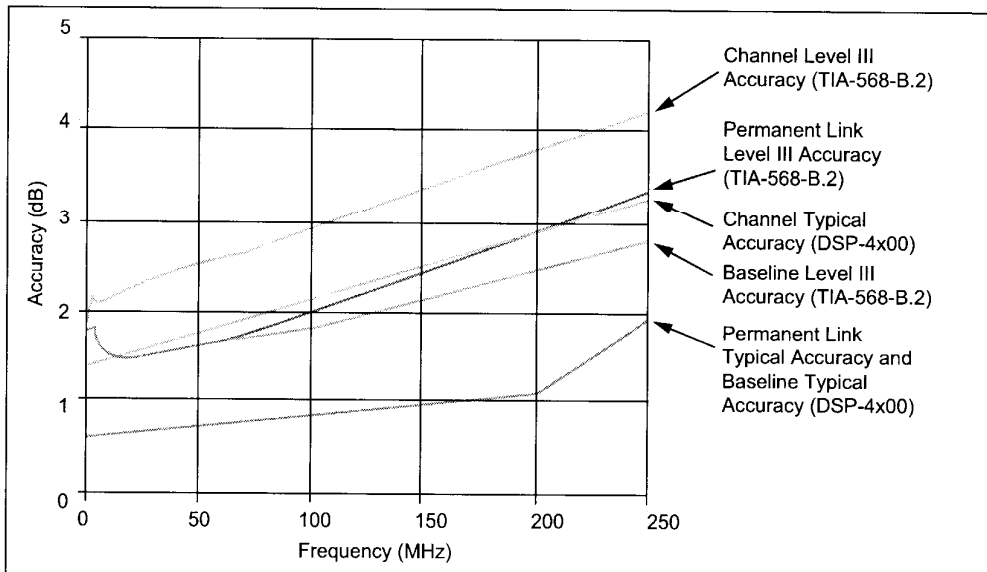


Figure 8-3. Pair-to-Pair NEXT Measurement Accuracy for a Channel

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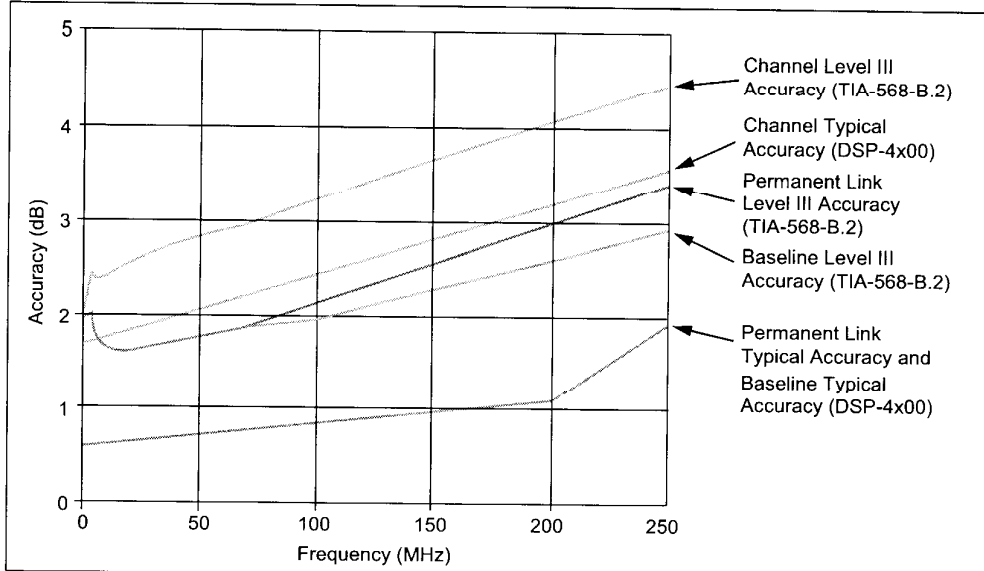


Figure 8-4. PSNEXT Measurement Accuracy for Channel

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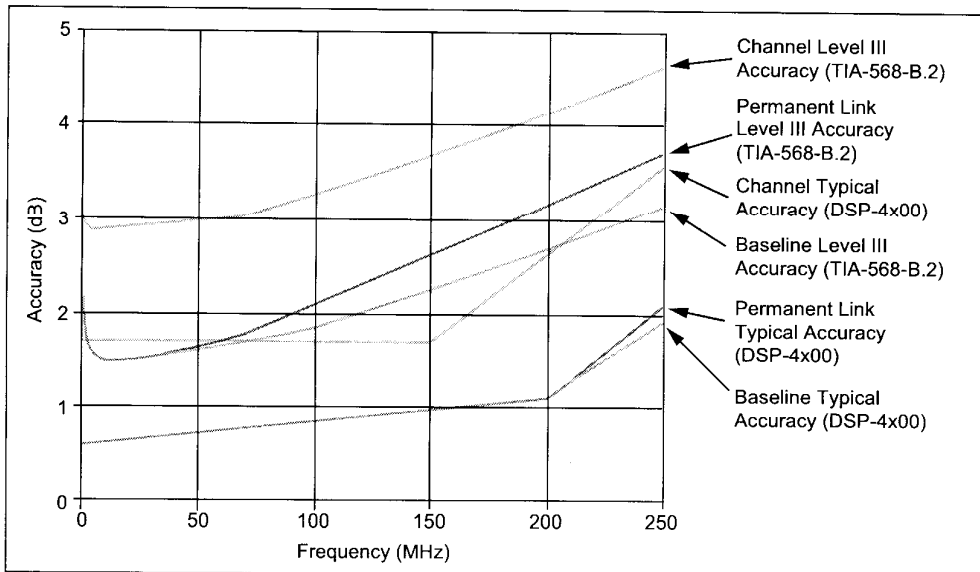


Figure 8-5. Pair-to-Pair ELFEXT Measurement Accuracy for Channel

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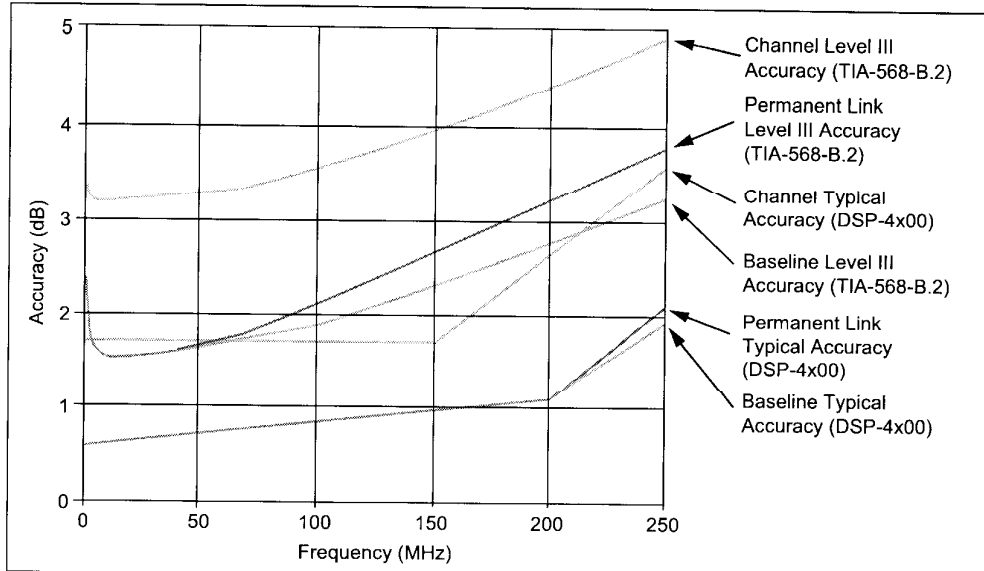


Figure 8-6. PSELFEXT Measurement Accuracy for Channel

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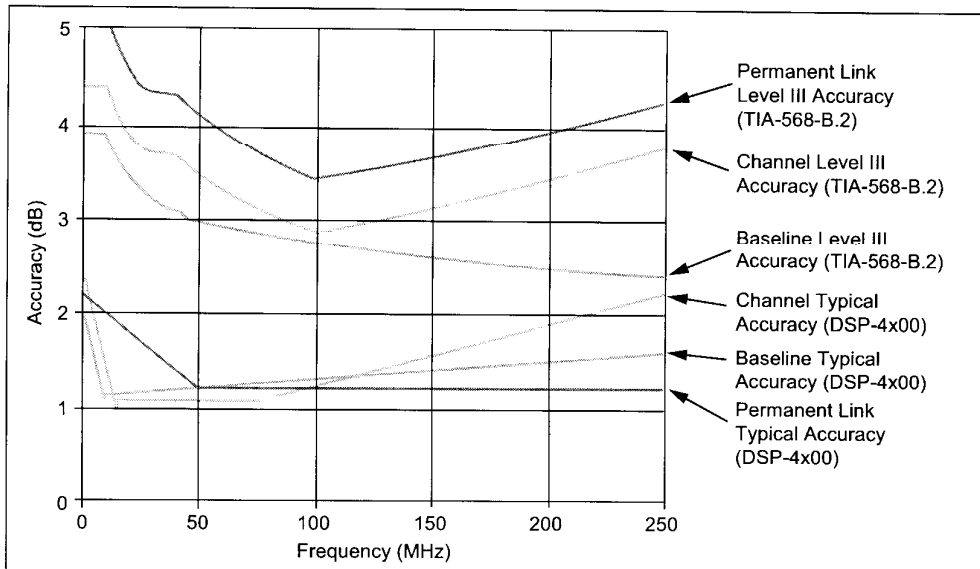


Figure 8-7. Return Loss Measurement Accuracy for Channel

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Note

The 3 dB rule generally applies at low frequencies.

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HDTDX™ Analyzer Specifications for Cables <100 m (328 ft)

The following performance is typical for cables less than 100 m (328 ft):

Distance accuracy: $\pm(1 \text{ ft (0.3 m)} + 2 \% \text{ distance})$

Distance resolution: 1 ft or 0.1 m

HDTDR™ Specifications for Cables <100 m (328 ft)

The specifications below are for HDTDR tests on cables less than 100 m (328 ft) long.

	Twisted Pair Cable	Coaxial Cable
Distance accuracy	$\pm(1 \text{ ft (0.3 m)} + 2 \% \text{ distance})$	$\pm(1 \text{ ft (0.3 m)} + 2 \% \text{ distance})$
Distance resolution	1 ft or 0.1 m	1 ft or 0.1 m

Impulse Noise

Adjustable from 10 mV to 500 mV in 10 mV steps. The default threshold is 270 mV.

Monitors either polarity of noise on pair 3, 6.

Minimum detectable impulse width: 10 ns

Characteristic Impedance

The test tool reports an estimate of the cable's impedance at 4 m from the beginning of the link. The accuracy of the measurement is relative to a 100 Ω terminating resistance.

	Twisted Pair Cable	Coaxial Cable
Range	70 Ω - 180 Ω	35 Ω - 100 Ω
Accuracy	$\pm (5 \Omega + 5 \% \text{Nominal} - \text{Measured})$	$\pm (5 \Omega + 5 \% \text{Nominal} - \text{Measured})$
Anomaly Threshold	15 % Reflection	10 % Reflection
Resolution	1 Ω	1 Ω

LAN Traffic Monitoring

Traffic tests are run through the DSP-LIA013 Channel/Traffic adapter's Monitor jack.

Monitors 10BASE-T or 100BASE-TX Ethernet traffic. Monitors pair 3,6 for either polarity of traffic. Generates a positive polarity link pulse on pair 1,2. Generates 100BASE-TX link signals on pair 1, 2.

Auto-negotiates between 10BASE-T and 100BASE-TX. Monitors pair 3, 6 for 10BASE-T or 100BASE-TX link pulses. Generates Auto-Negotiation signals on pair 1, 2.

Hub port capabilities test determines if a hub supports the following standards:

- Auto-negotiation
- 10BASE-T
- 100BASE-TX
- 100BASE-T4
- 100BASE-TX full duplex
- 10BASE-T full duplex

Hub port locator blinks the link LED on a 10BASE-T, 10/100BASE-TX, or 100BASE-TX hub.

Tone Generator

Generates a tone that can be detected by a tone probe, such as the Fluke Networks 140 A-Bug Tone Probe. The 2 kHz tone is generated on pair 1,2.

Serial Interface

Connector: DB9 (DTE male)

Baud rate: 1200 baud to 115,200 baud

Flow control: hardware, XON/XOFF, or none

Data format: 8 data bits, 1 stop bit, no parity

Printer formats: Epson, HP LaserJet, or Text Only (ASCII text)

Test results can be uploaded to a PC and software updates can be downloaded to the test tool and remote using LinkWare software.

PC Interface Cable

Table 8-5 shows the pin connections for the PC interface cable provided with the test tool. Table 8-6 shows the pin connections for the 9-to 25-pin adapter available from Fluke Networks (part number 929187).

Table 8-5. PC Interface Cable Connections

Test Tool End DB9S (female)	Pin	Direction	PC End DB9S (female)
Data Carrier Detect	1	<----	4
Receive Data	2	<----	3
Transmit Data	3	---->	2
Data Terminal Ready (always true)	4	---->	1
Signal Ground	5	<---->	5
Not connected	6		6
Request To Send (used only with hardware flow control)	7	---->	8
Clear To Send	8	<----	7
Not connected	9		9

Table 8-6. 9-to 25-pin Adapter (available from Fluke Networks)

9-pin Connector	25-pin Connector
3	2
2	3
7	4
8	5
6	6
5	7
1	8
4	20
9	22
Shell	Shell

Power

Main unit and remote: NiMH battery pack, 7.2 V, 3500 mAh

Typical NiMH battery life: 8 to 10 hours

Charge time: 4 hours

AC adapter/charger, USA version: Linear power supply; 108 V ac to 132 V ac input; 15 V dc, 1 A output

AC adapter/charger, international version: Switching power supply; 90 V ac to 264 V ac input; 15 V dc; 1 A output

Memory backup power in main unit: Lithium battery

Typical life of lithium battery: 5 years

Environmental Requirements

Operating temperature: 32 °F to 113 °F (0 °C to 45 °C)

Storage temperature: -4 °F to +140 °F (-20 °C to +60 °C)

Pollution degree: 2

Altitude: 6562 ft (2000 m)

Avoid use outside the operating boundaries shown in Figure 8-3.

Electromagnetic Compatibility

Emissions EN61326-1, Class A.

Immunity EN61326-1

Note: Exposure to a 3 V/m Rf field, in the range of 107 MHz – 148 MHz may cause a maximum noise floor offset of +.62 dB above the calculated specification of 1.5 dB.

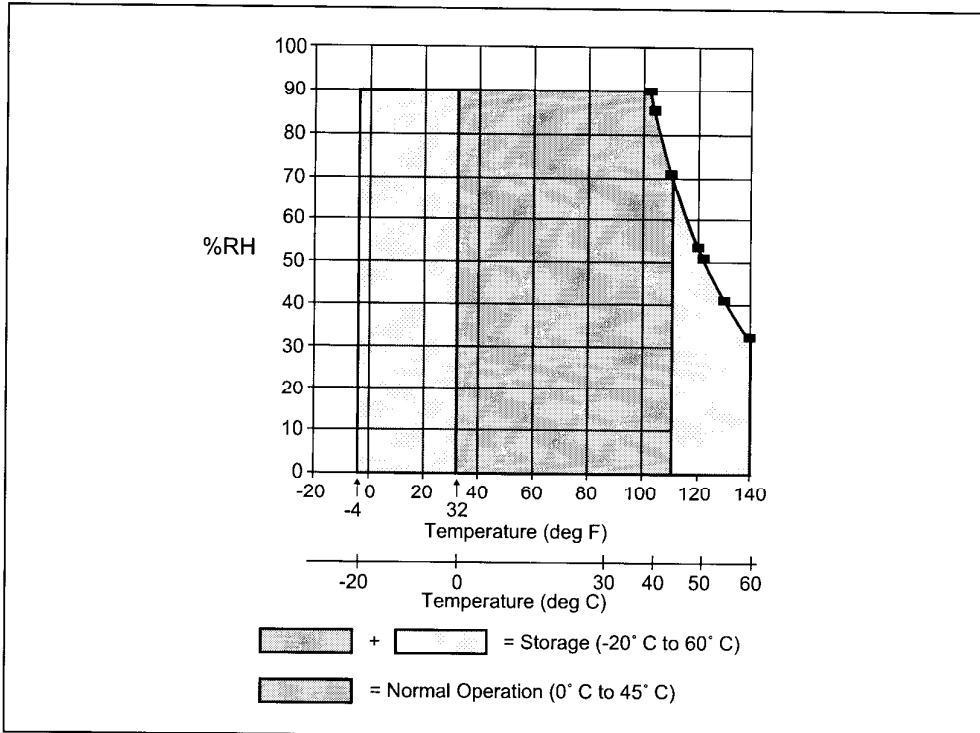




Figure 8-8. Operating Environment Specifications

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Input Ratings

A DSP-4000 Series test tool and remote are designed to measure unpowered cables. The inputs are protected against continuous, current-limited telco voltages (<100 mA) and can withstand occasional overvoltages of less than 30 V rms (42 V peak, 60 V dc).

Certification and Compliance

Symbol	Description
	Conforms to relevant European Union directives.
	Listed by Canadian Standards Association.

The test tool complies with the following standards:

CSA Standards: CAN/CSA-C22.2 No. 1010.1-92 + Amendment 2: 1997 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements

Safety: CAN/CSA-C22.2 No. 1010.1-92 + Amendment 2: 1997; Overvoltage Category II, Pollution degree 2, 30 V. EN61010, Amendments 1, OVERVOLTAGE (Installation) CATEGORY II, Pollution Degree 2 per IEC1010-1 refers to the level of Impulse Withstand Voltage protection provided. Equipment of OVERVOLTAGE CATEGORY II is energy-consuming equipment to be supplied from the fixed installation. Examples include household, office, and laboratory appliances.

Test Results Memory for the DSP-4100/4300

The 16 MB multimedia card stores the results of at least 250 Autotests with plot data included. More results can be stored if plot data is not included. The exact number of Autotests you can store depends on the number of tests run by the selected test standard. Compatible memory cards with greater or less capacity can also be used. A 32 MB card is available as an accessory.

LinkWare software lets you upload Autotest results to a PC from a memory card installed in the test tool or a memory card reader.

1 MB Flash EPROM allows firmware and test standard updates.

The DSP-4300 includes internal memory that can store the results of at least 250 Autotests with plot data included.

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Test Results Memory for the DSP-4000

512 KB nonvolatile RAM stores results from at least 500 Autotests. More storage may be available depending on the number of tests run by the selected test standard.

LinkWare software lets you upload Autotest results to a PC.

1 MB Flash EPROM allows firmware and test standard updates.

Dimensions

Main unit and remote (without LIA): 9.25" x 5" x 3"
(23.5 cm x 12.7 cm x 7.6 cm)

Weight

Main unit (without LIA): 3 lb., 4 oz (1.5 kg)

Remote (without LIA): 3 lb., 1 oz (1.4 kg)

Display

Type: Graphic bit-mapped LCD with backlight and adjustable contrast.

Size and resolution: 2.8" x 2.4" (7.1 cm x 6.1 cm), 15 lines, 30 characters per line, 240 x 200 bits.

Warranty

One year from date of purchase, including permanent link adapters. Other LIAs are warranted for 90 days (excluding tabs on RJ45 connectors). Personality modules are warranted to be free from manufacturing defects at the time of purchase.