FLUKE
networks®

DTX-PCxxS
Patch Cord Test Adapters

Users Manual

January 2011

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Introduction

The DTX-PCxxS Patch Cord Adapters let you use a DTX CableAnalyzer™ Series tester to test patch cords in accordance with TIA and IEC standards. The adapters feature special test jacks selected specifically for testing Cat 5e and 6 patch cords as specified in TIA-568-C.2 and IEC 61935-2, and Cat 6A patch cords as specified in IEC 61935-2.

Note

Test standards are subject to amendments. Contact the appropriate standards organization for details. Contact Fluke Networks for general information on standards and for DTX software or database updates that may result from changes to standards.

Unpacking

The DTX-PCxxS Patch Cord Adapter Set comes with the following:

DTX-PC5ES

- One DTX-PC5E/MN Cat 5e patch cord test adapter for the main DTX tester
- One DTX-PC5E/SR Cat 5e patch cord test adapter for the remote DTX tester
- DTX-PCxxS Product Manuals CD-ROM

DTX-PC6S

- One DTX-PC6/MN Cat 6 patch cord test adapter for the main DTX tester
- One DTX-PC6/SR Cat 6 patch cord test adapter for the remote DTX tester
- DTX-PCxxS Product Manuals CD-ROM

DTX-PC6AS

- One DTX-PC6A/MN Cat 6A patch cord test adapter for the main DTX tester
- One DTX-PC6A/SR Cat 6A patch cord test adapter for the remote DTX tester
- DTX-PCxxS Product Manuals CD-ROM

If something is missing or damaged, contact the place of purchase immediately.

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

+1-425-446-4519

- 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.

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 **Customer Support** > **Knowledge Base**.

Safety Information

⚠ Warning ⚠

To prevent possible fire, electric shock, personal injury, damage to equipment, or inaccurate test results, read the safety information in the *DTX CableAnalyzer Series Users Manual* before using the tester.

DTX Software Requirements

The DTX main and remote testers need software version 2.4.1 or later to work with the DTX-PCxxS adapters

To determine the software versions in your main and remote testers, do the following:

1 Connect the main and remote testers together with permanent link and channel adapters or two channel adapters and a patch cord.

2 Turn on both testers.

3 Turn the rotary switch to **SPECIAL FUNCTIONS**; then select **Version Information**.

The latest software version is available at no charge on the Fluke Networks web site. Download the update file from the website; then use LinkWare™ software to install new software into the DTX testers. See the *DTX CableAnalyzer Users Manual*, the *DTX CableAnalyzer Technical Reference Handbook*, or the online help in LinkWare for instructions.

Note

*Patch cord performance requirements may change as standards are amended. If requirements change, Fluke Networks will post an updated test specification database for the DTX tester on the Fluke Networks DTX software download page. To install a new database, use the **Modify DTX Test Limits** utility in LinkWare.*

Characterizing the Performance of the Adapters

When you receive the patch cord adapters, you should characterize their performance. Later, the test results can help you determine when the adapters' jacks need replacing or verify that the adapters are working properly. See Appendix A: "How to Characterize and Test the Performance of the Adapters".

How to Test Patch Cords

⚠ Caution

**Testing patch cords that have poorly crimped plugs may
reduce the life of the patch cord adapter's jacks substantially
or make them unusable.**

How to Set Up the Tester

1 Attach the DTX-PCxxS/MN adapter to the main DTX tester. Attach the DTX-PCxxS/SR adapter to the remote DTX tester.

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

3 On the **Twisted Pair** menu, select **Cable Type**.

4 Select the category of twisted pair cable used for the patch cords, then select the appropriate cable type.

5 On the **Twisted Pair** menu, select **Test Limit**.

6 Select the patch cord limit with the appropriate category and length.

   If the appropriate limit is not shown on the **Last Used** menu, press ⬭ F1 **More**; then select **Patch Cords** to see more patch cord limits.

   Notes

   If the patch cord's length is not listed in the limits database, select a limit with the next longest length. For example, if the patch cord is 2.2 m long, select a limit for a 2.5 m patch cord.

   CENELEC limits are preceded by "CLC" in the patch cord limits list.

How to Run the Patch Cord Test

1 Connect the patch cord to be tested to the main and remote testers, as shown in Figure 1.

2 Turn the rotary switch to Autotest; then press ⬭TEST.

3 To save the results, press ⬭SAVE, enter or select a cable ID; then press ⬭SAVE again.
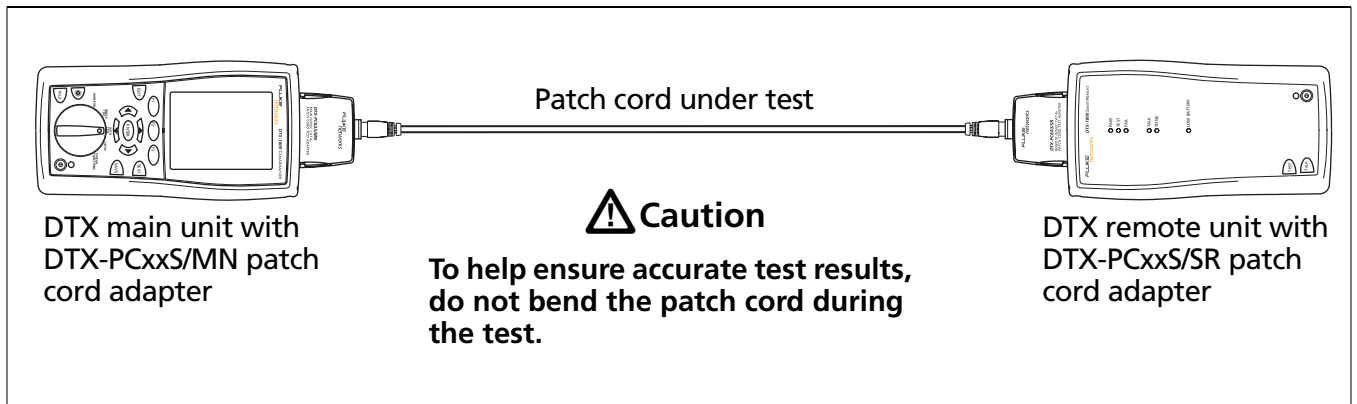
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Figure 1. Patch Cord Test Connections

Patch Cord Test Results

Patch cord tests evaluate the following:

- Wire map

- Return loss

- NEXT

The patch cord test specifications assume that insertion loss (attenuation), ACR-F (ELFEXT), dc resistance, length, propagation delay, and delay skew requirements are met by the patch cord's design; therefore, test limits for these measurements are not required.

Note

NEXT loss and return loss are measured in one direction only, as required by the patch cord test standard. For standard patch cords up to 5 m this method is adequate and can detect performance problems at the remote connection. For longer patch cords, Fluke Networks recommends repeating the test with the patch cord reversed.

Why Patch Cords Fail

Patch cords may fail because of faulty wiring, poor workmanship, poor quality materials, or damage to the cable or plug.

Failures may also occur when the patch cord adapter jacks need replacing or a patch cord adapter is defective. If the adapters' performance was characterized when the adapters were new, use the results and the reference patch cord to check the adapters' performance. See Appendix A.

The following sections give typical causes for wire map, return loss, and NEXT failures.

Wire Map Failures

Wire map failures are typically caused by the following:

- Wires connected to wrong pins at plug
- Faulty connections
- Damaged plug
- Damaged cable
- Wrong **Outlet Configuration** selected in setup
- Mix of T568A and T568B wiring standards (1,2 and 3,6 crossed)
- Conductive material stuck between pins at plug

Return Loss Failures

Return loss failures are typically caused by the following:

- Cable impedance not 100 Ω
- Patch cord handling causing changes in impedance
- Excessive untwisting of pairs at plug
- Poor quality plug
- Cable impedance not uniform (poor quality cable)
- Cable compression (pinches, kinks, etc.)
- Poorly matched plug and jack (most often affects Cat 6/Class E applications)
- Wrong test limit selected

The return loss plot can often tell you if a patch cord failed because of bad cable or a bad plug:

- Return loss failures at low frequencies (below 50 MHz) tend to be caused by the cable.
- Return loss failures at high frequencies tend to be caused by plugs.

Figure 2 shows examples of these failures for Cat 6 patch cords. The plot on the left shows results from a patch cord made with bad cable. The plot on the right shows results from a cord with a bad plug.
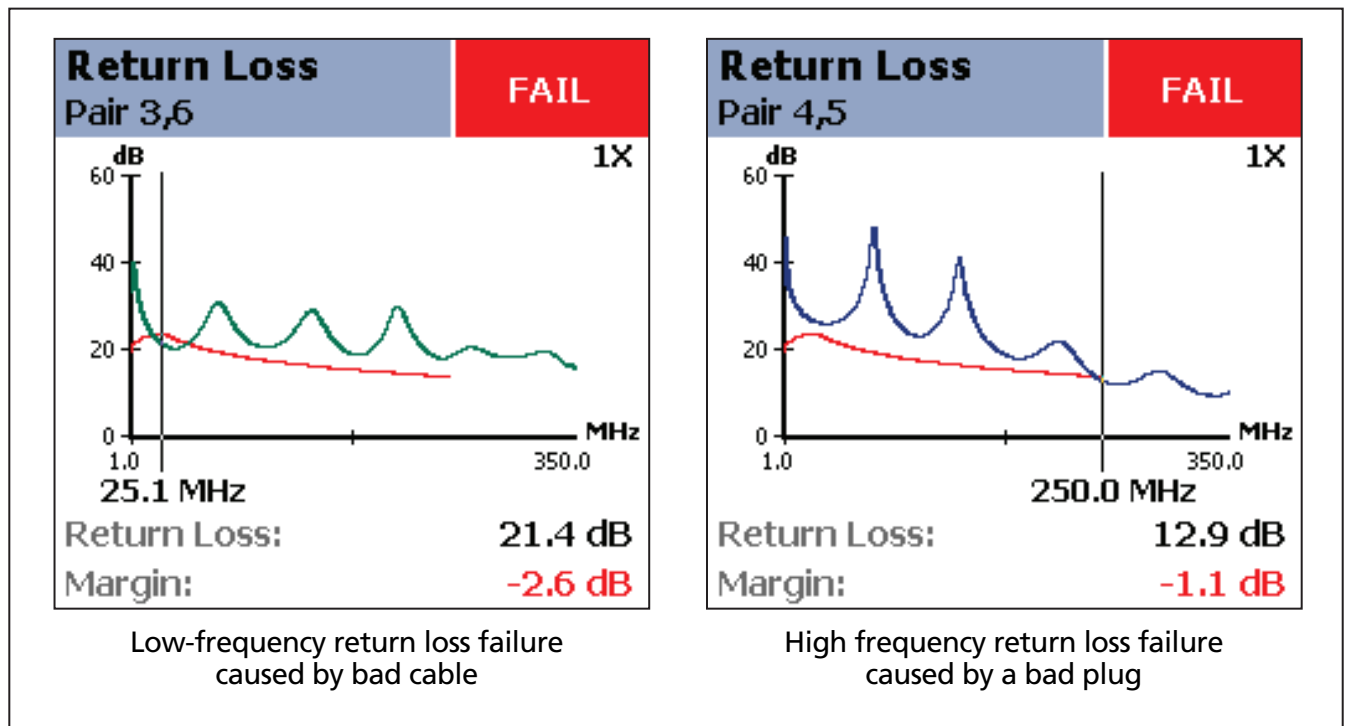

Low-frequency return loss failure caused by bad cable

High frequency return loss failure caused by a bad plug

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Figure 2. Return Loss Failures at Low and High Frequencies (Cat 6 patch cords)

NEXT Failures

NEXT failures are typically caused by the following:

- Excessive untwisting of pairs at plug. Most NEXT failures occur at plugs, where the twist in the wire pairs is interrupted.

- Poor quality plug

- Poor quality cable

- Poorly matched plug and jack (Cat 6/Class E applications)

- Cable compression (pinches, kinks, etc.)

- Excessive noise source near cabling under test. Use the impulse noise test to check for noise.

- Wrong test limit selected

Fault Information for Long Patch Cords

For 20 m patch cord limits, the tester's automatic diagnostics may help you determine why a patch cord failed. After an Autotest that failed, press (F1) **Fault Info** to see information about the failure.

Note

The tester's automatic diagnostics do not usually give complete fault information for patch cords shorter than 20 m.

Mechanical Stress Tests for Patch Cords

Every patch cord design should be evaluated for changes in performance—particularly return loss performance—under mechanical stress. Refer to the TIA or ISO/IEC standards for details on stress tests.

Since it is not practical to perform the stress tests on every patch cord produced, you can test samples of production patch cords to ensure quality. The sample size depends on the desired quality level. Alternately, you can use the stress tests to determine the possible shift in performance, then apply the shift to worst-case margins to ensure that patch cords meet specifications under worst-case conditions. You can apply the shift as you test, or you can use LinkWare software to upload test results to a PC for evaluation.

Replacing the Jacks in the Adapters

The RJ45 jacks in the DTX-PCxxS adapters are typically good for 5000 insertions when used continuously.

When used non-continuously, the lifetime may be reduced to 750 insertions. After 750 insertions, the gold plating that prevents oxidation on the contacts may be worn away; however, continuous use wipes off the oxidation and extends the life of the contacts.

⚠ Caution

Testing patch cords that have poorly crimped plugs may reduce the life of the patch cord adapter's jacks or make them unusable.

When to Replace the Jacks

You should replace the jacks when any of the following occur:

- Margins for patch cord tests begin to shrink.

- Patch cord tests, particularly wire map or return loss tests, begin to produce intermittent and/or inconsistent results.

- The jacks have been used for more than 5000 insertions.

- The test described in Appendix A: "How to Characterize and Test the Performance of the Adapters" fail or the results are noticeably different from those observed when the adapters were new.

How to Order Replacement Jacks

Table 1 shows the replacement parts available for the DTX-PCxxS Patch Cord Adapters. To order replacement jacks, contact Fluke Networks as described on page 2

Table 1. Replacement Jacks

Description	Fluke Networks Model Number
Set of two shielded RJ45 Cat 6A test jacks	DTX-PCTAC6AKS
Set of two shielded RJ45 Cat 6 test jacks	DTX-PCTAC6KS
Set of two shielded RJ45 Cat 5e test jacks	DTX-PCTAC5EKS

How to Replace the Jacks

⚠ **Caution** ⚡

To prevent damage to the adapters and to make sure that your test results are as accurate as possible:

- **The DTX-PCxxS adapters contain static-sensitive devices. When you replace the RJ45 jack, follow guidelines to prevent electrostatic discharge (ESD).**

- **Replace the jacks only with jacks of the same type. For example, do not put Cat 5e jacks onto Cat 6 circuit boards.**

Note

To ensure reliable operation, replace the entire DTX-PCxxS patch cord adapter after the RJ45 jack has been replaced 10 times.

1 Use a TORX PLUS® driver, size T-7, to remove the three screws from the backs of the patch cord adapters.

2 Take the adapter cases apart and remove the circuit boards from the cases.

3 Pull the RJ45 jacks off the circuit boards (Figure 3), being careful not to stress the boards.

4 Align the new RJ45 jacks on the connectors on the circuit boards. Note in Figure 3 how the insulation displacement connectors in the jacks slide into the connectors on the circuit boards.

5 Place the boards on a hard, flat surface; then push the RJ45 jacks onto the connectors on the boards. If firm pressure does not push the jack onto the connectors, realign the jack on the connectors before trying again.

6 Reassemble the cases.

7 If the performance of the adapters was characterized when the adapters were new, use the results and the reference patch cord to check the adapters' performance. See Appendix A.
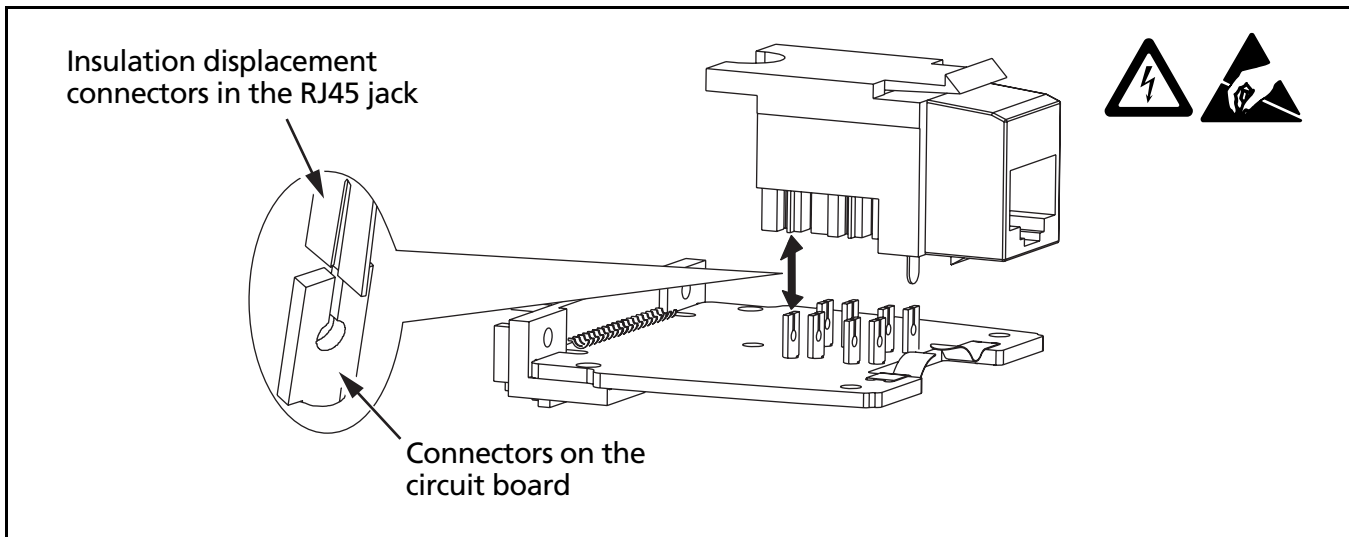

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Figure 3. Replacing the RJ45 Jack

Specifications

The DTX CableAnalyzer testers are guaranteed to meet these accuracy requirements at these categories of permanent link and channel pass/fail limits:

- They meet Level IIe requirements at Cat 5e limits.

- They meet Level III requirements at Cat 6 limits.

- They meet Level IIIe requirements at Cat 6A limits.

Refer to the *DTX CableAnalyzer Series Technical Reference Handbook* for details.

Appendix A: How to Characterize and Test the Performance of the Adapters

Introduction

This appendix describes two methods for characterizing the performance of the DTX-PCxxS adapters. You can use the results from this test for the following:

- Determining when the RJ45 jacks need replacing, or the adapters are otherwise damaged

  Category 5e, 6, and 6A patch cord test limits are very tight. You may see many failures and, consequently, may wonder if the test adapters are working properly. The RJ45 jacks in the adapters wear out with use. Worn jacks or other damage to the adapters can cause tests to fail. The performance test helps you determine when the jacks need replacing or the adapters need service center repair.

- Verifying the adapters' performance

  The performance test lets you verify the adapters' performance after you replace the RJ45 jacks in the adapters, purchase replacement or additional adapters, or anytime the adapters' performance seems questionable.

  While it is not possible to fully evaluate the adapters' performance in the field, the test described in this section help you characterize the adapters and determine if they are working properly.

DTX-PCxxS Performance Test Using a Reference Patch Cord

When you first receive your adapters, you can characterize their performance by testing a reference patch cord and saving the test results and the patch cord for future reference. Later, you can use the patch cord and its results to determine if the adapters' RJ45 jacks need replacing or to verify the adapters' performance.

To characterize the adapters when you first receive them, do the following:

1 Attach the DTX-PCxxS/MN adapter to the main DTX tester. Attach the DTX-PCxxS/SR adapter to the remote DTX tester.

2 Select an appropriate patch cord test limit in SETUP.

3 Run an Autotest on some patch cords to find one that passes. A PASS* result is adequate.

4 Save the test results from a compliant patch cord and mark the patch cord ends with "main" and "remote" as it was connected during the test. Store the reference patch cord for later use.

> *Note*
>
> *To help ensure consistent return loss measurements from the reference patch cord, do not mechanically stress the cord. Patch cord properties can change when the cord is bent or twisted.*
>
> *When you test the reference patch cord later, use the same main and remote DTX testers as were used for the initial test. The serial numbers of the testers are saved with the test results.*

To test the same adapters later, do the following:

1 Connect the reference patch cord between the same main and remote testers used for the original test. Be sure the marked ends of the patch cord go to the correct testers.

2 Run an Autotest; then save the results.

3 Compare the results with the reference patch cord's previous results. The difference between the old and new NEXT and RL results should be less than 0.5 dB near the PASS/FAIL limits.

4 If the old and new results are more than 0.5 dB apart near the PASS/FAIL limits, the RJ45 jacks may need replacing. See "Replacing the Adapter's Jacks" on page 9 for details.

DTX-PCxxS Performance Test Using a DTX-AXTERM Plug

A second method of characterizing and testing the performance of the adapters uses the DTX-AXTERM link terminator plug, which is available from Fluke Networks.

When you first receive your adapters, you can test both the main and remote adapters using a DTX-AXTERM plug and save the test results for future reference. Later, you can use the DTX-AXTERM plug and its results to determine if the adapters' RJ45 jacks need replacing or to verify the adapters' performance.

How to Characterize the DTX-PCxxS/MN Main Adapter

1 Attach the DTX-PCxxS/MN main adapter to the main DTX tester and insert the DTX-AXTERM plug, as shown in Figure 4.

2 Pull the DTX-AXTERM plug back slightly to its locking position.

3 Select the correct test limit:

- For a Cat 5e jack: **TIA Patch Cord Cat5e 0.5m**

- For a Category 6 jack: **TIA Patch Cord Cat6 0.5m**

- For a Category 6A jack: **ISO Patch Cord Cat6A 0.5m**

4 Turn the rotary switch to **SINGLE TEST** then select **NEXT**.

5 Press ⌨TEST. The tester will give a wire map error. Press (F3) to continue the test.

6 Move the cursor to 100 MHz.

- For a DTX-PCxxS/MN main adapter with a Category 5e jack, the value should be better than 43 dB.

- For a DTX-PCxxS/MN main adapter with a Category 6 or 6A jack, the value should be better than 52.5 dB at 100 MHz.

7 Save or record the values for the main adapter.

How to Characterize the DTX-PCxxS/SR Remote Adapter

1 Attach the DTX-PCxxS/SR remote adapter to the main DTX tester and insert the DTX-AXTERM plug, as shown in Figure 4.

2 Pull the DTX-AXTERM plug back slightly to its locking position.

3 Select the correct test limit:

- For a Cat 5e jack: **TIA Patch Cord Cat5e 0.5m**

- For a Category 6 jack: **TIA Patch Cord Cat6 0.5m**

- For a Category 6A jack: **ISO Patch Cord Cat6A 0.5m**

4 Turn the rotary switch to **SINGLE TEST** then select **NEXT**.

5 Press ⌨TEST. The tester will give a wire map error. Press (F3) to continue the test.

6   Move the cursor to 100 MHz.

- For a DTX-PCxxS/SR remote adapter with a Category 5e jack, the value should be better than 53 dB.

- For a DTX-PCxxS/SR remote adapter with a Category 6 or 6A jack, the value should be better than 62.5 dB at 100 MHz.

Note

The 10 dB difference between the main and remote adapters is due to the attenuation circuits in the remote adapter.

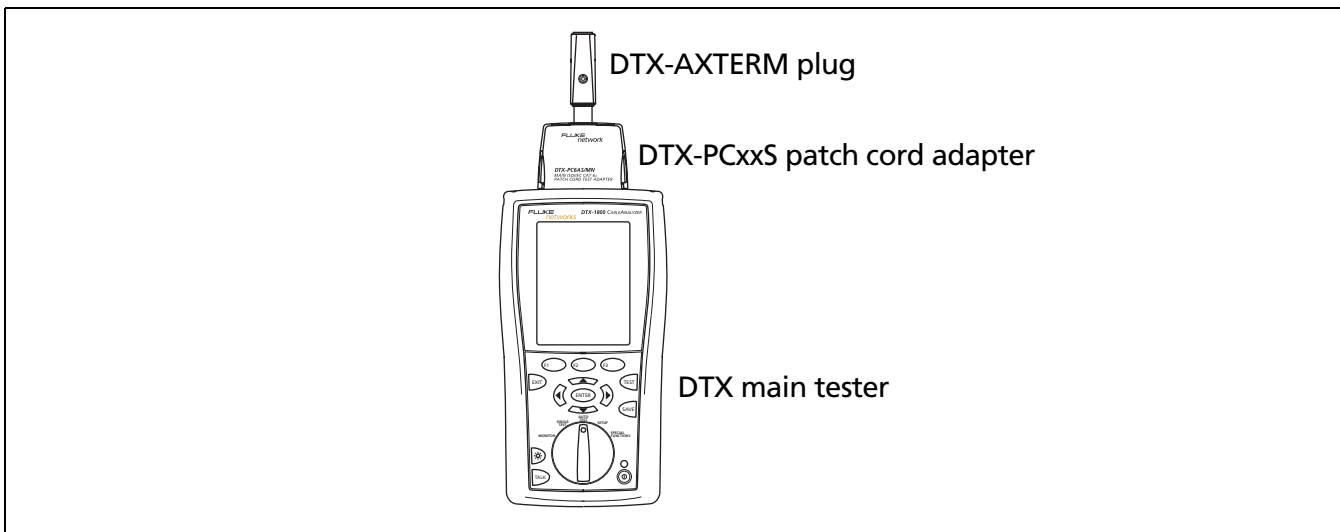**7**   Save or record the values for the remote adapter.

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Figure 4. Using a DTX-AXTERM Plug to Characterize and Test the Adapters

How to Test the Performance of the Adapters Later

To test the same adapters later, repeat the characterization tests above for the main and remote adapters using the same DTX-AXTERM plug and DTX CableAnalyzer main unit. If the old and new results are more than 0.5 dB apart at 100 MHz, the RJ45 jacks may need replacing. See "Replacing the Adapter's Jacks" on page 8 for details.