
P5570A/P5571A/P5572A PCIe 6 Protocol Analyzer - Hardware Guide

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Manual Part Number

P5570-91010

Edition

Edition 1.6, September 2025

Available in electronic format only

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CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Safety Summary

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 or operating instructions in the product manuals violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability for the customer's failure to comply with these requirements. Product manuals may be available on the Web. Go to www.keysight.com and type in your product number in the Search field at the top of the page.

General	Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.
Environmental Conditions	<p>This instrument is intended for indoor use in an installation category 2, pollution degree 2 environment. It is designed to operate at a maximum relative humidity of 85%r.H. and at altitudes of up to 2000 meters.</p> <p>Refer to the specifications tables for the ac mains voltage requirements and ambient operating temperature range.</p>
Before Applying Power	Verify that all safety precautions are taken. Make all connections to the unit before applying power. Note the instrument's external markings described in "Safety Symbols".
Ground the Instrument	If your product is provided with a grounding type power plug, the instrument chassis and cover must be connected to an electrical ground to minimize shock hazard. The ground pin must be firmly connected to an electrical ground (safety ground) terminal 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.
Fuses	See the user's guide or operator's manual for information about line-fuse replacement. Some instruments contain an internal fuse, which is not user accessible.
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	Only qualified, service-trained personnel who are aware of the hazards involved should remove instrument covers. Always disconnect the power cable and any external circuits before removing the instrument cover.
Cleaning	Clean the outside of the instrument with a soft, lint-free, slightly dampened cloth. Do not use detergent or chemical solvents.
Do Not Modify the Instrument	Do not install substitute parts or perform any unauthorized modification to the product. Return the product to a Keysight Sales and Service Office for service and repair to ensure that safety features are maintained.
In Case of Damage	Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

Safety Symbols

Table 1 Safety Symbol

Symbol	Description
	Direct current
	Alternating current
	Both direct and alternating current
	Three phase alternating current
	Earth ground terminal
	Protective earth ground terminal
	Frame or chassis ground terminal
	Terminal is at earth potential
	Equipotentiality
N	Neutral conductor on permanently installed equipment
L	Line conductor on permanently installed equipment
	On (mains supply)
	Off (mains supply)
	Standby (mains supply). The instrument is not completely disconnected from the mains supply when the power switch is in the standby position
	In position of a bi-stable push switch
	Out position of a bi-stable push switch

Symbol	Description
	Equipment protected throughout by DOUBLE INSULATION or REINFORCED INSULATION
	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.
	Indicates hazardous voltages and potential for electrical shock.
	Do not apply around or remove from HAZARDOUS LIVE conductors
	Application around and removal from HAZARDOUS LIVE conductors is permitted
	Indicates hot surface. Please do not touch.
	Indicates ionizing radiation.
	Indicates that anti-static precautions should be taken
CAT I	IEC Measurement Category I
CAT II	Measurement Category II
CAT III	Measurement Category III
CAT IV	Measurement Category IV

Compliance and Environmental Information

Table 2 Compliance and Environmental Information

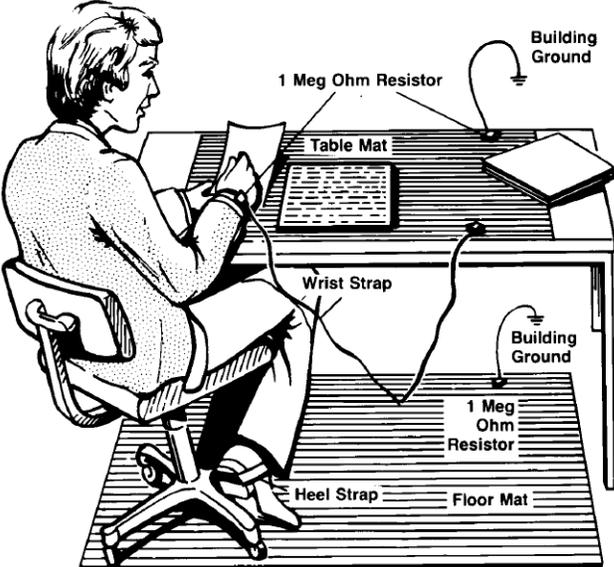
Safety Symbol	Description
	CSA is the Canadian certification mark to demonstrate compliance with the Safety requirements.
	The C-tick mark is a registered trademark of the Spectrum Management Agency of Australia. This signifies compliance with the Australia EMC Framework regulations under the terms of the Radio Communication Act of 1992.
	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.
	KC certification mark to demonstrate compliance with the South Korean EMC requirements. South Korean Class A EMC declaration This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.
	The crossed out wheeled bin symbol indicates that separate collection for waste electric and electronic equipment (WEEE) is required, as obligated by the EU DIRECTIVE and other National legislation. Please refer to keysight.com/go/takeback to understand your Trade in options with Keysight in addition to product takeback instructions.

CAUTION

Electrostatic discharge (ESD) can damage the circuits of the components on the hardware. Avoid applying static discharges to the front-panel connectors. Before connecting any coaxial cable to the connectors, momentarily short the center and outer conductors of the cable together. Avoid touching the front-panel connectors without first touching the frame of the instrument. Be sure the instrument and all connected devices (DUT, etc.) are properly earth-grounded (to a common ground) to prevent buildup of static charge and electrical over-stress. Take necessary anti-static precautions, such as wearing a grounded wrist strap, to minimize the possibility of electrostatic damage.

Electrostatic discharge (ESD) can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe work station. The following list and figure shows an example of a static-safe work station using two types of ESD protection. Purchase acceptable ESD accessories from your local supplier.

- Conductive table-mat and wrist-strap combination.
- Conductive floor-mat and heel-strap combination.



Both types, when used together, provide a significant level of ESD protection. Of the two, only the table-mat and wrist-strap combination provides adequate ESD protection when used alone. To ensure user safety, the static-safe accessories must provide at least 1 MW of isolation from ground.

WARNING

These techniques for a static-safe work station should not be used when working on circuitry with a voltage potential greater than 500 volts.

List of Acronyms

Acronym	Definition
PCIe	Peripheral Component Interconnect Express
AC	Alternating Current
DC	Direct Current
IEC	International Electrotechnical Commission
EMC	Electromagnetic Compatibility
WEEE	Waste Electric and Electronic Equipment
ESD	Electrostatic Discharge
DUT	Device Under Test
SUT	System Under Test
LTSSM	Link Training and Status State Machine
TLP	Transaction Layer Packets
API	Application Programming Interface
LED	Light Emitting Diode
USB	Universal Serial Bus
PCB	Printed Circuit Board
TRIG	Trigger
DSC	Downstream Component
USC	Upstream Component
LMT	Lane Margin Test
IO card	Input Output card
MIN	Minimum
MAX	Maximum
GUI	Graphical User Interface

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Specifications and Characteristics

Keysight Protocol Analyzer for PCI Express (PCIe) provides a test and debug solution for PCI Express to test up to the sixth generation of PCI Express technology. Keysight Protocol Analyzer for PCIe is an advanced traffic Analyzer that enables you to capture the incoming traffic from the PCIe devices including the DUT and Protocol Exerciser modules for analysis. The captured traffic can be computed to view decoded transactions and summarized LTSSM information using the P5500 PCIe Traffic Analysis application.

This chapter provides information on the features, components, and usage scenarios of the P5570A/P5571A/P5572A PCIe 6 Protocol Analyzer module. Also listed are some of the chief specifications of the Protocol Analyzer module.

NOTE

The Ethernet port on the Analyzer Card is currently non-functional.

NOTE

For information on installing and configuring the P5570A/P5571A/P5572A Analyzer card, refer to the Installation Guide.
For information on how to use the P5570A/P5571A/P5572A Analyzer card in conjunction with the P5500 PCIe Traffic Analysis software, refer to Keysight P5500 PCIe and CXL Traffic Analysis User Guide.

Features

This topic describes the features of the Keysight P5570A/P5571A/P5572A Analyzer card.

- It is a custom height (260 mm), half-length card as described in the PCI Express specification, and fits into every system including blade servers.
- It supports Gen1 (2.5 GT/s), Gen2 (5.0 GT/s), Gen3 (8.0 GT/s), Gen4 (16.0 GT/s), Gen5 (32.0 GT/s), and Gen6 (64.0 GT/s) speeds as per PCIe specifications.
- It supports capture of incoming traffic for analysis based on simple and advanced triggers configured in the software.
- It provides support for link widths ranging from x1 to x16.
- You can manage, control, and use it using the Protocol Analyzer GUI part of the P5500 software and APIs.

Components

This topic describes the hardware components of the P5570A/P5571A/P5572A Analyzer card.

The following images display the front and side views of the Keysight P5570A and P5571A/P5572A PCIe 6 Analyzer. The hardware components have been labeled in the following images.

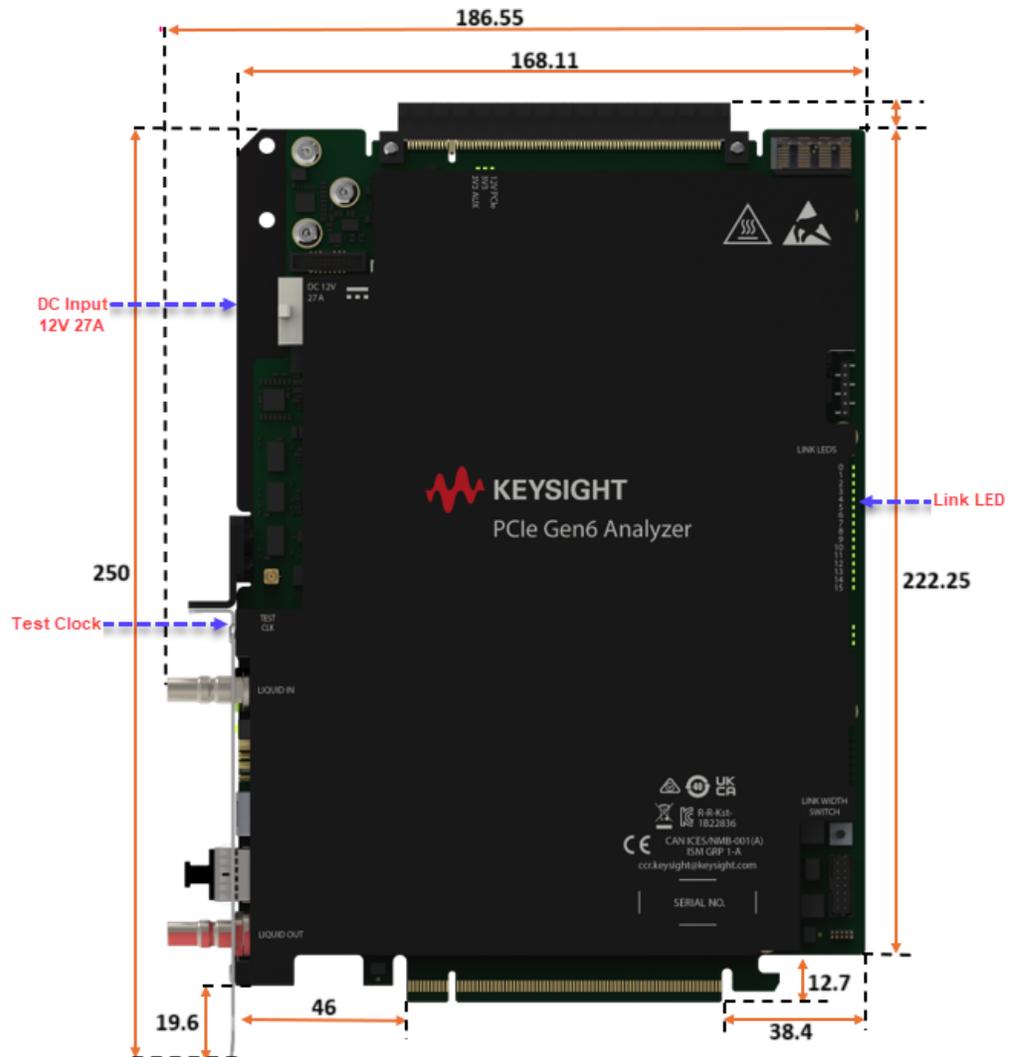


Figure 1 P5570A PCIe Protocol Analyzer - Front View



Figure 2 P5570A PCIe Protocol Analyzer - Side View

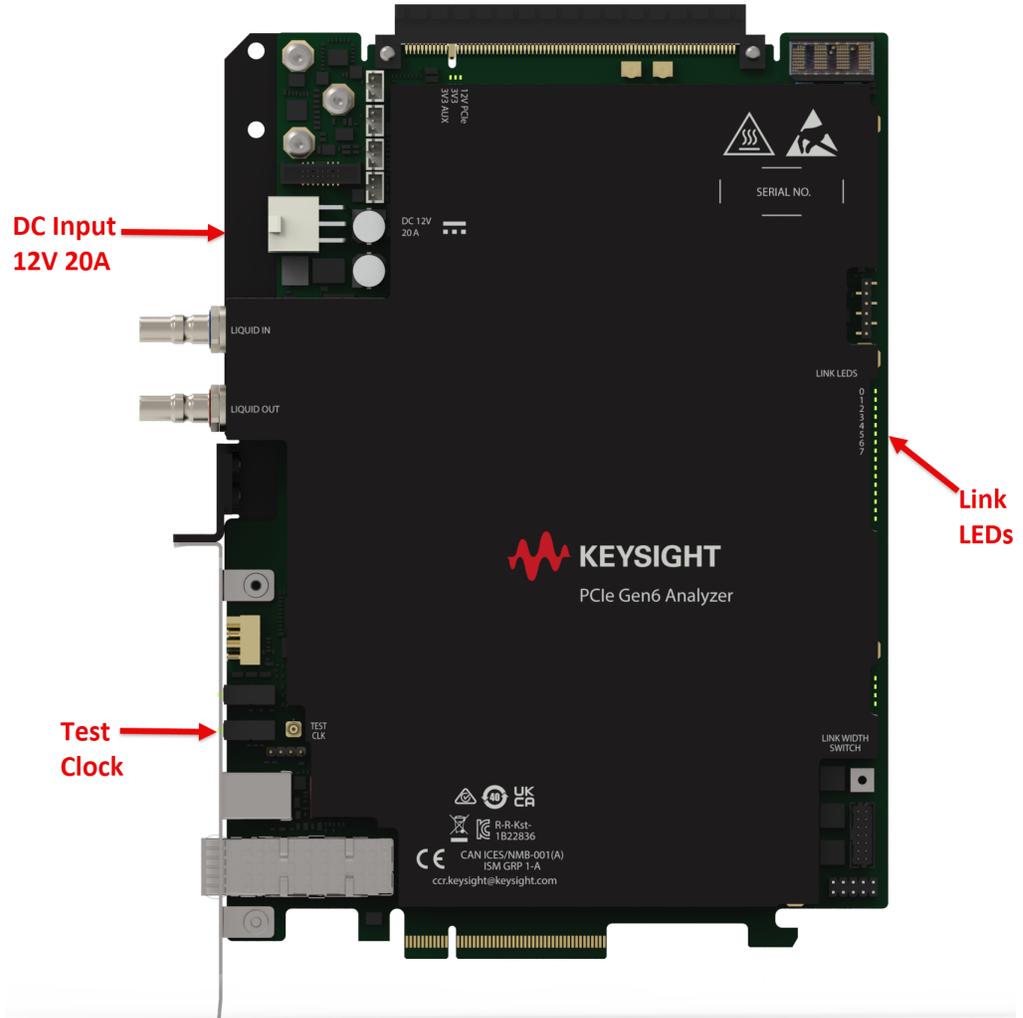


Figure 3 P5571A/P5572A PCIe Protocol Analyzer - Front View

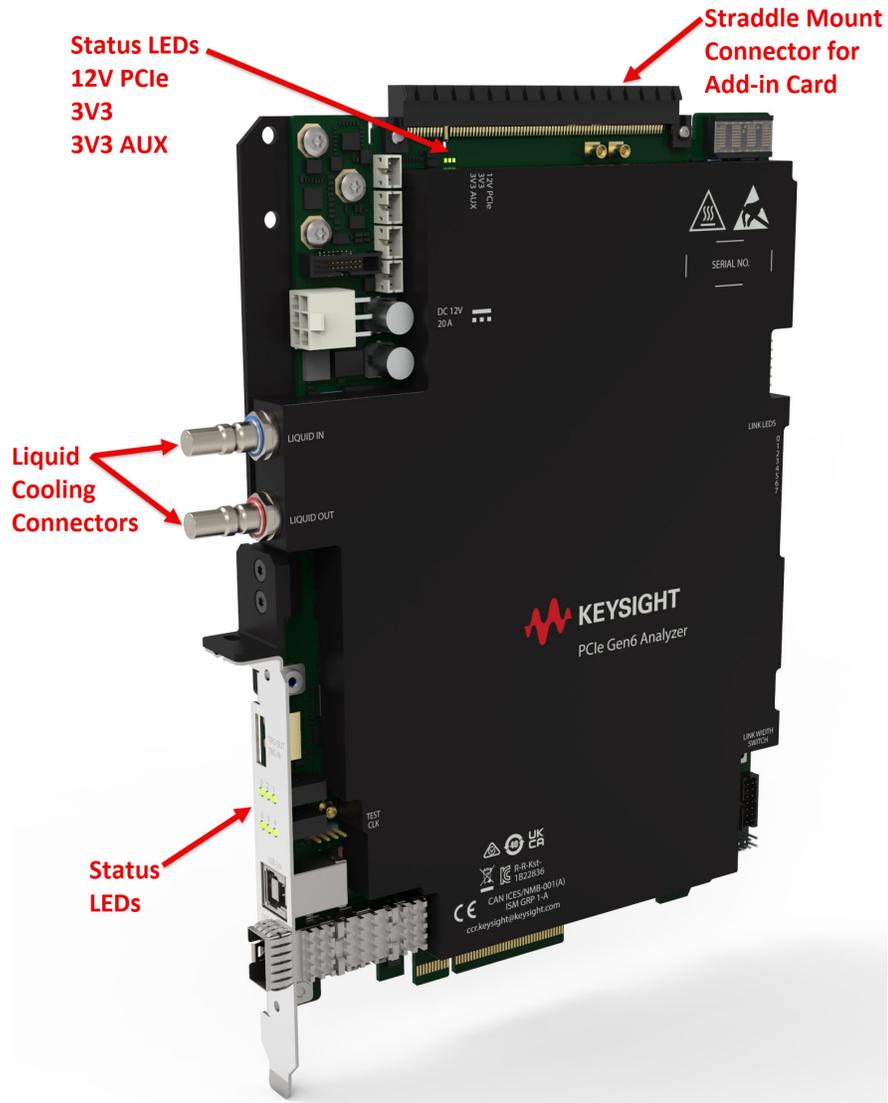


Figure 4 P5571A/P5572A PCIe Protocol Analyzer – Side View

Some of the hardware components shown in the above images are described below:

- **Straddle Mount Connector:** This component is used to connect the P5570A/P5571A/P5572A module with an add-in card.
- **LEDs (on board):** The following LEDs are available on the Analyzer board.
 - **Link LEDs:** This component has the LEDs to display the status information about the participating lanes of the link. Displays the status of the lanes in the link. All these LEDs are off if the link is not up. If the link is up, then the LEDs are on for only those lanes that are participating in the link.
 - **Status LEDs:** This component has status LEDs for 12V PCIe, 3V3, and 3V3 AUX near PCIe Straddle on the top side of the board.
- **Status LEDs (on front bracket):** This component has six status LEDs. Currently, only the following two LEDs are in use:

- LED 3: The ON state indicates that the FPGA Configuration or Bitfile Programming is done in the Analyzer.
- LED 2: The ON state indicates that the Auxiliary power supply of the Analyzer is working properly.

To get a description of each LED on the board and front bracket, please refer to “[Analyzer Card LEDs](#)” on page 18.

- **Link Width Switch:** This component is used to change the link widths.
- **Test CLK:** This component is used for clock verification purpose only.
- **USB Connector:** This component is used to connect P5570A/P5571A/P5572A with the controller PC using the USB cable.
- **Power Supply Connector:** This component is used to connect P5570A/P5571A/P5572A with the power supply.
- **TRIG OUT Connector:** This component is used to connect the P5570A/P5571A/P5572A card with other test equipments to trigger these test equipments.
- **TRIG IN Connector:** This component is used to connect the P5570A/P5571A/P5572A card with other test equipments such as Protocol Exerciser to receive a trigger from these test equipments when a specified condition is met.
- **LIQUID IN and LIQUID OUT:** These connectors are used to connect the P5570A/P5571A/P5572A card with the heat exchanger unit. For detailed information, please refer to “[Handling Liquid Cooled Analyzer](#)” section.

WARNING

Do not directly touch any component on the P5570A/P5571A/P5572A Analyzer card.

CAUTION

While establishing power connections, please make sure to plug the power supply connector first to the Exerciser/Analyzer card and then connect the power supply to the AC power.

CAUTION

Components on the P5570A/P5571A/P5572A Analyzer 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.

The edge connector, upper straddle mount connector and front Ethernet connector comes with a protective cover to protect it from electrostatic damage (as shown in [Figure 5](#) and [Figure 6](#)).



Figure 5 Protective Cover for Edge Connector



Figure 6 Protective Cover for Ethernet Connector

NOTE

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

Analyzer Card LEDs

The P5570A and P5571A/P5572A Analyzer card has a number of LEDs on the board and front bracket. This topic describes the meaning of each of these LEDs.

The following tables describe the LEDs on board and front bracket.

Table 3 P5570A Analyzer (x16 link width)

S.No	Reference Designator	LED Name	Description
1	DS1001		When this LED is on, it indicates 3V3 AUX power supply from PCIe connector is UP. This is displayed on the right side of the board.
2	DS1002	CEM Connector Voltages	When this LED is on, it indicates 3V3 power supply from PCIe connector is UP. This is displayed on the right side of the board.
3	DS1003		When this LED is on, it indicates 12V power supply from PCIe connector is UP. This is displayed on the right side of the board.
4	DS2701		On Board Voltages
5	DS3901	On Board Voltages	When this LED is on, it indicates first 1.2V supply is generated on board. This is displayed on the right side of the Board.
6	DS3101	On Board Voltages	When this LED is on, it indicates second 1.2V supply is generated on board. This is displayed on the right side of the Board.
7	DS2901	On Board Voltages	When this LED is on, it indicates third 1.2V supply is generated on board. This is displayed on the right side of the Board.
8	DS4720	Voltage Fault	When this LED is on, it indicates there is some fault in Core supply. This is displayed on the right side of the board.
9	DS4501	ERROR	When this LED is on, it indicates there is some error in programming. This is displayed on the right side of the board.

S.No	Reference Designator	LED Name	Description
10	DS3001	On Board Voltages	When this LED is on, it indicates 0.92V supply is generated on board. This is displayed on the right side of the board.
11	DS3401	On Board Voltages	When this LED is on, it indicates 0.88V supply is generated on board. This is displayed on the right side of the board.
12	DS2601_1	Done	When this LED is on, it indicates device is programmed successfully. This is displayed on the right side of the board.
13	DS2601_2	Power OK	When this LED is on, it indicates all voltages on the board is OK. This is displayed on the front panel board.
14	DS2601_3	Edge LED	This LED is general purpose LED. It can be defined any function according to requirement. This is displayed on the front panel board.

Table 4 P5571A Analyzer (x8 link width)

S.No	Reference Designator	LED Name	Description
1	DS1001		When this LED is on, it indicates 3V3 AUX power supply from PCIe connector is UP. This is displayed on the right side of the board.
2	DS1002	CEM Connector Voltages	When this LED is on, it indicates 3V3 power supply from PCIe connector is UP. This is displayed on the right side of the board.
3	DS1003		When this LED is on, it indicates 12V power supply from PCIe connector is UP. This is displayed on the right side of the board.
4	DS2501		On Board Voltages
5	DS3701		When this LED is on, it indicates first 1.2V supply is generated on board. This is displayed on the right side of the Board.
6	DS2901	On Board Voltages	When this LED is on, it indicates second 1.2V supply is generated on board. This is displayed on the right side of the Board.
7	DS2701		When this LED is on, it indicates third 1.2V supply is generated on board. This is displayed on the right side of the Board.
8	DS3202	Voltage Fault	When this LED is on, it indicates there is some fault in Core supply. This is displayed on the right side of the board.
9	DS4301	ERROR	When this LED is on, it indicates there is some error in programming. This is displayed on the right side of the board.
10	DS2801	On Board Voltages	When this LED is on, it indicates 0.92V supply is generated on board. This is displayed on the right side of the board.

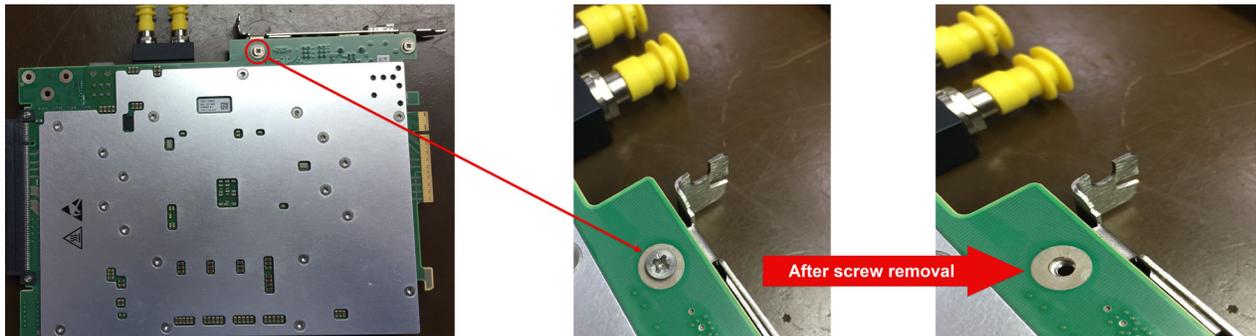
S.No	Reference Designator	LED Name	Description
11	DS3201	On Board Voltages	When this LED is on, it indicates 0.88V supply is generated on board. This is displayed on the right side of the board.
12	DS2401_1	Done	When this LED is on, it indicates device is programmed successfully. This is displayed on the right side of the board.
13	DS2401_2	Power OK	When this LED is on, it indicates all voltages on the board is OK. This is displayed on the front panel board.

Attaching the Auxiliary Bracket to the P5570A/P5571A/P5572A PCIe Protocol Analyzer Module

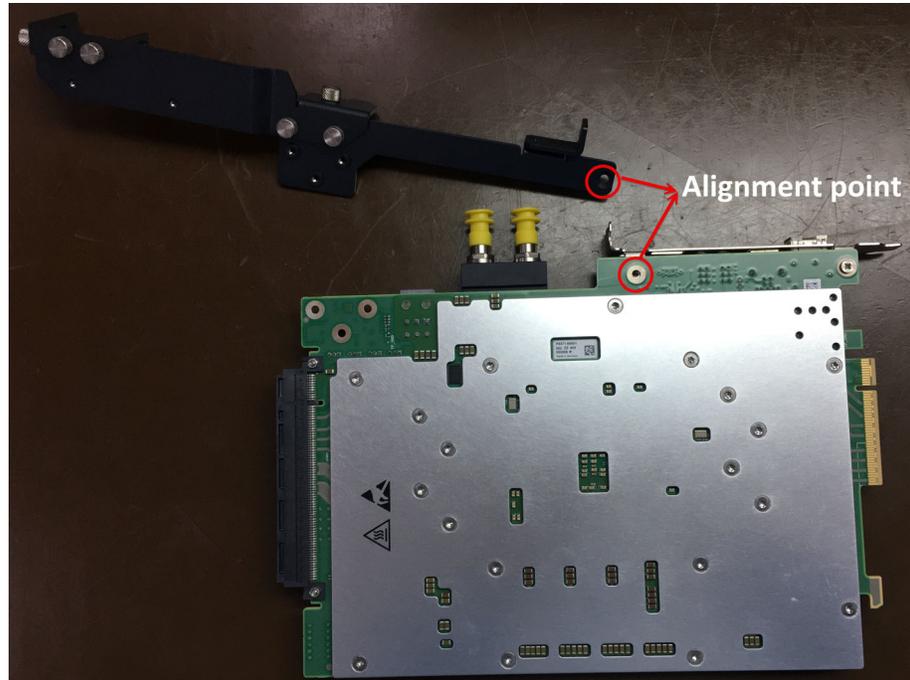
The Auxiliary Bracket for the Add-In Card (as shown in the photographs above) comes as a separate item in the kit that you receive. Screws are provided to attach this auxiliary bracket to the P5570A/P5571A/P5572A PCIe Analyzer module.

Perform the following steps to attach the auxiliary bracket to the P5570A/P5571A/P5572A PCIe Analyzer module:

- 1 Remove the screw from the bottom of the P5570A/P5571A/P5572A PCIe Analyzer module (as shown below) using PH1 screwdriver. Retain the screw for later use.

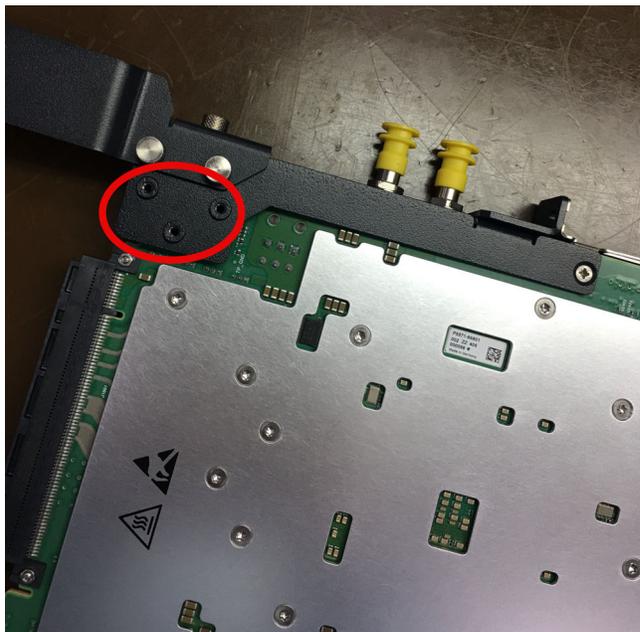


- 2 Align the auxiliary bracket in an orientation as shown below.

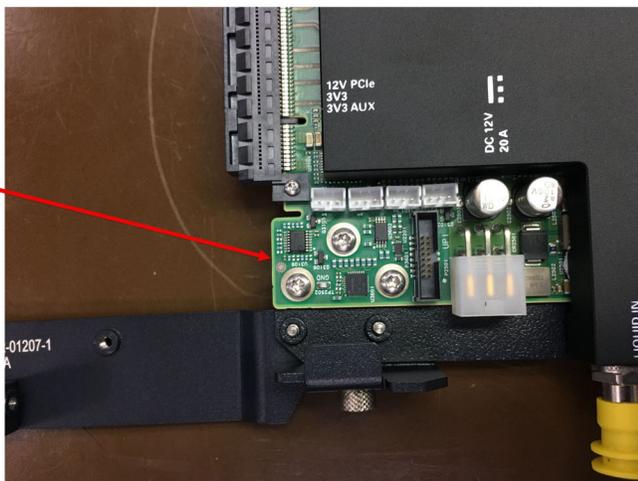
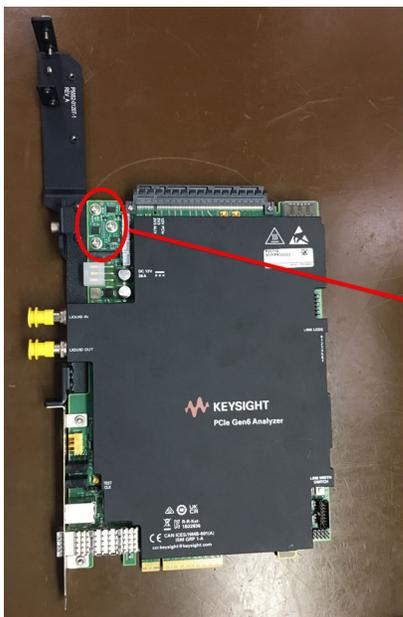


- 3 Use the PH1 screw to assemble the bracket with the Analyzer module. The module will look like the following image after assembly.





- 4 Notice the hole alignment of the area highlighted in red in the above image.
- 5 Rotate the unit to the top side. Locate the three holes as highlighted above and tighten with the provided screws using T10 torx screwdriver.



Usage Scenarios for PCIe 6 Protocol Analyzer

In the most common usage scenario, the P5570A/P5571A/P5572A PCIe 6 Protocol Analyzer module is placed between the motherboard or the system under test and the IO Card. The P5570A/P5571A/P5572A Analyzer module is connected to a controller PC that hosts the P5500 PCIe Traffic Analysis software via a USB connection. The Analyzer module captures and analyzes the traffic from the system under test and the IO card.

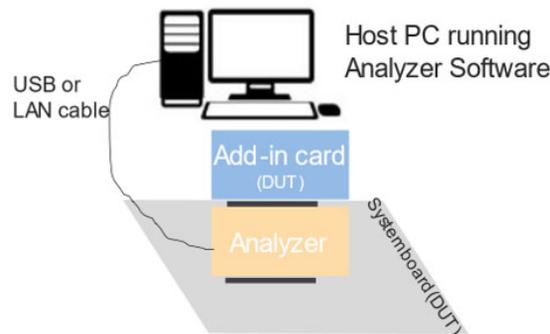


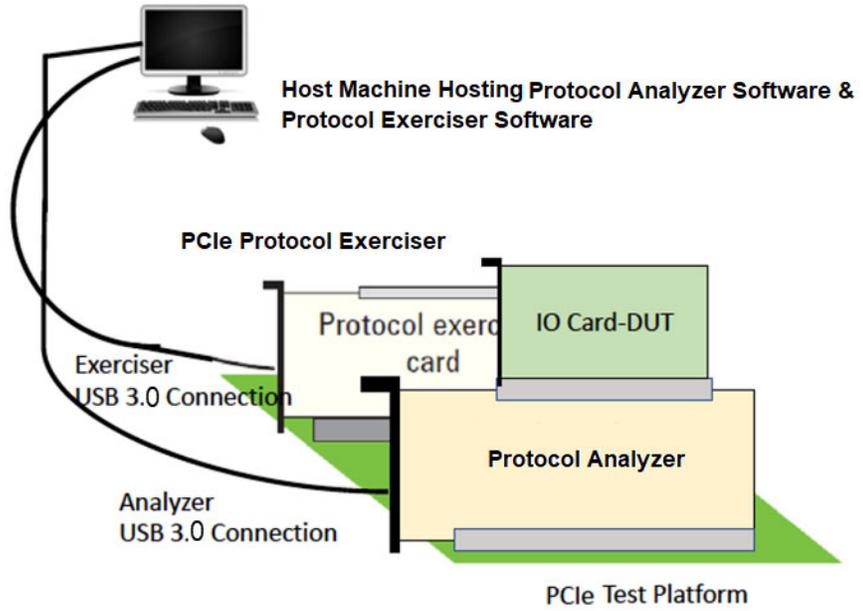
Figure 7 Use of Protocol Analyzer to Test Systemboard and Add-in Card

Using P5570A/P5571A/P5572A Analyzer Module In Conjunction with the P5573A/P5574A/P5575A Exerciser Module

The P5570A/P5571A/P5572A PCIe 6 Protocol Analyzer's main task is to capture and analyze the traffic from one or more PCIe devices. In cases where you need to test a single PCIe device, you can use the Analyzer in conjunction with the P5573A/P5574A/P5575A PCIe 6 Exerciser module, which provides the traffic from the other side. Thus, you might have the following usage scenarios for using the Exerciser and Analyzer modules together:

- System board or motherboard (DUT) -> Analyzer -> Exerciser as a device (or add-in card)
- P5563B Test Backplane -> Exerciser as a host (or the motherboard or system board) -> Analyzer -> Add-in Card (DUT)

The following image depicts the second usage scenario.



NOTE

For detailed information on how to set up the P5570A/P5571A/P5572A Analyzer card, refer to the Installation Guide.

Specifications

General characteristics	
Link Widths	P5570A: x1, x2, x4, x8, x16 with x16 PCIe Edge connector P5571A: x1, x2, x4, x8 with x8 PCIe Edge connector P5572A: x1, x2, x4 with x4 PCIe Edge connector
Data Rates	2.5 GT/s (Gen1), 5.0 GT/s (Gen2), 8.0 GT/s (Gen3), 16.0 GT/s (Gen4), 32 GT/s (Gen5), and 64.0 GT/s (Gen6)
Speed	64 GT/s (32 GBaud PAM4)
Clocking Architecture	Common clock architecture
Physical characteristics	
Dimensions	Analyzer (P5570A): Length: 186.5mm Height: 260.0 mm Width: 20.0 mm Analyzer (P5571A/P5572A): Length: 181 mm Height: 260.0 mm Width: 20.0 mm Liquid cooling module (E5571-61101): Length: 233 mm Height: 161.5 mm Width: 130.0 mm
Weight	0.9 Kg
Connectors	Power input, USB 3.0, liquid inlet and outlet (P5570A/P5571A/P5572A only), and two mini-coax connectors for trigger in and out.
Cover	The hardware board has a cover to provide rigidity to the board.
Power requirements	
Input	12 Vdc, 18 A minimum
Maximum power requirement	230 W
Keysight part number 0950-6475 external power supply supplied with the Analyzer	
Input	85 to 264VAC, 12VDC, 21A, 252W
Keysight part number 0950-6748 external power supply supplied with E5571-61101	
Input	90 to 264VAC, 24VDC, 2.5A, 60W

P5570A/P5571A/P5572A Specifications and Characteristics	
PCIe Edge Finger for System DUT	<p>P5570A: Consists of PCIe 6 x 16 PCB edge finger to support single slot PCIe card. The PCB has 82 gold-plated pins on top and 82 gold-plated pins on the bottom to support 164 pins, a requirement for PCIe x16 slot.</p> <p>P5571A: Consists of PCIe 6 x 8 PCB edge finger to support single slot PCIe card. The PCB has 49 gold-plated pins on top and 49 gold-plated pins on the bottom to support 98 pins, a requirement for PCIe x8 slot.</p> <p>P5572A: Consists of PCIe 6 x 4 PCB edge finger to support single slot PCIe card. The PCB has 32 gold-plated pins on top and 32 gold-plated pins on the bottom to support 64 pins, a requirement for PCIe x4 slot.</p>
Trigger Specifications	
Trigger output	
Output impedance	50 ohms
Threshold voltage	VOH - 2.4V VOL - 0.55V
Trigger input	
Vin Low Min	0V
Vin Low Max	0.9V
Vin High Min	2.0V
Vin High Max	3.3V
Input current	+/-5uA
Input impedance	50 ohms
Threshold voltage	2.0 V
Triggers on	Falling edge
Custom trigger cable (Keysight part number P5562-61601)	Trigger Fan Out Cable Set (Figure 8)
Auxiliary Bracket (Keysight part number P5571-01202)	Auxiliary Bracket Subassembly Analyzer, Liquid Cooled
USB 3.0 cable (Keysight part number 8121-3603)	28AWG 9-Conductor Type-A-Plug to Type-B-Plug 1m-LG Black
Environmental Specifications	
This instrument is intended for indoor use in an overvoltage category II, pollution degree 2 environment.	
Temperature	Operating: +5 °C to +35 °C Storage: 0 °C to +70 °C
Humidity	Operating: 15 to 85% non-condensing (Relative humidity) Storage: 15 to 95% (Relative humidity)
Altitude	2000 m (6,500 feet) maximum
EMC and Safety	IEC 61326-1 IEC 61010-1 / EN 61010-1 Canada: CSA C22.2 No. 61010-1 USA: UL 61010-1

WARNING

The P5570A/P5571A/P5572A Protocol Analyzer is intended to be used in an R&D environment and therefore mainly operated as an open instrument. For safe usage, do not operate the Analyzer unattended.



Figure 8 Keysight custom trigger cable

Handling Liquid Cooled Analyzer

This chapter provides instructions on how to handle the P5570A/P5571A/P5572A liquid cooled Analyzer module. [Figure 9](#) shows the setup of the Analyzer and heat exchanger.

Common coolants used for PC cooling with a minimum boiling point of 90 °C can be used for this hardware. Use of a coolant with an anti-corrosive is recommended to protect the hardware.

The amount of liquid coolant required for Analyzer hardware:

- P5570A: 230ml max (130ml Heatsink + 30ml External hose(1m) + 50ml reservoir + 20ml Heat exchanger)
- P5571A/P5572A: 205ml max (105ml Heatsink + 30ml External hose (1m) + 50ml reservoir + 20ml Heat exchanger)

Examples for compatible coolants are:

- Thermaltake T1000 Pure Clear (or other color)
- EK-CryoFuel Premix Clear (or other color)

WARNING

Please note that the above-listed examples are classified as non-hazardous. However, always refer to the respective material safety sheet for the handling of the coolant as well as personal protection.



Figure 9 Analyzer and Heat Exchanger setup for liquid cooling process

Please perform the following steps to handle the liquid cooled Analyzer:

- “Initial Turn-on of the Liquid Cooled Analyzer” on page 30
- “Empty Coolant from the Analyzer and Heat Exchanger Setup” on page 31

Initial Turn-on of the Liquid Cooled Analyzer

- 1 Connect the empty heat exchanger to the Analyzer module as shown in [Figure 10](#). Please keep the heat exchanger tank opening on top of the device closed while connecting the hoses to the module.

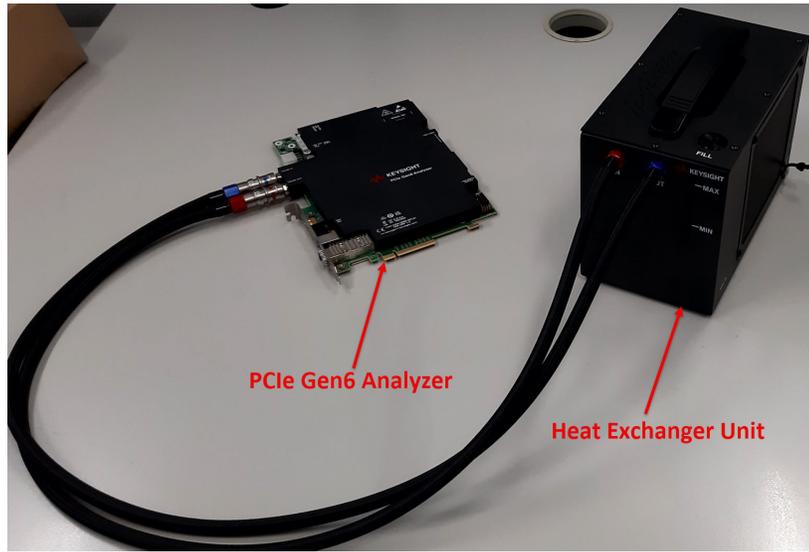


Figure 10 Connecting heat exchanger to the Analyzer module

- 2 Open the lid on the top of the heat exchanger tank and fill the coolant up to the **Max** marking as shown in [Figure 11](#).

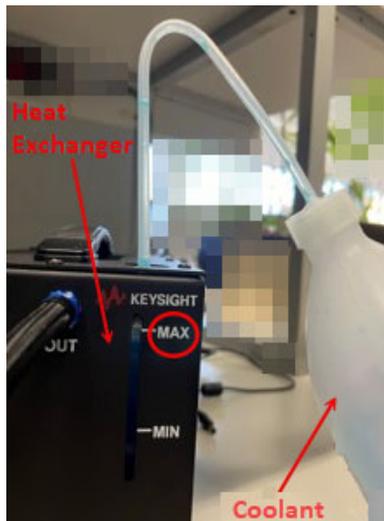


Figure 11 Filling heat exchanger with coolant

- Now, power on the heat exchanger. Upon the first power-up, the pump will start running and empty the heat exchanger tank. Keep filling the heat exchanger tank until the coolant level gets stable between “MIN” and “MAX” markings as shown in [Figure 12](#). Then seal the tank by screwing in the lid. The Analyzer module is now ready for use.

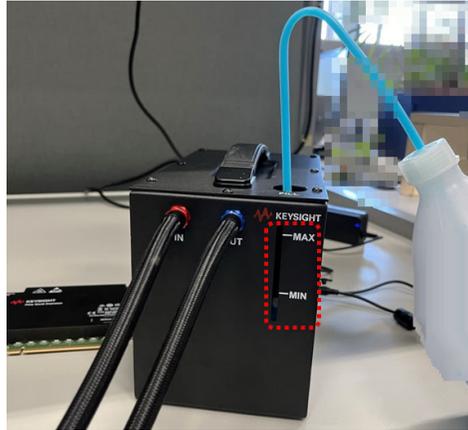


Figure 12 Adjusting coolant level between MIN and MAX markings

Empty Coolant from the Analyzer and Heat Exchanger Setup

- First, disconnect all the power supplies from the system. After that, disconnect the hose with red valve on the Analyzer side, then on the heat exchanger side. Please keep the heat exchanger side upright to avoid spilling. A paper towel or similar is sufficient to catch single drops of coolant that may exit from the heat exchanger while disconnecting the hose.
- Connect one end of the hose with red valve back to the Analyzer module and place its open end in a container where you want to store the coolant.
- Place the heat exchanger unit in an elevated position as shown in [Figure 13](#). The coolant will start exiting through the open end of the hose and empty the Analyzer and heat exchanger.

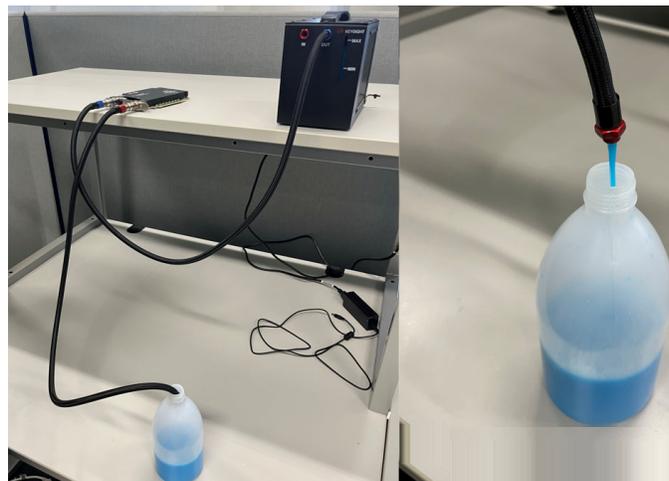


Figure 13 Emptying coolant from the Analyzer and heat exchanger

- 4 Once there is no coolant coming out anymore, connect the open end of the hose back to the heat exchanger. The Analyzer and heat exchanger are now empty. You can seal the heat exchanger tank by screwing in the lid.