

# **SYSTIMAX®**

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## **SOLUTIONS**

### **SYSTIMAX® Performance Verification of GigaSPEED® X10D Installations with Fluke Networks DTX 1800 CableAnalyzer™**

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**SYSTIMAX® Structured Connectivity Solutions**

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## Overview

The Fluke Networks **DTX 1800 CableAnalyzer™** instrument has been qualified by SYSTIMAX® Labs for verification of the Guaranteed **GigaSPEED® X10D** Channel Performance as well as Augmented Category 6 Channel and Permanent Link testing to the proposed EIA/TIA Category 6A specifications and the proposed ISO/IEC Class E<sub>A</sub> specifications. This document describes the field testing procedures for SYSTIMAX **GigaSPEED X10D** installations using the Fluke Networks **DTX 1800 CableAnalyzer**. The **GigaSPEED X10D** solution must be designed, installed, and tested by an authorized SYSTIMAX BusinessPartner in accordance with SYSTIMAX Guidelines. The **GigaSPEED X10D** solution components are listed in Table 1 below.

**Table 1. GigaSPEED X10D Solution Components**

<b>GigaSPEED X10D</b> 91 Series Cables
24-port UMP Panels
<b>GigaSPEED X10D</b> MGS500 Modular Outlets
<b>GigaSPEED X10D</b> GS10E Patch Cords

**Note:** Check **SYSTIMAX X10D** product information and guidelines for updates that may be available.

## GigaSPEED X10D Guaranteed Channel Performance

Registered **GigaSPEED X10D** installations in conformance with the relevant SYSTIMAX SCS guidelines are covered by the SYSTIMAX SCS 20 Year Assurance Program, with a **GigaSPEED X10D** Minimum Channel Performance Guarantee up to 500 MHz.

The **GigaSPEED X10D** Minimum Channel Performance Guarantee exceeds the Category 6 channel specifications in TIA/EIA-568B.2-1 and the Class E channel specifications in the ISO/IEC 11801 2nd Ed. (2002) by significant margins, and also exceeds the proposed Category 6A specifications in the Draft Amendment 10 to TIA/EIA-568B.2 and the proposed Class E<sub>A</sub> specifications for Amendment 1.1 to ISO/IEC 11801 on a swept frequency basis, as outlined in "*SYSTIMAX GigaSPEED X10D Solution Channel Performance Specifications*".

All parameters comply with the governing equations given in the SYSTIMAX SCS memorandum entitled "*SYSTIMAX GigaSPEED X10D Solution Channel Performance Specifications*" over the entire frequency range.

## Fluke Networks DTX 1800 CableAnalyzer

The **DTX 1800 CableAnalyzer** has a graphical display screen with front panel controls for easily controlling and viewing measurements. The Rotary Switch has SETUP, SINGLE TEST, and AUTOTEST positions to select the main operating modes. TEST and SAVE buttons support quick repetitive testing. On each test completion, the results are displayed, and scrolling and ENTER allow for detailed viewing. SAVE will auto-increment the test name, but name alterations can be made through scrolling, ENTER, and the flexible HOT KEYS.

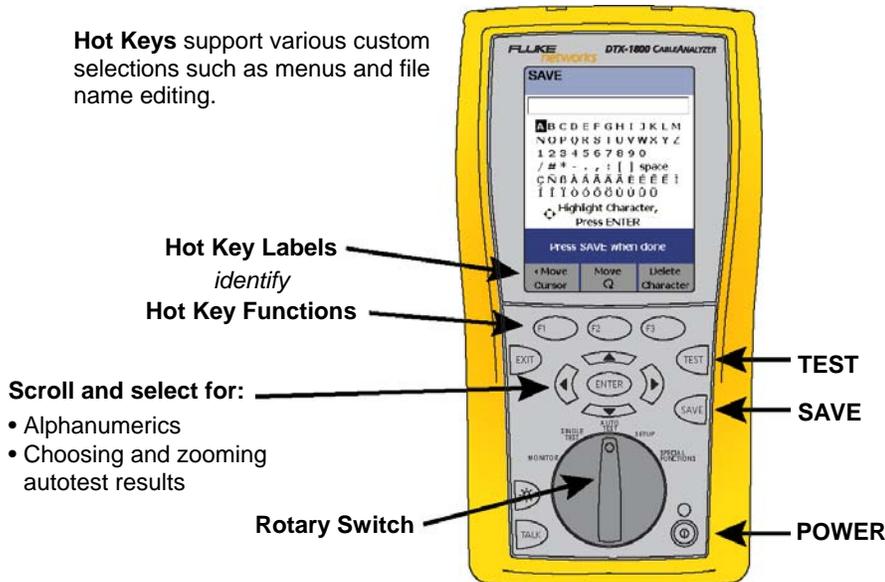


Figure 1. DTX 1800 CableAnalyzer

## Installation Test Configurations

The first step in certifying a cabling installation is checking the design documentation and inspecting the site for compliance and completion. Testing should be based on assurance that the site will not be altered at a later date without retesting. The Cabling standards define the following test configurations for installed cabling:

- **Channel configuration** – This includes all the cabling elements necessary to interconnect networking equipment. The Channel includes the work area cords, equipment cords and cross-connects that make up the end-to-end cabling system. Therefore, channel performance determines the overall quality of the communications and provides a true indication of end-to-end cabling system performance. All networking equipment should be designed for end-to-end channel performance.
- **Permanent Link configuration** – This only includes the “somewhat permanently” installed cabling from the Telecom Room (Floor Distributor) to the Work Area outlet, and may include a Consolidation Point.

**SYSTIMAX** Labs has qualified both Permanent Link and Channel testing. Permanent Link tests are most commonly performed by installers to verify proper cable installation and terminations. Channel tests are typically performed with the cords that are in place for each channel that is made ready to support networking equipment.

## Channel Configuration

The Channel configuration is intended to be used by system designers, installers, and users of data telecommunications systems to verify the end-to-end performance of cabling systems. A complete Channel includes the work area cords, equipment cords and cross-connects that make up the end-to-end cabling system. The elements of the common channel definition found in TIA-568B, and ISO/IEC 11801 2nd Ed. are shown in Figure 2 below.

Check with current **SYSTIMAX** product literature and design guidelines for proper cords, cables, and connectors and for suitable design solutions.

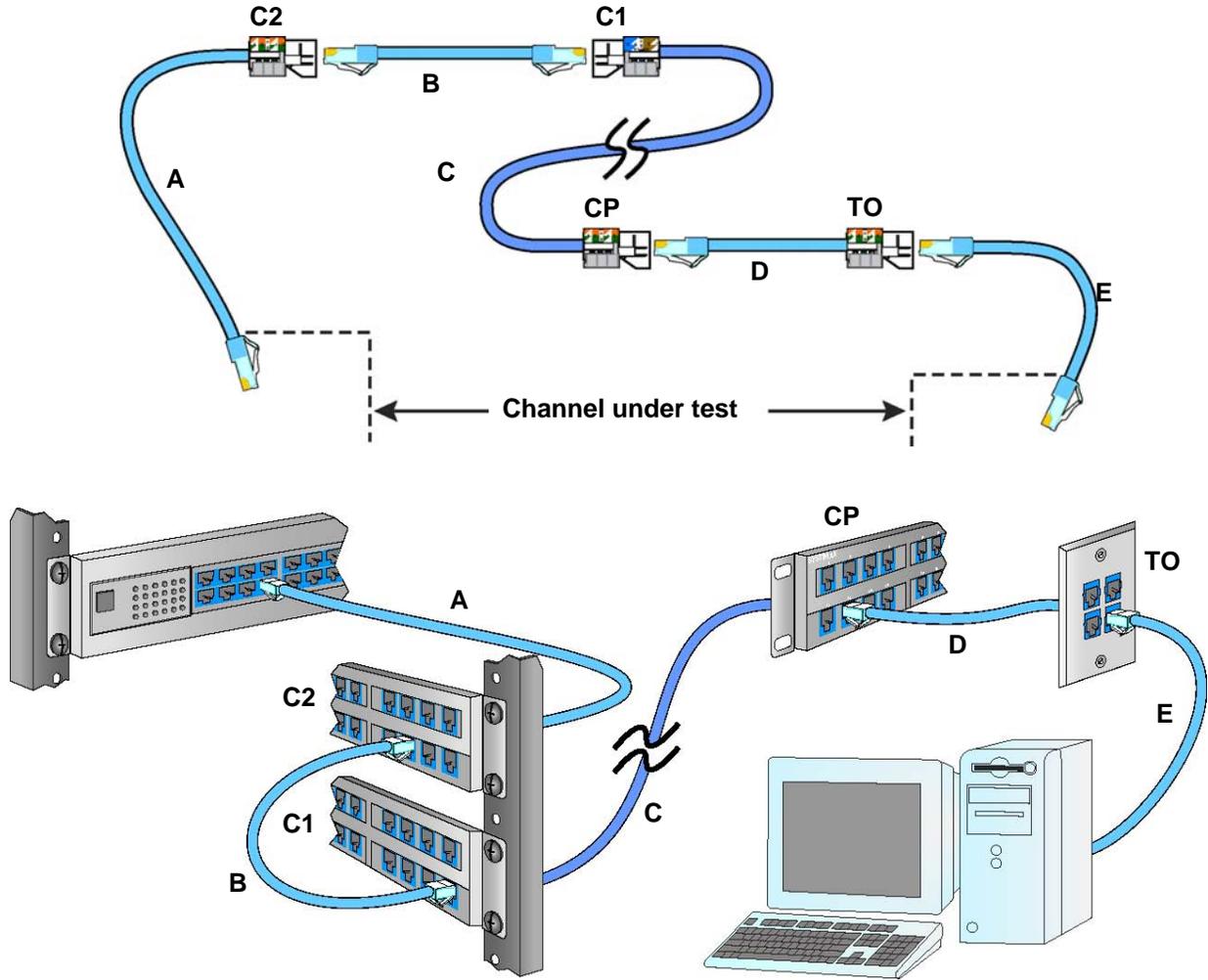


Figure 2. Channel configuration

**Cables and cords**

- A — Equipment cord
- B — Cross-connect cord
- C — Horizontal cabling
- D — Zone extension cord
- E — Work area cord

**Connecting hardware**

- TO — Telecommunications outlet
- CP — Consolidation point connector
- C1, C2 — Cross-connect

**Note:** The ISO/IEC 11801 2nd Ed. also includes 2-connector and 3-connector channel configurations.

## Permanent Link Configuration

The Permanent Link configuration is intended to be used by installers, and users of data telecommunications systems to verify the performance of cabling installed between the Telecommunications Room and the Work Area outlet. The Permanent Link configuration may include a Consolidation Point but does not include the Work Area cords, equipment cords, or cross-connects that make up the end-to-end cabling system. The elements of a common Permanent Link definition found in TIA-568B and ISO/IEC 11801 2nd Ed. are shown in Figure 3 below.

**Note:** While there is general agreement regarding the Category 6A/Class E<sub>A</sub> channel performance specifications (with minor discrepancies between ISO/IEC and TIA limits), the Permanent Link limits to be applied to Category 6A are currently under discussion, and the Permanent Link limits for class E<sub>A</sub> are not included in the proposed Amendment 1.1. Permanent Link limits for Class E<sub>A</sub> are the subject of further study for inclusion in Amendment 1.2.

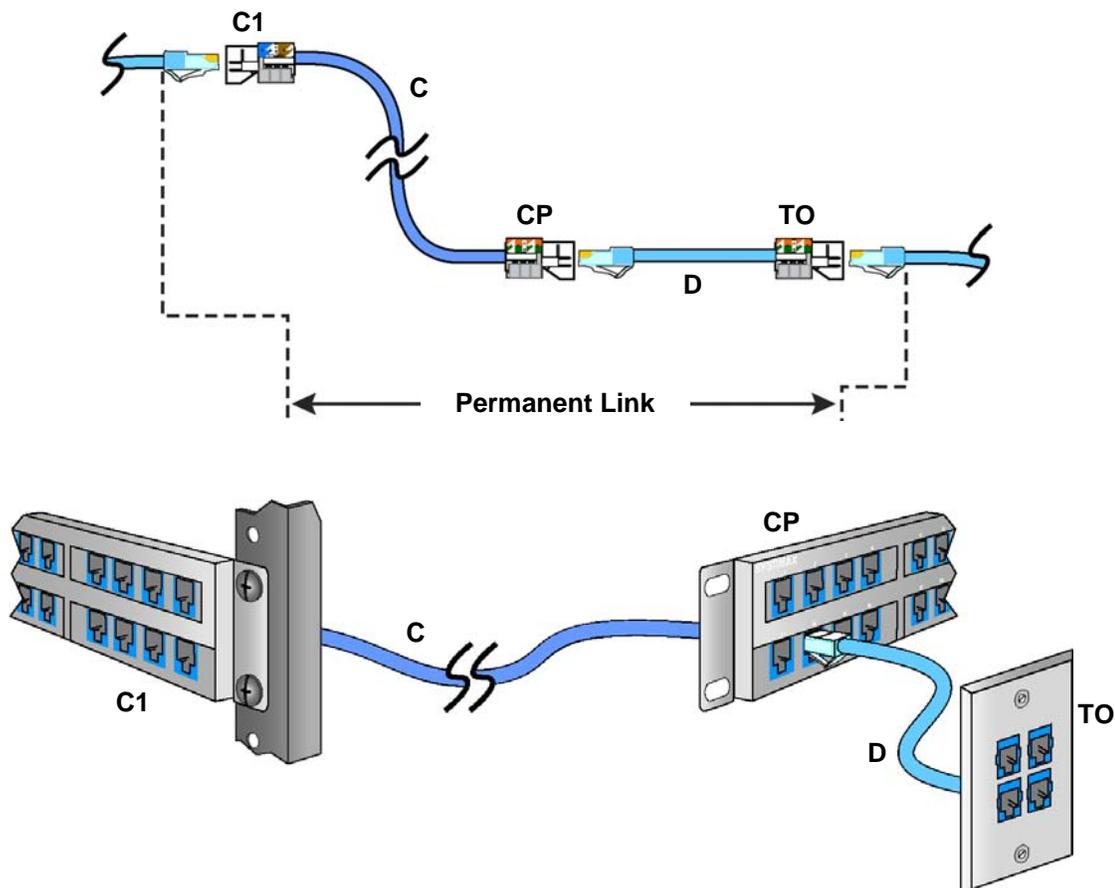


Figure 3. Permanent Link configuration and example

### Cables and cords

- C — Horizontal cabling
- D — Zone extension cord

### Connecting hardware

- TO — Telecommunications outlet
- CP — Consolidation point connector
- C1 — Interconnect

## Field Testing of GigaSPEED X10D Installations with the Fluke Networks DTX 1800 CableAnalyzer

The **DTX 1800 CableAnalyzer** is designed to verify Category 6A Channels and Permanent Links. The combination of main and remote units provide complete test results from both ends. Additionally, building backbone channels and data center channels may also be tested according to these guidelines. In order to perform accurate testing, it is important to follow the steps outlined below:

- Step 1.** – Verify that the latest Firmware is installed in the DTX CableAnalyzer.
- Step 2.** – Select the correct Test Interface Adapters (used for the Calibration as well as for testing).
- Step 3.** – Calibrate according to the recommendations from Fluke Networks (outlined below).
- Step 4.** – Select and verify the correct NVP, select the correct Autotest for the configuration to be tested.
- Step 5.** – Test, check, and save the result.

### Step 1. DTX 1800 CableAnalyzer Software and Firmware

Make sure the Firmware in the **DTX 1800 CableAnalyzer** is up-to-date. Firmware can be updated through a PC running Fluke Networks **Linkware™** test management software. The most recent versions of Firmware can be checked and downloaded from the Fluke Networks web site at <http://www.flukenetworks.com>.

**Note:** Make sure the latest version of **LinkWare™** is also used.

#### To update the DTX 1800 CableAnalyzer firmware:

1. Connect the **DTX 1800 CableAnalyzer** with either the Serial cable or the USB cable provided.
2. Run Linkware.
3. Select “Utilities / DTX Utilities / Software Update” from the menu.
4. Find and select the downloaded Firmware, and wait until completed.
5. Repeat this for the **Smart Remote DTX 1800 CableAnalyzer**.



Figure 4. Updating the Fluke DTX 1800 CableAnalyzer Firmware

## Step 2. DTX 1800 CableAnalyzer Test Interface Adapters

The **DTX 1800 CableAnalyzer** is shipped with a set of two Cat 6 / Class E Channel Adapters (DTX-CHA001S) and two Permanent Link Adapters (DTX-PLA001S).

- Each Channel Adapter has an “RJ45” interface for connecting to the channel under test, see Figure 5.
- Each Permanent Link Adapter has a Personality Module (PM06) with modular plugs for connecting to the Permanent Link under test, see Figure 6.

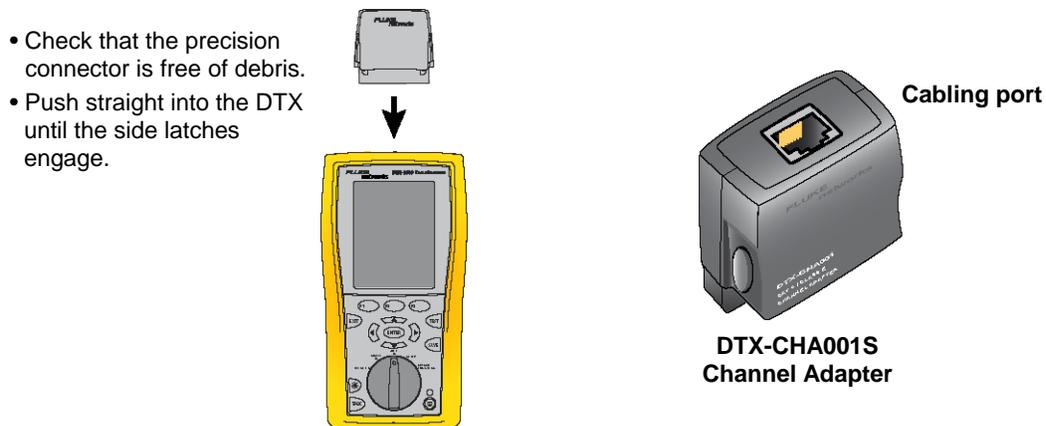


Figure 5. DTX 1800 Channel Adapters

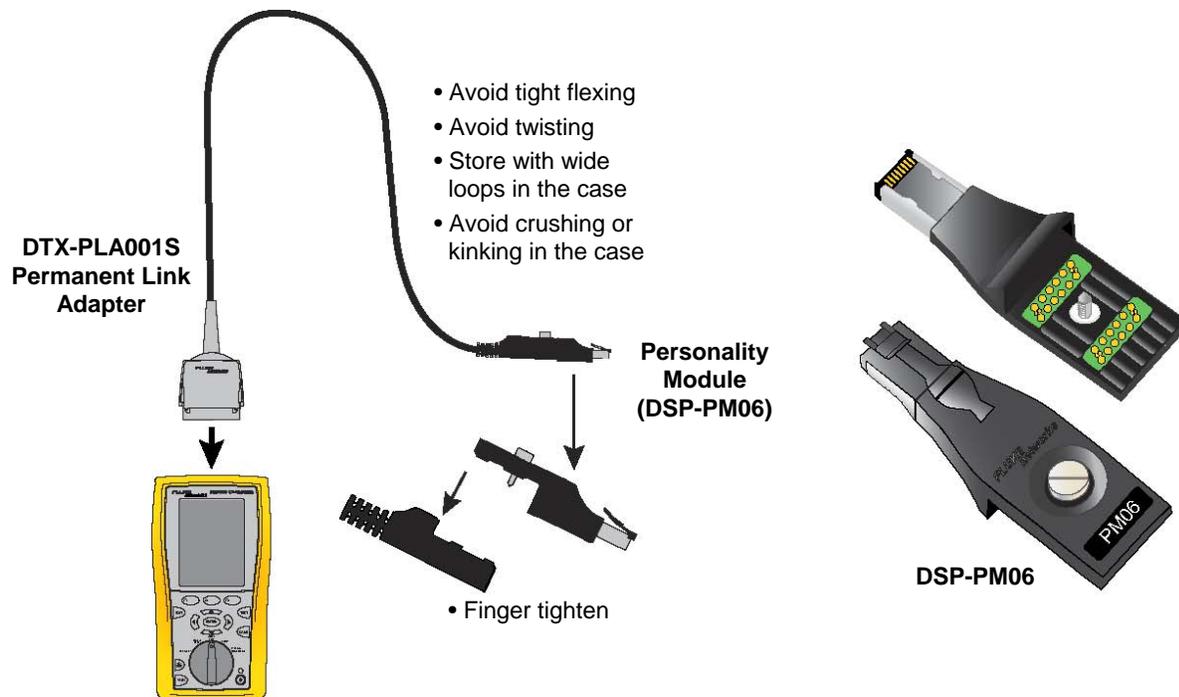


Figure 6. DTX 1800 CableAnalyzer Permanent Link Adapters

### Step 3A. Field Calibration

There is a Field Calibration in addition to a Factory Calibration. Fluke Networks recommends a Factory Calibration every twelve months, and a Field Calibration every 30 days. The Field Calibration relies on the Test Interface Adapters.

The primary calibration is to ensure that the Main and Smart Remote are operating at the same signal levels. This calibration sets a baseline for insertion loss, ELFEXT and DC resistance measurements. This is performed using the Permanent Link adapter with the PM06 Personality module and a channel adapter as shown in Figure 7.

This procedure will be automatically required when the main tester is used with a different Smart Remote. A tester can be referenced to two different Smart Remotes.

**Note:** Reference Setting should be done every 30 days to ensure maximum accuracy of test results.

**Note:** The Main and Smart Remote DTX must be turned on for 1 minute before Reference Setting.

#### To set the reference:

1. Attach a Permanent Link Adapter with the PM06 to the Main and connect the PM06 to a Channel adapter on the Remote. This will work for either Adapter of each type, but does not need to be done for each.
2. Turn the rotary switch on the Main Unit to SPECIAL FUNCTIONS.
3. Select Set Reference.
4. Press Test.
5. Press OK when done.

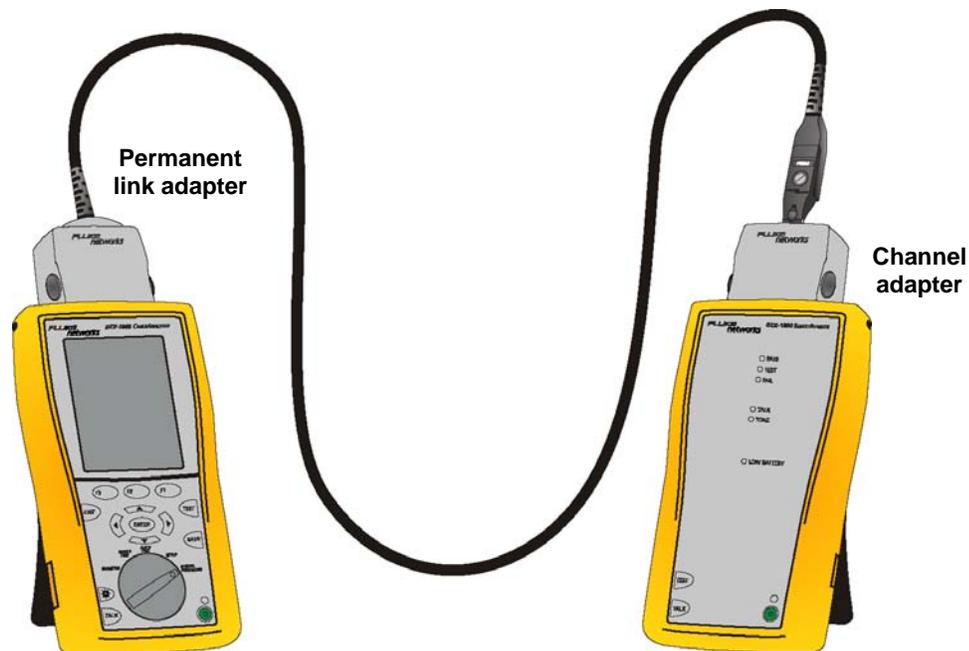


Figure 7. Setting the Reference for DTX 1800 CableAnalyzer

**Note:** When performing this calibration, ensure the Permanent Link Adapter cord is in good condition, and not tightly coiled, sharply bent, or otherwise damaged.

### Step 3B. Quick Check for proper Channel Test Operation

You can obtain an indication that the **DTX 1800 CableAnalyzer** is performing properly with this simple "quick check". This tests a single GS10E cord as a complete channel, and the result should show high margins.

#### To perform a "quick check":

1. Connect a 3 m GS10E cord to the Channel Adapters on both the Main and Remote(see Figure 8).
2. Turn the rotary switch on the **DTX 1800 CableAnalyzer** to SETUP and select Twisted Pair.

**Note:** NVP and outlet configuration are not important for this check.

3. Select the Test Limit as Augmented Cat 6 Channel (TIA AugCat 6 CH), and then select the Cable Type as Cat 6 UTP.

**Note:** Type and limit names may change as updates are downloaded.

4. Turn the rotary switch to AUTOTEST and press TEST.
5. Check the results:

- Insertion Loss should be < 2 dB
- NEXT margin should be > 12 dB
- RL margin should be > 6 dB
- ELFEXT margin should be > 16 dB

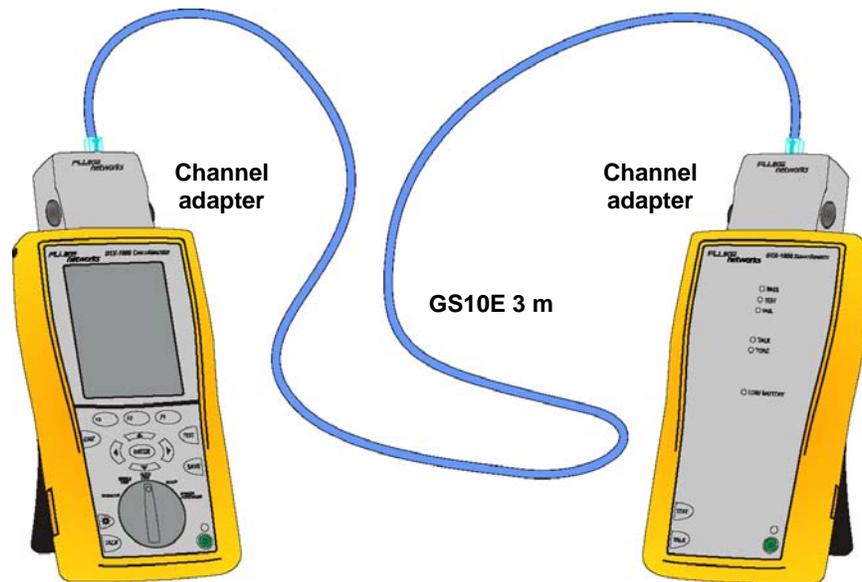


Figure 8. DTX 1800 CableAnalyzer Self Calibration Quick Check

### Step 3C. Permanent Link Adapter Calibration

This calibration is normally done at the factory. To achieve the best Return Loss accuracy when measuring Permanent Links, the DTX-PLA001 may be field calibrated with the "DSP-PLCAL Universal Permanent Link Calibration Kit." This calibration kit has OPEN, SHORT, and 100Ω LOAD references that are measured to allow the **DTX 1800 CableAnalyzer** to correct Return Loss errors.

**Note:** This calibration is not needed for channel measurements.

**Note:** This calibration kit is not included with the **DTX 1800 CableAnalyzer** and must be ordered separately.

#### To perform the permanent link adapter calibration:

1. Connect the **DTX 1800 CableAnalyzer** with either the Serial cable or the USB cable provided.
2. Run Linkware
3. Select "Utilities / DTX Utilities / Permanent Link Cal" from the menu
4. The software will prompt the user to connect the Calibration Kit port labeled "OPEN." This is connected in the same way as the DSP PM-06. It should be finger tightened, but make sure it is tight.
5. Repeat the calibration measurement for the "SHORT" and LOAD" ports as prompted.
6. Continue following the software instructions and do the same calibration for the other DTX-PLA001S Permanent Link Adapter.

**Note:** DO NOT TOUCH the gold contacts. Skin oil and other contaminants can degrade the gold contacts.

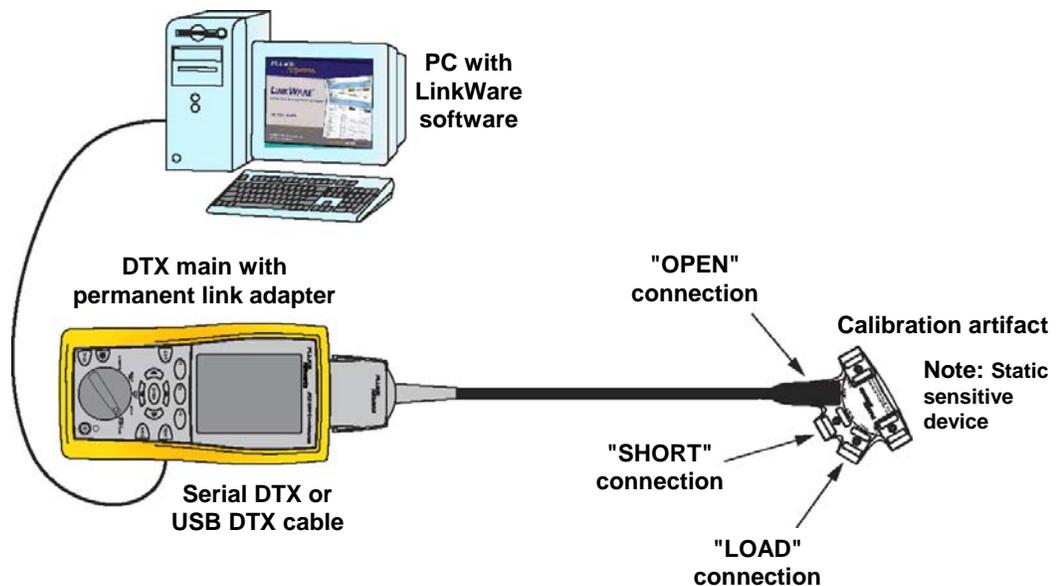


Figure 9. DTX 1800 CableAnalyzer Permanent Link Adapter (DTX-PLA001S) Calibration

**Note:** When performing this calibration, ensure the Permanent Link Adapter cord is in good condition, and not tightly coiled, sharply bent, or otherwise damaged.

### Step 3D. Quick Check for proper Permanent Link Test Operation

You can obtain an indication that the **DTX 1800 CableAnalyzer** is performing properly with this simple “quick check”. This tests the Calibration Kit as a complete Permanent Link, and the result should show high margins.

#### To perform a "quick check":

1. Attach the Permanent Link Adapters to both the main and remote DTX CableAnalyzers.
2. Remove the DSP-PM06 from each Permanent Link Adapter.
3. Connect both Permanent Link Adapters to the “through” connection in the DSP-PLCAL artifact as shown in Figure 10.
4. Turn the rotary switch to SETUP and select Twisted Pair.
5. Select the Test Limit as Augmented Cat 6 PL (TIA AugCat 6 PL), and then select the Cable Type as UTP.

**Note:** An alternative Test Limit is an application test called DTX-PL Self-test

6. Turn the **DTX 1800 CableAnalyzer** rotary switch to AUTOTEST and press TEST.
7. Check the results:
  - Insertion Loss should be < 2 dB
  - NEXT margin should be > 12 dB
  - RL margin should be > 4 dB
  - ELFEXT margin should be > 16 dB

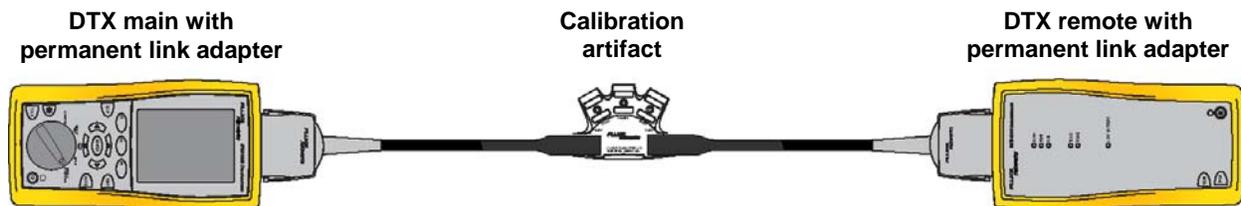


Figure 10. DTX-PLA001S Permanent Link Adapter Self Test

**Note:** When performing this check, ensure the Permanent Link Adapter cord is in good condition, and not tightly coiled, sharply bent, or otherwise damaged.

### Step 4. Select and Verify Correct NVP and Autotest

#### To begin testing, set up the DTX 1800 CableAnalyzer as follows:

1. Attach the appropriate Test Interface Adapters (Permanent Link or Channel) to both the main and remote DTX CableAnalyzers.
2. Turn the rotary switch to SETUP and select Twisted Pair.
  - Scroll to select the Cable Type as Cat 6 UTP or one of the SYSTIMAX 1091/2091/3091 cables, and then select the Test Limit (Augmented Cat 6 PL or Augmented Cat 6 Channel)
  - Scroll to select and verify the correct NVP (66% for 1091 and 3091, and 68% for 2091). NVP can be altered and tested before proceeding.
3. Turn the **DTX 1800 CableAnalyzer** rotary switch to AUTOTEST and verify that the correct test type is set.

**Note:** Setup and test key sequences, test and limit names may change with firmware and standards updates.

## Step 5A. Testing Permanent Link Performance of GigaSPEED X10D Installations

Compliance with the Category 6A Permanent Link specifications is demonstrated by achieving PASS results for all autotest parameters.

### To test permanent link performance:

1. Set up the DTX CableAnalyzers for Permanent Link testing.
2. Connect both Permanent Link Adapters to the **GigaSPEED X10D** Permanent Link.
3. Turn the **DTX 1800 CableAnalyzer** rotary switch to AUTOTEST and verify that the correct test type is set.
4. Press TEST. When the **DTX 1800 CableAnalyzer** signals completion, check the results and press SAVE.

**Note:** A Test Record name must be created by scrolling through and selecting alphanumeric. The DTX CableAnalyzer will auto-increment the name on subsequent tests.

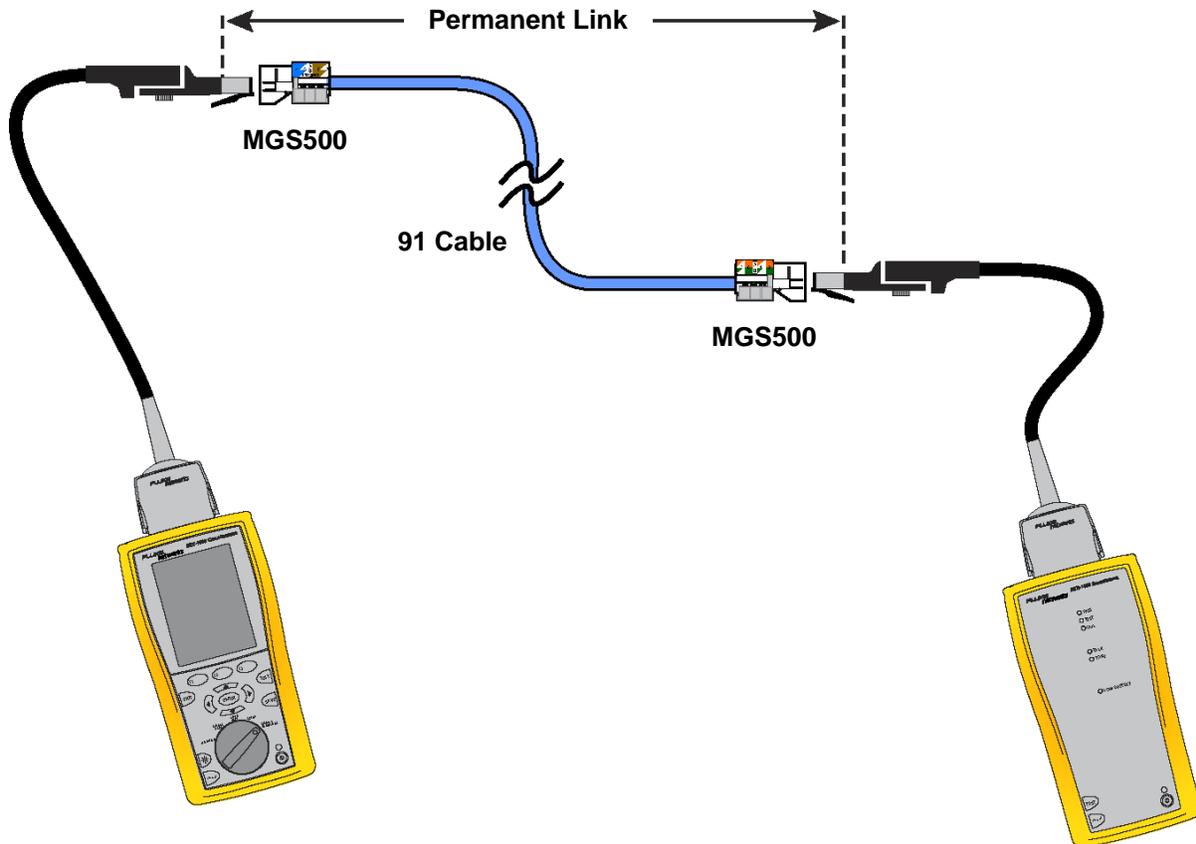


Figure 11. 2-Connector GigaSPEED X10D Permanent Link

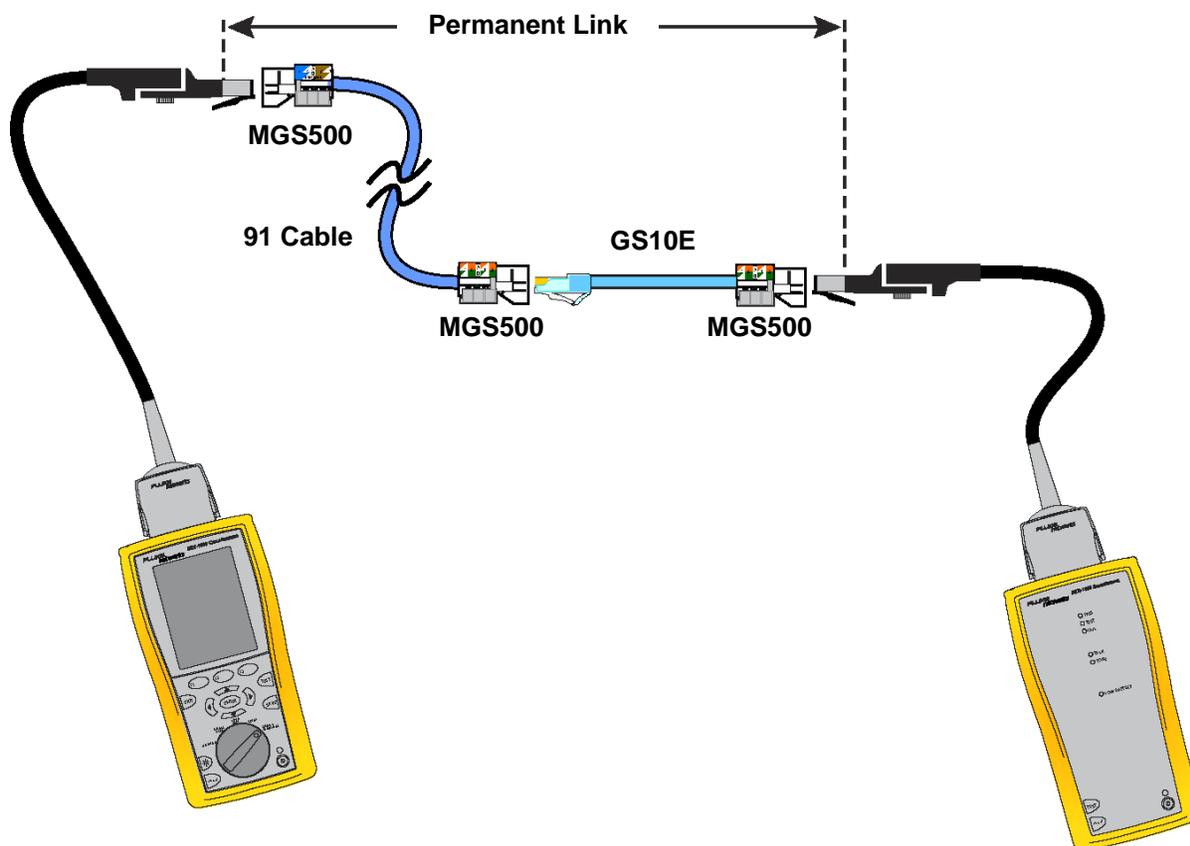


Figure 12. 3-Connector GigaSPEED X10D Permanent Link

### Step 5B. Testing Channel Performance of GigaSPEED X10D Installations

Compliance of installed **GigaSPEED X10D** Channels with the Guaranteed **GigaSPEED X10D** Channel Performance margins may be verified once the SYSTIMAX SCS Work Area Cords, Patch Cords and Equipment Cords are installed. Compliance with the guaranteed **GigaSPEED X10D** channel performance specifications is achieved by channel test results that show PASS for all Category 6A requirements and performance margin that is equal to or better than the **GigaSPEED X10D** Guaranteed Channel Margin.

#### To test channel performance:

1. Set up the DTX CableAnalyzers for channel testing.
2. Connect both ends of the **GigaSPEED X10D** channel to the main and remote DTX CableAnalyzers.
3. Turn the **DTX 1800 CableAnalyzer** rotary switch to AUTOTEST and verify that the correct test type is set.
4. Press TEST. When the **DTX 1800 CableAnalyzer** signals completion, check the results and press SAVE.

**Note:** A Test Record name must be created by scrolling through and selecting alphanumeric. The **DTX 1800 CableAnalyzer** will auto-increment the name on subsequent tests.

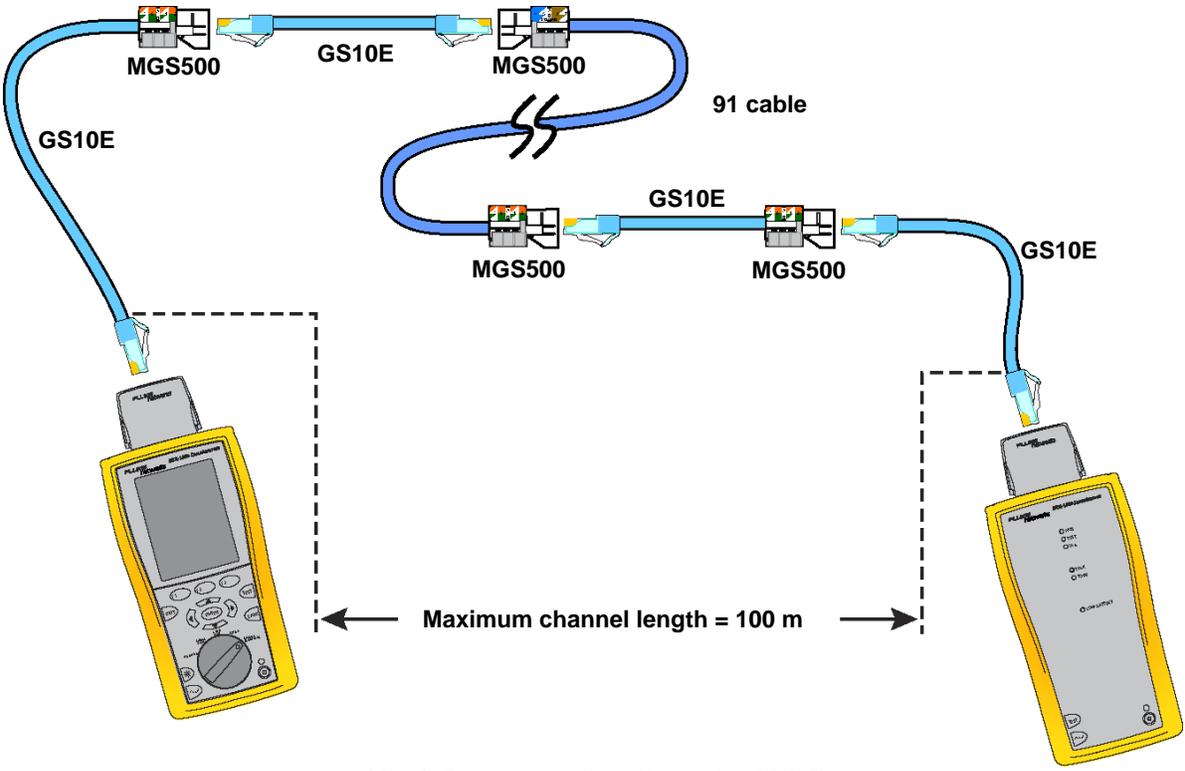


Figure 13. 4-Connector GigaSPEED X10D Channel

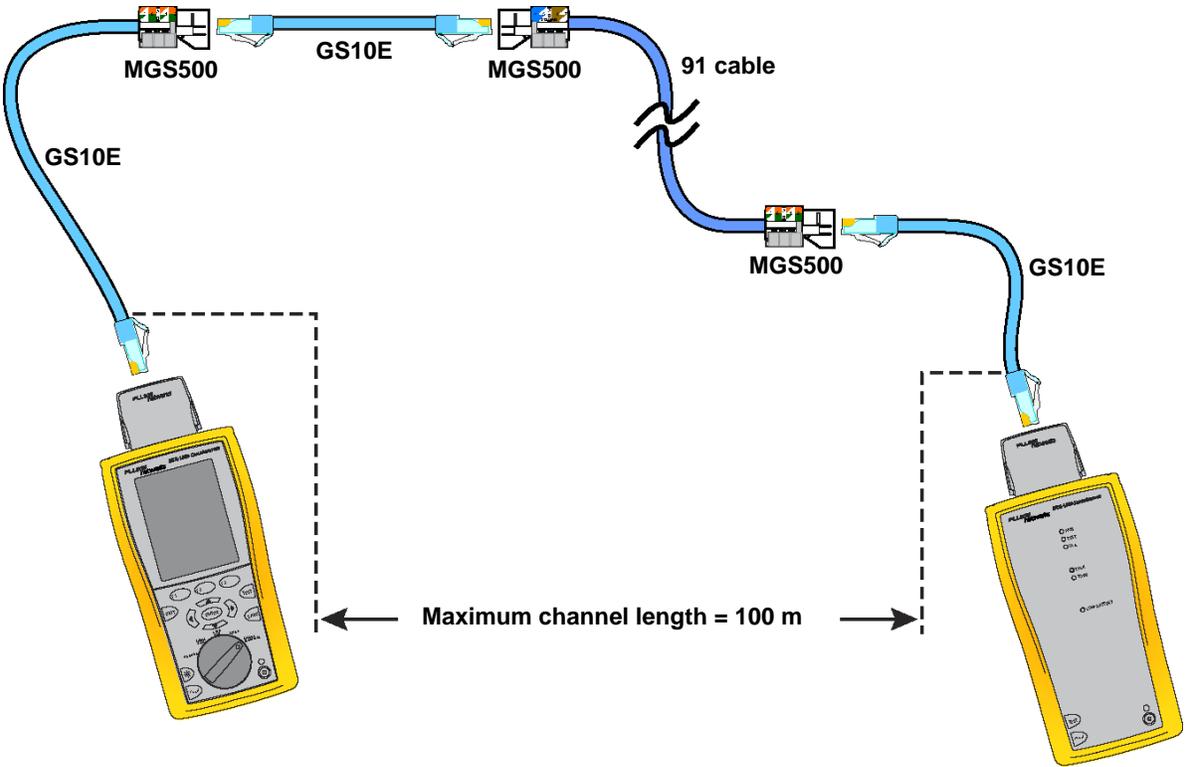


Figure 14. 3-Connector GigaSPEED X10D Channel with cross-connect

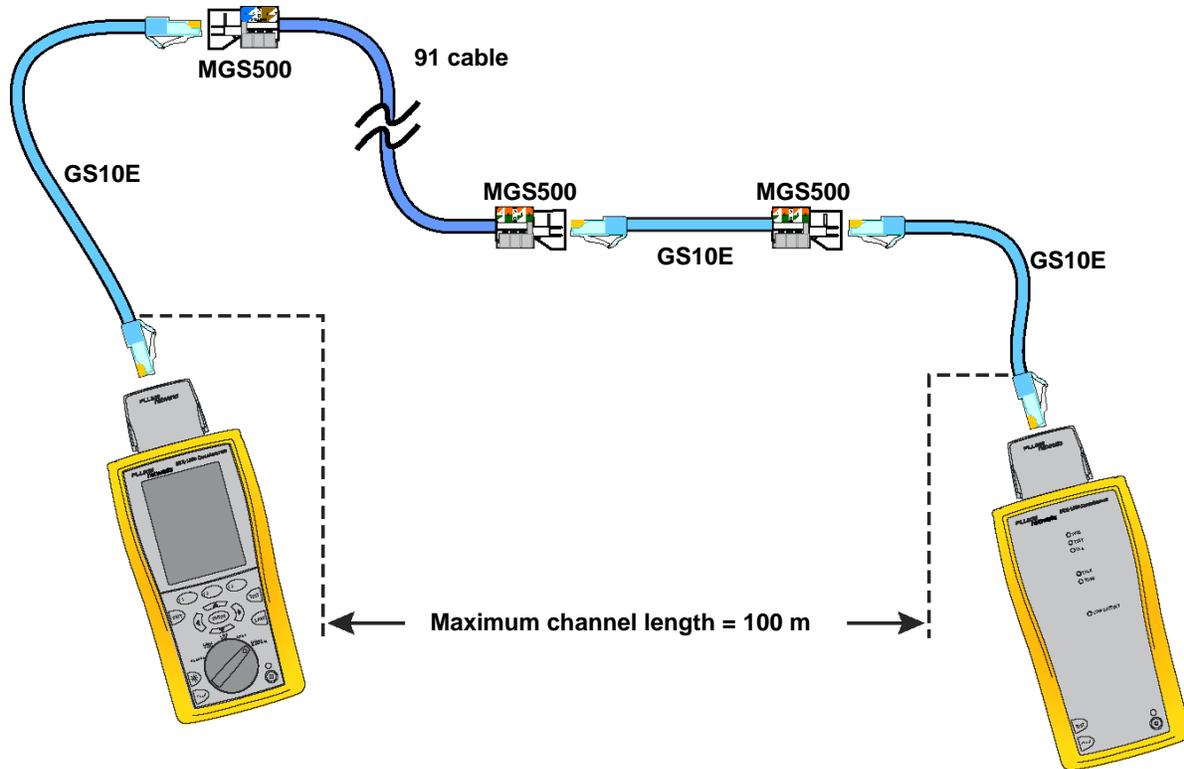


Figure 15. 3-Connector GigaSPEED X10D Channel with Interconnect and CP

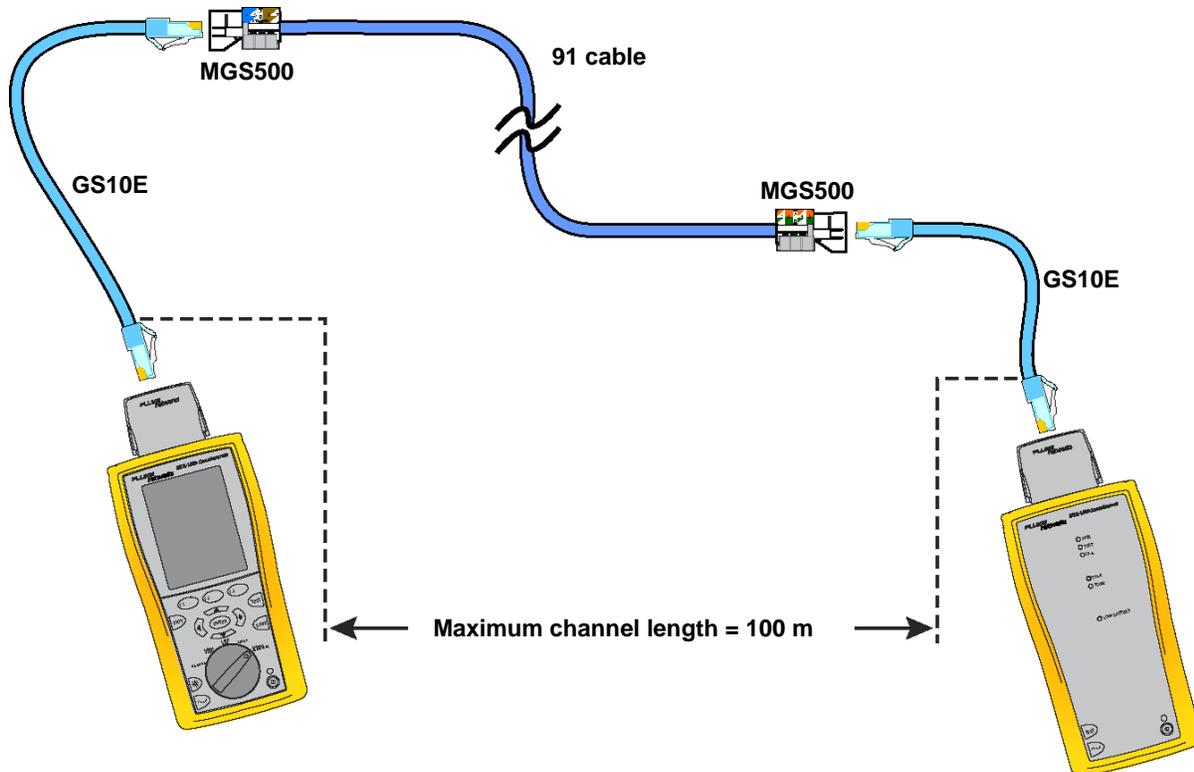


Figure 16. 2-Connector GigaSPEED X10D Channel (Interconnect at FD/TC, no CP)

## Uploading Test Results

### To upload test results:

1. Connect the **DTX 1800 CableAnalyzer** with either the serial cable or the USB cable provided.
2. Run LinkWare.
3. Select "File/Import from/DTX CableAnalyzer" from the menu.
4. Choose the Autotest results.
5. Use various features of LinkWare to view and sort results.
6. Select "File/Save As" from the menu.

## Troubleshooting Links and Channels

The **DTX 1800 CableAnalyzer** automatically troubleshoots many problems. Some problems require you to manually run and examine diagnostic tests.

Typical problems include the following:

- **A Conductor or Pair is Open**

The wiremap problem along with estimated cable distance is displayed. This is typically at a connection, and the open can be easily identified and fixed.

- **A Pair's Polarity is Reversed or Pairs are Swapped**

The problem is displayed but there is no way to tell where the error is, so you must check each connection for proper termination.

- **NEXT Fails**

The **DTX 1800 CableAnalyzer** will run an additional measurement, HDTD<sub>X</sub>. This displays the NEXT as a plot over the distance of the channel. Typically, the largest NEXT contribution shows up at a connection near the failing end and can be fixed with a retermination.

- **Return Loss Fails**

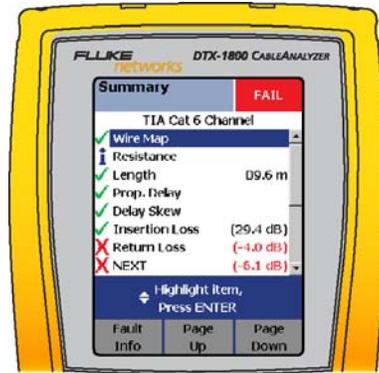
The **DTX 1800 CableAnalyzer** will run an additional measurement, HDTD<sub>R</sub>. This displays the RL as a plot over the distance of the channel. Typically, the largest RL contribution shows up at a connection and can be fixed with a retermination.

- **Attenuation Fails**

Usually one of the other parameters can help identify the location of the problem. This can also fail if the Link or Channel is too long, or if the wrong test standard is selected.

- **ELFEXT Fails**

Usually NEXT and HDTD<sub>X</sub> can help identify the location of the problem.



Failures are easily identified in RED.

The HDTDx and HDTDR Display identifies the largest contribution along the cabling distance. This is typically a termination near the failing end.

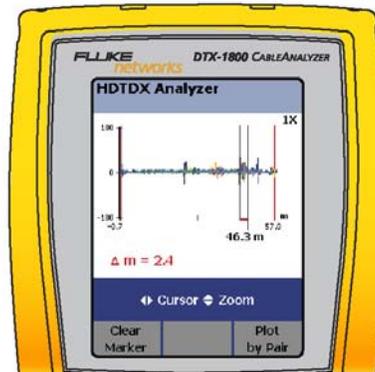


Figure 17. Troubleshooting with the DTX 1800 CableAnalyzer

**Note:** Individual measurements, including HDTDx and HDTDR can be run by turning the Rotary Switch to SINGLE TEST and selecting the measurement for channel measurements.

**Note:** The measurement plots can be saved for further analysis by selecting the following option during setup. This requires more memory and should be unselected unless the analysis is needed.

1. Turn the rotary switch to SETUP.
2. Select Instrument Settings.
3. Select Store Plot Data Standard.