FLUKE networks

DTX-1500

CableAnalyzer™

Technical Reference Handbook

March 2015 Rev. 1 5/2015

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Fluke Networks
PO Box 777
Everett, WA 98206-0777
USA

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Chapter 1: Getting Acquainted

Overview of Features

The DTX-1500 CableAnalyzers™ are rugged, hand-held instruments used to certify, troubleshoot, and document copper cabling installations. The testers feature the following:

- Certifies twisted pair and coaxial cabling to Cat 6A/Class E_A limits (500 MHz) in less than 10 seconds. Meets Level IIIe accuracy requirements.
- Color display clearly indicates PASS/FAIL results.
- Automatic diagnostics report distance to and likely causes of common faults.
- Toner feature helps you locate jacks and automatically starts an Autotest upon tone detection.
- Stores up to 250 Cat 6 Autotest results, including graphical data, in internal memory.
- Runs for at least 12 hours on the rechargeable lithium ion battery pack.
- LinkWare™ software lets you upload test results to a PC to create professional-quality test reports. LinkWare Stats software generates browsable, graphical reports of cable test statistics.

Note

The DTX-1500 tests only copper cabling. It is not compatible with accessories for testing fiber cabling or verifying network service.

Registration

Registering your product with Fluke Networks gives you access to valuable information on product updates, troubleshooting tips, and other support services. To register, fill out the online registration form on the Fluke Networks website at www.flukenetworks.com/registration.

Additional Resources for Cable Testing Information

The Fluke Networks Knowledge Base answers common questions about Fluke Networks products and provides articles on cable testing techniques and technology. To access the Knowledge Base, log on to www.flukenetworks.com, then click **SUPPORT** > **Knowledge Base**.

Contacting Fluke Networks

Note

If you contact Fluke Networks about your tester, have the tester's software and hardware version numbers available if possible.


www.flukenetworks.com


support@flukenetworks.com


+1-425-446-5500

- Australia: 61 (2) 8850-3333 or 61 (3) 9329 0244
- Beijing: 86 (10) 6512-3435
- Brazil: 11 3759 7600
- Canada: 1-800-363-5853
- Europe: +31-(0) 40 2675 600
- Hong Kong: 852 2721-3228
- Japan: 03-6714-3117
- Korea: 82 2 539-6311
- Singapore: 65-6799-5566
- Taiwan: (886) 2-227-83199
- USA: 1-800-283-5853

Visit our website for a complete list of phone numbers.

Unpacking

The DTX-1500 CableAnalyzers come with the accessories listed below. If something is damaged or missing, contact the place of purchase immediately.

For a complete list of the DTX kits, options, and accessories available, visit the Fluke Networks website.

- DTX-1500 CableAnalyzer with lithium-ion battery pack
- DTX-1500 Smart Remote with lithium-ion battery pack
- Two 6A/Class E_A channel adapters
- One 6-inch (15 cm) RJ45 reference patch cord
- Two headsets
- Carrying case
- Two carrying straps
- USB cable for PC communications
- Two ac adapters
- DTX-1500 Getting Started Guide

Certification and Compliance

Conforms to relevant Australian standards

Conforms to relevant European Union directives.

Conforms to relevant North American safety standards.

CFR Title 47, Part 15, Subpart B

⚠ Safety Information

Table 1-1 shows the international electrical symbols used on the tester or in this manual.

Table 1-1. International Electrical Symbols

	Warning: Risk of fire, electric shock, or personal injury.
	Warning or Caution: Risk of damage or destruction to equipment or software. See explanations in the manuals.
	Do not connect this equipment to public communications networks, such as telephone systems.
	Do not put products containing circuit boards into the garbage. Dispose of circuit boards in accordance with local regulations. To return unwanted products, contact the manufacturer's web site shown on the product or your local sales office or distributor.

⚠Warning⚠

To prevent possible fire, electric shock, or personal injury:

- **Read all safety information before you use the Product.**
- **Carefully read all instructions.**
- **Do not connect the tester to telephony inputs, systems, or equipment, including ISDN inputs. Doing so is a misapplication of this product, which could result in damage to the tester and create a potential shock hazard to the user.**
- **Do not open the case. You cannot repair or replace parts in the case.**
- **Do not modify the Product.**
- **Use only replacement parts that are approved by Fluke Networks.**
- **Do not touch voltages > 30 V AC rms, 42 V AC peak, or 60 V DC.**
- **Do not use the Product around explosive gas, vapor, or in damp or wet environments.**
- **Use this Product indoors only.**
- **Always turn on the Product before connecting it to a cable. Turning the Product on activates the tool's input protection circuitry.**
- **Do not connect the Product to voltages that are higher than the maximum voltage rating for the Product.**
- **For Products that have multiple connectors for different types of tests on copper cabling, disconnect unused test leads from the connectors before you do a test.**
- **Use the Product only as specified, or the protection supplied by the Product can be compromised.**
- **Do not use and disable the Product if it is damaged.**
- **Do not use the Product if it operates incorrectly.**
- **Batteries contain hazardous chemicals that can cause burns or explode. If exposure to chemicals occurs, clean with water and get medical aid.**
- **Remove the batteries if the Product is not used for an extended period of time, or if stored in temperatures above 50 °C. If the batteries are not removed, battery leakage can damage the Product.**

- **The battery door must be closed and locked before you operate the Product.**
- **Repair the Product before use if the battery leaks.**
- **Recharge the batteries when the low battery indicator shows to prevent incorrect measurements.**
- **Turn off the Product and disconnect all test leads, patch cords, and cables before you replace the battery.**
- **Do not disassemble or crush battery cells and battery packs.**
- **Do not put battery cells and battery packs near heat or fire. Do not put in sunlight.**
- **Do not operate the Product with covers removed or the case open. Hazardous voltage exposure is possible.**
- **Remove the input signals before you clean the Product.**
- **Have an approved technician repair the Product.**
- **Do not put metal objects into connectors.**
- **For Products with rechargeable batteries, use only AC adapters approved by Fluke Networks for use with the Product to supply power to the Product and charge the battery.**

⚠Caution

To avoid disrupting network operation, to avoid damaging the tester or cables under test, to avoid data loss, and to ensure maximum accuracy of test results:

- **Never connect the tester to an active network. Doing so may disrupt network operation.**
- **Never attempt to insert any connector other than an 8-pin modular (RJ45) connector into an adapter's jack. Inserting other connectors, such as RJ11 (telephone) connectors, can permanently damage the jack.**
- **Never operate portable transmitting devices, such as walkie-talkies and cell phones, during a cable test. Doing so might cause erroneous test results.**
- **To ensure maximum accuracy of copper cable test results, perform the reference procedure every thirty days as described under "Setting the Reference" in Chapters 3 and 5.**
- **Leave the module bay covers in place. See page 1-8.**

Basic Features

The following sections introduce the tester's basic features.

Physical Features

Figures 1-1 and 1-2 describe the tester's features. Figure 1-3 describes the smart remote's features.

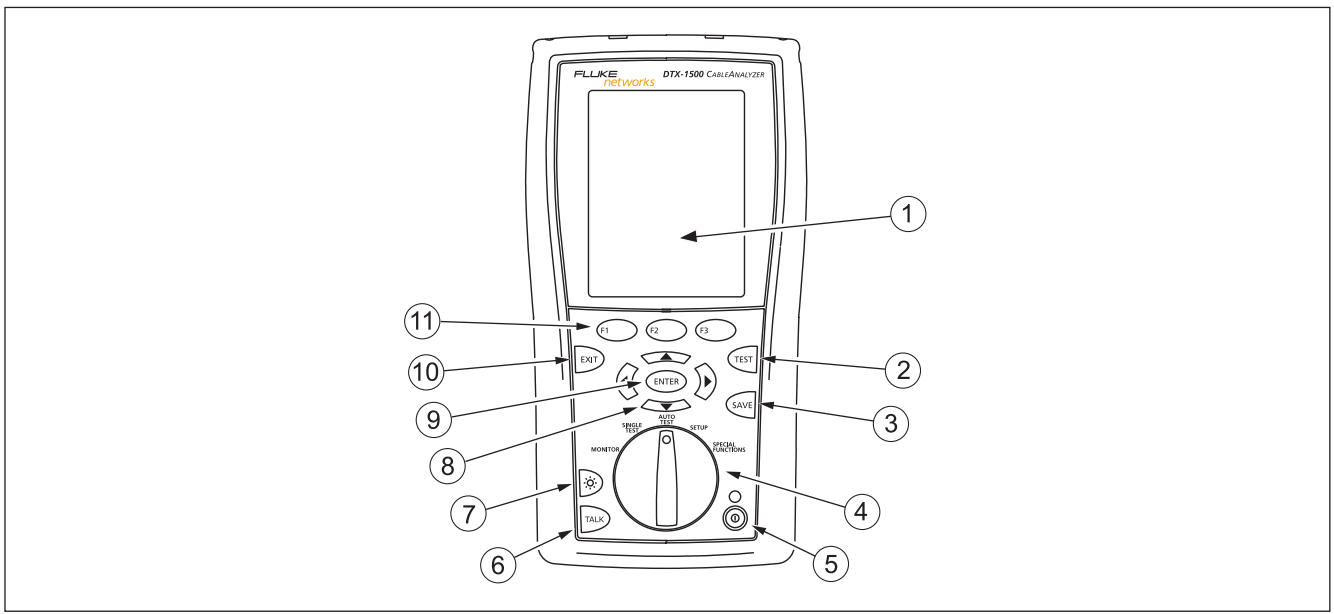

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Figure 1-1. Tester Front Panel Features

① LCD display with backlight and adjustable brightness.

② TEST: Starts the currently selected test. Activates the tone generator for twisted pair cabling if no smart remote is detected. The test starts when both testers are connected.

③ SAVE: Saves Autotest results in memory.

④ Rotary switch selects the tester's modes.

⑤ ⏻: On/off key.

⑥ TALK: Press to use the headset to talk to the person at the other end of the link.

⑦ ☼: Press to switch the backlight between bright and dim settings. Hold for 1 second to adjust the display contrast.

⑧ ◀ ▶ ▲ ▼: Arrow keys for navigating through screens and incrementing or decrementing alphanumeric values.

⑨ ENTER: Enter key selects the highlighted item from a menu.

⑩ EXIT: Exits the current screen without saving changes.

⑪ F1 F2 F3: The softkeys provide functions related to the current screen. The functions are shown on the screen above the keys.

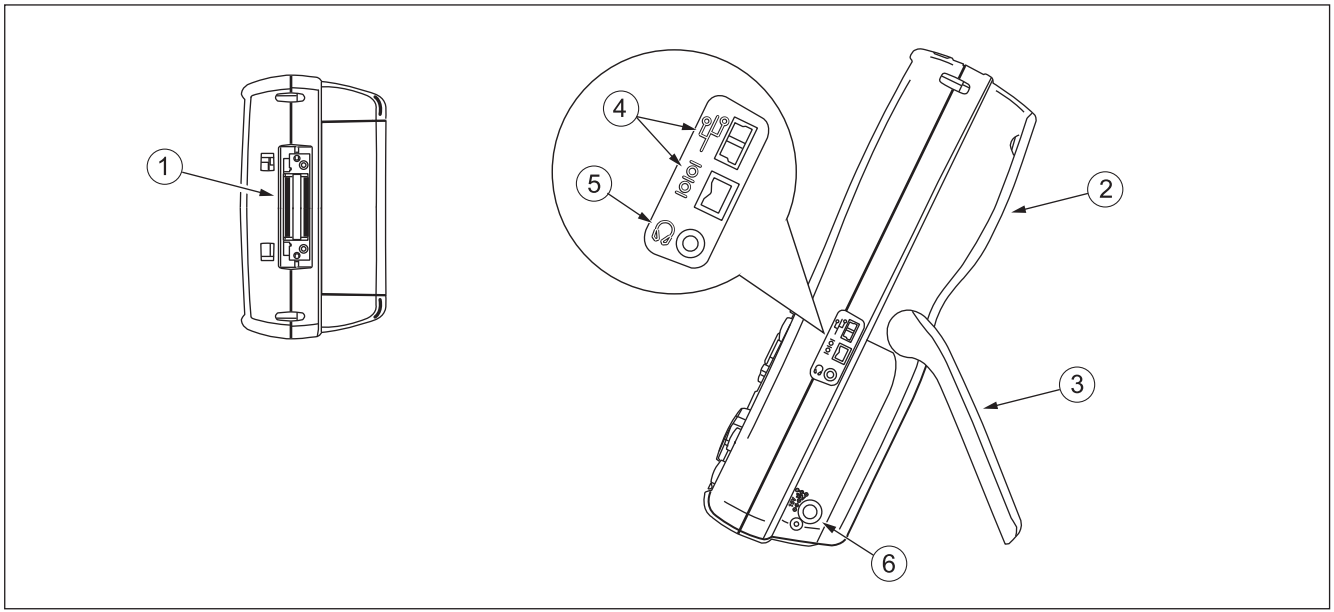

Figure 1-2. Tester Side and Top Panel Features

① Connector for the twisted pair interface adapters.

② Cover for the module bay. Leave the cover in place.

③ Bail.

④ USB () and RS-232C (): Ports for uploading test reports to a PC and updating the tester's software. The RS-232C port uses a custom DTX cable available from Fluke Networks. See Chapter 9 for more information.

⑤ Headset jack for talk mode.

⑥ Connector for the ac adapter. The LED turns on when the tester is connected to ac power.

- Red: Battery is charging.
- Green: Battery is charged.
- Flashing red: Charge timeout. The battery failed to reach full charge within 6 hours. See "If Something Seems Wrong" on page 9-7.

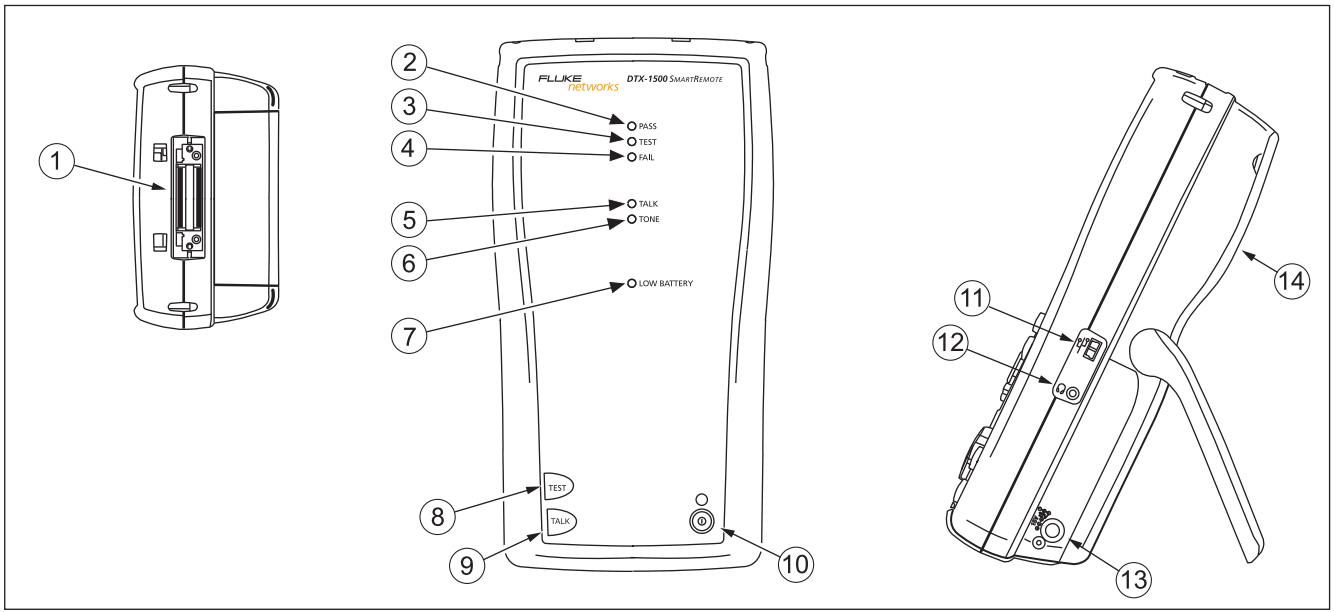

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Figure 1-3. Smart Remote Features

⚠ Caution

All the LEDs flash if the smart remote detects excessive voltage on the cable. Unplug the cable immediately if this occurs.

Note

The LEDs also act as a battery gauge. See Figure Figure 1-6 on page 1-15.

1. Connector for the twisted pair interface adapters.
2. Pass LED lights when a test passes.
3. Test LED lights during cable tests.
4. Fail LED lights when a test fails.
5. Talk LED lights when the smart remote is in talk mode. Press TALK to adjust the volume.
6. Tone LED lights and the tone generator turns on when you press TEST, but the main tester is not connected.
7. Low battery LED lights when the battery is low.
8. TEST: Starts the test currently selected on the main unit. Activates the tone generator for twisted pair cabling if no main tester is detected. The test starts when both testers are connected.
9. TALK: Press to use the headset to talk to the person at the other end of the link. Press again to adjust the volume. Press and hold to exit talk mode.
10. ⏻: On/off key.
11. USB (⇐) and RS-232C (◎◎): Ports for uploading test reports to a PC and updating the tester's software. The RS-232C port uses a custom DTX cable available from Fluke Networks. See Chapter 9 for more information.
12. Headset jack for talk mode.
13. Connector for the ac adapter, as described in Figure 1-2.
14. Cover for the module bay. Leave the cover in place.

Changing the Language

To change the tester's language:

1 Turn the rotary switch to **SETUP**.

2 Use ▼ to highlight **Instrument Settings** at the bottom of the list; then press ENTER.

3 Use ▶ and ▼ to find and highlight **Language** on tab **2** at the bottom of the list; then press ENTER.

4 Use ▼ to highlight the desired language; then press ENTER.

5 Use the arrow keys and ENTER to find and change other local settings on tabs **2**, **3**, and **4** under **Instrument Settings**.

Powering the Tester

⚠Warning⚠

Read the safety information starting on page 1-3 before using the tester.

You may power the tester with the ac adapter included or with the removable lithium ion battery pack.

If the tester does not turn on, refer to "If Something Seems Wrong" on page 9-7.

Charging the Battery

To charge the battery, connect the ac adapter to the battery pack, as shown in Figure 1-4.

You may charge the battery when it is attached or detached from the tester. Figure 1-4 shows how to remove the battery.

The battery charges fully in about 4 hours with the tester off. A fully-charged battery lasts for at least 12 hours of typical use.

Note

The battery will not charge at temperatures outside of 0 °C to 45 °C (32 °F to 113 °F). The battery charges at a reduced rate between 40 °C and 45 °C (104 °F and 113 °F).

- If the battery does not reach full charge within 6 hours, the battery LED flashes red. Verify that the battery was within the temperature range given above during charging and that the correct ac adapter was used. Disconnect then reconnect ac power and try charging the battery again. If the battery does not charge the second time, retrain the battery gauge as described on page 9-5.
- If the battery LED flashes red or the tester will not turn on, see "If Something Seems Wrong" on page 9-7.

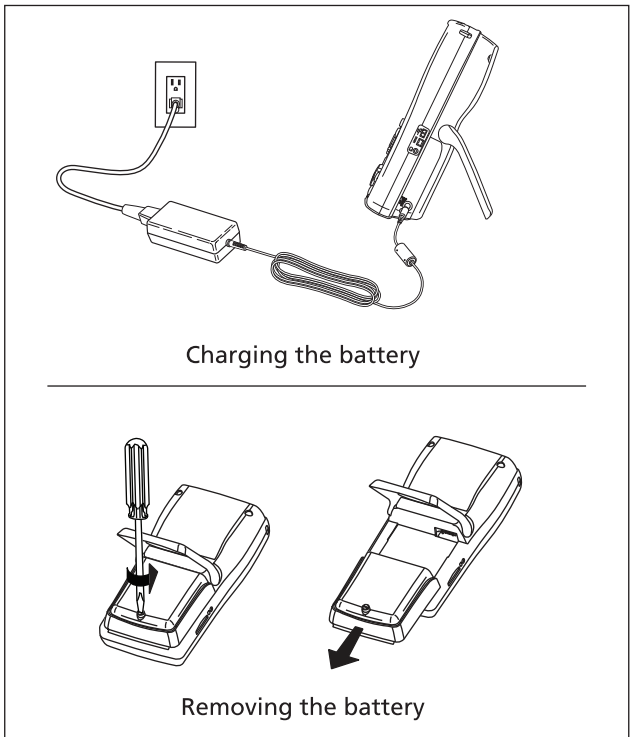

Figure 1-4. Charging and Removing the Battery

Checking the Battery Status

The battery status icon ( ) near the upper-right corner of the tester's main screens shows the battery's charge level. The smart remote's LEDs show the smart remote's battery status at the end of the power-up cycle, as shown in Figure 1-5.

To see more information about battery status:

1. Connect the tester and smart remote as shown in Figure 1-6. You may also connect the testers through a link.
2. Turn the rotary switch to **SPECIAL FUNCTIONS**.
3. Use ◁▽▷ to highlight **Battery Status**; then press ENTER.

   The **Time Remaining** value tells you approximately how long the main tester's battery will last based on the last 3 minutes of use.

The accuracy of the battery gauge may drift over time. If the battery status information seems incorrect, retrain the battery gauge as described in Chapter 9.

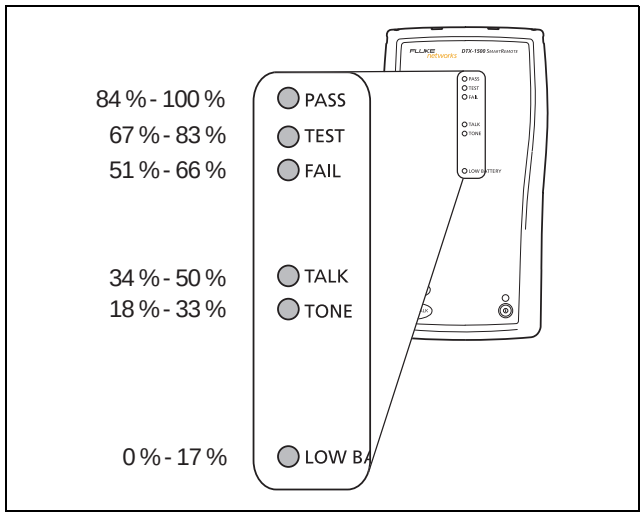

Figure 1-5. Remote Battery Status Shown After Power-up

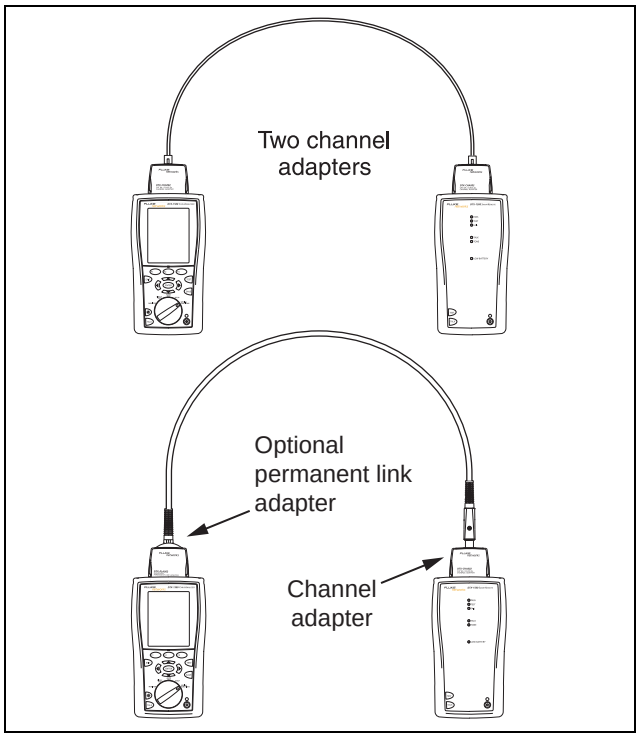

Figure 1-6. Connections for Using the Battery Status Function

About Link Interface Adapters and Modules

Link interface adapters provide the correct jacks and interface circuitry for testing different types of twisted pair LAN cabling.

The channel adapters provided are suitable for testing cabling up to Cat 6A/Class E_A.

Optional adapters let you test permanent link installations and coaxial cabling.

The adapter's Autotest counters are helpful for gauging wear on the adapter's jack or plug and for tracking the number of tests run on a job. You can view and reset the counters on the **Version Information** screen in **SPECIAL FUNCTIONS**. See "Checking the Hardware and Software Versions" on page 1-18.

Figure 1-7 shows how to attach and remove adapters.

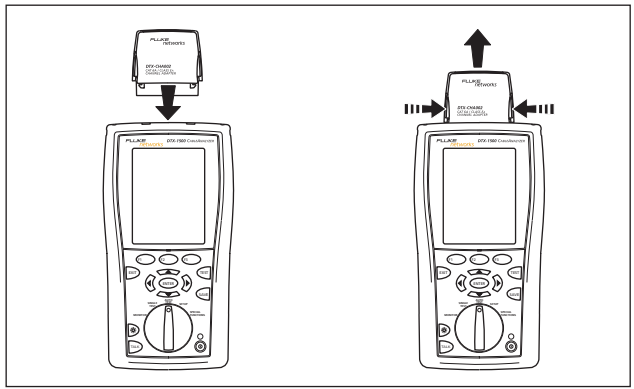

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Figure 1-7. Attaching and Removing Adapters

Verifying Operation

The tester performs a basic self test when you turn it on. To run a more thorough self test for an acceptance test or as part of a routine equipment check:

1 Connect the main and remote testers using one of the methods shown in Figure 1-8.

2 Turn the rotary switch to **SPECIAL FUNCTIONS**.

3 Use ◁▽▷ to highlight **Self Test**; then press ENTER.

4 Press TEST.

If the tester reports an error, refer to "If Something Seems Wrong" on page 9-7.

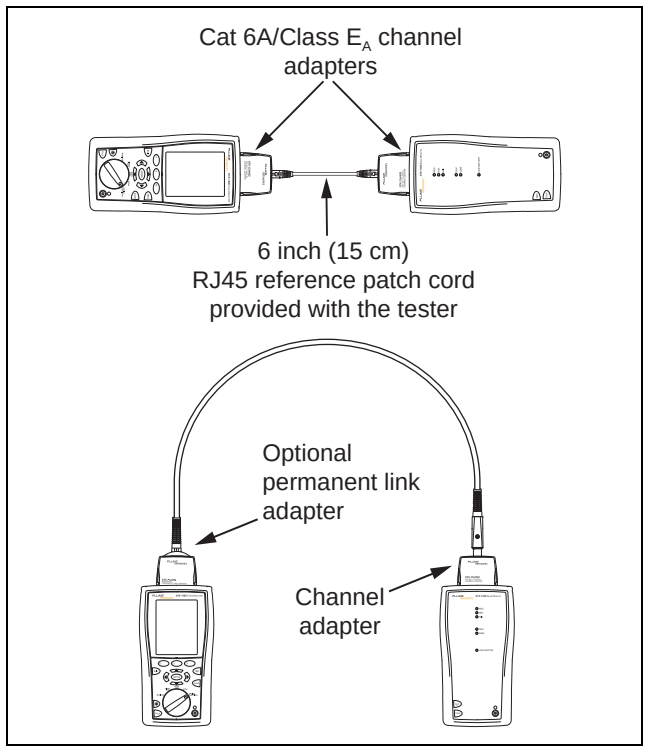


Figure 1-8. Self Test Connections

Checking the Hardware and Software Versions

To see information about the tester's hardware and software, the test limits and cable types databases, and the Autotest counts for attached link adapters:

1 Connect the tester and smart remote through adapters, as in Figure 1-8.

2 Turn the rotary switch to **SPECIAL FUNCTIONS**.

3 Use ◇ to highlight **Version Information**; then press ENTER.

4 Use the softkeys to switch among information screens for the tester, remote, and any adapters attached.

Information for link adapters includes the number of Autotests run with the adapter:

- **Autotest Count** is the total number of tests run with the adapter.
- **Current Series** is a counter you can reset.

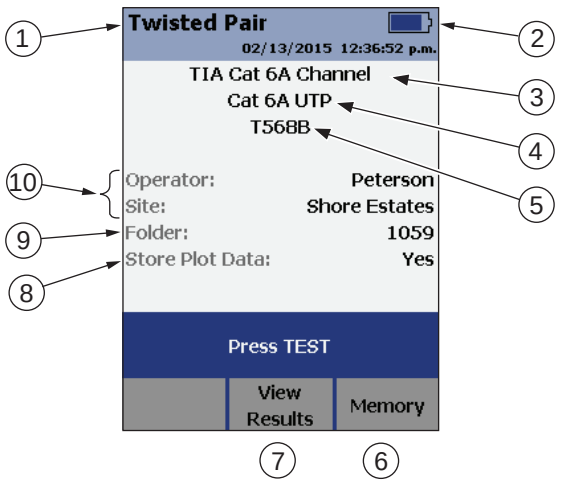
To reset the **Current Series** counter, use the softkeys to access the link adapter's **Version** screen; then press ENTER.

To determine if your tester needs a software update, visit the Fluke Networks website to see if an update is available. See Chapter 9 for details on updating the tester's software.

The Main Autotest Screen

The Autotest automatically runs all the tests necessary to certify that cabling meets the requirements of the selected test limit. You will probably use the Autotest more than any other of the tester's functions.

When you first turn the rotary switch to **AUTOTEST**, the main Autotest screen shows settings you should check before you start testing. Figure 1-9 describes this screen. You can change these settings in **SETUP**, as described in Chapters 2, 3,and 5.



(1) The media type selected for testing.

(2) Battery status icon.

(3) **Test Limit**: The tester compares test results to the selected limit to determine the PASS/FAIL result.

(4) **Cable Type**: The type of cable to be tested.

(5) **Outlet Configuration**: The wire mapping used for testing twisted pair cabling.

(6) Press F3 to check the memory status.

(7) Press F2 to view the results of the previous test.

(8) **Store Plot Data**

- **No**: Plot data is not saved, which lets you save more results. Saved results show worst margins and worst values for each pair.
- **Standard**: The tester displays and saves plot data for frequency-based tests such as NEXT, return loss, and attenuation. The tester saves data for the frequency range required by the selected test limit.
- **Extended**: The tester saves data beyond the frequency range required by the selected test limit.

(9) **Folder**: The folder where results will be saved.

(10) **Operator, Site: Operator:** The person using the tester and the job site name. These are stored with saved results.

Figure 1-9. The Main Autotest Screen (for Twisted Pair Media)

Setting User Preferences

The following sections describe how to change settings you may want to adjust when you first start using the tester.

Changing the Date, Time, and Date/Time Formats

1 Turn the rotary switch to **SETUP**, use ▼ to highlight **Instrument Settings**; then press ENTER.

2 Press ▶ to go to the tab with the **Date** and **Time** selections.

3 Use ▼ to highlight the setting you want to change; then press ENTER.

4 To change numbers in the date or time on the **Date** or **Time** screen, use ◀ ▶ to highlight the number; then use ▲ ▼ to change the number.

5 Press SAVE when you are done.

6 To change the date or time format, press F1 **Change Format** on the **Date** or **Time** screen. Use ▼ to highlight the format you want; then press ENTER.

Changing the Length Units

1 Turn the rotary switch to **SETUP**, use ▼ to highlight **Instrument Settings**; then press ENTER.

2 Press ▶ to go to the tab with the **Length Units** selection.

3 Use ▼ to highlight **Length Units**; then press ENTER.

4 Use ▼ to highlight the setting you want; then press ENTER.

Changing the Numeric Format

The tester can show decimal fractions with a decimal point (0.00) or a comma (0,00).

1 Turn the rotary switch to **SETUP**, use ▼ to highlight **Instrument Settings**; then press ENTER.

2 Press ▶ to go to the tab with the **Numeric Format** selection.

3 Use ▼ to highlight **Numeric Format**; then press ENTER.

4 Use ▼ to highlight the setting you want; then press ENTER.

Adjusting the Display Contrast

1 Press and hold ☼.

2 Use ◄ ► for coarse adjustments and F2 **◄Fine** F3 **Fine►** for fine adjustments.

3 F1 **Default Setting** sets the contrast to the default level.

4 Press ENTER when you are done.

The setting is retained when you turn the tester off. The contrast setting does not affect the battery life.

Setting the Power Down Timer

The power down timer turns off the tester after a selected period of inactivity. The timer starts when the backlight timer times out. If the backlight timer is disabled, the power down timer starts whenever the tester is not being used.

The smart remote turns off after 60 minutes of inactivity. This setting is not adjustable.

Note

The power down timer is inactive when the ac adapter is connected or when the USB serial port is active.

To set the power down timer:

1 Turn the rotary switch to **SETUP**, use ▼ to highlight **Instrument Settings**; then press ENTER.

2 Press ► to go to the tab with the **Power Down Time-Out** setting; then press ENTER.

3 Use ▼ to highlight the setting you want; then press ENTER.

Setting the Backlight Timer

The backlight timer turns off the backlight after a selected period of inactivity. Using the timer to turn off the backlight helps conserve battery power.

To set the backlight timer:

1 Turn the rotary switch to **SETUP**, use ▼ to highlight **Instrument Settings**; then press ENTER.

2 Press ► to go to the tab with the **Backlight Time-Out** setting. Use ▼ to highlight **Backlight Time-Out**; then press ENTER.

3 Use ▼ to highlight the setting you want; then press ENTER.

Enabling or Disabling the Beeper

To enable or disable the tones for key presses and testing progress:

1 Turn the rotary switch to **SETUP**, use ▼ to highlight **Instrument Settings**; then press ENTER.

2 Press ▶ to go to the tab with the **Audible Tone** setting. Use ▼ to highlight **Audible Tone**; then press ENTER.

3 Use ▼ to highlight the setting you want; then press ENTER.

Overview of Memory Features

All DTX testers have internal memory that can store at least 250 Autotest results, including graphical data. The maximum capacity of internal memory depends on the space taken by the tester's software.

Formatting the Internal Memory

Formatting erases all contents of the internal memory.

To format the internal memory:

1 Turn the rotary switch to **SPECIAL FUNCTIONS**, then select **Memory Status**.

2 Press F2 **Format**.

Creating Folders

You can organize your test results by saving them in folders.

To create a folder:

1 Turn the rotary switch to **SETUP**.

2 Use ▼ to highlight **Instrument Settings**; then press ENTER.

3 Press ▼ to highlight **Current Folder**; then press ENTER.

4 Press F3 **Create Folder**.

5 Use F1 F2 F3, ◀ ▶ ▲ ▼, and ENTER to enter a folder name. Press SAVE when you are done.

6 Use ▲ ▼ to highlight the new folder in the list of folders; then press ENTER.

Options for Entering Cable IDs

When you save a test, you enter a name for the test. At a job site, you usually name each test with the identification code assigned to the link tested. You can enter this ID character by character, or by selecting the ID from a pre-generated list.

To select a method for entering cable IDs:

1 Turn the rotary switch to **SETUP**.

2 Use ▼ to highlight **Instrument Settings**, then press ENTER.

3 Press ENTER to select **Cable ID Source.**

4 Use ▼ to highlight an ID source, then press ENTER.

5 The tester offers the following methods for entering cable IDs:

- **Auto Increment:** You enter an ID for the first test you save. After that, the tester increments the last character of the ID each time you press SAVE. See page 2-9 for details.
- **List:** Lets you select IDs from a list created with LinkWare software and downloaded to the tester. See the LinkWare online help for details. The ID list can be sequential or random.
- **Auto Sequence:** Lets you select IDs from a list of sequential IDs generated from a template in **SETUP**. The horizontal, backbone, and campus templates follow the ID formats specified in the ANSI/TIA/EIA-606-A standard. The **Free Form** template lets you create your own pattern. See page 2-9 for details.
- **None:** Lets you create an ID each time you press SAVE.

After you press SAVE, you can also edit an existing ID before using it for saving results.

To create a list of sequential IDs:

1 On the **Auto Sequence** screen, select a template.

2 On the **Auto Sequence** screen, select **Start ID**. Use the softkeys, ◀ ▶ ▲ ▼, and ENTER to enter the first ID in the sequential list. Press SAVE when you are finished.

3 Select **Stop ID**. Use the softkeys, ◀ ▶ ▲ ▼, and ENTER to enter the last ID in the sequential list. Press SAVE when you are finished

4 Press F3 **Sample List** to see what the list will look like.

When you use an ID from a list, the ID is marked with a "$".

See page 2-9 for more information on the **Auto Sequence** feature.

Automatically Saving Results

When **Auto Save Results** is set to **Yes**, the tester automatically saves Autotests using the next ID available from the **Cable ID Source**. The main Autotest screen shows the next ID. If **Cable ID Source** is set to **None** or all the IDs have been used, **Next ID** is blank and you enter IDs manually after each Autotest.

Selecting **No** lets you enter or select IDs manually after each Autotest.

To change the **Auto Save Results** setting:

1 Turn the rotary switch to **SETUP**.

2 Use ▼ to highlight **Instrument Settings**; then press ENTER.

3 Press ▶ to go to the tab with the **Auto Save Results** setting.

4 Press ENTER to select **Auto Save Results**.

5 Use ▼ to highlight **No** or **Yes**; then press ENTER.

Using the Talk Mode

The talk mode lets you talk to the person at the other end of a twisted pair link. Two-way communication over twisted pair requires one good wire pair.

Note

The talk mode is disabled during cable tests.

1 Connect the tester and smart remote to the cabling.

2 Plug headsets into the headset jacks on the testers.

3 Press TALK on either the tester or smart remote, then speak into the headset's microphone.

4 To adjust the volume at the main unit use ▲ ▼.

5 At the smart remote, use TALK to cycle through the volume settings.

6 To exit the talk mode at the main tester, press EXIT, turn the rotary switch to a new position, or start a test. At the smart remote, hold down TALK for two seconds.

About LinkWare and LinkWare Stats Software

The LinkWare™ Cable Test Management software lets you do the following:

- Upload DTX test results to a PC. See page 9-2.
- View test results.
- Add ANSI/TIA/EIA-606-A administration information to records.
- Organize, customize, and print professional-quality test reports.
- Update the tester's software.
- Create and download data to the DTX, such as Setup data and cable ID lists.
- Transfer custom limits between testers.

LinkWare software is available at no charge on the Fluke Networks website.

The LinkWare Stats Statistical Report software that is included with LinkWare software provides statistical analysis of cable test reports and generates browsable, graphical reports.

For instructions on LinkWare and LinkWare Stats software, see the guides for getting started and the online help available under **Help** on the LinkWare and LinkWare Stats menus.

Chapter 2: Tutorials on Setup and Test Procedures

The tutorials in this chapter guide you through setting up the tester, checking the tester's status, testing twisted pair cabling, and setting up cable ID lists.

Preparing to Save Tests

Step 1: Checking the Memory Space Available

1-1 Turn the rotary switch to **SPECIAL FUNCTIONS**.

1-2 Use ▼ to highlight **Memory Status**; then press ENTER.

Step 2: Entering Job Information

Job information includes the operator name, name of the job site, and the customer's company name. These settings are stored with results you save.

To enter job information:

2-1 Turn the rotary switch to **SETUP**.

2-2 Use ▼ to highlight **Instrument Settings**; then press ENTER.

2-3 Press ▶ to go to the tab with the **Operator** name setting. Press ENTER to select **Operator**.

2-4 Press F1 **Create**; then use F1 F2 F3, ◀ ▶ ▲ ▼, and ENTER to enter a name in the box. Press SAVE when you are done.

2-5 Figure describes the text editing screen.

2-6 Use ▼ to highlight **Site**; then press ENTER.

2-7 Press F1 **Create**; then use F1 F2 F3, ◀ ▶ ▲ ▼, and ENTER to enter the job site name in the box. Press SAVE when you are done.

2-8 Use ▼ to highlight **Company**; then press ENTER.

2-9 Use F1 F2 F3, ◀ ▶ ▲ ▼, and ENTER to enter the company name in the box. Press SAVE when you are done.

Step 3: Setting Up a Job Folder

You can organize test results by saving them in a folder named for the job.

To set up a job folder:

3-1 Turn the rotary switch to **SETUP**.

3-2 Use ▼ to highlight **Instrument Settings**; then press ENTER.

3-3 Press ▼ to highlight **Current Folder**; then press ENTER.

3-4 Press F1 **Create Folder**.

3-5 Use F1 F2 F3, ◄►, ▲, ▼, and ENTER to enter a folder name. Press SAVE when you are done.

3-6 Use ▲ ▼ to highlight the new folder in the list of folders; then press ENTER.

Step 4: Selecting a Cable ID Source

Cable IDs are names you enter for tests you save. You can select IDs from a pre-generated list, or enter them manually after each test. For this tutorial, you will enter IDs manually.

To select a cable ID source:

4-1 Turn the rotary switch to **SETUP**.

4-2 Use ▼ to highlight **Instrument Settings**; then press ENTER.

4-3 Press ENTER to select **Cable ID Source**.

4-4 Use ▼ to highlight **None**; then press ENTER.

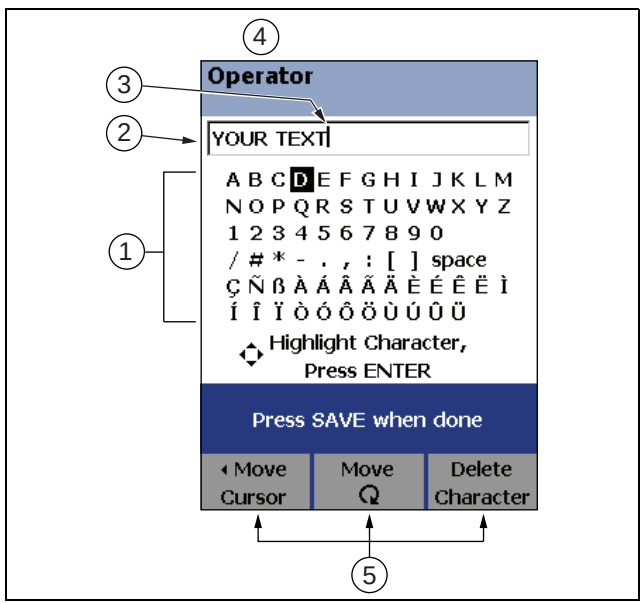


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Figure 2-1. Using the Text Editing Screen

① The characters available for use.

To select a character to enter in the text box, use ◄► ▲▼ to highlight the character; then press ENTER. The character is entered to the left of the cursor.

② The text you are entering.

③ The cursor. Use F1 and F2 to move the cursor.

④ The item you are editing.

⑤ Use F1 F2 F3 to move the cursor and delete characters.

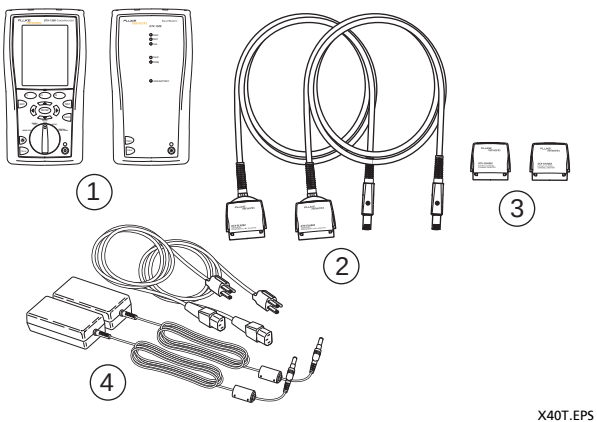
Certifying Twisted Pair Cabling

This tutorial familiarizes you with testing twisted pair cabling by guiding you through the following tasks:

- Attaching twisted pair adapters
- Checking the battery status and verifying operation with twisted pair adapters
- Running an Autotest
- Viewing the Autotest results
- Saving the results

Required Equipment

Figure 2-2 shows the equipment for testing twisted pair cabling.



① Tester and smart remote with battery packs

② Two channel adapters

③ Two ac adapters with line cords (optional)

Figure 2-2. Equipment for Certifying Twisted Pair Cabling

Step 1: Checking the Battery Status and Verifying Operation

Before you start doing cable tests, check the tester and smart remote's battery status, verify that the testers are in good working order, and set the reference.

1-1 Connect the main and remote testers using one of the methods shown in Figure 2-3.

1-2 Use ◡ to highlight **Battery Status**; then press ENTER. Press EXIT when you are done.

1-3 Use ◡ to highlight **Self Test**; then press ENTER.

1-4 Press TEST to start the self test.

1-5 When the self test is completed, press F2 **OK**.

Step 2: Setting the Reference

The reference procedure sets a baseline for insertion loss, ACR-F, and DC resistance measurements.

2-1 Use one of the methods shown in Figure 2-3 to connect the main and remote testers together.

⚠ Caution

When you use the two 6A/Class E_A channel adapters for the reference procedure, use only the 6 inch (15 cm) patch cord provided with the DTX-1500 to connect the testers together.

2-2 Turn the rotary switch to **SPECIAL FUNCTIONS**.

2-3 Press ENTER to select **Set Reference**.

2-4 Press TEST to start the reference procedure.

2-5 When the reference procedure is completed, press F2 **OK**.

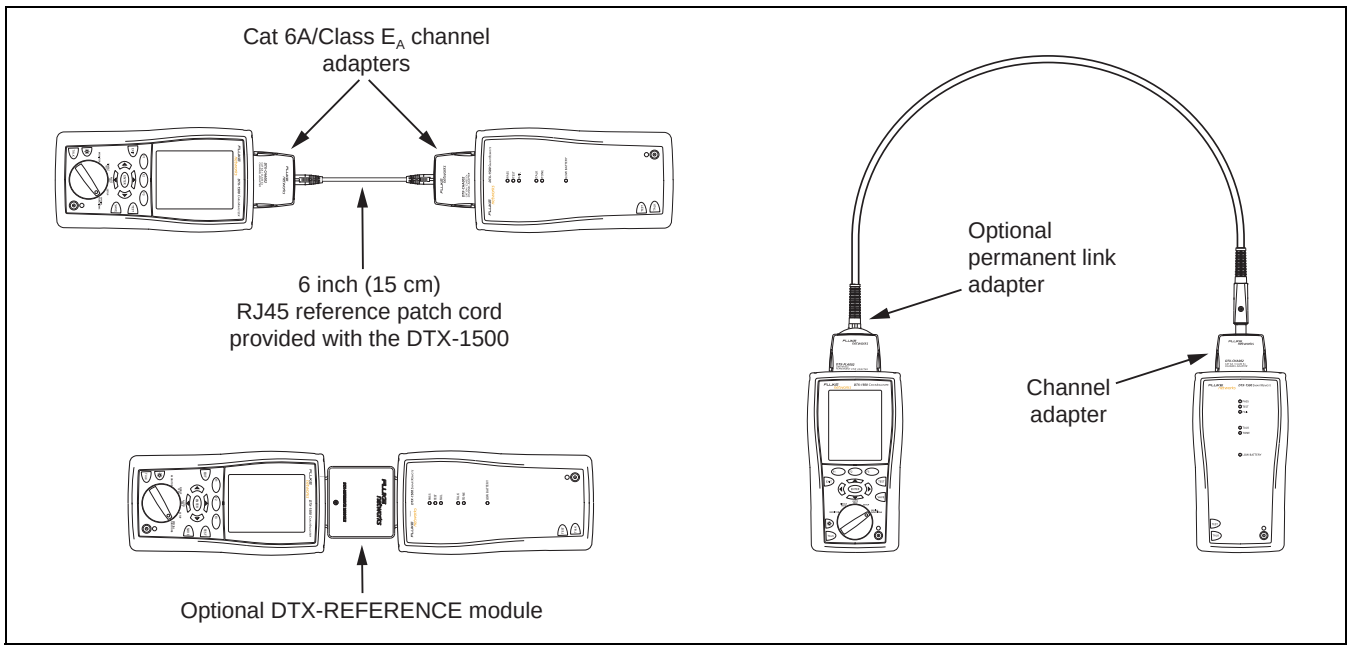


Figure 2-3. Battery Status, Self Test, and Reference Connections

Step 3: Selecting a Test Limit, Cable Type, and Outlet Configuration

Select the test limit, cable type, and outlet configuration specified for the job. The outlet configuration determines which cable pairs are tested and which pair numbers are assigned to the pairs.

3-1 Turn the rotary switch to **SETUP**; then press ENTER to select **Twisted Pair**.

3-2 On the **Twisted Pair** menu use ▼ and ENTER to select **Cable Type**. Cables are organized in groups:

UTP: Unshielded twisted pair cable

FTP: Foil screened twisted pair cable

SSTP: Screened/shielded twisted pair cable

Custom: Cable types entered by a DTX user

Manufacturer: Specific brands of twisted pair cable

3-3 Use ▼ to highlight the group for the cable type you will test; then press ENTER.

3-4 Use ▼ to highlight the cable type you will test; then press ENTER.

3-5 On the **Twisted Pair** menu, press ENTER to select **Test Limit**.

3-6 The first **Test Limit** screen shows the most recently-used limits. To see the list of test limit groups, press F1 **More**.

3-7 Use ▼ and ENTER to select a different limit group, if necessary, and to select the test limit required for the job.

If you are connecting the channel adapters together just to try an Autotest, select a Cat 6A Channel or equivalent limit.

3-8 If the currently-selected **Outlet Configuration** is not compatible with the selected **Test Limit**, the **Outlet Configuration** screen appears. Use ▲ ▼ to highlight an appropriate configuration; then press ENTER.

Step 4: Running the Autotest

4-1 Attach the correct adapters to the tester and smart remote.

4-2 Turn on the tester and smart remote; then connect them to the cabling. See Figure 2-4.

To run an Autotest without connecting to installed cabling, connect the tester and remote together using two channel adapters and a patch cord.

4-3 Turn the rotary switch to **AUTOTEST**.

4-4 Press TEST on the tester or smart remote.

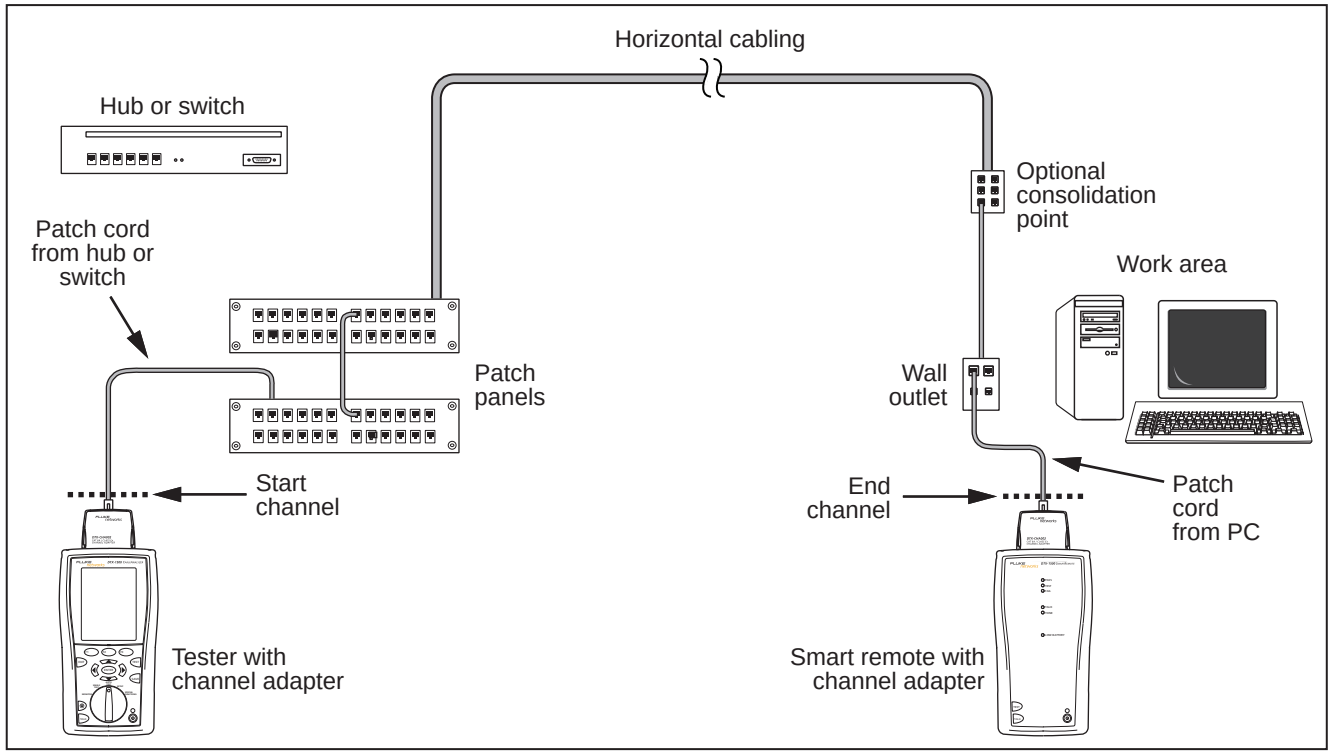


Figure 2-4. Channel Test Connections

Step 5: Viewing the Autotest Results

The **Summary** screen, shown in Figure 2-5, tells you if the test results met the selected test limit. This screen also shows a status for each measurement:

- ✔: PASS
- ✘: FAIL
- **i**: The results are for informational purposes only. The measurement is not required by the selected test limit.
- ✱: The measurement is within the tester's accuracy uncertainty range. See page 3-12 for details.

To see the results for an individual measurement, use ◡ to highlight the test; then press ENTER.

If the test failed, press F1 **Fault Info**. for a diagnosis of the fault. Figure 2-5 shows a typical diagnostic screen. The **Next Fault** softkey is available if the tester detected more than one fault. See Chapter 6 for more information on diagnosing faults.

See Chapter 3 for details on twisted pair test results.

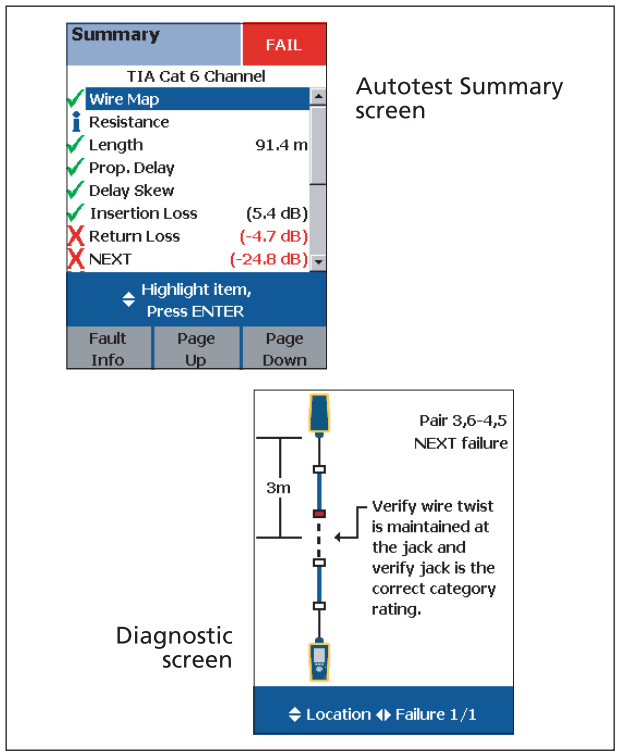


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Figure 2-5. Autotest Summary and Diagnostic Screens

Step 6: Saving the Results

6-1 Press SAVE.

6-2 Use the text editing screen to enter a name for the results. See Figure Figure on page 2-3 for details on editing text.

6-3 Press SAVE when you are done.

This concludes the tutorial on testing twisted pair cabling. For more information on testing twisted pair cabling, see Chapter 3.

Using the Auto Increment and Sequential Cable ID Features

The auto increment and sequential ID features generate cable IDs automatically. This frees you from having to enter IDs manually after each test.

These features are useful when you test installations with sequentially-numbered links.

When you use an ID from a list, the ID is marked with a "$".

Note

*The **List** feature lets you select IDs from a list created with LinkWare software and downloaded to the tester. See the LinkWare documentation for details.*

Using the Auto Increment Feature

The auto increment feature increments the last character in the ID you enter.

For example, if you save a test with the ID "A0", the tester increments the ID as follows:

A0, A1, A2…A9, A10, A11…A99, A100, A101…

Consecutive digits increment from right to left, but other characters do not.

Letters increment through the alphabet shown on the text editing screen:

1A, 1B, 1C…1Y, 1Z, 1Ç…1Û, 1Ü, 1A

To use the auto increment ID feature:

1 Turn the rotary switch to **SETUP**.

2 Use ⟨▼⟩ to highlight **Instrument Settings**; then press ENTER.

3 Press ENTER to select **Cable ID Source**.

4 ⟨▼⟩ to highlight **Auto Increment**; then press ENTER.

5 Run a test; then press SAVE.

6 Enter an ID in the **ID:** box.

7 Press SAVE again.

The next time you run a test and press SAVE, the incremented cable ID appears in the ID box. Press SAVE again to use the ID.

Creating a List of Sequential IDs

The tester includes templates for creating a list of sequential IDs. Three of these templates meet the ANSI/TIA/EIA-606-A standard for documenting cabling installations, as summarized in the next section. A fourth template lets you create your own ID pattern.

Letters and numbers in sequential IDs increment from right to left. The following characters are not incremented:

- Special characters: / # * - . , : [ ] space
- Characters that match between the start and stop IDs. For example if the start and stop IDs were ROOM1 and ROOM25, the characters “ROOM” would not increment.

For example, the following start and stop IDs could be used for testing the cabling in two rooms where each room has three cable drops:

Start ID: ROOM A DROP#1
Stop ID: ROOM B DROP#3

These IDs produce the following ID list:

ROOM A DROP#1
ROOM A DROP#2
ROOM A DROP#3
ROOM B DROP#1
ROOM B DROP#2
ROOM B DROP#3

The steps below guide you through creating a sequential ID list for the following scenario:

- You will test 12 cables in two patch panels: cables 1 through 6 in panel A and cables 1 through 6 in panel B.
- Both panels are located in telecommunications closet A on the third floor of the building.

Your IDs will follow the ANSI/TIA/EIA-606-A standard for horizontal links. See "About ANSI/TIA/EIA-606-A Cable IDs" on page 2-13 for details.

1 Turn the rotary switch to **SETUP**.

2 Use ▼ to highlight **Instrument Settings**, then press ENTER.

3 Press ENTER to select **Cable ID Source**.

4 Use ▼ to highlight **Auto Sequence**, then press ENTER.

5 Use ▼ to highlight **Template**, then press ENTER.

6 Use ▲ ▼ to highlight **Horizontal**, then press ENTER.

7 On the **Auto Sequence** screen, press F1 **Default** to transfer the default pattern into the **START ID** and **STOP ID**.

8 Use ▲ to highlight **Start ID**; then press ENTER.

9 Use F1 F2 F3, ◀ ▶ ▲ ▼, and ENTER to change the default ID to **03A-A01**.

Press SAVE when you are done.

10 Use ▼ to highlight **Stop ID**; then press ENTER.

11 Use F1 F2 F3, ◀ ▶ ▲ ▼, and ENTER to change the default ID to **03A-B06**.

Press SAVE when you are done.

12 Press F3 **Sample List**. You should see a list of 12 sequential IDs: **03A-A01** through **03A-B06**. If the tester beeps instead of showing the list, check your **Start** and **Stop** IDs for the problems listed below.

-continued-

13 Press EXIT to leave the sample list.

If the tester shows an error message, check your **Start** and **Stop** IDs for the problems listed below.

14 Press SAVE when you are done setting up the list. The list is saved in the tester's internal memory.

If the ID sequence is invalid, check the following:

- Verify that the types of characters in each position match between the start and stop IDs. For example, using the letter "O" as the third character in the **Start ID** and the number "0" as the third character in the **Stop ID** is not allowed.
- Verify that you are not using the characters / # * - . , : [ ] space or accented characters as incrementing characters. You may use these characters in IDs, but they must match between the **Start** and **Stop** IDs.
- Verify that the **Start** and **Stop** IDs have the same numbers of characters.
- Verify that the **Stop ID** is not sequentially greater than the **Start ID**. For example, using 25 as the **Start ID** and 10 as the **Stop ID** is not allowed.
- Verify that the **Start** and **Stop** IDs do not generate a sequence with more than 3000 IDs.

To use an ID from the auto sequence list:

1 Verify that the **Cable ID Source** in **SETUP** is set to **Auto Sequence**.

2 Run a test; then press SAVE.

3 To scroll through the ID list, use ▲ ▼. To scroll one page at a time, use ◀ ▶.

4 Select an ID from the ID list; then press SAVE again.

About ANSI/TIA/EIA-606-A Cable IDs

The following sections give basic examples of the 606-A IDs. For detailed information, including ID formats for other elements in cabling installations, contact the TIA to purchase a copy of the 606-A standard.

The examples use the following abbreviations:

- f = floor number
- s = telecom room letter
- a = patch panel letter
- n = For a horizontal link: port number
  For a backbone: backbone cable letter or number
- d = copper pair number in backbone cable
- b = building

Horizontal Link Identifier

Horizontal links run between telecommunications closets and work areas.

Format: fs-an

Example: 11C-D32

The link is on floor 11 in telecom room C, patch panel D, port 32.

Backbone Cable Identifier

Backbone cables run between telecommunication closets, usually on different floors.

Format: fs1/fs2-n.d

Example: 1B/5C-D.10

The cable is in the backbone cable that runs between floor 1, telecom room B and floor 5, telecom room C. The backbone cable is cable D. The cable is number 10 in backbone cable D.

Campus Cable Identifier

Campus cables are backbone cables that run between buildings.

Format: [b1-f s1]/[b2-fs2]-n.d

Example: LBRY-01A/AUD-01A-5.16

The cable is in the backbone cable that runs between the library (LBRY), floor 1, telecom room A and the auditorium (AUD), floor 1, telecom room A. The backbone cable is cable 5. The cable is number 16 in backbone cable 5.

Chapter 3: Certifying Twisted Pair Cabling

Setting the Reference

The reference procedure sets a baseline for insertion loss, ACR-F, and DC resistance measurements.

Run the tester's reference procedure at the following times:

- When you want to use the tester with a different smart remote. You can reference the tester to two different smart remotes.
- At least every 30 days. Doing so ensures maximum accuracy of test results.

You do not need to set the reference after changing link interface adapters.

To set the reference:

Note

Turn on the tester and smart remote and let them sit for 1 minute before setting the reference. Set the reference only after the testers have reached an ambient temperature between 10 °C and 40 °C (50 °F and 104 °F).

1 Use one of the methods shown in Figure 3-1 to connect the main and remote testers together.

⚠ Caution

When you use the two 6A/Class E_A channel adapters for the reference procedure, use only the 6 inch (15 cm) patch cord provided with the DTX-1500 to connect the testers together.

2 Turn the rotary switch to **SPECIAL FUNCTIONS**.

3 Highlight **Set Reference**; then press ENTER.

4 Press TEST.

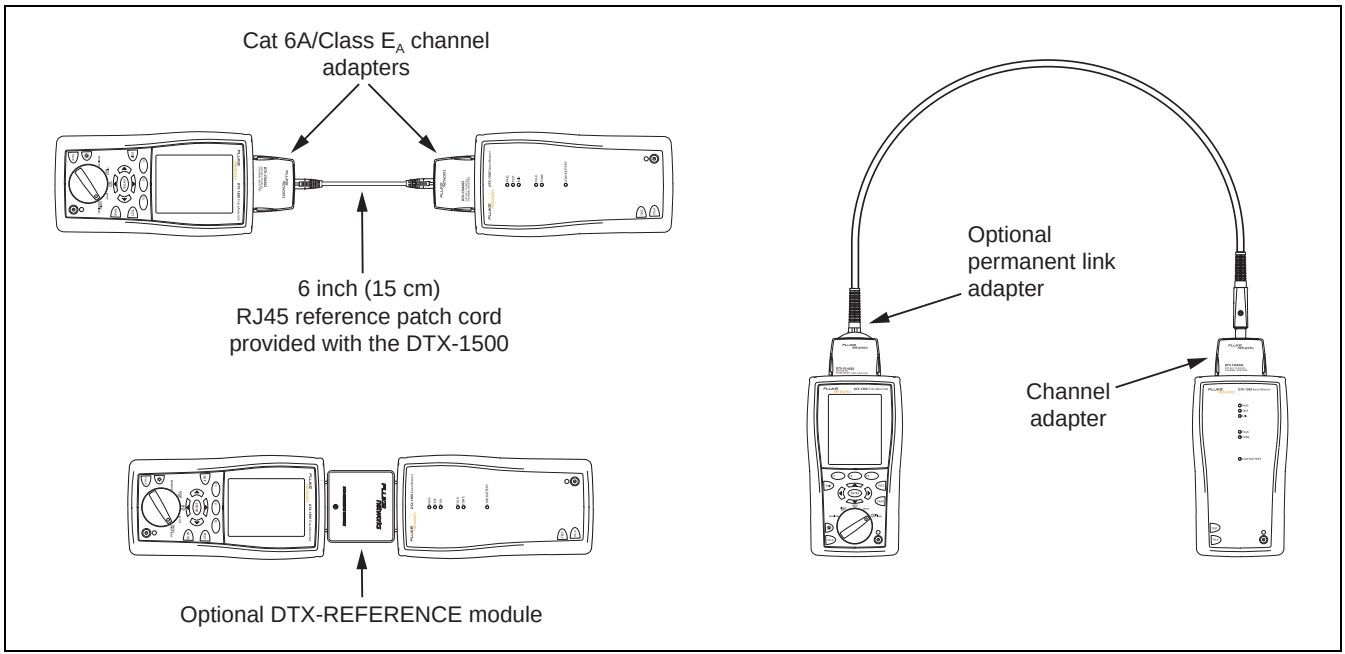

Figure 3-1. Twisted Pair Reference Connections

Twisted Pair Test Settings

Table 3-1 describes the settings that apply to twisted pair cabling tests.

To access the settings, turn the rotary switch to **SETUP**, use ◁▷ to highlight **Twisted Pair**; then press ENTER.

Table 3-1. Twisted Pair Test Settings

Setting	Description
SETUP > Twisted Pair > Test Limit	Select the appropriate test limit for the job. The **Cable Type** and **Outlet Configuration** screens appear if the current selections are not compatible with the test limit. Selecting **Custom** lets you create a test limit. See Chapter 7 for details.
SETUP > Twisted Pair > Cable Type	Select a cable type appropriate for the type you will test. The cable types are organized by type and manufacturer. Selecting **Custom** lets you create a cable type. See page 7-1 for details.
SETUP > Twisted Pair > NVP	Nominal velocity of propagation, which is used with the measured propagation delay to determine cable length. The default value defined by the selected cable type represents the typical NVP for that cable type. You may enter a different value if necessary. To determine the actual value, change the NVP until the measured length matches the known length of a cable. Use a cable at least 30 m (100 ft) long. See page 7-5. Increasing the NVP increases measured length.
SETUP > Twisted Pair > Outlet Configuration	The **Outlet Configuration** setting determines which cable pairs are tested and which pair numbers are assigned to the pairs. See Figure 3-2. To see the wire map for a configuration, press F1 **Sample** from the **Outlet Configuration** screen. Selecting **Custom** lets you create a configuration. See page 7-1 for details.
SETUP > Twisted Pair > HDTDX/ HDTDR	**PASS*/FAIL Only:** The tester shows HDTDX and HDTDR results only for Autotests with **PASS***, **FAIL***, or **FAIL** results. **All AUTOTESTs:** The tester shows HDTDX and HDTDR for all Autotests.

-continued-

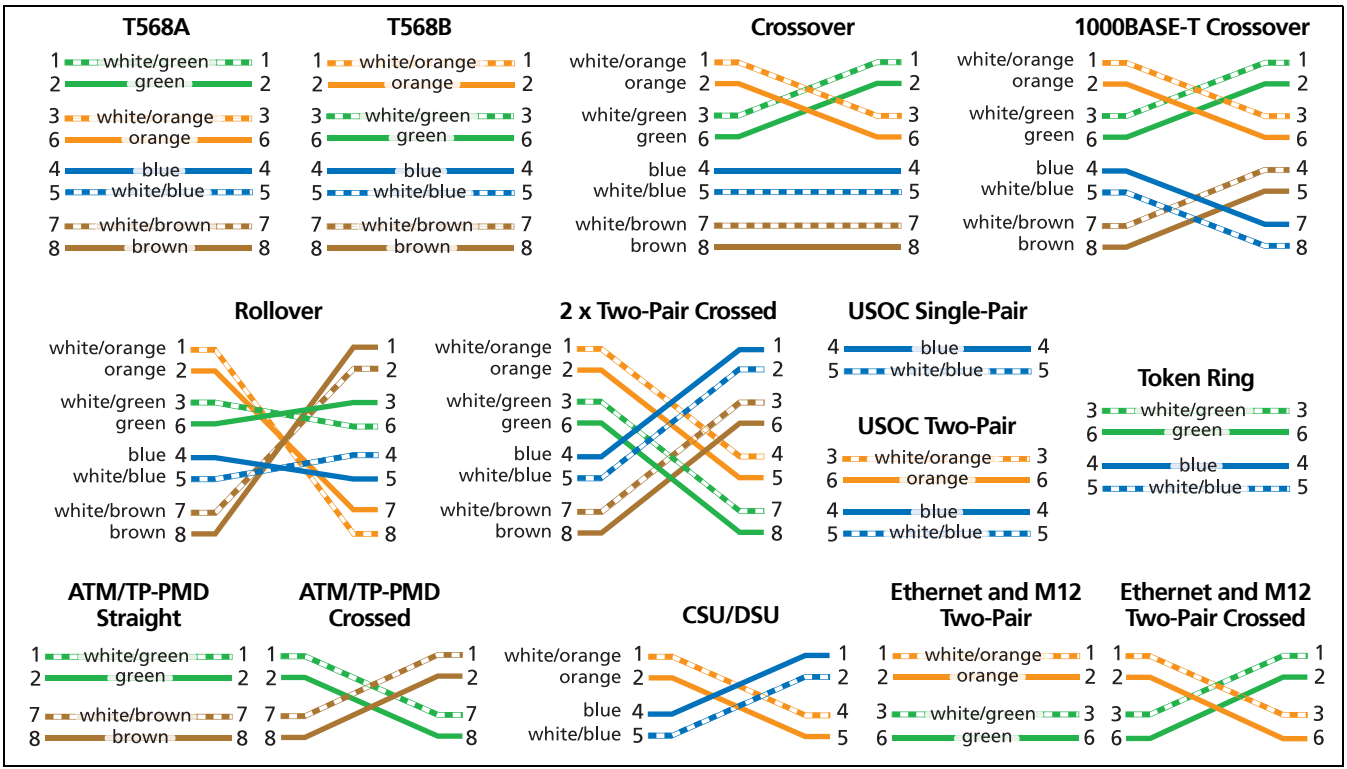

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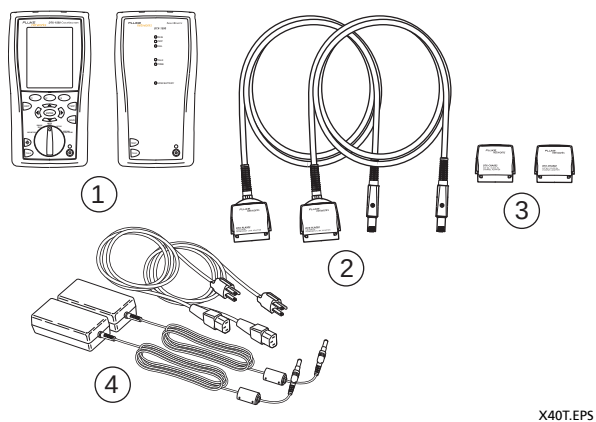
Figure 3-2. Outlet Configurations

Table 3-1. Twisted Pair Test Settings (cont.)

Setting	Description
SETUP > Twisted Pair > AC Wire Map	Select **Enable** to test cabling through a mid-span PoE (Power over Ethernet) device. Always disable the **AC Wire Map** test when not testing through a PoE device. See Chapter 4.
SETUP > Instrument Settings > Store Plot Data	**Standard**: The tester displays and saves plot data for frequency-based tests such as NEXT, return loss, and attenuation. The tester saves data for the frequency range required by the selected test limit. **Extended**: The tester saves data beyond the frequency range required by the selected test limit. **No**: Plot data is not saved, which lets you save more results. Saved results show worst margins and worst values for each pair.
SPECIAL FUNCTIONS > Set Reference	The tester must be referenced to the smart remote the first time the two units are used together. You should also set the reference every 30 days. See "Setting the Reference" on page 3-1.
SETUP > Instrument Settings	**Cable ID Source**, **Current Folder**, **Operator**, **Site**, **Company**, and **Auto Save Results** setting. See "Preparing to Save Tests" on page 2-1 and "Automatically Saving Results" on page 1-24.
SETUP > Instrument Settings > Power Line Frequency	Set to the power frequency in the area where the tester will be used. This setting helps keep ac noise (50 Hz or 60 Hz) from affecting wiremap and resistance measurements.
SETUP > Instrument Settings > Plot Grid	Select **Yes** to see a measurement grid on plots.

Autotest on Twisted Pair Cabling

Figure 3-3 shows the equipment needed for certifying twisted pair cabling.



1. Tester and smart remote with battery packs
2. For testing permanent links: two optional permanent link adapters
3. For testing channels: two channel adapters
4. Two ac adapters with line cords (optional)

Figure 3-3. Equipment for Certifying Twisted Pair Cabling

To run the Autotest on twisted pair cabling:

1. Verify that the settings listed in Table 3-1 are appropriate.
2. Attach adapters appropriate for the job to the tester and the smart remote.
3. Turn the rotary switch to **AUTOTEST** and turn on the smart remote. Connect to the cabling, as shown in Figure 3-4 or 3-5.
4. Press TEST on the tester or smart remote. To stop the test at any time, press EXIT.
5. The tester shows the Autotest **Summary** screen when the test is complete (see page 3-10). To view results for a specific parameter, use ▲ ▼ to highlight the parameter; then press ENTER.

   If the Autotest failed, press F1 **Fault Info** for possible causes of the failure.
6. To save the results, press SAVE. Select or create a cable ID; then press SAVE again.

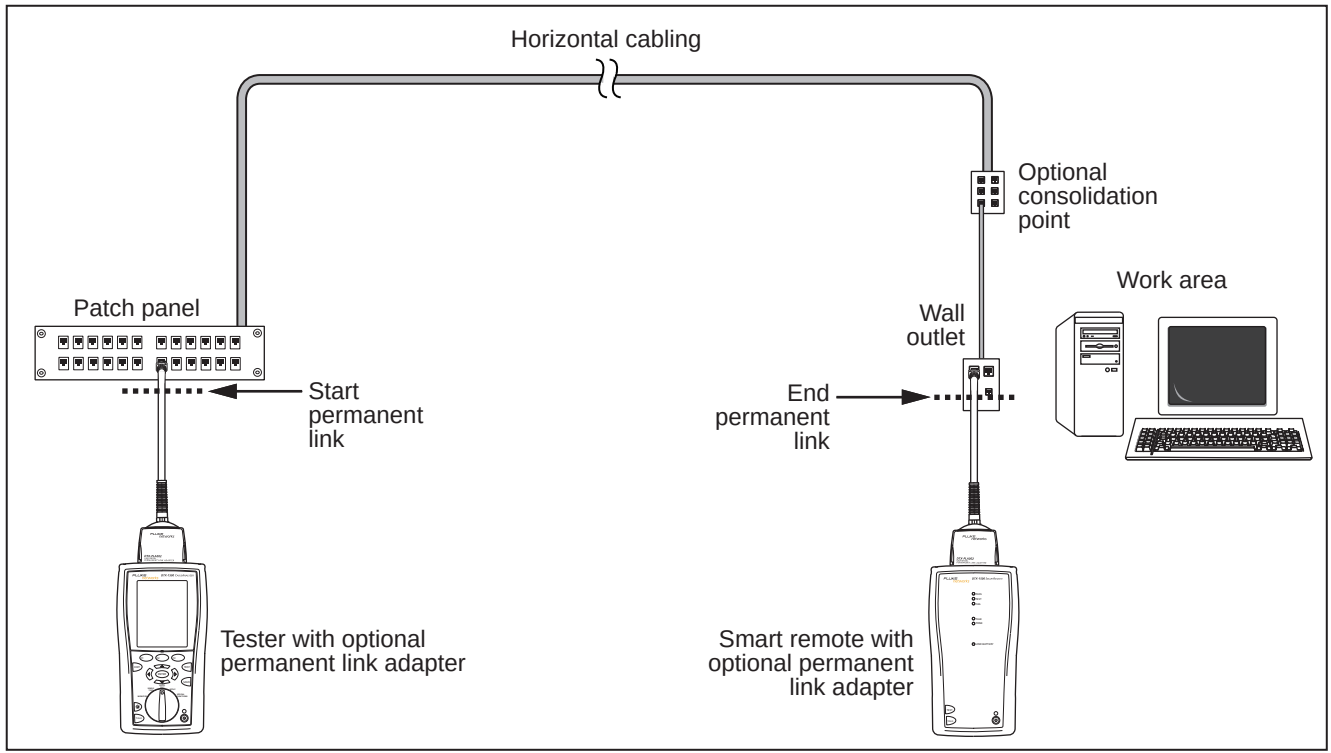


Figure 3-4. Permanent Link Test Connections

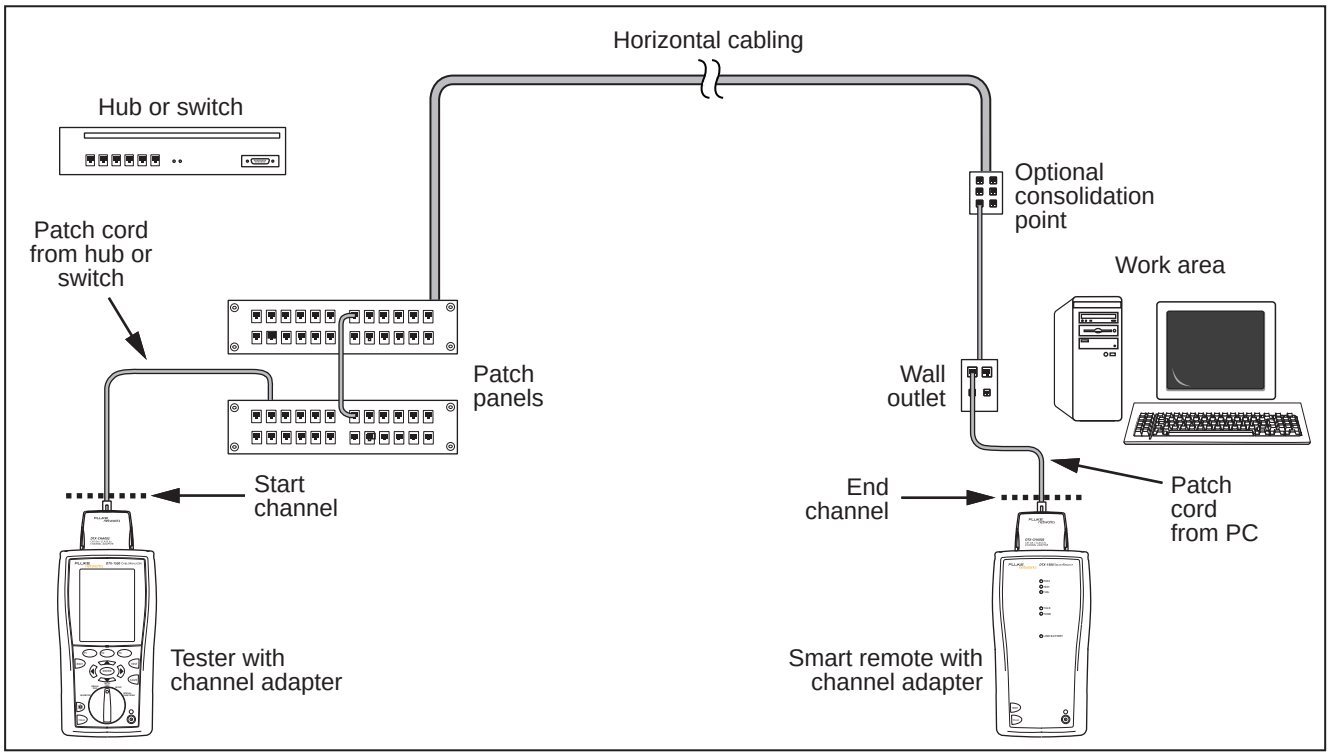


Figure 3-5. Channel Test Connections

Twisted Pair Autotest Results

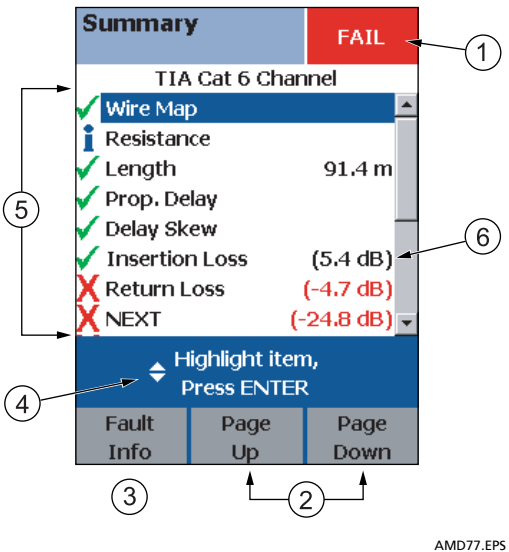
The tests listed below apply to twisted pair cabling.

Note

The Autotest runs some or all of the tests listed below, depending on the selected test limit.

- Wire map
- Resistance
- Characteristic impedance
- Length
- Propagation delay
- Delay skew
- Insertion loss (attenuation)
- NEXT (near-end crosstalk) and NEXT at the smart remote
- Return loss
- ACR-N (attenuation to crosstalk ratio at the near end) and ACR-N at the smart remote
- PS ACR-N (power-sum attenuation to crosstalk ratio) and PS ACR-N at the smart remote
- ACR-F (equal level far-end crosstalk)
- PS ACR-F (power-sum equal level far-end crosstalk)

Figure 3-6 describes the Autotest **Summary** screen.



1. **PASS:** All parameters are within limits.

   FAIL: One or more parameters exceed the limit.

   PASS*/FAIL*: One or more parameters are within the tester's accuracy uncertainty range, and the "*" notation is required by the selected test standard. See "PASS*/FAIL* Results" on page 3-12.

2. Press F2 or F3 to scroll the screen.
3. If the test failed, press F1 for diagnostic information.
4. Action prompt for the screen. Use ▼ ▲ to highlight a parameter; then press ENTER.
5. ✔: The measurement was within limits.

   i: The parameter was measured, but has no PASS/FAIL limit in the selected test limit. The results are for informational purposes only. See pages 3-13, 3-18, and 3-19.

   X: The measurement exceeds the limit.

   ✱: See "PASS*/FAIL* Results" on page 3-12.

6. The worst margin found for the test.

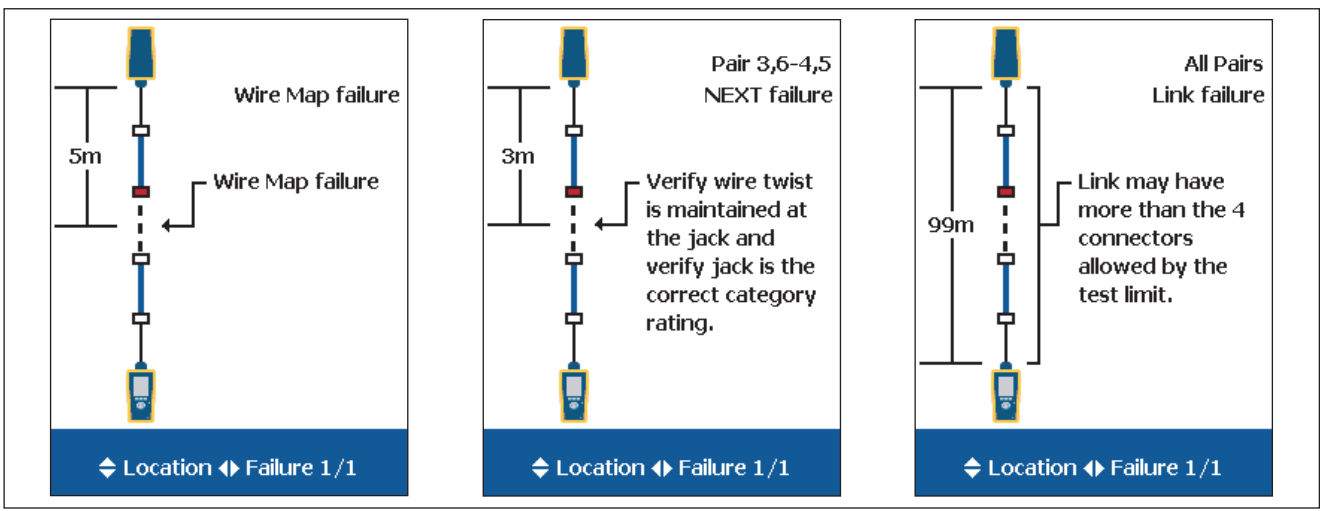
Figure 3-6. Autotest Summary Screen for Twisted Pair Cabling

Automatic Diagnostics

If an Autotest fails, press F1 **Fault Info** for diagnostic information about the failure. The diagnostic screens show likely causes of the failure and suggest actions you can take to solve the problem.

A failed test may produce more than one diagnostic screen. In this case, press ▲ ▼ ◀ ▶ to see additional screens.

Figure 3-7 shows examples of diagnostic screens.



AMD75.EPS

Figure 3-7. Examples of Automatic Diagnostic Screens

PASS*/FAIL* Results

A result marked with an asterisk means that measurements are in the tester's accuracy uncertainty range (Figure 3-8) and the "*" notation is required by the selected test standard. These results are considered marginal. Marginal passing and failing results are marked with blue and red asterisks, respectively.

A **PASS*** may be considered a passing result.

A **FAIL*** should be considered a failure.

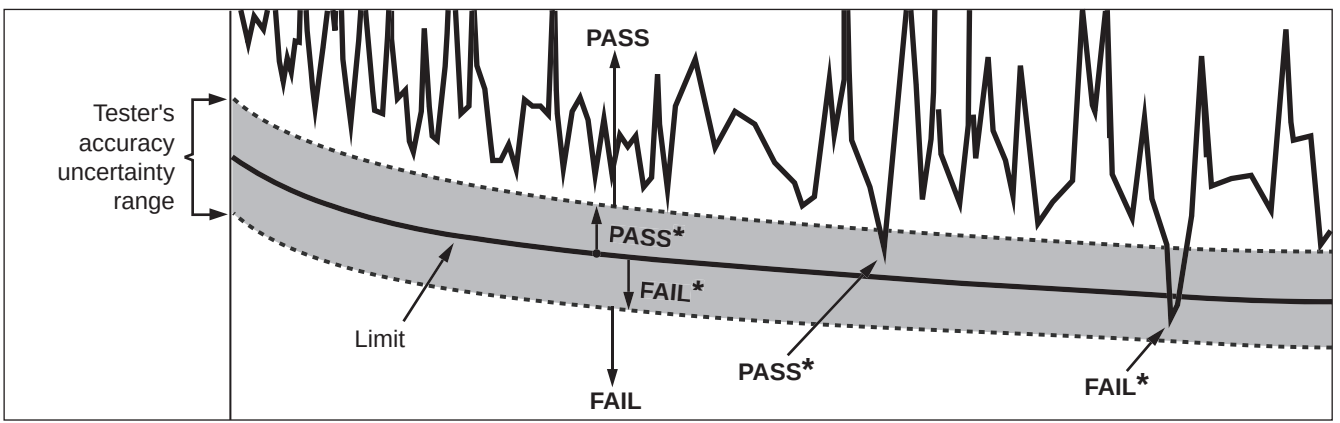


Figure 3-8. PASS* and FAIL* Results

About dB Rules

For some test limits, the results from some tests are ignored when a measurement is less than a certain value. For example, for all limits where return loss is measured, the return loss measurement is not evaluated against a limit at frequencies where insertion loss is less than 3 dB. This is the 3 dB rule.

When a measurement is not evaluated against a limit, the tester shows an **i** for the result. On the plot for that measurement, the limit line is black where the result is not evaluated. When you upload the results to LinkWare, N/A shows for the result.

The following sections summarize the dB rules. Tables 3-2 and 3-3 show the dB rules that apply to each test and the test limits that use the rules. For more information, see the Knowledge Base on the Fluke Networks website.

3 dB Rule

This rule applies to all test limits where return loss is measured.

At frequencies where insertion loss is less than 3.0 dB, return loss is not evaluated against a limit.

4 dB Rule

This rule applies to the following test limits:

- ISO/IEC 11801
- EN 50173
- Aus/NZ
- JIS

At frequencies where insertion loss is less than 4.0 dB, the measurements shown in Tables 3-2 and 3-3 are not evaluated against a limit.

12 dB Rule

This rule applies to the following test limits:

- ISO11801 Channel Class E_A
- ISO11801 PL2 Class E_A

If insertion loss is less than 12 dB at 450 MHz, a relaxed NEXT limit is used. See the Knowledge Base on the Fluke Networks website for details.

67 dB Rule for FEXT

This rule applies to TIA permanent link test limits where ACR-F is measured.

At frequencies where FEXT is less than 67 dB, ACR-F cannot fail.

67 dB Rule for PS FEXT

This rule applies to ISO/IEC channel test limits where PS ACR-F is measured.

At frequencies where PS FEXT is less than 67 dB, PS ACR-F cannot fail.

70 dB Rule for FEXT

This rule applies to TIA permanent link or ISO/IEC test limits where ACR-F is measured.

At frequencies where FEXT is less than 70 dB, ACR-F cannot fail.

70 dB Rule for PS FEXT

This rule applies to ISO/IEC permanent link test limits where PS ACR-F is measured.

At frequencies where PS FEXT is less than 70 dB, PS ACR-F cannot fail.

Table 3-2. dB Rules for Permanent Link Test Limits

Test	Class for Permanent Link Test Limit		
	D	E	E_A
NEXT	4 dB	4 dB	4 dB
PS NEXT	4 dB	4 dB	4 dB
ACR-N	4 dB	4 dB	4 dB
PS ACR-N	4 dB	4 dB	4 dB
ACR-F			70 dB
PS ACR-F			67 dB
Return Loss	3 dB	3 dB	3 dB

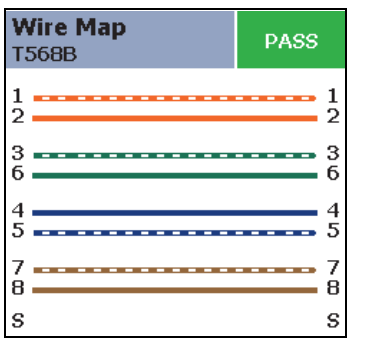
Table 3-3. dB Rules for Channel Test Limits

Test	Class for Channel Test Limit		
	D	E	E_A
NEXT	4 dB	4 dB	4 dB
PS NEXT	4 dB	4 dB	4 dB
ACR-N			
PS ACR-N			
ACR-F			70 dB
PS ACR-F			67 dB
Return Loss	3 dB	3 dB	3 dB

Wire Map

Wire map results show the connections between the main and remote testers. The tester checks the cable pairs required by the selected test limit. If the wire map test fails, you can continue or stop the Autotest. Figure 3-9 describes examples of wire map screens. For information on AC wire map screens, see Chapter 4.

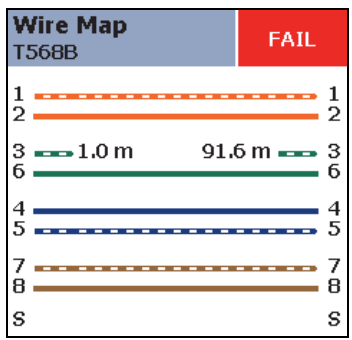
Tip: The wire map test in Single Test mode features a scanning function that runs the wire map test continuously. This function is helpful for locating intermittent wiring faults.



AMD143I.BMP

Correct wiring (568B)

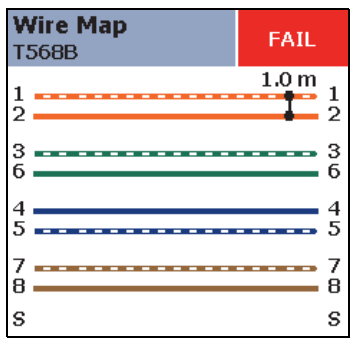
Shield continuity is shown if a shielded cable type (such as FTP or SSTP) is selected in SETUP.



AMD144I.BMP

Open

Wire 3 is open 1.0 m from the tester and 91.6 m from the smart remote.



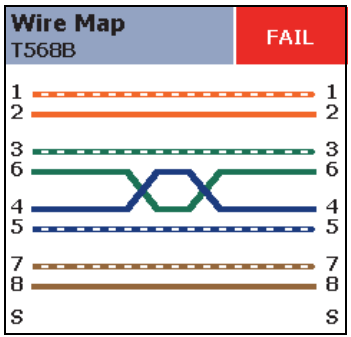
AMD81I.BMP

Short

Wires 1 and 2 are shorted 1 m from the smart remote. Shorts not within a cable pair are always shown at the near end (left side) of the wire map screen.

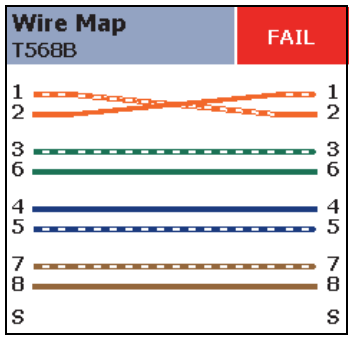
Figure 3-9. Wire Map Examples

-continued-



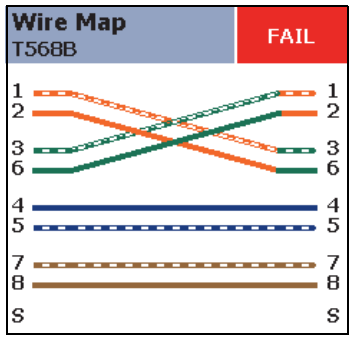
Split pair

A wire in the 3,6 pair is crossed with a wire in the 4,5 pair.



Reversed pair

Wires 1 and 2 are crossed.



Crossed pairs

Pairs 1,2 and 3,6 are crossed.

Figure 3-9. Wire Map Examples (cont.)

Resistance

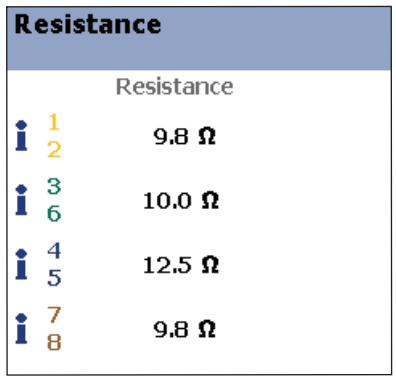
Resistance results show the dc loop resistance for each cable pair. The smart remote shorts the end of each pair to create the loops. A pair's resistance depends on the integrity of the contacts in the connector, the length of the pair, and its wire gauge.

Resistance problems always affect other tests. For example:

- A link that is too long has higher-than-normal resistance and will fail the length test.
- High-resistance connections reflect signals that cause the return loss test to fail. The tester's HDTDR test tells you the distance to the bad connection.

Most standards do not have a limit for resistance. The tester shows an **i** when no limit is available. Figure 3-10 shows the resistance results screen.

Tip: The resistance test in Single Test mode features a scanning function that runs the resistance test continuously. This function is helpful for locating intermittent resistance faults.



AMD85F.EPS

Figure 3-10. Resistance Results

Characteristic Impedance

Notes

Most test limits do not require the characteristic impedance measurement. Characteristic impedance is not displayed for these limits.

*Impedance measurements require a cable at least 13 ft (4 m) long. The tester shows **Unknown** for cables shorter than this.*

Characteristic impedance results show approximate characteristic impedance of each cable pair.

Characteristic impedance is the impedance a cable would have if the cable were infinitely long. Proper network operation depends on constant characteristic impedance throughout the system's cables and connectors. Abrupt changes in characteristic impedance, called anomalies, cause signal reflections that can cause network faults.

Length

Length results show the length of each cable pair. The **PASS/FAIL** result is assigned based on the shortest measured length. The lengths of the other pairs are shown with an **i**, meaning the measurements are for informational purposes only.

A 2 % to 5 % difference in measured length among cable pairs is normal because of the following:

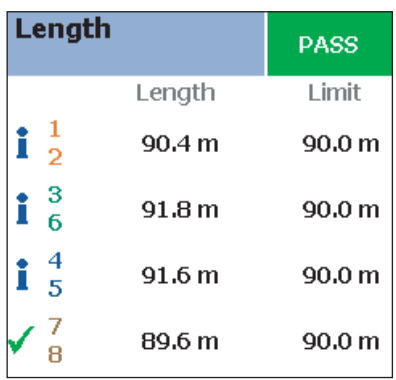
- Signals travel at slightly different speeds in each cable pair, but the tester uses the same speed to calculate the length of each pair.
- The twist rate varies slightly among cable pairs. If you untwisted and straightened all the pairs, they would have slightly different lengths.

Figure 3-11 shows a length results screen.

Notes

Differences between measured and actual length values can be caused by variations in the cable's NVP value. NVP values can vary among cable types, lots, and manufacturers. In most cases, these differences are minor and may be disregarded.

If the length of the shortest pair does not exceed the limit by 10 %, then the length test passes even if other pairs exceed the limit. This is the 10 % rule for length, as given in the ANSI/TIA standard. See the Fluke Networks Knowledge base for details.



AMD87F.EPS

Figure 3-11. Length Results

Propagation Delay and Delay Skew

Propagation delay is the time taken for a test pulse to travel the length of a cable pair. The delay is measured in nanoseconds. One nanosecond is one-billionth of a second, or 0.000000001 second. Propagation delays vary slightly among pairs because of small differences in electrical characteristics and length.

Delay skews are the differences in propagation delays between the shortest delay and the delays of the other cable pairs. The shortest delay is shown as “0 ns” in the delay skew results.

The propagation delay and delay skew results show a limit if the measurements are required by the selected test limit. Otherwise, the results always show **PASS**. Figure 3-12 shows the propagation delay and delay skew results screens.

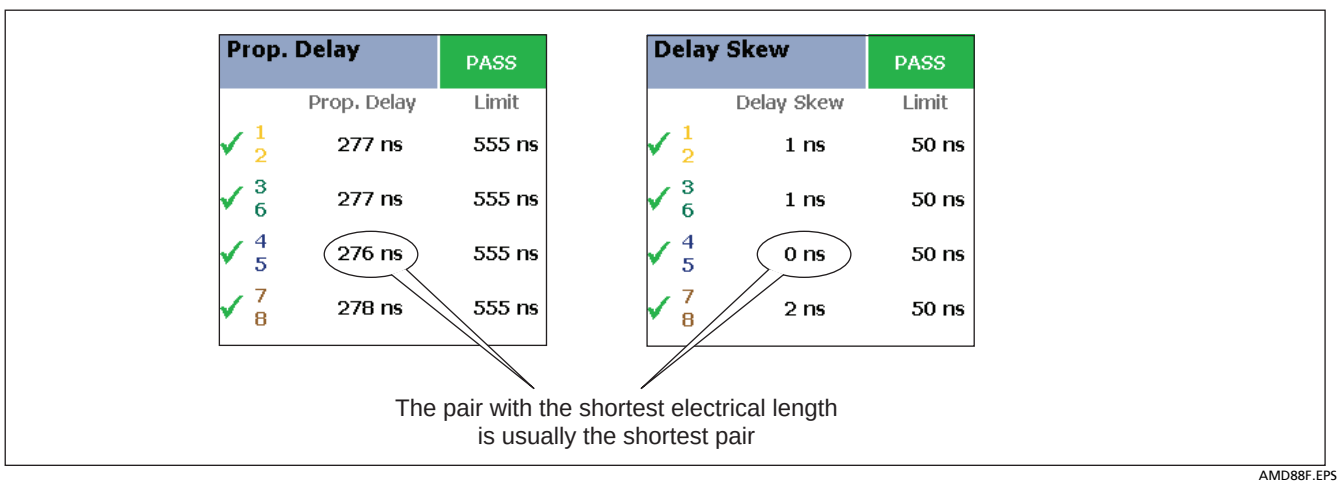


Figure 3-12. Propagation Delay and Delay Skew Results

Insertion Loss

Note

Insertion loss is also known as attenuation.

Insertion loss is the loss of signal strength over the cabling, as shown in Figure 3-13. Insertion loss is caused by the resistance of the copper wire and connecting hardware and by leakage of electrical energy through the cable's insulation.

At higher frequencies, signals tend to travel only near the surface of a conductor. This "skin effect", along with the cabling's inductance and capacitance, cause insertion loss to increase with frequency.

Figure 3-14 describes the insertion loss plot.

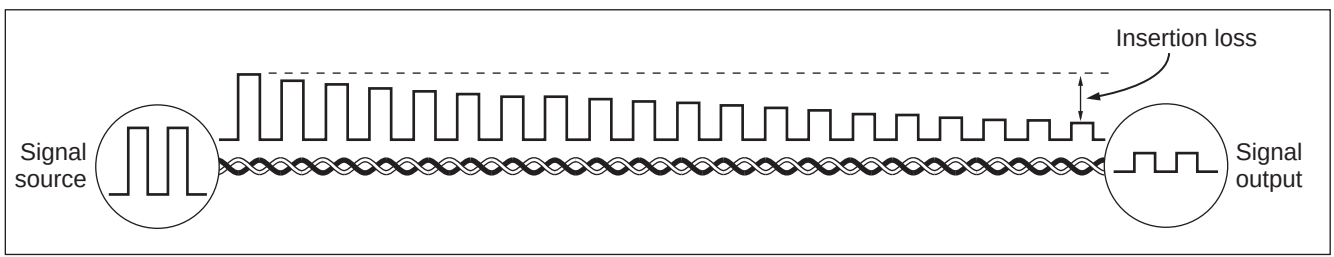
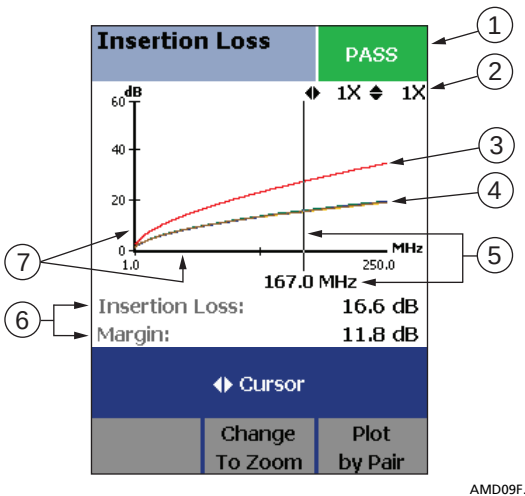


Figure 3-13. Insertion Loss is a Decrease in Signal Strength



1. The overall insertion loss result. "PASS*/FAIL* Results" on page 3-12 describes results marked with an asterisk.
2. Horizontal and vertical magnification levels for the plot. To change the magnification, press F2 **Change To Zoom**; then use ◀▶ or ▲▼ to zoom horizontally or vertically.
3. The limit line (in red) for insertion loss. The lower the measurements fall below the limit line, the better the cabling performance. Press F3 to see plots of individual pairs.
4. Measured insertion loss for the cable pairs. Lower insertion loss means better cabling performance.
5. The cursor and its location on the frequency scale. When you first view the plot, the cursor is placed at the worst margin. Use ◀▶ to move the cursor (if the plot is in zoom mode, press F2 **Change To Cursor** first).
6. The measured insertion loss and margin at the cursor's position. Margin is the difference between the measured value and the limit. Margin is negative if the pair failed.
7. The horizontal scale is the frequency range in megahertz. The vertical scale is the insertion loss range in decibels.

Figure 3-14. Insertion Loss Plot

NEXT (Near-End Crosstalk)

NEXT results show the crosstalk attenuation between cable pairs. NEXT is the difference in amplitude (in dB) between a transmitted signal and the crosstalk received on other cable pairs at the same end of the cabling. Higher NEXT values correspond to better cabling performance.

Because of insertion loss, crosstalk signals occurring farther from the signal source are weaker and cause less trouble than crosstalk nearer the source (Figure 3-15). For this reason, NEXT is measured from both ends of the cabling.

For NEXT failures, the tester's diagnostic screens (F1 **Fault Info**) may show more than one possible cause for the failure. In this case, you can use the HDTDX analyzer results to further diagnose the problem. See page 6-19 for details. Figure 3-16 describes the NEXT plot.

Note

The 4 dB rule may apply to your NEXT results. See page 3-13.

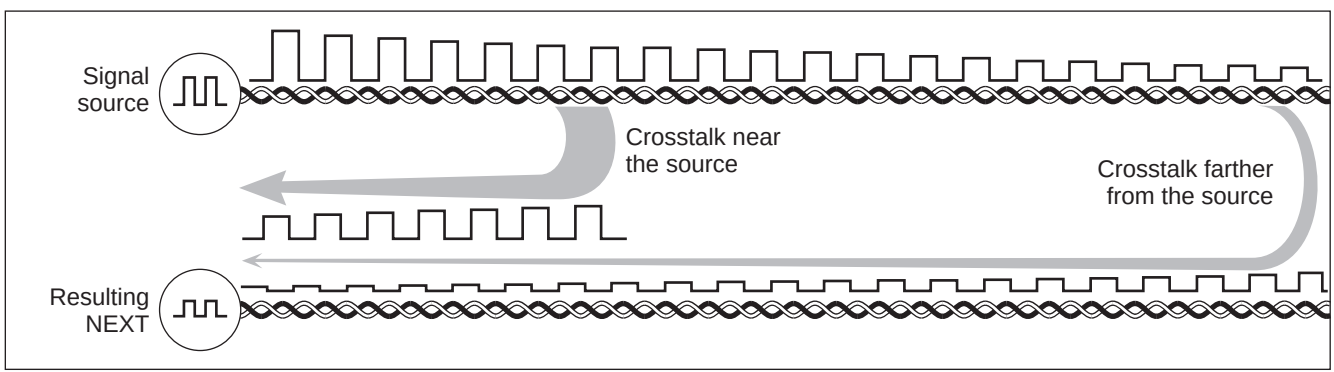
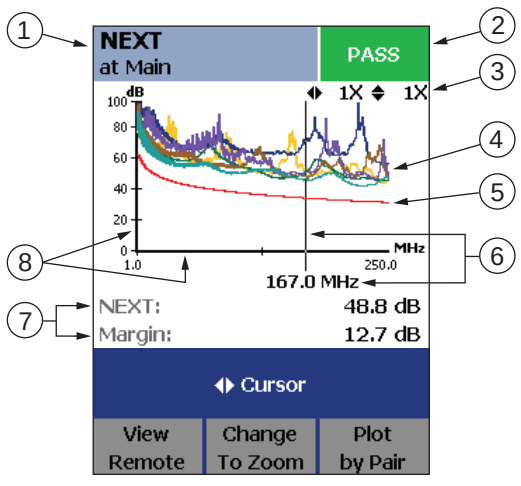


Figure 3-15. Near-End Crosstalk (NEXT)



1. The location of the NEXT results. Press F1 to switch between the tester and smart remote.
2. The overall NEXT result. "PASS*/FAIL* Results" on page 3-12 describes results marked with an asterisk.
3. Horizontal and vertical magnification levels for the plot. To change the magnification, press F2 **Change To Zoom**; then use ◀▶ or ▲▼ to zoom horizontally or vertically.
4. Measured NEXT for the cable pairs. Higher NEXT means better cabling performance.
5. The limit line (in red) for NEXT. The higher the measurements rise above the limit line, the better the cabling performance. If the line is black, NEXT is not evaluated at those frequencies. See page 3-13. Press F3 to see plots of individual pairs.
6. The cursor and its location on the frequency scale. When you first view the plot, the cursor is placed at the worst margin. Use ◀▶ to move the cursor (if the plot is in zoom mode, press F2 **Change To Cursor** first).
7. The measured NEXT and margin at the cursor's position. Margin is the difference between the measured value and the limit. Margin is negative if the pair failed.
8. The horizontal scale is the frequency range in megahertz. The vertical scale is the NEXT range in decibels.

Figure 3-16. NEXT Plot

ACR-N (Attenuation to Crosstalk Ratio at the Near End)

Note

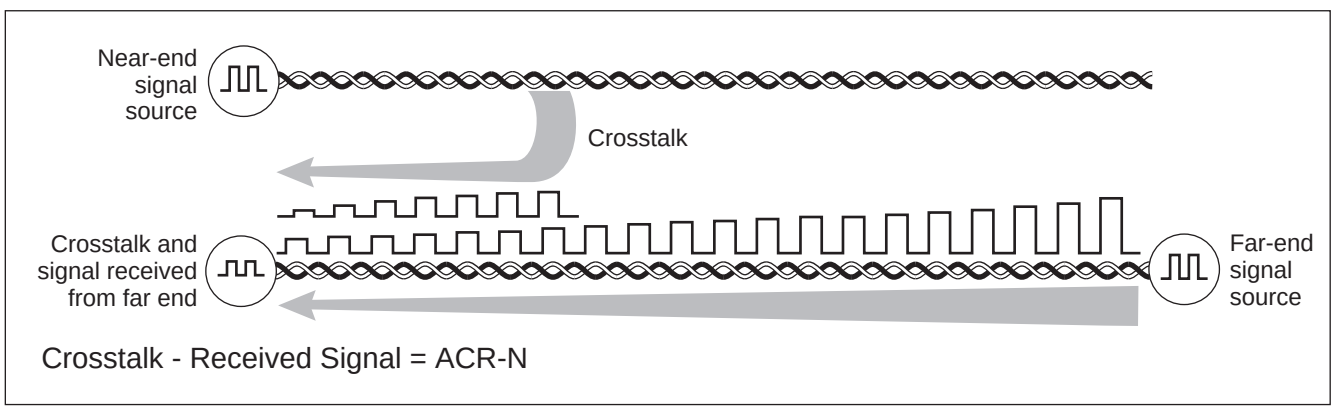
ACR-N is also known as ACR.

ACR-N is like a signal-to-noise ratio. ACR-N values indicate how the amplitude of signals received from a far-end transmitter compares to the amplitude of crosstalk produced by near-end transmissions, as shown in Figure 3-17. The tester calculates ACR-N as the difference (in dB) between NEXT and attenuation (insertion loss). Higher ACR-N values mean received signals are much larger than crosstalk signals. Higher ACR-N values correspond to better cabling performance.

Figure 3-18 describes the ACR-N plot.

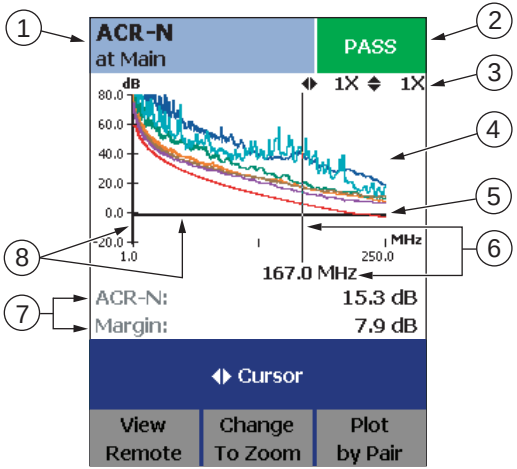
Note

The 4 dB rule may apply to your ACR-N results. See page 3-13.



AMD91F.EPS

Figure 3-17. Attenuation to Crosstalk Ratio, Near End (ACR-N)



(1) The location of the ACR-N results. Press F1 to switch between the tester and smart remote.

(2) The overall ACR-N result. "PASS*/FAIL* Results" on page 3-12 describes results marked with an asterisk.

(3) Horizontal and vertical magnification levels for the plot. To change the magnification, press F2 **Change To Zoom**; then use ◀▶ or ▲▼ to zoom horizontally or vertically.

(4) Measured ACR-N for the cable pairs. Higher ACR-N means better cabling performance.

(5) The limit line (in red) for ACR-N. The higher the measurements rise above the limit line, the better the cabling performance. If the line is black, ACR-N is not evaluated at those frequencies. See page 3-13. Press F3 to see plots of individual pairs.

(6) The cursor and its location on the frequency scale. When you first view the plot, the cursor is placed at the worst margin. Use ◀▶ to move the cursor (if the plot is in zoom mode, press F2 **Change To Cursor** first).

(7) The measured ACR-N and margin at the cursor's position. Margin is the difference between the measured value and the limit. Margin is negative if the pair failed.

(8) The horizontal scale is the frequency range in megahertz. The vertical scale is the ACR-N range in decibels.

Figure 3-18. ACR-N Plot

Return Loss

Return loss is the difference between the power of a transmitted signal and the power of the signals reflected back. The signal reflections are caused by variations in the cable's impedance. Figure 3-19 shows some common sources of reflections that create return loss.

High return loss means the cabling reflects very little of the transmitted signal back to the source. High return loss is especially important for high-speed systems, such as Gigabit Ethernet. The bi-directional (full-duplex) transceivers used in these systems use directional couplers to distinguish between incoming and outgoing signals. The couplers may interpret strong reflected signals as incoming data, resulting in data errors.

A return loss plot indicates how well a cable's impedance matches its rated impedance over a range of frequencies. Figure 3-20 describes the return loss plot.

For return loss failures, the testers diagnostic screens (F1 **Fault Info**) may show more than one possible cause for the failure. In this case, you can use the HDTDR analyzer results to further diagnose the problem. See page 6-22 for details.

Note

The 3 dB rule applies to return loss results. See page 3-13.

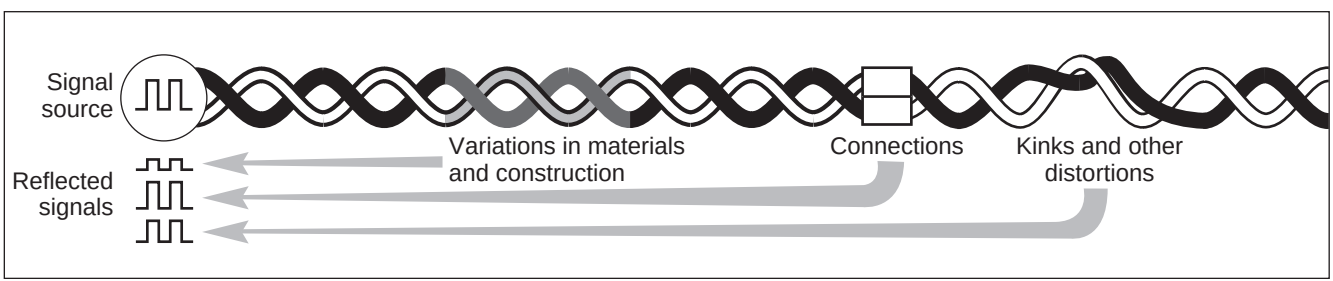
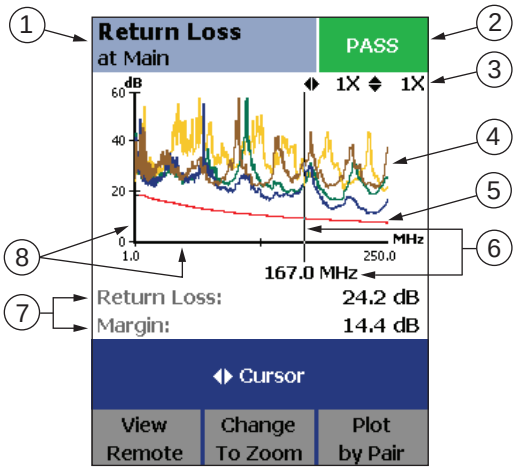


Figure 3-19. Sources of Return Loss



1. The location of the return loss results. Press F1 to switch between the tester and smart remote.
2. The overall return loss result. "PASS*/FAIL* Results" on page 3-12 describes results marked with an asterisk.
3. Horizontal and vertical magnification levels for the plot. To change the magnification, press F2 **Change To Zoom**; then use ◀▶ or ▲▼ to zoom horizontally or vertically.
4. Measured return loss for the cable pairs. Higher return loss means better cabling performance.
5. The limit line (in red) for return loss. The higher the measurements rise above the limit line, the better the cabling performance. If the line is black, return loss is not evaluated at those frequencies. See page 3-13. Press F3 to see plots of individual pairs.
6. The cursor and its location on the frequency scale. When you first view the plot, the cursor is placed at the worst margin. Use ◀▶ to move the cursor (if the plot is in zoom mode, press F2 **Change To Cursor** first).
7. The measured return loss and margin at the cursor's position. Margin is the difference between the measured value and the limit. Margin is negative if the pair failed.
8. The horizontal scale is the frequency range in megahertz. The vertical scale is the return loss range in decibels.

Figure 3-20. Return Loss Plot

PS NEXT (Power Sum Near End Crosstalk)

PS NEXT results show how much each cable pair is affected by the combined crosstalk from the other pairs. PS NEXT is the difference (in dB) between the test signal and the crosstalk from the other pairs received at the same end of the cabling. The tester uses the NEXT values to calculate PS NEXT. Higher PS NEXT values correspond to better cabling performance.

PS NEXT results are typically a few dB lower (worse) than worst-case NEXT results.

Note

The 4 dB rule may apply to your PS NEXT results. See page 3-13.

PS ACR-N (Power Sum Attenuation to Crosstalk Ratio, Near End)

Note

PS ACR-N is also known as PSACR.

PS ACR-N values indicate how the amplitude of signals received from a far-end transmitter compares to the combined amplitudes of crosstalk produced by near-end transmissions on the other cable pairs. PS ACR-N is the difference (in dB) between PS NEXT and attenuation (insertion loss). The tester uses the PS NEXT and attenuation results to calculate PS ACR-N values. Higher PS ACR-N values mean received signals are much larger than the crosstalk from all the other cable pairs. Higher PS ACR-N values correspond to better cabling performance.

PS ACR-N is the difference (in dB) between each wire pair's attenuation (insertion loss) and the combined crosstalk received from the other pairs. The tester uses the PS NEXT and attenuation values to calculate PS ACR-N values.

PS ACR-N results are typically a few dB lower (worse) than worst-case ACR-N results.

Note

The 4 dB rule may apply to your PS ACR-N results. See page 3-13.

ACR-F (Attenuation to Crosstalk Ratio, Far End)

Note

ACR-F is also known as ELFEXT.

While NEXT is measured at the same end as the signal source, FEXT (far-end crosstalk) is measured at the far end. Because all far-end crosstalk signals travel the same distance, they experience the same amount of attenuation, as shown in Figure 3-15. This means that all crosstalk signals contribute equally to noise at the far end. This is different from near-end crosstalk. At the near end, crosstalk occurring closer to the source contributes more to noise than crosstalk occurring farther from the source (Figure 3-21).

Note

The 70 dB rule may apply to your ACR-F results. See page 3-13.

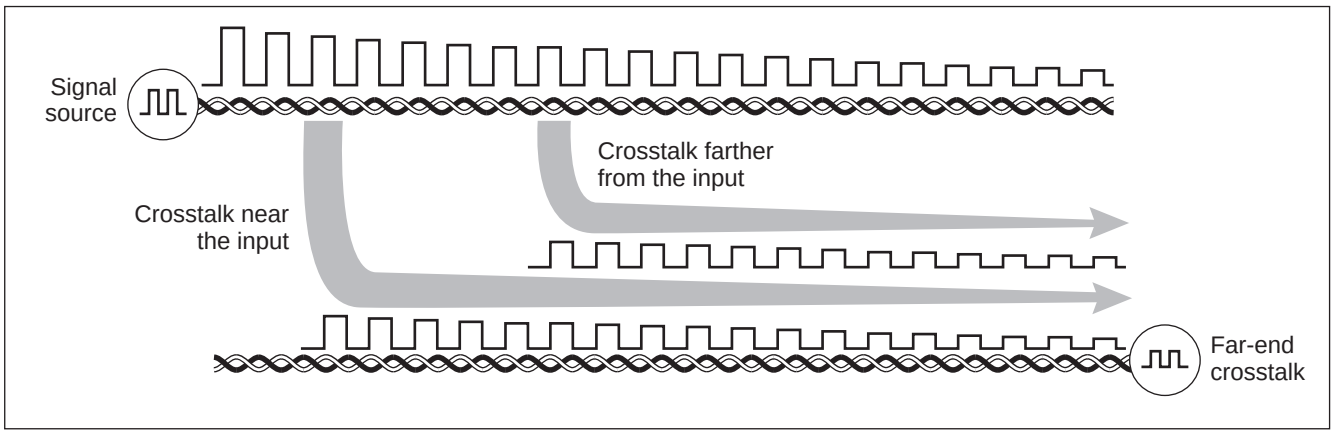


Figure 3-21. Far-End Crosstalk (FEXT)

Because of attenuation, FEXT on longer cables is less than FEXT on shorter cables of the same type. Subtracting the effects of attenuation normalizes the results for length and produces ACR-F (attenuation to crosstalk ratio, far end) values. Since ACR-F does not depend on length, it is used instead of FEXT to evaluate cable performance.

Because all far-end crosstalk signals travel the same distance, they tend to add up in phase. Therefore, high ACR-F is critical when two or more wire-pairs carry signals in the same direction. 1000BASE-T carries bi-directional signals on all four wire pairs, so ACR-F is a critical parameter for 1000BASE-T certification.

Like ACR-N, ACR-F represents a signal-to-noise ratio for the cabling. Higher ACR-F values mean that data signals received at the far end of the cabling are much larger than crosstalk signals received at the far end. Higher ACR-F values correspond to better cabling performance.

NEXT and ACR-F performance tends to be similar in cable, but may differ greatly in connecting hardware. Some connectors achieve good NEXT performance by balancing the inductive and capacitive currents that cause crosstalk. Since these currents are 180° out of phase at the near-end of the cabling, they cancel out, which eliminates crosstalk at the near end. However, currents that cancel at the near end add up at the far end, causing far-end crosstalk and poor ACR-F performance.

Figure 3-22 describes the ACR-F plot.

PS ACR-F Test

Note

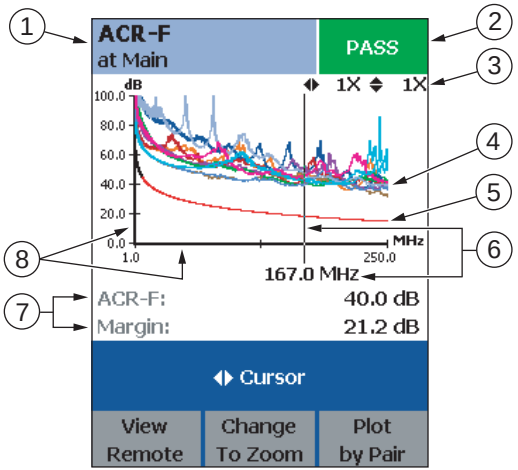
PS ACR-F is also known as PSELFEXT (power sum attenuation to crosstalk ratio, far-end).

PS ACR-F results show how much the far end of each cable pair is affected by the combined far-end crosstalk from the other pairs. PS ACR-F is the difference (in dB) between the test signal and the crosstalk from the other pairs received at the far end of the cabling. The tester uses the ACR-F values to calculate PS ACR-F. Higher PS ACR-F values correspond to better cabling performance.

PS ACR-F results are typically a few dB lower than worst-case ACR-F results.

Note

The 67 dB rule may apply to your PS ACR-F results. See page 3-13.



1. The location of the ACR-F results. Press F1 to switch between the tester and smart remote.
2. The overall ACR-F result. "PASS*/FAIL* Results" on page 3-12 describes results marked with an asterisk.
3. Horizontal and vertical magnification levels for the plot. To change the magnification, press F2 **Change To Zoom**; then use ◀▶ or ▲▼ to zoom horizontally or vertically.
4. Measured ACR-F for the cable pairs. Higher ACR-F means better cabling performance.
5. The limit line (in red) for ACR-F. The higher the measurements rise above the limit line, the better the cabling performance. If the line is black, ACR-F is not evaluated at those frequencies. See page 3-13. Press F3 to see plots of individual pairs.
6. The cursor and its location on the frequency scale. When you first view the plot, the cursor is placed at the worst margin. Use ◀▶ to move the cursor (if the plot is in zoom mode, press F2 **Change To Cursor** first).
7. The measured ACR-F and margin at the cursor's position. Margin is the difference between the measured value and the limit. Margin is negative if the pair failed.
8. The horizontal scale is the frequency range in megahertz. The vertical scale is the ACR-F range in decibels.

Figure 3-22. ACR-F Plot

Running Single Tests

The tester's single test mode (**SINGLE TEST** on the rotary switch) lets you run individual tests for isolating cabling failures and quickly testing repairs. You can run some single tests without a remote. Table 3-4 shows which tests require a smart remote.

Single tests use the selected test limit to produce a PASS/FAIL result for the test. Each single test also produces results for other measurements. For example, the wire map test also produces propagation delay and delay skew results. To see these results, press EXIT when the single test is finished; then press F2 **View Results**.

To save a single test, press SAVE, select or create a cable ID; then press SAVE again.

Table 3-4. Smart Remote Requirements for Twisted Pair Single Tests

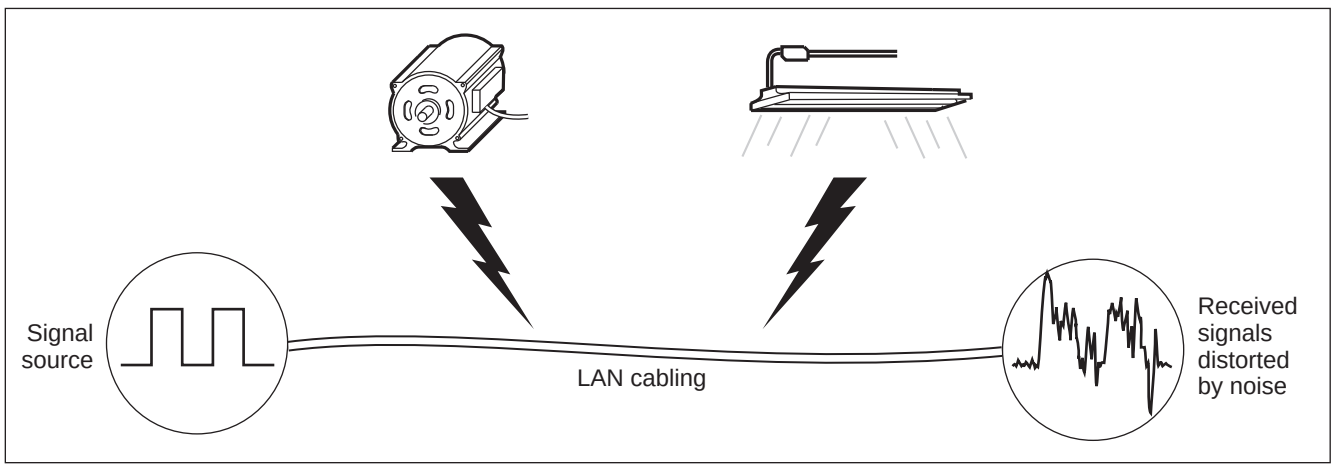
Test	Smart Remote Requirements*
HDTDX analyzer	Recommended. Without a smart remote, results for short cables may be unreliable.
HDTDR analyzer	Optional. Without a smart remote, the plot shows large reflections at the end of the cabling.
Wire Map	Recommended. Without a remote some faults, such as split pairs and opens at the far-end connector, cannot be detected.
AC Wire Map	Required. See Chapter 4.
Resistance	Optional.
Impedance	Optional. Test is available only for limits that require the impedance measurement.
Length	Optional.
Propagation Delay	Optional.
Delay Skew	Optional.
Insertion Loss	Required.
NEXT/PS NEXT	Recommended. The NEXT test may fail if the end of the cabling is not properly terminated with a remote or resistors.
ACR-F/PS ACR-F	Required.
ACR-N/PS ACR-N	Required.
Return Loss	Recommended. The return loss test may fail if the end of the cabling is not properly terminated with a remote or resistors.
* Note: If a remote is not required for a test, the test runs without activating the toner when no remote is detected.	

Monitoring Impulse Noise

Impulse noise is electrical noise generated by fluorescent lights, electric motors, electric heaters and air conditioners, photocopiers, refrigerators, microwave ovens, and other electric devices. Active links in the same pathway can also cause noise.

Noise distorts the shape of digital signals, as shown in Figure 3-23. Too much noise can cause transmission errors, resulting in poor network performance.

The impulse noise test lets you monitor noise on inactive twisted pair cabling to determine if the noise may affect network operation.



AMD95F.EPS

Figure 3-23. Causes and Effects of Noise

The test takes noise voltage samples every second on pair 3, 6. The test produces a PASS/FAIL result if the selected standard specifies a noise limit.

Note

Monitoring impulse noise without a smart remote may produce unreliable test results.

To monitor impulse noise:

1. Attach twisted pair link interface adapters to the tester and smart remote.
2. Turn the rotary switch to **MONITOR** and turn on the smart remote; then connect to the testers to the ends of the cabling.
3. Press TEST.
4. To adjust the noise threshold, press F3 **Stop**; then use ▲ ▼ to change the value. Press TEST to resume testing.

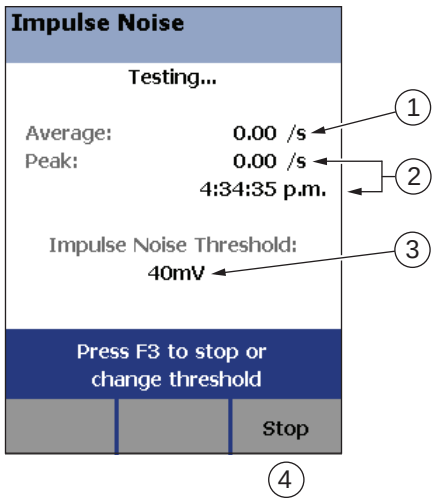
Tip: Fluke Networks recommends a noise threshold of 30 mV with an average pulse rate below 0.01/sec for testing 1000BASE-T (Gigabit Ethernet) cabling.

To stop the test at any time, press EXIT.

Note

If you disconnect the tester and smart remote during the impulse noise test, it takes several minutes for the remote to stop testing.

Figure 3-24 describes the impulse noise test results.



1. The average number of noise hits per second.
2. The highest number of noise hits per second since the start of the test. The time shows when the peak was recorded.
3. The minimum level of noise considered to be a noise hit. To change the threshold, press F3 **Stop**; then use ▲ ▼.
4. To stop the test, press F3 **Stop**.

Figure 3-24. Impulse Noise Test Results

Using the Tone Generator

The tone generator on the tester and smart remote produces a distinct signal for locating cables and jacks with a tone probe such as a Fluke Networks IntelliTone™ probe. The tone probe converts the toner's signal to audible tones that get louder as you get closer to the cable or jack transmitting the signal.

The tone generator also activates a sleeping or powered-down tester or smart remote connected to the other end of the cabling.

Note

The tone generator does not generate the IntelliTone signal.

To use the tone generator:

1. Attach a twisted pair adapter to the tester or smart remote.
2. Connect the tester or smart remote to the cabling as shown in Figure 3-25.
3. To turn on the tester's toner, turn the rotary switch to **AUTOTEST** or **SINGLE TEST**; then press TEST.
4. To turn on the smart remote's toner, press TEST.
5. Use a tone probe to locate the cable or jack transmitting the tone.

   Note

   The toner's signal may not be detectable along shielded cable, but can be detected at a patch panel or outlet.
6. To start the test selected on the tester, connect the far-end unit to the cabling.

   To turn off the tester's toner, press EXIT.

   To turn off the smart remote's toner, press TEST.

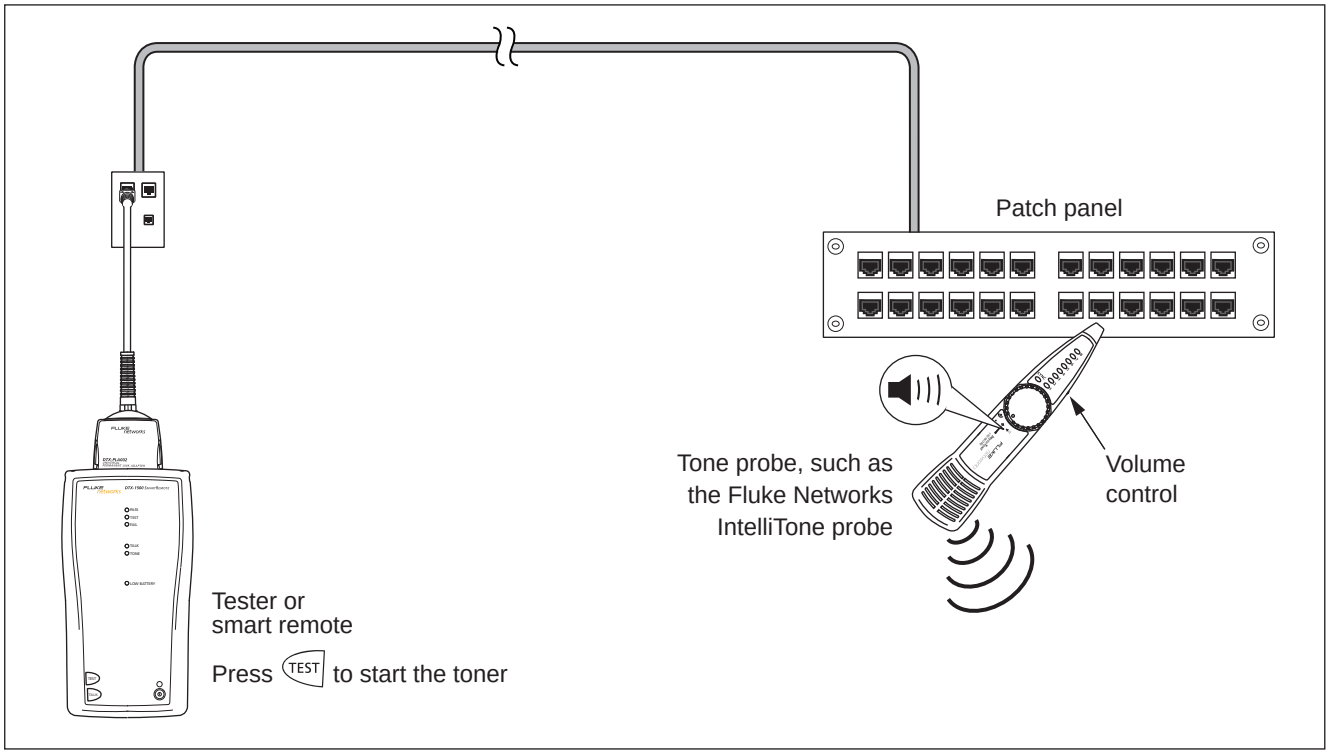


Figure 3-25. Using the Tone Generator

Chapter 4: Testing Twisted Pair Through a PoE Device

The AC wire map test lets you test links connected through midspan PoE (Power over Ethernet) devices. When you enable this test, the tester uses AC signals instead of DC signals to test the wire map between the main and remote testers. The tester does not provide information on the PoE device.

Enabling the AC Wire Map Test

1. Turn the rotary switch to **SETUP**.
2. Press ENTER to select **Twisted Pair**.
3. Press ▷ to select tab **2**.
4. Press ▽ to highlight **AC Wire Map**; then press ENTER.
5. Use ▽ to highlight **Enable**; then press ENTER.

Note

Always disable the AC Wire Map test when not testing through a PoE device.

Autotest Through a PoE Device

1. Enable the **AC Wire Map** test.
2. Connect to the cabling as shown in Figure 4-1.
3. Verify that the PoE device is turned off.
4. Run an Autotest as described on page 3-6.

Notes

When the AC Wire Map test is enabled:

- *The Autotest may run slower.*
- *Some tests, such as resistance, are not run.*
- *The Autotest does not stop if a wire map fault is detected.*
- *The AC Wire Map test requires a smart remote.*

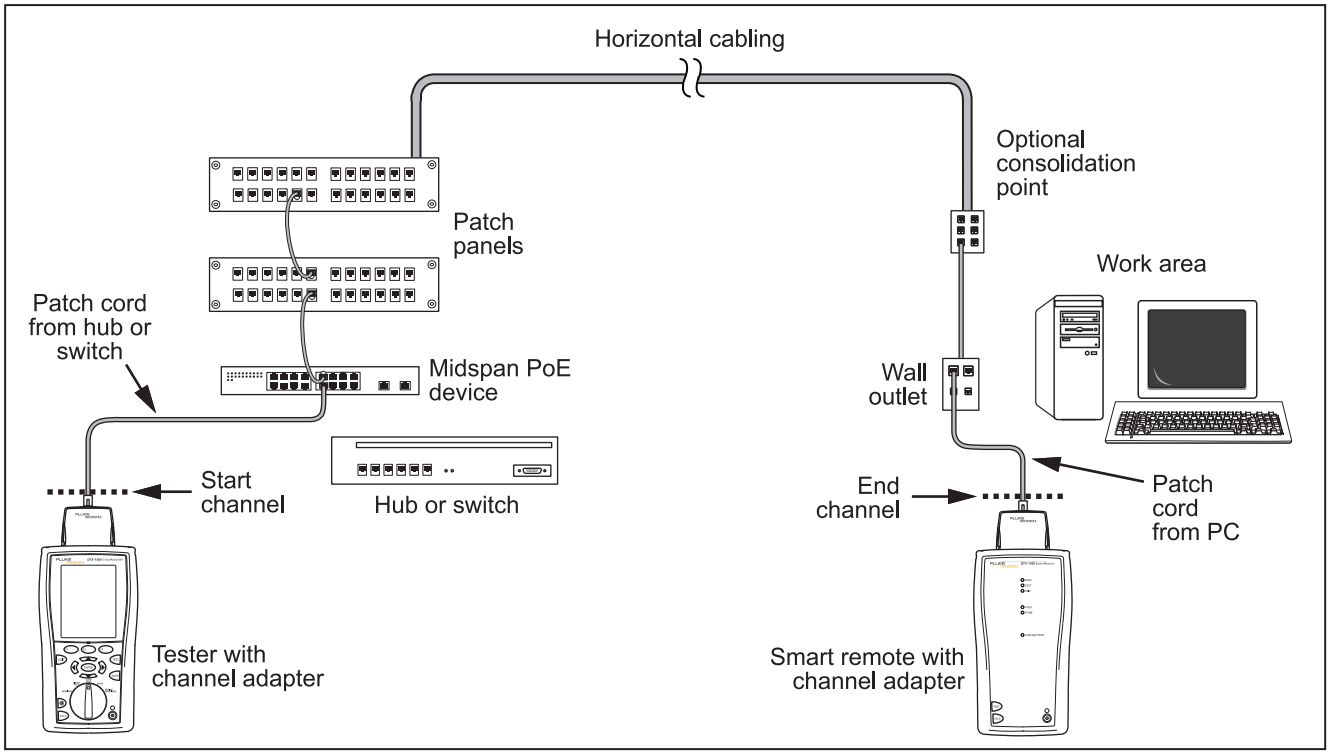


Figure 4-1. Testing a Channel Through a PoE Device

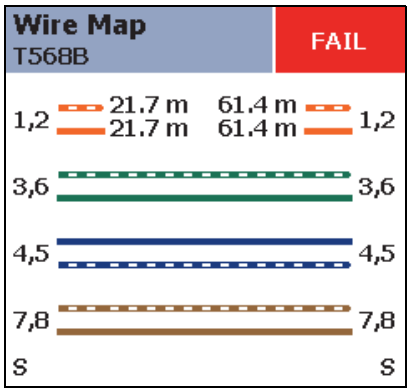
AC Wire Map Results

AC wire map results are similar to the wire map results shown in Chapter 3. In some cases, the fault information provided by AC wire maps is less specific. For example, if a wire is shorted to a wire in another pair, the AC wire map shows all four wires shorted. This occurs because the AC electrical characteristics of some faults limit the measurements available from the fault.

Figure 4-2 describes examples of AC wire map screens.

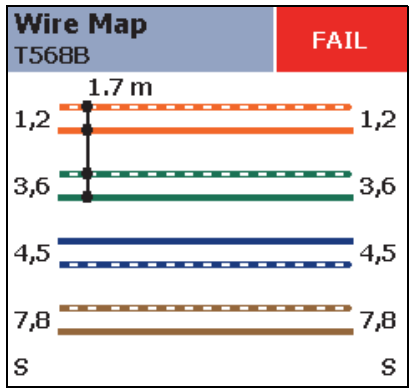
When the tester detects multiple wire map faults or cannot map the cable wiring, it may not display the wire map screen, but may show a diagnostics screen instead. Figure 4-3 describes examples of these screens.

Tip: To isolate faults when limited wire map or fault information is available, disable the AC wire map test; then test the cabling after the PoE device. Also test the patch cord connecting the PoE to the link.



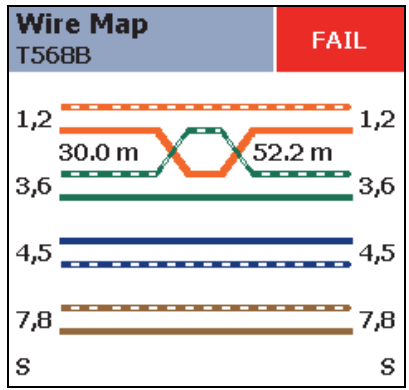
AMD52.BMP

Open on pair 1,2. The open is 21.7 m from the tester and 61.4 m from the remote. The open may be on either or both wires.



AMD50.BMP

Short between pairs 1,2 and 3,6. The short is 1.7 m from the tester. The short may be between two, three, or all four wires.



AMD45.BMP

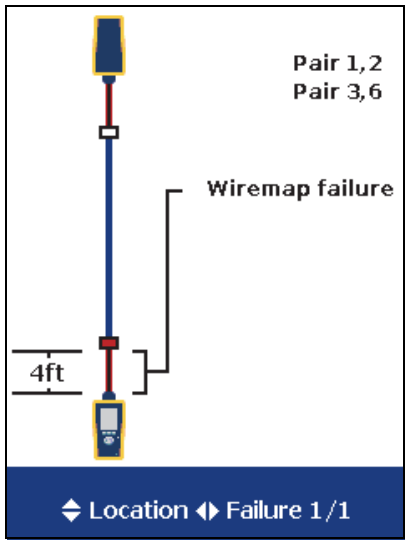
Split pair on pairs 1,2 and 3,6. The split pair starts 30.0 m and ends 52.2 m from the main tester.

Notes

AC wire maps show the wire pair numbers next to each other if there is a fault on the cable.

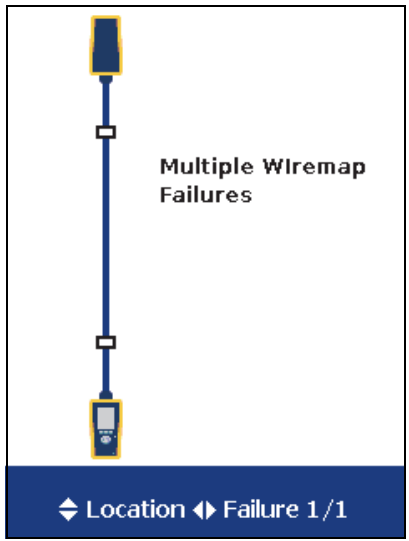
AC wire maps do not show the shield connection unless there is a short to the shield.

Figure 4-2. AC Wire Map Examples



AMD43.BMP

The tester detected one or more wire map faults on pairs 1,2 and 3,6 about 4 ft from the tester. The distance to faults may not be given for some types of complex faults.



AMD44.BMP

The tester detected multiple, complex faults on the cabling.

Figure 4-3. Examples of AC Wire Map Results for Complex Faults

Running the AC Wire Map Test as a Single Test

To run the AC Wire Map test as a single test, enable the test in SETUP, turn the rotary switch to **SINGLE TEST**; then select **Wire Map**.

Note

The scanning function is not available for the AC wire map test.

Chapter 5: Certifying Coaxial Cabling

Certifying coaxial cabling requires the optional DTX-COAX coaxial adapters.

Verifying Operation

1 Connect the main and remote testers as shown for setting the reference in Figure 5-1.

2 Turn the rotary switch to **SPECIAL FUNCTIONS**.

3 Use  to highlight **Self Test**; then press ENTER.

4 Press TEST.

If the tester reports an error, refer to "If Something Seems Wrong" on page 9-7.

Setting the Reference

The reference procedure sets a baseline for insertion loss and resistance measurements.

Run the tester's reference procedure at the following times:

When you want to use the tester with a different smart remote. You can reference the tester to two different smart remotes.

Every 30 days. Doing so ensures maximum accuracy of test results.

You do not need to set the reference after changing link interface adapters.

To set the reference, do the following:

Note

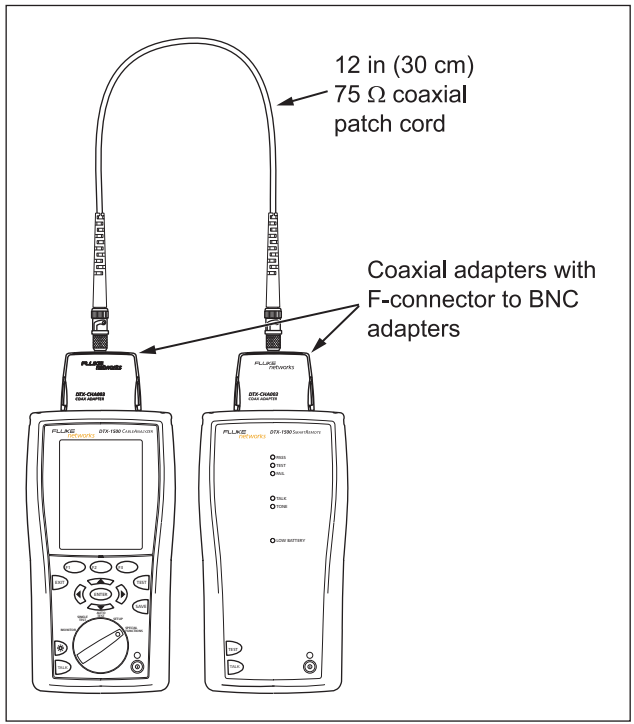
Turn on the tester and let it sit for 1 minute before setting the reference. Set the reference only after the testers have reached an ambient temperature between 10 °C and 40 °C (50 °F and 104 °F).

1 Attach coaxial adapters to the main and remote testers, screw in the F-connector to BNC adapters; then make the connections shown in Figure 5-1.

2 Turn the rotary switch to **SPECIAL FUNCTIONS**.

3 Highlight **Set Reference**; then press (ENTER).

4 Press (TEST).



X140.EPS

Figure 5-1. Coaxial Reference Connections

Coaxial Test Settings

Table 5-1 describes the settings that apply to coaxial cabling tests.

To access the settings, turn the rotary switch to **SETUP**, use  to highlight **Coax**; then press ENTER.

Table 5-1. Coaxial Cable Test Settings

Setting	Description
SETUP > Coaxial > Test Limit	Select the appropriate test limit for the job.
SETUP > Coaxial > Cable Type	Select a cable type appropriate for the type you will test.
SETUP > Coaxial > NVP	Nominal velocity of propagation, which is used with the measured propagation delay to determine cable length. The default value defined by the selected cable type represents the typical NVP for that cable type. You may enter a different value if necessary. To determine the actual value, change the NVP until the measured length matches the known length of a cable. Use a cable at least 30 m (100 ft) long. See page 7-5. Increasing the NVP increases measured length.

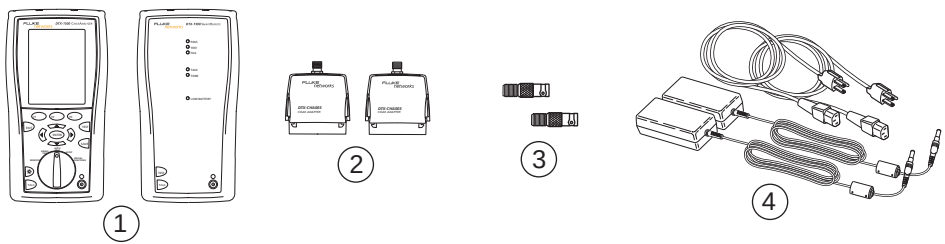
-continued-

Table 5-1. Coaxial Cable Test Settings (cont.)

Setting	Description
SETUP > Instrument Settings > Store Plot Data	**Standard**: The tester displays and saves plot data for insertion loss. The tester saves data for the frequency range required by the selected test limit. **Extended**: The tester saves data beyond the frequency range required by the selected test limit. **No**: Plot data is not saved, which lets you save more results. Saved results show only worst margins and worst values for each pair.
SPECIAL FUNCTIONS > Set Reference	The tester must be referenced to the smart remote the first time the two units are used together. You should also set the reference every 30 days. See "Setting the Reference" on page 5-1.
Settings for saving tests	**Cable ID Source**, **Current Folder**, **Operator**, **Site**, and **Company**. See "Preparing to Save Tests" in on page 2-1.
SETUP > Instrument Settings > Power Line Frequency	Set to the power frequency in the area where the tester will be used. This setting helps keep ac noise (50 Hz or 60 Hz) from affecting resistance measurements.

Autotest on Coaxial Cabling

Figure 5-2 shows the equipment needed for certifying coaxial cabling.



1. Tester and smart remote with battery packs
2. DTX coaxial adapters with female-to-female F-connector adapters installed
3. F-connector-to-BNC adapters (for testing network coaxial cabling)
4. Two ac adapters with line cords (optional)

Figure 5-2. Equipment for Certifying Coaxial Cabling

To run the Autotest on coaxial cabling:

1. Verify that the settings listed in Table 5-1 are appropriate.
2. Attach coaxial adapters appropriate to the tester and the smart remote.
3. Turn the rotary switch to **AUTOTEST** and turn on the smart remote. Connect to the cabling, as shown in Figure 5-3 for network cabling or Figure 5-4 for video cabling.
4. Press TEST on the tester or smart remote. To stop the test at any time, press EXIT.

   The tester shows the Autotest **Summary** screen when the test is complete (see page 5-9). To view results for a specific parameter, use ▲ ▼ to highlight the parameter; then press ENTER.
5. To save the results, press SAVE. Select or create a cable ID; then press SAVE again.

Note

If you turn off the main or remote unit while the two units are connected through coaxial adapters, the unit will turn on again.

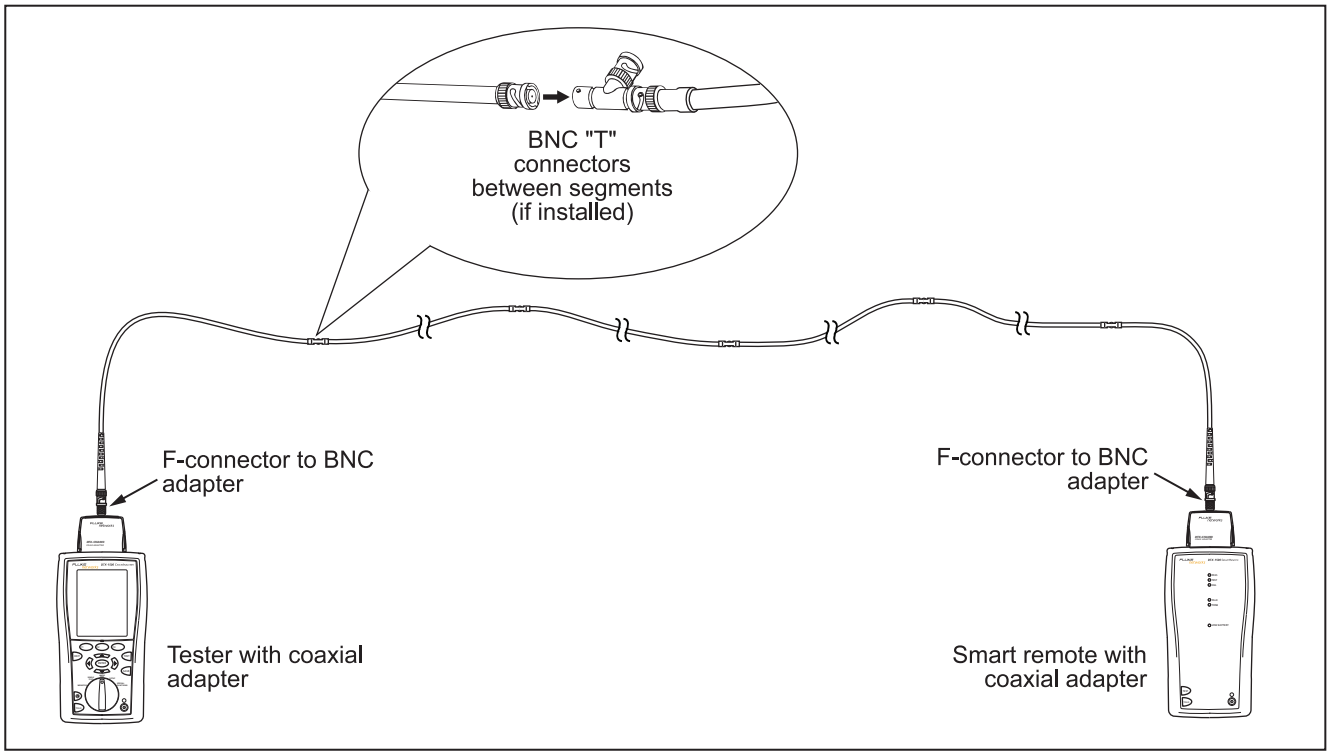


Figure 5-3. Coaxial Network Cabling Test Connections

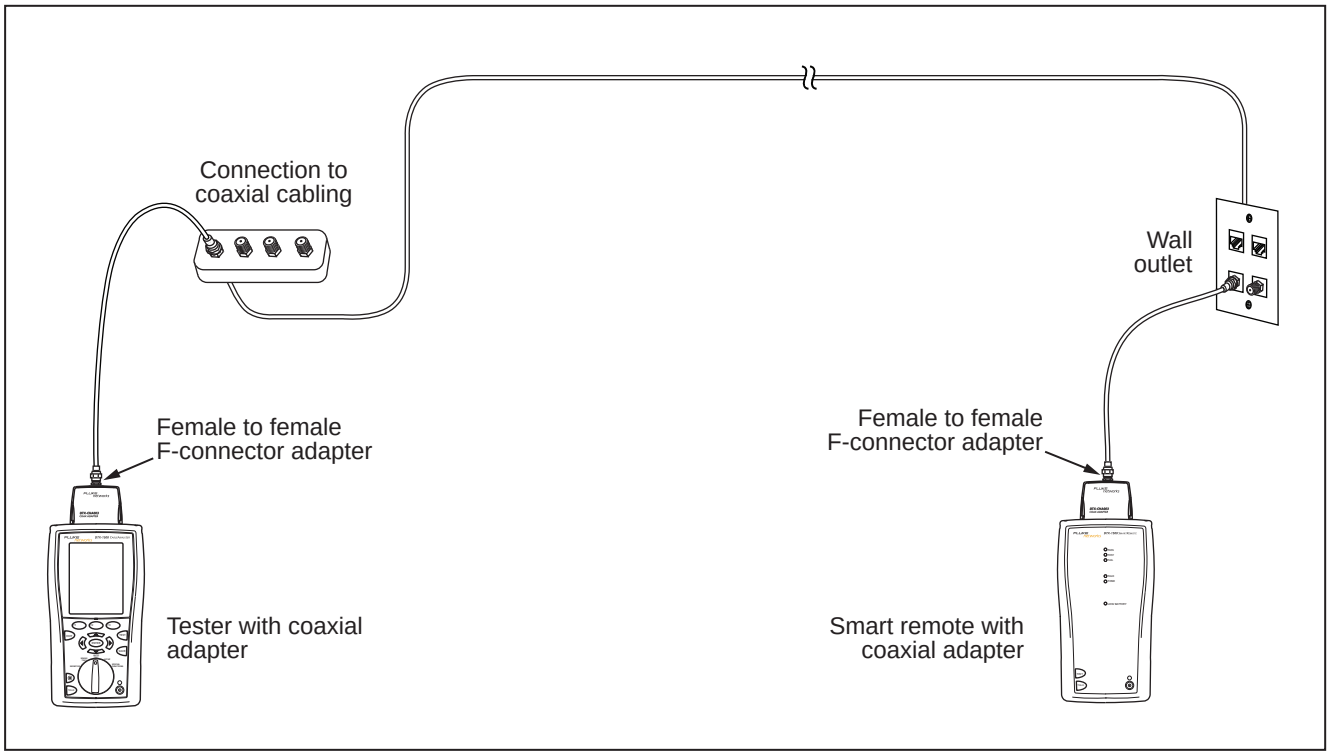


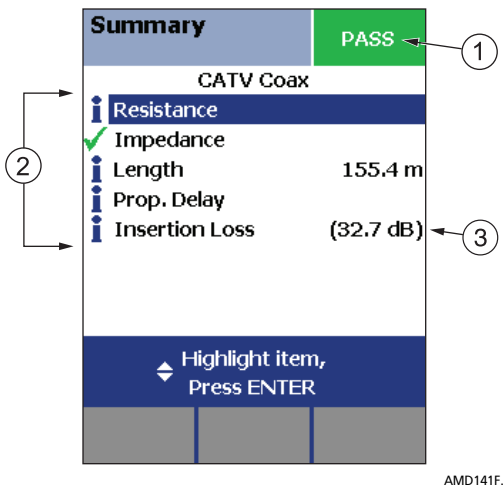
Figure 5-4. Coaxial Video Cabling Test Connections

Coaxial Autotest Results

Figure 5-5 describes the Autotest **Summary** screen, which lists the tests that apply to coaxial cabling.

Note

The Autotest runs some or all of the tests shown in Figure 5-5*, depending on the selected test limit.*



1. **PASS:** All parameters are within limits.
   FAIL: One or more parameters exceed the limit.
2. ✔: The test passed.
   i: The parameter was measured, but has no PASS/FAIL limit in the selected test limit.
   X: The test failed.
3. The worst margin found for the test.

Figure 5-5. Autotest Results for Coaxial Cabling

HDTDR Analyzer

The HDTDR™ (High-Definition Time Domain Reflectometry) analyzer plots the locations and magnitudes of reflections caused by impedance anomalies. See page 6-22.

Resistance

Resistance results show the dc loop resistance for the center conductor and shield. The smart remote shorts the conductor and shield to create the loop.

Most standards do not have a limit for resistance. The tester shows an **i** when no limit is available.

Tip: The resistance test in Single Test mode features a scanning function that runs the resistance test continuously. This function is helpful for locating intermittent faults.

Impedance

Note

*Impedance measurements require a cable at least 13 ft (4 m) long. The tester shows **Unknown** for cables shorter than this.*

Impedance results show the approximate characteristic impedance of the cable at a point approximately 13 ft (4 m) from the tester.

Characteristic impedance is the impedance a cable would have if the cable were infinitely long. Good cabling has relatively constant characteristic impedance throughout the cable and connectors.

Changes in impedance cause signal reflections in cabling. In computer networks, signal reflections can cause network faults. In video systems, reflections can cause poor reception.

Length

Length results show the length of the cabling.

Note

Differences between measured and actual length values can be caused by variations in the cable's NVP value. NVP values can vary among cable types, lots, and manufacturers. In most cases, these differences are minor and may be disregarded.

Propagation Delay

Propagation delay is the time taken for a test pulse to travel the length of the cabling. The delay is measured in nanoseconds. One nanosecond is one-billionth of a second, or 0.000000001 second.

Insertion Loss

Insertion loss is the loss of signal strength over the cabling. Insertion loss is caused by the resistance of the copper wire and connecting hardware and by leakage of electrical energy through the cable's insulation.

At higher frequencies, signals tend to travel only near the surface of a conductor. This "skin effect", along with the cabling's inductance and capacitance, cause insertion loss to increase with frequency.

Running Single Tests

The tester's single test mode (**SINGLE TEST** on the rotary switch) lets you run individual tests for isolating cabling failures and quickly testing repairs. You can run some single tests without a remote. Table 5-2 shows which tests require a smart remote.

Single tests use the selected test limit to produce a PASS/FAIL result for the test.

To save a single test, press SAVE, select or create a cable ID; then press SAVE again.

Table 5-2. Smart Remote Requirements for Coaxial Single Tests

Test	Smart Remote Requirements*
HDTDR analyzer	Optional. Without a smart remote, the plot shows large reflections at the end of the cabling.
Resistance	Smart remote or terminator required for loop resistance measurement.
Length	Not required. Because a coaxial cable terminator eliminates signal reflections, the tester cannot measure the length of terminated cabling. The tester shows **End Not Found** in this case.
Impedance	Optional. Without a smart remote or terminator, the tester cannot measure the impedance of cables longer than 984 ft (300 m). The tester shows **Unknown** in this case.
Propagation delay	Not required. Because a coaxial cable terminator eliminates signal reflections, the tester cannot measure the propagation delay of terminated cabling. In this case, the tester shows **End Not Found**.
Insertion Loss	Required.

* If a remote is not required for a test, the test runs without activating the toner when no remote is detected.

Chapter 6: Diagnosing Twisted Pair Cabling Faults

Using the Automatic Diagnostics

The DTX-1500 testers help you isolate cabling faults by automatically diagnosing Autotest failures. For twisted pair tests, press F1 **Fault Info** after a failed Autotest to see information about the location and likely cause of the fault.

Avoiding Tester-Induced Failures

Some test failures can be avoided if the tester is properly maintained and configured. To keep your tester in top condition, follow these guidelines:

- Keep the tester's software current. The latest software is available on the Fluke Networks website. See page 9-2 for details on installing updates.
- Set the reference for the twisted pair adapters at least every 30 days. See page 3-1 for details.
- Run the self test before going to the job site. See page 1-17 for details.
- Be sure to select the correct test standard and cable type for the job.
- Send the testers to a Fluke Networks service center every 12 months for factory calibration.

Common Causes of Copper Cabling Failures

Table 6-1 describes common causes of test failures on twisted pair and coaxial cabling.

Table 6-1. Diagnosing Twisted Pair Test Failures

Wire Map: open • Wires connected to wrong pins at connector or punchdown blocks • Faulty connections • Damaged connector **Tip:** The wire map test in Single Test mode features a scanning function that runs the wire map test continuously. This function is helpful for locating intermittent wiring faults.
Wire Map: split pair or reversed pair Wires connected to wrong pins at connector or punchdown block.
Wire Map: crossed wires • Wires connected to wrong pins at connector or punchdown block. • Mix of 568A and 568B wiring standards (12 and 36 crossed). • Crossover cables used where not needed (12 and 36 crossed).

Table 6-1. Diagnosing Twisted Pair Test Failures (cont.)

Wire Map: short • Damaged connector • Damaged cable • Conductive material stuck between pins at connector. • Improper connector termination • Wrong application for cable
"Bad patch cord" message appears (indicates excessive crosstalk over the first 2 m of the cabling) • Poor quality patch cord used for channel • Cable on permanent link interface adapter is badly distorted or damaged • Wrong test standard selected
A test passes, but the plot shows that measurements exceed the limit A dB rule may apply. See "About dB Rules" on page 3-13.
Resistance gives FAIL, FAIL*, or PASS* result • Cabling is too long • Bad connection due to oxidized or loose contacts • Wire gauge is too thin • Wrong patch cord type used **Tip:** The resistance test in Single Test mode features a scanning function that runs the resistance test continuously. This function is helpful for locating intermittent resistance faults. Note that the resistance test is available in Single Test mode only if the selected standard has a limit for resistance.

-continued-

Table 6-1. Diagnosing Twisted Pair Test Failures (cont.)

Characteristic impedance exceeds the limit or an anomaly is detected • Bad connection • Cable compression (tight cable ties, pinches, kinks, etc.) • Mismatch of cable types • Water in cable jacket • Excessive loading at coaxial cable tap • Incorrect terminator value (coaxial cable)
Length gives a FAIL result • Cable is too long (may need to remove coiled service loops) • NVP is set incorrectly
Length exceeds the limit, but the length test did not fail If the length of the shortest pair does not exceed the limit by 10 %, then the length test passes even if other pairs exceed the limit. This is the 10 % rule for length, as given in the ANSI/TIA standard. See the Fluke Networks Knowledge base for details.
Propagation delay or delay skew gives FAIL result • Cable is too long (may need to remove coiled service loops) • Cable uses different insulation materials on different pairs
Insertion loss gives FAIL, FAIL*, or PASS* result • Cabling is too long • Poor quality patch cord • Bad connection • Wrong cable type in installation • Wrong test standard selected

Table 6-1. Diagnosing Twisted Pair Test Failures (cont.)

Return loss gives FAIL, FAIL*, or PASS* result

- Patch cord or cable impedance not 100 Ω
- Patch cord handling causing changes in impedance
- Excessive amount of cable jammed into outlet box
- Tight service loops in telecommunications closet
- Excessive untwisting of pairs at connector
- Poor quality connectors
- Cable impedance not uniform (poor quality cable)
- Mismatches in cable construction (such as cable from different manufacturers)
- Water in cable jacket
- Cable compression (tight cable ties, pinches, kinks, etc.)
- Poorly matched plug and jack (6A/Class E_A applications)
- Wrong test standard selected
- Defective link interface adapter

Tip: The HDTDR test in Single Test mode features a scanning function that runs the HDTDR test continuously. This function can be helpful for locating return loss faults caused by tight loops and cable compression. See page 6-22.

-continued-

Table 6-1. Diagnosing Twisted Pair Test Failures (cont.)

NEXT, PS NEXT, ACR-F, PS ACR-F gives FAIL, FAIL*, or PASS* result

- Excessive untwisting of pairs at connector
- Poor quality patch cords
- Poor quality connectors
- Poor quality cable
- Poorly matched plug and jack (6A/Class E_A applications)
- Incorrect link interface adapter
- Cable compression (tight cable ties, pinches, kinks, etc.)
- Inappropriate use of couplers
- Excessive noise source near cabling under test. Use the impulse noise test to check for noise.
- Wrong test standard selected

Note

Fixing NEXT problems usually corrects ACR-F problems.

Tip: The HDTDX test in Single Test mode features a scanning function that runs the HDTDX test continuously. This function can be helpful for locating crosstalk faults caused by cable compression and noise sources. See page 6-19.

Impulse noise is detected

- Electrical devices near the cabling are generating noise pulses.
- There is an active link in the same bundle as the cabling under test.
- Verify that the tester and smart remote are operating correctly. Connect the units together and run an Autotest.

The HDTDX Analyzer

The HDTDX™ (High-Definition Time Domain Crosstalk) analyzer plots the locations and magnitudes of crosstalk on the cabling under test. The analyzer, along with the tester's automatic diagnostics, helps you isolate the causes of NEXT and ACR-F failures.

Running the HDTDX Analyzer

After an Autotest, you can view HDTDX results if the Autotest test failed or had a **PASS*** result, or if **HDTDX/HDTDR** in Setup is set to **All AUTOTESTs**.

To see HDTDX results for a failed Autotest, select **HDTDX Analyzer** on the Autotest **Summary** screen.

To run the HDTDX analyzer as a single test:

Note

You can run the HDTDX analyzer with or without a smart remote. Without a remote, results on short cables may be unreliable.

1 Turn the rotary switch to **SINGLE TEST** and verify that the test limit and cable type are correct. Change them in **SETUP** if necessary.

2 Attach the appropriate interface adapters to the tester and smart remote.

3 Turn on the smart remote; then connect the tester and remote to the cabling.

4 Turn the rotary switch to **SINGLE TEST**, select **HDTDX Analyzer**; then press TEST.

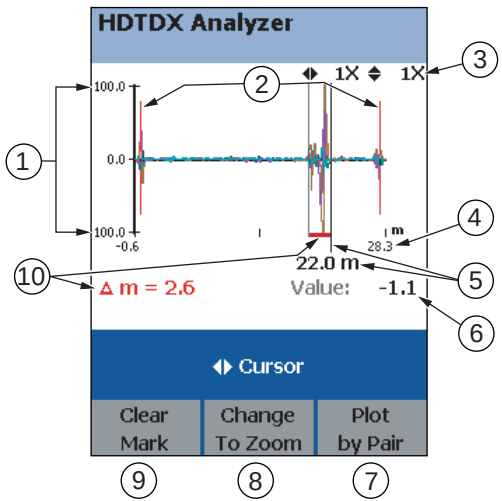
5 To run the HDTDX analyzer continuously, press F3 **Plot by Pair** to select a pair; then press ENTER to start the scanning function.

6 To save the results, press SAVE. Select or create a cable ID; then press SAVE again.

Note

*If **Store Plot Data** is set to **No**, the HDTDX plot will not be included in saved results.*

Figure 6-1 describes the HDTDX plot.



AMD19F.EPS

(1) The magnitude of crosstalk. Crosstalk levels plotted are adjusted to compensate for insertion loss. This means the plot represents the magnitudes of signals at the crosstalk source.

(2) The beginning and end of the cabling under test. For a permanent link, the plot shows some of the permanent link adapter cable before and after the cabling under test.

(3) Horizontal and vertical magnification levels for the plot. In zoom mode, use ◀▶ and ▲▼ to zoom in or out at the cursor's location.

(4) The distance to the end of the cabling.

(5) The cursor and the distance to the cursor from the tester. In cursor mode, use ◀▶ to move the cursor.

(6) The crosstalk magnitude at the cursor's location.

(7) Shows the crosstalk plots by pair. Press EXIT to return to the plot of all pairs.

(8) Toggles the display between zoom and cursor modes.

(9) Sets or clears the measurement marker. See (10).

(10) The distance between the measurement cursors.

To use the measurement cursors (with the plot in cursor mode):

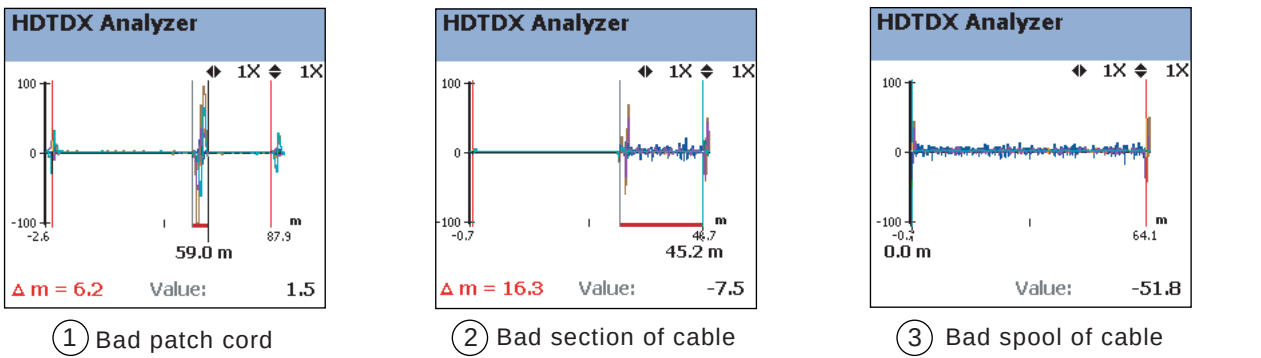
1 Press F1 **Clear Mark** if necessary; then use ◀▶ to move the cursor to the beginning of an area of interest. Use ▲▼ to zoom in on the area if desired.

2 Press F1 **Set Mark**; then use ◀▶ to move the second cursor to the end of the area of interest.

Figure 6-1. HDTDX Plot (permanent link adapters used)

Recognizing Faults on HDTDX Plots

Figure 6-2 shows how some common faults appear on HDTDX plots.



① A bad patch cord about 53 m from the tester.

② Bad section of cable near the smart remote.

③ A spool of cable with poor NEXT performance. This cable produced a **FAIL** result. Note the crosstalk along the entire length of the cable.

Figure 6-2. Interpreting HDTDX Plots

The HDTDR Analyzer

The HDTDR™ (High-Definition Time Domain Reflectometry) analyzer plots the locations and magnitudes of reflections caused by impedance anomalies. The analyzer, along with the tester's automatic diagnostics, helps you isolate the causes of return loss failures.

Running the HDTDR Analyzer

After an Autotest, you can view HDTDR results if the Autotest test failed or had a **PASS*** result, or if **HDTDX/HDTDR** in Setup is set to **All AUTOTESTs**.

To see HDTDR results for failed Autotest, select **HDTDR** on the Autotest **Summary** screen.

To run the HDTDR test as a single test:

Note

Though you can run the HDTDR analyzer without a smart remote, the following steps assume you are using a remote.

1 Turn the rotary switch to **SINGLE TEST** and verify that the test limit and cable type are correct. Change them in **SETUP** if necessary.

2 Attach the appropriate interface adapters to the tester and smart remote.

3 Turn on the smart remote; then connect the tester and remote to the cabling.

4 Turn the rotary switch to **SINGLE TEST**, select **HDTDR Analyzer**; then press TEST.

5 To run the HDTDR analyzer continuously, press F3 **Plot by Pair** to select a pair; then press ENTER to start the scanning function.

6 To save the results, press SAVE. Select or create a cable ID; then press SAVE again.

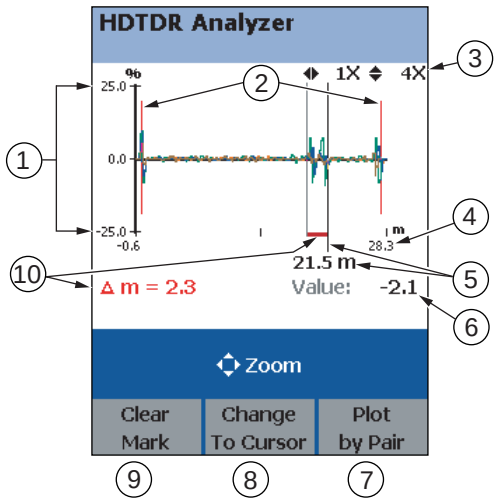
Note

*If **Store Plot Data** is set to **No**, the HDTDR plot will not be included in saved results.*

Figure 6-3 describes the HDTDR analyzer plot.

Recognizing Faults on HDTDR Plots

Figure 6-4 on page 6-24 shows how some common faults appear on HDTDR plots.



AMD97F.EPS

(1) The percentage of the HDTDR test signal reflected back to the tester. See Figure 6-4. Reflections plotted are adjusted to compensate for insertion loss. This means the plot represents the magnitudes of signals at the reflection source.

(2) The beginning and end of the cabling under test. For a permanent link, the plot shows some of the permanent link adapter cable before and after the cabling under test.

(3) Horizontal and vertical magnification levels for the plot. In zoom mode, use ◀▶ and ▲▼ to zoom in or out at the cursor's location.

(4) The distance to the end of the cabling.

(5) The cursor and the distance to the cursor from the tester. In cursor mode, use ◀▶ to move the cursor.

(6) The reflection percentage at the cursor's location.

(7) Shows the reflection plots by pair. Press EXIT to return to the plot of all pairs.

(8) Toggles the display between zoom and cursor modes.

(9) Sets or clears the measurement marker. See (10).

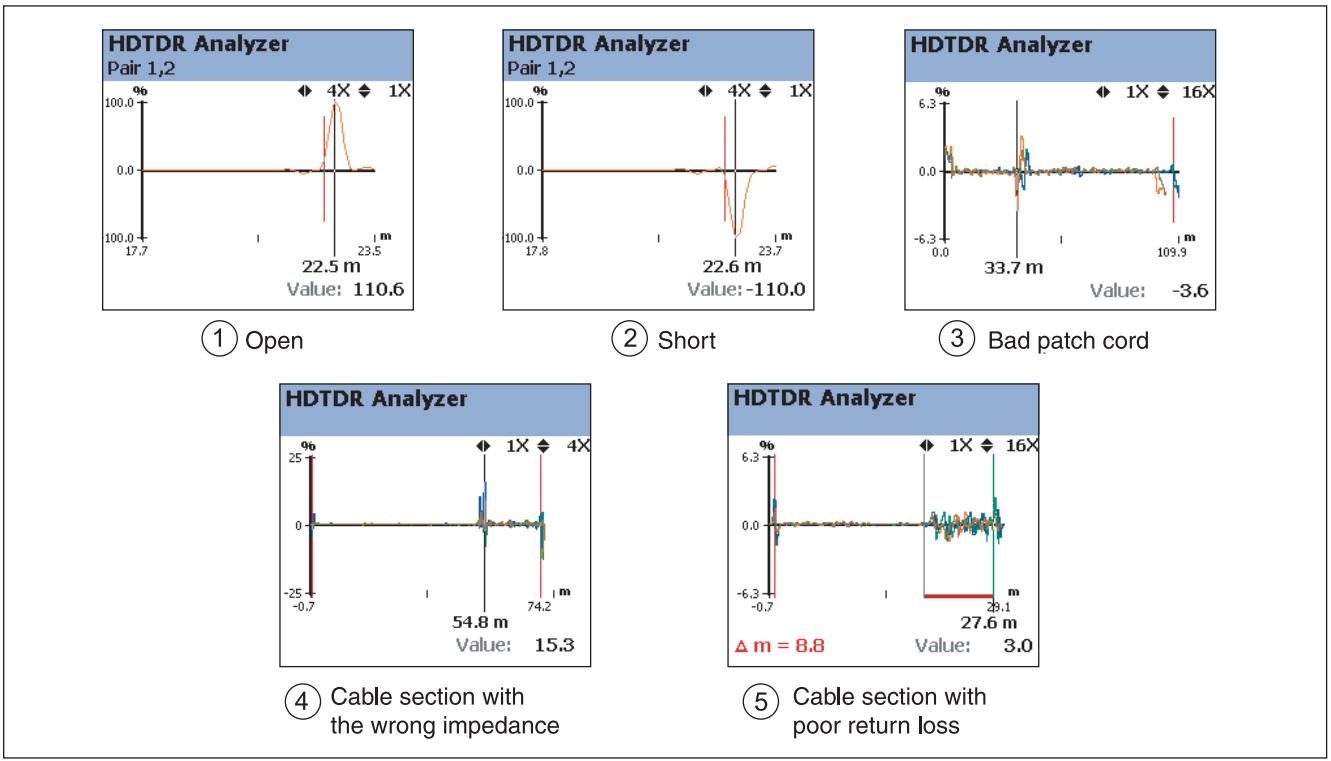
(10) The distance between the measurement cursors.

To use the measurement cursors (with the plot in cursor mode):

1 Press F1 **Clear Mark** if necessary; then use ◀▶ to move the cursor to the beginning of an area of interest. Use ▲▼ to zoom in on the area if desired.

2 Press F1 **Set Mark**; then use ◀▶ to move the second cursor to the end of the area of interest.

Figure 6-3. HDTDR Plot (permanent link adapters used)



AMD100F.EPS

Figure 6-4. Interpreting HDTDR Plots

① Open on pair 1,2 near the smart remote. A positive reflection indicates an increase in impedance. Opens are large increases in impedance and create large positive reflections.

② Short on pair 1,2 near the smart remote. A negative reflection indicates a decrease in impedance. Shorts are large decreases in impedance and create large negative reflections.

③ Bad patch cord at about 33 m.

④ A link with a section of cable that has higher impedance (120 Ω) than the rest of the cable. The bad section starts at about 54 m. Note the positive pulse where the impedance increases at the beginning of the bad section, and the negative pulse where impedance decreases at the end of the section.

⑤ A link with a section of cable that has poor return loss. The section produces reflections along its entire length.

Chapter 7: Custom Test Settings

You can customize the following test settings:

- Twisted pair cable types
- Twisted pair test limits
- Outlet configurations for twisted pair cable
- NVP for twisted pair or coaxial cable

Creating a Custom Twisted Pair Cable Type

You can create up to nine custom twisted pair cable types. A custom twisted pair cable type includes the following settings:

- Custom cable name
- Baseline cable type for default values
- Nominal velocity of propagation (NVP)

To create a custom twisted pair cable type:

1 Turn the rotary switch to **SETUP**; then select **Twisted Pair**.

2 Select **Cable Type**; then select **Custom**.

3 Press F1 **Create**.

4 On the **Custom** screen, select **Name**; then use the text editing screen to enter a name for your custom cable type. Press SAVE when you are done.

5 On the **Custom** screen, select **Use Default Values From**, select a cable group; then select a cable type as a baseline for your custom cable type.

6 To change the NVP for your custom cable, select **NVP** on the **Custom** screen. You may set the NVP to a specified value, or determine the actual NVP of a sample of cable. See "Changing the NVP" on page 7-5.

-continued-

7 From the **Custom** screen, press SAVE when you are done creating the cable type.

The tester saves the custom cable type in the **Custom** list, with asterisks (*) before and after the name.

Creating a Custom Twisted Pair Test Limit

You can create up to nine custom twisted pair test limits. A custom twisted pair test limit includes the following settings:

- Custom limit name
- Baseline limit for default settings
- Maximum length
- Resistance test enabled or disabled
- Insertion loss test enabled or disabled
- NEXT test enabled or disabled
- PS NEXT test enabled or disabled
- ACR-F test enabled or disabled
- PS ACR-F test enabled or disabled
- ACR-N test enabled or disabled
- PSACR test enabled or disabled
- Return loss test enabled or disabled

To create a custom twisted pair limit:

1 Turn the rotary switch to **SETUP**; then select **Twisted Pair**.

2 Select **Test Limit**, press F1 **More**; then select **Custom**.

3 Press F1 **Create**.

4 On the **Custom** screen, select **Name**; then use the text editing screen to enter a name for your custom limit. Press SAVE when you are done.

5 On the **Custom** screen, select **Use Default Values From**, select a test limit group; then select a limit as a baseline for your custom limit.

6 The **Custom** screen shows other settings on multiple tabs for the twisted pair limit. Use ▲ ▼ and ENTER to select settings to change. Use ◀ ▶ to move among the tabs.

See page 3-3 for details on twisted pair test settings.

7 From the **Custom** screen, press SAVE when you are done creating the limit. The tester saves the custom limit in the **Custom** list, with asterisks (*) before and after the name.

Creating a Custom Outlet Configuration

You can create up to nine custom outlet configurations. A custom outlet configuration includes the following settings:

- Custom outlet name
- Baseline outlet configuration for default settings
- Testing enabled or disabled for each wire pair

To create a custom outlet configuration:

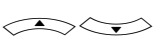
1 Turn the rotary switch to **SETUP**; then select **Twisted Pair**.

2 Select **Outlet Configuration**; then select **Custom**.

3 Press F1 **Create**.

4 On the **Custom** screen, select **Name**; then use the text editing screen to enter a name for your custom configuration. Press SAVE when you are done.

5 On the **Custom** screen, select **Use Default Values From**; then select an outlet configuration as a baseline for your custom configuration.

6 On the **Custom** screen use  and ENTER to select wire pairs to enable or disable.

7 If the baseline configuration has additional wire pairs, use  to move among the tabs.

8 From the **Custom** screen, press SAVE when you are done creating the outlet configuration.

The tester saves the custom configuration in the **Custom** list, with asterisks (*) before and after the name.

Editing Custom Settings

The editing function lets you change values in existing custom settings.

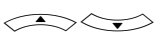
To edit an existing custom cable, test limit, or outlet configuration:

1 Turn the rotary switch to **SETUP**; then select **Twisted Pair**.

2 On the **Twisted Pair** menu, select the item that includes the custom settings you want to edit (**Cable Type**, **Test Limit**, **Outlet Configuration**).

3 If you selected **Test Limit**, press F1 **More**.

4 Select **Custom**.

5 Use  to highlight a custom setting; then press F3 **Edit**.

6 Make your changes on the **Custom** screen; then press SAVE.

Deleting Custom Settings

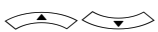
To delete a custom cable, test limit, or outlet configuration:

1 Turn the rotary switch to **SETUP**; then select **Twisted Pair**.

2 On the **Twisted Pair** menu, select the item that includes the custom settings you want to delete (**Cable Type Test Limit**, or **Outlet Configuration**).

3 If you selected **Test Limit**, press F1 **More**.

4 Select **Custom**.

5 Use  to highlight a custom setting.

6 Press F2 **Delete**; then press F3 **Yes**.

Changing the NVP

The tester uses an NVP value (nominal velocity of propagation) and the signal delay through cable to calculate the length of twisted pair and coaxial cabling.

The default value defined by the selected cable type represents the typical NVP for that cable type. These values are usually accurate enough for certifying cable; however, you can increase the accuracy of length measurements by adjusting the NVP to a specified or actual value.

Note

NVP values can vary among cable types, lots, and manufacturers. In most cases, these differences are minor and may be disregarded.

Setting the NVP to a Specified Value

This procedure lets you set the NVP to a specified value, such as the value specified by the manufacturer. The NVP value applies to the selected cable type.

To enter a specified NVP value:

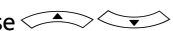
1 If you are in the middle of creating a custom cable type, go to step 4.

2 Turn the rotary switch to **SETUP**.

3 Select **Twisted Pair** or **Coax**.

4 Do one of the following:

- To change the NVP for the selected cable type, select **NVP** on the **Twisted Pair** or **Coax** menu.
- To change the NVP for a custom twisted pair cable type, create a custom cable type or select one for editing; then select **NVP** on the **Custom** screen. See page 7-1 for details on creating custom cable types.

5 Use  to change the NVP value; then press  .

Determining a Cable's Actual NVP

You can determine a cable's actual NVP by adjusting the measured length to match a known length of cable. The NVP value applies to the selected cable type.

To determine a cable's NVP:

1 If you are in the middle of creating a custom cable type, and a twisted pair or coaxial adapter is already attached to the tester, go to step 5.

2 Attach a twisted pair or coaxial adapter to the tester.

3 Turn the rotary switch to **SETUP**.

4 Select **Twisted Pair** or **Coax**.

-continued-

5 Do one of the following:

- To change the NVP for the selected cable type, select **NVP** on the **Twisted Pair** or **Coax** menu.
- To change the NVP for a custom twisted pair cable type, create a custom cable type or select one for editing; then select **NVP** on the **Custom** screen. See page 7-1 for details on creating custom cable types.

6 Connect a known length of twisted pair cable to the tester. The cable should be at least 30 m (100 ft) long.

7 Press TEST.

8 Use ▲ ▼ to change the NVP until the measured length matches the known length of the cable; then press SAVE.

Resetting the NVP to the Default Value

You can reset the NVP to the default value defined by the selected cable type by re-selecting the cable type in **SETUP**.

To reset the NVP to the default value:

1 Turn the rotary switch to **SETUP**; then select **Twisted Pair** or **Coax**.

2 On the **Twisted Pair** or **Coax** menu, select **Cable Type.**

3 If you selected **Twisted Pair**, select the cable group that contains the desired cable type.

4 Select a cable type on the **Cable Type** menu. The NVP value on the **Twisted Pair** or **Coax** screen returns to the value defined by the cable type.

Transferring Custom Settings Between Testers

To transfer custom limits, cable types, and outlet configurations between testers, use the **Modify DTX Test Limits** utility in LinkWare software. This utility lets you upload custom settings from a tester to a PC, then download the settings to other testers. See the LinkWare online help for details.

Chapter 8: Memory Functions

Memory Capacity

The DTX-1500 can store up to 250 Cat 6 Autotest results, including graphical data, in internal memory.

The maximum capacity of internal memory depends on the space taken by the tester's software.

Checking the Memory Status

To check the memory status, turn the rotary switch to **SPECIAL FUNCTIONS**, use ▼ to highlight **Memory Status**; then press ENTER.

Or, press F3 **Memory** from the main Autotest screen.

Figure 8-1 describes the memory status screen.

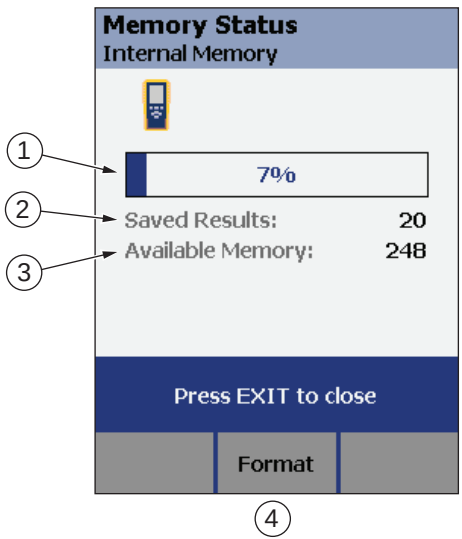
Automatically Saving Results

When **Auto Save Results** is set to **Yes**, the tester automatically saves Autotests using the next ID available from the **Cable ID Source**. The main Autotest screen shows the next ID. If **Cable ID Source** is set to **None** or all the IDs have been used, **Next ID** is blank and you enter IDs manually after each Autotest.

Selecting **No** lets you enter or select IDs manually after each Autotest.

To change the **Auto Save Results** setting:

1. Turn the rotary switch to **SETUP**.
2. Use ▼ to highlight **Instrument Settings**; then press ENTER.
3. Press ▶ to go to the tab with the **Auto Save Results** setting.
4. Press ENTER to select **Auto Save Results**.
5. Use ▼ to highlight **No** or **Yes**; then press ENTER.



1. The bar graph shows how much memory space is used.
2. **Save Results:** The number of results saved in memory.
3. **Available Memory:** The approximate number of results you can save in memory. The exact number depends on the selected test limit and other test settings, as well as the length of the cables you test.
4. Press F2 to format the memory.

⚠ Caution

Formatting the memory deletes all test results and custom limits and cable types.

Figure 8-1. Memory Status Screen Features

Working with Folders

You can create folders for each job to organize your test results. The tester saves test results in the folder you select.

Creating a New Folder

To create a new folder:

1 Turn the rotary switch to **SETUP**.

2 Use ▼ to highlight **Instrument Settings**; then press ENTER.

3 On the **Instrument Settings** screen, use ▼ to highlight **Current Folder**; then press ENTER.

4 Press F1 **Create Folder**.

5 Use the softkeys, ◀ ▶ ▲ ▼, and ENTER to enter a folder name. Press SAVE when you are finished.

Changing Folders

To change the current folder:

1 Turn the rotary switch to **SETUP**.

2 Use ▼ to highlight **Instrument Settings**; then press ENTER.

3 On the **Instrument Settings** screen, use ▼ to highlight **Current Folder**; then press ENTER.

4 Use ▲ ▼ to highlight a folder name; then press ENTER.

Note

*Changing folders from the **View Results** screen in **SPECIAL FUNCTIONS** does not change the current folder in **SETUP**.*

Deleting Folders

To delete a folder and all the results it contains:

1 Turn the rotary switch to **SPECIAL FUNCTIONS**.

2 Use ▼ to highlight **View/Delete Results**; then press ENTER.

3 If necessary, press F1 **Change Folder** to find the folder you want to delete.

4 Press F2 **Delete**.

5 Use ▼ to highlight **Current Folder**; then press F3 **Delete**.

Viewing and Managing Saved Results

To view and manage saved results, turn the rotary switch to **SPECIAL FUNCTIONS**, use ▼ to highlight **View/Delete Results**; then press ENTER.

Figure 8-2 describes the **View Results** screen.

Deleting Results

To delete results:

1 Turn the rotary switch to **SPECIAL FUNCTIONS.**

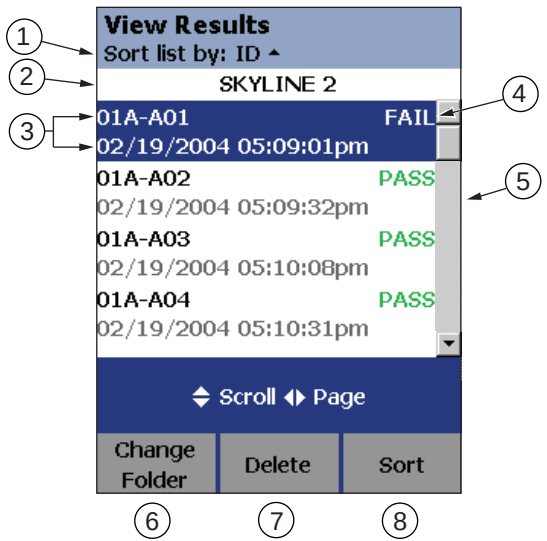
2 Use ▼ to highlight **View/Delete Results**; then press ENTER.

3 If necessary, press F1 **Change Folder** to find the result(s) you want to delete.

4 Press F2 **Delete**; then use ▼ to highlight an option:

- **Current Result:** Deletes the result highlighted on the previous screen.
- **All Results in Folder:** Deletes all results in the current folder.
- **Current Folder:** Deletes the current folder and all its contents.
- **All Results in Tester:** Deletes all results in memory.

5 Press F3 **Delete**; then press F3 **Yes**.



1. Sorting order of the list of results. For example, **ID ▲** means the list is sorted by cable IDs in ascending order. Press F3 **Sort** to change the order.
2. Name of the current folder. Press F1 **Change Folder** to select a different folder.
3. The result's cable ID and the date and time the test was completed.
4. The overall result for the test. See page 3-12 for details on **PASS*** and **FAIL*** results.
5. Scroll bar, which appears when there is more than one screen of results to view. Press ▲ ▼ to scroll up and down. Press ◀ ▶ to scroll up or down a screen at a time
6. Press F1 **Change Folder** to select a different folder.
7. Press F2 **Delete** to delete results or folders.
8. Press F3 **Sort** to sort the list of results.

Figure 8-2. View Results Screen

Renaming Results

To rename saved results:

1 On the **View Results** screen, select the result you want to rename.

2 On the **Summary** screen, press SAVE.

3 Enter an new ID for the result; then press SAVE.

Sorting Results

You can sort the list of saved results in ascending or descending order by the following parameters:

- PASS/FAIL result
- Cable ID
- Date and time the test was completed

To sort results:

1 On the **View Results** screen, press F3 **Sort**.

2 Use ▼ to highlight the field you want to sort by.

3 Press F1 **Ascending** or F3 **Descending**.

The sorting order applies only to the current folder. The current sorting order is indicated at the top of the **View Results** screen, as shown in Figure 8-2 on page 8-5.

The default order is descending by date. The sorting order reverts to the default when you turn off the tester.

Formatting the Memory

⚠ Caution

Formatting the memory deletes all test results and custom limits and cable types.

To format the memory:

4 Turn the rotary switch to **AUTOTEST**.

5 Press F3 **Memory**.

6 Press F2 **Format**; then press F3 **Yes**.

You can also format the memory in **SPECIAL FUNCTIONS** mode:

1 Turn the rotary switch to **SPECIAL FUNCTIONS.**

2 Use ▼ to highlight **Memory Status**; then press ENTER.

3 Press F2 **Format**; then press F3 **Yes**.

Uploading Results to a PC

To upload results to a PC:

1 Install the latest version of LinkWare software on your PC.

2 Turn on the tester.

3 Connect the tester to the PC with the USB cable included or the DTX serial cable available from Fluke Networks.

4 Start LinkWare software on the PC.

Click **Import**  on the LinkWare toolbar. Select the tester's model from the list.

5 Select the records you want to import; then click **OK**.

See the LinkWare online help for details on creating reports with LinkWare.

Chapter 9: Maintenance and Specifications

Maintenance

⚠Warning⚠

To avoid possible fire, electric shock, personal injury, or damage to the tester:

- **Do not open the case. No user-serviceable parts are inside.**
- **Replacing electrical parts yourself will void the tester's warranty and might compromise its safety features.**
- **Use only specified replacement parts for user-replaceable items.**
- **Use only Fluke Networks authorized service centers.**

⚠Caution

Replacing electrical parts yourself might void the tester's calibration and compromise its accuracy. If the calibration is void, cable manufacturers might not extend their warranty to the cabling you install.

Reference Procedure for Link Interface Adapters

The reference procedure sets a baseline for various measurements. You should perform the reference procedure every 30 days or whenever you start using the tester with a different remote.

See “Setting the Reference” on pages 3-1 for twisted pair cable and 5-1 for coaxial cable.

Factory Calibration

The tester requires calibration at a service center once a year to ensure that it meets or exceeds the published accuracy specifications. Contact an authorized Fluke Networks Service Center for information on getting your tester calibrated.

To see when the tester last received a service calibration, turn the rotary switch to **SPECIAL FUNCTIONS**; then select **Version Information**. The tester's calibration date is also shown on reports uploaded to a PC.

Updating the Tester's Software

Keeping your tester's software current gives you access to new features and the latest test limits.

To get a software update, download the update from the Fluke Networks website or contact Fluke Networks to get the update by other means.

To see the software version installed in your main and remote testers, turn the rotary switch to **SPECIAL FUNCTIONS**; then select **Version Information**.

You can update your tester with a PC or with another tester that is already updated, as described in the following sections.

⚠ Caution

To avoid unexpected loss of power, connect the ac adapter to the tester when updating the software.

Note

Changes to the update procedure may be posted on the DTX CableAnalyzer software page on the Fluke Networks website.

Updating with a PC

1. Install the latest version of LinkWare software on your PC.
2. Download the DTX CableAnalyzer update file from the Fluke Networks website, or contact Fluke Networks to get the update by other means. Save the file to your hard drive.
3. Make the connections shown in Figure 9-1. Use the USB or DTX serial cable to connect to the PC. (The USB connection, if available, is faster.) Turn on the tester and the smart remote.

Note

The DTX serial cable connects a PC's DB-9 RS-232 serial port to the miniature RS-232 serial port on the DTX-1500 tester. This cable is available from Fluke Networks. Table 9-3 on page 9-24 shows the pin connections for this cable.

4 Select **Utilities** > **DTX Utilities** > **Software Update** from the LinkWare menu, locate and select the .dtx (DTX update) file; then click **Open**.

5 The tester reboots, then prompts you about updating the smart remote's software. Press F2 **OK** to update the smart remote's software.

6 To verify the update, turn the rotary switch to **SPECIAL FUNCTIONS**; then select **Version Information.**

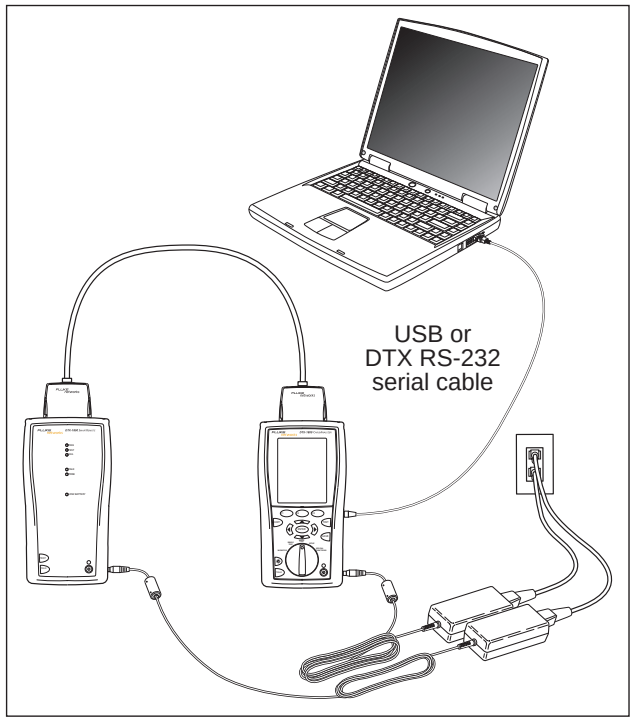


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Figure 9-1. Twisted Pair Connections for Updating the Software with a PC

Updating with Another Tester

You can update a tester's software using another tester that is already updated.

1 Connect an updated tester or smart remote to a tester or smart remote that needs updating, as shown in Figure 9-2.

Note

One of the units must be a main tester.

2 Turn on both units; then press TEST on either.

3 The testers compare software versions. If one has more recent software, the main tester prompts you about updating the older software.

4 Press F2 **OK** to start the update process.

5 To verify the update, turn the rotary switch to **SPECIAL FUNCTIONS**; then select **Version Information.**

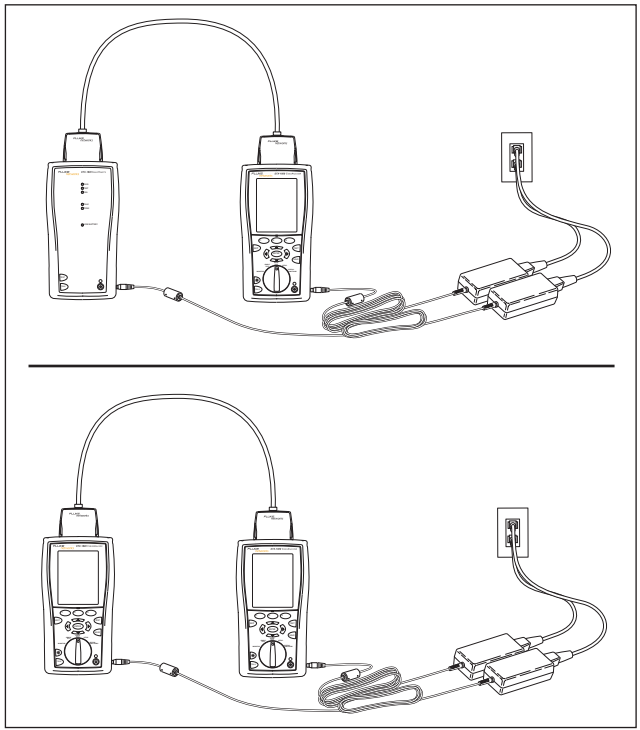

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Figure 9-2. Updating the Software with an Updated Tester

Updating the Limits or Cable Types Database

Fluke Networks may release a test limits or cable types database that is not part of a software update. To install a new database in your tester, use the **Modify DTX Test Limits** utility in LinkWare software. See the LinkWare online help for details.

Cleaning

Clean the display with glass cleaner or isopropyl alcohol and a soft, lint-free cloth. Clean the case with a soft cloth dampened with water or water and a mild soap.

⚠ Caution

To avoid damaging the display or the case, do not use solvents or abrasive cleansers.

Retraining the Battery Gauge

The accuracy of the battery gauge may drift over time if the battery is frequently recharged before being fully discharged. Retraining the battery gauge restores its accuracy.

Retraining can take 17 to 30 hours. The time is shorter if you start with the batteries discharged.

To retrain the battery gauge:

1. Connect the main and remote testers together using two channel adapters and a patch cord.
2. Connect the ac adapters to the main and remote testers. Turn on both testers.
3. Turn the rotary switch to **SPECIAL FUNCTIONS**; then select **Battery Status**. Verify that both the main and remote battery gauges are shown. If the remote gauge is missing, check the connections between the two units.
4. Press F1 **Train Battery**.
5. To abort the retraining, hold down the power key (⏻) on the main and remote testers until they turn off.

Retraining is complete when the testers have turned off and the LED by the ac adapter connection is green.

Replacing the Battery Pack

Replace the lithium ion battery pack when its life becomes noticeably shorter or when it fails to reach full charge. The battery is normally good for up to 400 charge/discharge cycles.

Note

Dispose of the lithium ion battery pack in accordance with local regulations.

Replacing the Internal Battery

An internal lithium battery maintains the tester's clock, when you remove the battery pack. This battery typically lasts about 5 years. When the battery begins to fail, the tester will lose the current date and time when you remove the battery pack. If the internal lithium battery fails, send the tester to a Fluke Networks service center for a replacement.

Storage

Before storing the tester or an extra battery for an extended period, charge the battery to between 70 % and 90 % of full charge. Check the battery every 4 months and recharge if necessary.

Keep a battery attached to the tester during storage. Removing the battery for long periods shortens the life of the internal lithium battery that maintains the clock.

See "Environmental and Regulatory Specifications" on page 9-9 for storage temperatures.

Options and Accessories

For the latest list of DTX CableAnalyzer options and accessories visit the Fluke Networks website at **www.flukenetworks.com**.

To order options and accessories, contact Fluke Networks as described on page 1-2.

If Something Seems Wrong

If something seems wrong with the tester, refer to Table 9-1.

If Table 9-1 does not help you solve a problem with the tester, contact Fluke Networks for additional help. See page 1-2 for contact information.

If possible, have the tester's serial number, software and hardware versions, and calibration date available. To see this information, turn the rotary switch to **SPECIAL FUNCTIONS**; then select **Version Information**.

For warranty information, refer to the warranty at the beginning of this manual. If the warranty has lapsed, contact Fluke Networks for repair prices.

Table 9-1. Troubleshooting the Tester

The keypad does not respond. Press and hold ⏻ until the tester turns off. Then turn the tester on again. If the problem persists, update the tester's software if a newer version is available.
System error occurs. Press F2 **OK**. If the tester does not recover, press and hold ⏻ until the tester turns off. If the error recurs, update the tester's software. If the tester already has the latest software, contact Fluke Networks for assistance.
The tester will not turn on, even with the ac adapter connected. The battery may be completely discharged. Let the battery charge for a few minutes with the tester off.
The battery LED is flashing red. The battery did not reach full charge within 6 hours. Verify that the battery was charged within the temperature range of 32 °F to 113 °F (0 °C to 45 °C). Disconnect then reconnect ac power and try charging the battery again. If the battery does not charge the second time, retrain the battery gauge. See page 9-5

-continued-

Table 9-1. Troubleshooting the Tester (cont.)

The tester will not turn on even when the battery is charged. The battery's safety switch has tripped. Connect the ac adapter for a few minutes to reset the switch.
All the LEDs on the smart remote are flashing The smart remote detects excessive voltage on the cable. Unplug the cable immediately.
Test results appear to be incorrect. The tester may not be configured correctly. For example, the wrong test standard or cable type may be selected or the NVP or n value may be incorrect. The tester may need referencing. See Chapter 3 for twisted pair test settings or Chapter 5 for coaxial test settings.

Specifications

Environmental and Regulatory Specifications

Operating temperature	32 °F to 113 °F (0 °C to 45 °C)
Storage temperature	-4 °F to +140 °F (-20 °C to +60 °C)
Operating relative humidity (% RH without condensation)	32 °F to 95 °F (0 °C to 35 °C): 0 % to 90 % 95 °F to 113 °F (35 °C to 45 °C): 0 % to 70 %
Vibration	Random, 2 g, 5 Hz-500 Hz
Shock	1 m drop test with and without an adapter attached
Safety	IEC 61010-1: Measurement Category None, Pollution Degree 2
Altitude	Operating: 4,000 m (3,048 m with AC adapter) Storage: 12,000 m
EMC	EN 61326-1: Portable
FC	CFR Title 47, Part 15, Subpart B

⚠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 tester and create a potential shock hazard to the user.

Service Calibration Period

One year.

Standard Link Interface Adapters

6A/Class E_A channel adapters

- Plug type and life: shielded 8-pin modular (RJ45); >5000 insertions
- Tests supported: shielded and unshielded cable, TIA Cat 3, 4, 5, 5e, 6, 6A and ISO/IEC Class C, D, E, and E_A channels

Cable Types Tested

- Shielded and unshielded twisted pair (STP, FTP, SSTP, and UTP) LAN cabling:
- TIA Category 3, 4, 5, 5e, 6, and 6A: 100 Ω
- ISO/IEC Class C and D: 100 Ω and 120 Ω

Note

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

Time for Autotest

Time for a full, 2-way Autotest of Category 6 UTP cable: 9 seconds

Tone Generator Specifications

Generates tones that can be detected by a tone probe, such as a Fluke Networks IntelliTone™ probe. The tones are generated on all pairs.

Frequency range of tones: 440 Hz to 831 Hz

Summary of Performance Specifications

Note

All specifications for tests on twisted pair cabling apply to 100 Ω cable. Contact Fluke Networks for information on measurement performance for cable with a different impedance.

For Category 6/Class E test modes or below, the DTX CableAnalyzer is compliant with Level III requirements of TIA-568-C.2-1 and IEC 61935-2.

Length

Note

Length specifications do not include the uncertainty of the cable's NVP value.

Parameter	Twisted Pair Cabling	
	Without Remote	With Remote
Range	800 m (2600 ft)	150 m (490 ft)
Resolution	0.1 m or 1 ft	0.1 m or 1 ft
Accuracy	± (0.3 m + 2 %); 0 m to 150 m ± (0.3 m + 4 %); 150 m to 800 m	± (0.3 m + 2 %)

Delay Skew

Parameter	Twisted Pair Cabling
Range	0 ns to 100 ns
Resolution	1 ns
Accuracy	± 10 ns

Propagation Delay

Parameter	Twisted pair cabling	
	Without Remote	With Remote
Range	4000 ns	750 ns
Resolution	1 ns	1 ns
Accuracy	± (2 ns + 2 %); 0 ns to 750 ns ± (2 ns + 4 %); 750 ns to 4000 ns	± (2 ns + 2 %)

DC Loop Resistance Test

Parameter	Twisted pair cabling
Range	0 Ω to 530 Ω
Resolution	0.1 Ω
Accuracy	± (1 Ω + 1 %)
Overload Recovery Time	Less than 10 minutes to rated accuracy following an overvoltage. Referencing is required after repeated or prolonged overvoltage.

Table 9-2. Level IIIe Accuracy Performance Parameters per IEC Guidelines

Parameter	Baseline Field Tester	Field Tester with Level IIIe Permanent Link Adapter	Field Tester with Level IIIe Channel Adapter
Dynamic range	3 dB over test limit PPNEXT and FEXT 65 dB PS NEXT and FEXT 62 dB		
Amplitude resolution	0.1 dB		
Frequency range and resolution	1 MHz to 31.25 MHz: 125 kHz 31.25 MHz to 100 MHz: 250 kHz 100 MHz to 250 MHz: 500 kHz 250 MHz to 500 MHz: 1 MHz		
Dynamic Accuracy NEXT	± 0.75 dB		
Dynamic Accuracy ACR-F	± 1.0 dB (FEXT dynamic accuracy is tested to ± 0.75 dB)		

Table 9-2. Level IIIe Accuracy Performance Parameters per IEC Guidelines (cont.)

Parameter	Baseline Field Tester	Field Tester with Level IIIe Permanent Link Adapter	Field Tester with Level IIIe Channel Adapter
Source/load return loss	1 MHz to 300 MHz: 20 – 12.5 log(f/100), 20 dB maximum 300 MHz to 500 MHz: 14 dB	1- 300 MHz: 18 – 12.5 log(f/100), 20 dB maximum 300 MHz to 500 MHz: 12 dB	
Random Noise Floor	100 - 15 log(f/100), 90 dB maximum	95 - 15 log(f/100), 85 dB maximum	
Residual NEXT	90 – 20 log(f/100) (measured to 85 dB maximum)	85 - 20 log(f/100) (measured to 85 dB maximum)	72.4 - 15 log(f/100) (measured to 85 dB maximum)
Residual FEXT	80 - 20 log(f/100) (measured to 85 dB maximum)	75 - 20 log(f/100) (measured to 85 dB maximum)	60 - 15 log(f/100) (measured to 85 dB maximum)
Output Signal Balance	40 - 20 log(f/100) (measured to 60 dB maximum)	37 - 20 log(f/100) (measured to 60 dB maximum)	

-continued-

Table 9-2. Level IIIe Accuracy Performance Parameters per IEC Guidelines (cont.)

Parameter	Baseline Field Tester	Field Tester with Level IIIe Permanent Link Adapter	Field Tester with Level IIIe Channel Adapter
Common Mode Rejection	40 - 20 log(f/100) (measured to 60 dB maximum)	37 - 20 log(f/100) (measured to 60 dB maximum)	
Tracking	± 0.5 dB (applicable when IL > 3 dB)		
Directivity	(applicable when IL > 3 dB) 1 MHz to 300 MHz: 27 - 7log(f/100), 30 dB maximum 300 MHz to 500 MHz: 23.7 dB	1 MHz to 300 MHz: 25 - 7log(f/100), 25 dB maximum 300 MHz to 500 MHz: 21.7 dB (applicable when IL > 3 dB)	
Source Match	20 dB (applicable when IL > 3dB)		
Return loss of Termination	(applicable when IL > 3 dB) 1 MHz to 250 MHz: 20 - 15log(f/100), 25 dB maximum 250 MHz to 500 MHz: 14 dB	1 MHz to 250 MHz: 18 - 15log(f/100), 25 dB maximum 250 MHz to 500 MHz: 12 dB (applicable when IL > 3dB)	

Measurement Accuracy

The DTX-1500 CableAnalyzer testers measure up to 500 MHz and meet or exceed accuracy Level IIIe requirements.

Worst case accuracy performance parameters are used for asterisk (*) results reporting. These are based on computation of the overall measurement accuracy based on the worst case of each parameter at each frequency data point. Observed differences between laboratory equipment and DTX CableAnalyzers using calibration verification artifacts were used as a confirmation.

Accuracies computed from the parameters in Table 9-2 are shown in Figures 9-3 through 9-6.

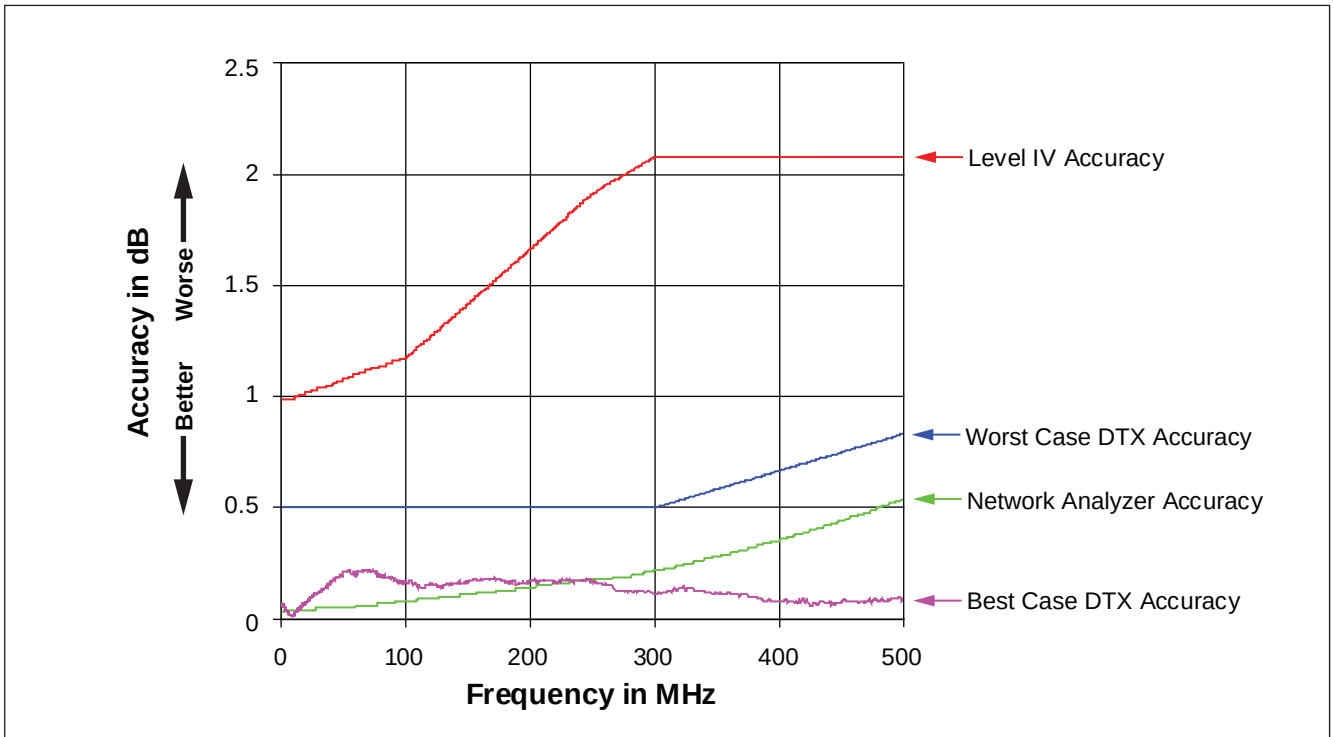
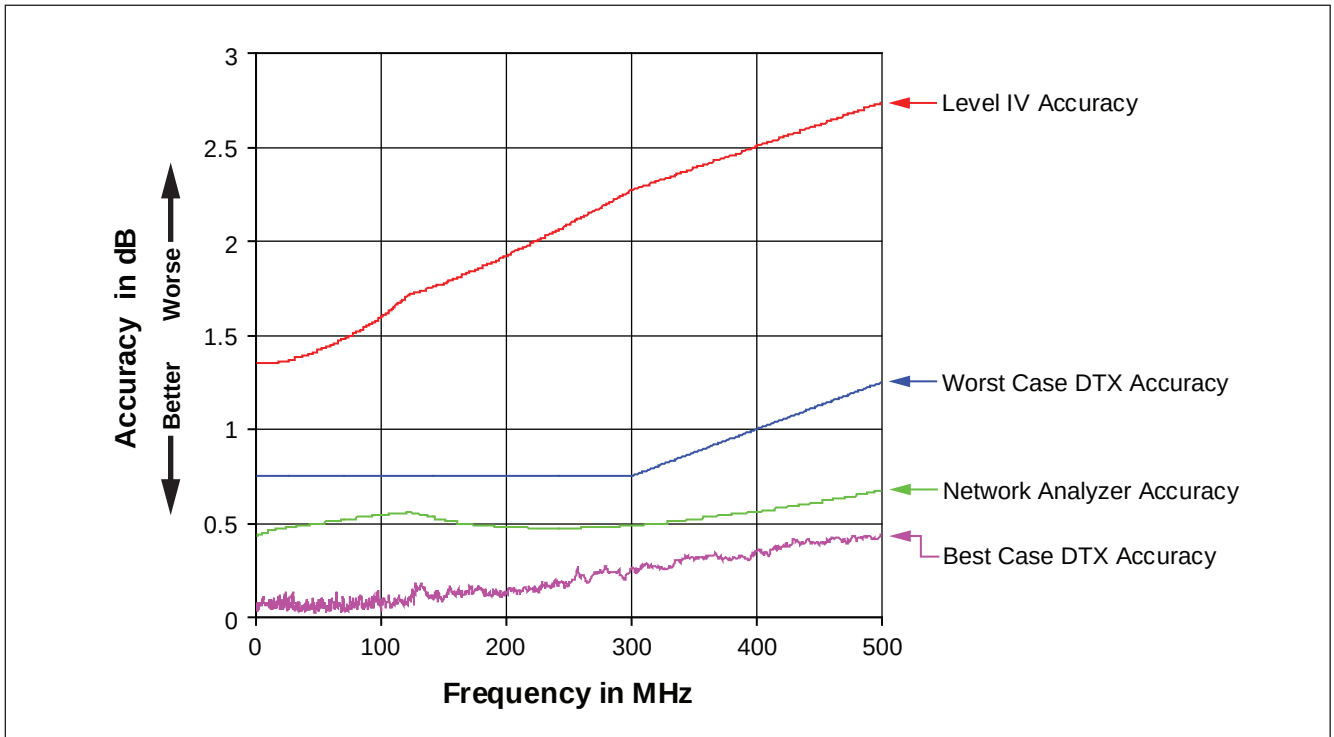


Figure 9-3. Baseline Insertion Loss Measurement Accuracy



X111.EPS

Figure 9-4. Baseline NEXT Loss Measurement Accuracy

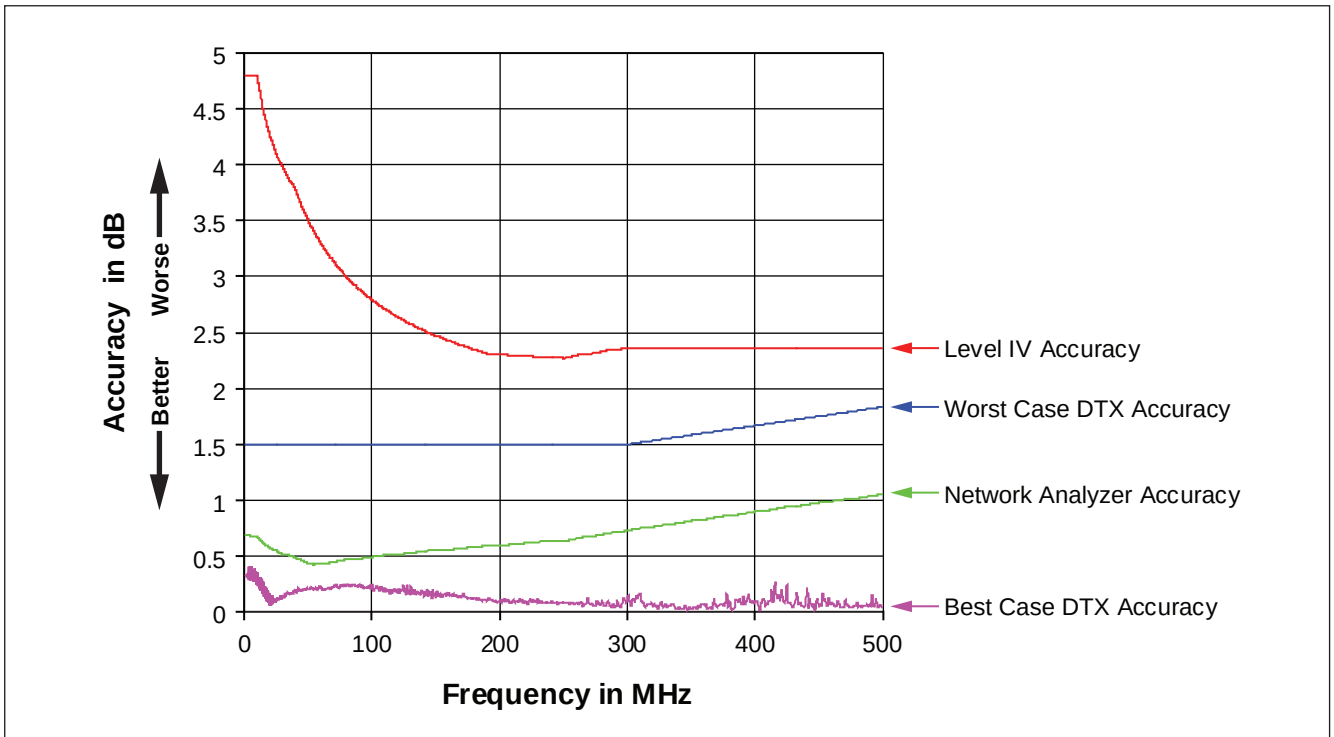
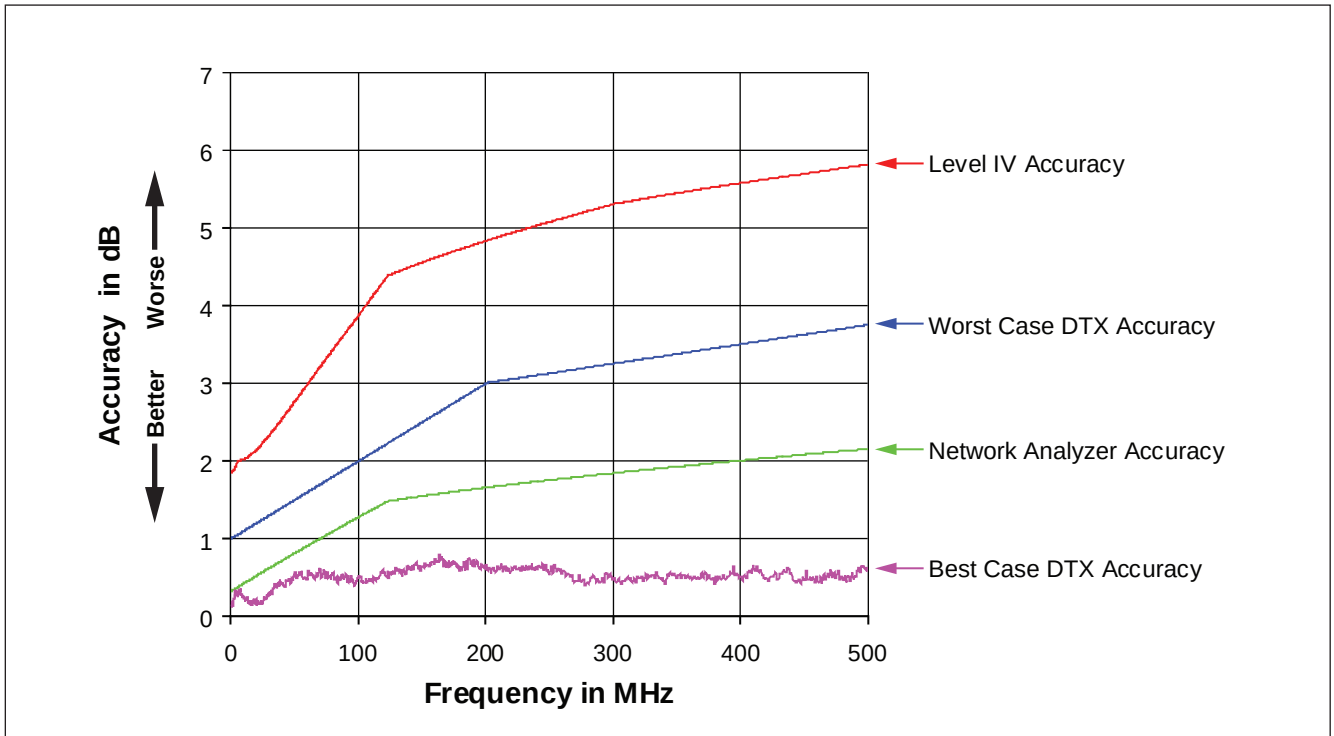


Figure 9-5. Baseline Return Loss Measurement Accuracy



X113.EPSs

Figure 9-6. Baseline ACR-F Measurement Accuracy

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

The specifications below are typical for cables less than 100 m (328 ft).

Parameter	Twisted Pair Cable
Distance accuracy	± (1 ft (0.3 m) + 2 % distance)
Distance resolution	1 ft or 0.1 m

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

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

Parameter	Twisted Pair Cable
Distance accuracy	± (1 ft (0.3 m) + 2 % distance)
Distance resolution	1 ft or 0.1 m

Characteristic Impedance

The tester 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.

Parameter	Twisted Pair Cable
Range	70 Ω - 180 Ω
Accuracy	± (5 Ω + 5 % of |100 Ω – Measured|)
Resolution	1 Ω

Impulse Noise

Adjustable from 10 mV to 500 mV in 10 mV steps.

Monitors either polarity of noise on pair 3, 6.

Minimum detectable impulse width: 10 ns

DTX-COAX Coaxial Adapter Specifications

Input connector	Male F-connector. BNC adapter allows connection to coaxial network cabling
Cable types tested	Coaxial video and network cabling
Length	Range: 800 m (2625 ft) with or without remote Resolution: 0.1 m or 1 ft Accuracy: 0 m to 150 m (0 ft to 492 ft): ±(0.3 m + 2 %) 150 m to 800 m (492 ft to 2625 ft): ±(0.3 m + 4 %)
Propagation delay	Range: 4000 ns with or without remote Resolution: 1 ns Accuracy: 0 ns to 750 ns: ±(2 ns + 2%); 750 ns to 4000 ns: ±(2 ns + 4%)
Loop resistance	Range: 0 Ω to 530 Ω Resolution: 0.1 Ω Accuracy: ±(1 Ω + 1 %)

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DTX-COAX Coaxial Adapter Specifications (cont.)

Insertion loss	Frequency range and resolution:	1 MHz to 31.25 MHz: 125 kHz 31.5 MHz to 100 MHz: 250 kHz 100.5 MHz to 250 MHz: 500 kHz 251 MHz to 900 MHz: 1 MHz
	Source/load return loss (typical): (75 Ω reference impedance)	1 MHz to 300 MHz: 20 – 12.5 log(f/100), 20 dB maximum 300 MHz to 900 MHz: 14 dB
	Random noise floor (typical):	90 dB
Characteristic impedance	Range: 45 Ω to 110 Ω Resolution: 1 Ω Accuracy: ± (5 Ω + 5 % of |75 Ω – Measured|)	
HDTDR	Range: 350 m (1148 ft) with or without remote Resolution: 0.1 m or 1 ft Accuracy: 0 m to 150 m (0 ft to 492 ft): ±(0.3 m + 2 %) 150 m to 350 m (492 ft to 1148 ft): ±(0.3 m + 4 %)	

Power

Notes

You do not need to fully discharge the battery before recharging it.

The battery will not charge at temperatures outside of 0 °C to 45 °C (32 °F to 113 °F). The battery charges at a reduced rate between 40 °C and 45 °C (104 °F and 113 °F).

- Main unit and remote: Lithium-ion battery pack, 7.4 V, 4000 mAh
- Typical battery life: 10 to 12 hours.
- Charge time (with tester off): 4 hours (below 40 °C)
- AC adapter/charger: Switching power supply; 100 V ac to 250 V ac input; 15 V dc; 1.2 A output

Memory backup power in main unit: Lithium battery

Typical life of lithium battery: 5 years

Input Ratings

A DTX-1500 tester 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

Conforms to relevant Australian standards

Conforms to relevant European Union directives.

Listed by the Canadian Standards Association.

CFR Title 47, Part 15, Subpart B

Regulatory Information

This equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15B, Subpart J of the FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of the equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

Memory for Test Results

Internal memory stores up to 250 Cat 6 Autotest results, including graphical data.

1 MB Flash EPROM allows software and test limit updates.

LinkWare software lets you upload Autotest results to a PC.

Serial Interfaces

The tester and smart remote have a USB client interface. The main DTX-1500 testers also have an RS-232 (EIA/TIA-232) interface.

Table 9-3. DTX RS-232 Cable Pin Connections

Tester End (IEEE 1394)			PC End (female DB9)	
Signal Name	**Pin**	**Direction**	**Pin**	**Signal Name**
Data carrier detect	1	←	4	Data terminal ready
Transmit data	2	→	2	Receive data
Receive data	3	←	3	Transmit data
Signal ground	4	←→	5	Signal ground

Dimensions (without adapter)

8.5 in x 4.5 in x 2.3 in (21.6 cm x 11.4 cm x 5.8 cm), nominal

Weight (without adapter)

2.4 lb (1.1 kg), nominal

Display

3.7 in (9.4 cm) diagonal, 1/4 VGA, passive color, transmissive LCD with backlight.

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Symbols

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–P–

–R–

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–W–

–X–

–Z–