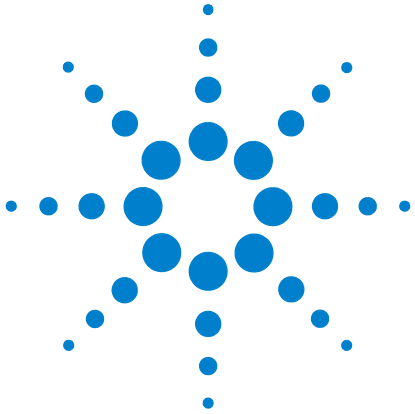

Agilent
System Protocol Tester

Hardware and Probing

Agilent Technologies

Notices

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Installation Guides

You can find the installation guides for different components of the product on the product CD. Agilent recommends you to do not switch on the instrument before you have understood all the applicable installation instructions and have met all the installation prerequisites.

Where to find more information

You can find more information about System Protocol Tester from the following link:

http://www.agilent.com/find/spt

You can also look for search a local contact for assistance on the following link:

http://www.agilent.com/find/assist

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Safety Symbols on Instruments

Indicates warning or caution. If you see this symbol on a product, you must refer to the manuals for specific Warning or Caution information to avoid personal injury or damage to the product.

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.

Indicates hot surface. Please do not touch.

Indicates laser radiation turned on.

CSA is the Canadian certification mark to demonstrate compliance with the Safety requirements.

CE compliance marking to the EU Safety and EMC Directives.

ISM GRP-1A classification according to the international EMC standard.

ICES/NMB-001 compliance marking to the Canadian EMC standard.

Safety Summary

General Safety Precautions

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument.

Agilent Technologies Inc. assumes no liability for the customer's failure to comply with these requirements.

Before operation, review the instrument and manual for safety markings and instructions. You must follow these to ensure safe operation and to maintain the instrument in safe condition.

General

This product is a Safety Class 1 instrument (provided with a protective earth terminal). The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

All Light Emitting Diodes (LEDs) used in this product are Class 1 LEDs as per IEC 60825-1.

Environment Conditions

This instrument is intended for indoor use in an installation category II, pollution degree 2 environment. It is designed to operate at a maximum relative humidity of 95% and at altitudes of up to 2000 meters.

Refer to the specifications tables for the ac mains voltage requirements and ambient operating temperature range.

Before Applying Power

Verify that all safety precautions are taken. The power cable inlet of the instrument serves as a device to disconnect from the mains in case of hazard. The instrument must be positioned so that the operator can easily access the power cable inlet. When the instrument is rack mounted the rack must be provided with an easily accessible mains switch.

Ground the Instrument

To minimize shock hazard, the instrument chassis and cover must be connected to an electrical protective earth ground. The instrument must be connected to the ac power mains through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Do Not Operate in an Explosive Atmosphere

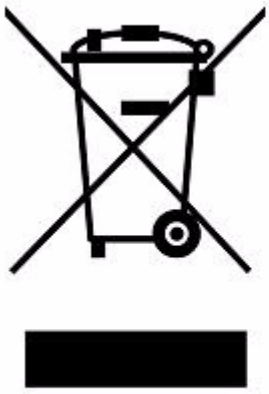
Do not operate the instrument in the presence of flammable gases or fumes.

Do Not Remove the Instrument Cover

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made only by qualified personnel.

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

Environmental Information



This product complies with the WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/ electronic product in domestic household waste.

Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as a "Monitoring and Control instrumentation" product.

Do not dispose in domestic household waste.

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Printing History

Agilent Technologies, Inc. can issue revisions between the product releases to reflect the latest and correct information in the guide. Agilent Technologies, Inc. also reserves its right to not issue a new edition of the guide for every system release.

The name of the guide and its part number are:

Manual Name: Agilent Serial Protocol Tester - Hardware and Probing Guide

Manual Part Number: E2960-97000

The edition number of the guide, publishing time of the guide, and applicable release number of the product are given in the following table.

Edition	Published	Applicable Release
5	September 2009	7.2

Manual available in electronic format only.

Contents

1 N5305A I/O Module

The System Protocol Tester platform consists of a two-slot or a four-slot chassis, which is an Agilent wide standard to provide a small and flexible platform to accommodate up to four independent add-in modules. In the System Protocol Tester platform, a chassis is connected with a controller PC that manages the behavior of the I/O modules. These I/O modules are the key element of System Protocol Tester and enables the platform to handle a specific protocol. In the System Protocol Tester platform, these I/O modules are plugged into the chassis slots.

In the System Protocol Tester platform, the N5305A serial I/O module is used for testing various serial protocols up to the x8 lane width at the rate of 3.125Gbs per lane. This module is always used with the E7900 four-slot or E7912 two-slot chassis. This is because these chassis provide the power and other infrastructure, such as ethernet connection, which are required to work with the I/O module.

Module Installation

For information on installing serial I/O modules into a chassis, please refer to *Agilent System Protocol Tester, Installation Guide* (part no. *E2960-91010*).

Software Packages

Serial I/O modules can have various software packages. These packages enable a module to exhibit different properties that are loaded to a module at the start of a particular session.

Software packages for wider link widths also include the smaller link widths.

How to tell which Software Packages are loaded

If an I/O module comes with a package loaded from the factory, it will have a sticker at the bottom side showing all pre-loaded packages.

For packages purchased subsequently, software access is needed to read the board data.

If you are working with APIs, then call `AgtSWPackageList` to show all installed packages.

How to install additional Software Packages via the API

You will receive a license sheet for each individual software package on each serial I/O module. The number on the sheet is needed to enable the software package for this particular module.

To install a software package using API, call `AgtSWPackageInstall`. This loads the software package on the module.

NOTE Please note that this process is coupled to the serial number of the module, and cannot be moved to another module.

How to install additional Software Packages via the User Interface

From the graphical user interface of the Exerciser or Analyzer for PCIe, select **File > Software Packages** to install and manage the installation of additional software packages.

External Interface

In this topic, you will learn about:

- Connecting the Reference Clock
- Connecting the external high-speed trigger cable
- Trigger Out Latency

Connecting the Reference Clock

The N5305A Serial I/O Module offers a separate output for the reference clock.

The clock rate is dependent on the protocol running on the module. For PCI Express, this is the reference clock as defined by the specification, namely 100MHz. The reference clock provided at the output is always the same as used by the circuits on the I/O module. If the I/O module runs with external clock (such as provided by a system through the Probe Board), this clock will also be routed to the Reference Clock out connector. If the I/O Module runs with the internal oscillator, the output will be derived from this.

To use the clock, e.g. to trigger an oscilloscope, connect an SMA cable to the connector labeled Clock Output, and connect the other end to the oscilloscope or other measurement equipment.

NOTE Agilent's System Protocol Tester supports one clock per I/O module.

Connecting the external high-speed trigger cable

The *Sync* port on the front panel allows the serial I/O module to trigger another serial I/O module, an external device like a logic analyzer, or to be triggered from another serial I/O module.

This allows point-to-point connections with the following possible scenarios given in Table 1:

Table 1 Scenarios

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 Sync port allows connecting serial I/O modules with the delivered cable and other PCIe devices with a standard header. To connect, use the trigger cable delivered with the chassis and connect to the connector marked *Sync* on the I/O module. The notch has to be at the bottom for the cable to fit (Figure 1).

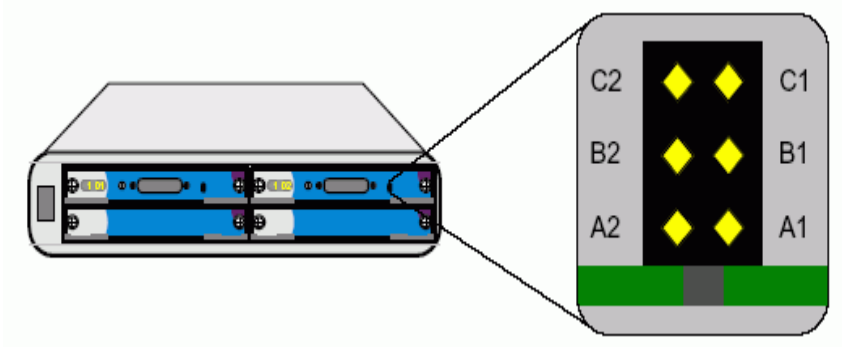


Figure 1 Sync Port

Table 2 provides the details of the pins.

Table 2 Pins

Pin Name	Function	Level	Comments
A1, A2	Ground		
B1	External Trigger Out	LVCMOS level, active high (low: 0V; high: 2.5V)	Signal is active for 3 clock cycles (24ns)
B2	External Trigger In	LVCMOS level, active high (low: 0V; high: 2.5V)	Signal must be active for 3 clock cycles (24ns)

Table 2 Pins

Pin Name	Function	Level	Comments
C1, C2	Not connected		

Trigger Out Latency

For an I/O module configured as a Protocol Analyzer, the latency between *packet transmitted* to *External Trigger Out* on the front panel is given in Table 3.

Table 3 Trigger Out Latency

Link Width	Typical Latency
*1	1820 ns
*2	1196 ns
*4	886 ns
*8	730 ns

External Interface Specification

Table 4 provides a brief description and specification of the external interface.

Table 4 External Interfaces

Interface	Description	Specification
External Clock Out	Provide the reference clock from the I/O modules, e.g. for triggering an oscilloscope.	Single-Ended SMA connector Amplitude: 750 mV p-p (AC-coupled) Frequency: depending on protocol, 50MHz – 125MHz (multiplied by 25 (PCI Express) or by 20 for serial transmission speed).
I/O Interface	Interface to the Probe.	This is the standard connector for all E2960 series products, and is used to connect the probe board to the I/O modules. Use the black I/O cable provided with your system, or the E2942A Single probe y-cable.
Sync	High-Speed Synch/Trigger connection.	Connect the trigger cable delivered with the chassis to connect two I/O modules.

Table 5 provides the mechanical dimensions of the external interfaces.

Table 5 Mechanical Dimensions

Attribute	Value
Length	312 mm
Width	205 mm
Height	28 mm

2
N5306A I/O Module

This chapter provides information on the N5306A I/O module used for PCIe.

N5306A I/O Module

Figure 2 shows the N5306A I/O module.

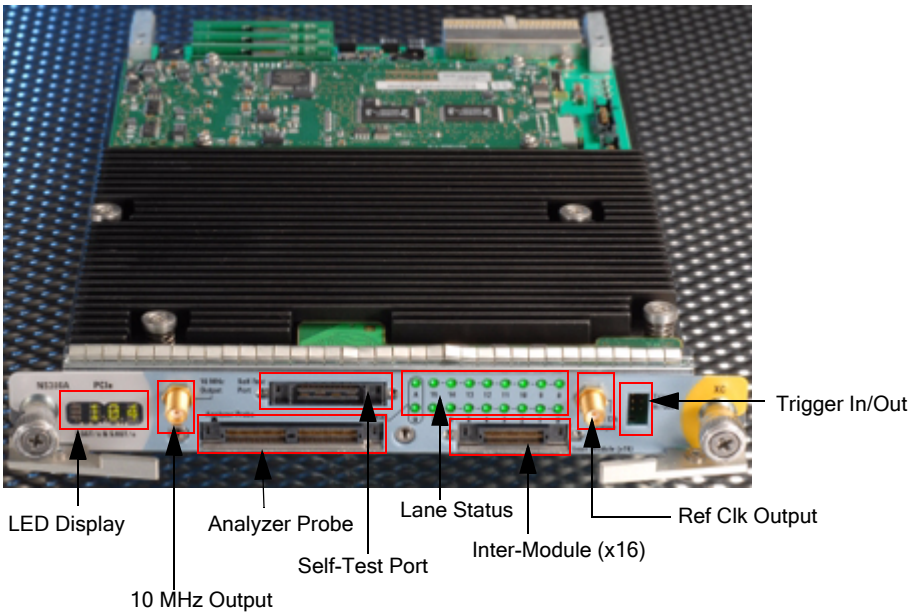


Figure 2 N5306A I/O Module

As shown in Figure 2, the N5306A I/O module has the following components:

- **LED Display**: This component is used to display the diagnostic information when fatal faults are discovered, and to indicate progress during the bootstrap. If everything is working properly, then this component displays the module number, such as 103.
- **10 MHz Output**: This component is a reference clock, which is used for generating timestamps in Protocol Analyzer. This component delivers 10 MHz output.
- **Analyzer Probe**: This component is used to connect the midbus probe *module connector* with N5306A.

  For complete information on midbus probe, refer to *Agilent Soft Touch Midbus Probe, User's Guide*.

  For information on plugging midbus probe module connector with N5306A Analyzer Probe, refer to *Agilent System Protocol Tester, Installation Guide*.

- **Self-Test Port**: This component is a loopback board, and is used to connect the midbus probe *tip* with N5306A. The one side of this loopback board has a retainer for the probe, and the other side has the connector for the self-test port. To verify if N5306A I/O module and midbus probe are working properly, plug in this loopback board into the self-test port and then watch the lane status.
- **Lane Status**: This component has 18 LED bullets that displays the status of the lane by using different colored bullets. Two bullets, labelled **A** and **B**, indicate global status information. Different colors used to indicate global status information are:
  - **Grey**: This colored bullet means system is not configured.
  - **Red**: This colored bullet means the speed is not detected or the system is not configured.
  - **Yellow**: This colored bullet represents speed of 2.5 Gb/s.
  - **Green**: This colored bullet represents speed of 5 Gb/s.

  Other 16 LED bullets, labelled **0** to **15**, indicate the status of each lane. These bullets are:
  - **Red**: This colored bullets means that there are no signals or the lane is electrically idle.
  - **Orange**: This colored bullet marks the presence of invalid signals on the lane.
  - **Green**: This colored bullet means that the data on the lane is deskewed.
  - **Blinking Green**: This colored bullet means that the data on the lane is skewed. It corresponds to *yellow* in the Port Overview pane in the Protocol Analyzer GUI.
  - **Grey**: This colored bullet means that the lane is not configured. For example, if you are using x4 link width, then first four bullets of the lane would be green and rest of the bullets would be grey colored bullets.
- **Inter-Module (x16)**: This component is used to share information with another N5306A I/O module in the same chassis. The features of this component are not yet supported by the System Protocol Tester platform.
- **Ref Clk Output**: This components is a *reference clock*, which N5306A use to process the data internally. This components delivers 100 MHz output.

- **Trigger In/Out**: This component is used to listen to *external trigger in* from a different device or send *external trigger out* to another device.

  Figure 3 shows meaning of the pins of the Trigger In/Out component.

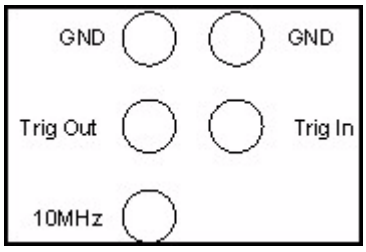


Figure 3 Trigger In/Out Pins

The following are some important points about the Trigger In/Out component:

- The outputs circuitry is designed to work into open in order to fit to the LA input that is typically in the K-ohms range.
- Maximum trigger input voltage should not exceed 3.3V.
- Trigger Out and 10 MHz Out have nominal output level of 2.0V after 20 ns minimum pulse width.
- Minimum Trigger In duration is ~20ns.

NOTE Use *trigger cable* to send or receive external trigger in and out events.

WARNING **Do not directly touch any component on the I/O module. It may be hot.**

CAUTION Components on the I/O module are sensitive to the static electricity. Therefore, take necessary anti-static precautions, such as wear a grounded wrist strap, to minimize the possibility of electrostatic damage.

3
N5322A Extended Interface Module

This chapter provides information on the N5322A extended interface module used for PCIe.

N5322A Extended Interface Module

The N5322A extended interface module is used with the N5306A module to capture the traffic of DUTs that use PCIe power management (L0s, L1, L2/L3).

Figure 4 shows the N5322A extended interface module.

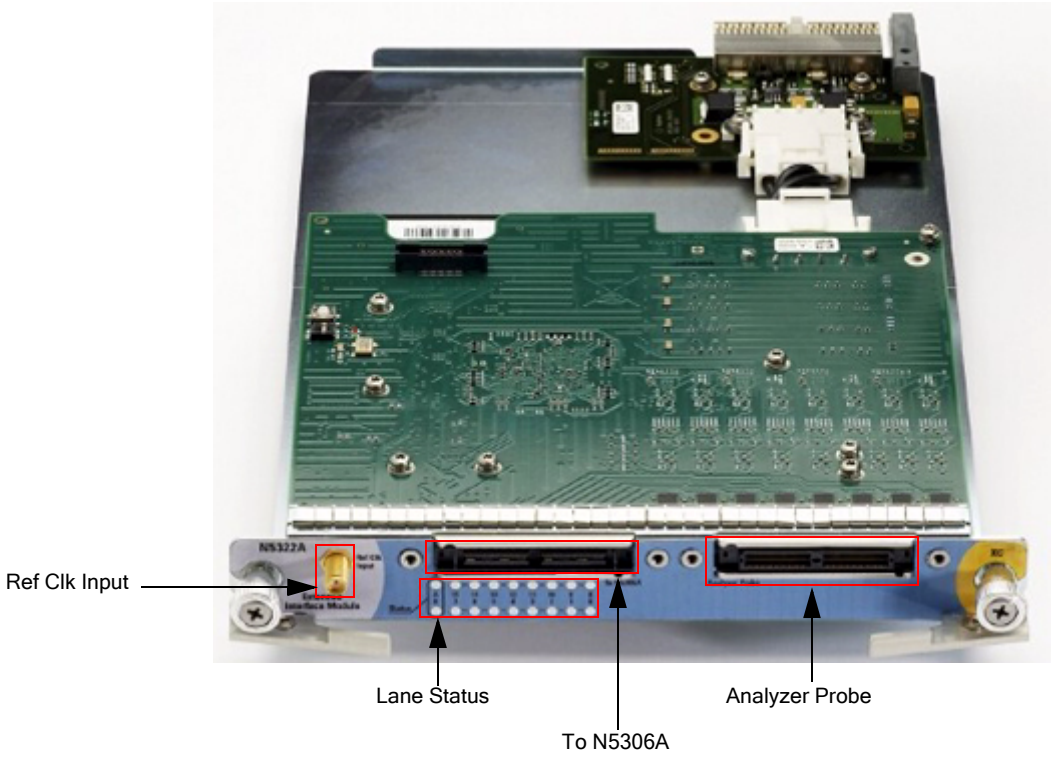


Figure 4 N5322A Extended Interface Module

As shown in Figure 4, the N5322A module has the following components:

- **Ref Clk Input**: This component is used as an alternate 100 MHz reference clock input.
- **Analyzer Probe**: This component is used to connect the N5322A module with the following probe types:
  - N4241A Straight
  - N4242A Swizzled
  - N4243A Split Cable
  - N5315A Solid Slot Interposer
  - N5317A PCIe Gen1 Probe Connection Cable

- N4241F Flying Leads

- **To N5306A**: This component is used to connect N5322A with N5306A using the Extended Interface Module interconnect cable.

  Figure 5 shows how you can use N5322A and N5306A modules, and a probe type together.

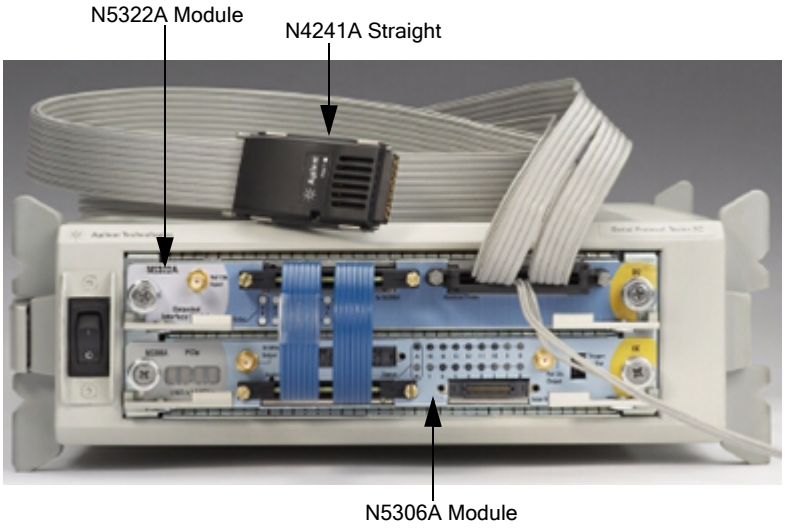


Figure 5 N5322A paired with N5306A

NOTE

N5322A and N5306A modules should be used as a pair. That is:

- Use 1 N5306A and 1 N5322A for a x8 setup
- Use 2 N5306A and 2 N5322A for a x16 setup.

- **Lane Status**: This component has 18 LEDs that display the status of the lane by using different colors. Two LEDs, labelled **A** and **B**, indicate global status information. Different colors used to indicate global status information are:

  - **Green**: This colored LED means that N5322A and N5306A modules are connected, the Port Overview pane in Protocol Analyzer is showing *Connected*, and also the check box for N5322A in the Hardware Setup dialog box is *selected*.

- **Yellow**: This colored LED means that N5322A and N5306A modules are connected, the Port Overview pane in Protocol Analyzer is also showing *Connected*, but the check box for N5322A in the Hardware Setup dialog box is *not selected*.
- **Red**: This colored LED means that N5322A is not connected with N5306A.

Other 16 LEDs, labelled **0** to **15**, indicate the status of each lane. These LEDs are:

- **Green**: This colored LED means that the lane is not in electrical idle state.
- **Grey**: This colored LED means that the lane is not configured. For example, if you are using x4 link width, then first four bullets of the lane would be green and rest of the bullets would be grey colored bullets.
- **Red**: This colored LED means there are no signals or the lane is electrically idle.

WARNING **Do not directly touch any component on the N5322A module. It may be hot.**

CAUTION Components on the N5322A module are sensitive to the static electricity. Therefore, take necessary anti-static precautions, such as wear a grounded wrist strap, to minimize the possibility of electrostatic damage.

4
N5308A Exerciser Card

This chapter provides information on the N5308A exerciser card used for PCIe.

N5308A Exerciser Card

Figure 6 shows the N5308A exerciser card.

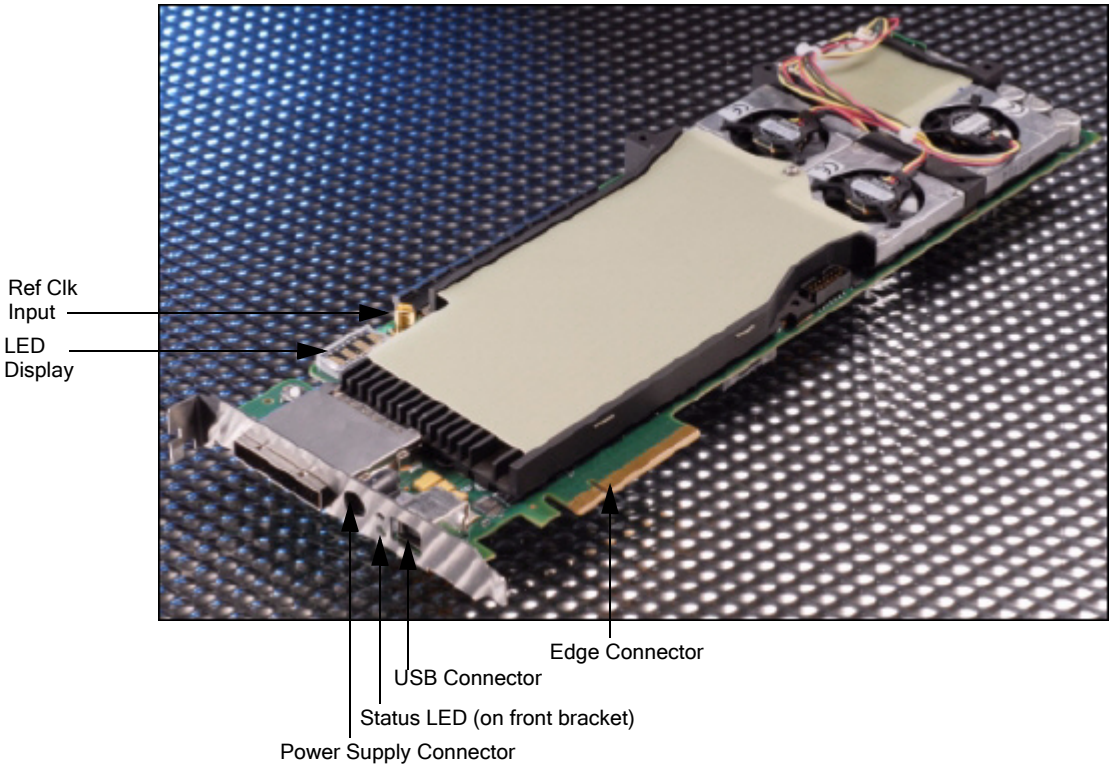


Figure 6 N5308A Exerciser Card

Components shown in Figure 6 are described below:

- **Ref Clk Input**: This component can be used as an alternative 100 MHz reference clock input.
- **LED Display**: This component displays the module number, such as *module number 10003*, to which N5308A is configured. The module number displayed here scrolls horizontally from right to left.
- **Power Supply Connector**: This component is used to connect N5308A with the external power supply.

  Use the power supply delivered with N5308A only.
- **Status LED (on front bracket)**: This LED represents the following different states:
  - *No light* state means there is no link up.

  - *Green light* means there is a link up at the Gen2 speed.
  - *Blinking green light* means there is a link up at the Gen1 speed.
- **USB Connector**: This component is used to connect N5308A with the controller PC using the USB cable.
- **Edge Connector**: This component is used to connect N5308A with a PCIe Connector on the backplane board, or with a system.

  This component comes with a protective foam cover to protect it from electrostatic damage (Figure 7).

Figure 7 Protective Foam Cover for Edge Connector

NOTE Please remove the protective foam cover before using the card, and attach it again when the card is not in use.

- **Status LEDs (on board)**: This component has 20 LEDs to display the status information.
  - First 16 LEDs displays the status of the link.
  - Last four LEDs displays the status of the exerciser card itself.
- **Trigger Connector**: This component is a six-pin header located at the top-right corner of the card, and is used to connect the trigger cable (N5306-61604) to enable triggering between Protocol Exerciser and Protocol Analyzer. In this situation, the other end of the trigger cable is plugged into the trigger connector of the Protocol Analyzer module.

  You can also use this connector for cross-triggering with other instruments, such as Logic Analyzer.

Figure 8 shows the meaning of the pins in the Trigger Connector component.

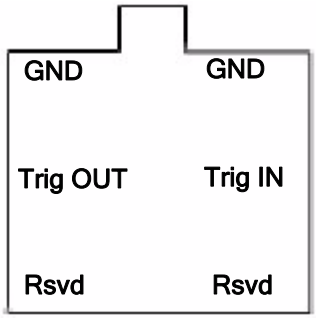


Figure 8 Trigger Connector Pins

Figure 9 shows the Status LEDs and Trigger Connector components.

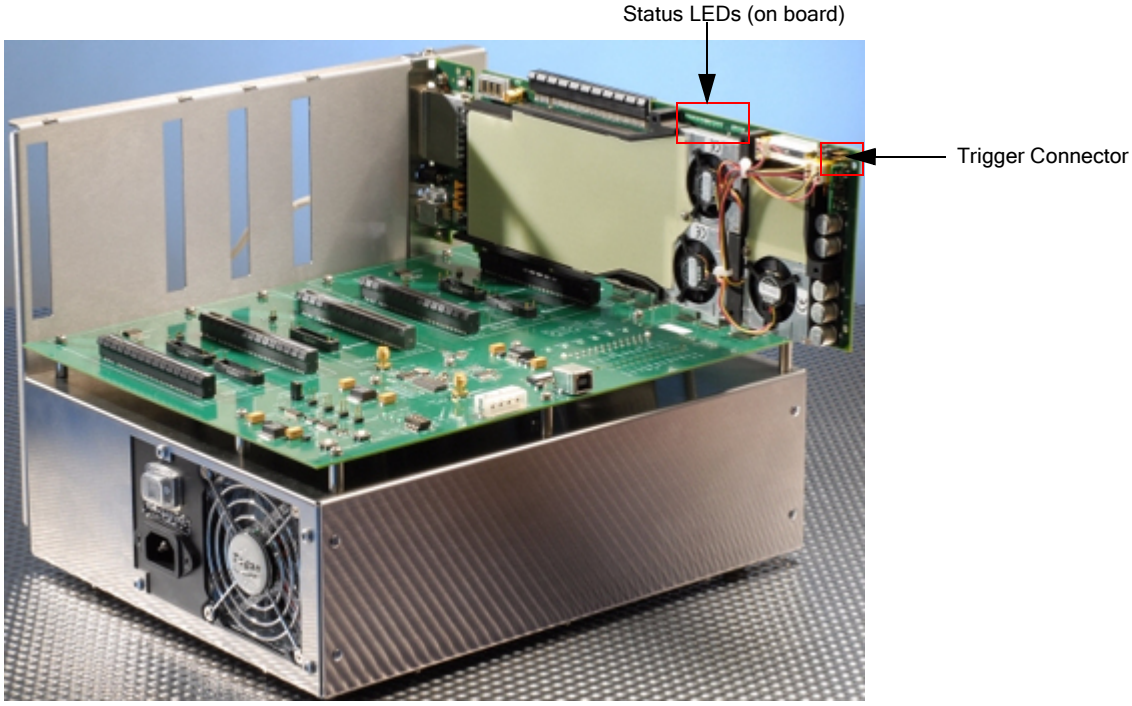


Figure 9 N5308A Exerciser Card

WARNING **Do not directly touch any component on the N5308A exerciser card. It may be hot.**

CAUTION Components on the N5308A exerciser card are sensitive to the static electricity. Therefore, take necessary anti-static precautions, such as wear a grounded wrist strap, to minimize the possibility of electrostatic damage.

NOTE For more information on the N5308A exerciser card, refer to:

- *Agilent System Protocol Tester, Installation Guide*
- *Agilent Protocol Exerciser, User's Guide*

4 N5308A Exerciser Card

5
N5309A Exerciser Card

This chapter provides information on the N5309A exerciser card used for PCIe.

N5309A Exerciser Card

Figure 10 displays the N5309A exerciser card.

Figure 10 N5309A Exerciser Card

Components of the N5309A exerciser card are described below:

- **Ref Clk Input**: This component can be used as an alternative 100 MHz reference clock input.
- **LED Display**: This component displays the module number, such as *module number 10003*, to which N5309A is configured. The module number displayed here scrolls horizontally from right to left.
- **Status LEDs (on board)**: This component has the following LEDs to display the status information.

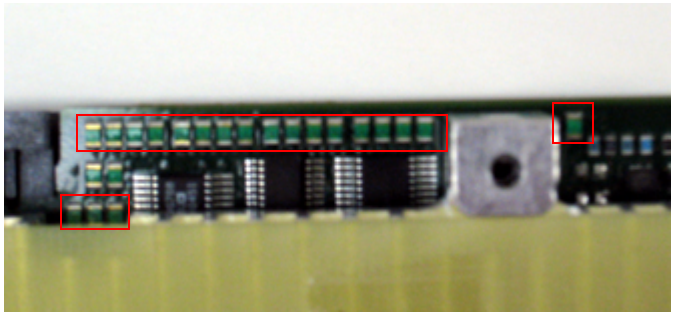


Figure 11 N5309A Exerciser card - Status LEDs

- First 16 LEDs displays the status of the link.
- One LED, separately highlighted on the right, is for the power status of the board.
- Last three LEDs shows the power status of DUT.

- **Edge Connector**: This component is used to connect N5308A with a PCIe Connector on the backplane board, or with a system.
- **Trigger Connector**: This component is a six-pin header, and is used to connect the trigger cable (N5306-61604) to enable triggering between Protocol Exerciser and Protocol Analyzer. In this scenario, the other end of the trigger cable is plugged into the trigger connector of the Protocol Analyzer module.

  You can also use this connector for cross-triggering with other instruments, such as Logic Analyzer.

  Figure 12 shows the meaning of the pins in the Trigger Connector component:

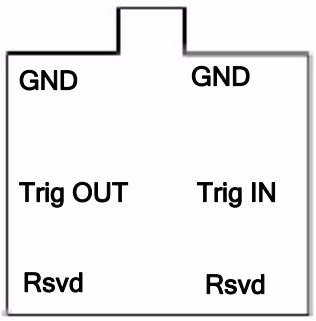


Figure 12 Trigger Connector Pins

- **Power Supply Connector**: This component is used to connect N5309A with the external power supply.

  Use the power supply delivered with N5309A only.
- **Status LED (on front bracket)**: This LED represents the following different states:
  - *No light* state means there is no link up.
  - *Green light* means there is a link up at the Gen2 speed.
  - *Blinking green light* means there is a link up at the Gen1 speed.
- **USB Connector**: This component is used to connect N5309A with the controller PC using the USB cable.

Figure 13 shows the Trigger Connector, Power Supply Connector, Link Status LED, and USB Connector components.

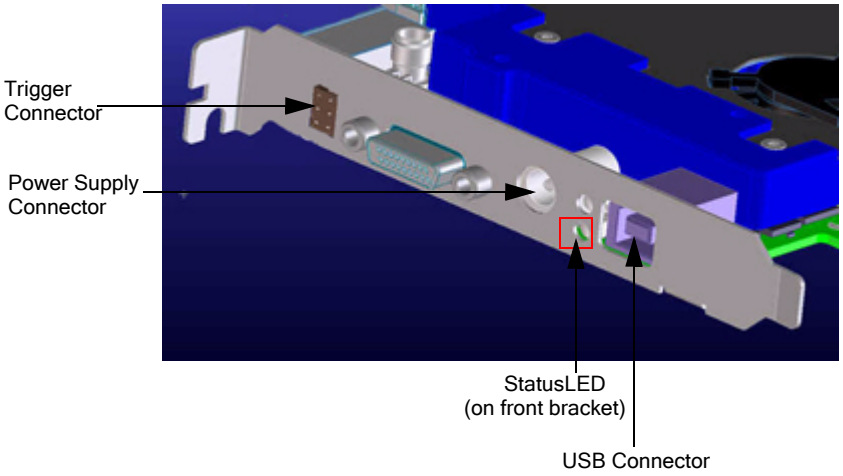


Figure 13 N5309A Exerciser Card

NOTE

The N5309A exerciser card also has the *Extension Card Connector* component at its top, which is used to connect the *Exerciser Extension Card* with N5309A. For more information on this component and exerciser extension card, refer to *Chapter 6*, "N5309-66417 Exerciser Extension Card.

For more information on the N5309A exerciser card, refer to:

- *Agilent Protocol Exerciser for PCI Express, User's Guide*

WARNING **Do not directly touch any component on the N5309A exerciser card. It may be hot.**

CAUTION Components on the N5309A exerciser card are sensitive to the static electricity. Therefore, take necessary anti-static precautions, such as wear a grounded wrist strap, to minimize the possibility of electrostatic damage.

5 N5309A Exerciser Card

6
N5309-66417 Exerciser Extension Card

This chapter provides information on the N5309-66417 exerciser extension card used with the N5309A exerciser card for PCIe.

N5309-66417 Exerciser Extension Card

Figure 14 displays the N5309-66417 exerciser extension card.

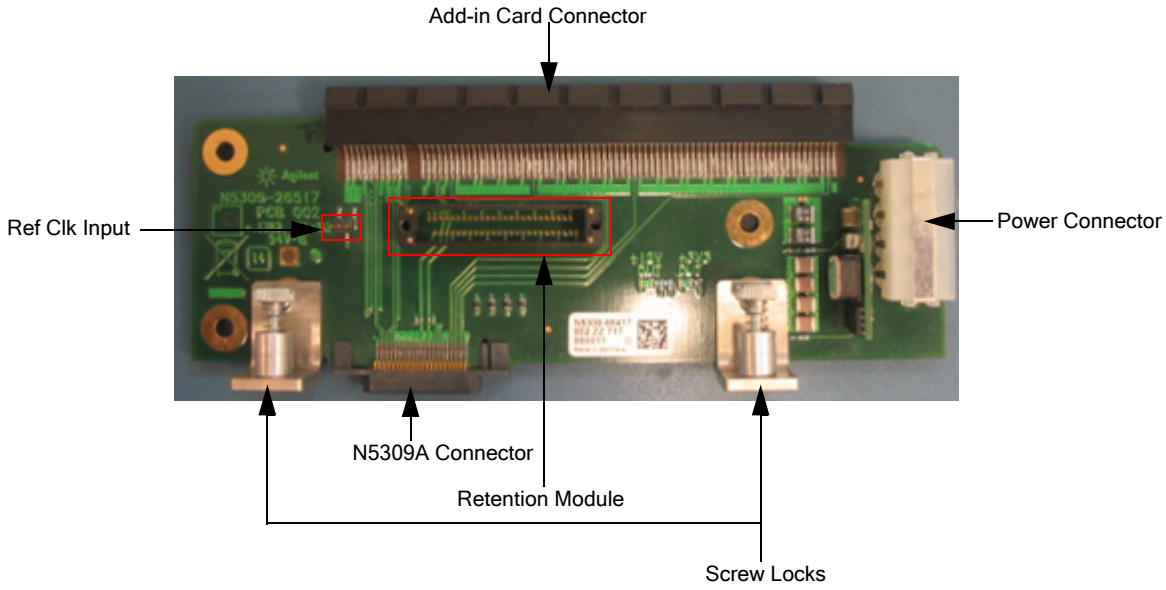


Figure 14 N5309-66417 Exerciser Extension Card

Components of the N5309-66417 exerciser extension card are described below:

- **Ref Clk Input**: This component can be used as an alternative 100 MHz reference clock input.
- **Add-in Card Connector**: This component is used to connect any add-in PCIe card at the top of N5309-66417.
- **Retention Module**: This component is used to connect the midbus probe, which is then used for capturing traffic between the N5309A exerciser card and the add-in card.
- **Power Connector**: This component is used to provide power supply to an add-in card, which is hooked on the N5309-66417 card.
- **N5309A Connector**: This component is used to connect the N5309-66417 card with the N5309A exerciser card.

To connect the two cards:

a Insert the N5309A Connector component into the *Extension Card Connector* component of the N5309A card.

b Tighten the *screw locks* of the N5309-66417 card to tightly align it with the N5309A card.

Figure 15 shows the N5309-66417 card connected with the N5309A card.

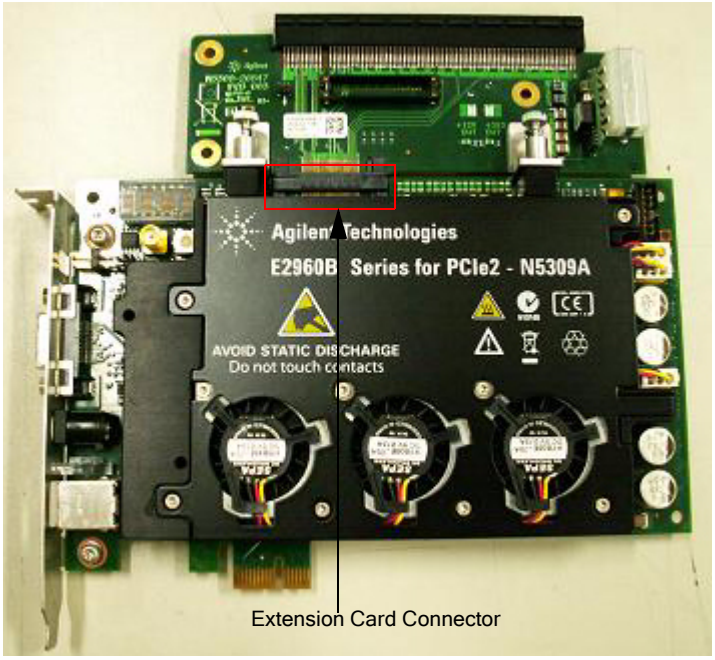


Figure 15 N5309-66417 connected with N5309A

NOTE The N5309-66417 exerciser extension card supports linkup only on the x1 link width.

WARNING **Do not directly touch any component on the N5309-66417 exerciser extension card. It may be hot.**

CAUTION Components on the N5309-66417 exerciser extension card are sensitive to the static electricity. Therefore, take necessary anti-static precautions, such as wear a grounded wrist strap, to minimize the possibility of electrostatic damage.

7
N5323A Jammer Card

This chapter provides information on the N5323A jammer card used for PCIe.

N5323A Jammer Card

Figure 16 displays the N5323A Jammer card.

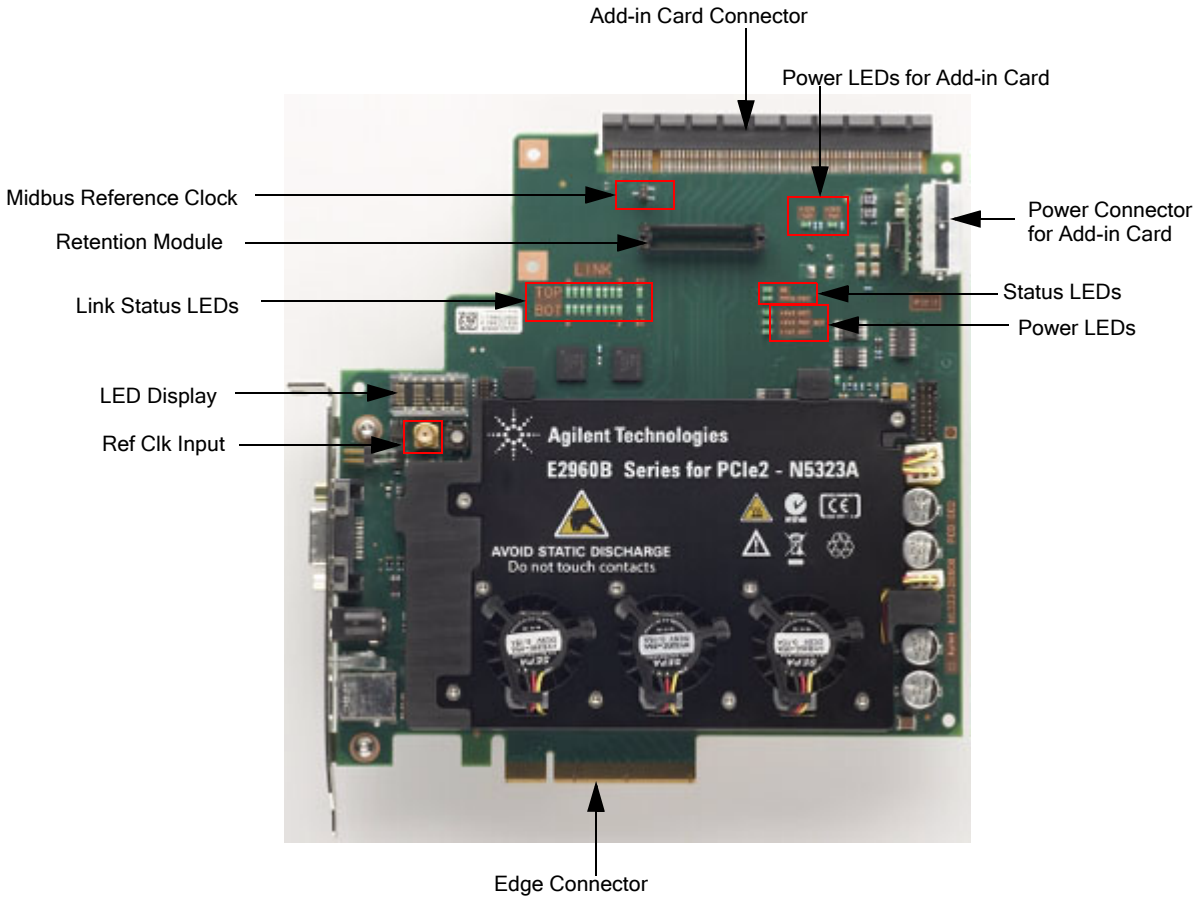


Figure 16 N5323A Jammer Card

Components of the N5323A jammer card are described below:

- **Ref Clk Input**: This component can be used as an alternative 100 MHz reference clock input.
- **LED Display**: This component displays the following messages:
  - *Module number* (such as module number 10003) to which N5323A is configured. The module number displayed here scrolls horizontally from right to left.
  - *Serial number* of the board, when you open the *Update GUI* tool from *Start* > *Programs* > *Agilent N2X* > *PCIE Jammer 71. Release*.

- *FPPR* when the firmware is being programmed.
- *FWPR* when the firmware is programmed, and the board requires a power cycle.

- **Retention Module**: This component is used to connect the midbus probe to the N5323A jammer card (Figure 17), which allows midbus probe to be used for capturing traffic between N5323A and the add-in card.

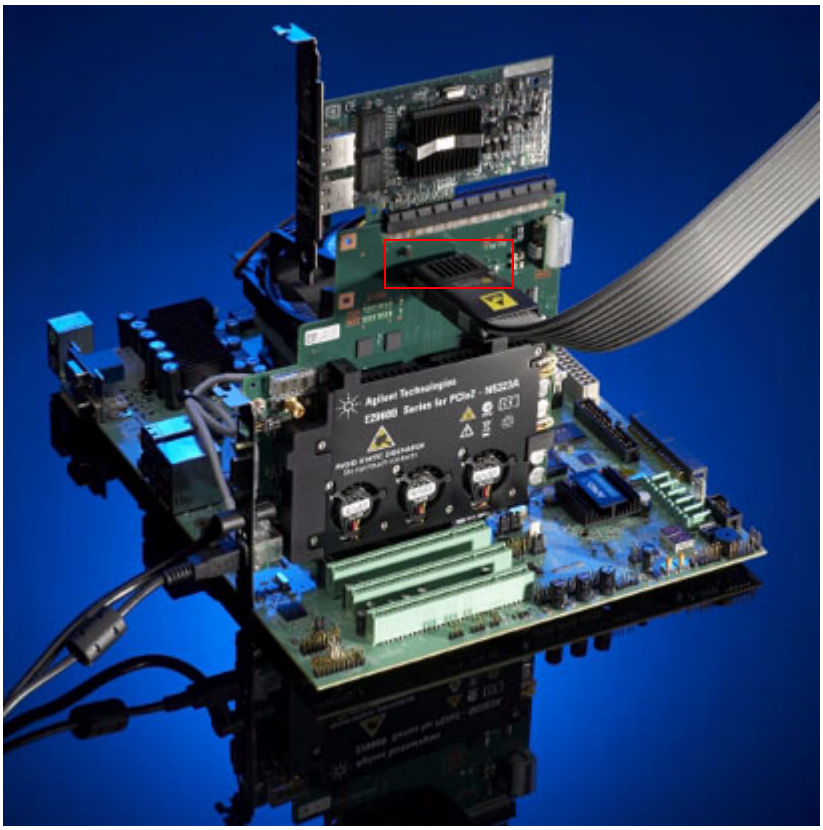


Figure 17 Midbus probe plugged into the retention module

- **Midbus Reference Clock**: This component can be used to connect the reference clock to the midbus probe.

NOTE For information on midbus probe, refer to *Agilent Soft Touch Midbus Probe, User's Guide* and *Agilent System Protocol Tester, Installation Guide*.

- **Power Connector for Add-in Card**: This component is used to provide power supply to the add-in card, which is hooked on the N5323A jammer card.

- **Power LEDs for Add-in Card**: This component has two LEDs marked as *+3V3 TOP* and *+12V TOP* displaying the status of the PCIe power to the add-in card.
- **Edge Connector**: This component is used to connect N5323A with a PCIe Connector on the backplane board, or with a system.
- **Add-in Card Connector**: This component is used to connect any add-in PCIe card at the top of N5323A.
- **Link Status LEDs**: This component has the following LEDs to display the PCIe link status information.

  The upper row (labelled *TOP*) displays the status of the *link to add-in-card*, and the lower row (labelled *BOT*) displays the status of the *link to system* or *backplane*.

  The link status LEDs (*labelled ST*) represent the following states:

  - *No light* state means there is no link up.
  - *Green light* means there is a link up at the Gen2 speed.
  - *Blinking green* light means there is a link up at the Gen1 speed.
- **Status LEDs**: This component has two LEDs marked as *HB* and *FPGA RDY* displaying the status of the board.

  Flashing HB LED shows that the micro controller is running, and FPGA RDY shows that the FPGA image is loaded and ready.
- **Power LEDs**: This component has three LEDs marked as *+3V3 BOT*, *+3V3 BOT AUX*, and *+12V BOT* displaying the status of the PCIe power supplies from the system or backplane.
- **Trigger Connector**: This component is a six-pin header (Figure 19), and is used to connect the trigger cable (N5306-61604) to enable triggering between Jammer and Protocol Analyzer. In this scenario, the other end of the trigger cable is plugged into the trigger connector of the Protocol Analyzer module.

  You can also use this connector for cross-triggering with other instruments, such as Logic Analyzer.

  Figure 18 shows the meaning of the pins in the Trigger Connector component:

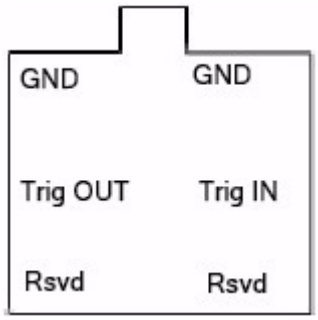


Figure 18 Trigger Connector Pins

- **Power Supply Connector**: This component is used to connect N5323A with the external power supply.

  Use the power supply delivered with N5323A only.

- **USB Connector**: This component is used to connect N5323A with the controller PC using the USB cable.

N5323A Jammer Card shows the Trigger Connector, Power Supply Connector, Link Status LED, and USB Connector components.

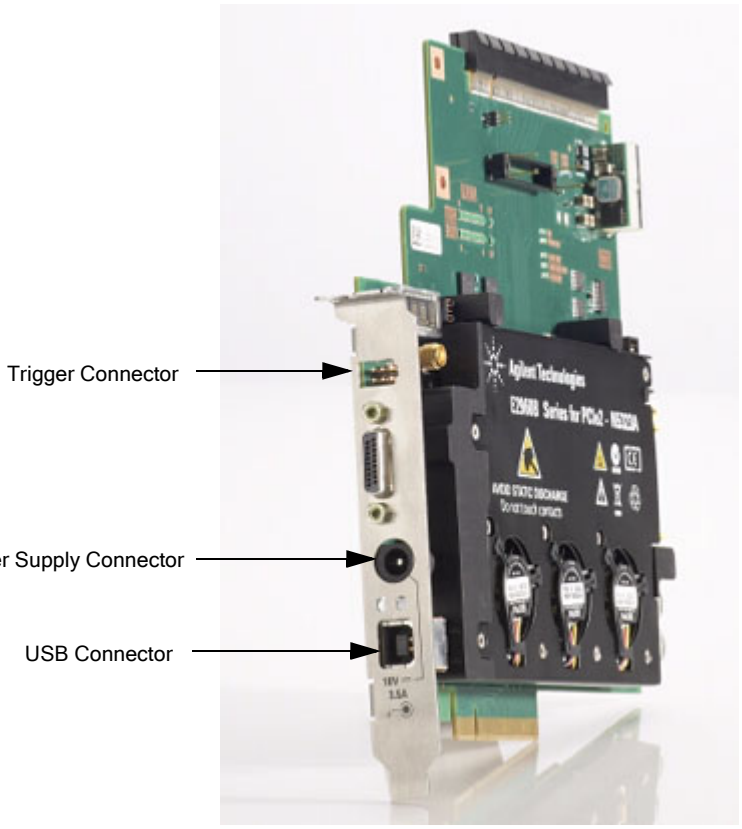


Figure 19 N5323A Jammer Card

WARNING **Do not directly touch any component on the N5323A jammer card. It may be hot.**

CAUTION Components on the N5323A jammer card are sensitive to the static electricity. Therefore, take necessary anti-static precautions, such as wear a grounded wrist strap, to minimize the possibility of electrostatic damage.

8
1735A Fibre Channel Test Module

The 1735A fibre channel test module fits in a universal chassis that you can easily expand or upgrade. You can use a two-slot or four-slot chassis for mobile or bench testing. Using this module, you can configure and monitor tests over LAN through a convenient graphical user interface or TCL-based script for automated testing. The modular system architecture supports from two to hundreds of time-synchronized test ports in a single test session, which you can configured according to your testing needs.

External Interfaces

In this topic, you will learn about:

- “Connecting the Reference Clock

Connecting the Reference Clock

The 1735A Fibre Channel Test Module offers a separate input for the reference clock (Figure 20).

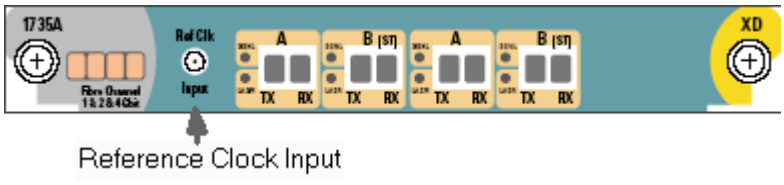


Figure 20 Reference Clock Input

To use the clock, connect an SMA cable to the connector labeled RefClk Input and connect the other end to the clock source or other test equipment.

Table 6 provides a brief specification details about the reference clock.

Table 6 Reference Clock Specifications

Attribute	Value
DC max	+/- 8 V
AC max	+/- 600 mv
Peak - Peak Voltage	800 mv +/- 400 mv

9
N5315 Solid Slot Interposer Card

This chapter provides information on the N5315 solid slot interposer card used for PCIe.

N5315 Solid Slot Interposer Card

The *N5315 solid slot interposer* card comes in four form factors: x1, x4, x8 and x16 link width.

Figure 21 shows the N5315 solid slot interposer card for the x16 link width.

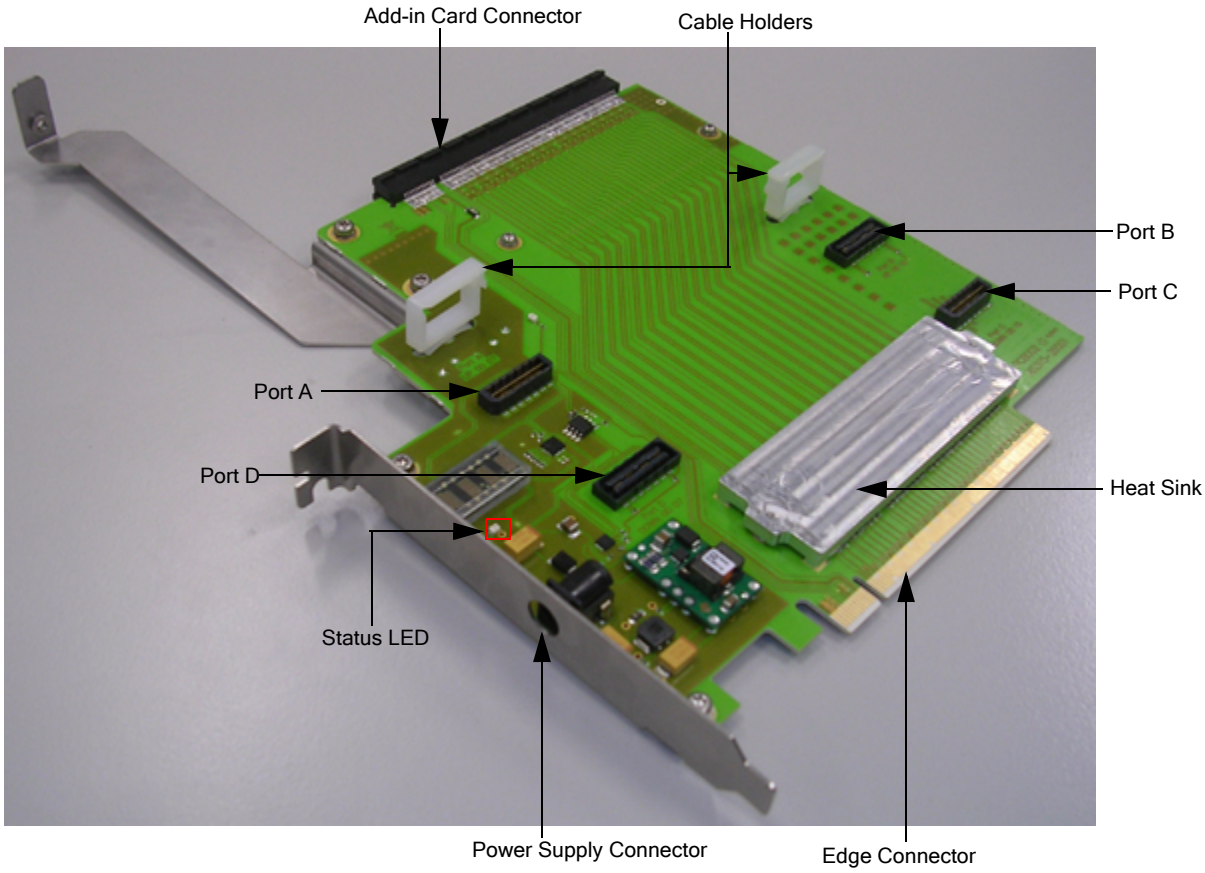


Figure 21 N5315 Solid Slot Interposer Card

Components shown in Figure 21 are described below:

- **Add-in Card Connector**: This component is used to connect any add-in PCIe card at the top of N5315.
- **Edge Connector**: This component is used to connect N5315 with a PCIe Connector on the backplane board, or with a system.

  This component comes with a protective foam cover to protect it from electrostatic damage (Figure 22).

Figure 22 Protective Foam Cover for Edge Connector

NOTE Please remove the protective foam cover before using the card, and attach it again when the card is not in use.

- **Ports**: N5315 has the following ports:
  - **Port A**: This port is for lanes 0-7, downstream.
  - **Port B**: This port is for lanes 8-15, downstream.
  - **Port C**: This port is for lanes 8-15, upstream.
  - **Port D**: This port is for lanes 0-7, upstream.

  If you use N5315 for x8 link width, then Port B and C will not be available.
- **Cable Holders**: These components hold the *N5315-61601 Solid Slot Interposer* cables that connect the N5306A I/O module to the N5315 card.

  Figure 23 shows the N5315-61601 cable.

Figure 23 N5315-61601 Solid Slot Interposer cable

To use this cable, plug its *Module Connector* in the *Analyzer Probe* component of the N5306A I/O module, and plug its *port connectors* in the ports of the N5315 card.

For example, a x8 setup requires one N5315-61601 cable, whereas a x16 setup requires two N5315-61601 cables.

For a x8 setup, plug the port connectors of the N5315-61601 cable into port A and D of the N5315 card, and its module connector into the Analyzer Probe component of the N5306A I/O module.

For a x16 setup, plug the port connectors of the one N5315-61601 cable into the A and D ports, and the port connectors of the second cable into the B and C ports. After this, plug the module connectors of these two cables into the Analyzer Probe components of the two N5306A I/O modules.

Figure 24 shows the two N5315-61601 cables connected to the ports and supported by the cable holders.

Figure 24 N5315 with Cables

- **Status LED**: This component indicates whether the N5315 card is powered. It has the following two states:
  - *No light* means the card is not powered.

- *Green light* means the card is powered.

- **Heat Sink**: This component absorbs and dissipates heat of the card.
- **Power Supply Connector**: This component is used to connect N5315 with the external power supply.

  Use the power supply delivered with N5315 only.

NOTE

Power supply specifications are:

Input: 100 - 240V~, 47 - 63Hz 130 - 160VA 1.5A MAX

DC Output: +18 ⎓ 3.6A 63W MAX

WARNING

Do not directly touch any component on the N5315 solid slot interposer card. It may be hot.

CAUTION

Components on the N5315 solid slot interposer card are sensitive to the static electricity. Therefore, take necessary anti-static precautions, such as wear a grounded wrist strap, to minimize the possibility of electrostatic damage.

9 N5315 Solid Slot Interposer Card

10
N5316A Backplane Board for PCIe

This chapter provides information on the N5316A test backplane board used for PCIe 5 Gb/s.

N5316A Test Backplane Board for PCIe 5 Gb/s

Figure 25 and Figure 26 shows the N5316A test backplane board for PCIe 5 Gb/s.

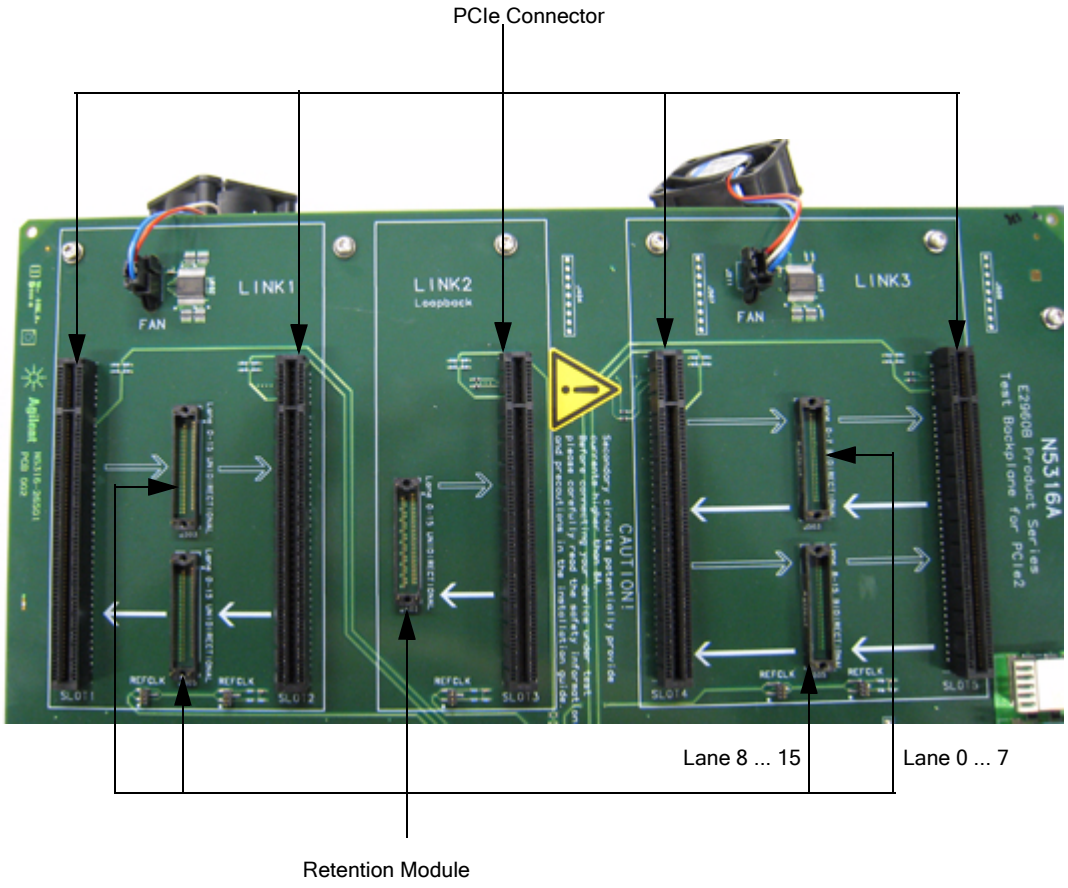


Figure 25 N5316A Backplane Board

As shown in Figure 25, the N5316A backplane board has:

- Five *retention modules* for midbus probe.
- Five *PCIe connectors* for the slot interposer cards, exerciser cards, and other add- in cards (like LAN or graphic card).

  As shown on the backplane board, arrows between the retention modules and PCIe connectors show the direction in which the traffic flows.

  All these retention modules and PCIe connectors are arranged inside the following three sections:

- **LINK1**: The retention modules in this section are unidirectional and can support link width upto x16. One direction of lanes 0...15 is routed to each retention module supporting upto x16. Using N4241A midbus probe here will display only upstreams or downstreams lanes on the I/O module. To view lanes in both directions, use the N4242A midbus probe.
- **LINK2**: The retention module and PCIe connector in this section is used for loopback, wherein one PCIe card transmits packets as well as receives its own transmitted packets. Here, the midbus probe in the retention module captures the traffic flowing through loopback.
- **LINK3**: The retention modules in this section are bidirectional and can support upto x8 link width. Both directions of lanes 0...7 are routed to one retention module, and lanes 8...15 to the other. Using a N4241A midbus probe, you can capture upto x8 link width on one retention module.

NOTE Lanes and directions are printed on the N5316A backplane board as well.

The main application of this board is in testing an add-in card, such as a LAN or graphic card, using an exerciser card and a midbus probe. In this case, you plug the exerciser card into one PCIe connector and the add-in card into the other PCIe connector. Then, you plug the midbus probe into one of the retention module between the add- in and exerciser cards. This enables you to capture and analyze the traffic flowing between the add-in and exerciser cards.

- Five *REFCLK connectors* (reference clock connector), one for each PCIe connector. You use these connectors when you want to supply external clock feed to the PCIe connectors. In this situation, you use the Y- cable, whose tail is plugged into the external clock source and two heads into the two REFCLK connectors.
- Two *fan connectors* for the exhausts that you can use to keep the temperature of the board under control.

NOTE For information on midbus probe, refer to *Agilent Midbus 2.0, User's Guide* and *Agilent System Protocol Tester, Installation Guide*.

NOTE For information on setting up the metal sheet and exerciser card, refer to *Agilent System Protocol Tester, Installation Guide*.

Figure 26 shows some more components of the N5316A test backplane board for PCIe 5 Gb/s.

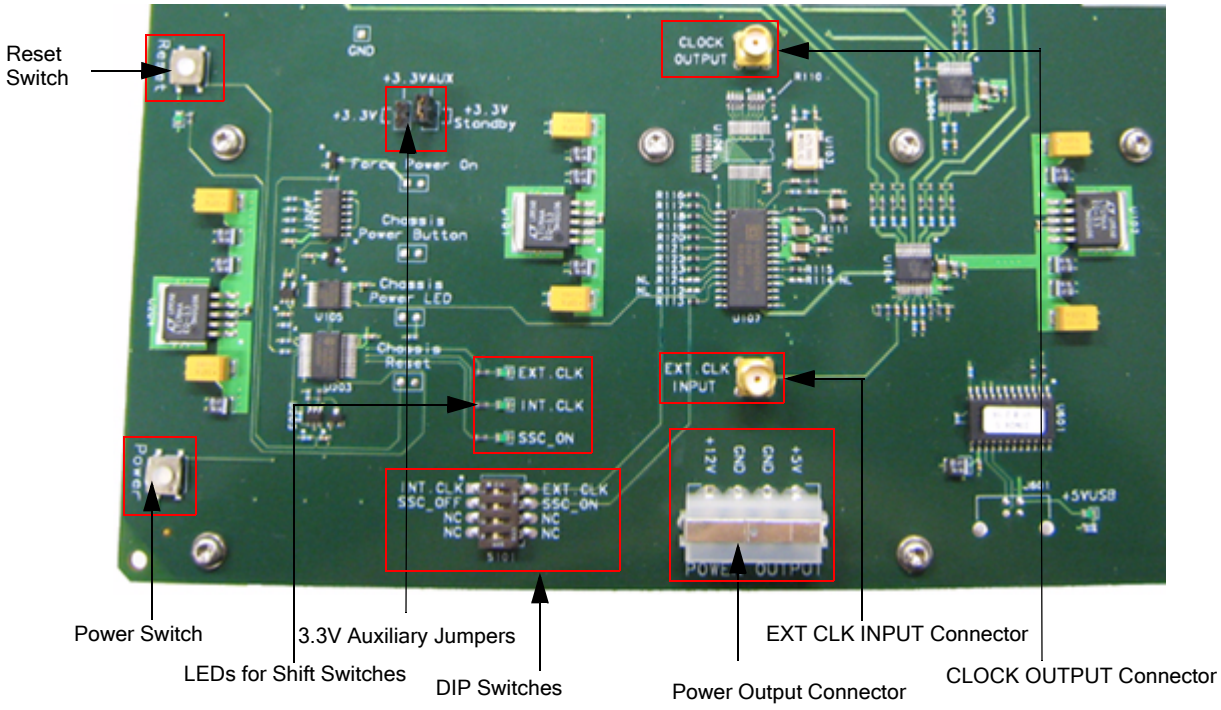


Figure 26 N5316A Backplane Board

As shown in Figure 26, the N5316A backplane board has:

- A *power switch*, which is used to switch off and on the power supply to the circuits of the board.

  This power switch is given in addition to the main power switch of the board. Therefore, switching *ON* the main power switch is a *prerequesite* to start using the backplane board.
- A *reset switch*, which resets all the circuits of the board.
- Four *DIP switches*:
  - One to choose between internal and external clock (*INT CLK* and *EXT CLK*).

  - One to choose between disabling and enabling SSC (*SSC_OFF* and *SSC_ON*).
  - The other two switches are not connected to the board.
- The following LEDs to show the status of above mentioned switches:
  - **EXT CLK**: It glows when the external clock is enabled.
  - **INT CLK**: It glows when the internal clock is enabled.
  - **SSC_ON**: It glows when you shift the above mentioned switch towards the SSC_ON label.
- A *CLOCK OUTPUT* connector, which provides a clock feed to an external device. You generally use this component when you want to synchronize an external device with the clock cycle of the backplane board.

  The specifications of CLOCK OUTPUT connector are:
  - *Terminate into 50 Ohm*
  - *Level: Approximately 800mVpp*
- A *EXT CLK INPUT* connector, which is used to receive a clock feed for the backplane board from an external device. You generally use this component when you want to synchronize the backplane board with the clock cycle of an external device.

  The specifications of EXT CLK INTPUT connector are:
  - *AC coupled*
  - *Level: Approximately 800mVpp*
- A *power output* connector, which has four pins: one +5V, one +12V, and two GND. Use these pins judicially to power-up an external module.
- Two *3.3V auxiliary jumpers*:
  - 3.3V is directly connected to the power switch, which means it turns on when you press the power switch.
  - 3.3V Standby is powered on as soon as the board is powered on by the main switch.

WARNING **Do not directly touch any component on the N5316A backplane board. It may be hot.**

CAUTION Components on the N5316A backplane board are sensitive to the static electricity. Therefore, take necessary anti-static precautions, such as wear a grounded wrist strap, to minimize the possibility of electrostatic damage.

CAUTION During normal operations, N5316A operates safely. Nevertheless, the circuits of 3.3V and 12V on PCI Express connectors and 5V on the Power Output connector are not limited and may provide currents higher than 8A. In case of failure, for example short circuit, such a circuit presents the risk of causing fire. Therefore, to limit the energy and avoid damage, we urgently recommend implementing one of the following preventive measures:

1. Limit the circuits of your product under test with a 4A IEC fuse (5A UL fuse) at the input.

2. Operate the N5316A in a fire enclosure.

Table of electrical specification is given below:

U⎓ Output	**Imax Output**
+3.3V	28A
+5V	42A
+12V	22A

11
N5328A Half Size Midbus Probe

This chapter provides information on the N5328A half size midbus probe used for PCIe.

N5328A Half Size Midbus Probe

There are situations when the space constraints in a board's design prevent having a full sized probe to capture and debug signals. In such situations, the customer compromises and creates a half sized foot print instead. For such situations, Agilent provides the N5328A half size midbus probe, which you can connect to the smaller foot prints to capture the traffic.

The N5328A half size midbus probe supports two different footprints: *straight* and *alternate*.

Figure 27 shows the N5328A half size midbus probe cable.

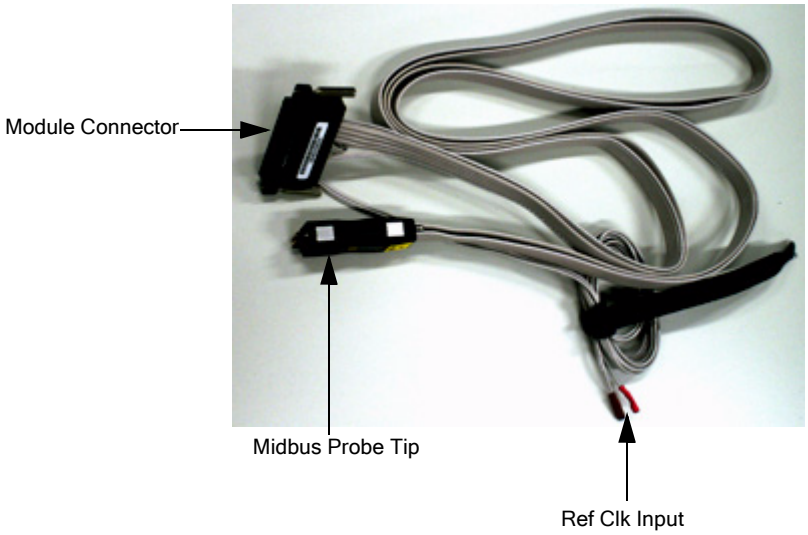


Figure 27 N5328A Half Size Midbus Probe

Components shown in Figure 27 are described below:

- **Module Connector**: This component connects to the *Analyzer Probe* component of the N5306A I/O module.

  For information on N5306A I/O module, refer to *Chapter 2*, N5306A I/O Module.

- **Midbus Probe Tip**: This component connects to half size foot print on the board. Figure 28 shows the midbus probe tip plugged into the retention module for the half size foot print on the backplane board.

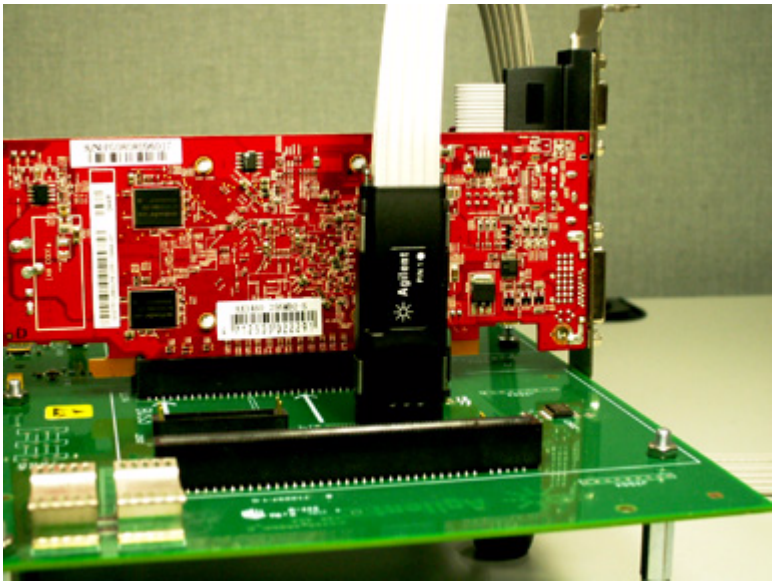


Figure 28 Connecting Midbus Probe Tip

NOTE For information on retention modules, refer to Chapter 10, N5316A Backplane Board for PCIe.

Setting Up the Probe

To setup the probe cable:

1. Solder and secure the retention module on DUT from two sides of the midbus probe footprint.
2. Connect **Module Connector** of the probe cable into the **Analyzer Probe** slot on the N5306A I/O module.
3. Plug the midbus probe **Tip** into the retention module on the backplane board.

   To do this:

   a. Align the *PIN 1* label (adjacent to the *white bullet*) on the probe with the PIN 1 label on the layout board.

   b. Slide the midbus probe Tip into the retention module and gently tighten the thumbscrews located at the top of the midbus probe Tip. The thumbscrews should be tightened to a snug fit, but do not over tighten. If needed, you can use a screwdriver to ensure a secure connection.

4 Do the following if you need to supply an external reference clock to Protocol Analyzer:

- Connect the **Ref Clk Input** cables to the reference clock header of the target board.

Footprint Pinout of the Probe

Table 7 shows the pinout arrangement for the straight half size midbus probe footprint.

Table 7 Footprint pinout for straight half size midbus probe

Pin #	Signal Name	Pin #	Signal Name
		G1	GND
2	GND	1	C0p - Upstream
4	C0p - Downstream	3	C0n - Upstream
6	C0n - Downstream	5	GND
8	GND	7	C1p - Upstream
10	C1p - Downstream	9	C1n - Upstream
12	C1n - Downstream	11	GND
14	GND	13	C2p - Upstream
16	C2p - Downstream	15	C2n - Upstream
18	C2n - Downstream	17	GND
20	GND	19	C3p - Upstream
22	C3p - Downstream	21	C3n - Upstream
24	C3n - Downstream	23	GND
G2	GND		

Table 8 shows the pinout arrangement for the alternate half size midbus problem footprint.

Table 8 Footprint pinout for alternate half size midbus probe

Pin #	Signal Name	Pin #	Signal Name
		G1	GND
2	GND	1	C0p - Upstream
4	C1p - Upstream	3	C0n - Upstream

Table 8 Footprint pinout for alternate half size midbus probe

Pin #	Signal Name	Pin #	Signal Name
6	C1n - Upstream	5	GND
8	GND	7	C2p - Upstream
10	C3p - Upstream	9	C2n - Upstream
12	C3n - Upstream	11	GND
14	GND	13	C0p - Downstream
16	C1p - Downstream	15	C0n - Downstream
18	C1n - Downstream	17	GND
20	GND	19	C2p - Downstream
22	C3p - Downstream	21	C2n - Downstream
24	C3n - Downstream	23	GND
G2	GND		

Mechanical Dimensions

Please ensure the following pre- requisites are met for the design:

- Solder mask must not extend above the pad height for a distance of .005 inches from the pad.
- Via- in- pad is allowed if the vias are filled level with the pad or the via hole size is less that .005 inches.
- Permissible surface finishes on pads are HASL, immersion silver, or gold over nickel. The height of the pads contacted by the probe must be within +/- .007 inches of the bottom surface of the retention module.

The half size midbus probe footprint that needs to be designed into the target board can be observed in Figure 29. The figure displays the detailed layout dimensions for the footprint. Notice that the half size midbus probe softouch connector has 26 pins, but figure shows only 24 pins.

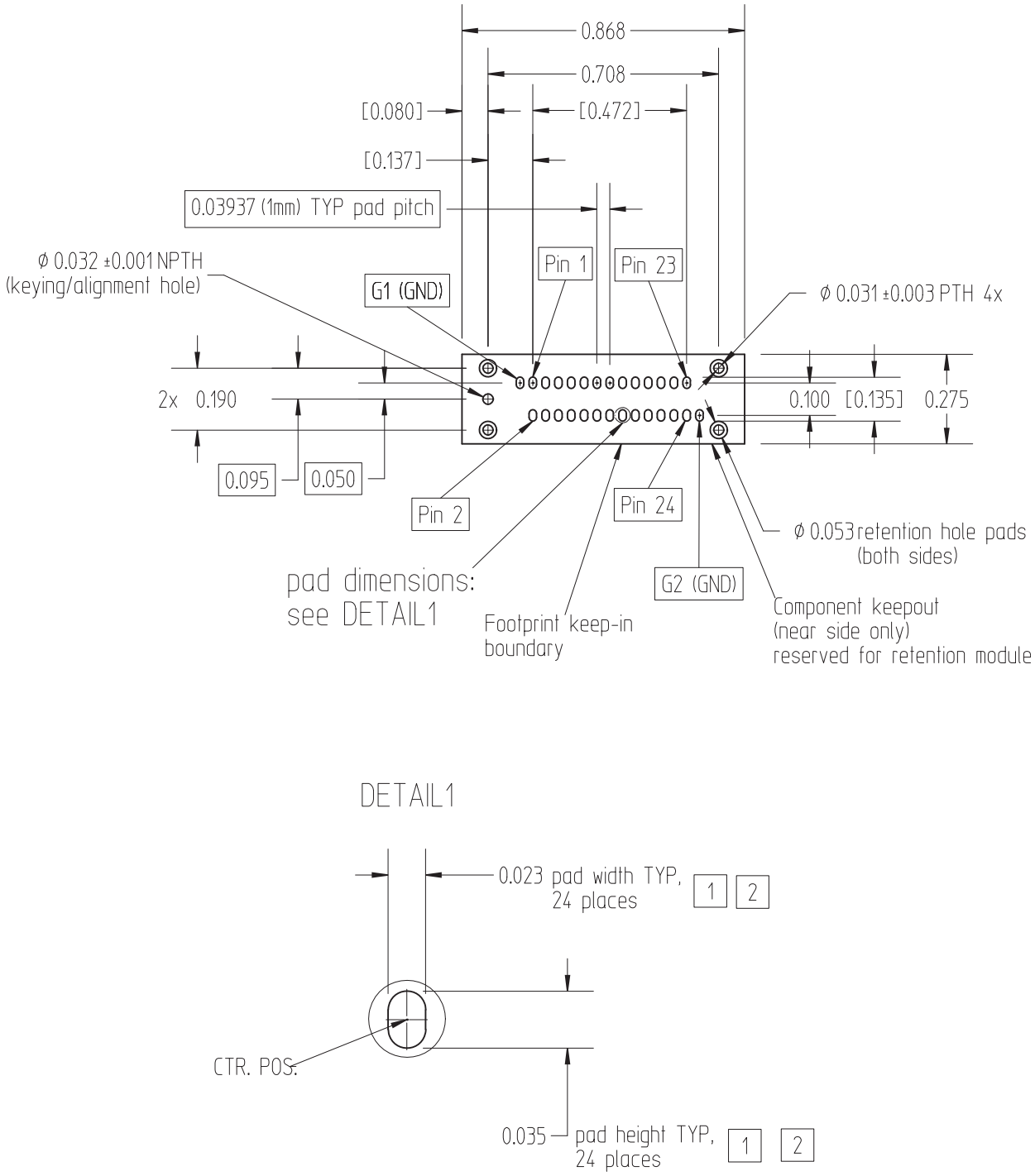


Figure 29 Dimensions of N5328A

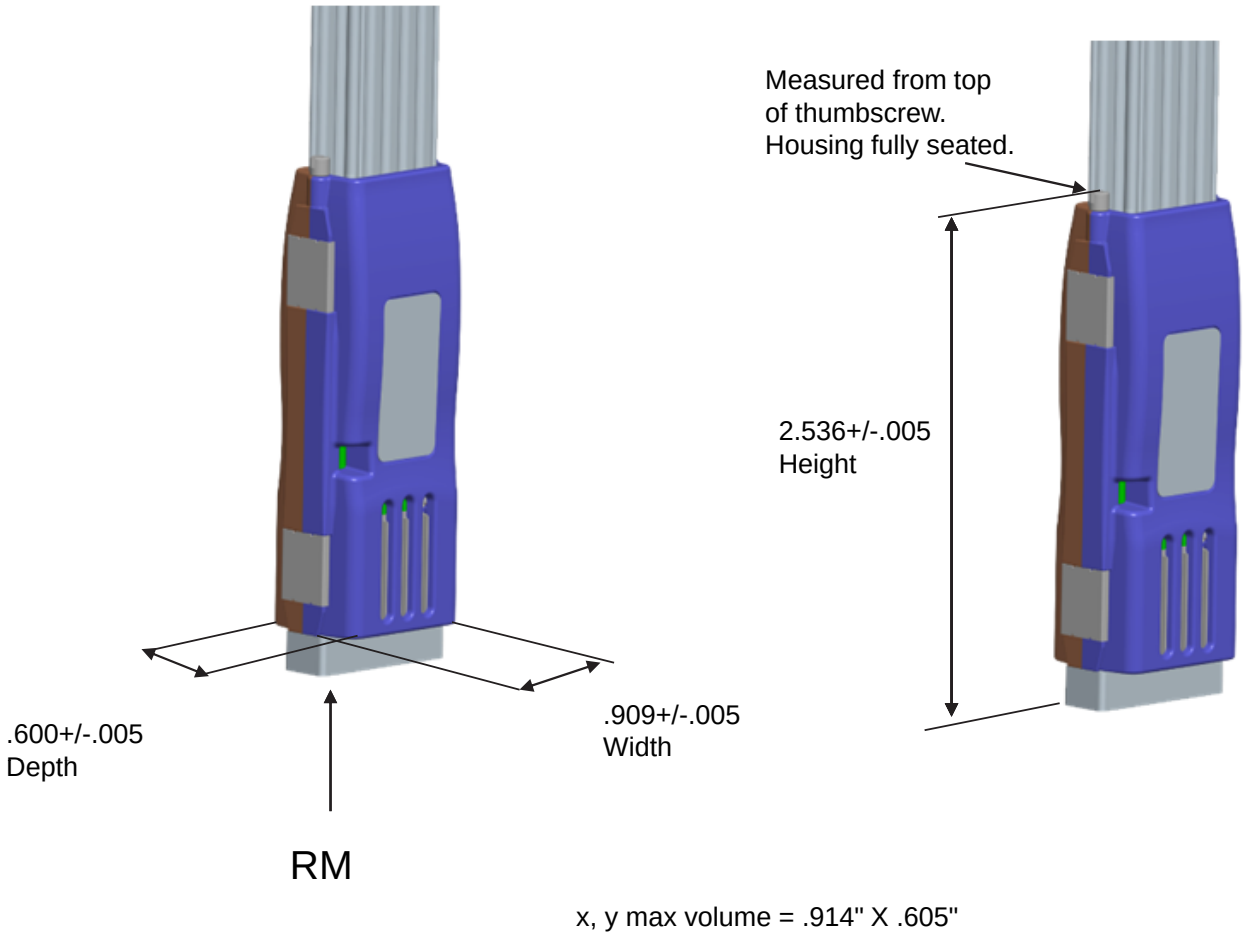


Figure 30 Half size midbus keepout volume

Electrical Characteristics

Logical probing of the PCI Express bus is achieved through tapping a small amount of energy off the probed signals and channelling this energy to the logic analyzer. In order to avoid excessive loading conditions, the use of tip resistors, or isolation resistors, is employed. These relatively high impedance tip resistors enable the logic analyzer to sample bus traffic without significantly loading the probed signals. A high-level block diagram of a generic PCI Express bus with a logic analyzer interface is given in Figure 31. Note that this would be repeated for each differential pair within a PCI Express link.

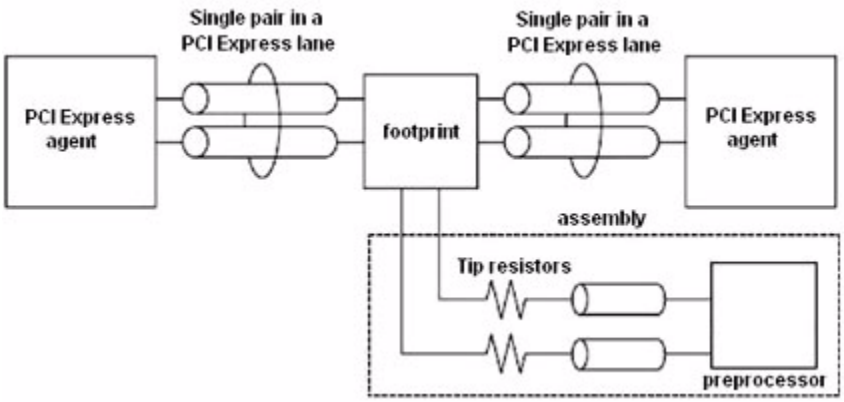


Figure 31 Generic PCI Express bus with Protocol Analyzer

Midbus placement within system topology

For analyzer to reliably capture logical transactions on the bus, adequate signal eye must be made available to the midbus. It is incumbent upon the platform designers to ensure that sufficient signal eye is available to the midbus while the midbus load is in place so that proper signal capture can be performed. This must be verified via electrical simulation utilizing the load model provided in Figure 33.

The eye requirements are measured by eye height and eye width, forming a diamond shape. These requirements are described pictorially in Figure 32.

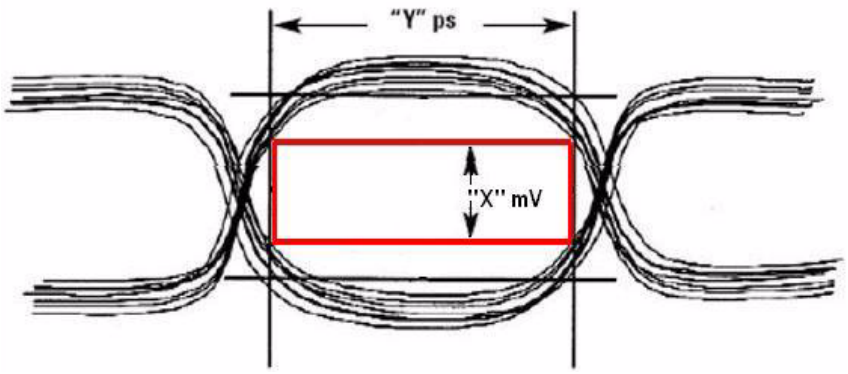


Figure 32 Example of eye specifications as seen at the midbus pad

Table 9 details the specific eye requirements for Agilent Technologies. Address questions to Agilent Technologies for the most current eye requirements.

Table 9 PCI Express midbus footprint placement interconnect specification

	Agilent Technologies Specification
Min. eye height at midbus pad[1]	60 mV
Min. eye width at midbus pad	0.6 UI (120 ps at midbus footprint), i.e. Jitter tolerance of 0.4 UI
Length matching requirements of the P/N sides of the differential pairs[2]	±5 mil
Length matching requirements -pair to pair	same as PCI Express specification

1 Measured in differential units, e.g. Vppdiff = |2*(Vp – Vn)|

2 Interconnect must length match ±5 mils from source to midbus footprint pad for each polarity of the differential pair

The eye characteristics given in Table 9 must be maintained for all probed channels, regardless of direction. Overall, these midbus placement specifications limit the electrical distance between the driver pin and the midbus attach point. Conceivably, probing both directions in lanes of a long PCI Express link may require two separate footprints and midbus assemblies, while probing both directions of relatively short links may be accomplished with one midbus. Regardless of implementation, refer to usage restrictions as listed in the “Overview and Configuration Support” section. The same midbus eye requirements exist for all links substrates (e.g. FR4, cables, etc).

An additional constraint on midbus footprint placement involves the relative location of the AC coupling capacitors. The capacitors may be placed either between the driver and midbus, or between the midbus and receiver, as long as both capacitors of a differential pair are placed in the same fashion. Other pairs within a link do not need to maintain this capacitor placement configuration.

Load Model

The Agilent Technologies load model for the midbus is given in Figure 33. This model is subject to change. For the most current models, it is recommended that the platform designer contact Agilent Technologies directly.

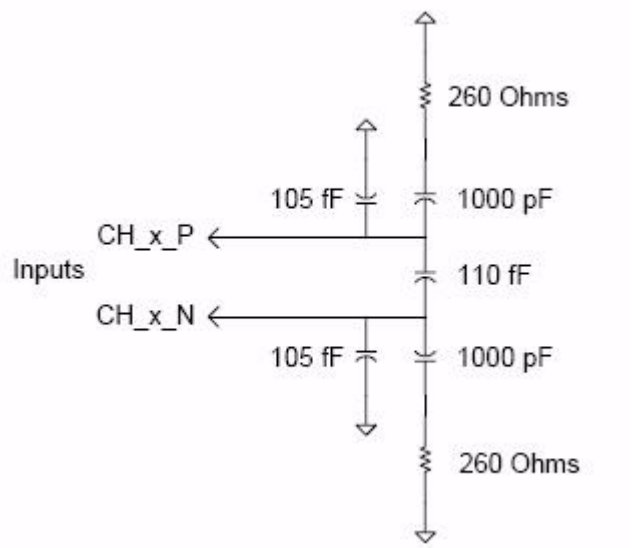


Figure 33 Load model for midbus probe

Reference Clock

Mechanical Design

A 3-pin header (1 by 3, 0.05 inch center spacing) will provide the connection for reference clock to the midbus. A small high impedance clock probe will connect to this header to the midbus. Note that an individual reference lock header is required for each PCI Express clock domain on the system.

The following are recommended part numbers for through-hole and surface mount versions of the 3-pin header for reference clock:

- Through-hole:

Samtec* TMS-103-02-S-S

- Surface mount:

Samtec* FTR-103-02-S-S

* The probe can be plugged onto the pin header in either orientation.

Table 10 Reference clock header pinout

Signal	Pin Number
REFCLKp	1 (or 3)*

Table 10 Reference clock header pinout

Signal	Pin Number
GND or N/C	2
REFCLKn	3 (or 1)*

Reference clock probe keep-out volume Keep-out volumes for the reference clock probes are given in Figure 11. The pin headers reside symmetrically within the keep-out volume on the target system. For more specific information on keep-out volumes for particular solutions please contact Agilent Technologies.

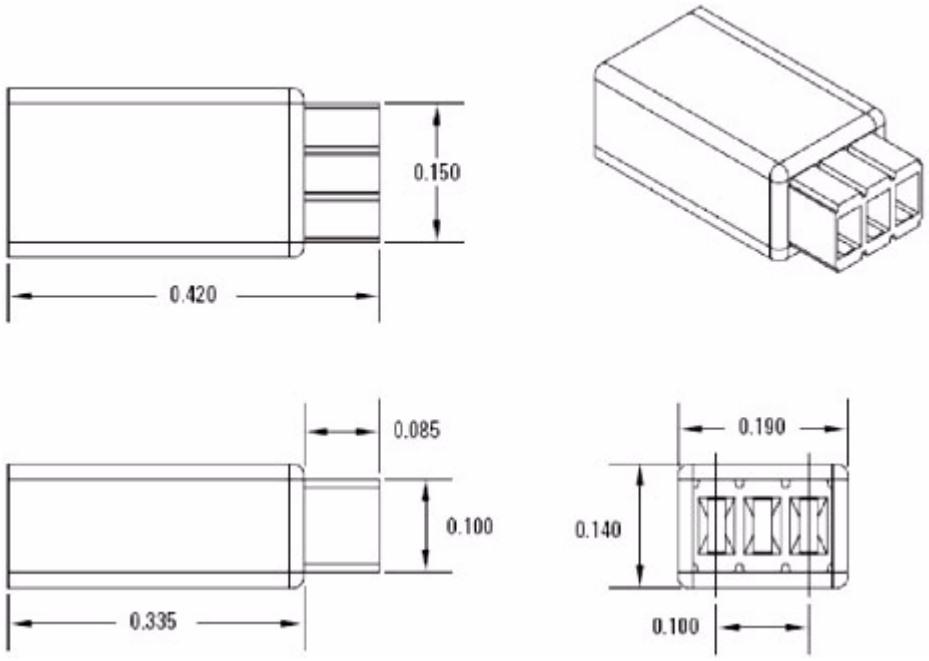


Figure 34 Reference clock probe keep-out volume

Electrical Properties

Table 11 Midbus reference clock electrical requirements

Midbus Requirement	Symbol	Min.	Max.	Comments
Differential voltage at ref clock attach point	Vppdiff	0.8 V	2V	Vppdiff = |2*(Vrefclockp – Vrefclockn)|

Table 11 Midbus reference clock electrical requirements

Midbus Requirement	Symbol	Min.	Max.	Comments
Reference clock frequency without SSC	f	100 MHz -300 ppm	100 MHz +300 ppm	
Reference clock frequency with SSC	f	100 MHz -0.5%	100 MHz +0%	

If reference clock tolerance is less than ±300 ppm, there is no need for providing reference to the midbus. If the reference clock tolerance is greater than ±300 ppm, there is a need for providing reference (SSC) to the midbus.

Midbus reference clock probe load model Load models for the reference clock probe are given in this section. System designers will be expected to perform simulations of the reference clock networks with the header and midbus load models to ensure good signal integrity of the reference clocks at the header to the midbus. The pin header parasitics may be obtained from the connector vendor.

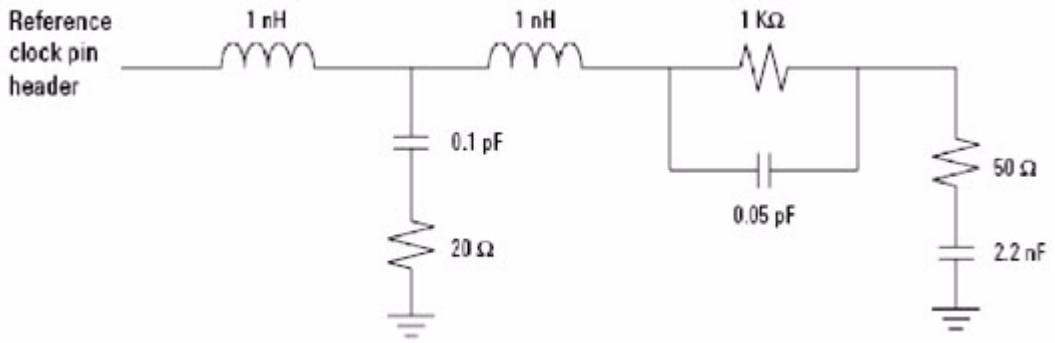


Figure 35 Reference clock probe load model

WARNING **Do not directly touch any component on the N5328A half size midbus probe. It may be hot.**

CAUTION Components on the N5328A half size midbus probe are sensitive to the static electricity. Therefore, take necessary anti-static precautions, such as wear a grounded wrist strap, to minimize the possibility of electrostatic damage.

12
N4241F Flying Lead Probe

This chapter provides information on the N4241F flying lead probe used for PCIe.

N4241F Flying Lead Probe

The *N4241F flying lead probe* is a probing solution for the N5306A I/O module, which you can use in situations where it is difficult to use midbus probes and solid slot interposer cards.

The N4241F flying lead probe allows probing of individual lanes, regardless of where they are routed. This eliminates the need to have signals routed to one probing point.

NOTE

For information on solid slot interposer, refer to *Chapter 9*, "N5315 Solid Slot Interposer Card.

For information on midbus probe, refer to *Agilent Soft Touch Midbus Probe 2.0, User's Guide*.

Figure 36 shows the N4241F flying lead cable set for x8 PCIe.

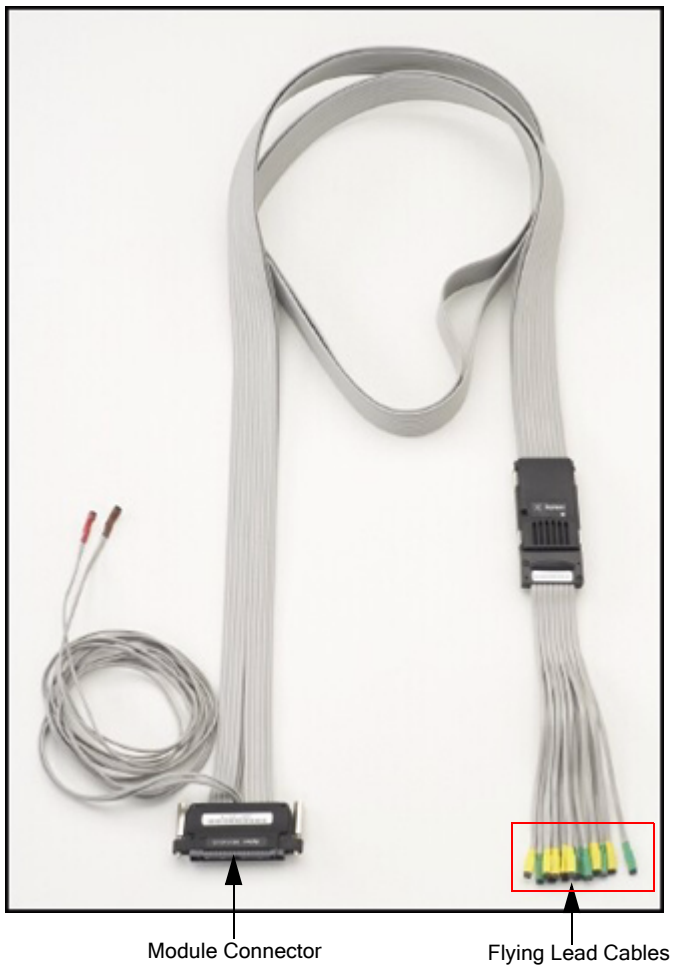


Figure 36 N4241F Flying Lead Probe

Components shown in Figure 36 are described below:

- **Module Connector**: This component connects to the *Analyzer Probe* component of the N5306A I/O module.

  For information on N5306A I/O module, refer to *Chapter 2*, "N5306A I/O Module.

- **Flying Lead Cables**: This component connects to DUT. There are 16 flying lead cables that you can use to connect to DUT via *resistors* (Figure 37).

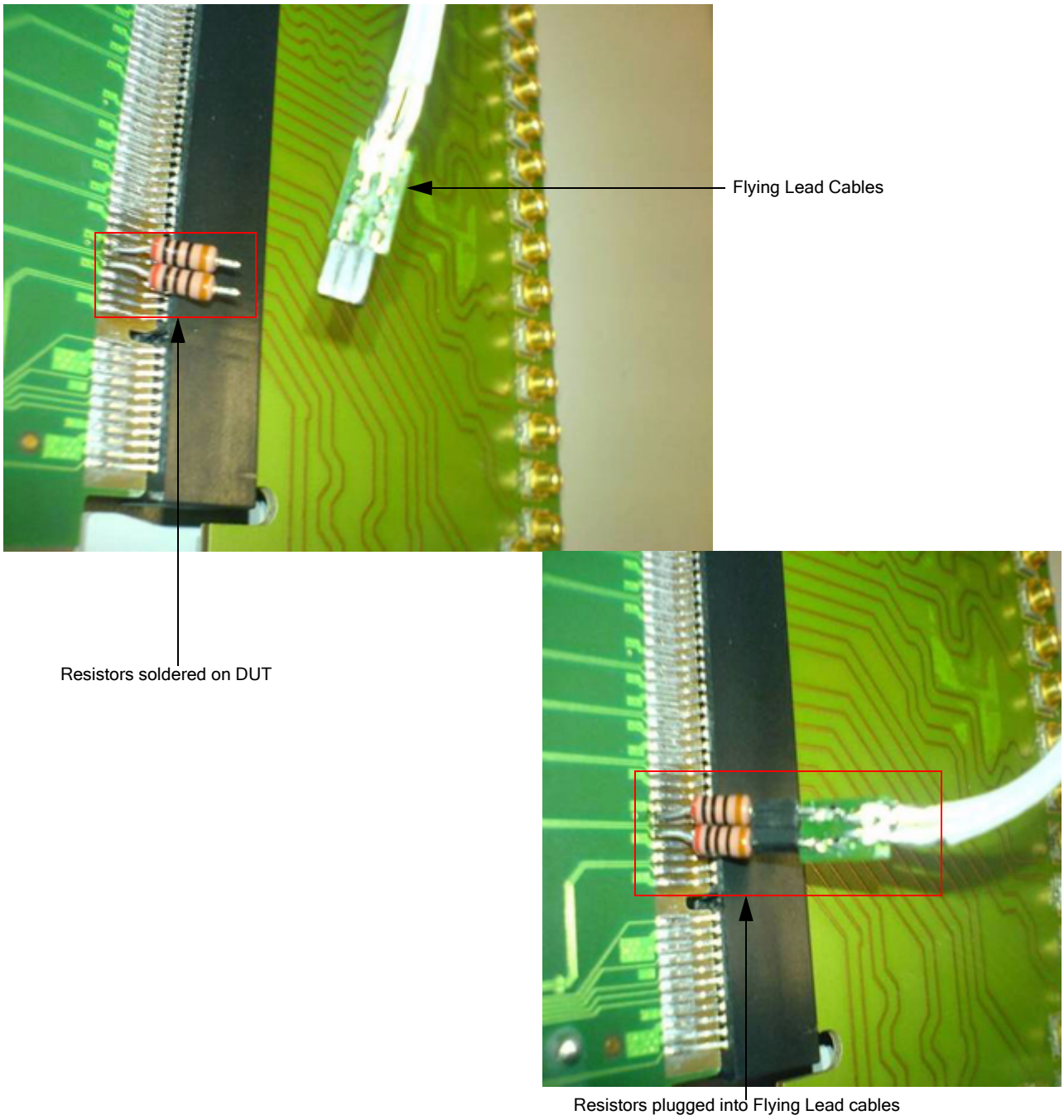


Figure 37 Flying Lead Cables using Resistors to connect with DUT

As shown in Figure 37, the one end of resistors is first soldered onto DUT, and the other end is plugged into the flying lead cables.

NOTE You can also solder resistors directly to the traces on the board. However, you should do this very carefully or these traces may get broken while soldering or releasing resistors.

Resistor Dimensions

Figure 38 shows the dimensions of the resistors (E5381-82101 Flying Leads Resistor Kit), which you will be getting with the flying lead cables.

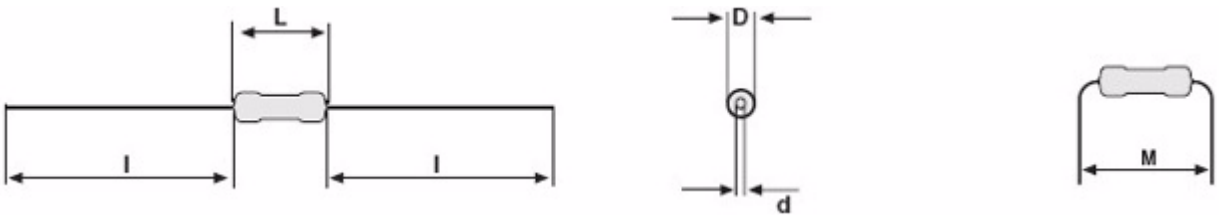


Figure 38 Dimensions of the resistors

NOTE You can purchase more resistor kits from Agilent Parts Direct using its part number.

Table 12 provides measurements of the resistor dimensions.

Table 12 Measurements of the resistor dimensions

Dimension Type	Measurement
$D_{max.}$	1.6 mm
$L_{max.}$	3.6 mm
$d_{nom.}$	0.5 mm
$l_{min.}$	29.0 mm
$M_{min.}$	5.0 mm
MASS	125 mg

As given in Table 12, the diameter of the resistor ends ($d_{nom.}$) is 0.5 mm. Therefore, the eye diameter on DUT, to which the one end of the resistor is soldered, should be 0.6 mm to properly hold the resistor. The other end of the resistor, which is plugged into the flying lead cables, should

be short enough to avoid it from bending. Additionally, the distance between the eyes on a DUT should be large enough to avoid any contact between adjacently soldered resistors.

The diagram and the highlighted part in Figure 39 shows how you should be connecting resistors with eyes on DUT and flying lead cables.

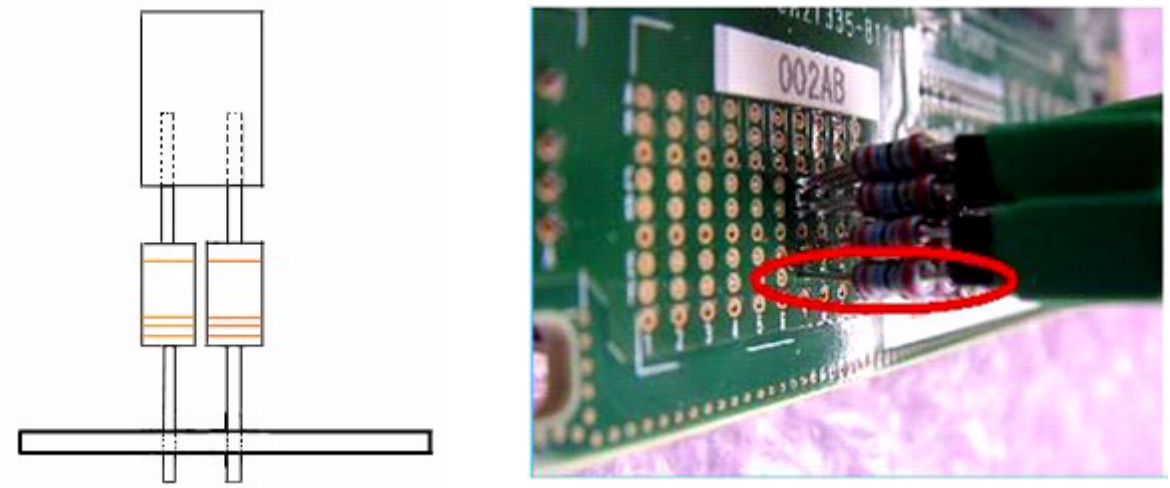


Figure 39 Resistors connecting with eyes and Flying Lead Cables

Lane Mapping

Table 13 provides the lane mapping information of the flying lead cables.

Table 13 Lane Mapping for N4241 Flying Lead Cables

Probe Label	x8 configuration with one N5306A module		x16 configuration with two N5306A modules
A0	upstream	Lane 0	Lane 0
A1	upstream	Lane 1	Lane 2
A2	upstream	Lane 2	Lane 4
A3	upstream	Lane 3	Lane 6
A4	upstream	Lane 4	Lane 8
A5	upstream	Lane 5	Lane 10
A6	upstream	Lane 6	Lane 12
A7	upstream	Lane 7	Lane 14
B0	downstream	Lane 0	Lane 1

Table 13 Lane Mapping for N4241 Flying Lead Cables

Probe Label	x8 configuration with one N5306A module		x16 configuration with two N5306A modules
B1	downstream	Lane 1	Lane 3
B2	downstream	Lane 2	Lane 5
B3	downstream	Lane 3	Lane 7
B4	downstream	Lane 4	Lane 9
B5	downstream	Lane 5	Lane 11
B6	downstream	Lane 6	Lane 13
B7	downstream	Lane 7	Lane 15

Importing Points About Using N4241F

The following list provides more information about the N4241F flying lead probe:

- Its length is 60 inches (152.4 cm), and the length of its flying lead cables is 5.9 inches (15 cm).
- It supports 2.5 Gb/s and 5 Gb/s operation.
- It has input resistance of 297 Ohms.

  215 Ohms from internal tip resistor in series with 82 Ohms from external resistor.
- It allows probing of individual lanes, regardless of where they are routed. This eliminates the need to have signals routed to one probing point.
- It uses solder-on resistors for reference clock connections.
- Probe as close as possible to the receiver on the link.
- When soldering resistors, keep the channel side of the resistor as short as possible, as it will act as a stub and create reflection. However, the length of the probing resistors should match by +/-1 mm.
- Make sure that all resistors that are used to probe the channels on one direction of a PCIe link are placed in the same relative places. Symmetry between the two paired resistors is very important.

NOTE For more information on N4241F and its electrical characteristics, refer to the *Agilent E2960B Series for PCI EXPRESS 2.0* data sheet.

WARNING **Do not directly touch any component on the N4241F flying lead cable set. It may be hot.**

CAUTION Components on the N4241F flying lead cable set are sensitive to the static electricity. Therefore, take necessary anti-static precautions, such as wear a grounded wrist strap, to minimize the possibility of electrostatic damage.

13
Probe Board

This chapter provides information on both, active and passive probe boards, which are designed to fit with the E2960 series of products.

Overview

In this section, you will learn about:

- Slot/Interposer probe boards for PCI Express for Exerciser and/or Analyzer
- Passive probe boards for PCI Express for Analyzer only

Slot/Interposer probe boards for PCI Express for Exerciser and/or Analyzer

The Slot/Interposer probe board exists in three different variations to accommodate different link widths. This active probe can be used to connect an Exerciser or Analyzer to a system or device under test.

The E2942A Single Probe Y-Cable can only be used with this active probe.

- E2938A: Probe board for PCI Express x1, for link widths up to x1.
- E2939A: Probe board for PCI Express x4, for link widths up to x4.
- E2968A: Probe board for PCI Express x8, for link widths up to x8.

Passive probe boards for PCI Express for Analyzer only

The Passive probe board exists in three different variations to accommodate different link widths. This probes works as non-intrusive slot interposer for the Analyzer.

- E2945A: Passive probe board for PCI Express x1, for link widths up to x1.
- E2946A: Passive probe board for PCI Express x4, for link widths up to x4.
- E2947A: Passive probe board for PCI Express x8, for link widths up to x8.

All variations have a x16 straddle mount connector on top to accommodate add-in cards having slot connectors of any width up to x16.

NOTE Please note that the Probe Board Type determines the maximum link width, regardless of the connector width of the add-in card ("DUT").

About Active Probe Boards

In this section, you will learn:

- Setting Up an Active Probe Board
- Powering DUT
- Understanding External Interface
- Understanding the Mechanical Dimensions of an Active Probe Board

Setting Up an Active Probe Board

The probe board installation depends on the use case that you intend:

- Exerciser To Upstream
- Exerciser To Downstream
- Analyzer

Exerciser To Upstream

In this case, Protocol Exerciser acts as end-node or upstream port of a switch to a system or switch (Figure 40).

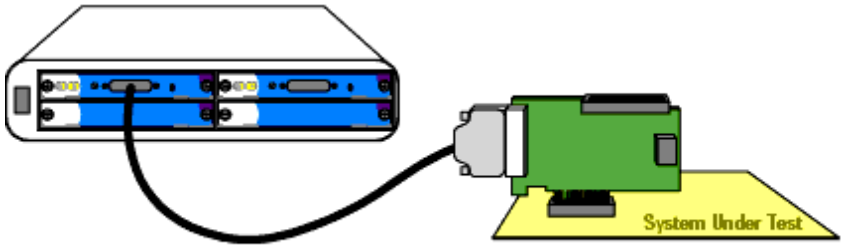


Figure 40 Exerciser to Upstream

To set up Exerciser to Upstream:

1. Plug the probe board into the PCI Express slot on your system or motherboard under test.
2. If the motherboard has a chassis, firmly screw the metal bracket of the probe board to the chassis.
3. Connect the black I/O cable to the probe board and to the I/O module and fasten the screws tightly.
4. Power up DUT.

Now you can start Protocol Exerciser session (To Upstream) using API or GUI.

The probe board is powered from the I/O Module and will only draw minimal power from the slot.

The power indication LED's on the upper left corner shows the power state of the system.

NOTE For information powering up DUT for passive probe board, refer to Powering DUT on page 94.

NOTE See separate instructions when using the E2942A Y-Cable

Exerciser To Downstream

In this case, the exerciser acts as downstream port of a switch or as root complex to an add-in card (Figure 41).

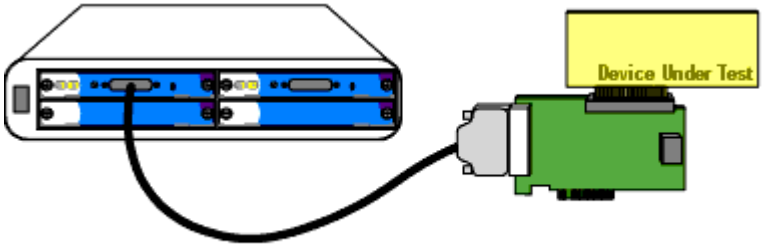


Figure 41 Exerciser to Downstream

To set up Exerciser to Downstream:

1. Place the probe board loosely on an ESD protected table, or plug it into a passive backplane. Plug the add-in card into the straddle-mount DUT connector on top of the probe board.
2. Connect the black I/O cable to the probe board and to the I/O module, and fasten the screws tightly.
3. The probe board is powered from the I/O module. To power the DUT you can either use power from a passive backplane, through the system connector, or using the external power connector. For more details see Powering

the DUT. The power indication LED's on the upper left corner will show the power state of the DUT.

4 Power up DUT.

Now you can start the exerciser session (To Downstream) from the API or from the GUI.

NOTE See separate instructions when using the E2942A Y-Cable.

Analyzer

In this case, the DUT is connected through the probe board to a system, and Analyzer monitors the traffic between the to devices (Figure 42).

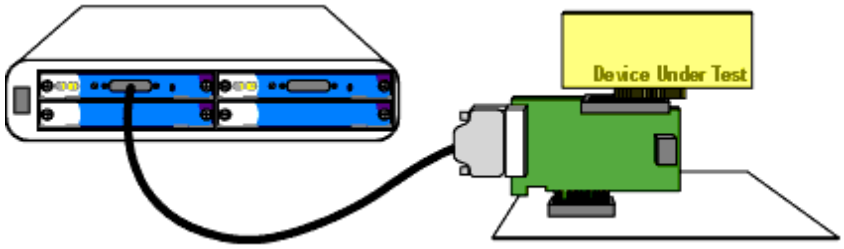


Figure 42 Analyzer to DUT

To set up Analyzer to Device Under Test:

1 Plug the probe board into the PCI Express slot on your system or motherboard. If the motherboard has a chassis firmly screw the metal bracket of the probe board to the chassis.

2 Plug the add-in card into the straddle-mount DUT connector on top of the probe board.

3 Connect the black I/O cable to the probe board and to the I/O module, and fasten the screws tightly.

4 The probe board is powered from the I/O module. To power the DUT you can either use power from the system, through the system connector, or use the external power connector.

For more details see Powering the DUT. The power indication LED's on the upper left corner will show the power state of the DUT and the system.

5 Now you can start the analyzer session from the API or from the GUI.

WARNING **Do not directly touch any component on the I/O module. Also, if you are using the E2968A probe board, then please do not touch the surface of the board. It may be hot.**

CAUTION Components on the I/O module are sensitive to the static electricity. Therefore, take necessary anti-static precautions, such as wear a grounded wrist strap, to minimize the possibility of electrostatic damage. Also, you should not operate a chassis with empty slots. Fill empty slots with blanking plates to ensure correct operation of the chassis.

Powering DUT

The probe boards offers two choices for providing power to the straddle-mount slot on top.

DUTs can be powered:

- Using System Power
- Using External Power

Using System Power

Place all three power jumpers into the top positions. This will route power from the system connector to the DUT connector on all power rails: 3.3V, 3.3V aux, and 12V. The power LED's will indicate both system and DUT power states.

Power for the logic on the probe board itself comes from the I/O module through the black I/O cable. Therefore the additional load on the system when using the probe board is minimal compared to plugging the DUT directly into the system.

Using External Power

Place all three power jumpers into the lower positions. This will route power from the external power connectors to the DUT connector. On-board DC/DC converters will translate

the externally provided 12V to the required power rails: 3.3V, 3.3V aux. The 12V rail is directly fed from the external connector.

The external power connector is a standard hard-drive connector, as found in standard PCs, and provided by standard AT(X) power supplies.

Understanding External Interface

Figure 43 shows all external interfaces of the Probe Board.

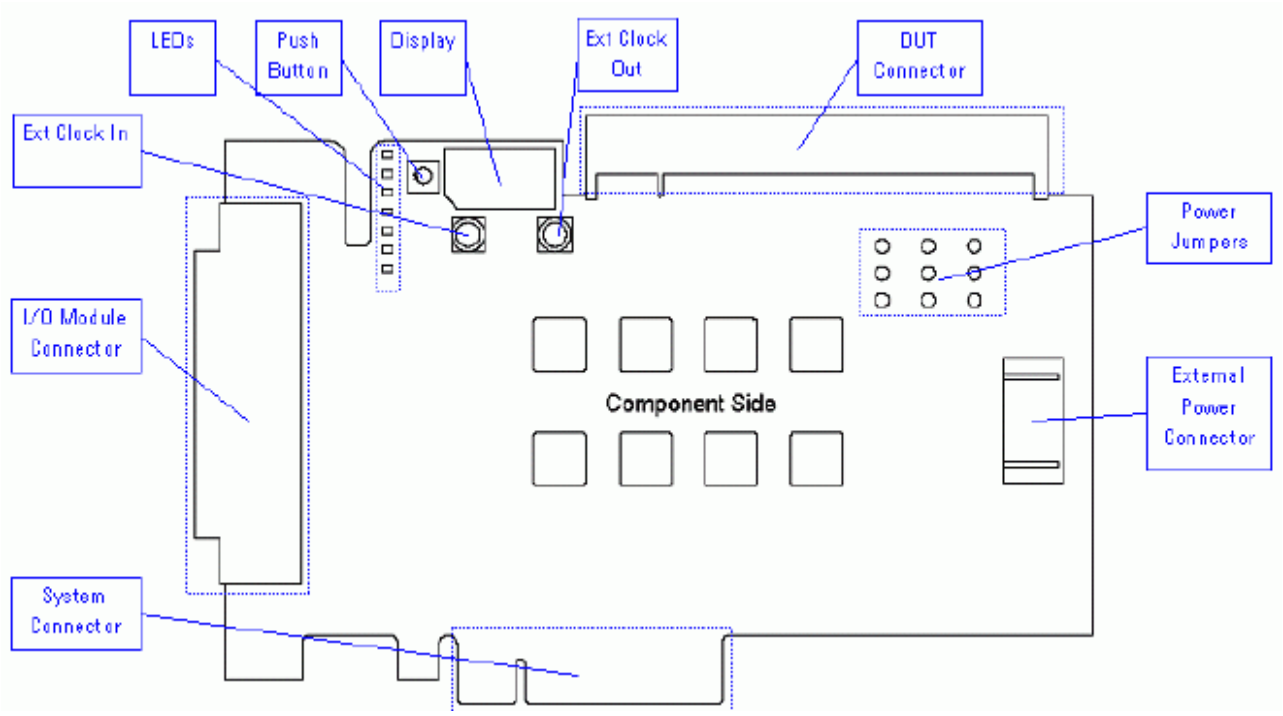


Figure 43 External Interfaces of the Probe Board

Table 14 provides a brief description of these external interfaces.

Table 14 External Interfaces of the Probe Board

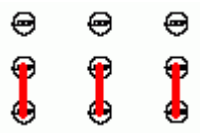
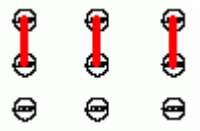
Interface	Description	Specification
External Clock In	Provide a reference clock to the I/O modules and DUT. If there is "Exerciser to Downstream" and the external clock is enabled, the external clock must be applied using this connector.	Single-Ended ECL Amplitude: 0.8V p-p Level: ± 4.5V max Frequency: 50MHz – 100MHz (multiplied by 25 for serial transmission speed)
External Clock Out	Provides the user with the reference clock as used by the I/O module and DUT.	Single Ended ECL Amplitude 0.7V Level ± 0.35V
LED	6 LEDs indicating the power states of system and DUT. LEDs as seen top-to-bottom. LEDs will light if corresponding voltage is available.	• System: 3.3V Aux • System: 12V • System: 3.3V • DUT: 3.3V Aux • DUT: 12V • DUT: 12V • reserved
Push Button	The push button is not used at this time.	
DUT Connector	Provides a x16 slot connector for the DUT.	Defined like the slot connector in "PCI Express™ Card Electromechanical Specification, Revision 1.0a, April 15, 2003". Depending on the probe board type, only x1,x4, or x8 lanes are connected.
Power Jumpers	To switch power supply for the DUT plugged into the DUT connector: • **External Power**: Connect ATX power supply to "External Power Connector". • **System Power**: Power for DUT is provided by system.	 

Table 14 External Interfaces of the Probe Board

Interface	Description	Specification
External Power Connector	Connect an AT-hard-drive power connector, as provided by a standard AT(X) power supply. The probe board uses only the 12V at the connector, 5V is unconnected.	Power consumption: Max 2.3A total at 12V at external power connector. Provides max 3A for 3.3V, 0.5A for 3.3V aux, max 1A for 12V at the DUT connector.
System Connector	The system connector is a standard PCI Express card edge connector as defined in the "PCI Express™ Card Electromechanical Specification, Revision 1.0a, April 15, 2003". It's width depends on the type of probe board: x1 for the E2938A, x4 for the E2939A, and x8 for the E2968A.	
I/O Module Connector	This is the standard connector for all E2960 series products, and is used to connect the probe board to the I/O modules. Use the black I/O cable provided with your system, or the E2942A Single probe y-cable.	

Understanding the Mechanical Dimensions of an Active Probe Board

The Probe Boards are "Standard, Half Length Cards", as defined by the "PCI Express™ Card Electromechanical Specification Revision 1.0a, April 15, 2003", section 6.1.

Figure 14 shows the probe board dimensions.

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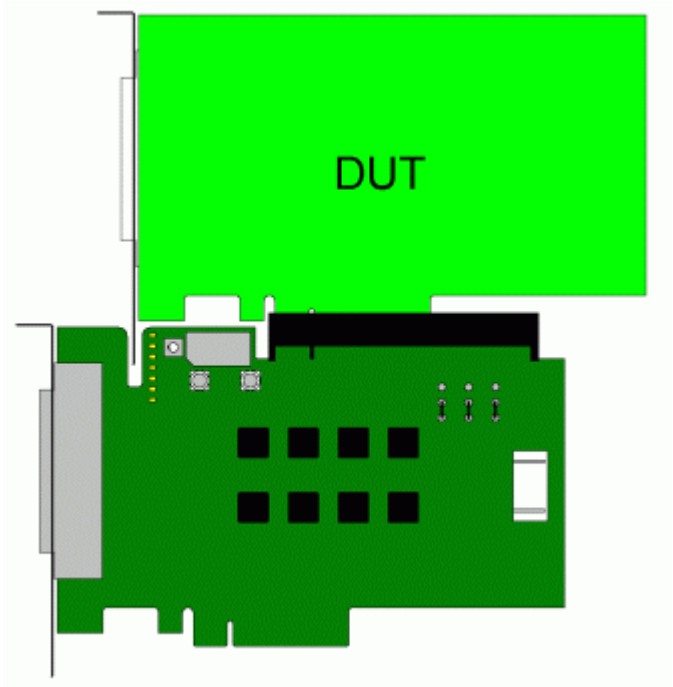


Figure 44 Probe Board Dimensions

Table 15 provides a brief description about the probe board dimensions.

Table 15 Probe Board Dimension

Attribute	Sub-attribute	Measurement
Length	Excluding I/O Connector	167.65 mm
	Including I/O connector	173.00 mm
Height	Excluding metal bracket	111.15 mm
	Total, including metal bracket	126.00 mm
Component Height	Component Side	Max. 14.47mm (according to spec)
	Solder Side	2.94 mm (at DUT connector, spec: 2.47mm)
DUT Position	Horizontal	Set back by 27mm
	Vertical	Elevated by 125mm

About Passive Probe Boards

In the E2960 series, you can use all passive probe boards for Protocol Analyzer. However, you cannot use any passive probe board for Protocol Exerciser.

NOTE You can use a passive probe board with a DUT even if it is wider than DUT. For example, you can use a x8 passive probe board with a x4 add-in card. However, there is a minor possibility that the system under test, if its receiver-detect circuit is very sensitive, may not linkup with the underlying DUT. To avoid this situation, use a passive probe board that matches DUT's link width, or tape the unused pins of the passive probe board.

In this section, you will learn:

- Setting Up a Passive Probe Board
- Powering DUT
- Understanding the External Interface of the Passive Probe Board

Setting Up a Passive Probe Board

In the hardware setup, the probe board connects DUT to the system, and Protocol Analyzer monitors the traffic between the two devices.

To Set Up a Passive Probe Board

1. Plug the probe board into the PCI Express slot on your system or motherboard.
2. If motherboard has a chassis, then firmly screw the metal bracket of the probe board to chassis.
3. Plug the add-in card into the straddle-mount DUT connector on top of the probe board.
4. Connect the black I/O cable to the probe board and to the I/O module, and fasten the screws tightly
5. Power up DUT.

   You can now start a Protocol Analyzer session using API or GUI. This automatically configures the probe board.

NOTE For information powering up DUT for passive probe board, refer to Powering DUT on page 94.

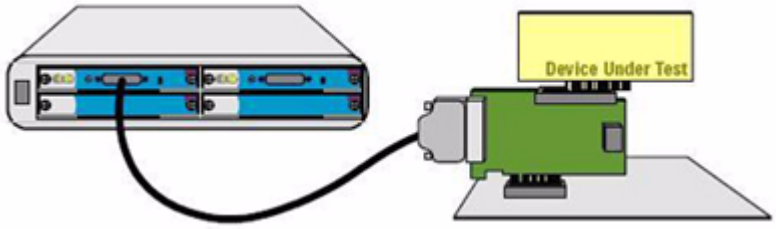


Figure 45 Passive Probe Board Setup

Powering DUT

The probe boards offers two choices for providing power to the straddle-mount slot on top.

DUTs can be powered:

- Using System Power
- Using External Power

NOTE Power supply for the logic on the probe board itself comes from the I/O module through the black I/O cable. Therefore, the additional load on the system when using the probe board is minimal, compared to plugging the DUT directly into the system.

Using System Power

To use system power for DUT:

- Place both power jumpers of the passive probe board towards the *left-side* of the system.

  This routes power from the system connector to the DUT connector on all power rails: 3.3V, 3.3V aux, and 12V.

Using External Power

To use external power for DUT:

- Place both power jumpers of the passive probe board towards the *right-side* of the system.

  This routes power from the external power connectors to the DUT connector.

The on-board DC/DC converters will translate the externally provided 12V to the required power rails: 3.3V. The 12V rail is directly fed from the external connector, and the 3.3V aux is always provided by the system.

NOTE The external power connector is a standard hard-drive connector, as found in standard PCs, and is provided by the standard AT(X) power supplies.

Understanding the External Interface of the Passive Probe Board

Figure 46 shows all external interfaces of the Probe Board.

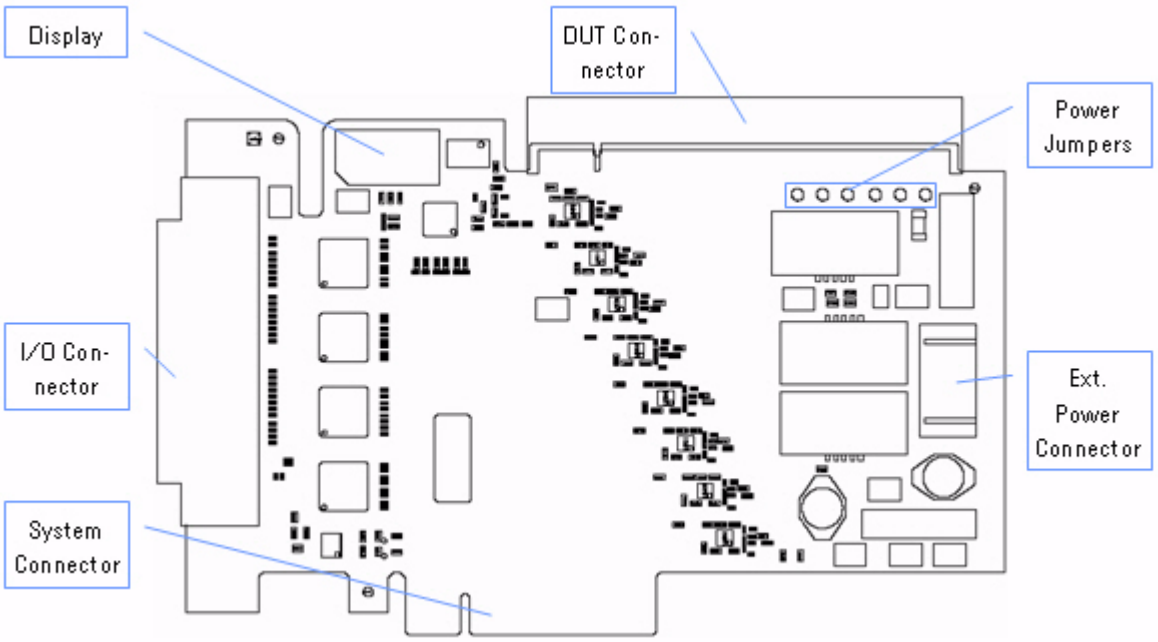


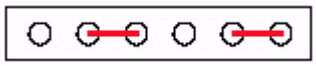
Figure 46 Passive Probe Board - External Interface

Table 16 provides a brief description of these external interfaces.

Table 16 Passive Probe Board - External Interface Specification

Interface	Description	Specification
Display	LED dot-matrix display identifying the connected I/O module and probe board modes.	If properly configured, the display shows *xxxp*. Here, *xxx* is the module number of the connected I/O module, such as *103p*.

Table 16 Passive Probe Board - External Interface Specification

Interface	Description	Specification
DUT Connector	Provides a x16 slot connector for DUT.	Defined like the slot connector in *PCI Express™ Card Electromechanical Specification, Revision 1.0a, April 15, 2003*. Depending on the probe board type, only x1, x4, or x8 lanes are connected.
Power Jumpers	To switch power supply for DUT plugged into the DUT connector: • **External Power**: Connect ATX power supply to *External Power Connector*. • **System Power**: Power for DUT is provided by the system.	Power supplies for 3.3V and 12V are switchable. The 3.3V Aux will always be provided by the system.  
External Power Connector	Connect an AT-hard-drive power connector, as provided by a standard AT(X) power supply. The probe board uses only the 12V at the connector, 5V is unconnected.	Power consumption: Max 2.3A total at 12V at ext power connector Provides max 3A for 3.3V, 0.5A for 3.3V aux, max 1A for 12V) at the DUT connector
System Connector	Card-Edge connector to plug Probe Board into a system or backplane.	The system connector is a standard PCI Express card edge connector, as defined in the *PCI Express™ Card Electromechanical Specification, Revision 1.0a, April 15, 2003*. Its width depends on the type of probe board: x1 for the E2945A, x4 for the E2946A, and x8 for the E2947A.
I/O Module Connector	Connector to connect to Serial I/O Module.	This is the standard connector for all E2960 series products, and is used to connect the probe board to the I/O modules. Use the black I/O cable provided with your system.

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E2942A Single Probe Y-Cable

The E2942A Single Probe Y-Cable provides a convenient way to connect both Protocol Exerciser and Protocol Analyzer to a system using a single probe board. Whenever you use Protocol Analyzer to monitor the traffic coming from and directed to the Protocol Exerciser, this is the recommended tool.

E2942A Single Probe Y-Cable Installation

The Y-Cable connects on probe board, and two Serial I/O modules, one of which will be configured as Analyzer, and one as Exerciser (Figure 47).

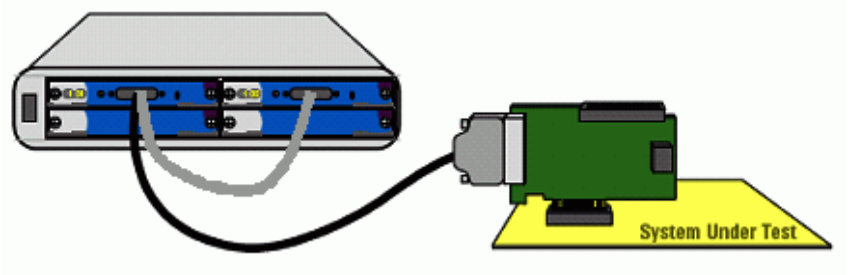

Figure 47 Y-Cable in System Protocol Tester

Installing the Y-cable

1. Plug the Probe Board into the System Under Test.
2. Connect the connector marked “Probe Board” at the end of the black segment to the Probe Board.
3. Connect the connector marked “Analyzer” in the middle of the two segments to the I/O Module to be used as Protocol Analyzer.
4. Connect the connector marked “Exerciser” at the end of the white segment (For some products, this segment will also be black) to the I/O Module to be used as Protocol Exerciser.
5. For all three connectors, fasten the screws tightly to ensure proper seating and signal integrity.
6. Start the Protocol Analyzer session for the Analyzer module.
7. Start the Protocol Exerciser session ("To Upstream") for the Exerciser module.

NOTE The Y-Cable delays packets sent in both directions by 300ns to 400ns.

Mechanical Dimensions

Length of black segment connecting Probe Board and Analyzer: 1.5m. Length of white segment connecting Analyzer and Exerciser: 0.5m

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