Agilent E2960 PCI Express

Protocol Exerciser and Analyzer for PCI Express Installation Guide

Agilent Technologies

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To ensure adequate cooling and ventilation, a gap of at least 2 inches (50 mm) must be left around all vent holes.

Do NOT operate with empty slots: Fill any empty slots with blanking plates to ensure correct operation of the chassis.

Do NOT stack more than 8 free-standing chassis.

I/O modules may become hot during use. Do NOT touch any of the components on a module as you remove it from the chassis.
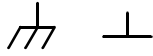
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Indicates the field wiring terminal that must be connected to ground before operating the equipment. Protects against electrical shock in case of fault.

Frame or chassis ground terminal. Typically connects to the equipment's metal frame.

Indicates hazardous voltages and potential for electrical shock.

Indicates that antistatic precautions should be taken.

This symbol indicates hot surfaces, please do not touch.

Indicates laser radiation when turned on.

Safety requirements for electrical equipment for measurement, control, and laboratory use CAN/CSA C22.2 No. 1010.1 (1993) UL 3101, 3111 (First Editions) This equipment has also been evaluated to IEC 61010 edition 1 including amendments 1 and 2.

$C\epsilon$

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ISM 1—A

This is the symbol for an Industrial, Scientific, and Medical Group 1 Class A product.

Contents

Introduction

Welcome to the Agilent E2960 Series Protocol Exerciser and Protocol Analyzer for PCI Express.

The Agilent E2960 Series uses Agilent's Serial Protocol Tester XC as a platform. Installing the Exerciser and the Analyzer thus takes three steps:

- Set up the platform
- Set up the Exerciser and/or the Analyzer
- Connect the test objects

Contents of the manual   This manual is structured according to these steps:

- *"Introduction"* (the present chapter): This chapter provides an overview of the E2960's purpose and its main parts. It also provides an overview of the steps required for installation.

- *"Setting Up the Platform" on page 17*: This chapter explains how the Serial Protocol Tester XC platform is set up. It gives an overview of the platform's components and the way these components interact. It also describes the prerequisites that must be met for the PCs required to control the test equipment.

- *"Bringing Up the System" on page 31*: This chapter deals mainly with the software—first-time installation and configuration, initial operation, and de-installation.

- *"Connecting to the Test Object" on page 49*: This chapter explains how to connect a System Under Test (SUT) or Device Under Test (DUT, usually an add-in board) to the probe supplied with the tester.

Reader assumptions   Readers should have a basic understanding of how to configure a LAN, because the E2960 is operated via 100BaseT Ethernet connections.

Literature   General and detailed information on PCI Express can be obtained from Intel (*http://www.intel.com/technology*) and the PCI-SIG web site (*http://www.pcisig.com*).

Features and technical data of the Agilent PCI Express hardware and software are published in the data sheet "Agilent Technologies E2960 Series Exerciser and Protocol Analyzer for PCI Express", publication number 5988-8679EN.

Updated product information   For updated product information please visit also *http://www.agilent.com/find/E2960_series.*

Intended Use

Background   PCI Express, a protocol introduced to the public in 2002, will change the way computer systems will be built in the near future.

PCI Express operates at 2.5 GBit/s and uses two low voltage differential signals (LVDS) lines for transmitting and receiving data.

Such a four-wire connection, called a PCI Express link x1 (pronounced: by one), is the foundation of PCI Express. Several of these links can be combined to provide higher bandwidth. The specification calls out for PCI Express x1, x2, x4, x8, x16, and x32. A by eight PCI Express link (x8) features a bandwidth of 40 Gbit/s.

The Agilent solution   With the E2960 Series, Agilent Technologies provides a family of Protocol Analyzers and Exercisers for PCI Express designed to support the increased need for analysis and validation.

The E2960 Series provides two types of testers:

• Protocol Exerciser for PCI Express (x1 to x8)

• Protocol Analyzer for PCI Express (x1 to x8)

Both tools are based on the same chassis and Serial I/O Module, combined with unique software packages.

The Protocol Exerciser for PCI Express

The Protocol Exerciser for PCI Express is able to generate and respond to all types of PCI Express transactions. In addition, it allows you to create various PCI Express protocol variations and violations.

Another key feature is the ability to insert errors and test the behavior of designs in response to these errors. Errors can be generated and inserted on the physical, data link, and transaction layers.

The Protocol Exerciser for PCI Express is controlled by a graphical user interface, a C/C++ program, or a Tcl script.

Validating PCI Express systems The Protocol Exerciser can be used to validate a PCI Express system (*Upstream* testing).
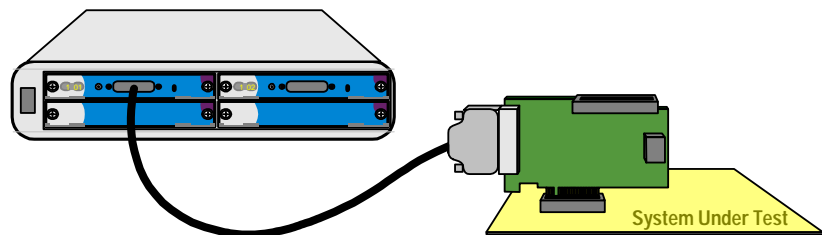

Figure 1   Protocol Exerciser Setup for Testing a System (Upstream)

Bringing up and debugging PCI Express devices The Protocol Exerciser can also be used to bring up and debug a device (*Downstream* testing).
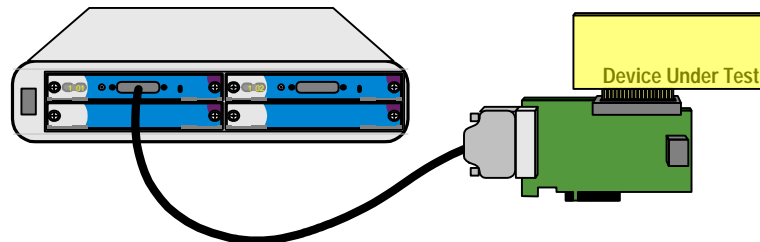

Figure 2   Protocol Exerciser Setup for Testing a Device (Downstream)

The Protocol Exerciser functionality includes testing the physical and data link layer capabilities of a PCI Express device as well as simulating such devices on the transaction layer.

The Protocol Exerciser for PCI Express is also well suited for validating the inter-operability and stability of chipsets and systems.

The Protocol Analyzer for PCI Express

The Protocol Analyzer for PCI Express is used for capturing and analyzing the traffic between two PCI Express endpoints.

Listening to a system and add-in card   You can insert the Protocol Analyzer between a device and a system to capture the traffic.
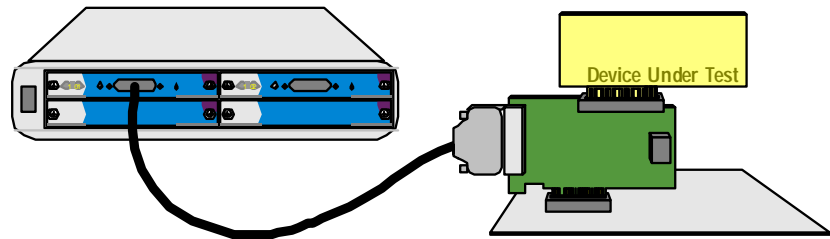

Figure 3   Protocol Analyzer Setup for Testing Communication to an Add-In Card

Listening to two chips on a motherboard   You can connect the Protocol Analyzer to a midbus footprint on the motherboard to listen to the traffic between two chips. See the data sheet for the E2941A Midbus Probe for details.
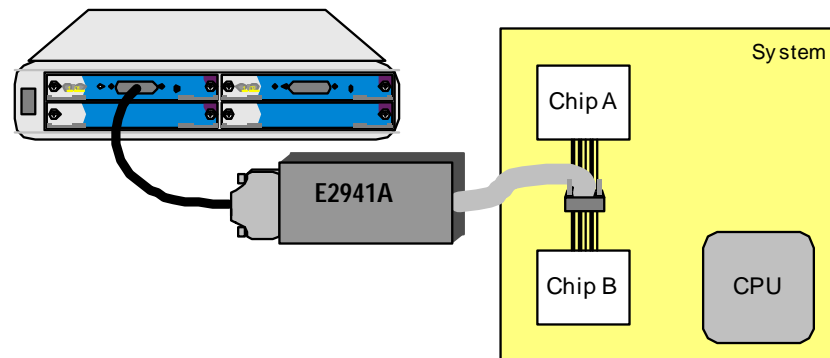

Figure 4   Protocol Analyzer Setup for Testing Communication between two Chips

The Protocol Analyzer captures traffic simultaneously from both directions, including training sequences, packets on the data link layer (DLLPs), and packets on the transaction layer (TLPs). It has 1 GB of trace memory.

The Protocol Analyzer for PCI Express includes a sophisticated trigger sequencer. Its graphical user interface allows you to filter the captured data and to view and investigate the packets in a variety of formats. It can also be controlled by a C/C++ program or a Tcl script.

System Components

The Agilent PCI Express hardware and softwares are built on the Serial Protocol Tester XC platform. This platform includes:

- Two-slot or four-slot chassis
- Serial I/O modules

The Agilent PCI Express hardware and software complement this platform with various application-specific hardware and software:

- Probes
- Cables
- Software packages

The software runs on a controller PC and optionally a remote client PC, which is used to set up, run, and evaluate the tests. These PCs are *not* part of the Agilent PCI Express hardware and software.

The following figure shows an example.
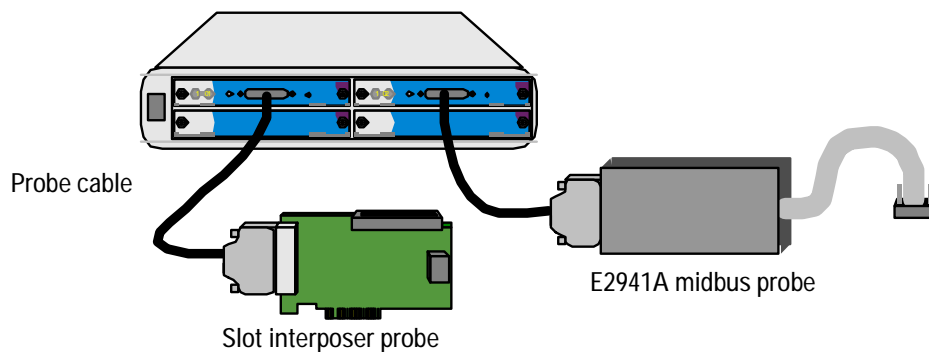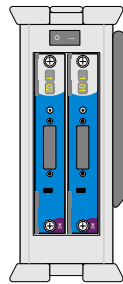
Four-slot chassis with two Serial I/O Modules

Figure 5   Parts of the System

Chassis

Two types of chassis are available:

- The two-slot chassis accommodates up to two Serial I/O Modules. It is preferred as a portable unit. It has a handle that makes it easy to carry it around.

- The four-slot chassis houses up to four Serial I/O Modules. It can be placed on the benchtop or mounted in a rack.

Two-slot chassis

Four-slot chassis
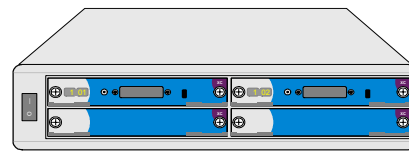
Figure 6   Chassis

Serial I/O Module

The Serial I/O Module is a truly versatile component. It is based on FPGA technology and hence not only field-upgradable but also re-programmable to perform various tasks. Software programs the Serial I/O Module to act as a component of a Protocol Exerciser or Protocol Analyzer.

Every Serial I/O Module has a LAN interface that is connected to an Ethernet hub in the chassis.

At the front side, the module has two screwlocks and two extraction levers. The front connector connects the module through a cable to the probe.

Figure 7   Serial I/O Module (Top View)

The module has also an LED matrix display. At power-up, the four-characters matrix display shows diagnostic messages (see *Display Codes* in FrequentlyAskedQuestions.chm for the interpretation). After that, it displays the module's ID number in the system. The ID number is a combination of chassis number and module number in the chassis. For example, 102 means module 2 in chassis 1.

NOTE   Unused slots in a chassis must be filled with blanking plates to ensure proper airflow inside the chassis.

Probes

Agilent offers three probes for connecting the Serial I/O Module to the system and/or device to be tested:

Active slot interposer probe   The active slot interposer probe is plugged into a PCI Express slot on the motherboard of the system under test (SUT). It provides a slot that can be used for an add-in card as device under test (DUT). It is an active probe that can be used for both Protocol Exerciser and Protocol Analyzer systems.
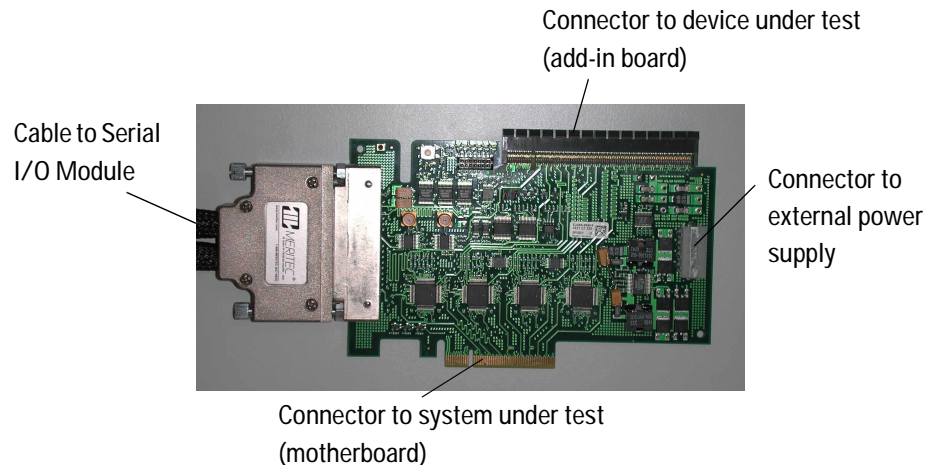

Figure 8   Active Slot Interposer Probe

Different slot interposer probes are available to match different connectors and board layouts for PCI Express x1, x4, or x8 implementations.

A x16 connector on the top of the slot interposer probe makes it possible to plug in an add-in board holding the device under test (DUT). This connector accepts all kinds of add-in boards, from x1 to x16.

When plugged into a motherboard, the slot interposer probe and the add-in board are powered by the motherboard. When the slot interposer probe is not plugged into a motherboard, you have to connect its standard AT-type power connector to a PC power supply.

E2941A midbus probe   The midbus probe is only supported by Protocol Analyzer systems.

The midbus probe is plugged into a dedicated socket between two chips on a motherboard. It is used to monitor the traffic between two chips on the motherboard.

Passive slot interposer probe   The passive slot interposer probe is only supported by Protocol Analyzer systems. It provides true non-intrusive probing for devices that do not tolerate an active load.

The passive probe is designed like the active slot interposer probe. It can be plugged into a motherboard and it can accommodate an add-in board. When it is not plugged into a motherboard, it can be powered by an external supply.
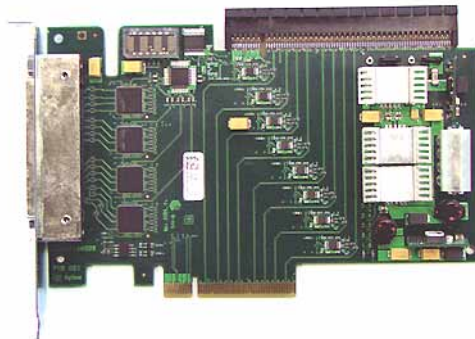

Figure 9   Passive Slot Interposer Probe

Different passive probes are available to match different connectors and board layouts for PCI Express x1, x4, or x8 implementations.

Cables

The following cables are provided with a chassis:

- Power cord
- Straight-through LAN cable with RJ-45 connectors
- Crossover LAN cable with RJ-45 connectors
- Sync cable for daisy-chaining chassis

Additionally, a trigger cable is provided with each Serial I/O Module, and the necessary cabling is provided with each probe.

Software

Different software packages are provided for operating the hardware as a Protocol Exerciser or a Protocol Analyzer for PCI Express. They are called ESP (Exerciser software package) and ASP (Analyzer software package).

The same hardware can be used for testing PCI Express x1, x2, x4, and x8 components, but the software differs:

- A software package for x1 supports tests at x1 bandwidth.

- A software package for x4 supports tests at x1, x2, and x4 bandwidth.

- A software package for PCI Express x8 supports all tests up to x8.

The software has to be installed on one or several PCs. There are two kinds of PC:

- The PC on which the controlling server software is installed and to which the chassis are connected is called the Controller PC. It must be a PC with 100BaseT Ethernet interface.

- You can work at a client and access the Controller PC remotely over the LAN (optional).

Overview of the Installation

To install the Protocol Exerciser or Protocol Analyzer for PCI Express the following steps should be carried out in the given order:

1 Unpack the test equipment and check the shipment for completeness (see *"System Components" on page 11*).

2 Ensure that the installation requirements are met and set up the platform (see *"Setting Up the Platform" on page 17*).

3 Install and configure the software on the designated Controller PC and on the optional client PC (see *"Bringing Up the System" on page 31*).

4 Power up the system and ensure all chassis and modules are operational (see *"How to Power Up the System" on page 46*).

5 Finally connect the tester to your test objects (see *"Connecting to the Test Object" on page 49*).

Setting Up the Platform

This chapter provides information you need to understand the operation principles and to set up the Serial Protocol Tester XC platform. In order to do so, it provides three sections:

- *"Control Flow" on page 18* explains the basic operation of the Serial Protocol Tester XC platform. It gives an overview of the components involved, specifies the software used, and describes how the individual components interact with each other to control the test.

- *"Possible Setups" on page 22* shows you four different setups that can be used to connect the components and integrate them into your corporate LAN.

- *"Setting Up the Test Equipment" on page 24* describes the prerequisites to be met and explains how to set up the hardware for the platform.

NOTE
Refer to *"Bringing Up the System" on page 31* to see how to set up the software for the Agilent Protocol Exerciser and Protocol Analyzer for PCI Express.

Control Flow

To understand the basic operation of the Serial Protocol Tester XC platform, you need to know how the individual components interact with each other to control the test. This will also help you to set up the components as required.

Basically, there are three components involved in controlling the test. Each component fulfills different tasks. To communicate with each other, these are connected via LAN.
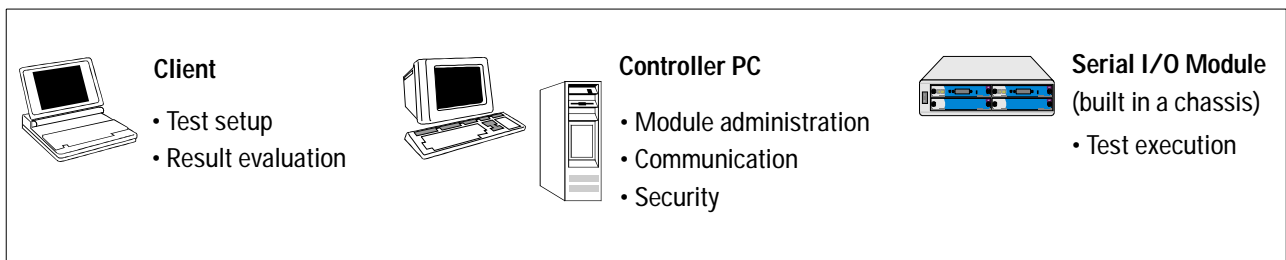
Client

- Test setup
- Result evaluation

Controller PC

- Module administration
- Communication
- Security

Serial I/O Module
(built in a chassis)

- Test execution

Figure 10   Overview of Components and their Tasks

Client
: The client is the PC you work at. With the user interfaces provided by the tester software, you can start a session or connect to an existing one. When you have connected to a session, you can set up and run the test.

The client may be a remote PC (for example, a laptop), but it can also be an integral part of the Controller PC.

Controller PC
: The Controller PC administers all Serial I/O Modules connected to it and stores the firmware required to execute the tests.

It also administers the communication between the clients and the Serial I/O Modules and manages the security settings for the test environment.

In a larger test environment, there may be one or several Controller PCs, controlling different Serial I/O Modules. Several remote PCs may be connected as clients. A client connects to a module through the Controller PC serving this module.

Serial I/O Module
: Each Serial I/O Module executes one "personality" (either exerciser or analyzer) at a time. The personality is defined by the FPGA configuration and firmware loaded to the Serial I/O Module.

Software Used

To fulfill their specific tasks, each component uses a certain set of software for operation. Some of this software comes with the Agilent tester software, some is part of the Windows operating system.
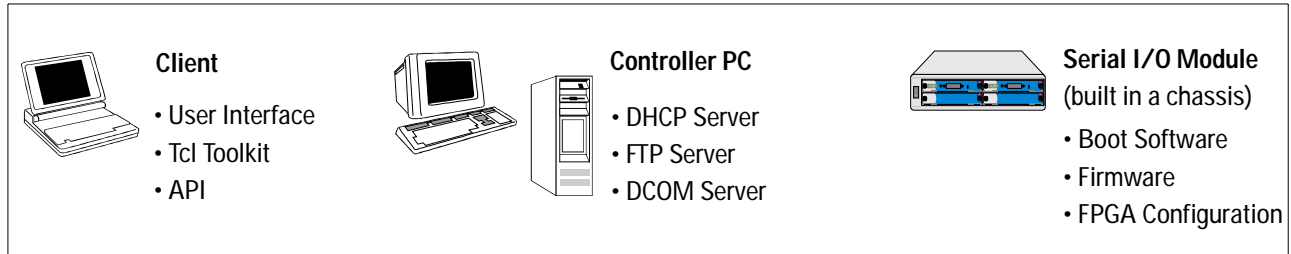

Figure 11 Overview of components and software used

On the *Controller PC*, the following software packages must be installed:

- FTP server

- *Controller* software

- *Client* software

- DCOM server

See *"Installing the Tester Software" on page 36* for details.

On the *client*, only the *Client* software must be installed (see *"How to Install the Tester Software" on page 36* for details). This includes the user interfaces and the programming interfaces.

Client software   The Client software provides several interfaces to set up, start and stop the tests and to evaluate the test results.

- The Agilent tester software provides a GUI for controlling the test. The GUI uses DCOM to communicate with the Controller PC.

- The Tcl Toolkit (Tcl/Tk) Version 8.3 is installed on the Controller PC with the Agilent tester software. This allows communicating with the controller by means of Transaction Control Language commands (which also use DCOM).

- The Agilent tester software provides an API providing commands to control tests from user-written software. These commands also use DCOM to communicate with the Controller PC.

NOTE   To access the Controller PC remotely, access rights have to be granted in the DCOM configuration on the Controller PC.

Controller software	The software to control the modules includes the following packages:

- The DHCP server (Dynamic Host Configuration Protocol) running on the Controller PC assigns a unique IP address to each connected I/O module.

  The DHCP server is installed with the Agilent tester software. For detailed information on how to configure DHCP to assign the IP addresses as required, see *"How to Configure DHCP" on page 38*.

NOTE	The DHCP server installed with the Agilent tester software uses special ports, which are different from the standard port used for DHCP. Thus, this DHCP server will not interfere with another DHCP server running within your corporate LAN. The following ports are used:

  – Port 7901 for requests sent from a Serial I/O Module

  – Port 7902 for answers sent from the Controller PC

- The FTP server is used to transfer data to the Serial I/O Modules. The FTP server is included in the Internet Information Services (IIS), which are part of Windows 2000. The Serial I/O Modules use an anonymous login to download data from the Controller PC. For detailed information on how to install and enable the IIS FTP server, see *"How to Install and Enable FTP" on page 31*.

- The Client software communicates with the Controller PC through DCOM (Distributed Component Object Model). A DCOM server is part of Windows 2000.

  The Agilent tester software installs some services to DCOM. For detailed information on how to set up the DCOM server to allow the clients access to these services, see *"How to Configure the DCOM Server" on page 33*.

Serial I/O Module	The Serial I/O Module is based on FPGA technology. Several pieces of software are used on the modules:

- The boot software includes a module to send out a broadcast message to notify the module to the controller(s) and to request an IP address.

- The FPGA configuration and the firmware are loaded to the Serial I/O Module for each session separately. They define the tasks to be performed by the module.

  All files needed for operation of the Serial I/O Modules are stored on the controller PC. Therefore, no explicit update of the firmware on the Serial I/O Module is necessary. The files are updated with new versions of the Framework software.

Course of events

The following communication events take place during operation of the Serial Protocol Tester XC test environment:

1. On power on, the Serial I/O Module identifies itself to the system and requests an IP address. For this broadcast message it uses port 7901.

2. The DHCP server running on the Controller PC automatically assigns an IP address to the Serial I/O Module as specified in its configuration file. For this answer it uses port 7902.

   This IP address is used for all further communication.

3. The Serial I/O Module downloads lower-level firmware from the Controller PC via FTP (anonymous login).

4. When a session is started, the client communicates with the Controller PC through DCOM. The application to be run (analyzer or exerciser) is defined.

5. The Controller PC informs the module about the request.

6. The module downloads the required FPGA configuration and the firmware from the Controller PC via FTP (anonymous login). These actually personalize the Serial I/O Module to perform the required Exerciser or Analyzer functionality.

7. The FPGA is configured and the firmware is executed on the Serial I/O Module.

8. During the session, data is transferred between client and Serial I/O Module through the Controller PC.

Possible Setups

To work with the Protocol Exerciser and Analyzer, different setups are possible:

- Mobile Instrument
- Private LAN

These setups are described in the following sections.

Mobile Instrument

You can run the *Controller* and the *Client* software on the same laptop and connect the chassis directly to the laptop to set up a mobile instrument.
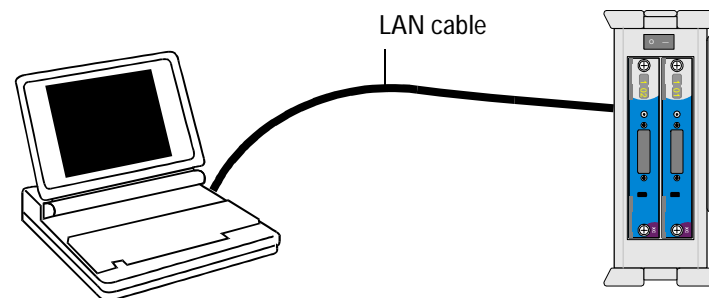

Figure 12   Mobile instrument

Prerequisites   The laptop is connected to the chassis via LAN.

Advantage   You can transport the mobile instrument and set up a test environment easily at different places. You can use this setup for demos.

Disadvantage   You can operate the Serial I/O Modules from the laptop only. You do not have access to the I/O modules via any other PC, because the laptop cannot be connected to the corporate LAN at the same time.

Private LAN

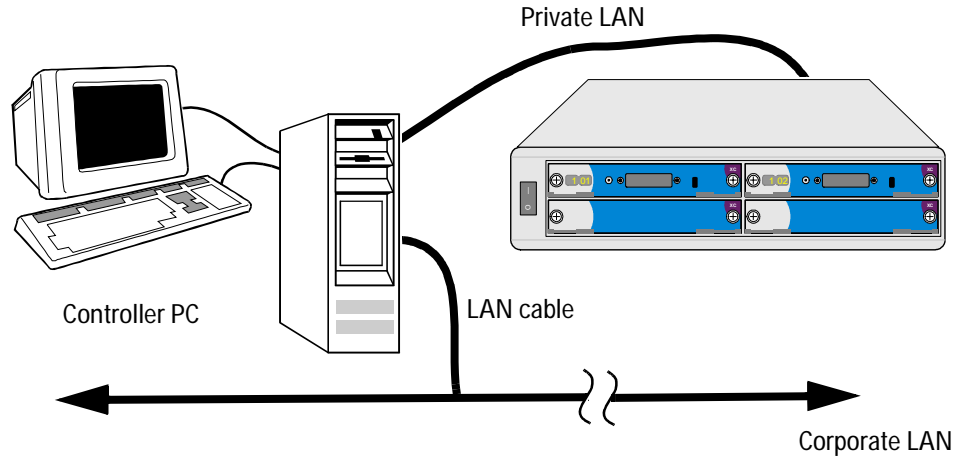You can set up a test environment with two different LAN connections.

Figure 13   Private LAN

The controller software runs on the Controller PC. The client software can run on the Controller PC and any number of other PCs within the LAN. The Serial I/O Modules are not integrated into the corporate LAN. They are connected only to the Controller PC via a private LAN.

Prerequisites   To connect the Controller PC to a private LAN as well as to the corporate LAN, the Controller PC must have two LAN interfaces.

Advantage   In this setup, you have access to the controller PC from anywhere within the corporate LAN. You would use this setup for a standard test system.

NOTE   You can connect any number of clients to the Controller PC through your corporate LAN. In this case, DCOM access to the Controller PC must be granted to all users at the clients.

Setting Up the Test Equipment

This section explains:

- *"Hardware Prerequisites" on page 24*

- *"How to Install Serial I/O Modules" on page 25*

- *"How to Connect a Chassis to the Controller PC" on page 27*

- *"How to Set Up and Interconnect Multiple Chassis" on page 27*

Hardware Prerequisites

You must provide a Controller PC and a client that fulfill certain requirements to install the software and to operate the platform.

You may also wish to connect several chassis to that PC or mount four-slot chassis in a rack.

Controller PC Requirements   The Controller PC requires at least:

- The following operating system:
  - Windows 2000, Service Pack 3
  - Windows XP, Service Pack 2
- 256 MB RAM (512 MB or more recommended)
- Two 100BaseT LAN interfaces
- 500 MB free disk space on drive C

Client PC Requirements   The client requires at least:

- The following operating system:
  - Windows 2000, Service Pack 3
  - Windows XP, Service Pack 2
- 256 MB RAM (512 MB or more recommended)
- 100BaseT LAN interface
- 500 MB free disk space on drive C
- Microsoft .NET Framework 1.1

  The .NET Framework is included with the software.

NOTE   These requirements are subject to change. For updated information refer to the "Agilent Technologies E2960 Series Exerciser and Protocol Analyzer for PCI Express" data sheet and visit also *http://www.agilent.com/find/E2960_series*.

Installation in a Rack   The two-slot chassis are meant for benchtop use. The four-slot chassis can be stacked on the benchtop or mounted in a rack.

For rack-mounting, you need a standard EIA 19-inch rack. One or multiple four-slot chassis can be attached to the two front posts.

Suitable attachment devices are provided with every four-slot chassis: Brackets, screws, and clip-on hexnuts.

How to Install Serial I/O Modules

The Serial Protocol Tester XC is a hot-plug architecture. You do not have to power down the chassis when you are removing or adding Serial I/O Modules or blanking plates.

NOTE   If the chassis is powered on and you wish to remove a Serial I/O Module, always make sure that the module is not in use by a test session. When the module is ready for use, it displays its number and a 'trail' of pixels snakes round the perimeter of the display. When locked by a session, the display is constant, showing only the number.

How to Remove an I/O Module or a Blanking Plate

CAUTION   The components on the I/O modules are sensitive to static electricity. To minimize the possibility of electrostatic damage, please take the necessary anti-static precautions (for example, wear a grounded wrist strap).

To remove a blanking plate or Serial I/O Module:
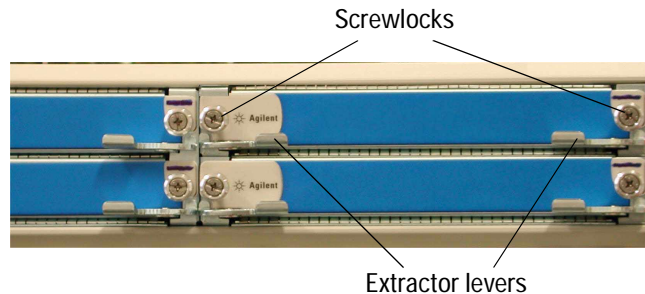
1 Unscrew the screwlocks.

Screwlocks

Extractor levels

Figure 14   Removing a Module

2 Pull the extractor levers outwards and pull them gently towards you.

3 Pull out the module, holding it only by the front panel and metal case.

WARNING

Be careful not to touch any of the components on the module. The components may be hot.

4 Place the module on a hard, flat surface. Never stack one module on top of another.

How to Insert a Blanking Plate or I/O Module

To insert a blanking plate or Serial I/O Module:

1 Line up the blanking plate or module with the slot.
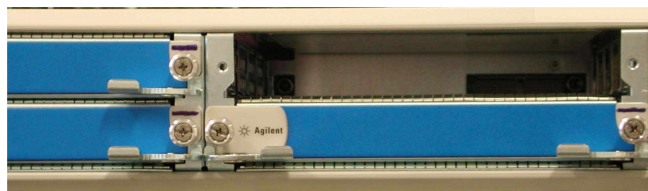
Figure 15   Empty Slot

2 Close the extractor levers and push the module firmly into place.

3 Tighten the screwlocks until finger tight.

CAUTION

Never operate a chassis with an empty slot. Fill any empty slots with blanking plates to ensure proper airflow inside the chassis and cooling of the modules.

How to Connect a Chassis to the Controller PC

The two-slot chassis and the four-slot chassis have the same connector assembly at the rear:
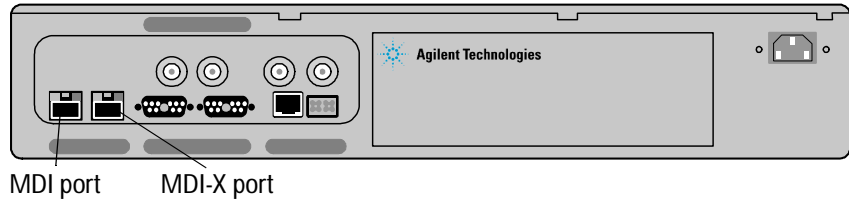

MDI port   MDI-X port

Figure 16   Chassis Connectors

For connecting the chassis to the Controller PC, you always use a LAN connection to establish a direct connection between the chassis and the Controller PC. Use the MDI-X port and the straight-through LAN cable.

Use the supplied power cord to connect the chassis to mains power.

WARNING

Always use the power cord supplied with the chassis.

Do not block the access to a power cord or switch, in case you need to disconnect power in an emergency.

How to Set Up and Interconnect Multiple Chassis

If your test requires multiple chassis, you must connect them with the following cables:

- Sync cables

- LAN cables

Follow the instructions in the following sections.

How to Set Up Multiple Chassis

NOTE   A single chassis is portable. Before setting up or rack-mounting multiple chassis, consider the distances. The distance between the chassis position and the systems or devices under test is limited by the probe cables. This cable, which connects an I/O module to the associated probe, has a length of 1.5 m.

The simplest way to set up multiple chassis is to stack them on the benchtop.

The accessories of a four-slot chassis include four rubber feet. These feet should be inserted at the bottom before stacking the chassis. A two-slot chassis can be put on the top of the pile. It can be operated in vertical and horizontal position.

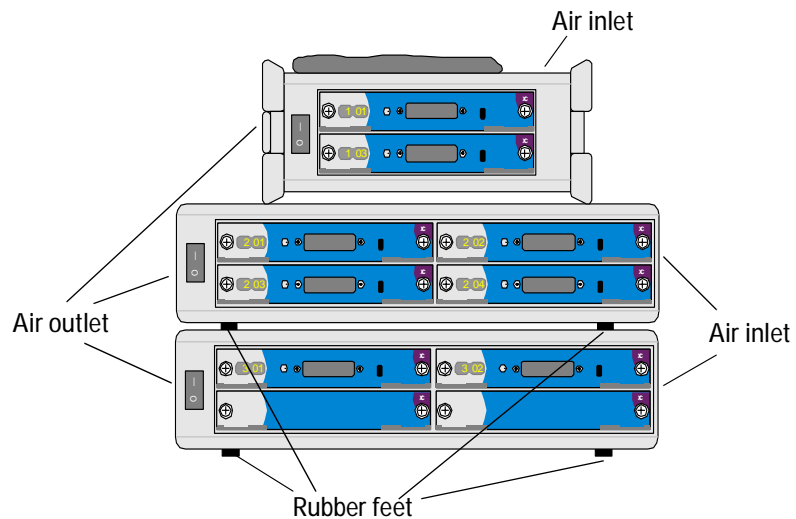A setup like this is illustrated in the following figure:

Figure 17   Pile of Chassis

NOTE   The four-slot chassis can also be mounted in a standard 19-inch rack. Their accessories include two mounting brackets, screws, and clip-on hexnuts to attach them to the front posts. Rear posts are not used.

CAUTION   The chassis have ventilation holes. When you set up or mount chassis, ensure that these holes are not blocked. A minimum gap of 50 mm (2 inches) must be left free around all ventilation holes to protect the devices from overheating.

How to Interconnect Chassis

To interconnect multiple chassis:

1 Select the chassis you want to use as the master chassis.

2 Use the sync cable provided to connect the chassis.

   The sync cable carries clock and event lines. It is used to synchronize the timing across all chassis and modules. The first

chassis in the chain becomes chassis #1, the second becomes chassis #2, and so on.

The cable and the sync ports are color-coded. Connect the sync OUT (pink) of the master chassis to the sync IN (green) of the slave.
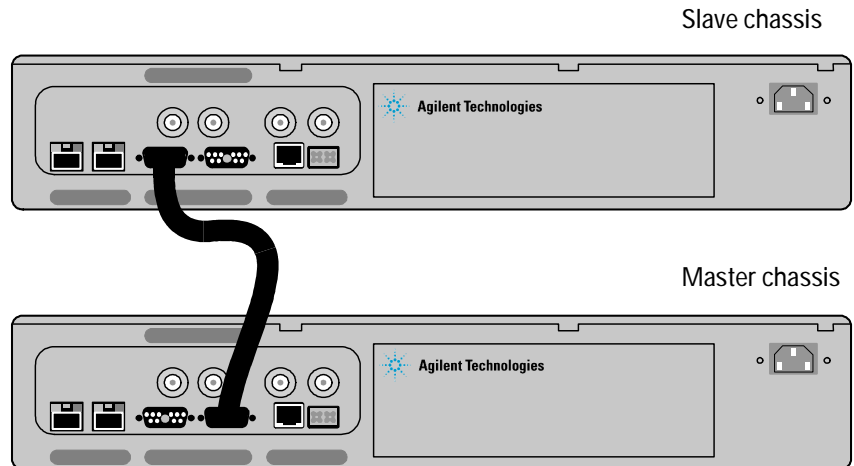
Slave chassis

Master chassis

Figure 18   Chassis-to-Chassis Connection

In this example, the lower chassis is the master.

You may wish to have the first chassis on the top of the pile. If this is desired, reverse the connection.

NOTE   If you have a two-slot chassis, this must always be the first chassis in the chain.

3 Connect the LAN ports of the chassis using the delivered straight-through LAN cables to daisy-chain them starting from the MDI port of the master chassis to the MDI-X port of the next chassis.

4 Connect the chassis to mains power.

WARNING   Use the supplied power cords.

Do not block the access to a power cord or switch, in case you need to disconnect power in an emergency.

How to Connect Modules for Triggering

The Serial I/O Modules have a **Sync** port on the front panel:
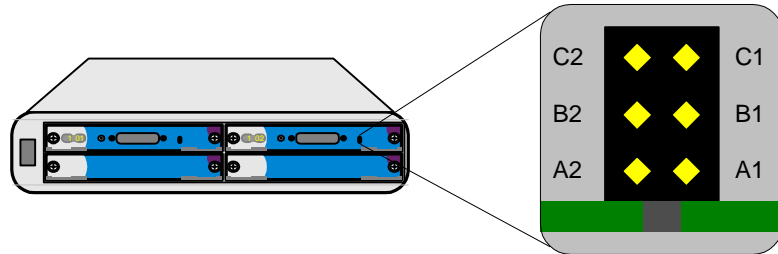
Figure 19   Sync Port on Serial I/O Modules

The pins on this port are as follows:

Pin Name	Function	Level	Comment
A1, A2	Ground		
B1	External Trigger Out	LVCMOS level, active high (low: 0V, high: 2.5 V)	Signal is active for 3 clock cycles (24 ns)
B2	External Trigger In	LVCMOS level, active high (low: 0V, high: 2.5 V) trigger on rising edge after synchronization)	Signal must be active for 3 clock cycles (24 ns)
C1, C2	Not connected		

The **Sync** port allows the Serial I/O Module to trigger another Serial I/O Module or external device (such as a logic analyzer) or to be triggered from another Serial I/O Module or external device. This allows point-to-point connections between two exercisers, an exerciser and an analyzer, or with an external device.

The **Sync** port allows connecting Serial I/O Modules with the delivered cable and other PCI Express devices with a standard header.

The following scenarios are possible:

Scenario	Use
Exerciser <-> Exerciser	For synchronized operation of block memories
Exerciser -> Analyzer	For triggering an Analyzer (e.g. on data compare or protocol violation)
Analyzer <-> Analyzer	For cross-triggering across busses

The trigger behavior can be defined in the user interface.

Bringing Up the System

This chapter explains how to put the Agilent PCI Express hardware and software into operation after the Agilent's Serial Protocol Tester XC platform has been set up. For details see:

- *"How to Install and Enable FTP" on page 31*
- *"How to Configure the Firewall" on page 32*
- *"How to Configure the DCOM Server" on page 33*
- *"Installing the Tester Software" on page 36*
- *"How to Configure DHCP" on page 38*
- *"How to Power Up the System" on page 46*
- *"How to Power Down the System" on page 47*

NOTE   When you put the tester software into operation, it is necessary to shut down and restart the PC several times. If you perform all steps in the described order, it is sufficient to shut down and restart after installing the tester software and after configuring DCOM.

How to Install and Enable FTP

NOTE   FTP only has to be installed on the controller PC.

The File Transfer Protocol (FTP), a component of the operating system's Internet Information Services (IIS), is required to download firmware to the test modules.

NOTE   FTP might already be installed on your PC. In this case, you simply enable it by activating the *ftp Publishing Service* in the Microsoft Management Console.

If FTP is not installed on your PC, proceed as follows:

1 Choose *Start*, *Settings*, *Control Panel* and double-click the *Add/Remove Programs* icon.

2 Select the *Add/Remove Windows Components* button, on the left hand side, to open the *Windows Components Wizard* dialog box.

3 Select *Internet Information Services* (IIS) from the list. Click the *Details* button.

4 In the IIS dialog box, select *File Transfer Protocol (FTP) Server* and click *OK*.

The *Common Files* and *IIS Snap-In* components will be auto-selected.

5 Click the *Next* button to complete the installation.

NOTE   If a component required by IIS is not installed on your PC, the Installation Wizard prompts you to install it from the Windows CD.

NOTE   The files controlled by the FTP Server are stored in the subdirectories of: `C:\Inetpub\ftproot`

How to Configure the Firewall

NOTE   The firewall only has to be configured on the Controller PC.

If the Controller PC has an active firewall (which is the default with Windows XP, SP 2), the firewall has to be configured so that the DHCP server on the controller PC can assign IP addresses to the Serial I/O Modules when they boot.

If a firewall is active and has *not* been configured to allow the DHCP server access to the LAN, the Serial I/O Modules will not boot.

The following describes how the Windows XP firewall is configured. For other firewalls, see the user documentation provided with the firewall to see how to add programs to the firewall.

To configure the Windows XP firewall to work with the PCI Express software:

1 Choose *Start*, *Settings*, *Control Panel* and double-click the *Firewall* icon.

2 Open the *Selections* tab.

3 Add the following programs:

– `<InstallDirectory>\bin\resourcemanager.exe`

– `<InstallDirectory>\bin\sessionexec.exe`

– `C:\dhcpdnt\dhcpdnt.exe`

`<InstallDirectory>` is the installation location of the PCI Express software on the machine. By default, this is:

`C:\Program Files\Agilent\E2960 Series for PCI Express\`

How to Configure the DCOM Server

NOTE   The DCOM server only has to be configured on the controller PC.

The Client software communicates with the Controller PC via DCOM.

To use DCOM for remote access, you must assign rights to users on each Controller PC:

1 From the Windows taskbar, click *Start > Run*.

2 Type in "dcomcnfg".
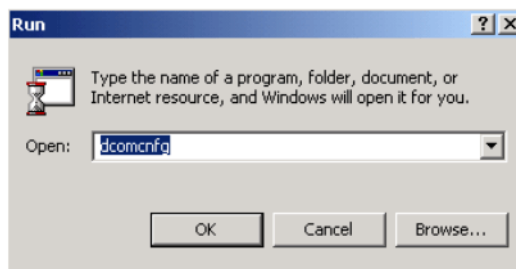
Figure 20   Opening the DCOM Configuration Properties

3 Click *OK*.

The *Distributed COM Configuration Properties* dialog box opens.
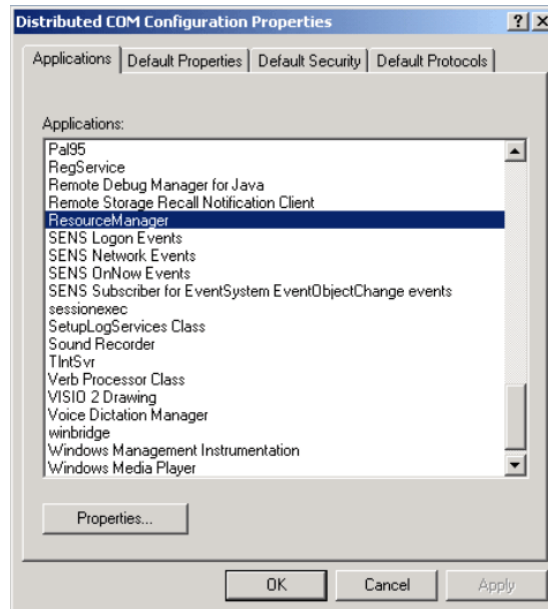
Figure 21   DCOM Configuration Properties dialog box

4 Select the *Applications* tab.

5 From the list of applications, select the *Resource Manager* and click the *Properties* button.

The *Resource Manager Properties* dialog box opens.
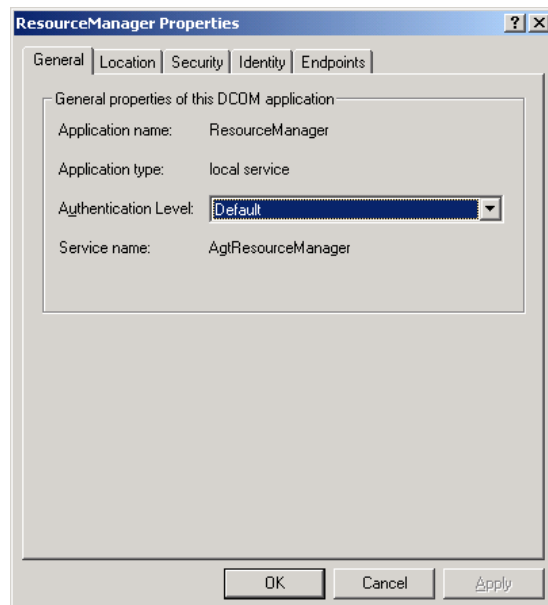
Figure 22   ResourceManager Properties dialog box

6 Select the *Security* tab.
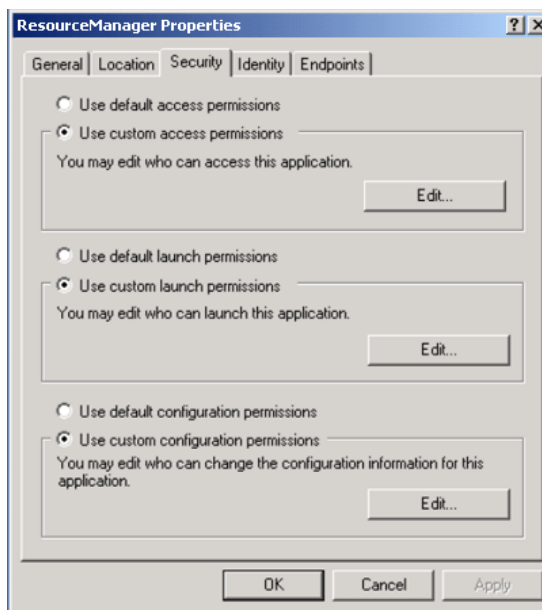
Figure 23   ResourceManager Properties dialog box, Security tab

7 Enable *Use custom access permissions* and click the *Edit* button. The *Registry Value Permissions* dialog box opens.

8 Click the *Add* button.

The *Add Users and Groups* dialog box opens.

9 Click the *Search* button.

10 In the *Find Account* dialog box, enter the name of the user you want to grant access to, and click the *Search* button.

11 Select the user and click the *Add* button.

This user now appears in the *Add Names* list in the *Add Users and Groups* dialog box.

12 As type of access, select *Allow Access*.

13 Click *OK* to confirm your settings.

14 In the *Registry Value Permissions* dialog box, click *OK* to return to the *ResourceManager Properties* dialog box.

15 Repeat steps 7 to 14 for the *Use custom launch permissions* and the *Use custom configuration permissions*.

16 After completing the configuration for the *ResourceManager* application, repeat these steps for the *sessionexec* application.

Start in *Distributed COM Configuration Properties* dialog box, select *sessionexec* from the list of applications, and click the *Properties* button.

17 Finally, shut down and restart the system.

Installing the Tester Software

The client and controller software is provided as three packages on a single CD-ROM:

- Framework

  The Framework is only installed on the controller PC.

- Protocol Exerciser

- Protocol Analyzer

  The Protocol Exerciser and Protocol Analyzer packages have to be installed on all PCs that will act as clients. This also includes the controller PC if it will be used to run (or set up) tests.

When you install the Protocol Exerciser or Protocol Analyzer packages, the Microsoft .NET Framework will also be installed (if it is not yet installed).

Prerequisites   See also *"Hardware Prerequisites" on page 24* for the minimum requirements on the controller PC and clients.

How to Install the Tester Software

NOTE   You can only install the tester software on the controller PC if the FTP server has already been installed. If you have not yet installed the FTP server, do this now (see *"How to Install and Enable FTP" on page 31*).

To install the tester software:

1 Insert the CD-ROM.

2 If the InstallShield wizard does not appear automatically after a few seconds, access the CD drive with the Windows Explorer and double-click `Setup.exe`.

3 Follow the instructions on the screen.

The default installation directory is
`C:\Program Files\Agilent\E2960 Series for PCI Express`
You can also choose a different directory.

Installation on the Controller PC For the Controller PC, select the *Controller PC Installation* setup.

Installation on a client PC A client PC may access the Controller PC through the company or lab LAN and thus operate the PCI Express Protocol Exerciser or Protocol Analyzer hardware. For such a PC, select the *Client Installation* setup.

Reboot After installing the software, you must reboot the computer. This is necessary to activate the services included in the package.

How to Uninstall the Software

If you wish to uninstall the tester software:

1 From the Windows *Settings* menu, select *Control Panel*.

2 Double-click the *Add/Remove Programs* icon.

3 Select the software you wish to remove.

4 Click *Remove* or *Add/Remove* (depends on the version of Windows).

How to Update/Upgrade the Software

When you receive a Protocol Exerciser and/or Protocol Analyzer for PCI Express, the Exerciser Software Package (ESP) and Analyzer Software Package (ASP), respectively, are preconfigured according to your order.

The software comes with a certificate that provides a license key and states the serial number of the Serial I/O Module concerned.

NOTE Keep this certificate at a secure place in case you need to update the software.

If you wish to upgrade your software, for example, from x1 to x4, you must enter the new license key coming with the software.

1 In the *File* menu of the Exerciser or Analyzer software, select
Software Package Management.
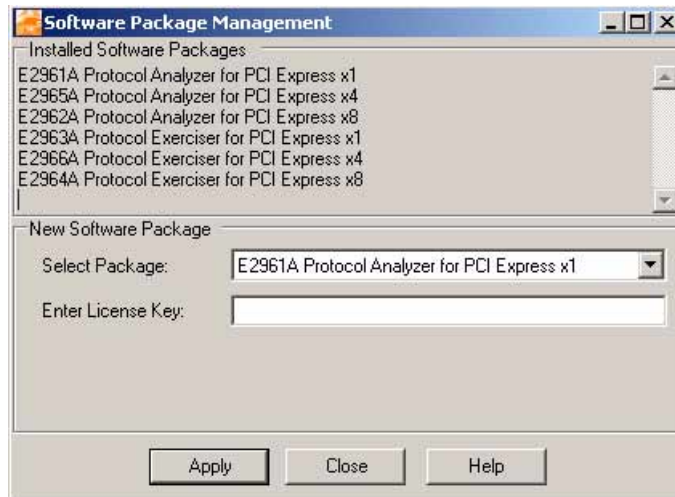
Figure 24   Software Package Management Window

2 Enter the new license key.

3 Save the certificate for possible updates.

How to Configure DHCP

NOTE   DHCP only has to be configured on the controller PC.

The necessary DHCP configuration files are installed with the
Framework. Under most circumstances, the default settings should be
OK for your network environment.

The following sections provide the information you need if changes to
the DHCP configuration are necessary for your environment:

• *"What is DHCP?" on page 39*

  Provides a description of DHCP and the default Agilent settings.

• *"Configuring the LAN Card" on page 40*

  Tells you how to configure the LAN card used for the private
  network.

- *"Changing the DHCP Configuration" on page 42*

   Informs you where you can change the DHCP settings.

- *"Disabling DHCP" on page 44*

   Provides the information necessary if DHCP must be disabled.

What is DHCP?

In a network, each machine requires a unique IP address, just as each telephone requires a unique number. The Dynamic Host Configuration Protocol (DHCP) is a communications protocol that allows the central and automatic management of IP addresses in an organization's network.

To obtain IP addresses without announcement and approval, three classes of networks are reserved for private (non-routed) use only. These are:

Class	IP range	Description
Class A	10.0.0.0 – 10.255.255.255	1 net with 16777214 members
Class B	172.16.0.0 – 172.31.255.255	16 nets with 65534 members each
Class C	192.168.0.0 – 192.128.255.255	256 nets with 254 members each

To prevent possible network conflicts, the Serial I/O Modules should be part of a private network. Due to the space requirements, Agilent uses a Class C network.

Default DHCP settings   The default Agilent configuration is as follows:

- Subnet: 192.168.100.0

- Netmask: 255.255.255.0

- DHCP server IP: 192.168.100.1

- IP range: 192.168.100.200 – 192.168.100.254

NOTE   The DHCP server installed with the Agilent tester software uses special ports, which are different from the standard port used for DHCP. Thus, this DHCP will not interfere with another DHCP server running within your corporate LAN.

The following ports are used:

- Port 7901 for requests sent from a Serial I/O Module to the Controller PC

- Port 7902 for answers sent from the Controller PC

Configuring the LAN Card

The LAN card on the controller PC to be used in the private LAN has to be configured in the Network Settings. Specifically, it is necessary to set a specific IP address and the subnet and gateway.

The default Agilent settings are:

- IP address: 192.168.100.1

- Subnet: 255.255.255.0

- Gateway: 192.168.100.1 (this machine)

NOTE   If you cannot use the Agilent default configuration, change these settings as well as the DHCP settings in consultation with the network administrator.

To configure the LAN card:

1 Open the *Control Panel* (click *Start*, *Control Panel*).

2 In the *Control Panel*, click *Network and Dial-Up Connections*.

The *Network and Dail-Up Connections* window opens and shows all possible LAN connections for the machine.
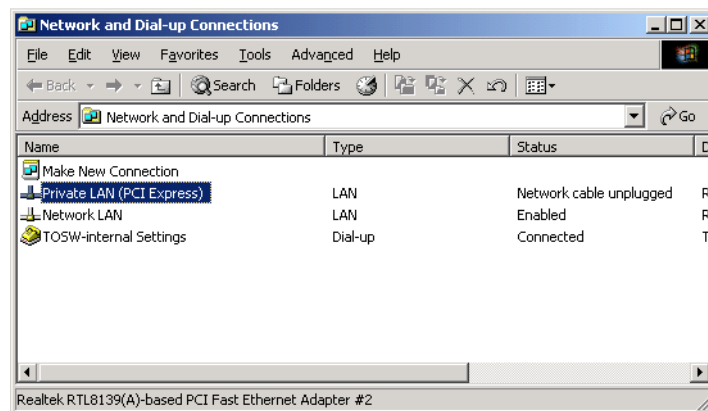
Figure 25   Network and Dial-up Connections Dialog Box

3 Right-click the LAN connection that represents the LAN card for the private network and select *Properties* from the pop-up menu.

The Properties dialog box for the LAN connection opens.
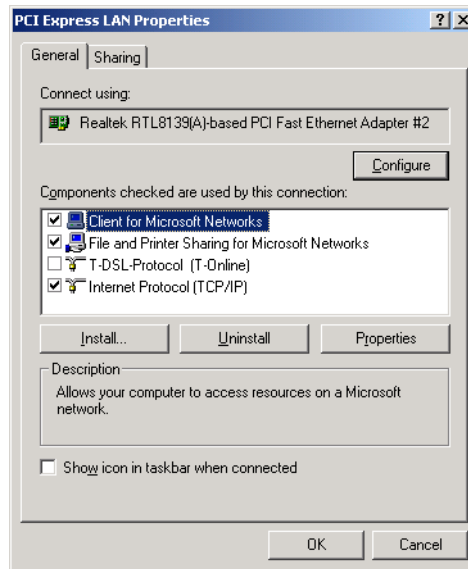
Figure 26   LAN Properties Dialog Box

4 In the *LAN Properties* dialog box, select *Internet Protocol* and click *Properties*.

The *Properties* dialog box for the Internet Protocol opens.
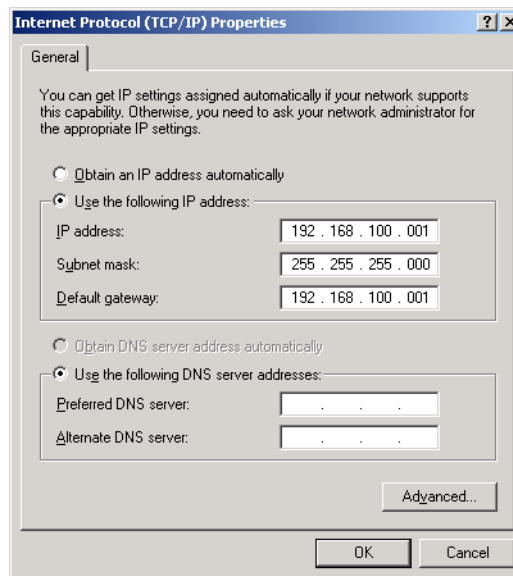
Figure 27   Internet Protocol Properties Dialog Box

5 Select *Use following IP address*, and enter the required values (Agilent defaults shown above).

Changing the DHCP Configuration

If the default DHCP configuration cannot be used (for example, because the subnet is already in use), you can change the configuration.

The DHCP configuration is defined in the DHCP configuration file (`C:\dhcpdnt\dhcp.conf`) and in the DHCP registry file (`C:\dhcpdnt\dhcpd.reg`). These files can be edited with any ASCII text editor (for example, Notepad).

DHCP configuration file   The DHCP configuration file has three entries for configuring the private network:

- `subnet`

- `netmask`

- `range dynamic-bootp`

    This is the range of IP addresses assigned to the Serial I/O Modules.

Figure 28   Default DHCP Configuration File

Modify these entries as required for your network. Once you are finished, first restart the DHCP service and then the Serial I/O Modules.

Restarting the DHCP service   To restart the DHCP service:

1 Open the *Control Panel* (*Start -> Control Panel*).

2 Double-click the *Administrative Tools*.

3 Double-click *Services*.

4 In the Services window, right-click *dhcpdnt* and select *Restart* from the pop-up menu.

When the Serial I/O Modules now boot, they are assigned IP addresses according to the new settings.

After that, if you have changed the subnet, you have to edit the DHCP registry file.

DHCP registry file   The DHCP registry file is used to set the IP address of the DHCP server.

To change the DHCP registry:

1 Open the DHCP registry file with the Notepad.
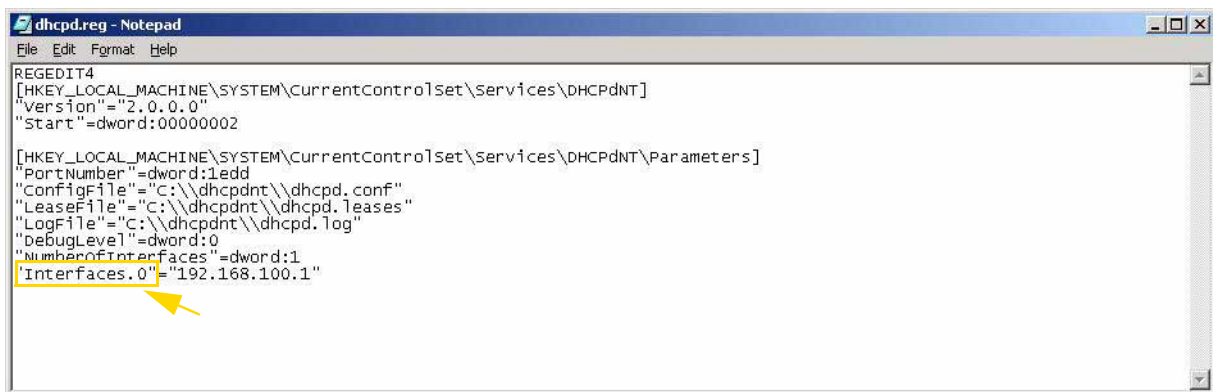
Figure 29   DHCP Registry File

2 Enter the IP address of the LAN card that is connected to the Serial I/O Modules under `"Interfaces.0"`. This is the address used as the DHCP server. This address must be within the subnet.

3 Save the DHCP registry file.

4 In the Windows Explorer, double-click the DHCP registry file.
   This updates your system registry.

Disabling DHCP

If DHCP is not desired in your environment, it is necessary to disable it and use the MAC addresses of the Serial I/O Modules to assign them their IP addresses.

To disable DHCP:

1 Open the DHCP configuration file with Notepad.

The DHCP configuration file is located under `C:\dhcpdnt\dhcp.conf`.

2 In the DHCP configuration file, comment out (#) the automatic configuration lines:

```
# boot-unknown-clients
# range dynamic-bootp
```

The `subnet` / `netmask` line must remain uncommented.

3 Uncomment the MAC-configuration lines for each Serial I/O Module (if necessary, use copy and paste to create the necessary number of configurations).

```
host hostname {
    hardware ethernet LAN address;
    fixed-address IP address;
}
```

Note that each definition is closed with a semicolon (`;`).

4 Determine the MAC addresses of your Serial I/O Modules. You can find the addresses on labels on each Serial I/O Module.
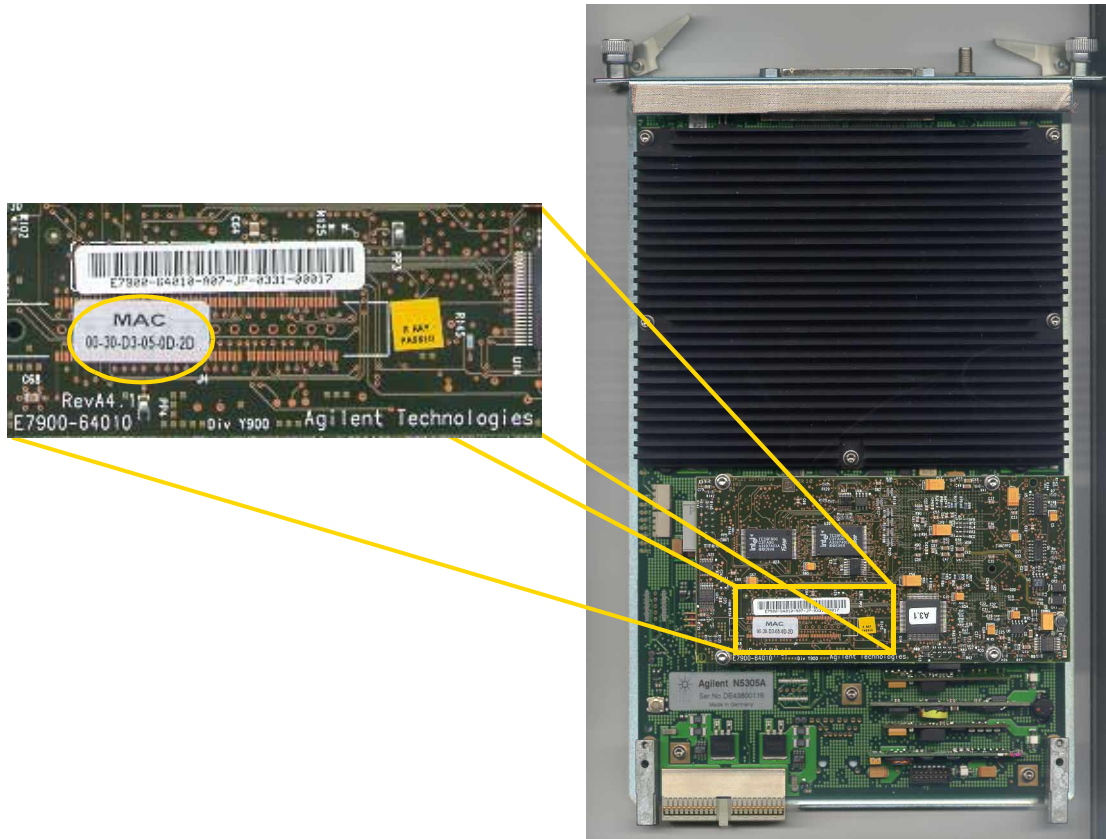
Figure 30   Serial I/O Module With Label Showing the MAC Address

5 Enter a name (not evaluated — no special characters allowed), the MAC address and the IP address of the Serial I/O Module in the DHCP configuration file.

Note that the IP addresses of the Serial I/O Modules must be within the defined subnet.

6 Save the DHCP configuration file.

Restart the DHCP service (see *"Restarting the DHCP service" on page 43*) and reboot the Serial I/O Modules. The Serial I/O Modules will be assigned IP addresses according to the new settings.

How to Power Up the System

The Resource Manager on the Controller PC detects new devices automatically. The DHCP server on the Controller PC automatically assigns an IP address to each module.

Power up procedure   To switch on the system:

1 Power up the Controller PC. This starts the Resource Manager, which keeps track of all the chassis currently connected and powered on.

2 If you have connected the chassis through an Ethernet switch or hub, make sure that the switch or hub is powered on.

3 After the PC is running, power up each chassis, using the power switch on the front of each chassis. The modules in the chassis will boot up at this time.

In case of multiple chassis, turn on the chassis in the order they are connected, leaving the chassis that is at the end of the daisy-chain until last.

4 Watch the matrix displays of the modules.

When booting, the I/O modules display the following sequence of codes:
BHW1 – BHW2 – BNET – BIP – BAPP –
KHW1 – KHW2 – KNET – KIP – KAPP

When the module is ready for use, it displays its number and a 'trail' of pixels snakes around the perimeter of the display.

If a problem occurs during the boot sequence, the code shows what stage was reached, and a message may be scrolled across the display. For information about diagnostics and troubleshooting, see *Frequently Asked Questions* in the online Help.

Getting started   For getting started examples and information about sample setup files provided by Agilent, refer to the online Help.

How to Power Down the System

To power down the PCI Express test system:

1 Shut down the Controller PC — perform the Windows shut down procedure. This ensures that any session is properly terminated.

2 Switch off the Controller PC.

3 Switch off the chassis.

Connecting to the Test Object

The test object can be a computer system, an add-in board, or both.

In any case:

1 Connect the probe to the Serial I/O Module.

2 Then connect the probe to the system or device under test.

This chapter provides some setup examples.

WARNING

Do not touch the surface of the slot interposer probe or any of the components on the slot interposer probe. These may be very hot.

Do not put the slot interposer probe onto highly combustible materials.

PCI Express Protocol Exerciser Setup Examples

The Protocol Exerciser for PCI Express can simulate any communication via PCI Express. It can stimulate the end point and react on the signals from the end point.

Testing a system   The following setup can be used to test a system:
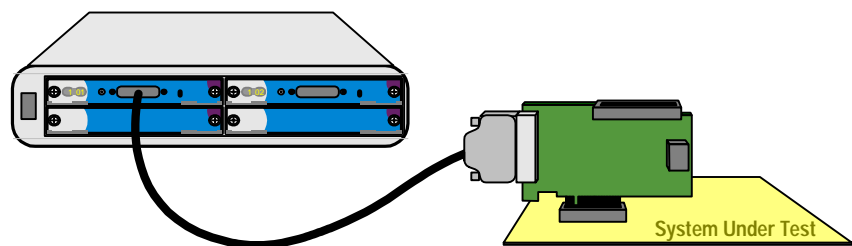
Figure 31   Protocol Exerciser Setup for Testing a System (Upstream Test)

Note that the passive probe is for traffic analysis only and cannot be used for a protocol exerciser.

Testing a plug-in device   The following setup can be used to test the behavior of a device:
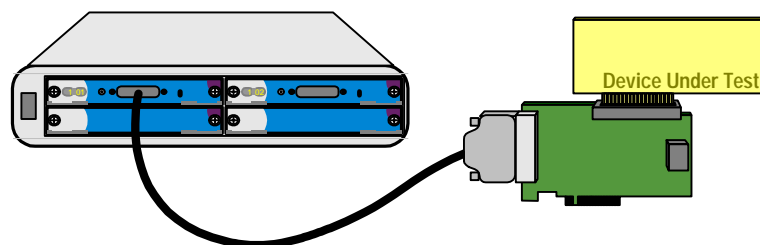
Figure 32   Protocol Exerciser Setup for Testing a Device (Downstream Test)

In this case, you have to connect an external power supply to the active slot interposer probe to power the device under test.

NOTE   The exerciser must be set up and running (session started, configuration space set up, link trained) before the device or system under test is started. A system could, for example, shut off the slot if no one is listening.

PCI Express Protocol Analyzer Setup Examples

The Protocol Analyzer for PCI Express listens to and captures the traffic on a PCI Express link.

Analyzing traffic between a system and add-in board

To analyze the traffic between a system and an add-in board, you insert the active or passive slot interposer probe between the two devices, as shown in the figure below:
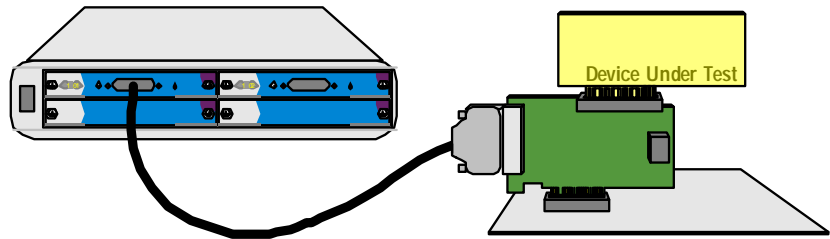
Figure 33 **Protocol Analyzer Setup for Testing Communication**

Power is provided to the probe and the add-in board by the PCI Express connector on the system motherboard, or via an external power supply.

Analyzing Traffic between two chips

To analyze the traffic within a system between two chips (which are also PCI Express end points), you insert the midbus probe in a dedicated socket, as shown in the following figure:
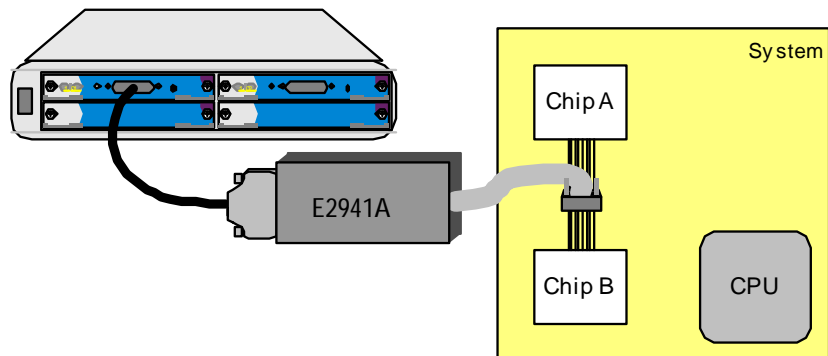
Figure 34 **Protocol Analyzer Setup for Testing Communication between two Chipsets**

In both cases, all communication between the two PCI Express devices is routed through the probe and the Serial I/O Module. The Protocol Analyzer simply eavesdrops on the communication.

PCI Express Combined Setup Example

Analyzing traffic between a DUT and an Exerciser

You may wish to set up a system so that the Analyzer captures traffic between a device under test and an Exerciser. In this case, the probe that is set up as an Analyzer has to be located between the DUT and the Exerciser probe, as indicated in the following figures:
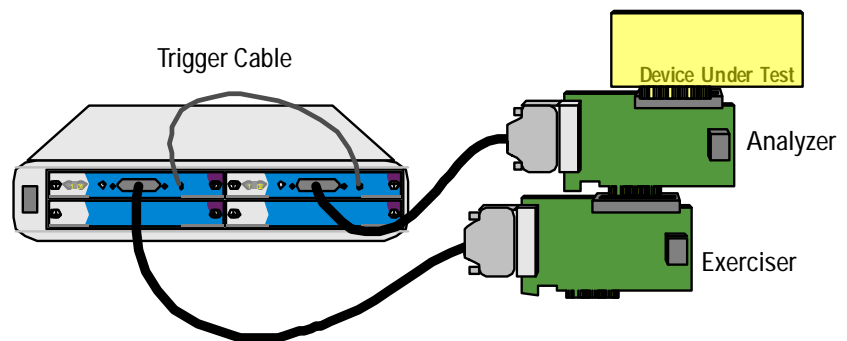

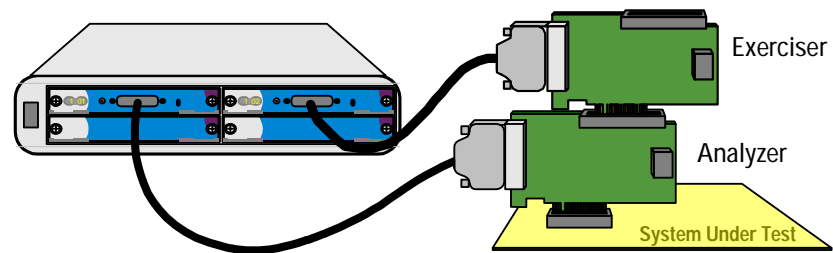**Figure 35   Protocol Analyzer Setup with Exerciser and DUT**

Figure 36   Protocol Analyzer Setup with Exerciser and SUT

An external power supply must be connected to the Exerciser for this setup. Alternatively, the Exerciser could be plugged into a motherboard (which would then supply the power).

NOTE   The exerciser must be set up and running (session started, configuration space set up, link trained) before the device or system under test is started. A system could, for example, shut off the slot if no one is listening.

Additionally, the Analyzer must be set up and running. Otherwise, the Analyzer will not pass the traffic between the two devices. A system could then shut off the slot.

You can optionally use a trigger cable to allow the Exerciser to trigger the Analyzer, for example, upon the sending of a certain receiver pattern.

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