Installation Guide

M9021A, M9022A, M9023A, M9024A

Keysight PXIe System Modules and Cable Interface

KEYSIGHT TECHNOLOGIES

Notices

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Safety Information

CAUTION

A CAUTION denotes a hazard. It calls attention to an operating procedure or practice 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 denotes a hazard. It calls attention to an operating procedure or practice, 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 Information

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.

General

Do not use this product in any manner not specified by the manufacturer. The protective features of this product must not be impaired if it is used in a manner specified in the operation instructions.

Before Applying Power

Verify that all safety precautions are taken. Make all connections to the unit before applying power. Note the external markings described under "Safety Symbols".

Ground the Instrument

Keysight chassis are 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.

Do Not Operate in an Explosive Atmosphere

Do not operate the module/chassis in the presence of flammable gases or fumes.

Do Not Operate Near Flammable Liquids

Do not operate the module/chassis in the presence of flammable liquids or near containers of such liquids.

Cleaning

Clean the outside of the Keysight module/chassis with a soft, lint-free, slightly dampened cloth. Do not use detergent or chemical solvents.

Do Not Remove 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.

Keep Away From Live Circuits

Operating personnel must not remove equipment covers or shields. Procedures involving the removal of covers and shields are for use by service-trained personnel only. Under certain conditions, dangerous voltages may exist even with the equipment switched off. To avoid dangerous electrical shock, DO NOT perform procedures involving cover or shield removal unless you are qualified to do so.

Do Not Operate Damaged Equipment

Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to an Keysight Technologies Sales and Service Office for service and repair to ensure the safety features are maintained.

Do Not Block The Primary Disconnect

The primary disconnect device is the appliance connector/power cord when a chassis used by itself, but when installed into a rack or system the disconnect may be impaired and must be considered part of the installation.

Do Not Modify the Instrument

Do not install substitute parts or perform any unauthorized modification to the product. Return the product to an Keysight Sales and Service Office 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.

CAUTION

Do NOT block vents and fan exhaust: To ensure adequate cooling and ventilation, leave a gap of at least 50mm (2") around vent holes on both sides of the chassis.

Do NOT operate with empty slots: To ensure proper cooling and avoid damaging equipment, fill each empty slot with an AXIe filler panel module.

Do NOT stack free-standing chassis: Stacked chassis should be rack-mounted.

All modules are grounded through the chassis: During installation, tighten each module's retaining screws to secure the module to the chassis and to make the ground connection.

WARNING

Operator is responsible to maintain safe operating conditions. To ensure safe operating conditions, modules should not be operated beyond the full temperature range specified in the Environmental and physical specification. Exceeding safe operating conditions can result in shorter lifespan, improper module performance and user safety issues. When the modules are in use and operation within the specified full temperature range is not maintained, module surface temperatures may exceed safe handling conditions which can cause discomfort or burns if touched. In the event of a module exceeding the full temperature range, always allow the module to cool before touching or removing modules from the chassis.

Safety Symbols

Products display the following symbols:

Refer to manual for additional safety information.

Earth Ground.

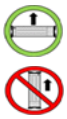
Chassis Ground.

Alternating Current (AC).

Direct Current (DC).

Standby Power. Unit is not completely disconnected from AC mains when power switch is in standby position

Indicates that antistatic precautions should be taken.



Operate the PXIe chassis in the horizontal orientation. Do NOT operate this chassis in the vertical orientation.

The CSA mark is a registered trademark of the Canadian Standards Association and indicates compliance to the standards laid out by them. Refer to the product Declaration of Conformity for details.

Notice for European Community: This product complies with the relevant European legal Directives: EMC Directive (2004/108/EC) and Low Voltage Directive (2006/95/EC).

The Regulatory Compliance Mark (RCM) mark is a registered trademark. This signifies compliance with the Australia EMC Framework regulations under the terms of the Radio Communication Act of 1992.

ICES/NMB-001

ICES/NMB-001 indicates that this ISM device complies with the Canadian ICES-001.

This symbol represents the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of this product.

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.

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This product complies with the WEEE Directive (2002/96/EC) marking requirement. The affixed product label (see below) 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 1, this product is classified as a “Monitoring and Control instrumentation” product.

Do not dispose in domestic household waste.

To return unwanted products, contact your local Keysight office for more information.

Contents

Introduction

Keysight's M9021A PCIe Cable Card Interface and M9022A, M9023A, and M9024A PXIe system modules provide a cabled PCIe link between a PXIe or AXIe chassis and an external computer, or a computer embedded in a PXIe chassis.

With an external computer you can connect up to 4 chassis via a star or cascade configuration. The star configuration can be either x8 or x16 links.

With a computer embedded in a chassis, you can connect up to 4 chassis with a cascade configuration at x8.

The interface card provides the following features:

- M9021A* *PCIe Cable Interface Card*. Gen 2 at 5GT/s, x8, Single Port.
  It can be used to interconnect multiple M9018 Chassis and connect to an AXIe chassis.

The system modules provide the following features:

- M9022A *Single Port System Module*. Up to Gen 3 at 8 GT/s with x8 lanes.
- M9023A *Dual Port System Module*. Up to Gen 3 at 8 GT/s with x8 lanes.
- M9024A *Dual Port System Module*. Up to Gen 3 at 8 GT/s with x8 or x16 lanes.
  The module also has IO ports: two LAN, four USB 2.0, two USB 3.0 and one GPIB.

The PCIe cable connections provide very high bandwidth serial links between modules on different chassis and a host computer. These links are transparent to computer applications and allow direct control of PXI and PXIe modules. Use the Y1202A 2-meter or Y1203A 0.5-meter cables to:

- Connect system modules to a PC with a host adapter module
- Connect system modules to a the front panel of an M9037 embedded PC
- Connect system modules to system module in adjacent chassis in a cascade or "daisy chain"

These modules can be used in a wide range of configurations with the PCIe cables connecting up to four chassis in Star or Cascade topologies. There are a few examples later in this document in "Connecting a PC to a PXIe or AXIe Chassis" on page 32. See:

- Figure 14, "Basic external PC system configuration," on page 32
- Figure 15, "Simple two chassis configuration," on page 33
- Figure 16, " x16 Connection to the PXIe chassis," on page 34

* The M9021A uses special features built into the Keysight M9018 chassis and is *not* compatible with the PXIe System Slot in other PXIe chassis.

- Figure 17, “ M9037A Embedded Controller to a second PXIe chassis,” on page 35
- Figure 18, “ Cascade or “Daisy Chain” of PXIe Chassis,” on page 36

For additional information on using these chassis inter-connection components, see the document *Multiple PCIe and AXIe Chassis System Configuration Tool*; found at www.keysight.com by searching on the document name.

System Limitations

Enumeration Limitations

All of the modules can be used with embedded controllers or external PCs. However, PCs are not equal in their ability to enumerate PCIe devices. The set of PCs where operation has been verified is listed in the document *PC Tested Configurations with PCI/AXIe Chassis* (5990-7632EN). Find this document at www.keysight.com by searching on the document title or document number.

Multiple M9024A Limitations

The additional ports on the M9024A operate like IO ports on the PC. For multiple chassis systems, only one M9024A can be used. For multiple chassis systems with an M9037A Embedded Controller, a single M9024A may be installed in a target chassis.

Step 1: Unpack and Inspect the Module

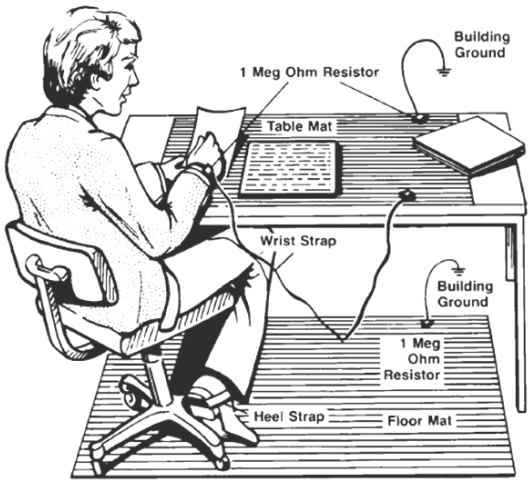
CAUTION Keysight's PXIe Modules are shipped in materials that prevent static electricity damage. The modules should only be removed from the packaging in an anti-static area ensuring that correct anti-static precautions are taken. Store all modules in anti-static envelopes when not in use.

ESD

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 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 MΩ of isolation from ground.



Inspect for damage

After unpacking the module, carefully inspect it for any shipping damage. Report any damage to the shipping agent immediately, as such damage is not covered by the warranty.

CAUTION To avoid damage when handling a module; do not touch exposed connector pins.

1. After unpacking the module, verify that all items listed on the packing list are included.
2. Inspect the module for shipping damage.
3. Save all packing material for storage or return shipment to Keysight.

If you need to return the module

Should it become necessary to return a Keysight module for repair or service, follow the steps below:

1. Review the warranty information shipped with your product.
2. Contact Keysight to obtain a return authorization and return address. If you need assistance finding Keysight contact information go to www.keysight.com/find/assist (worldwide contact information for repair and service) or refer to the **Support** information on the product web page, for example: www.keysight.com/find/M9021A.
3. Write the following information on a tag and attach it to the malfunctioning equipment.
   - Name and address of owner. A Post Office box is not acceptable as a return address.
   - Product model number (for example, M9021A)
   - Product serial number (for example, TWXXXXXXXX). The serial number label is located on the side of the module.
   - A description of failure or service required.
4. Carefully pack the module in its original ESD bag and carton. If the original carton is not available, use bubble wrap or packing peanuts, place the instrument in a sealed container and mark the container “FRAGILE”.
5. On the shipping label, write ATTENTION REPAIR DEPARTMENT and the service order number (if known).

NOTE If any correspondence is required, refer to the product by model number and serial number.

Step 2: Verify Shipment Contents

Your shipment should have included the following:

- The Keysight M902xA module that you ordered.
- Use the *Keysight Product Software and Information CD* or go to product pages on www.keysight.com for drivers and installation documentation

NOTE

A driver is required for the M9022A, M9023A and M9024A modules. Refer to "Step 4. Install the Driver" on page 15 for driver installation information. A single driver install utility services the M9022A, M9023A and M9024A modules. It is available on the software CD as well as on each of the Keysight product web sites:

www.keysight.com/find/M9022A

www.keysight.com/find/M9023A

www.keysight.com/find/M9024A

NOTE

The most current version of Keysight IO Libraries is required prior to installing and running any other software. The latest version can be downloaded from: www.keysight.com/find/iosuite.

NOTE

A GPIB cable is NOT supplied with the M9024A System Module. Note that the GPIB cable is a standard micro type 2 GPIB cable with standard pin wiring and is compatible with the M9037A Embedded Controller GP-IB cable. It is available from Keysight as an accessory cable, part number Y1260A.

Step 3: Install the System or Cable Interface Module in the Chassis

The Keysight Cable Interface Module and System Modules have been designed for easy installation. However, the following standard precautions, installation procedures, and general information must be observed to ensure proper installation and to prevent damage to the board, other system components, or injury to personnel.

NOTE Keysight's M9021A cable interface module can operate only with the x8 switch fabric found on the M9018 chassis. It will not work on other PXIe chassis.

CAUTION **The following safety precautions must be observed when installing or operating the Keysight System Modules. Exercise care when handling the module as the heat sink can get very hot. Do not touch the heat sink when installing or removing the module. The board should not be placed on any surface or in any form of storage container until the board and heat sink have cooled to room temperature.**

NOTE M9018 PXIe Chassis Backplane Switch for M9021A:

The M9021A cable interface module does not derive power from the chassis connector used by PXIe embedded controllers. Instead, the module uses the top connector on the chassis backplane for its 3.3V and 12V power. However, a switch on the M9018 chassis backplane must be set to supply those voltages to the connector. The default position of the switch is to the left and does not supply the voltages to the connector. To use the System Module or Cable Interface module in Slot 1 of the M9018 chassis, you must move the slide switch to the right before installing the module. Refer to the M9018 chassis documentation for more information.

Ensure the M9018 backplane switch is in the right-hand position when using the M9021A.

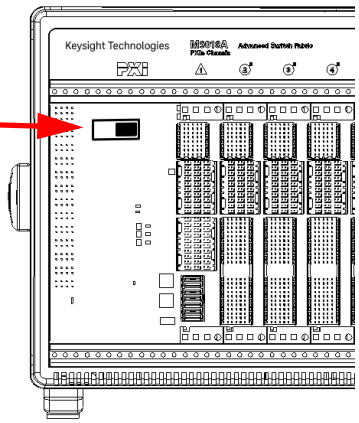


Figure 1 M9018 Backplane Switch

Setting this switch is not required for the M9022A, M9023A, or M9024A.

Step 4. Install the Driver

NOTE This installation requires that you first install the Keysight IO Libraries Suite. The latest version can be downloaded from: www.keysight.com/find/iosuite.

The M9022A, M9023A, and M9024A System Modules require a driver installed on the host PC. These System Modules work with Windows 7 SP1 32/64 bit and Windows 8.1 Update1 32/64 bit and Win 10 32/64 bit. One install program works for all 3 System Modules. This single driver is available at each of the product's Keysight web page:

www.keysight.com/find/M9022A

www.keysight.com/find/M9023A

www.keysight.com/find/M9024A

From the product website, select **Visit Technical Support > Drivers, Firmware & Software**. Select the **M902x** driver. Follow the on-screen instructions to install the driver on your host PC.

The M9021A Cable Interface Module does not require a driver.

If the driver installation does not detect an M902x module it will display the following message. click **Yes** to continue the installation.

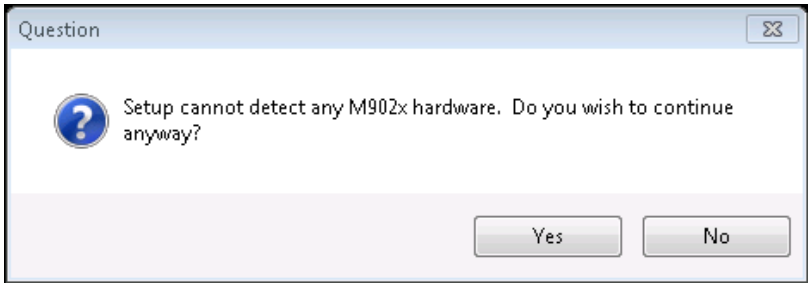


Figure 2 M902x Installer cannot detect an M902x module

M9024A Driver Installation

Have the M9024A in the chassis when you install the PXIe System Module driver. If you install the software without the M9024A present, the USB 2.0, USB 3.0, and GPIB port drivers will not be installed. Later, if you add an M9024A, you will need to rerun the installer.When you rerun the installer, choose Modify to load the additional drivers.

Using Different PCIe Chassis

The M9021A card interface module only works the Gen 2 PCIe M9018 chassis. When using the M9021A with the M9018, use the chassis *PCIe Switch Fabric Configurator* to set the chassis switch fabric to 1x8.

To use the M9022A, M9023A, or M9024A system modules with the M9018 chassis, use the chassis *PCIe Switch Fabric Configurator* to set the chassis switch fabric to 2x8.

The link configuration for the Gen 3-capable M9019A chassis is fixed, so there is no need to configure the chassis switch fabric when using the M9022A, M9023A, or M9024A system modules.

NOTE For a full discussion of PCIe link configuration, see the topic "Viewing the PCIe Link Configuration" in the Software Front Panel (SFP) help system for the chassis, or "PCIe Link Configuration" in the *Keysight M9018 PXIe Chassis User Guide*.

General Installation Considerations

The following table shows which PXIe chassis slots the System Modules or M9021A Cable Interface module may be installed in:

PXIe Chassis Slots and glyphs		
	PXIe System Slot 	**PXIe Peripheral Slot** 
M9021A	**X** (M9018 chassis only)	**X** (M9018 chassis only)
M9022A	**X**	–
M9023A	**X**	–
M9024A	**X**	–

NOTE

Some non-Keysight PXIe chassis manufacturers install small chassis stops just to the left of the slot 1 guide rails (both top and bottom). Refer to the photo below. These must be removed prior to installing the M9024A System Module. They snap in and are easily pulled out.

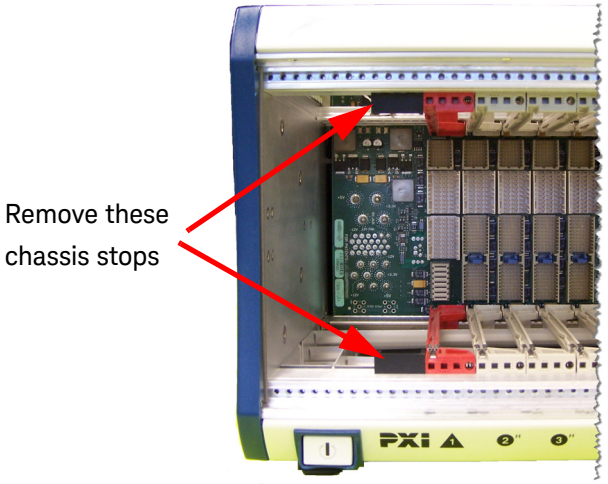


Figure 3 Chassis Stop Locations

Follow these steps to install the module in a PXIe chassis.

1. Turn off the host PC and the PXIe chassis. The chassis should be plugged into an AC power source; the AC power cord grounds the chassis and protects it from electrical damage while modules are installed.
2. On the M9018 chassis, set the rear panel **INHIBIT** switch to **DEF**.
3. Remove the module from its protective bag. Observe electrostatic discharge precautions.
4. Ensure the switches on the Cable Interface Module or the System Module are set correctly.
   a. Refer to "M9021A Switch Settings" on page 19 for information on the M9021A switches.
   b. Refer to "Module switch settings summary" on page 25 for information on the System Module switches.
5. Remove the screw protection caps from the module retaining screws.
6. Push down on the module's ejector/injector handle.
7. Carefully align the module board edges with the chassis guide rails (red guide rails for slot 1) and insert the module into the guide rails.

8 Push inward on the module until it is firmly seated in the chassis. (Do not force the handle if there is resistance; this may damage the connectors and/or backplane.)

9 Pull up on the ejector/injector handle to firmly seat the module.

10 Tighten the module's captive retaining screws.

11 A slot blocker should be installed immediately to the left of the slot 1 module to ensure proper airflow.

12 Attach the PCIe cable by first pulling back on the retractor ring. With the keyed slot aligned with the key ridge on the PCIe adapter, insert the cable connector into the cable port connector on the adapter until the cable locks in place.

13 Attach the other end of the cable to the PCIe adapter on your Host computer.

NOTE

If you are using a external PC, you must power up the chassis BEFORE you power up the PC. When you power down your system, shut down the PC BEFORE you power down the chassis.

If you are using an embedded controller in a multi-chassis configuration, you must power up the target chassis BEFORE you power up the chassis containing the embedded controller.

14 Power up the PXIe chassis. Verify that the chassis fans are operating and free of obstructions that may restrict air flow.

15 Power up the Host PC.

M9021A PCIe Cable Interface Module Installation

The M9021A uses special features built into the Keysight M9018 chassis and is not compatible with the PXIe System Slot in other PXIe chassis.

M9021A Switch Settings

Switch	Description
S201	Ensure that S201 is in the NC position (right side down).
S301	For applications, where the M9021A provides a cabled PCIe link between the M9018 chassis and an external host computer, install the M9021A in the system slot (slot 1) of the M9018 PXIe chassis. The two switches on S301 must be in the Target (right) position. This is the default setting. For connecting to a downstream RAID solution, such as the JMR mass storage, the M9021A must be installed in a x8 hybrid slot (either slot 2, 6, 11, or 15) in the PXIe chassis. In this case, both switches on S301 should be in the Host (left) position.

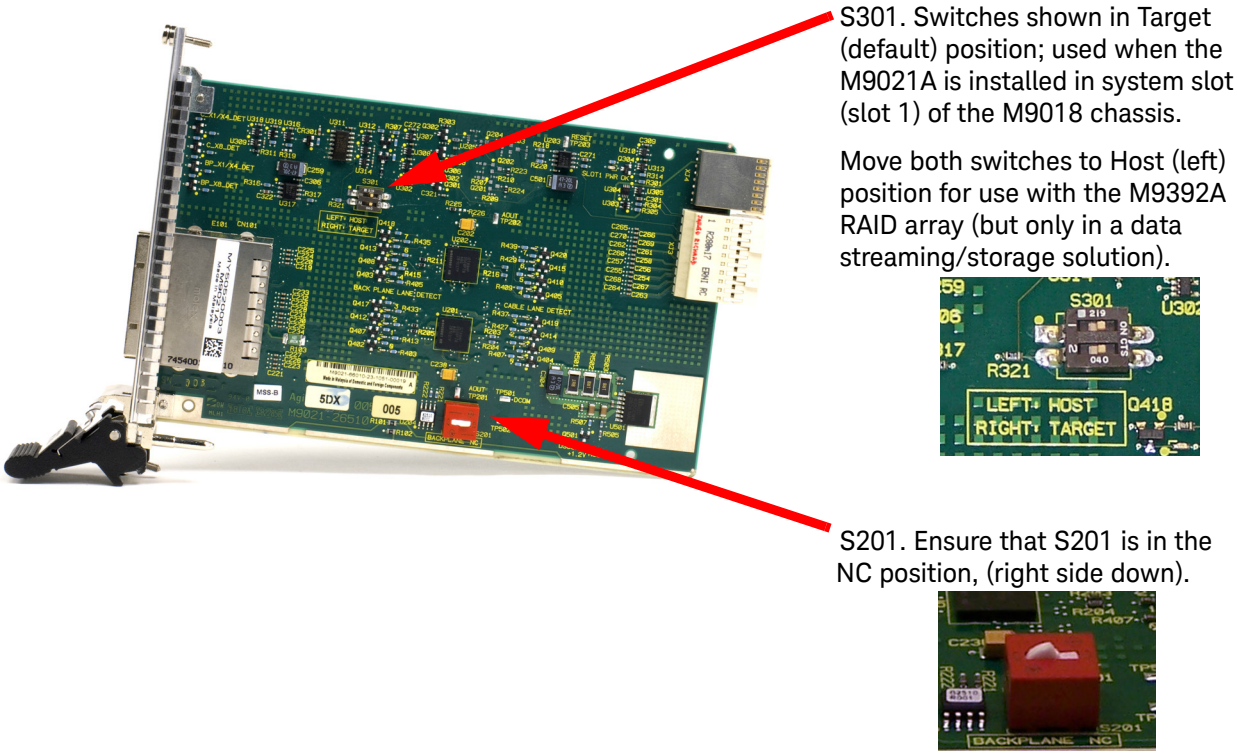


Figure 4 M9021A Switch Locations

M9021A LEDs

The M9021A Cable Interface module has both front panel and PC board LEDs that indicate how many PCIe lanes are actually being used to communicate between the PC and the chassis. If your chassis application is running slower than you expect, check the M9021A LEDs to see how wide your data path is to the chassis.

NOTE If you remove a slot 2 module or filler panel to view the M9021A LEDs, ensure that the module or filler panel is reinstalled. This is required to maintain chassis cooling as well as minimize radio frequency interference.

The M9021A front panel has four LEDs to indicate the communication speed to the host controller. The following table describes the LED indications:

Configuration to Host PC	M9021A Front Panel LEDs	PC Board (or side) LEDs
x1 PCIe Link	x4 Cable & x4 Chassis	Single pair yellow LEDS
x4 PCIe Link	x4 Cable & x4 Chassis	4 pairs yellow LEDs
x8 PCIe Link	x4 Cable & x4 Chassis x8 Cable & x8 Chassis	All 8 pairs yellow LEDs

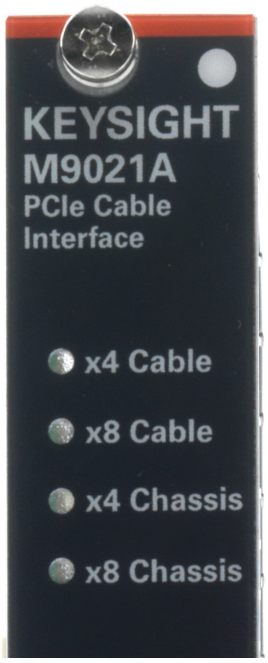


Figure 5 M9021A Front Panel LEDs

Figure 6 shows the LEDs that are illuminated for single lane (x1) communications to the chassis, which is provided by the M9045 PCIe Express Card Adapter. The left-most set of LEDs indicates the number of lanes communicating to the chassis backplane, while the right-most set of LEDs indicates the number of lanes communicating to the host PC.

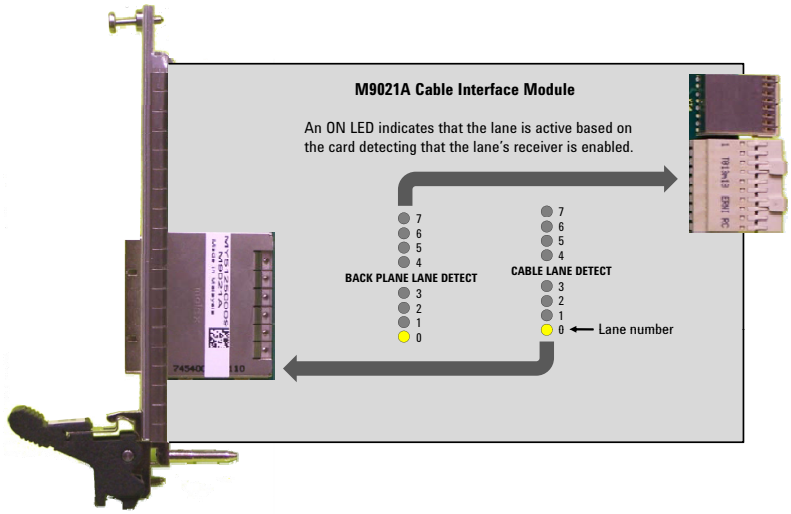


Figure 6 Single lane communications between host controller and the chassis

Figure 7 shows the LEDs that are illuminated for x4 communications.

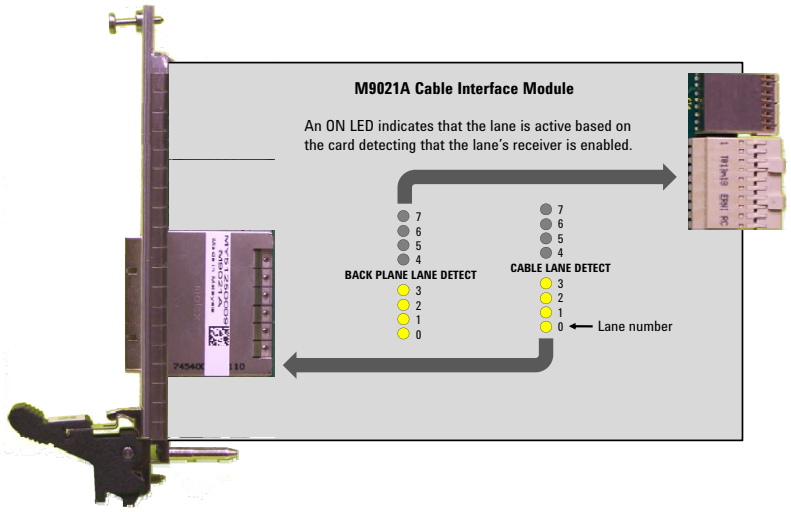


Figure 7 x4 communications between the host controller and the chassis

Figure 8 shows the LEDs that are illuminated for x8 communications. An example of eight lane communications would be an eight lane M9048A PCIe Desktop Adapter installed in an x8 (mode x8) slot or in an x16 (mode x16) slot.

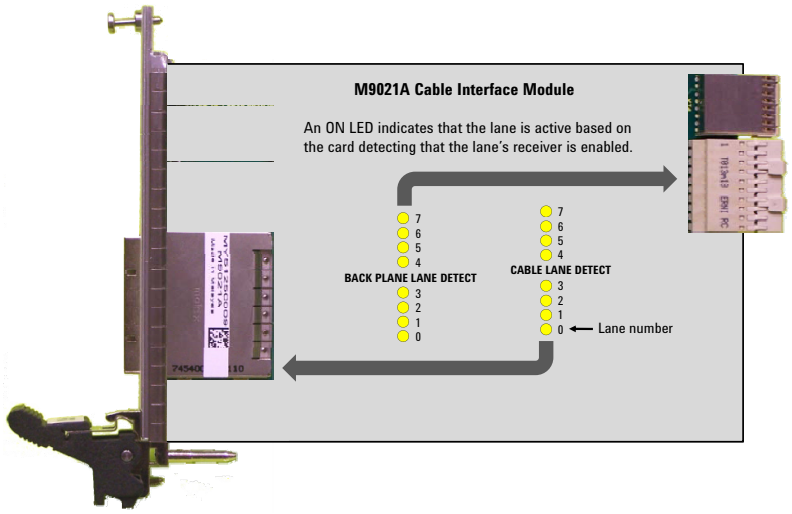


Figure 8 x8 communications between the host controller and the chassis

M9022A, M9023A, M9024A System Module Installation

Understanding Features Controlled by Switch Settings

Mode Settings

The Mode settings, Host and Target, do not apply to the M9022A because it has only one PCIe port on the front panel.

The M9023A and M9024A are Dual Port System Modules. Each port can have a PCIe cable plugged into it to support high speed data communications.

PCIe Port 1 is always a “target,” but the PCIe Port 2 can be configured via switch settings to be either ‘host” or “target.” The default setting for the PCIe Port 2 is “host.”

PCIe Port	Mode	x8 a single PCIe cable	x16, two PCIe cables to PC
1	Target	target	target
2	Host (default)	host	target

Mode Host (default) x8

The top port (PCIe Port 1) is always connected to the upstream device (that is, the device closest to the computer); for example when the upstream device is a PC, PCIe Port 1 is the target. In the default configuration the PCIe Port 2 connects to a downstream device; for example when the downstream device is a chassis, PCIe Port 2 is the host. Both of these connections will use a single 8 lane PCIe cable. See Figure 18 for an example PCIe cable topography that uses this configuration.

Mode Target x16

The other mode “target” is possible via switch settings. In this mode PCIe Port 2 connects to a upstream device. There are no downstream devices. This mode is used to achieve maximum bandwidth between a chassis and a PC. With 2 x8 PCIe cables working in parallel, the total number of lanes of communication is 16. See Figure 16, “ x16 Connection to the PXIe chassis,” on page 34 for an example of a PCIe cable topology that uses this configuration.

Note that when two cables are connecting a PC to chassis, the top cable connector on PC host adapters must be connected to the top (PCIe Port 1) on the M9023A or M9024A. Likewise, the bottom two ports must connected to each other.

Transfer Rate Settings

Link settings determine the fastest transfer rate at which the module will support PCIe. The default switch setting allows the PCIe links to train to a maximum of Gen3. The module will train its link to a slower speed if the other end of the link cannot support Gen3.

Some devices are old or low performance and can not support Gen3 speeds.

Sometimes a device also cannot correctly follow the PCIe training protocol and the link fails to connect reliably. As a workaround or diagnostics debug step, you can throw the switches on the M9022A, 23A, and 24A modules to lower the maximum speed to Gen 1. This lower speed may allow the device to function reliably.

Using the M9024A on an M9018 with 4x4 PCIe Switch Fabric

M9024A can be used in an M9018 or M9019A PXIe Chassis. The M9018 can be configured using the *PCIe Switch Fabric Configurator* to set the PXIe Chassis switch fabric to one of 1x8, 2x8, or 4x4. The 2x8 configuration is the default configuration for the M9022A, M9023A, and M9024A modules. However, if you set the M9018 to a switch fabric of 4x4, and you are using the M9024A, you will need to make a switch setting change on the M9024A so that the IO ports will operate properly.

Module switch settings summary

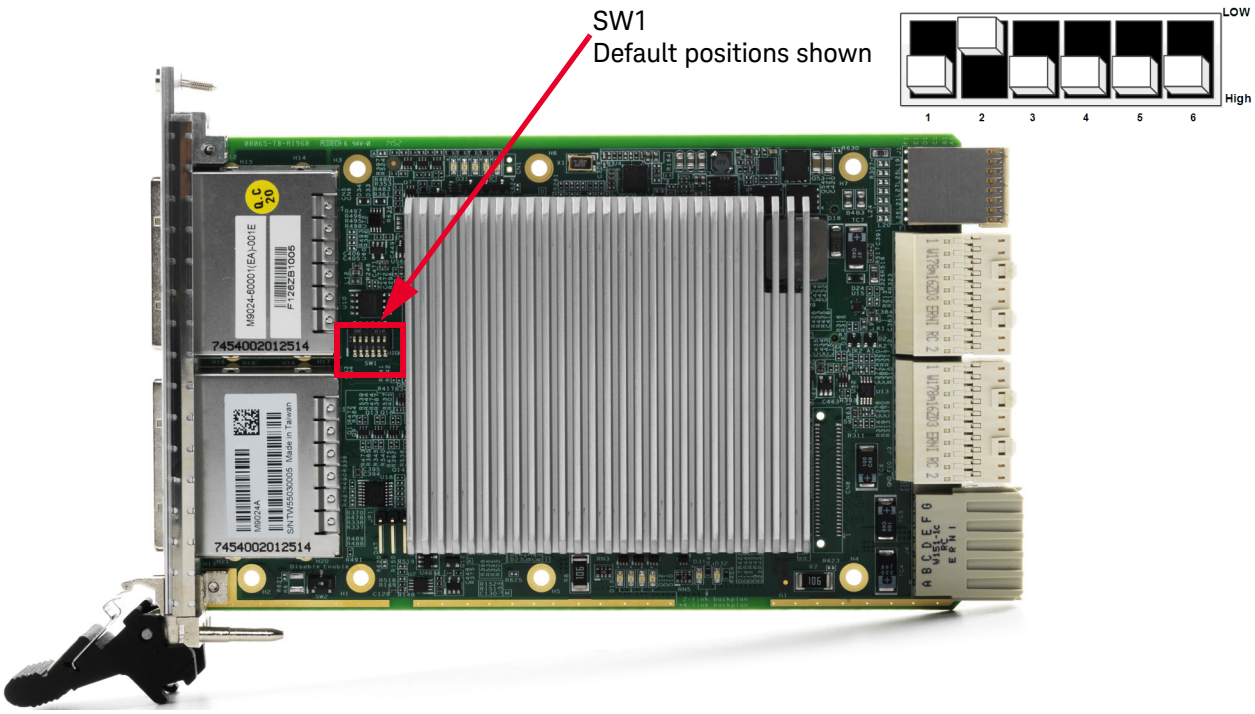


Figure 9 M9022A, M9023A, M9024A Switches

SW1 Switch Function	SW1 (x means don't care) 1	2	3	4	5	6	Notes
Mode Host (default)	H	L	x	x	x	x	Cable port 1 is PCIe x8 input (target mode), Cable port 2 is PCIe x8 output (downstream port to next chassis)
Mode Target	H	H	x	x	x	x	Cable ports 1 and 2 combined as PCIe x16 input. Both ports are in target mode.
Link speed Gen 3 (Default)	x	x	H	H	x	x	PCIe link speed is set to a maximum of Gen 3
Link speed Gen 1	x	x	H	L	x	x	PCIe link speed is set to a maximum of Gen 1
M9024A: x8 (default)	x	x	x	x	H	x	
M9024A: 4x4	x	x	x	x	L	x	Use this with M9018 that has a switch fabric of 4x4.

M9022A, M9023A, M9024A Front Panel LEDs Summary

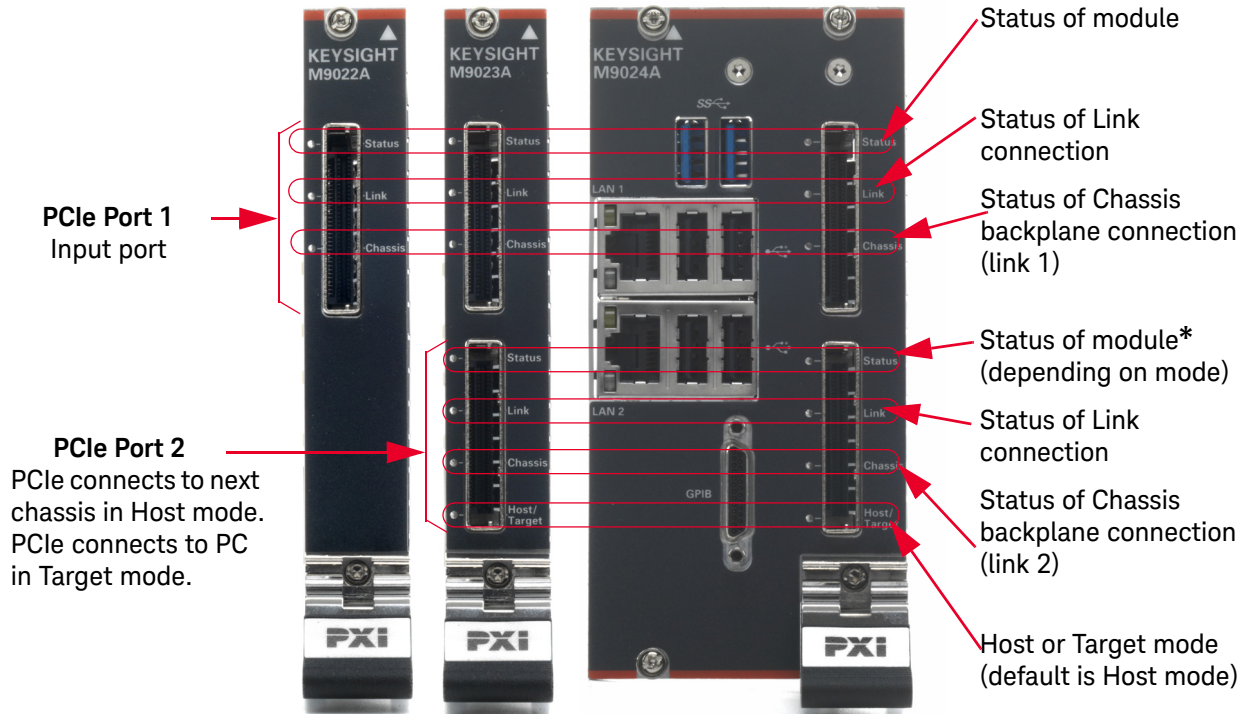


Figure 10 M9022A, M9023A, M9024A Front Panel LEDs

* The lower port "Status of module" definition depends on the mode of the lower port. If the lower port is in the default mode, "Host", then this LED is shown the status of the lower port. If the lower port is in mode 'target," then this LED is a copy of the top LED "Status of module."

LED	Color	Description
Status of Module	Off	No power.
	Red	Power Supply problem or FPGA (normal to go briefly Red on power-up and power-down.)
	Blue	Module okay but no link present.
	Green	Link present.
Status of Link connection	Off	No link present
	White	Gen 1 Connection
	Blue	Gen 2 Connection
	Green	Gen 3 Connection
Status of backplane connection (Top LED is Link 1 status Bottom LED is Link 2 status)	Off	No link present
	White	Gen 1 Connection
	Blue	Gen 2 Connection
	Green	Gen 3 Connection
Host or Target mode	Green	Host mode (default) (x8)
	Blue	Target mode (x16)

There are also a series of five LEDs across the top of the PC board and six LED across the bottom of the PC board indicating power and configuration.

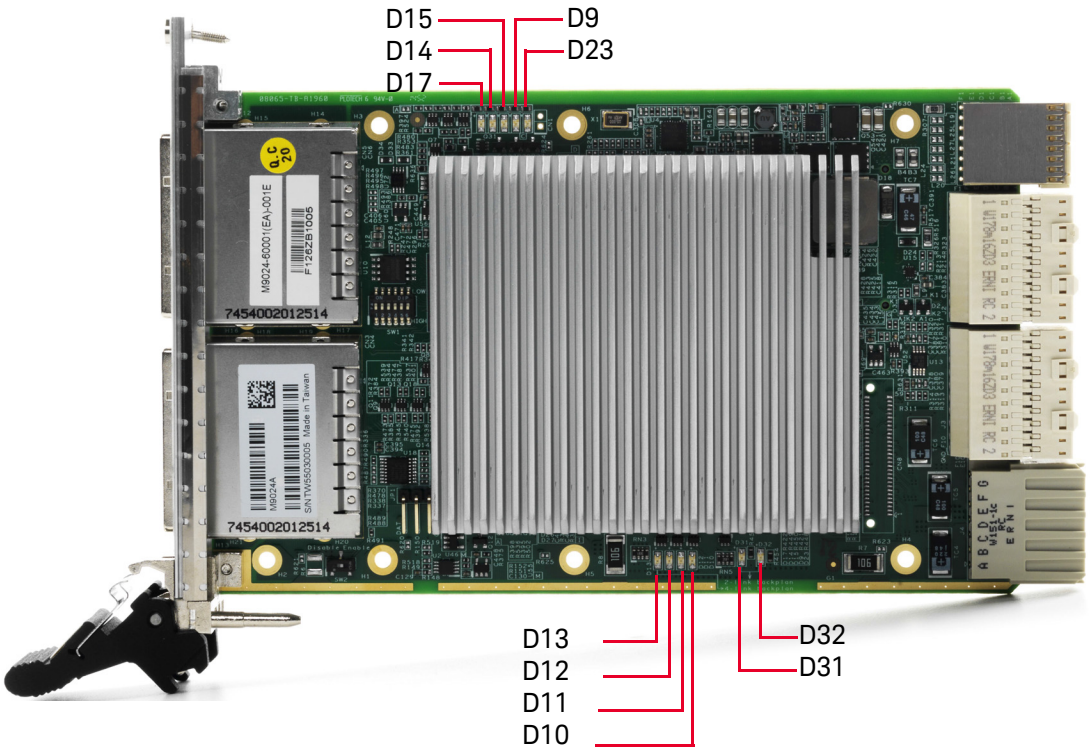


Figure 11 M9022A, M9023A, M9024A PC Board LEDs

LED	Indicates
D17	PXIe power is okay
D14	0.9 VDC power is okay
D15	1.8 VDC power is okay
D9	FPGA configuration is okay
D23	PCIe link status for FPGA
D10 - D13	PCIe Link Status when the backplane is 4-link routing. When the backplane is 2-link routing, D10 indicates PCIe link status for left side mezzanine board.
D31- D32	PCIe Link Status when the backplane is 2-link routing. When the backplane is 4-link routing, D31 indicates PCIe link status for left side mezzanine board.

On the backside of the M9024A module are two LEDs:

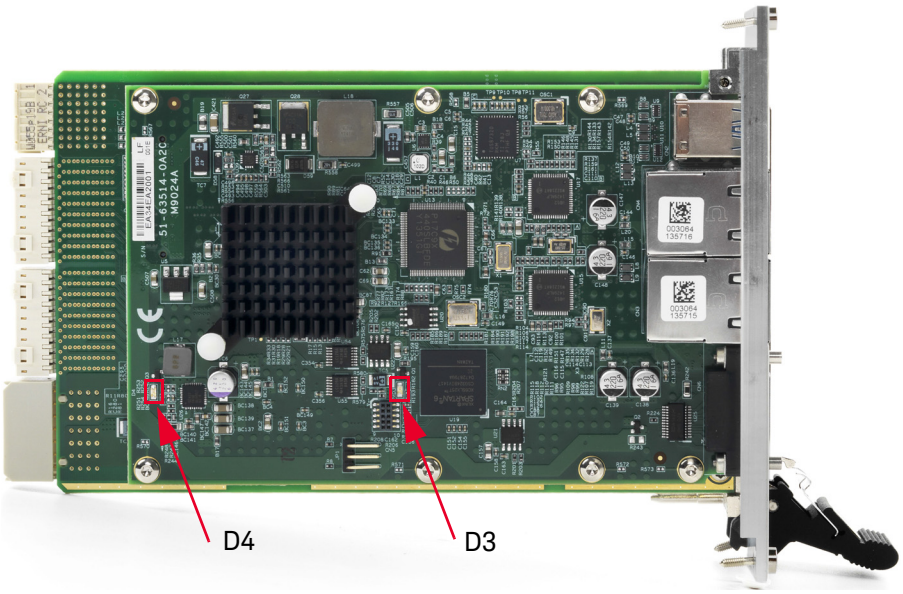


Figure 12 Back of M9024A module showing two LEDs

LED	Indicates
D3	Configuration is okay for GPIB controller
D4	1.0 VDC power is okay

M9024A I/O Interfaces

To use the M9024A USB, Ethernet and GPIB ports, use the IO Libraries to verify the programming address. These ports cannot be used to control the PXIe chassis. The IO ports are an extension of the Windows PC and should be observable in Windows Device Manager.

USB*

Keysight's M9024A System Module provides four USB 2.0 Type A ports and two USB 3.0 Type A ports on the faceplate. All USB ports are compatible with high-speed, full-speed and low-speed USB devices.

Differences between USB 2.0 and USB 3.0 USB 3.0 is the latest version of the Universal Serial Bus (USB). It provides better speed and more efficient power management than USB 2.0. USB 3.0 is backward compatible with USB 2.0 devices; however, data transfer speeds are limited to USB 2.0 levels when these devices inter-operate.

	USB 2.0	USB 3.0
Backwards Compatibility	USB 1.1	USB 1.1 and USB 2.0 (data transfer speeds are limited to USB 1.1 or USB 2.0 levels)
Speed	480 Mbps (known as High Speed/ HS)	10 times faster than USB 2.0. Super Speed or SS, 4.8 Gbps
Signaling Method	Half duplex	Full duplex (Asynchronous -- it can send and receive data simultaneously)
Power	Up to 500 mA	Up to 900 mA. Allows better power efficiency with less power for idle states. Can power more devices from one hub.
Number of wires within cable	4	9
Cables and Connectors	Grey color	Blue color. USB 3.0 receptacles are electrically compatible with USB 2.0 plugs if they physically match. USB 3.0 type-A plugs and receptacles are completely backward compatible, and USB 3.0 type-B receptacles accept USB 2.0 and earlier plugs. However, USB 3.0 type-B plugs will not fit into USB 2.0 and earlier receptacles. This means that USB 3.0 cables cannot be used with USB 2.0 and USB 1.1 peripherals, although USB 2.0 cables can be used with USB 3.0 devices, if at USB 2.0 speeds.

* The USB 2.0 and 3.0 ports do not support the USB Battery Charging specification. Do not connect non-standard or defective USB devices.

Ethernet

The M9024A has two RJ-45 connectors with link speed/activity LEDs on the faceplate.

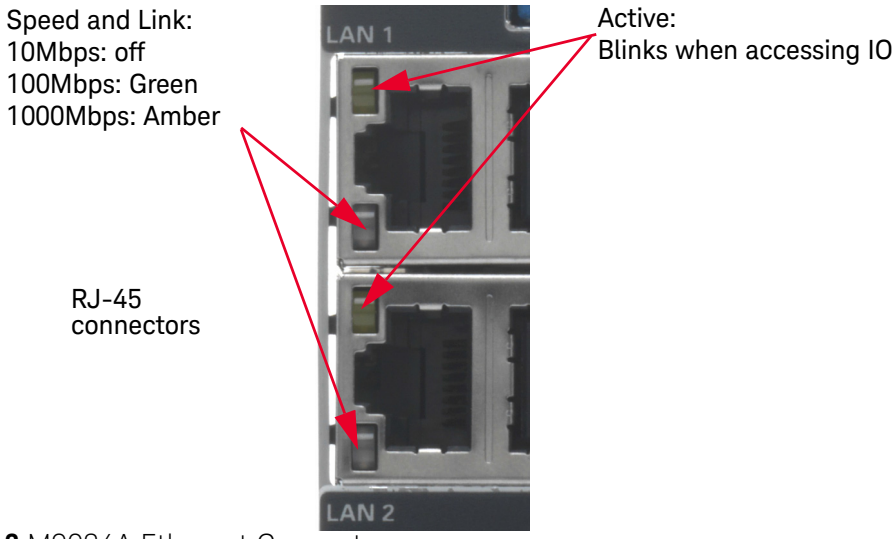


Figure 13 M9024A Ethernet Connectors

Status		Speed LED (Green/Amber)	Activity LED (Amber)
Network link is not established or system is powered off		OFF	OFF
10 Mbps	Link	Off	ON
	Active	Off	Blinking
100 Mbps	Link	Green	ON
	Active	Green	Blinking
1000 Mbps	Link	Amber	ON
	Active	Amber	Blinking

GPIB connector

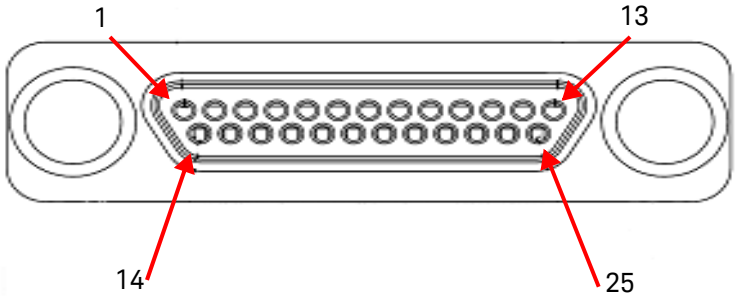
The GPIB connector on M9024A is a D-sub 25-pin connector and is used to control external bench-top instruments. The on-board GPIB controller has the following features:

- Compatible with the IEEE 488 standard
- Up to 1.5MB/s data transfer rates
- On-board 2 KB FIFO for read/write operations
- Connect up to 14 instruments
- GPIB is a standard VISA Resource

NOTE A GPIB cable isn't supplied with the M9024A. The GPIB cable is a specific type available from Keysight as an accessory cable; part number Y1260A. This cable also works with the M9037A Embedded Controller's GPIB port. The M9024A GPIB port is **not** compatible with the GPIB cable, part number M9036-31301, used with the M9036A Embedded Controller.

NOTE Please install the most recent version of Keysight IO Libraries Suite to use the GPIB.

The following table provides the pin-out of the front panel D-sub 25-pin GPIB connector.



Pin	Signal	Description	Pin	Signal	Description
1	DIO1#	GPIB Data 1	14	DIO6#	GPIB Data 6
2	DIO2#	GPIB Data 2	15	DIO7#	GPIB Data 7
3	DIO3#	GPIB Data 3	16	DIO8#	GPIB Data 8
4	DIO4#	GPIB Data 4	17	REN	Remote Enable
5	EOI	End or Identify	18	GND	Signal Ground
6	DAV	Data Valid	19	GND	Signal Ground
7	NRFD	Not Ready for Data	20	GND	Signal Ground
8	NDAC	Not Data Accepted	21	GND	Signal Ground
9	IFC	Interface Clear	22	GND	Signal Ground
10	SRQ	Service Request	23	GND	Signal Ground
11	ATN	Attention	24	GND	Signal Ground
12	Shield	Chassis Ground	25	GND	Signal Ground
13	DIO5#	GPIB Data 5			

Connecting a PC to a PXIe or AXIe Chassis

The following examples show a few of the possible configurations between a PC (both PXIe embedded PC and an external PC) and a PXIe or AXIe chassis. Many other configurations are possible.

External PC to a single chassis configuration

The simplest system consists of an external PC with a PCIe Host Adapter card (such as the Keysight M9048B) connected to a PXIe or AXIe chassis. A PXIe chassis requires a System Module or Cable Interface Module such as the Keysight M9021A. An AXIe chassis does not require a system module interface, because a cable port is included in the ESM half height module.

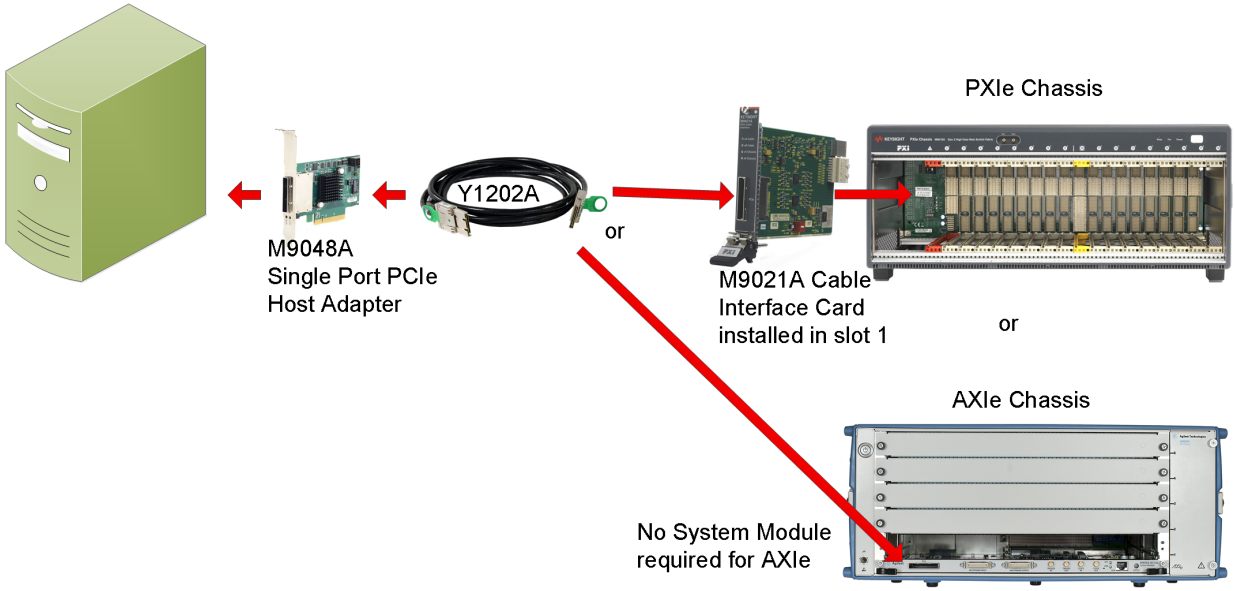


Figure 14 Basic external PC system configuration

External PC to two chassis configuration

Another simple system consists of an external PC with a PCIe Host Adapter card (such as the Keysight M9049A) connected to two PXIe or AXIe chassis. A PXIe chassis requires a System Module such as the Keysight M9022A. An AXIe chassis does not require a system module interface, because a cable port is included in the ESM half height module. The link speed is determined by the chassis; for example, Gen 2 speed with the M9018 PXIe chassis or the M9502A or M9505A AXIe chassis; Gen 3 speed is available with Gen 3 PXIe chassis such as the M9019A.

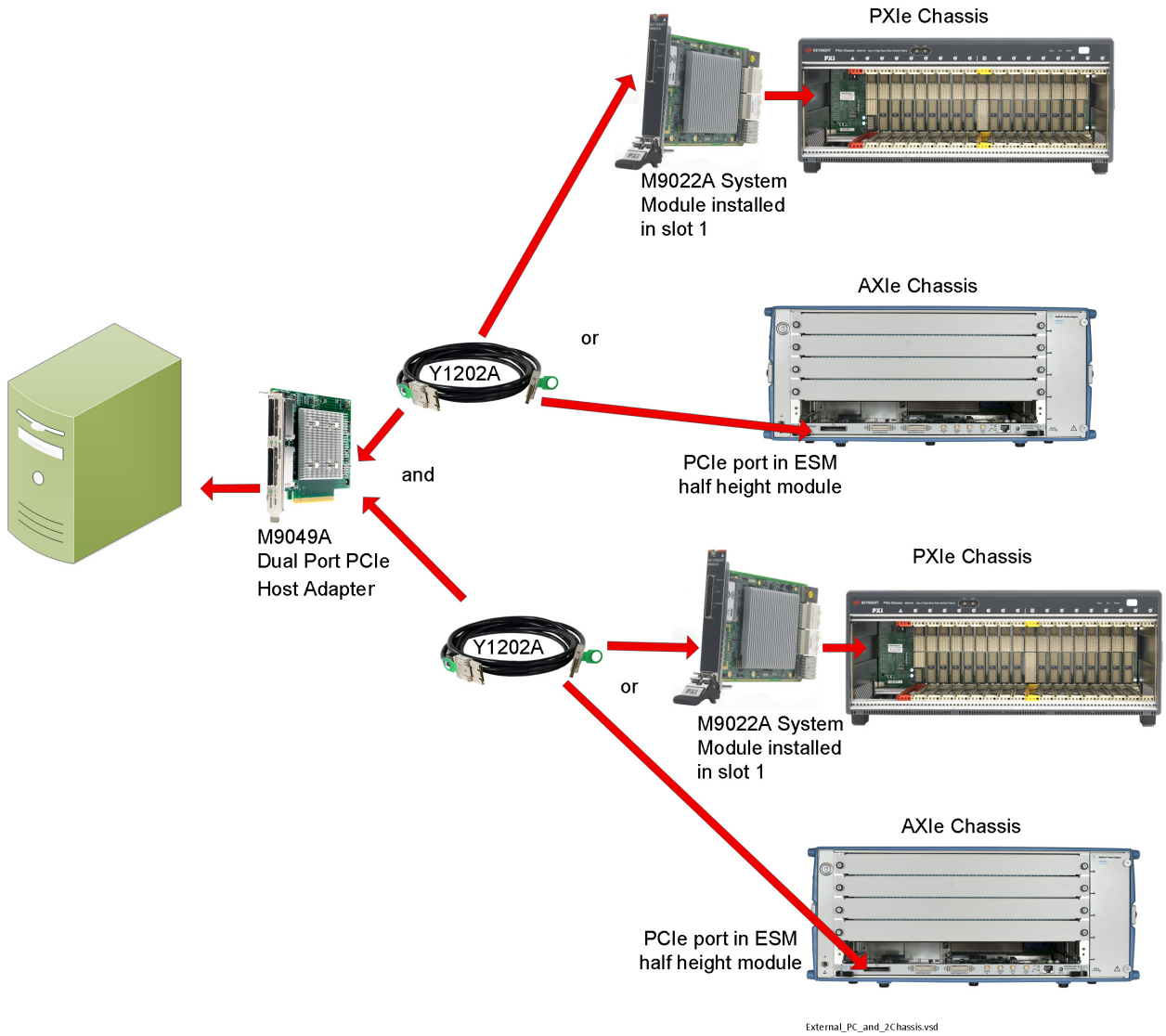


Figure 15 Simple two chassis configuration

External PC, X16 connection to single PXIe chassis configuration

The following configuration represents the fastest speed (x16) between the PC and the chassis. Make certain that all switches on the interface modules are set correctly to configure this operation. Make certain the top connector on the M9049A module connects to the top connector on the M9023A module and the bottom connectors connect together.

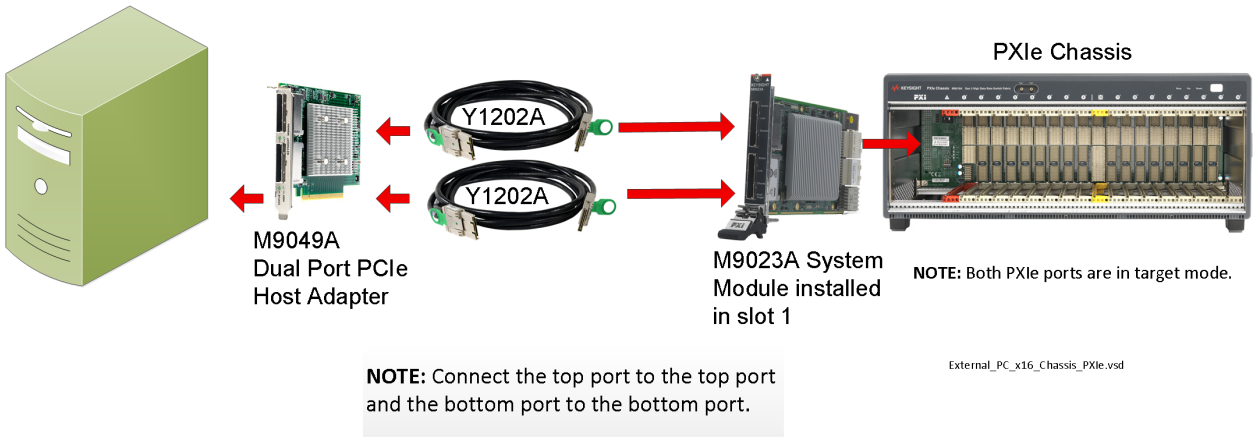


Figure 16 x16 Connection to the PXIe chassis

M9037A Embedded Controller to second chassis

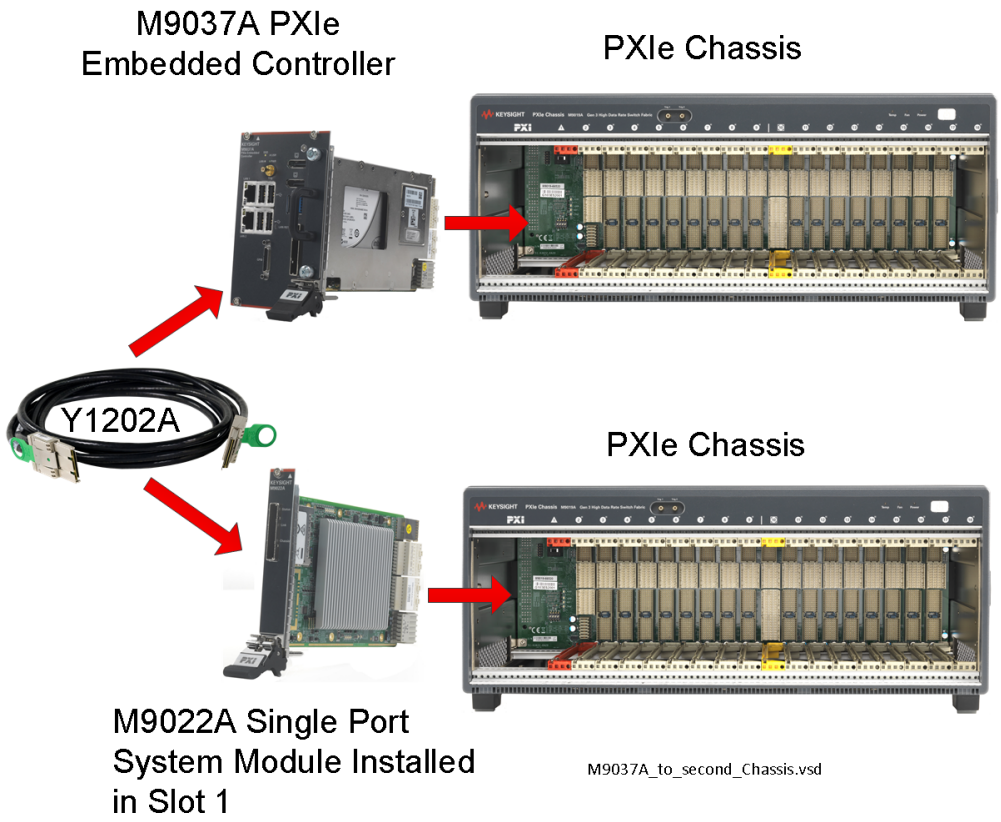


Figure 17 M9037A Embedded Controller to a second PXIe chassis

M9037A Embedded Controller to Cascade of PXIe Chassis

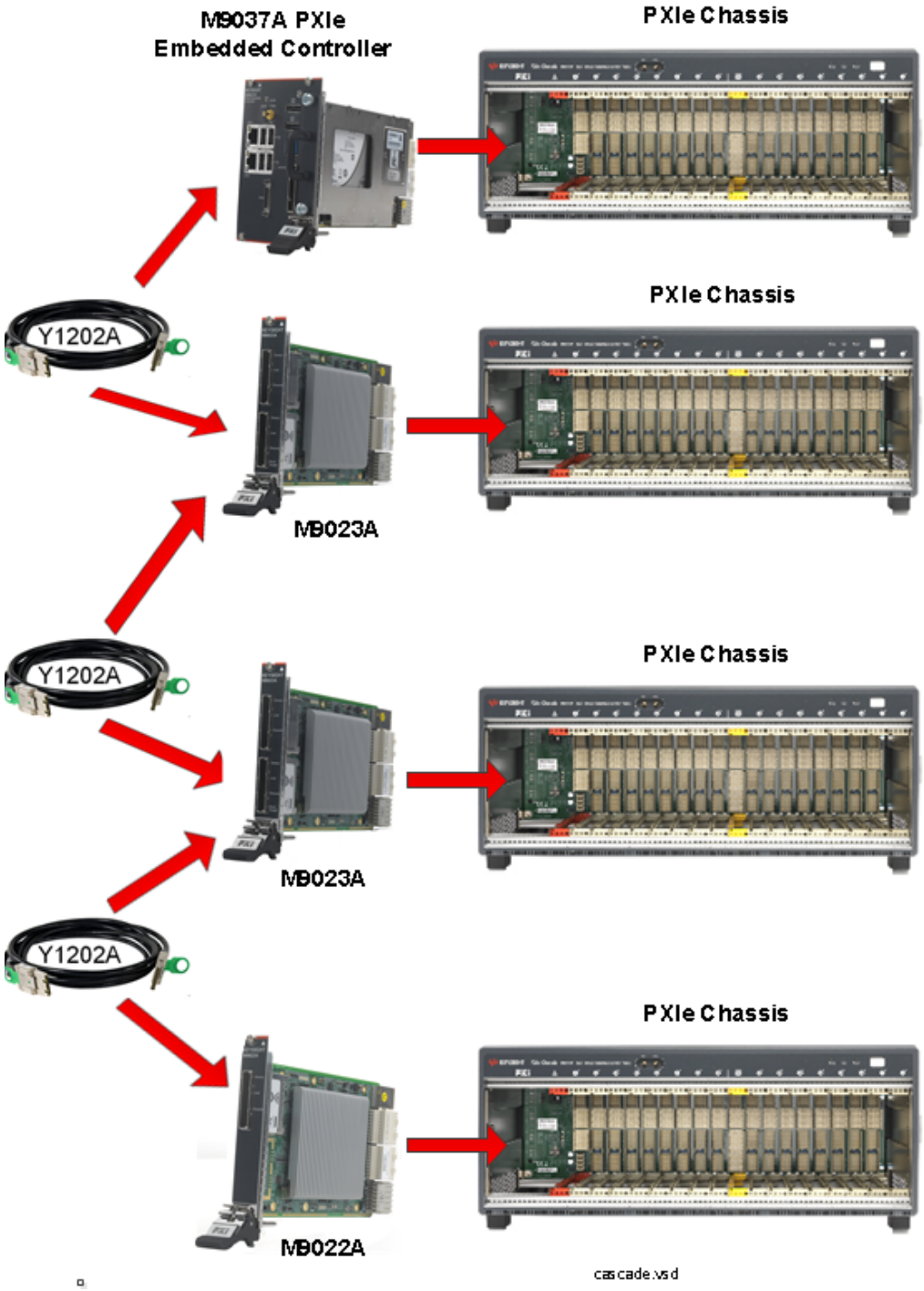


Figure 18 Cascade or “Daisy Chain” of PXIe Chassis

Module Characteristics

Module Characteristics	M9021A	M9022A	M9023A/M9024A
Size:	1 slot 3U PXIe	1 slot 3U PXIe	1 slot 3U PXIe
Supported Chassis	M9018	all PXIe chassis	all PXIe chassis
Link Configurations			
PXIe Backplane	Gen2 x8	Gen3 x8 + x16	Gen3 x8 + x16
PCIe Target Port	Gen2 x8	Gen3 x8	Gen3 x8
PCIe Host Port	Gen1 x8	not applicable	Gen3 x8
PCIe Dual Target Port	not applicable	not applicable	Gen3 x16 (dual x8)
Front panel connector	One x8 iPass PCIe cable connector	One x8 PCIe iPass cable connector	Two x8 PCIe iPass cable connectors
Front panel indicators	LEDs for PCIe lane status and link size	Power/Present indicator: blue (power up), Green (power up and link present) Speed indicator: green Gen3, blue Gen2, white Gen1	
Power consumption (typical)	5 W	15 W	16 W / 18 W
Cable length (max)	Up to 2 meter passive cable supported	Up to 2 meter passive cable supported*	Up to 2 meter passive cable supported*
Operating Temperature	0° C – 55° C	0° C – 55° C	0° C – 55° C

* Contact Keysight for information about longer optical cable support.

Related Products

Product	Description
M9048B	PCIe Host Adapter: Single Port (x8), Gen 3
M9049A	PCIe Host Adapter: Dual Port (1x16, 2x8), Gen 3
Y1202A	PCIe cable: x8, 2.0M
Y1203A	PCIe cable: x8, 0.5M, used for chassis-to-chassis in racked multiple chassis systems

Troubleshooting and Service

There are no user-serviceable parts on these modules. For troubleshooting, refer to the LED descriptions earlier in this guide ("M9021A LEDs" on page 20). If the LEDs are not lit at all, there may be no power applied. Also, ensure the switches are set correctly.

If you are unable to establish communications from the host controller PC to the chassis, check the following.

- Ensure the appropriate chassis drivers and system module driver are installed on the host controller PC.
- Check if a faulty PCIe adapter card is plugged into the host controller PC
- Check for a faulty PCIe cable
- Check the chassis power supply

NOTE A download-able driver is required for the M9022A, M9023A and M9024A modules. Refer to "Step 4. Install the Driver" on page 15 for driver installation information.

NOTE The most current version of Keysight IO Libraries is recommended prior to installing and running any other software. The latest version can be downloaded from: www.keysight.com/find/iosuite.

NOTE The additional ports on the M9024A operate as IO ports on the PC's PCIe bus. For multiple chassis systems with an M9037A Embedded Controller, the M9024A may be installed in slave chassis.

If power is applied and the switches are set correctly, and either the LEDS are not lit or are lit incorrectly, the module may be defective.

Replacement part numbers are as follows:

Module	Replacement Part Number
M9022A	M9022-66101
M9023A	M9023-66101
M9024A	M9024-66101

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