User Guide

Keysight M9506A 5-Slot AXIe Chassis

![KEYSIGHT TECHNOLOGIES]

Notices

Manual Part Number

M9506-90005

Edition

Edition 1, September 2019
Published in USA

Keysight Technologies
1400 Fountaingrove Parkway
Santa Rosa, CA 95403 USA

Trademarks

AXIe is a registered trademark of the AXIe Consortium.

PXI is a registered trademark of the PXI Systems Alliance.

PICMG®, Compact PCI®, and AdvancedTCA® are registered trademarks of the PCI Industrial Computer Manufacturers Group.

PCI-SIG®, PCI Express®, and PCIe® are registered trademarks of PCI-SIG.

Thunderbolt and the Thunderbolt logo are trademarks of Intel Corporation or its subsidiaries in the U.S. and/or other countries.

Sales and Technical Support

To contact Keysight for sales and technical support, refer to the support links on the following Keysight websites:

 www.keysight.com/find/M9506A (product-specific information and support, software and documentation updates)

www.keysight.com/find/assist (worldwide contact information for repair and service)

Declaration of Conformity

Declarations of Conformity for this product and for other Keysight products may be downloaded from the Web. Go to http://keysight.com/go/conformity and click on "Declarations of Conformity." You can then search by product number to find the latest Declaration of Conformity.

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

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.

Chassis is rated for Indoor use only.

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.

This product is designed for use in installation category II AND pollution degree 2.

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 a 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 a 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

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.

Products display the following symbols:

Warning, risk of electric shock

Refer to manual for additional safety information.

Earth Ground.

Chassis Ground.

Alternating Current (AC).

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

Antistatic precautions should be taken.

CAT I
CAT II   IEC Measurement Cate-
CAT III   gory I, II, III, or IV
CAT IV

For localized Safety Warnings, Refer to Keysight Safety document (p/n 9320-6792).

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.

The CE marking is a registered trademark of the European Community (if accompanied by a year, it is the year when the design was proven). It indicates that the product complies with all relevant directives.

The Regulatory Compliance Mark (RCM) is a registered trademark of the Australian Communications and Media Authority.

ICES/NMB-001

This is a marking to indicate product compliance with the Industry Canada Interference-Causing Equipment Standard (ICES-001); Cet appareil ISM est conforme a la norme NMB du Canada.

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.

MSIP-REM-Kst-BLM9506A

South Korean Certification (KC) mark. It includes the marking's identifier code which follows this format: MSIP-REM-YYY-ZZZZZZZZZZZ.

A 급 기기 (업무용 방송통신기자재)
이 기기는 업무용 (A 급) 전자파적합기
기로서 판 매자 또는 사용자는 이 점을 주
의하시기 바라 며 , 가정외의 지역에서
사용하는 것을 목적으 로 합니다.

Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC

This WEEE symbol indicates separate collection for electrical and electronic equipment, mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal.

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

Contents

8 Troubleshooting and Service

1   Introduction

This chapter provides a brief introduction to the AXIe chassis.

KEYSIGHT
TECHNOLOGIES

M9506A 5-Slot AXIe Chassis Description

The Keysight M9506A AXIe chassis is a modular instrument chassis fully compatible with the AXIe Wide PCIe specification. It allows multiple application-specific instrument modules to share a common chassis frame, power supply, cooling system, PCI Express (PCIe) x16 Generation 3 (Gen 3) backplane, Gigabit LAN hub, local bus for module-to-module signaling, and host PC connections. The full rack chassis provides five general purpose peripheral slots that accept 1U AXIe instrument modules.

Additional features include:

- Up to 300 W per slot power
- Five AXIe Wide compliant slots
- PCIe x16 Gen 3 Backplane allows module to module communication
- Default PCIe configuration merges both cable ports to one Gen 3 x16 PCIe Cable Port.
- Open AXIe Zone 3 for custom use (cable access, analog backplane, etc.)
- Thunderbolt 3 Connection Port[*]
- Cascaded PCIe for multiple chassis systems
- Parallel and Star Triggering
- Push-pull fan system for quieter operation

The chassis includes a half-height Embedded System Module (ESM) which manages chassis functions. The ESM provides all shelf manager functions, plus these AXIe extensions:

- host PC connectivity (Gen 3 PCIe x8/x16, Thunderbolt 3, Ethernet)
- sources timing signals (CLK100, SYNC and FCLK)
- routes STRIG (Star Trigger) to instruments through the backplane
- two bi-directional trigger front panel access ports route trigger signals through to the backplane parallel trigger bus and Star Triggers to each slot
- provides backplane PCIe and Ethernet communication between modules

Other than a power button/status light (on the ESM), all monitoring, control and communication with the chassis requires a *host PC*. This can be an *embedded* PC specifically designed for use in an AXIe chassis (such as the Keysight M9537A Embedded Controller) or *remote* (a rackmount, desktop, or laptop) PC.

The Gen 3 PCIe Cable Interface ports provides up to a 8GB/s (theoretical) for Gen 3 x8, and 16 GB/s (theoretical) for Gen 3 x16. The Thunderbolt 3 port provides a Gen 3 x4 link with up to 4 GB/s (theoretical) bandwidth.

---

* Thunderbolt [TM] is the brand name of an interface standard developed by Intel (in conjunction with Apple) that allows connection of external peripherals to a computer. Thunderbolt 3 specification provides Gen 3 PCI Express (PCIe), DisplayPort, and DC power in one USB-C compatible cable; only PCIe is supported on the M9506A. Charging devices such as laptop computers over Thunderbolt 3 is **not** supported on the M9506A.

M9506A at a Glance

The M9506A is shipped with bumpers and two carry handles installed for benchtop use (these remove for rack mounting). The front panel is shown below:

Left Fan Assembly

Slots
The Embedded System Module (ESM) is in the bottom slot; the other five slots are for instrument modules.

AXIe Zone 3

Chassis Backplane
Provides PCIe and GbE interfaces, clock and synchronization signals, and power to installed modules

On-Standby switch with Status LED

Right Fan Assembly
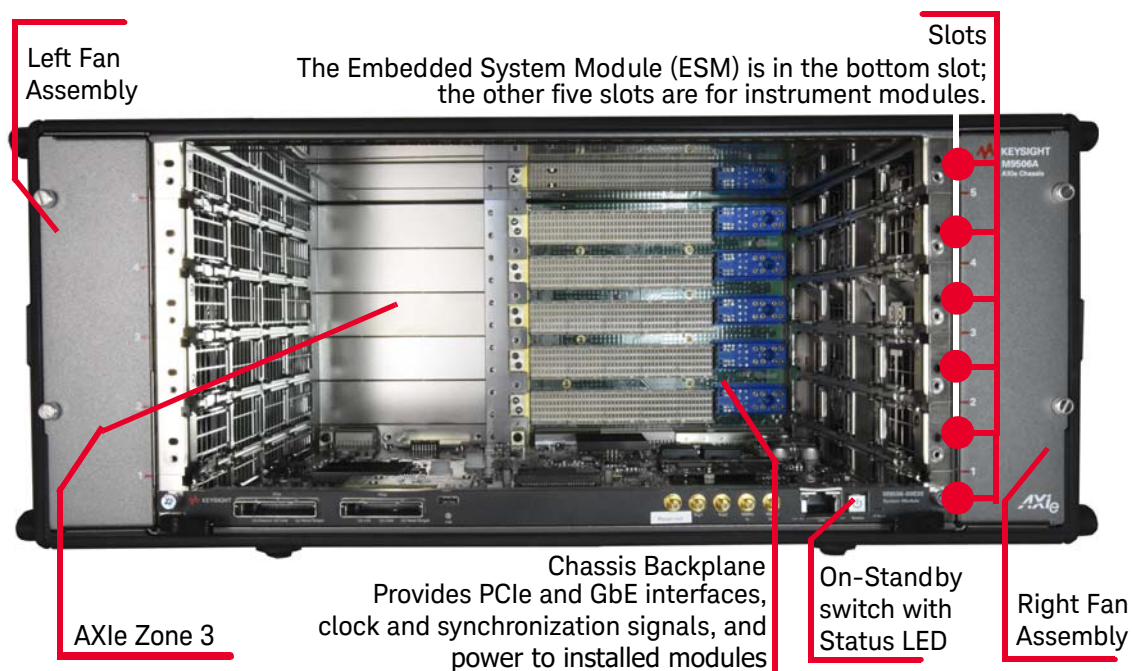
AXIe Embedded System Module (ESM) at a Glance

The ESM is installed in a half-height slot at the base of the chassis. It:

- tracks inserted modules and manages power requirements

- monitors chassis temperature and controls variable-speed chassis fans

- monitors module sensors and reports component failures to a system log

- acts as a Gigabit Ethernet switch; forwards frames along the backplane

- connects an external host PC to the chassis

- provides trigger routing between front panel trigger ports and backplane parallel and star trigger lines to all modules.

- provides a 100 MHz clock reference to all modules, which can be locked to an external 10 MHz clock source.

- provides two Gen 3 x8 PCIe cable ports, one Thunderbolt 3, & one LAN port.

NOTE The M9506A chassis is not compatible with the M9502A or M9505A AXIe chassis ESM module. Nor is the M9506A ESM compatible with the M9502A or M9505A AXIe Chassis.

ESM Front Panel

1		Reserved for future use.
2	Power Switch	Turns the chassis power on or off. The status indicator light is a bi-color LED. Flashing green indicates the chassis is powered on and booting. Solid green indicates normal operation. Red indicates a power-up error.
3	LAN Port	RJ45 connector. Connects the host PC to the chassis, auto crossover. Amber Link/Activity LED, Bicolor Speed LED (Amber = 1Gbps, Green = 100Mbps, Off = 10Mbps). An embedded controller module does not use this port; for direct communication with the ESM.
	Clock	External clock connections. SMB connectors with ESD suppression.
4	10 MHz Clock Out	Extends the internal clock source to external instruments. 3.3V CMOS, 50Ω line drive, 3-state, AC Coupled.
5	10 MHz Clock In	Accepts an external 10 MHz clock. Input range: 5Vpk-pk, AC coupled, 50 ohm terminated, 250mV minimum swing
	Trigger	Bi-directional, external trigger connections. Extends backplane parallel & star trigger to external instruments. SMB connectors with ESD suppression.
6	TRIG1, TRIG2	Output: 3.3V CMOS, 50Ω output impedance (push-pull) open drain capable. Input: Adjustable threshold input range -5V to +5V, 250 mV minimum swing.
7	GPS	External GPS Antenna Port, requires M9506A-GPS Option.
8	Thunderbolt	Thunderbolt 3 port with USB-C connector.
9	PCIe Cable Port	Used to create a x16 link to Host Adapter or connect Cascaded chassis Gen 3 compliant PCIe x8 connector.
10	PCIe Cable Port	Connects a remote host PC to the chassis via PCIe. Gen 3 compliant PCIe x8 connector.

PCIe Cable Ports and Status LEDs. These Upstream \ Downstream ports can be merged to form single X16 port.

LED	Color	Description
Chassis (Link speed between ESM and backplane)	Off	No connection present
	White	Gen 1 connection
	Blue	Gen 2 connection
	Green	Gen 3 connection
Link (left port for x8 mode or both ports x16 mode)	Off	No link present
	White	Gen 1 connection
	Blue	Gen 2 connection
	Green	Gen 3 connection
Link (right port)	Off	No link present in x8 mode or if in merged x16 mode
	White	Gen 1 connection
	Blue	Gen 2 connection
	Green	Gen 3 connection
Host or Target Mode (right port)	Off	Right cable port is merged with left port to form X16
	Green	Host more (default) Right port is Downstream facing
	Blue	Target Mode Right port is Upstream facing

NOTE The M9506A chassis is not compatible with the M9502A/M9505A AXIe chassis ESM module. Nor is the M9506A ESM compatible with the M9502A/M9505A AXIe Chassis.

What is Thunderbolt 3?

Thunderbolt 3 provides PCI Express (PCIe) connectivity with data transfer rates at up to 40 Gbps[*]. There are no Upstream or Downstream ports with Thunderbolt 3.

Thunderbolt 3 uses USB-C and requires Thunderbolt 3 certified cables for correct operation. To quickly check whether the port you have on a host PC is a USB-C or Thunderbolt 3 version, look next to or just above the port for a Thunderbolt icon (a lightning bolt).[†] Your host PC must have a Thunderbolt 3 port. Even though they use the same cables, Thunderbolt 3 is not USB-C compatible. Thunderbolt 3 cables have no polarity and are reversible – connect either end to the PC or chassis.

Plugging a Thunderbolt 3 device into a Thunderbolt 3 port, provides between 20 and 40 Gbps maximum throughput, depending on the type of cable you're using:

- Passive Thunderbolt 3 cables are identical to USB-C cables and plug into Thunderbolt 3 or USB-C ports and achieve data rates up to 20 Gbps.

- For maximum data transfer rate over Thunderbolt 3, use active cables. Active Thunderbolt 3 cables achieve full 40 Gbps throughput. Active optical cables can extend connection length from 6 feet up to approximately 200 feet.

NOTE	Factory default is PCIe Cable Ports configured as x16 Gen 3. If you want to use the Thunderbolt 3 port, you must set a switch on the ESM. See "SW56 Switch Positions" on page 143.

CAUTION	Thunderbolt 3 is hot-swappable. However, avoid removing the cable after the system is powered on. Doing so may cause errors in data transmission.
	Do not connect USB Type C (USB-C) devices into the Thunderbolt port on the M9506A ESM.

---

* Thunderbolt 3 provides PCIe connectivity and provides faster data transfer than a standard PCIe interface. It requires short, <0.5 M or active Thunderbolt 3 cables for highest speed. Charging devices such as laptop computers over Thunderbolt 3 is **not** supported on the M9506A.

† The original Thunderbolt and Thunderbolt 2 interfaces use mini DisplayPort-shaped connectors that are not compatible with Thunderbolt 3.

AXIe Instrument Modules

The chassis slots accept AXIe instrument modules. These may comprise one or more instruments for signal injection, data acquisition, and measurement. Install them in any available AXIe slot.

The drawing below illustrates the AXIe module's general layout, backplane connections and chassis fasteners, viewed from the top.
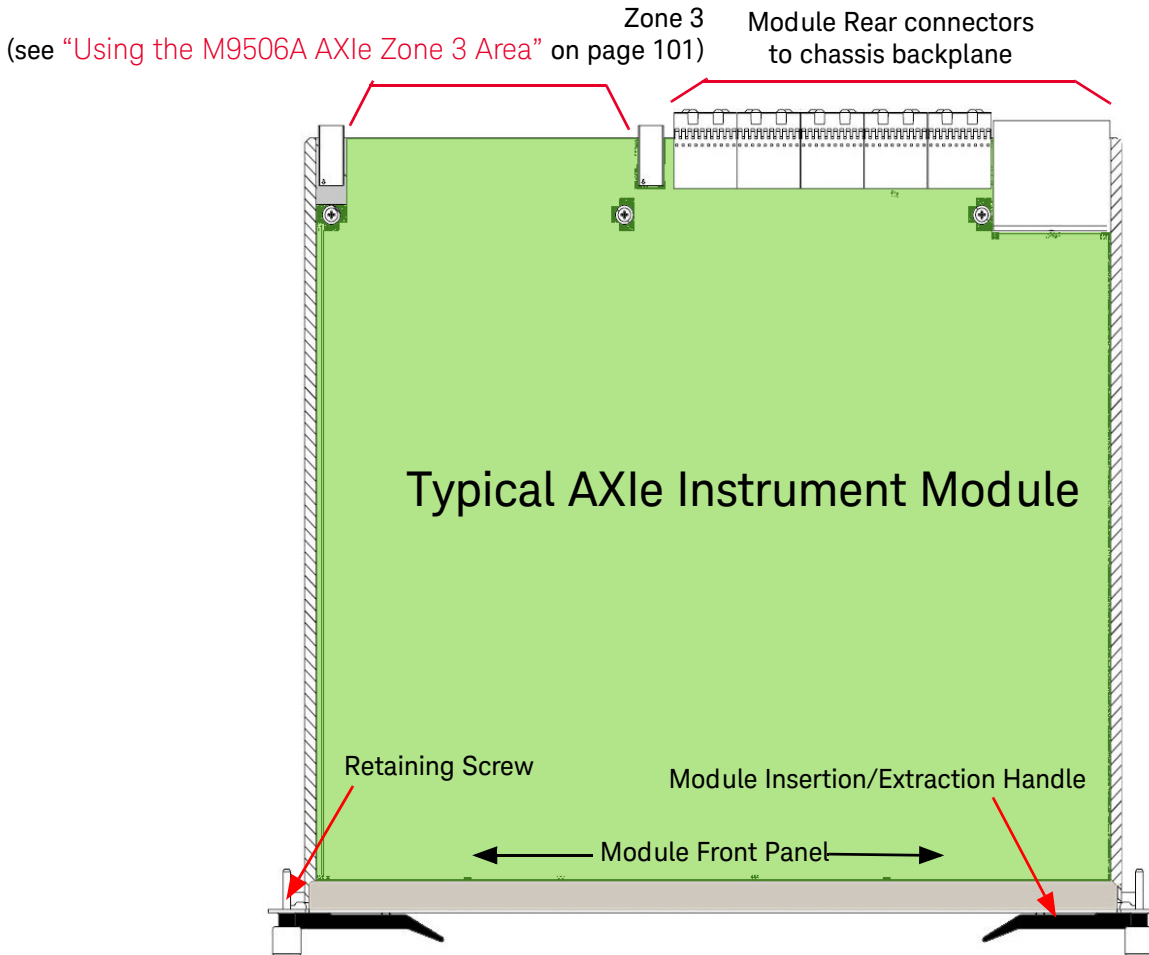
Test connections are made at the module's front panel. The front panel and backplane connectors will vary depending on the module.

M9506A AXIe System Block Diagram

"M9506A AXIe System Block Diagram (Graphic)" on page 19 shows a block diagram of a M9506A 5-slot AXIe chassis system, showing the chassis and the host PC. The key points regarding this diagram are:

- The diagram shows the host PC interfaces to the chassis: (1) The PCIe Cable ports, (2) Thunderbolt 3 interface, and (3) the LAN interface. The PCIe Cable ports and Thunderbolt links route through the ESM PCIe Switch to the slot x16 PCIe links. The LAN interface links are routed through the LAN Switch to the slot Gb Ethernet signals. The PCIe and Thunderbolt interface links can also be routed to the slot Gb links (through the network interface controller and the LAN Switch). However, the LAN interface links cannot be routed to the slot x16 PCIe signals.

- The network interface controller (NIC) is an Intel I210 NIC. The PCIe Switch and the NIC provide an x1 path from the chassis PCIe interface to the LAN Switch and, ultimately, the Shelf Manager (described further below).

NOTE	If you're using the PCIe interface to connect to the chassis, the Intel I210 NIC will appear to Windows as a locally-installed device. Windows 7 and Windows 10 provide the necessary Intel NIC driver.

- Install either the M9048B or the M9049A PCIe Desktop Adapter in the host PC to provide a PCIe interface. The PCIe Desktop Adapter is used in desktop or rack-mount computers. A PCIe cable (Y1202A, 2.0 m cable) connects the adapter to the AXIe chassis. For Thunderbolt access, a standard Thunderbolt cable connects the ESM to the host PC. For LAN access, a standard Ethernet cable connects the ESM to the host PC.

- The chassis contains a processor called the *Shelf Manager* that monitors the status of the chassis sensors and the module sensors over the Intelligent Platform Management Bus (IPMB). The Shelf Manager also controls the fan speeds and provides the chassis Web Interface. The Web Interface allows you to use your browser to monitor the status of the chassis and configure certain aspects of chassis operation, such as the trigger subsystem.

- The chassis supports two Soft Front Panel (SFP) utilities. SFP runs on the host PC and provides the same monitor and control functionality as the chassis Web Interface.

- Keysight provides host PC drivers for the chassis. These drivers provide programmable control and monitoring of the chassis trigger bus and sensors.

- The chassis contains customer upgradeable firmware. To check if a later version is available, go to the website below for your product, then click the tabs/links indicated: www.keysight.com/find/M9506A
then select **Technical Support > Drivers & Software > Firmware Update**

CAUTION Some AXIe test system software applications, such as the Keysight logic and protocol analyzer software and modules, sets and uses specific trigger lines in the AXIe chassis. Do not use the AXIe chassis Soft Front Panel (SFP) software or the AXIe chassis web interface to set or reroute any of the AXIe chassis trigger lines. Rerouting any of the trigger lines may cause the application software to not function correctly.

NOTE In order for a computer to serve as host PC, its BIOS must support enumeration of PCIe slots in the AXIe chassis; many computers are not capable of enumerating a sufficient number of PCIe slots to ensure that slots in an external chassis are enumerated. Keysight maintains a document listing the integrated, rack mount, desktop and laptop computers that have been verified to properly enumerate PCIe devices in the AXIe chassis, at www.keysight.com/find/M9506A.

For general host PC requirements, such as operating system and RAM requirements, please refer to the *M9506A AXIe Chassis Startup Guide.*

M9506A AXIe System Block Diagram (Graphic)

NOTES:

1. PCIe and LAN connectivity:

   A. If the chassis PCIe interface is connected and the chassis LAN interface isn't connected, the Intel NIC provides a means for the PC to access the LAN Switch – this provides PC access to the Shelf Manager as well as access to the Gb Ethernet connections to each slot.

   B. While the Intel NIC allows the host PC to use the PCIe interface to access the LAN Switch (and the devices connected to the LAN Switch), the reverse does not apply –– the PC cannot use the LAN interface and the Intel NIC to access the slot PCIe x16 interfaces.

2. PCIe Generation (Gen) 1 peak speed is 2.5 Gb/s per lane. PCIe Gen 2 peak speed is 5.0 Gb/s per lane. PCIe Gen 3 peak speed is 8.0 Gb/s per lane. Taking into account encoding and other overhead, typical Gen 3 performances in Gb/s are as follows for x8 and x16: **x8**: 8 Gb/s
   x16: 16 Gb/s

3. The PCIe Switch internal buffering allows the chassis to communicate to the host PC at 16 Gb/s, and simultaneously communicate at 8 Gb/s to each of two x8 module slots.

ESD Precautions

CAUTION	Keysight's AXIe chassis and instrument modules are shipped in materials which prevent static electricity damage. These instruments 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 installed.

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.
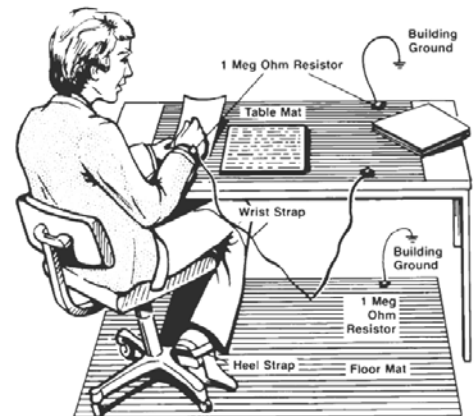
Power–Up and Power–Down

Circuit Breaker

The chassis circuit breaker is a toggle switch, marked OFF (O) when open and ON (I) when closed:

Circuit Breaker Open (OFF)   Circuit Breaker Closed (ON)
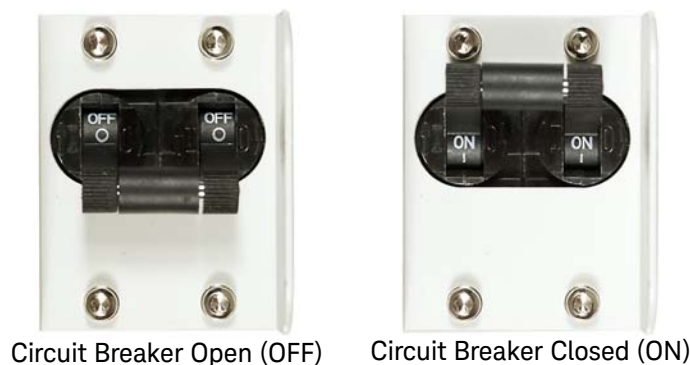
Power Modes

The chassis has three power modes:

OFF   With the power cord removed or the circuit breaker in the open position, the chassis is **OFF**.

STANDBY   With the power cord connected, the circuit breaker closed, and the front panel switch in the standby position (status light off), the chassis is in **STANDBY** mode. Although no power is supplied to the ESM and installed modules when in Standby, the chassis is energized and consumes power. Chassis fans will not operate, but internal PSU (power supply unit) fans may come on.

ON   With the power cord attached, circuit breaker closed, and the front panel switch in the **ON** position (status light on or blinking), the chassis is **ON**. Power is supplied to the ESM and installed modules. Fans will operate as dictated by chassis thermal load.

ON/STANDBY Switch

The chassis **ON/STANDBY** switch is located on the ESM module. It is lit when the chassis is **ON**. The **STATUS** light in the ESM's **ON/STANDBY** switch cycles as described on the next page. It is possible that the chassis is OFF but the status light blinks red. See the table on the next page.

To Power Up the Chassis

1. Plug-In Chassis   Using the supplied cord, connect the chassis to an appropriate AC power main. Use with a ground-fault circuit interrupter (GFCI) is not recommended.

2. Close Circuit Breaker   Close the rear panel circuit breaker (ON position).

3. Press On/Standby Button   Press the ESM's **ON/STANDBY** switch. It should light when depressed

The **STATUS** light in the ESM's **ON/STANDBY** switch cycles as follows:

Status Color	Flash Rate	Chassis Power State	Description
Off		Off	Chassis is powered off
RED	1 flash every 5 seconds	Off	Fault - Power Supply Unit (PSU) Over Temperature
	2 flashes every 5 seconds	Off	Other PSU fault
	3 flashes every 5 seconds	Off	ESM/Chassis Power Fault
	4 flashes every 5 seconds	Off	ESM/Chassis Over Temperature Fault
	Solid (no flashes)	On	Unrecoverable alert
GREEN	1 second on, 1 second off	On	1. Chassis is powered on but not ready for enumeration or 2. Self test error
	0.5 second on, 0.5 second off	On	Power button has been pushed and chassis is shutting down
	Solid (no flashes)	On	Chassis is powered on and ready for enumeration

CAUTION   The chassis and host PC must be powered up and down in the following sequence. The chassis should be powered up first, which initiates its built-in Power-on Self Test (POST). During POST, the chassis STATUS LED will blink green and then stay green continuously when the ESM is ready. The ESM then powers up each module slot. The remote host PC should be turned on only after all installed modules have performed their initialization—see your module documentation for initialization information. An embedded controller such as the M9537A handles this sequence automatically.

**Chassis power
(High = powered up)**

The STATUS LED flashes green at power-on while the chassis performs self test. It will stay green continuously when the ESM is ready. The ESM then powers up each module slot.

**Chassis
STATUS LED**

module initialization

The PC should be turned on only after all installed modules have performed their initialization. See your module documentation for initialization information.

**Host PC
(High = turned on)**

The chassis must be powered up before the PC is turned on to ensure that the PC BIOS will enumerate the chassis slots as the PC boots.

If, while the chassis was powered down, its configuration was changed in any way, the PC may need to be restarted after Windows comes up (as indicated by the Windows splash screen).

It is recommended that the PC be shut down before the chassis is powered down because many PCs don't have the capability to safely remove (eject) PCIe-connected devices. Powering-down the chassis first can disrupt operation of the PC.

In brief, the host PC must be off whenever the chassis is powered up or down. Note the possible need to restart the host PC (after Windows starts) if the chassis configuration has been changed in any way while the PC was turned off.

NOTE Some AXIe instrument modules (also known as Blades) take longer to be ready for enumeration than the PXI link ready requirement of 100 ms. Consequently, it is possible for some controllers (such as the Keysight M9537A Embedded Controller) to enumerate the chassis before all of the individual modules are ready and therefore not enumerate them. If you have a situation where Keysight Connection Expert and/or the Windows Device Manager consistently do not find specific instrument modules when the chassis powers up, increase the module initialization time.

While the power sequencing shown above doesn't apply to an embedded controller (because an embedded controller and chassis are powered simultaneously), an embedded controller may need to be restarted (after Windows starts) if the chassis configuration was changed in any way while the chassis and embedded controller were turned off.

To Power Down the Chassis

For routine power-down or to cycle power to the chassis, momentarily (< 5 seconds) press the chassis **ON/STANDBY** switch. The main chassis fans gradually drop in speed to off, and the power supply unit (PSU) fans gradually return to idle speed as the PSU cools. This is normal.

CAUTION If you are using an embedded AXIe controller such as the Keysight M9537A, pressing he ESM power switch initiates a Windows OS shutdown.

CAUTION For routine power-down, do not use the circuit breaker to turn the chassis off. Doing so interrupts power to the power supply fans, which may shorten the life of the PSU. Use the front panel On/Standby switch to power down the unit, and allow the PSU fans to return to idle before removing power from the chassis.

Once the chassis has cooled, you may isolate the chassis from AC power as needed. This is usually done by opening the circuit breaker.

NOTE Pressing and holding the power **ON/STANDBY** switch for greater than five (5) seconds shuts down the power supply immediately. If the chassis is in a fault condition, the fault resets and the chassis goes to the OFF state.

The Chassis INHIBIT Switch

The method of powering up the chassis depends on the position of the INHIBIT switch on the chassis rear panel, which can be set to the **DEF** (**DEF**ault) position or to the **MAN** (**MAN**ual) position. These two methods work as follows:

- **INHIBIT** switch in the **DEF** position — In this position, the front panel power push button is used to switch the chassis between ON and Standby—hence, this is known as the ON/Standby push button.

- **INHIBIT** switch in the **MAN** position — In this position, the Inhibit signal (pin 5 on the DB-9 connector) controls chassis power. The chassis is powered up by applying a logic high signal to the Inhibit signal. When the Inhibit pin (pin 5) is pulled low, the chassis is in Standby. This is the factory default position

Use of the **INHIBIT** switch in the **DEF** position and the ON/Standby push button to power up the chassis is assumed unless otherwise noted. For information on using the Inhibit signal on the rear panel DB-9 connector to power the chassis up and down, see "Chassis Inhibit/Voltage Monitoring" on page 98.
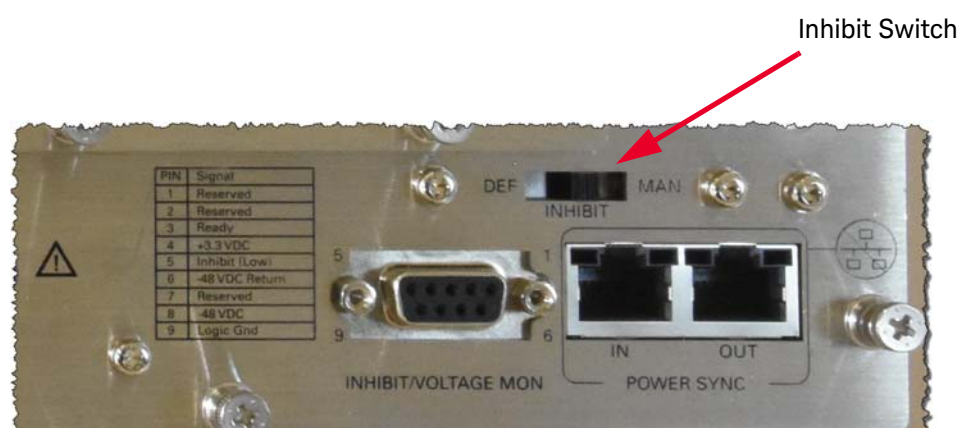
Figure 1   Chassis Power Inhibit Switch, DB9 Connector, Power Sync Connectors

> **NOTE**
>
> Leave the **INHIBIT** switch in the **DEF** position when connecting the AC power cord to the chassis. After inserting the power AC power cord, then move the **INHIBIT** switch to the **MAN** position.

The RJ45 connectors are for multiple chassis power-up synchronization. Cables used for multiple chassis power-up synchronization purposes should not exceed 30 m in length. Straight CAT5 or better cables recommended. Refer to "Multi-Chassis Power Sync" on page 114 for information on these connectors.

> **CAUTION**
>
> The RJ45 connectors are for multiple chassis power-up synchronization. Do not connect LAN cables from your corporate LAN to these connectors.

Related Documentation

The M9506A documentation includes:

- *M9506A AXIe Chassis Startup Guide*

  provides just the basics to get you started with your AXIe chassis. Provided in print with each new chassis, it can also be viewed in PDF form on the **Software and Product Information CD**. The **Startup Guide** includes:

  - A high-level overview of the AXIe chassis and basic nomenclature
  - Unpacking the contents and planning your installation
  - Connecting to a host PC
  - Loading chassis software
  - Verifying basic chassis operation

- *M9506A AXIe Chassis User Guide. This printable PDF document. A complete guide for configuring, operating, and troubleshooting the chassis.*

- *M9506A AXIe Chassis Specification Guide.* Contains technical specifications for all manufacturing versions of the M9506A AXIe Chassis. Specifications published in the data sheet apply only to the current manufacturing version of the equipment.

- *M9506A AXIe Chassis Security Guide.* This document details the internal memory locations of the M9506A 5-Slot AXIe chassis. It describes instrument security features and the steps necessary to declassify the products through memory sanitization or removal.

- Help files for the two Soft Front Panel drivers (Monitor SFP and Trigger SFP).

- Help files for the two IVI-C (**KtMAXIeMon**, **KtMAXIeTrig**) and two IVI .NET (**KtMAXIeMon**, **KtMAXIeTrig**) device drivers.

  The interactive help provides instruction for programming the chassis using Microsoft development environments.

- Keysight M9506A Data Sheet. The Data Sheet contains complete physical and electrical specifications for the chassis.

Product specifications, available accessories, firmware and software may change over time. Please check the Keysight website at www.keysight.com/find/M9506A for the latest updates to the product software, Guides, Help files and Data Sheets.

Product Warranty

To find warranty information on your M9506A AXIe chassis, go to www.keysight.com/find/warranty and enter your model number (M9506A) in the **Product Number** field, and enter the serial number from the chassis rear panel in the **Serial No.** field.

Miscellaneous Information

This product has been designed and tested in accordance with accepted industry standards, and has been supplied in a safe condition. The documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

2 Chassis Installation

This chapter begins where the Startup Guide leaves off, and provides the detailed procedures for module installation and removal, operational verification, rack mounting, and module software installation.

NOTE	IMPORTANT: The installation and setup information in this manual is generic. Some AXIe modules and systems may require a different installation and setup procedure than described in this manual. Refer to the installation documentation supplied with your AXIe module and or system for detailed installation information.

CAUTION	The instrument has auto-ranging line voltage input, be sure the supply voltage is within the specified range and voltage fluctuation do not exceed 10 percent of the nominal supply voltage.

CAUTION	Use Keysight supplied power cord or one with same or better electrical rating."

KEYSIGHT
TECHNOLOGIES

CAUTION   Consider proper ergonomics when lifting or carrying the instrument. Two person lift is recommended.

CAUTION   Cleaning connectors with alcohol shall only be done with the instruments power cord removed, and in a well-ventilated area. Allow all residual alcohol moisture to evaporate and the fumes to dissipate prior to energizing the instrument.

CAUTION   Safety of any system incorporating the equipment is the responsibility of the assembler of the system.

WARNING   **If this product is not used as specified, protection provided by the equipment could be impaired. Chassis must be used in a normal condition (in which all means for protection are intact) only."**

WARNING   **To prevent electrical shock, disconnect the Keysight Technologies Model M9506A from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.**

WARNING   **No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.**

WARNING   **Install the instrument so that the detachable power cord is readily identifiable and is easily reached by the operator. The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch. Alternatively, an externally installed switch or circuit breaker (which is readily identifiable and is easily reached by the operator may be used as a disconnecting device.**

WARNING   **This is a Safety Protection Class I Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

Installing and Removing AXIe Modules

The AXIe chassis accepts modules conforming to the single slot, 1U AXIe standard. These may include:

- AXIe embedded controller module
- AXIe Filler Modules; chassis are NOT shipped with AXIe Filler Modules. These are order-able separately with Keysight part number Y1221A.

The insertion and removal procedures are the same for all module types except filler modules.

CAUTION

Static Electricity—The components and connectors on modules are sensitive to static electricity. To minimize electrostatic damage, take the necessary anti-static precautions.

Empty Slots—Except for performing initial chassis verification or troubleshooting, do not operate the chassis with empty slots. Always insert a filler module or instrument module into empty slots. This is especially important for the slots on either side of an instrument module. This allows proper air flow and cooling, and provides EMI shielding for the chassis and installed components. Leaving slots empty can increase fan speed, raise ambient noise, overheat components, and shut down modules.

ESM—The Embedded System Manager is integral to the operation of the chassis. Except for troubleshooting purposes, do not remove the ESM.

Hot Swap—AXIe does not explicitly support hot swap for instrument modules. Keysight recommends fully powering down the chassis before installing or removing modules

Embedded Controller Module—Manually initiate a graceful shutdown of the controller operating system and power off the chassis before removing the module.

Installing AXIe Modules

1 Power down but do not unplug the AXIe chassis from the AC power (see "To Power Down the Chassis" on page 24).

2 Plan slot usage. If you are using an embedded AXIe controller module such as the Keysight M9537A, it must be in Slot 1. If there are modules that will be removed often, insert them into the topmost slots.

3 Locate the (left and right) guide rails for each slot. The example below shows the right side guide rails in the M9506A with all slots empty; typically one or more will be covered.

Spring guides center the module's
PCB at the entry of the guide rail
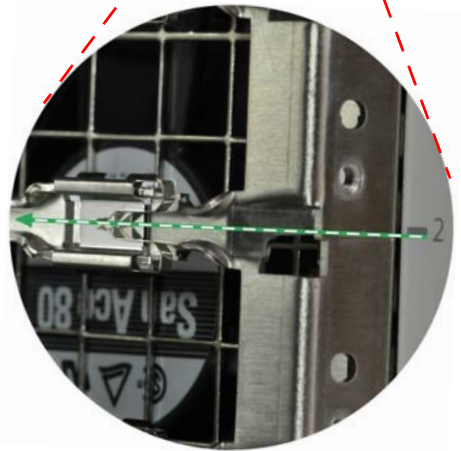
| **NOTE** | No AXIe chassis filler modules are shipped with the chassis. They are order-able separately with Keysight part number Y1221A. For proper chassis and slot cooling, all unused chassis slots must have an AXIe Filler Module installed. |

4 Align the module's circuit board with the guide rails on both ends of the chassis. If the module has metal plates covering the circuit board, be sure to insert the circuit board and not the metal plates into the rails. Slide the board gently into the two rails. If the fit is tight, slide the board back out and recheck alignment.

5 Locate the insertion/extraction handles at each side of the module's front panel. Extend the ends of both handles, by pulling them inwards towards each other; the plastic handle end slides about 1 cm on the metal handle shaft. Then fully open the handles by pivoting them out towards you until they are perpendicular to the front panel. The left handle is shown below, from the top view, correctly extended.
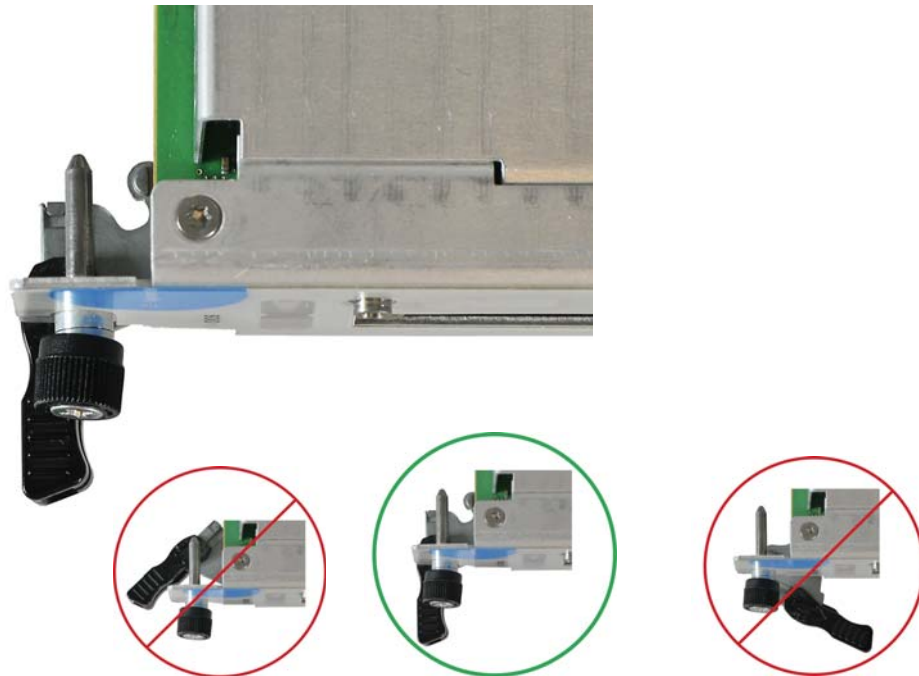
If either handle is misaligned, you will not be able to properly install the module.

6 Slide the module completely into the chassis. When the module's backplane connectors contact the chassis backplane, you will feel resistance and the two handles will begin to close toward each other. The module's faceplate will be about 1 cm from the chassis front panel.

7 Continue nudging the module faceplate gently but firmly with your thumbs, until the handles are pressed up against the chassis and the module's front panel lies flush with the chassis' front panel. This seats the module firmly in the chassis backplane. If necessary, gently press inward (toward the chassis) on the handles to ensure full insertion.

8 Tighten the captive retaining screws at both sides of the module.

.

CAUTION | **Modules are grounded through the chassis. Tighten the module retaining screws to ensure a proper ground connection.**

9 Retract the handle ends by sliding them outward on their metal shafts, away from each other, toward the chassis edge; this secures them out of the way of test connections.

10 Repeat steps 4 through 9 for additional modules, as needed. Ensure that each slot has an instrument or AXIe Filler Module (Y1221A) installed.

11 Power up the AXIe chassis. Verify that the chassis fans are operating and free of obstructions that may restrict airflow.

Removing a Module

The instructions below apply to all module types. The Embedded System Module (ESM) has the same extraction handles and retaining screws as instrument modules. If you should ever have to remove the ESM, follow the instructions for instrument modules below.

1 Power down but do not unplug the AXIe chassis from the AC power.

2 Fully loosen the captive retaining screws on both sides of the module.

CAUTION | **Ensure you fully loosened the captive module retaining screws before trying to extract any module. If you attempt to pull the module out by the screws (for Filler Modules) or by using the extraction handles (other modules) with these screws still engaged, damage to the chassis or module could result.**

3 For an AXIe Filler Module, grasp the panel by the two captive retaining screws, and slide it out of the chassis.

For all other modules, locate the insertion/extraction handles at each side of the module's front panel. Extend the plastic ends of both handles by sliding them outward on their metal handle shafts, inwards towards each other.

4 Open the handles by pivoting them out towards you, away from the chassis. Place each thumb at the inside of the handle, forefinger outside the handle, and rotate the handles with your thumbs. When the handles are perpendicular with the chassis, stop. The module should now be unseated the module from the chassis backplane and its faceplate from the chassis front panel.

5 Grasp the levers to slide the module out of the chassis.

Setting Up a Host PC

Following the *M9506A AXIe Chassis Startup Guide*, you should have selected a host PC, made physical connection to the chassis, and communicated with the chassis using its Web Interface. You may have then disconnected the host PC from the chassis in order to install modules or mount the chassis. Re-establish that connection, per the *M9506A Startup Guide*.

NOTE	If you find that your AXIe chassis driver is no longer able to connect, check your host controller's Network Adapter settings to make certain that the related NIC card has not been disabled.

CAUTION	**Do not enable the Microsoft Windows sleep mode on the host PC. The PC may not have proper chassis enumeration when it wakes up and unpredictable operation may result.**

Installing Module Soft Front Panel and Device Drivers

Each installed module typically requires device drivers and control software. You do not need to install them to verify basic chassis operation, but would logically install them on the host PC at this time. For Keysight instrument modules, refer to the instrument page at Keysight.com. For others, consult the module provider for software requirements and instructions.

External PC, PCIe x16 Connection to Single M9506A

The following configuration represents the highest throughput (x16) between the PC and one 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 left PCIe connector on the M9506A ESM module and the bottom connector on the M9049A module connects to the right PCIe connector on the M9506A ESM module.

NOTE	The default PCIe Cable Port Configuration is x16 as shown in the following figure. This requires using both PCIe Cable Ports on the front of the ESM. To change the configuration to two x8 ports, you must set a switch on the ESM. Refer to "SW56 Switch Positions" on page 143.
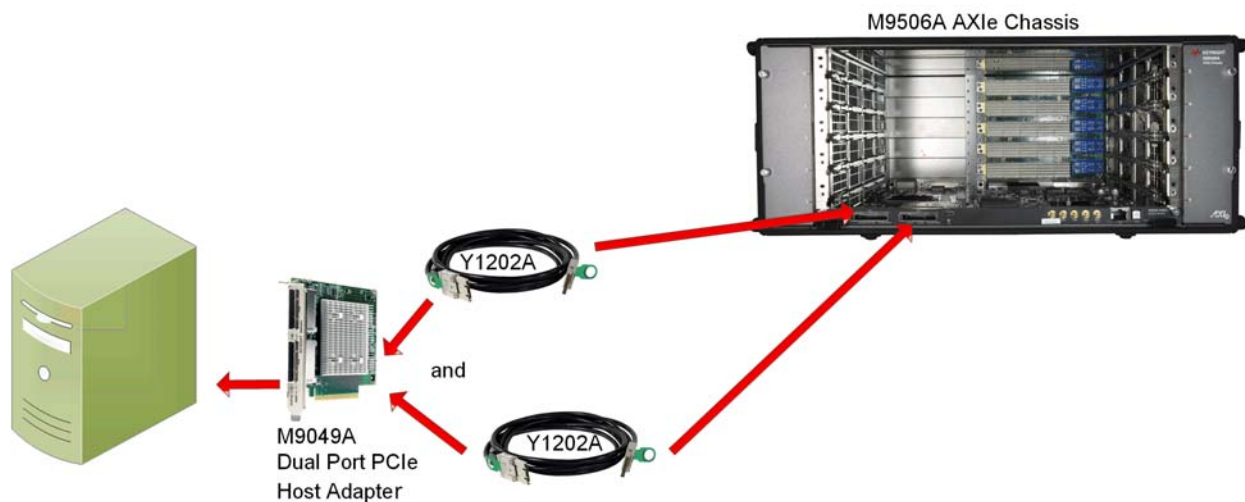
Figure 2   x16 Connection to the PXIe chassis

External PC, PCIe x8 Connection to Single M9506A

Figure 3 below illustrates a simple single-chassis system. It consists of an external PC with a PCIe Host Adapter card (such as the Keysight M9048B or M9049A) connected to one M9506A AXIe chassis.

> **NOTE**   **IMPORTANT:** The default PCIe Cable Port Configuration is x16. To change the configuration to two x8 ports, you must set a switch on the ESM. Refer to "SW56 Switch Positions" on page 143.
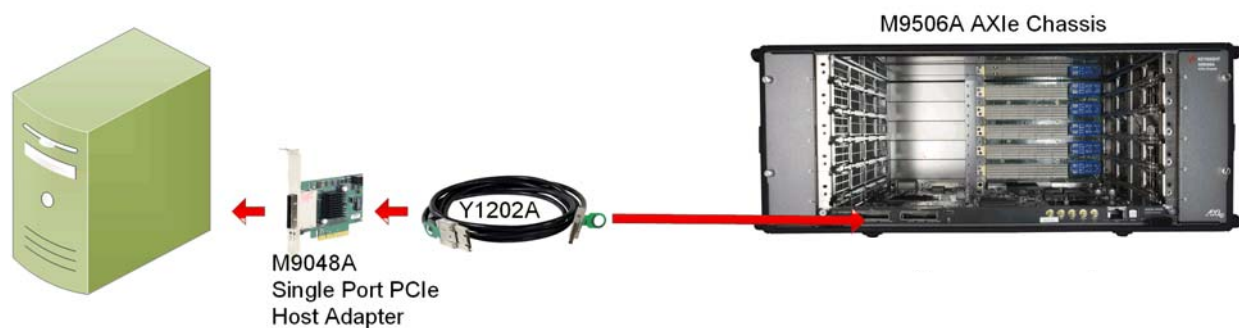
Figure 3   Connecting an External PC to the M9506A with x8 PCIe

External PC, Thunderbolt Connection to Single M9506A

Figure 4 below illustrates connecting the M9506A chassis to an external PC using a Thunderbolt cable.

NOTE	The default configuration for the ESM is to use the cable PCIe ports. To use the Thunderbolt port, you must set a switch on the ESM. Refer to "SW56 Switch Positions" on page 143.
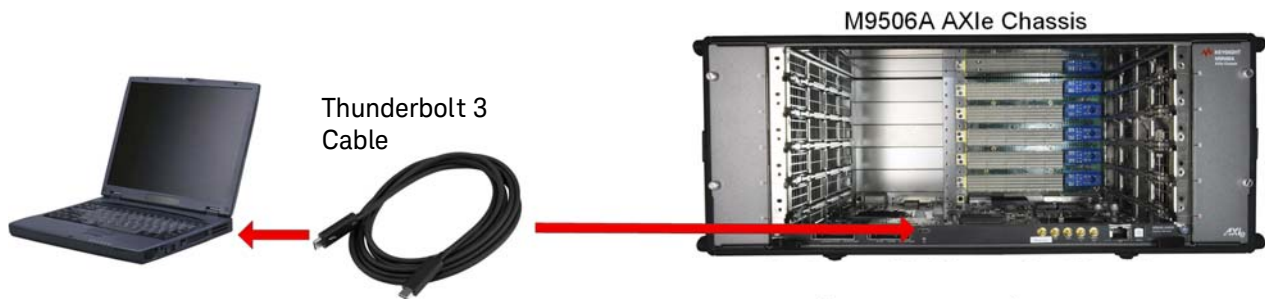
Figure 4   Connecting an External Laptop PC to the M9506A with Thunderbolt 3

Verifying Operation with Modules Installed

In the *M9506A AXIe Chassis Startup Guide*, you should have verified basic power-on operation of the AXIe chassis and communication with the host PC. Then you have reconnected the host PC, and loaded chassis and module software drivers. Reverify that Connection Expert communicates with the chassis and installed modules.

NOTE	The LAN connection to the ESM provides communication to the chassis only -- chassis firmware updates, web interface to monitor/control the chassis, etc. It does not provide communication with individual AXIe modules. Use the PCIe or Thunderbolt 3 ports to control AXIe modules.

- Power up the chassis and wait for the solid green status light on the ESM.

- Wait for the modules Status LED to trun green.

- Power up the host PC. This allows the host PC's BIOS to recognize the PCIe devices in the chassis.

- You may need to run the appropriate *Add Hardware* process in Windows for the host PC's operating system to correctly recognize and enumerate modules on the PCIe bus.

- Establish chassis communication with *Keysight Connection Expert*.

- *Keysight Connection Expert* should recognize the chassis and all installed modules, and they should be listed on the chassis Web Interface Module Configuration Page.

- After driver installation is complete, restart your PC. The Ethernet Controller **Found New Hard ware Dialog** should no longer appear.

The chassis Shelf Manager (on the ESM) knows whether the power supply is connected to a Low Line or a High Line AC source and the power the installed AXIe modules are requesting. At power-up, if the modules are requesting more power than is available, then the Shelf Manager prevents one or more modules from powering up.

For example, if a chassis is connected to a Low Line AC source (940 W maximum) but five modules are installed in the chassis and each module attempts to draw 200 VA, then only four of them will power on – the fifth would require more power than is available. In this situation, you would need to connect the chassis to a High Line AC source.

Use the chassis Web Interface (see Chapter 3, Navigating the Web Interface on page 55) or the Host PC's Device Manager to determine if all modules are powered on.

Using the M9537A Embedded Controller LAN Ports

If you installed a Keysight M9537A Embedded Controller in the Keysight AXIe chassis, there are a total of three LAN ports accessible on the front panels -- two on the M9537A controller and one on the Embedded System Module (ESM). Windows Device Manager shows a total of five (5) individual Network Interface Cards (NICs); one is not used and one connects to the chassis backplane.

CAUTION   Changing the LAN port connection or removing the LAN cable, may cause Keysight Connection Expert to lose track of LAN-enabled instruments. Reboot the AXIe chassis to restore the complete list of LAN-enabled instruments. Read the following for details.

Note that NIC 3 is not used. NIC numbering on your controller may be different.
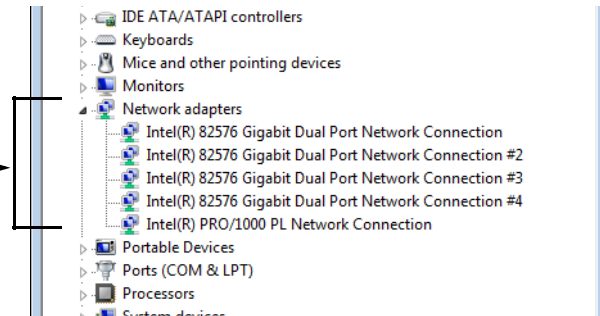
Figure 5   Windows Device Manager showing Network Connections

This section provides overall guidance on selecting and using the M9537A LAN ports. The controller uses the Keysight IO Libraries configuration file to keep track of all instrument connections. Any change to LAN connections after running Connection Expert (adding, removing, or changing LAN cable connections) may cause a change in LAN address and therefore cause Connection Expert to lose track of instruments. If your application programs rely on a specific IP address, these programs may cease to operate if you change LAN cable connections.

Changes to the ESM PCIe (including Thunderbolt 3) or LAN connection are only detected as the ESM is powered up. Perform the following steps when you change either of these two connections:

1 Within *Keysight Connection Expert*, delete the LAN interfaces (right click on the interface then select **Delete**). This causes Connection Expert to forget all instrument history.

2 Shut down Windows on the M9537A Embedded Controller.

3 After Windows shuts down, power down the AXIe chassis using the chassis power button.

4 Make the desired cabling change to the ESM PCIe and/or LAN connections.

5 Power up the AXIe chassis using the chassis power button.

6 Run *Keysight Connection Expert* and verify that the LAN interfaces are operating correctly and that Connection Expert finds the AXIe chassis.

NOTE *Keysight Connection Expert* should automatically identify the AXIe chassis and installed modules.

General Recommendations

As a general rule, connect a network LAN cable to the ESM's LAN port and connect LXI instruments to the M9537A's LAN ports. While other configurations are viable, this configuration provides the fastest and most consistent reporting in Keysight Connection Expert. Refer to Figure 6.

- Where you have the network and instruments connected when the chassis and controller first power on determines how quickly Keysight Connection Expert locates network instruments. If necessary, shut down the controller and chassis and reboot.

- If you remove a LAN cable while chassis power is applied, *Connection Expert* may not find all of the instruments available on the network.

  For example, if the LAN cable is connected to the ESM when power is first applied to the chassis and subsequently moved to one of the two LAN ports on the controller (while the chassis is still powered on), *Connection Expert* may only find the M9537A controller and AXIe modules installed in the chassis. Shut down the controller and chassis and reboot to restore *Connection Expert's* ability to locate other network instruments.

- Connect external LAN-enabled instruments (LXI instruments) to the M9537A controller LAN ports. This allows Keysight Connection Expert to automatically find the instruments. These instruments will have a local LAN IP address or private network range.

  LXI instruments may be connected to the ESM's LAN port but Connection Expert may not automatically find them when these instruments are not located on the same LAN subnet range. However, instruments may be added manually using Connection Expert's Add Address feature.

- If you are using an external LAN router or switch, cycling power on the chassis may cause the IP address of the chassis ESM and controller to change. Therefore you may want to set a static IP address. Refer to your particular network device's documentation for information on setting static IP addresses.

  With the Keysight M9537A Embedded Controller installed in the AXIe chassis, the x8 PCIe connection and the Thunderbolt 3 port on the ESM module are disabled. However, the PCIe cable detect mechanism may reset the hardware when attaching a PCIe cable. This hardware reset may change the IP address.

Connect external LXI instruments to the M9537A Controller LAN ports

M9506A chassis with M9537A Embedded Controller

Connect ESM LAN port to corporate LAN Network
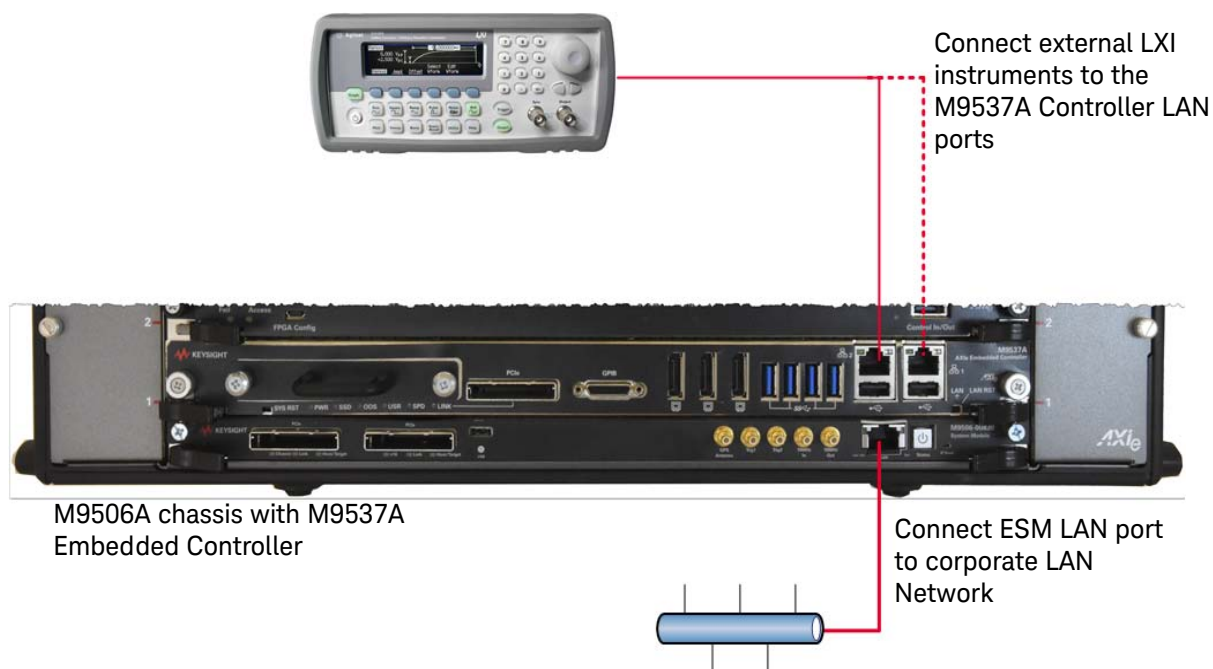
Figure 6   Recommended LAN Connections

The above figure shows the recommended LAN connections to the AXIe chassis/ESM and the M9537A Controller. Two other possible LAN connections are shown in the following figure. Note that you may need to manually add instrument IPO addresses to *Keysight Connection Expert*.

Connect external LXI instruments to the M9537A Controller LAN ports

M9506A chassis with M9537A Embedded Controller

Connect external LXI instruments to the corporate LAN

M9506A chassis with M9537A Embedded Controller

Connect external LXI instruments to the corporate LAN
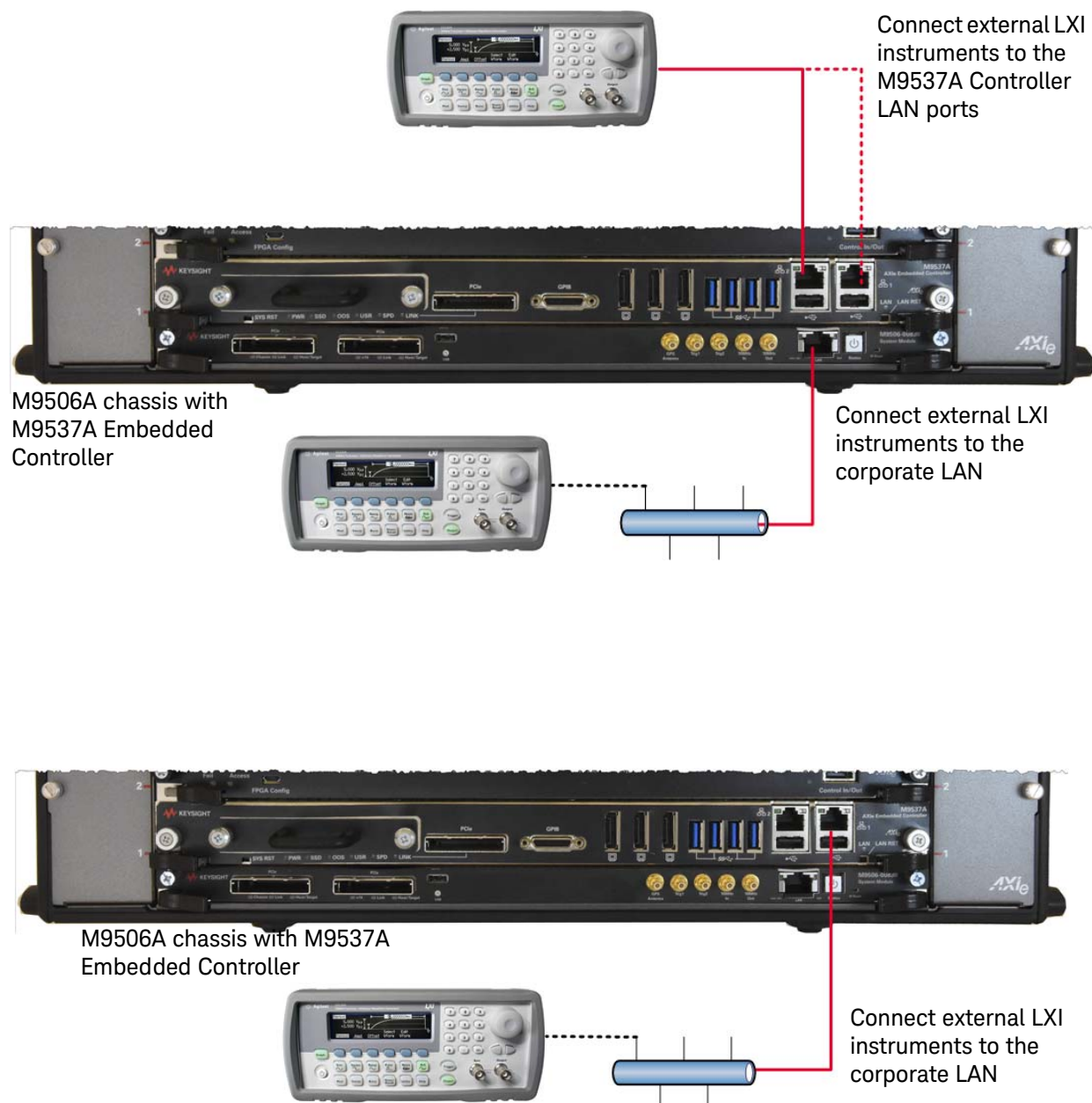
Figure 7   Possible Alternate LAN Connections. You may need to manually add instrument IP addresses to *Keysight Connection Expert* (see text)

Using an External Controller

Changes to the ESM PCIe or LAN connection are only detected as the ESM powers up. Perform the following steps when you change either of these two connections:

1   Within Keysight Connection Expert, delete the LAN interfaces (right click on the interface then select **Delete**). This causes Connection Expert to forget all instrument history.

2   Turn off the remote host controller.

3   Power down the AXIe chassis using the chassis power button.

4   Make the desired cabling change to the ESM PCIe and/or LAN connections.

5   Power up the AXIe chassis.

6   Power on the remote host controller.

7   Run Keysight Connection Expert and verify that the LAN interfaces are operating correctly and that Connection Expert finds the AXIe chassis.

Mounting the Chassis

Environmental and Power Considerations

Consider your anticipated chassis weight (with modules installed), power and ventilation requirements, benchtop use and rackmounting options to ensure safety and optimize access to test and control instrumentation.

Weight   The M9506A chassis weighs 23.5 kg (51.8 lbs) with ESM but no other installed modules. It weighs significantly more fully loaded with AXIe modules. It is typically used rackmounted, but can also be used on the bench, with proper support and ventilation.

AC Input   The chassis power limits are:

100/120 VAC (Low Line), 50-60 Hz	200/240 VAC (High Line), 50-60 Hz
1380 W maximum	2000 W maximum

NOTE	The instrument can operate with mains supply voltage fluctuations up to ±10% of the nominal voltage.

NOTE	The main power cord can be used as the system disconnecting device. It disconnects the mains circuitry from the mains supply.

The chassis Shelf Manager (ESM) knows whether the power supply is connected to a Low Line or a High Line AC source and the power requested the installed AXIe modules. At power-up, if any module requests more power than is available, then the Shelf Manager prevents one or more modules from powering up.

For example, if a chassis is connected to a Low Line AC source (940 VA maximum) but five modules are installed in the chassis and each module attempts to draw 200 VA, then only four of them will power on – the fifth would require more power than is available. In this situation, you would need to connect the chassis to a High Line AC source.

Use the chassis Web Interface (see Chapter 3, Navigating the Web Interface on page 55) or the Host PC's Device Manager to determine if all modules are powered on.

<table>
<tr><td>**WARNING**</td><td>**Avoid overloading an electrical circuit. Ensure your AC power line matches the AC Input requirements listed above.**

In case you need to power down the chassis in an emergency, make sure that you have clear and quick access to the primary disconnect. If the chassis is rackmounted, this primary disconnect can be a power system on the rack or the circuit breaker on the chassis.</td></tr>
</table>

Ventilation   The chassis is designed to dissipate up to 300 W* per instrument slot. Depending on load, the chassis and power supply fans may exhaust significant heat. Whether used on the benchtop or rackmounted, operate in a well ventilated environment and allow at least 2" (5 cm) clearance around both sides of the chassis.

Airflow through the chassis is from right to left; that is fresh air is drawn in from the right side and exhausted from the left side.

<table>
<tr><td>**CAUTION**</td><td>Do not block the vent holes on the chassis. This may cause overheating and damage to components. Leave a gap of at least 2" (50mm) around all vent holes and fan exhaust areas.</td></tr>
</table>

Figure 8   Chassis Airflow

When installing the instrument(s) into a cabinet consideration shall be given to the convection flow into and out of the cabinet. Consideration shall also be given to the individual instruments to avoid having the heated discharge of one instrument, now becoming the cooling intake air for another instrument.

Another area of concern is verification that the maximum ambient operating temperature of the instrument(s) is not exceeded by cabinet installation. Keysight recommends forced air convection whenever an instrument(s) are

---

* Limit total slot dissipation to 940 W when using 100/120 VAC (a maximum of three slots dissipating 300 W each are supported). See chassis specifications.

installed in a cabinet and further recommends that the maximum operating temperature of the cabinet be reduced 10 °C from the lowest, of the maximum operating temperature of a single instrument.

If there are any concerns or special requirements a Keysight Field Engineer should be consulted to assure instrument(s) temperature compliance and performance."

Rackmounting the Chassis

Keysight's Y1227A Rack Mount Kit, is required to rack mount the M9506A chassis. The kit includes mounting instructions and parts.

General Rack Mounting Guidelines

To rack mount the chassis, follow these guidelines:

- Always begin installing the chassis and heavy instruments at the bottom of the rack and work up. This maintains a lower center of gravity and reduces the possibility of the rack tipping.

- Anti-tipping feet, if available with the rack, should always be extended.

- For maximum cooling and optimum rack thermal efficiency, place the instrument or chassis with the greatest power consumption towards the top of the rack. This promotes efficient cooling since heat rises when placed nearer to the top of the rack, high power instruments will not unnecessarily heat other instruments. However, in doing this, do not violate the guideline that the heaviest instruments should be placed at the bottom of the rack.

- If instruments or modules in the chassis are consuming maximum power, 1U of rack space is required for ventilation below the chassis.

| **NOTE** | When removing the bumpers, save all screws, bumpers and carry handles. Reinstall them if you remove the chassis from the rack to make it portable or for desktop use or to ship the chassis. |

| **CAUTION** | If you have been using the chassis with modules and bumpers installed, remove all modules (including the ESM) before removing the bumpers. This makes handling the chassis easier and reduces the chance of damaging modules. See "Removing a Module" on page 34. |

| **CAUTION** | Do not attempt to install the carry handles without the front and rear bumpers. Do not install handle screws without handle and bumpers installed. Handle screws are too long without the other components installed and could result in damage to the chassis. If you remove the chassis from a rack, you should reinstall both the front and rear bumpers and the carry handles |

Remove / Install Carry Handles and Bumpers

1 The M9506A AXIe chassis has two carry handles which must be removed before removing the plastic bumpers. Remove the two #2 Phillips screws securing the carry handles.See Figure 9 below.

2 Remove the #2 Phillips screws from each side of both bumpers. See Figure 9 below.

.
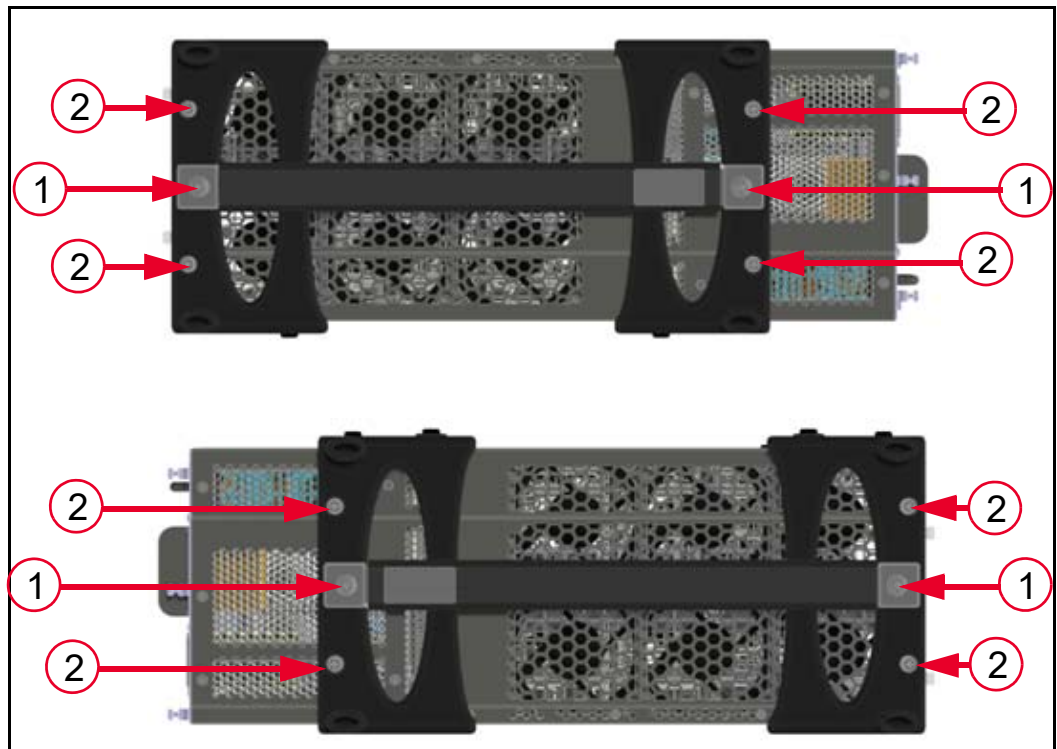
Figure 9   Removing the Carry Handle Screws

3 Remove the three #1 Phillips flat head screws from the top of each bumper.
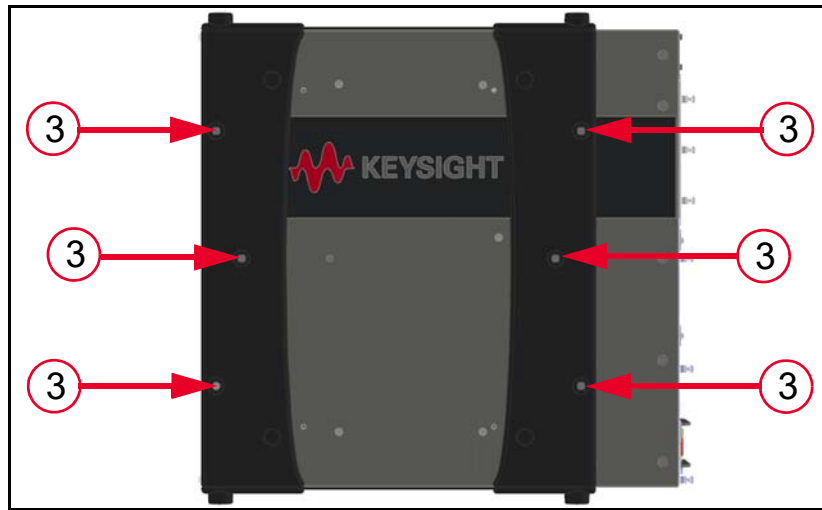
Figure 10 Removing the Chassis Bumpers

4 Carefully turn the chassis onto it's top. Remove the four plastic feet from the bottom of each bumper. Each foot is attached to the chassis through the bumper with a small #2 Phillips screw retained at the back of the foot with a plastic washer. Loosen each screw just enough to disengage it from the chassis. The foot, screw and washer will remain intact. See Figure 11.
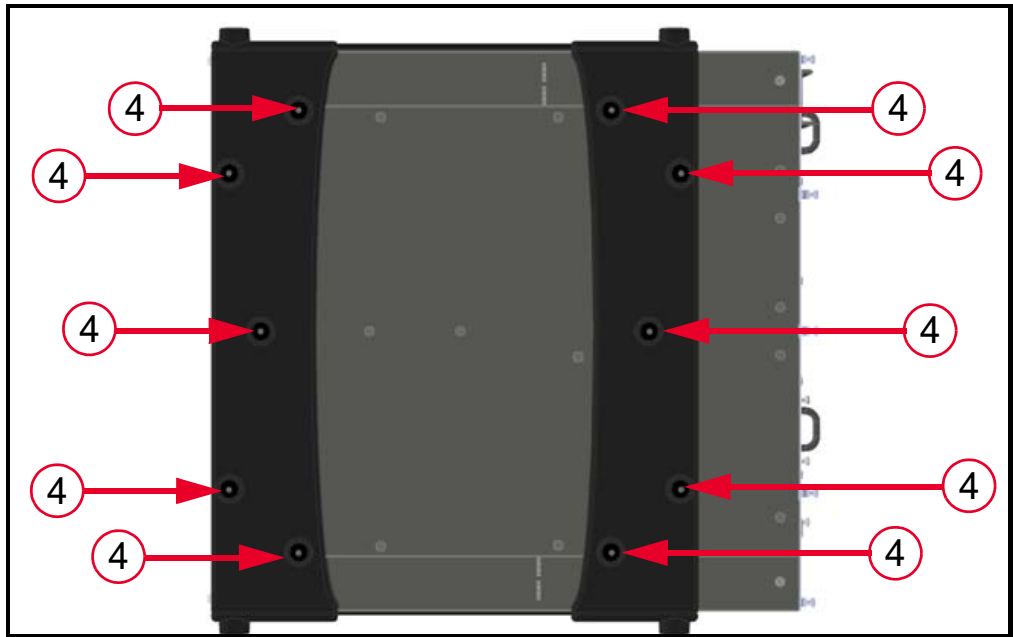
Figure 11   Removing the Chassis Bumpers

5 Slide the bumpers off the chassis.

6 Refer to Figure 12 below. With a flat-blade screwdriver, loosen the four fan tray retaining screws and remove both the right and left fan trays from the chassis.

Figure 12 Remove the Chassis Fan Trays

Replace Chassis Flanges from Both Sides of Chassis

7 Remove the four screws from each original chassis flange as shown below. Retain the screws, they are used when installing the new flanges.

Remove original Chassis Flanges
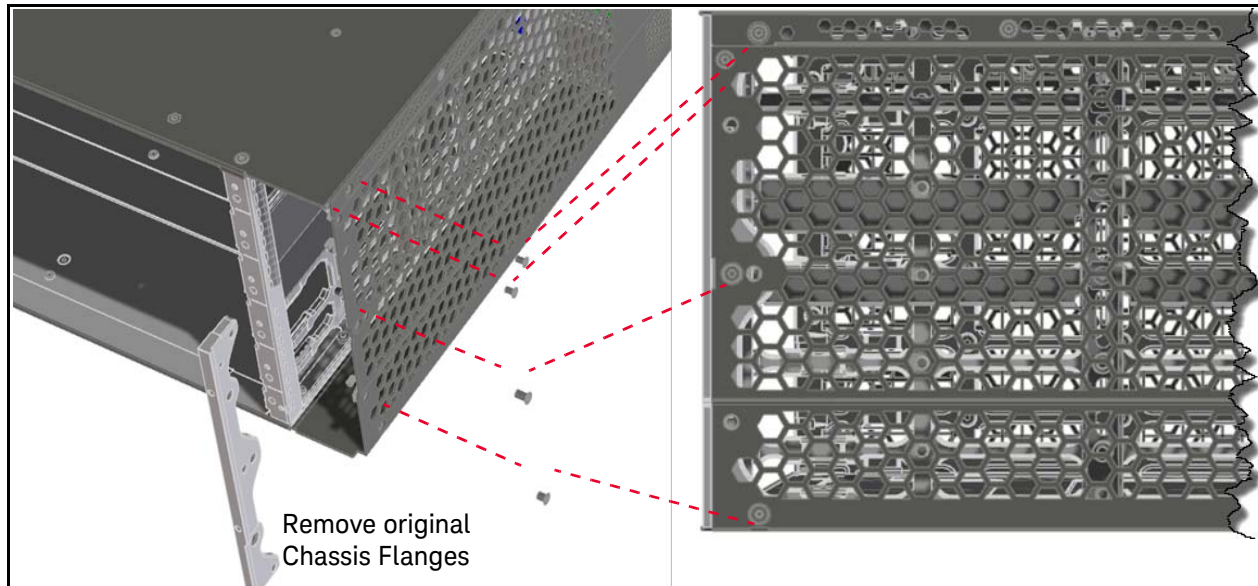
Figure 13   Remove Original Chassis Flanges from Both Sides of the Chassis

8 Install the new chassis flanges on both sides of the chassis.

9 Use the screws removed from the original chassis flanges to install the new rack flanges.
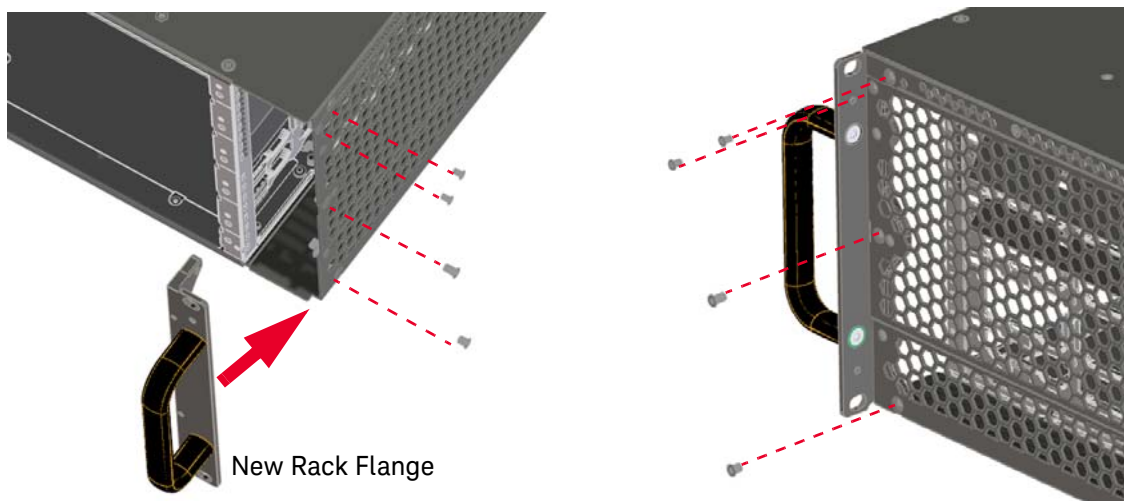
New Rack Flange

Figure 14   Install New Rack Flanges

10 Reinstall both fan trays into the chassis. Hand tighten the four retaining screws.

Install Rails onto Rack

11 Install four Channel Nuts on the rear rack columns (two on each side). Place one immediately above a slot on the rack and one immediately below the slot. See Figure 15, "Install Four Channel Nuts" below.
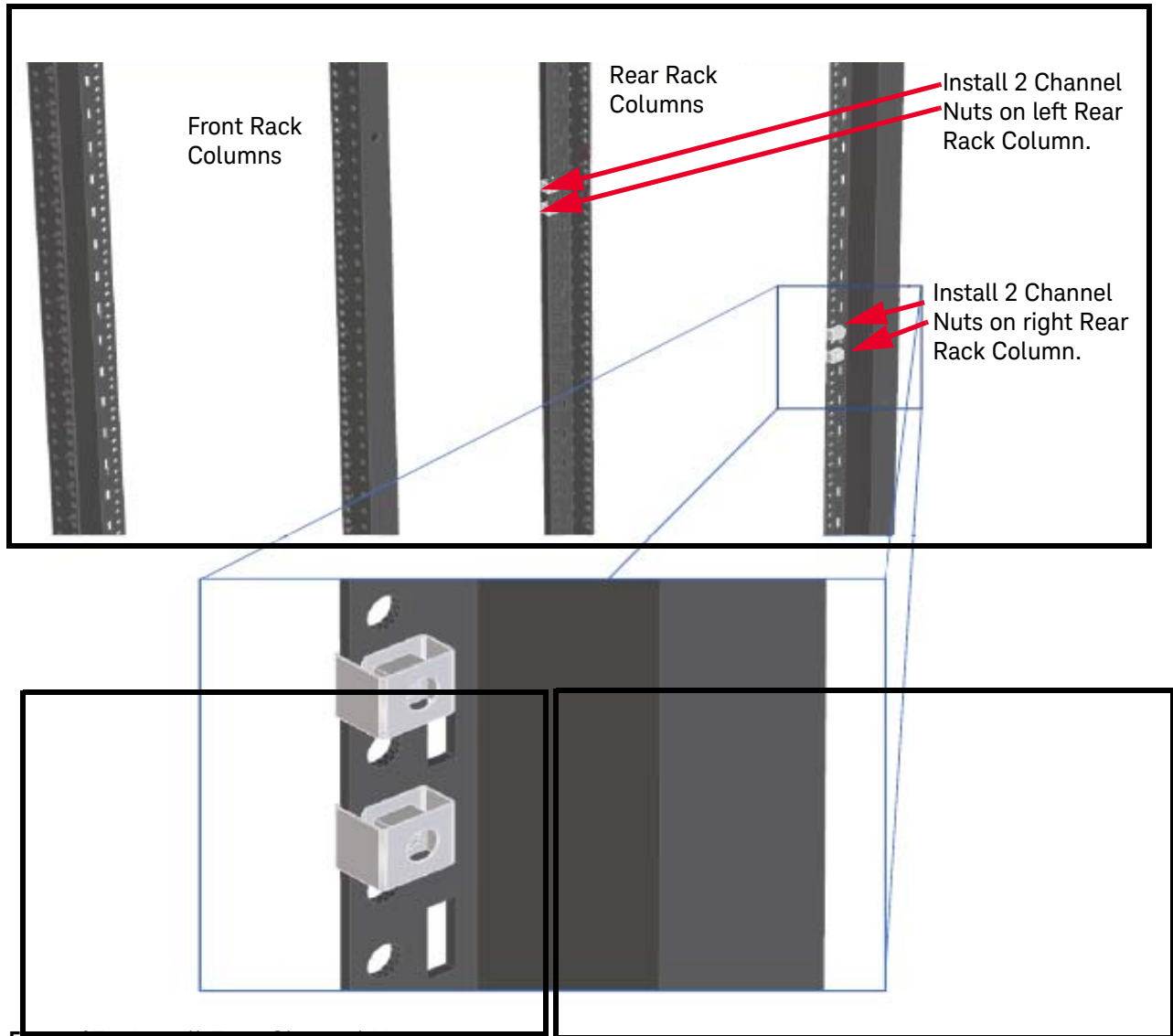
Figure 15 Install Four Channel Nuts

12 Install the two rack rails. Ensure the retaining tabs fit into the slots on the rack rails. See Figure 16 and Figure 17 below.
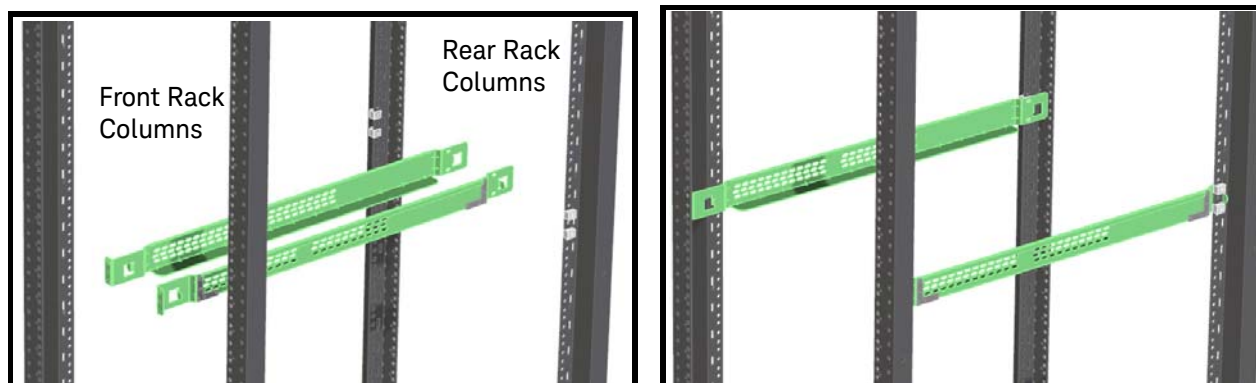
Figure 16   Install Rack Rails

Ensure retainers on the front and rear of the rails are firmly engaged in the rack column slots

Ensure Position Lock tab is firmly engaged into the rack holes in the front rack columns

On rear rack columns, install 10-32 Pan Head T25 Torx Screws to secure rail to rack frame
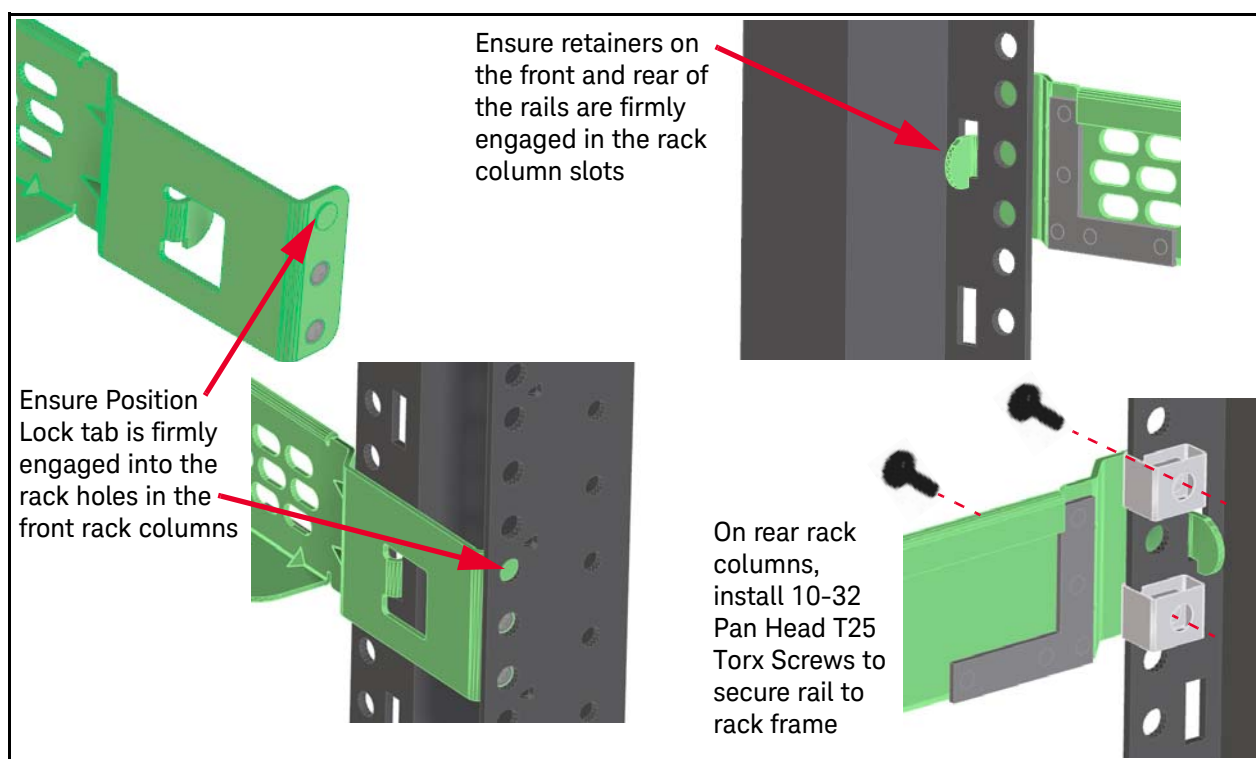
Figure 17   Rail Locking Tabs (Front and Rear)

13 Use four of the 10-32 Pan Head T25 Torx screws to secure the rails to the Channel Nuts installed in Step 11 above.

14 Install two channel nuts on the front left and right rack columns 4U up from the rails.
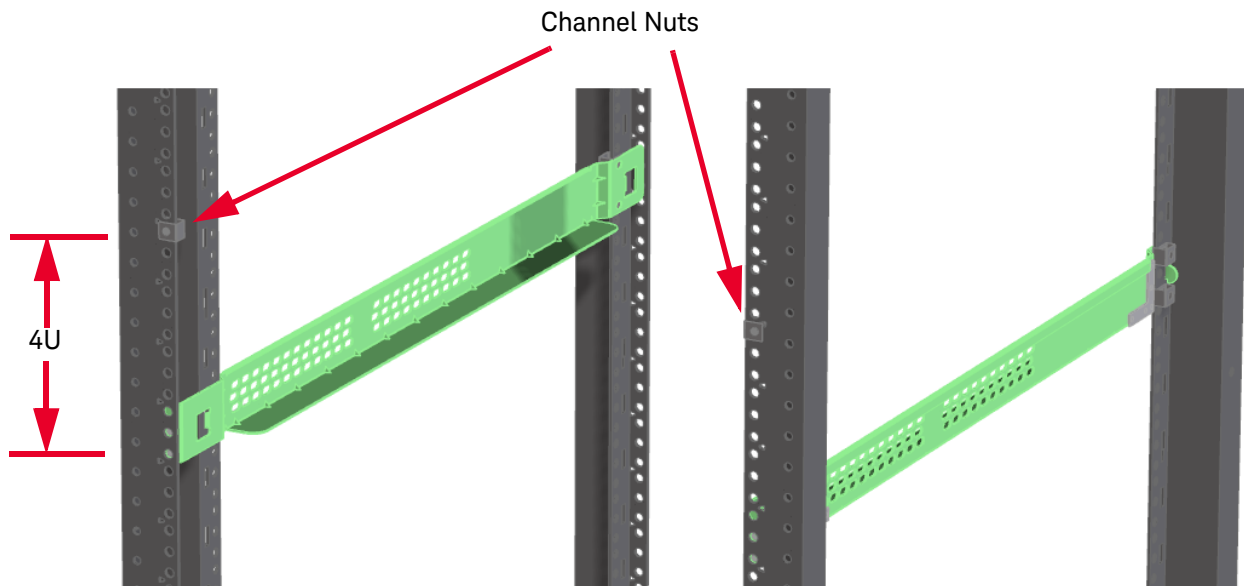
Channel Nuts

Figure 18   Install Upper Channel Nuts on Front Rack Rails

15 Slide the M9506A chassis onto the installed Rack Rails. See Figure 19.
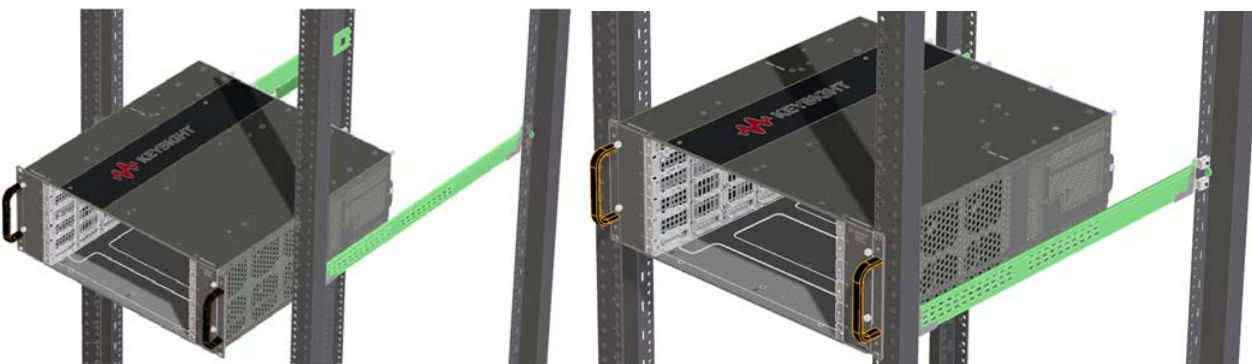
Figure 19   Install the Chassis onto the Rack Rails

WARNING   **To prevent injury during rack mounting, the chassis should be empty. Two people should lift the chassis into the rack.**

16 Install two Channel Nuts on the rack behind the top of the Rack Flange. Slide the M9506A chassis into the rack until the rack mount front handle flanges are against the rack's vertical columns. Secure the chassis to the rack using four Adapter Dress Screws – one on each side. The top two dress screws screw into the two channel nuts; the bottom dress screws go in the bottom holes of the rack flanges and screw into the installed rack rails.
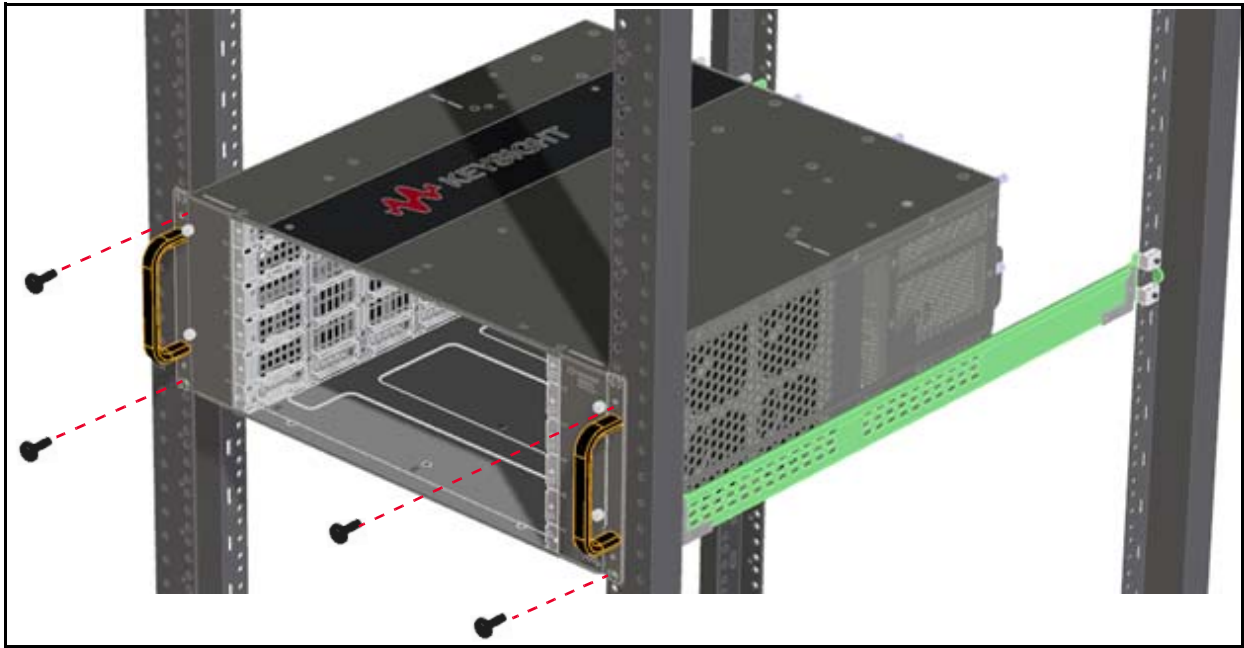
Figure 20   Install Four Adapter Dress Screws

| NOTE | If the rack will be moved excessively or over long distances, you should use a strap to secure the chassis to the rack slides. |

Reinstalling the Bumpers and Carry Handles

If you remove the chassis from the rack to make it portable or for desktop use or ship the chassis, reinstall the front and rear bumpers and carry handles. Reverse the previous procedures to install the bumpers and handles.

| CAUTION | Do not attempt to install the carry handles without the front and rear bumpers. Do not install handle screws without handle and bumpers installed. Handle screws are too long without the other components installed and could result in damage to the chassis. If you remove the chassis from a rack, you should reinstall both the front and rear bumpers and the carry handles. |

3   Navigating the Web Interface

This chapter provides a complete overview of the M9506A AXIe chassis Web Interface, which allows for chassis monitoring and configuration.

The Web Interface is stored in the chassis firmware, and may evolve in look and functionality as newer versions of the firmware are developed. The examples in this manual reflect the firmware at time of product introduction.

NOTE   The LAN connection to the ESM provides communication to the chassis only. For example, chassis firmware updates use the web interface to monitor and control the chassis. It does not provide communication with individual AXIe modules. Use the PCIe or Thunderbolt 3 connection to control individual AXIe modules.

CAUTION   Some AXIe test system software applications, such as the Keysight AXIe Based Logic Analyzer Software and modules, sets and uses specific trigger lines in the AXIe chassis. Do not use the AXIe chassis Soft Front Panel (SFP) software or the AXIe Chassis Web Interface to set or reroute any of the AXIe chassis trigger lines. Rerouting any of the trigger lines may cause the application software to not function correctly.

KEYSIGHT
TECHNOLOGIES

Launching the Web Interface

Launch the web interface from any web browser using the ESM's IP address: 169.254.1.0.

NOTE	If you have problems launching the chassis Web interface, check your browser's proxy settings. When Keysight Connection Expert launches a Web interface for a chassis, it hands off the **http://<address>** to the browser or dedicated web application. Therefore, it should not use a proxy.

Launch the Web Interface from Keysight Connection Expert

1 Open **Keysight Connection Expert** using one of these three methods:

   – Click the IO control (🔵) in your Windows notification tray to the right of the task bar and click:

      Keysight Connection Expert.

   – From the Windows Start menu, select:
      All Programs > Keysight IO Libraries Suite > Keysight Connection Expert

   – From a Command Prompt window, type:
      <c>:\Program Files\Keysight\IO Libraries Suite\KeysightConnectionExpert.exe

      The **Keysight Connection Expert** window displays:
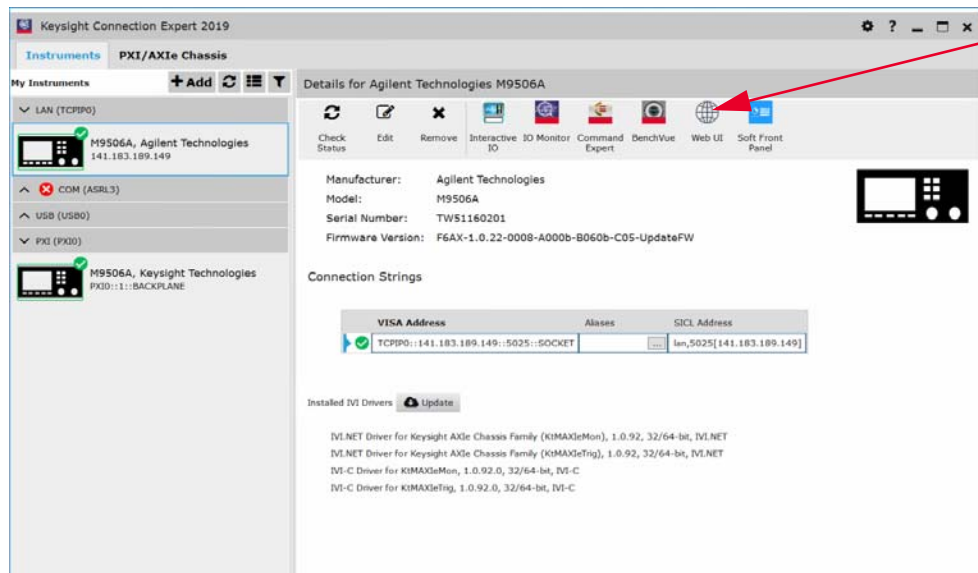
2 The **Instrument I/O on this PC** pane shows instrument connections on your PC. If connected through PCIe or Thunderbolt 3, the chassis appears under the PXI0 interface. If connected through LAN, both the chassis and ESM appear under the LAN interface.

3 To launch the Web Interface, select the M9506A chassis in **Connection Expert**. Then, click the **Web UI** button as shown above. The Web Interface displays in a new window:

Web Interface Home Page

<table>
<tr><td>

NOTE

</td><td>

If you have problems launching the Web interface, check your browser's proxy settings. When Keysight Connection Expert launches a Web interface for a chassis, it passes the *http://<address>* to the browser. Therefore, it should not use a proxy.

</td></tr>
</table>

The home page displays identifying information about your chassis and LAN connection. Clicking the **More Information** (⌄ More Information) button.

Chassis Firmware Version (see)

Clicking **Turn On Front Panel Identification Indicator** causes the ESM front panel STATUS light (in the power switch) to flash steadily; use this to quickly identify the chassis you are communicating with.

Web Page Menu

The six tabs and Help Question Mark across the top are the Web Interface's Menu:
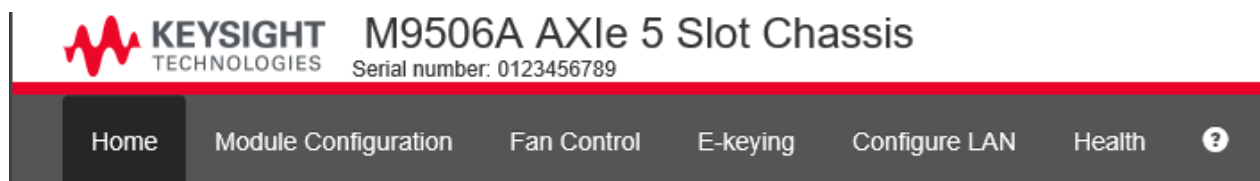
Home Page   Shows general Information about the chassis, such as product identification, firmware version and LAN parameters.

Module Configuration Page   View basic product and model information for instrument modules loaded in the chassis.

Fan Control Page   Displays the fan operating level for module cooling.

E-Keying Page   Shows the connection protocols each module has with other modules in the chassis over the backplane (read-only). E-keying permission occurs as modules activate during power on.

Configure LAN Page   View/change IP address, domain, and subnet. Display service discovery information and LAN status.

Health Page   Shows read-only diagnostic information for chassis fan speed, voltage rails, and temperature sensors. It also shows voltage rails and temperature sensors on AXIe modules if they are so equipped.

Help Button   The Help button ( ) provides general help for the current page.

Module Configuration Page

Click the **Module Configuration** tab to display the Module Configuration page. This page shows the physical slot number and identifying information for recognized modules installed in the chassis including the Embedded System Module, power supply and fan tray information.

The above example shows an M9506A chassis with three installed modules (slots 2, 3 and 4).

Fan Control Page

The Fan Control page screen shows the fan and cooling status for the fan trays in the chassis and allows you to set the fan operating level.
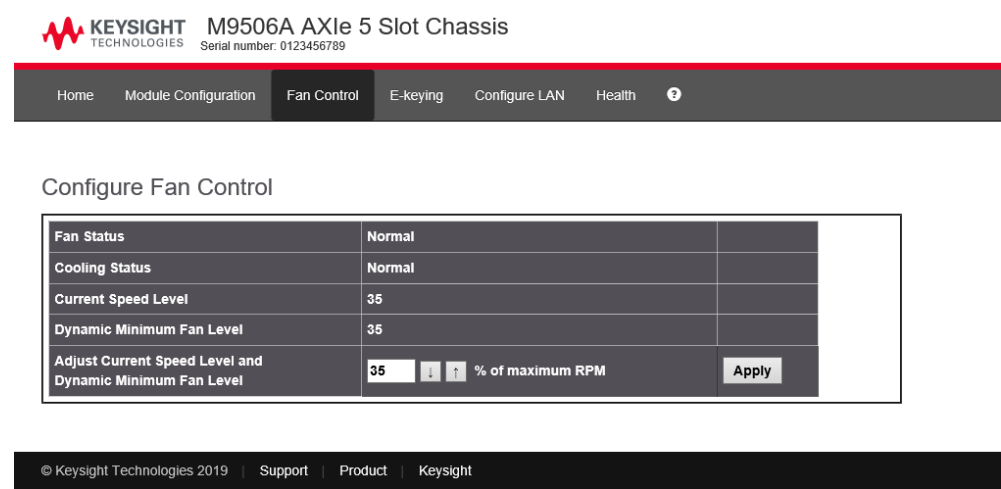
For detailed information on understanding and controlling Dynamic Minimum Fan Level, see "Configure Fan Control" on page 77.

E-Keying Page

E-Keying (short for Electronic Keying) is a process in which compatible matches over links between different modules are identified and enabled for use. For more information on the details of E-Keying, refer to "Electronic Keying (E-Keying)" on page 97.

In general, you do not need to understand how E-Keying works. The E-Keying process is managed by the ESM shelf manager. The following two figures illustrate the Module E-Keying Activity display in the Module Configuration Page.

In the following graphic, note that modules in Slots 3 and 4 (column 1 "From Slot" and column 2 "To Slot") have an Enabled status and use the AXIe Local Bus (62 pair Local Bus). This simply states that the Shelf Manager has given the two modules permission to communicate directly (E-Keying) over the AXIe backplane local bus. Also note that both modules are enabled to use the AXIe Timing STRIG link and the PCI Express fabric.

More information on AXIe E-Keying is available on the AXIe Consortium website: www.axiestandard.org.

See also, "Electronic Keying (E-Keying)" on page 97 of this manual.

Module E-Keying Configuration

This table describes the electronic keying link activity permitted by the shelf manager. A status of 'enabled' indicates an interface and associated link is permitted to be established. It does not indicate whether the link is alive and active. Modules may have many interfaces. A blank status indicates an interface is available, but not in use. Clicking on any heading will sort the table according to that column.

From Slot	To Slot	Status	Interface	Link Type	Extension	Group	Channel	Port
Backplane			Base (0x00)	PICMG 3.0 Base 10/100/1000 BASE-T	(10/100/1000 BASE-T) (0x0)	0x00	1	1
Backplane	2	Enabled	Base (0x00)	PICMG 3.0 Base 10/100/1000 BASE-T	(10/100/1000 BASE-T) (0x0)	0x00	2	1
Backplane			Base (0x00)	PICMG 3.0 Base 10/100/1000 BASE-T	(10/100/1000 BASE-T) (0x0)	0x00	3	1
Backplane			Base (0x00)	PICMG 3.0 Base 10/100/1000 BASE-T	(10/100/1000 BASE-T) (0x0)	0x00	4	1
Backplane			Base (0x00)	PICMG 3.0 Base 10/100/1000 BASE-T	(10/100/1000 BASE-T) (0x0)	0x00	5	1
Backplane			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x33	1	1,2,3,4
Backplane			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x00	1	1,2,3,4
Backplane			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x00	1	1,2
Backplane			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x00	1	1
Backplane			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x33	2	1,2,3,4
Backplane			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x33	3	1,2,3,4
Backplane			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x33	4	1,2,3,4
Backplane			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x34	5	1,2,3,4
Backplane			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x00	5	1,2,3,4
Backplane			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x00	5	1,2
Backplane			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x00	5	1
Backplane			AXIE Timing (0x02)	CLK100	(System slot output) (0x1)	0x00	2	1
Backplane			AXIE Timing (0x02)	SYNC	(System slot output) (0x1)	0x00	3	1
Backplane			AXIE Timing (0x02)	STRIG	(All STRIG links) (0x1)	0x00	5	1
Backplane			AXIE Timing (0x02)	STRIG	(All STRIG links) (0x1)	0x00	6	1
Backplane	3	Enabled	AXIE Timing (0x02)	STRIG	(All STRIG links) (0x1)	0x00	7	1
Backplane	4	Enabled	AXIE Timing (0x02)	STRIG	(All STRIG links) (0x1)	0x00	8	1
Backplane			AXIE Timing (0x02)	STRIG	(All STRIG links) (0x1)	0x00	9	1
2	Backplane	Enabled	Base (0x00)	PICMG 3.0 Base 10/100/1000 BASE-T	(10/100/1000 BASE-T) (0x0)	0x00	1	1
2			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x00	1	1,2,3,4
2			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x00	1	1,2
2			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x00	1	1
2	Backplane	Enabled	AXIE Fabric (0x00)	PCI Express Fabric	(5 GT/s reversed) (0x3)	0x00	1	1,2,3,4
2			AXIE Fabric (0x00)	PCI Express Fabric	(5 GT/s reversed) (0x3)	0x00	1	1,2
2			AXIE Fabric (0x00)	PCI Express Fabric	(5 GT/s reversed) (0x3)	0x00	1	1
2			AXIE Fabric (0x00)	PCI Express Fabric	(2.5 GT/s reversed) (0x1)	0x00	1	1,2,3,4
2			AXIE Fabric (0x00)	PCI Express Fabric	(2.5 GT/s reversed) (0x1)	0x00	1	1,2
2			AXIE Fabric (0x00)	PCI Express Fabric	(2.5 GT/s reversed) (0x1)	0x00	1	1
2			AXIE Fabric (0x00)	PCI Express Fabric	(5 GT/s normal) (0x2)	0x00	1	1,2,3,4
2			AXIE Fabric (0x00)	PCI Express Fabric	(5 GT/s normal) (0x2)	0x00	1	1,2
2			AXIE Fabric (0x00)	PCI Express Fabric	(5 GT/s normal) (0x2)	0x00	1	1
2			AXIE Timing (0x02)	FCLK	(Instrument slot input) (0x2)	0x00	1	1
3			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x00	1	1,2,3,4
3			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x00	1	1,2
3			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x00	1	1
3	Backplane	Enabled	AXIE Fabric (0x00)	PCI Express Fabric	(5 GT/s normal) (0x2)	0x00	1	1,2,3,4
3			AXIE Fabric (0x00)	PCI Express Fabric	(5 GT/s normal) (0x2)	0x00	1	1,2
3			AXIE Fabric (0x00)	PCI Express Fabric	(5 GT/s normal) (0x2)	0x00	1	1
3			AXIE Local Bus (0x01)	OEM GUID-based (0xf0)	(62-pair local bus) (0x3)	0x00	1	1
3	4	Enabled	AXIE Local Bus (0x01)	OEM GUID-based (0xf0)	(62-pair local bus) (0x3)	0x00	2	1
3			AXIE Timing (0x02)	FCLK	(Instrument slot input) (0x2)	0x00	1	1
3			AXIE Timing (0x02)	CLK100	(Instrument slot input) (0x2)	0x00	2	1
3			AXIE Timing (0x02)	SYNC	(Instrument slot input) (0x2)	0x00	3	1
3	Backplane	Enabled	AXIE Timing (0x02)	STRIG	(All STRIG links) (0x1)	0x00	4	1
4			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x00	1	1,2,3,4
4			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x00	1	1,2
4			Fabric (0x01)	PICMG 3.4 PCI Express Fabric	(PCI Express Base) (0x0)	0x00	1	1
4	Backplane	Enabled	AXIE Fabric (0x00)	PCI Express Fabric	(5 GT/s normal) (0x2)	0x00	1	1,2,3,4
4			AXIE Fabric (0x00)	PCI Express Fabric	(5 GT/s normal) (0x2)	0x00	1	1,2
4			AXIE Fabric (0x00)	PCI Express Fabric	(5 GT/s normal) (0x2)	0x00	1	1
4	3	Enabled	AXIE Local Bus (0x01)	OEM GUID-based (0xf0)	(62-pair local bus) (0x3)	0x00	1	1
4			AXIE Local Bus (0x01)	OEM GUID-based (0xf0)	(62-pair local bus) (0x3)	0x00	2	1
4			AXIE Timing (0x02)	FCLK	(Instrument slot input) (0x2)	0x00	1	1
4			AXIE Timing (0x02)	CLK100	(Instrument slot input) (0x2)	0x00	2	1
4			AXIE Timing (0x02)	SYNC	(Instrument slot input) (0x2)	0x00	3	1
4	Backplane	Enabled	AXIE Timing (0x02)	STRIG	(All STRIG links) (0x1)	0x00	4	1

Configure LAN Page

Initial releases of the AXIe chassis have IP configuration set to Automatic; the IP Address, Subnet Mask and Default Gateway are set automatically and cannot be changed.

When you make a LAN connection between host PC and chassis ESM, and then power-on the chassis, the following process happens:

1   The chassis, as client, seeks a Dynamic Host Configuration Protocol (DHCP) server to set the IP configuration.

2   If you connected the chassis and PC to a corporate LAN, the network will provide the DHCP addresses.

3   If you made a direct LAN connection (physical LAN or implicit LAN connection through PCIe), the chassis reverts to link-local addressing.

| **NOTE** | If you are having difficulty 'finding' a specific AXIe chassis on a network, you can search by the mDns Instrument Name, which includes the unique chassis serial number. This number is located at the rear of the chassis. |

Health Page

The Sensors section of the Chassis Health page lists sensor measurements for each module slot. The sensors are vendor-specific, and the type of readings will vary by module. Below is a portion of the Sensors section from a chassis with two modules installed.

Monitoring Chassis Backplane Temperature

There are nine chassis temperature sensors which measure chassis temperature in degrees Celsius: four sensors on the ESM, three on the backplane, one on the PCIe mezzanine, and one on the power module next to the PSU.

These temperatures are listed in the **Sensors** section of the Chassis Health page. They are provided as an indication of ambient chassis temperature only; the individual slot temperatures reported by installed modules control the chassis fans.

	Status	ID	Type	Name	Lower Critical	Reading	Upper Critical
	Nominal	20	Temperature	CPU2 Temp		0.00 degrees C	80.00 degrees C
1	-empty-						
	Status	*ID*	*Type*	*Name*	*Lower Critical*	*Reading*	*Upper Critical*
Chassis	**M9506A AXIe 5 Slot Chassis**	**Active**					
	Status	*ID*	*Type*	*Name*	*Lower Critical*	*Reading*	*Upper Critical*
	Nominal	120	Temperature	External Temp1		30.00 degrees C	76.00 degrees C
	Nominal	121	Temperature	External Temp2		34.00 degrees C	76.00 degrees C
	Nominal	122	Temperature	External Temp3		32.00 degrees C	76.00 degrees C
	Nominal	123	Temperature	External Temp4		45.00 degrees C	75.00 degrees C
	Nominal	124	Temperature	Backplane Temp 1		26.00 degrees C	70.00 degrees C
	Nominal	125	Temperature	Backplane Temp 2		27.00 degrees C	70.00 degrees C
	Nominal	126	Temperature	Backplane Temp 3		29.00 degrees C	70.00 degrees C
	Nominal	127	Temperature	Mezzanine Temp		37.00 degrees C	75.00 degrees C
	Nominal	128	Temperature	Power Board Temp		34.00 degrees C	70.00 degrees C
	Nominal	200	Voltage	Volsensor1 1.8V	1.66 Volts	1.80 Volts	1.94 Volts
	Nominal	201	Voltage	Volsensor2 1.8V	1.66 Volts	1.80 Volts	1.94 Volts
	Nominal	202	Voltage	Volsensor3 1.8V	1.66 Volts	1.80 Volts	1.94 Volts
	Nominal	203	Voltage	Volsensor4 1.8V	1.66 Volts	1.80 Volts	1.94 Volts
	Nominal	204	Voltage	Volsensor5 5V	4.71 Volts	4.99 Volts	5.36 Volts
	Nominal	205	Voltage	Volsensor6 1.2V	1.10 Volts	1.23 Volts	1.30 Volts
	Nominal	206	Voltage	Volsensor7 USB	4.29 Volts	5.02 Volts	16.01 Volts
	Nominal	207	Voltage	Volsensor8 2.5V	2.34 Volts	2.51 Volts	2.68 Volts
	Nominal	208	Voltage	Volsensor9 2.5V	2.34 Volts	2.52 Volts	2.68 Volts
	Nominal	209	Voltage	Volsensor10 1V	0.92 Volts	1.02 Volts	1.08 Volts
	Nominal	210	Voltage	Volsensor11 1V	0.92 Volts	1.01 Volts	1.08 Volts
	Nominal	211	Voltage	Volsensor12 0.9V	0.83 Volts	0.91 Volts	0.97 Volts
	Nominal	212	Voltage	Volsensor13 0.9V	0.83 Volts	0.91 Volts	0.97 Volts
	Nominal	213	Voltage	Volsensor14 0.9V	0.83 Volts	0.90 Volts	0.97 Volts
	Nominal	214	Voltage	Volsensor15 0.9V	0.83 Volts	0.90 Volts	0.97 Volts
	Nominal	215	Voltage	Volsensor16 3.3V	3.07 Volts	3.27 Volts	3.52 Volts
	Nominal	217	Voltage	Volsensor18 3.3V	3.07 Volts	3.30 Volts	3.52 Volts
	Nominal	218	Voltage	Volsensor19 5V	4.64 Volts	5.03 Volts	5.35 Volts
	Nominal	219	Voltage	Volsensor20 12V	11.24 Volts	11.96 Volts	12.83 Volts
	M9506A Power Supply	**Active**					
	Status	*ID*	*Type*	*Name*	*Lower Critical*	*Reading*	*Upper Critical*
	Nominal	220	Voltage	PSU VOUT	45.12 Volts	51.84 Volts	53.12 Volts
	Nominal	221	Current	PSU IOUT	0.00 Amps	3.40 Amps	30.00 Amps
	Nominal	222	Temperature	PSU Temp	0.00 degrees C	50.00 degrees C	90.00 degrees C
	Nominal	223	Voltage	PSU VIN	88.00 Volts	243.00 Volts	270.00 Volts
	M9506A Fan Tray	**Active**					
	Status	*ID*	*Type*	*Name*	*Lower Critical*	*Reading*	*Upper Critical*
	Nominal	3	Fan	Fan 0	1500.00 RPM	3840.00 RPM	
	Nominal	4	Fan	Fan 1	1500.00 RPM	3720.00 RPM	
	Nominal	5	Fan	Fan 2	1500.00 RPM	3720.00 RPM	
	Nominal	6	Fan	Fan 3	1500.00 RPM	3720.00 RPM	
	Nominal	7	Fan	Fan 4	1500.00 RPM	3780.00 RPM	
	Nominal	8	Fan	Fan 5	1500.00 RPM	3660.00 RPM	
	Nominal	9	Fan	Fan 6	1500.00 RPM	3660.00 RPM	
	Nominal	10	Fan	Fan 7	1500.00 RPM	3660.00 RPM	
	Nominal	11	Fan	Fan 8	1500.00 RPM	3600.00 RPM	
	Nominal	12	Fan	Fan 9	1500.00 RPM	3600.00 RPM	
	Nominal	13	Fan	Fan 10	1500.00 RPM	3780.00 RPM	
	Nominal	14	Fan	Fan 11	1500.00 RPM	3600.00 RPM	
	Nominal	15	Fan	Fan 12	2015.00 RPM	3055.00 RPM	

Voltage sensors provide a measurement of the power supply voltages. Most AXIe modules also provide an indication of the power supply voltages available to them.

The bottom part of the chart lists the individual fans in the chassis and their current fan speed. If any one fan is running considerably lower than the rest or has stopped, it may mean that the fan tray should be replaced. Refer to Chapter 8, Troubleshooting and Service on page 131 for troubleshooting information.

4 Using the Soft Front Panels

This chapter provides a brief overview of the two M9506A AXIe chassis Soft Front Panel (SFP) drivers–**Monitor SFP** and **Trigger SFP**. While the Web Interface runs in a browser window and accesses the web server built into the chassis, the SFPs are executables which run on a PC and communicates to the chassis using the IVI drivers. SFPs are installed automatically when the chassis IVI drivers are installed.

NOTE   Two SFP drivers are included with the M9506A – a **Monitor SFP** and a **Trigger SFP**. Both drivers are installed automatically when you install the IVI drivers. Make certain that you use the appropriate SFP for your purposes. Refer to the SFP Help files for detailed information.

CAUTION   Some AXIe test system software applications, such as the Keysight AXIe Based Logic Analyzer Software and modules, sets and uses specific trigger lines in the AXIe chassis. Do not use the AXIe chassis Soft Front Panel (SFP) software or the AXIe Chassis Web Interface to set or reroute any of the AXIe chassis trigger lines. Rerouting any of the trigger lines may cause the application software to not function correctly.

KEYSIGHT
TECHNOLOGIES

Starting the Soft Front Panels

After the chassis drivers are installed, either SFP can be started from the Start menu as follows:

Start > Keysight > AXIe Chassis Monitor SFP

Start > Keysight > AXIe Chassis Trigger SFP

The SFP help system can be launched from the Windows **Start** menu as well. For detailed information on the features and functionality of the SFP, see the SFP help system.

NOTE	**IMPORTANT**: If your chassis is connected to the host PC via a LAN connection, and Keysight Connection Expert has discovered the chassis as a LAN device, then the Soft Front Panel software will also find the chassis.
	However, if you connected the chassis to the host PC via PCIe cable, you must manually add the chassis to the LAN device tree. This is true, even if Keysight Connection Expert has found the chassis and listed it under the PXI device tree. To add the chassis as a LAN device, select the LAN tree, then select Add Instrument. The chassis must be added as Socket protocol (typically port 5025).

Monitor Soft Front Panel Screens

The **Monitor** SFP has five tabs: **Fans, Chassis, Power Supply,** and **Slot View**, that provide information about the chassis such as installed modules, monitor and control the chassis fan speeds, monitor chassis temperature sensors, and the chassis voltages. If a chassis temperature or fan speed, or power supply voltage exceed the threshold value, an Alarm condition occurs and the SFP indicator turns red indicating the fault.

Utilities include chassis **Reset**, **Self-Test**, **Firmware Update** and the **Hardware Service Wizard.**

Tools allows for monitoring IVI driver calls from the SFP.

The following graphic shows an M9506A 5-slot chassis Monitor SFP showing the **Fan** tab.
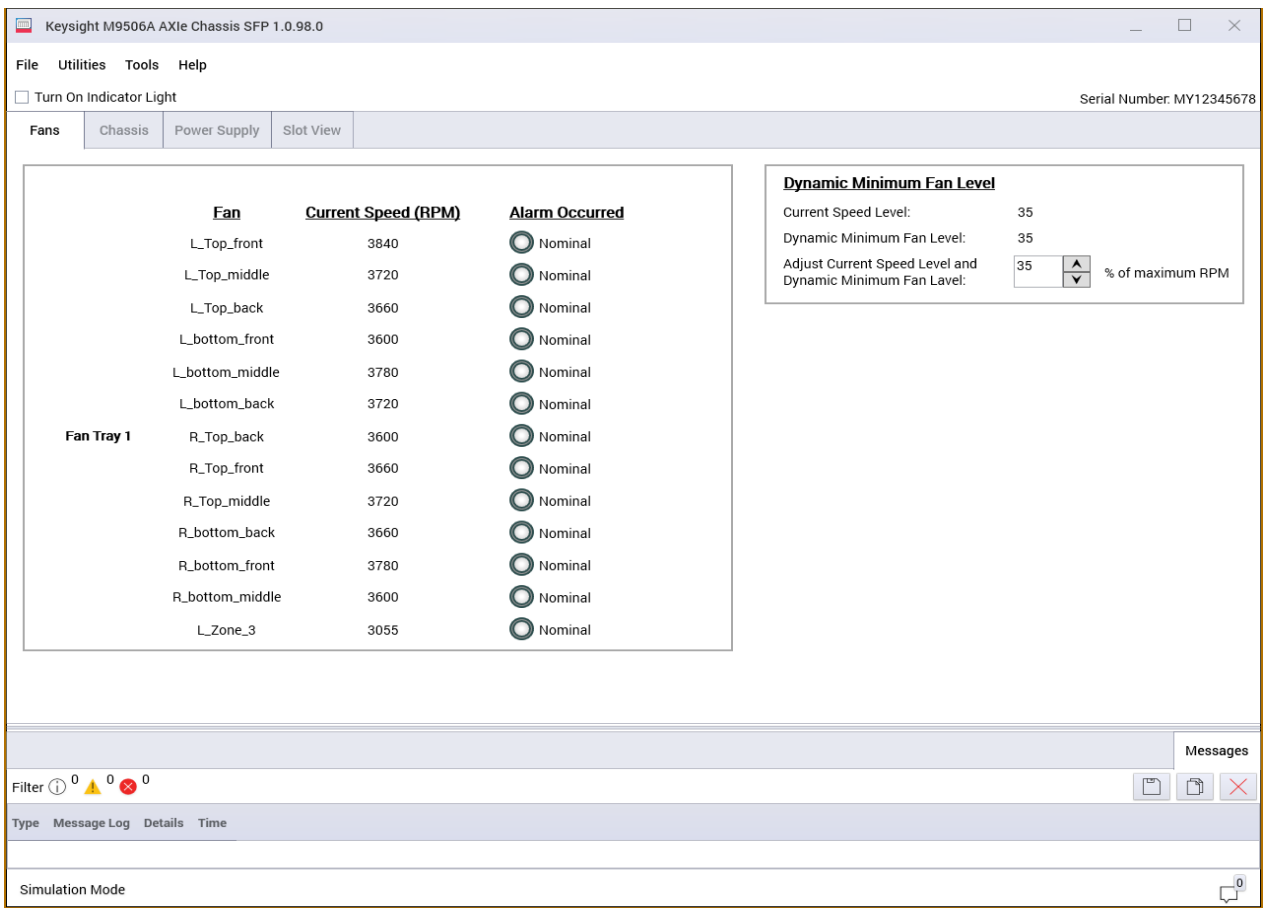
For detailed information on understanding Dynamic Minimum Fan Level, see "Configure Fan Control" on page 77.

Trigger Soft Front Panel Screens

The **Trigger SFP** has four tabs: **Crosspoint Switch, Ports, System Clock & Backplane Sync,** and **Trigger Port**. The graphic below shows the Crosspoint Switch screen. Refer to the Trigger Soft Front Panel help file for detailed use information.
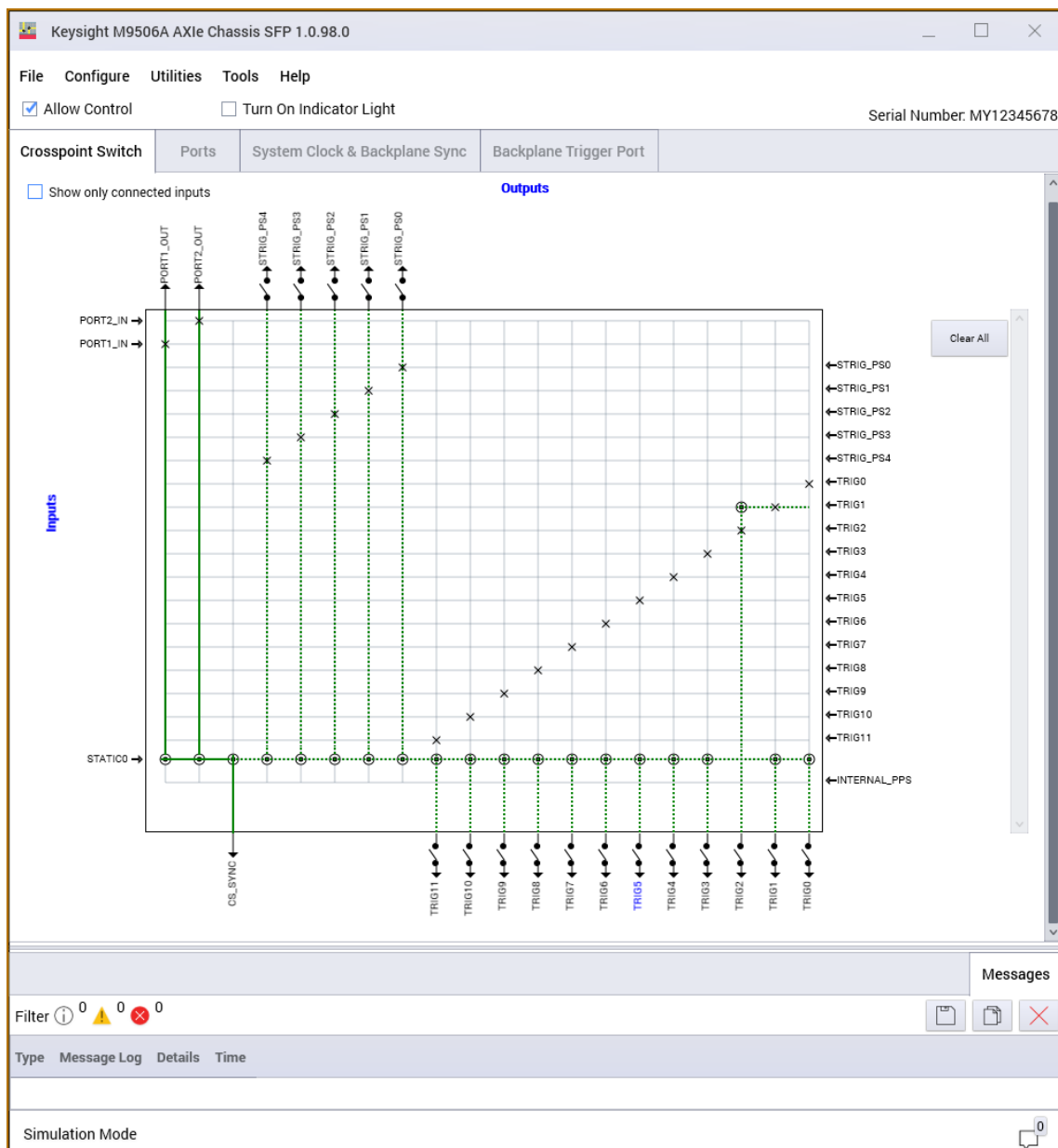
Note that you must check the "Allow Control" checkbox to actually control the M9506A chassis. This check box is provided to prevent changes from being inadvertently made to the trigger routing.

5   Features and Functions

This chapter explains the monitoring, synchronization, triggering and signal routing options for the AXIe chassis.

KEYSIGHT TECHNOLOGIES

Chassis Block Diagram

Figure 21 below is a simplified diagram showing how signals are routed between the Embedded System Module (ESM) front panel, and chassis backplane slots.
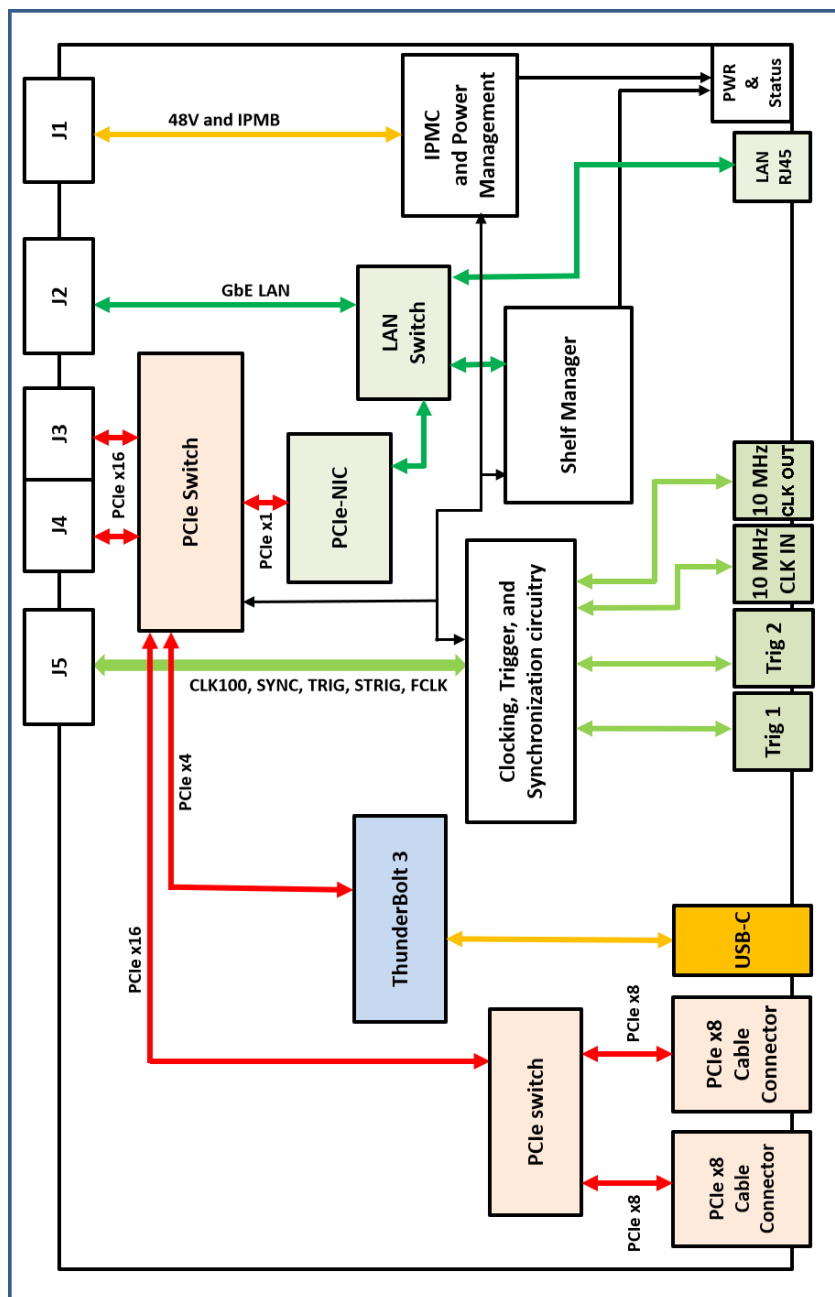
Figure 21   Simplified M9506A ESM Block Diagram

A block diagram of a complete M9506A 5-slot AXIe chassis system with a host PC is presented on the next page.

Keysight M9506A AXIe Chassis System

Keysight M9506A AXIe Chassis

The PCIe x16 connections to each slot can only be accessed from the chassis PCIe interface. However, the Gb Ethernet connections to each slot can be accessed from both the PCIe interface (through the Intel NIC and LAN Switch) and through the chassis LAN interface.

Modules may connect to the PCIe x16 interface and/or the Gb Ethernet interface. Refer to your module documentation for information on the interface(s) it uses.

PCIe x16 (Gen 3) to each slot

Gb Ethernet to each slot

Slot 5
Slot 4
Slot 3
Slot 2
Slot 1

Parallel and star trigger lines

Synchronization and Triggering

Chassis Firmware

IPMB – Intelligent Platform Management Bus

Shelf Manager
- Monitors/controls fan speeds
- Monitors temperature sensors
- Monitors module sensors
- Provides Web Interface

LAN Switch

Intel I210 Network Interface Card

The slot PCIe interfaces cannot be accessed from the chassis LAN interface.

PCIe Switch

IMPORTANT: PCIe is logically an extension of the host PC backplane. If the PCIe interface is used to connect to the chassis, the chassis Intel I210 NIC will appear to Windows as if it is installed directly in the PC. Windows 7 and Windows 10 provide the necessary Intel NIC driver.

If you're connected to the chassis using only the LAN interface, the NIC will not be visible to the Host Controller PC.

ESM PCIe interface

PCIe cable (Gen 3, x8)

ESM Thunderbolt Interface

Chassis LAN interface

Thunderbolt Interface

Site LAN hub, router, or switch

CAUTION: Do not attach a LAN cable after communications has been established over the PCIe cable. Doing this will disrupt PCIe communications, and will not provide LAN communications – the chassis will become inaccessible and rebooting of the PC will be required to restore communications.

If you need both LAN and PCIe communications, connect both cables prior to powering-up the chassis.

PCIe Adapter

M9048, M9049 PCIe Desktop Adapter (x8)

LAN

Host PC

Keysight Connection Expert

Keysight Connection Expert displays connection information separately for the chassis and for each module installed in the chassis.

Chassis Web Interface

The Web Interface uses PCIe, LAN, or Thunderbolt 3.

AXIe Chassis Soft Front Panel (SFP)

AXIe Chassis Monitor SFP

AXIe Chassis Trigger SFP

The SFPs use PCIe, LAN, or Thunderbolt 3.

Application program

IVI-C driver

IVI.NET driver

In performing the Initialize() call for either driver, the application program specifies a VISA resource name. If only PCIe is connected, the resource name may appear like:

"TCPIP0::169.254.1.0::5025::SOCKET"

where 169.254.1.0 is an example private IP address. If only LAN is connected, the resource name may appear like:

"TCPIP0::192.168.5.2::5025::SOCKET"

where 192.168.5.2 is an example DHCP-assigned IP address. If both LAN and PCIe are connected, the LAN VISA resource name is used.

NOTES:

1. PCIe and LAN connectivity:

   A. If the chassis PCIe interface is connected and the chassis LAN interface isn't connected, the Intel NIC provides a means for the PC to access the LAN Switch – this provides PC access to the Shelf Manager as well as access to the Gb Ethernet connections to each slot.

   B. While the Intel NIC allows the host PC to use the PCIe interface to access the LAN Switch (and the devices connected to the LAN Switch), the reverse does not apply -- the PC cannot use the LAN interface and the Intel NIC to access the slot PCIe x16 interfaces.

2. PCIe Generation (Gen) 1 peak speed is 2.5 Gb/s per lane. PCIe Gen 2 peak speed is 5.0 Gb/s per lane. PCIe Gen 3 peak speed is 8.0 Gb/s per lane. Taking into account encoding and other overhead, typical Gen 3 performances in Gb/s are as follows for x8 and x16: **x8:** 8 Gb/s **x16:** 16 Gb/s

3. The PCIe Switch internal buffering allows the chassis to communicate to the host PC at 16 Gb/s, and simultaneously communicate at 8 Gb/s to each of two x8 module slots.

A Note on M9506A Drivers

A total of six (6) drivers and Soft Front Panels (SFPs) are provided for the M9506A chassis with ESM. The SFPs are as follows:

- Two IVI Monitor Drivers (IVI-C and IVI .NET **KtMAXIeMon**) for monitoring the chassis temperature sensors, setting fan speed, and utility functions.
- Two IVI Trigger Drivers (IVI-C and IVI .NET **KtMAXIeTrig**).
- Two Soft Front Panel (SFP) Drivers (**AXIe Chassis Monitor SFP** and **AXIe Chassis Trigger SFP**)

Make certain that you have the latest drivers installed on your host controller prior to programming the chassis and ESM.

The most up-to-date installer is available on the M9506A web page: www.keysight.com/find/M9506A.

ESM Shelf Management Functions

On the M9506A, the ESM provides the following Shelf Manager functions:

- Monitor and control chassis fan speed
- Monitor chassis backplane temperature
- Monitor module health, as provided by the module vendor (may include voltages and temperatures, fuse status, alarms and alarm setpoints)
- Automatically and safely shutdown power upon a fan tray or power supply unit (PSU) failure

Configure Fan Control

The minimum chassis fan speed is approximately 600 RPM; the maximum fan speed is approximately 6000 RPM. Using a range of 10 to 100 (percentage of maximum), you can manually set the minimum speed you want the fans to operate at — 10 means the fan speed of approximately 2200 RPM and 100 is the maximum fan speed of approximately 6000 RPM.

CAUTION   Do not attempt to set the fan speed **below 10 %.**

NOTE   Regardless of where you set the minimum fan speed, if the temperature inside the AXIe chassis rises, the fans speed increases to provide additional cooling. The resolution of the Current Fan Level, as shown on the Chassis Health interface page, is an approximation of the fan speed.

The Fan Control page has the following five fields:

Fan Status   The shelf manager continuously monitors chassis fan speed, looking for indication that one or more fans are not turning. **Normal** fan status represents a fan speed of approximately 2200 RPM (or higher when required by instrumentation load). Below that speed, the shelf manager reports an alarm condition for that fan, it attempts to increase fan speed and continues to monitor. Failure of one fan will not result in interruption of power to installed modules.

Cooling Status   The shelf manager continuously monitors reported module temperatures, looking for indication that one or more modules is outside its optimal temperature range. This range is specified by the module, as are the thresholds for alarm conditions. Typically only high temperatures generate an alarm, although it is possible to specify low temperature alarm levels as well.

In the event of a high temperature alarm from any module, the shelf manager responds by increasing chassis fan speed and continuing to monitor. If the Upper Non-Recoverable threshold is reached, the shelf manager requests the module to power down to its inactive state. Because this level is set by the module, it may not indicate that the module has failed, only that continued operation is inadvisable until the module cools.

NOTE   Refer to the Chassis Health page for detailed information about individual modules, temperature alarms, etc.

Current Speed Level   This is the level the fans are currently operating and is controlled by the Shelf Manager. It increases from a set minimum as needed to adjust for changes in chassis temperature. The range is from 10 to 100, where 10 is the slowest speed level and 100 is the highest speed level. The Current Speed Level indicates an approximate percentage of maximum fan RPM. Therefore, a level of 40 indicates the fans are operating at approximately 40% of maximum RPM, and 100 indicates the fans are operating at 100% of maximum RPM. Note, the default/reset value is 10.

Dynamic Minimum Fan Level   This is the minimum fan level the shelf manager algorithm sets as it actively monitors the overall system temperature and temperature threshold events received from instrument modules. Over time, the algorithm adjusts this level towards the user-specified minimum fan level provided the cooling status remains at Normal.

Adjust Current Speed Level and Dynamic Minimum Fan Level   This user adjustable parameter sets both values. This level is kept in non-volatile RAM until you change it; cycling power to the chassis does not change the minimum fan level. Adjust the minimum fan level by entering a value in the field, or clicking the up/down arrows, and then clicking the **Apply** button.

Note that you can individually set the Current Speed Level and the Dynamic Minimum Fan Level programmatically. The Web UI and the Soft Front Panel binds these two together. Setting the Current Speed Level is always temporary because the Dynamic Minimum Fan Level algorithm continuously adjusts the fan speed towards a dynamic minimum when cooling conditions permit. For example, consider a situation where the chassis and installed modules require a fan speed of 50 to maintain proper cooling. If you attempt to manually set the Current Fan Speed to a lower value (40 for example) the algorithm overrides the setting and maintains the fan speed to provide adequate cooling. Conversely, if you manually set the fan speed to a higher value (65 for example), the algorithm sets that fan speed and does not change it unless additional cooling becomes required.

Of course, since the actual cooling requirements for the chassis and modules may continuously change, that actual fan Current Speed Level and the Dynamic Minimum Fan Speed also change over time.

Example of Chassis Fan Speed

The following graph illustrates how the chassis fan speed operates. For simplicity, only one temperature event is shown; in reality, temperature events may happen frequently causing the fan Current Speed Level to change and the Dynamic Minimum Fan Speed to gradually change.
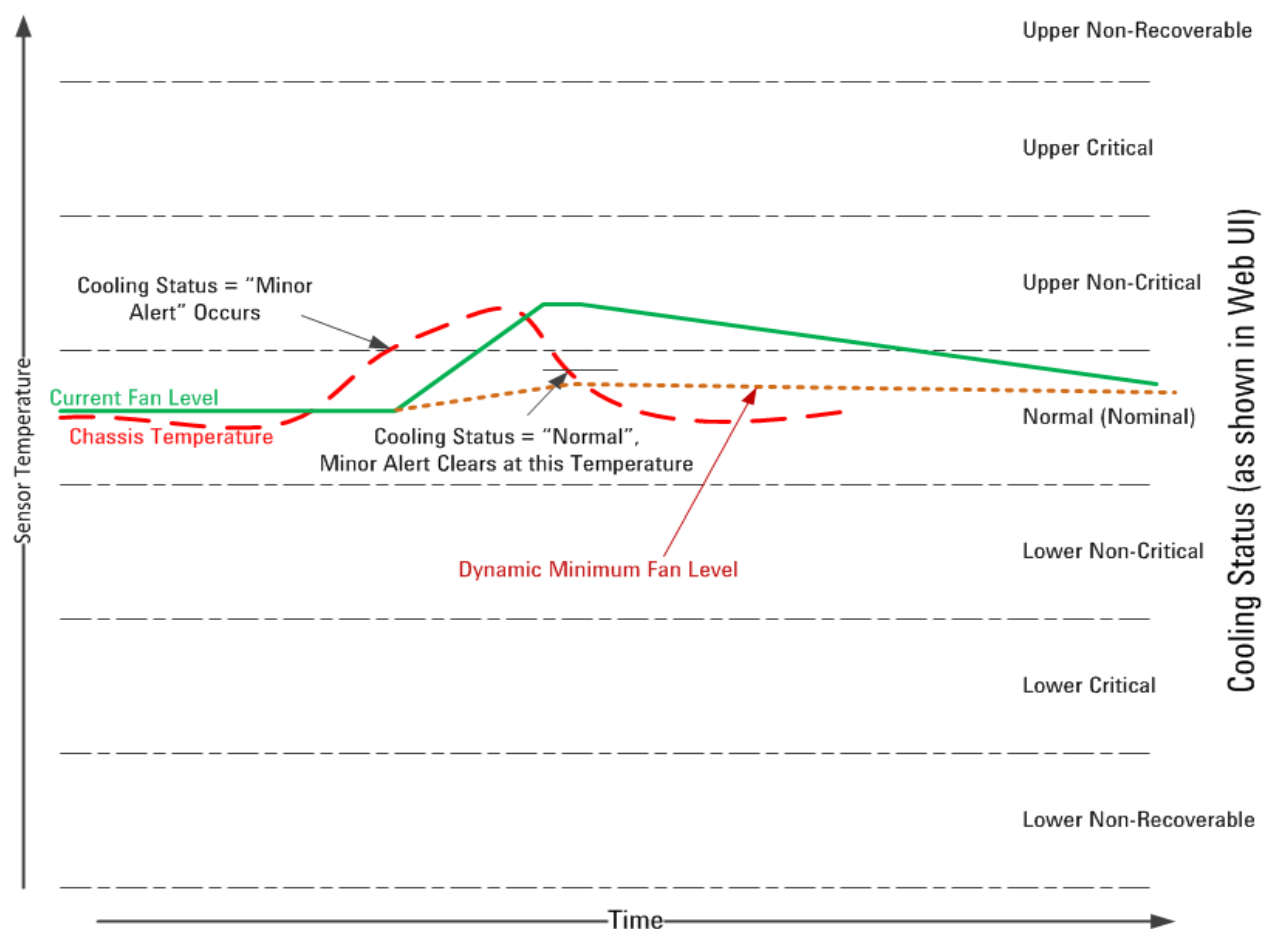
At the beginning, assume the chassis is reporting a Nominal cooling status. The Dynamic Minimum Fan Level is approximately the same as the fan Current Speed Level. When one (or more) temperature sensors reports that a temperature has increased above its Nominal range and is now above its Upper Non-Critical threshold, a Minor Alert occurs on the cooling status. At this point, the chassis fan Current Speed Level begins ramping up to provide additional cooling. Note that the change is not instantaneous.

When the temperature sensors report that the temperature has dropped back into the Nominal range (because of hysteresis it is actually a few degrees below the Upper Non-Critical threshold), the chassis fan Current Speed Level begins to gradually slow down, compensating for the reduced heat load.

During this entire time, the Dynamic Minimum Fan Level algorithm is recalculating to provide a new minimum fan speed. As additional temperature events occur, and the Current Fan Level changes, the Dynamic Minimum Fan Level algorithm recalculates the minimum fan speed required to ensure optimal cooling in the chassis.

Controlling Fan Speed

You can set the *minimum fan level*, over a range from 10 to 100 as a percentage of maximum fan speed, by setting that level in the **Adjust Current Speed Level** and **Dynamic Minimum Fan Level** fields and clicking the **Apply** button. This specifies the minimum level at which you want the chassis fans to run. The Shelf Manager increases fan speed from that minimum if required by an alarm condition (low fan speed or high module temperature).

NOTE   If the minimum fan speed is changed using the Web Interface, the newly-set value will become the chassis power-on default value. This is unlike other parameters set using the Web Interface, which do not persist through a power cycle. For more detailed information on controlling the fans using the Web Interface, refer to "Configure Fan Control" on page 77.

The power supply (PSU) fans are controlled automatically, you cannot manually override them.

Self-Test

The ESM supports two types of self-test:

- Power-on Self-Test (POST) – This test happens on the Shelf Manager as soon as the chassis powers up. As noted, this type of self-test is referred to as "POST".

- After-POST self-test – This test is initiated by the user either via the SFP or programmatically using the Self-Test IVI call: **KtMAXIeMon.Utility.SelfTest("TestResult","TestMessage");**.

Unless noted otherwise, references to "self-test" always refers to the self test that is either initiated from the SFP or initiated programmatically. The phrase "self-test" does not refer to POST.

The front panel Status LED shows the following LED states:

- OFF - standby

- Green (blinking) - ESM/Shelf Manager is booting up and waiting for modules to be ready for enumeration

- Green (solid) - power up complete and ready for enumeration

- Red - failure/service required.

The power on self-test (POST) routines are automatically executed at power on. If POST passes, the status LED will be solid green. If POST fails, the status LED continues blinking green.

If POST passed (the Status LED is green), and then self-test is subsequently run and fails, the Status LED begins blinking green. Similarly, if POST failed (Status LED blinking green), but then if self-test is subsequently run and passes, the Status LED turns solid Green.

Regardless of what causes the Status LED to blink green (a POST failure or a failure during running of self-test), it will turn solid green again if Self-Test is run and passes.

Self-test runs a series of tests and any failure generates an error consisting of an error code (**TestResult**) and error message (**TestMessage**).

A single Self-Test error queue in the ESM holds both the power-on self-test errors and the user-initiated self-test errors. Power-on Self-Test error messages are identified by the "(POST)" prefix; user-initiated self-test messages do not have a prefix.

Running the user-initiated self-test (either from the Soft Front Panel or programmatically) preserves any unread power-on test messages in the queue, but erases any other (user-initiated) unread messages before running the tests.

You can use the Soft Front Panel or the IVI Self-TestErrorQuery call to view the errors.

When you open the Soft Front Panel's Self-Test dialog box, any previous results are automatically displayed. If you then click the **Run Self-Test** button, the new self-test results are displayed below any previous results.

Refer to Chapter 8, Troubleshooting and Service on page 131 and Appendix A, Self-Test Error Codes on page 149 for detailed information.

GPS Synchronization

The M9506A-GPS option adds GPS synchronization ability along with an external antenna port on the front panel. It provides an accurate 1 Pulse Per Second (PPS) output; the 10/100 MHz reference can be locked to this clock. The PPS signal can be propagated to trigger I/O and trigger events can be timestamped. Other GPS information is also provided including latitude, longitude, and altitude direction and speed.

- Propagate the 1 PPS output to modules via backplane trigger resources.

- GPS can generate up to 4 future trigger events at a specified time-stamp. Event can be routed to any trigger resource tied to the crosspoint switch.

- GPS can time-stamp trigger events from any source with the GPS-synchronized Time of Day (ToD). Trigger Events can be come from any trigger resource tied to the crosspoint switch.

Multiple M9506A ESMs with GPS Receivers

There is one preferred way to connect and synchronize multiple M9506A GPS receivers:
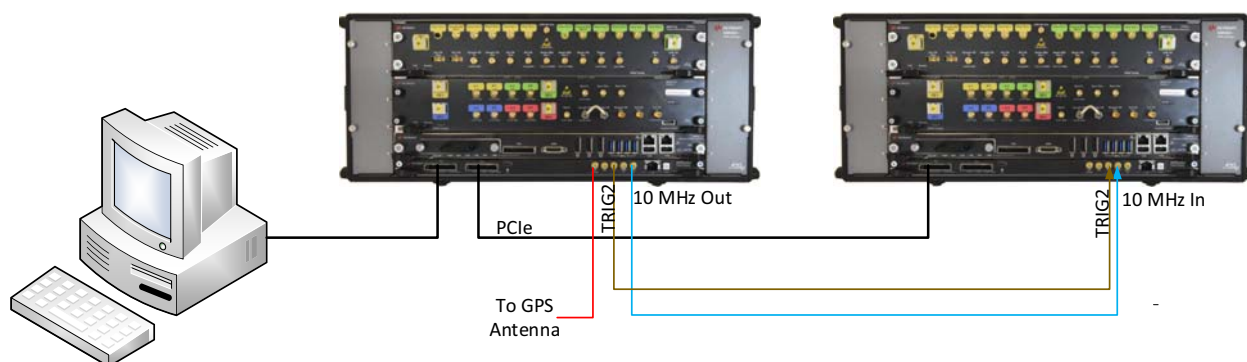
Figure 22   Multiple M9506A Chassis with 1 GPS Master and 1 Slave GPS Receivers

Clocks and Triggering

Keysight's M9506A AXIe chassis provides several triggering and timing options. These allow you to achieve time-aligned operation of multiple instrument modules installed in the chassis.

Although the triggering and timing options can be inter-operated, it is easiest to understand them using distinct Clock Bus and Trigger Bus subsystems, each providing ESM front panel and backplane signal connections.

CAUTION — Some AXIe test system software applications, such as the Keysight AXIe Based Logic Analyzer Software and modules, sets and uses specific trigger lines in the AXIe chassis. Do not use the AXIe chassis Soft Front Panel (SFP) software to set or reroute any of the AXIe chassis trigger lines. Rerouting any of the trigger lines may cause the application software to not function correctly.

Block Diagram

The block diagram on the next page shows the overall clock and trigger subsystem used in the M9506A ESM. Each subsection is described in detail on the following pages. An Output cannot be assigned to itself as an Input; this is indicated by the "**X**" in the diagram. The default connection for the TRIG[0:11] lines is connected to STATIC0; this is indicated by a "●" in the diagram.

Star Trigger Bus and Trigger Bus outputs can be inverted and enabled or disabled. Inverting bus lines are shown as a buffer superimposed over an inverter.This is shown as:
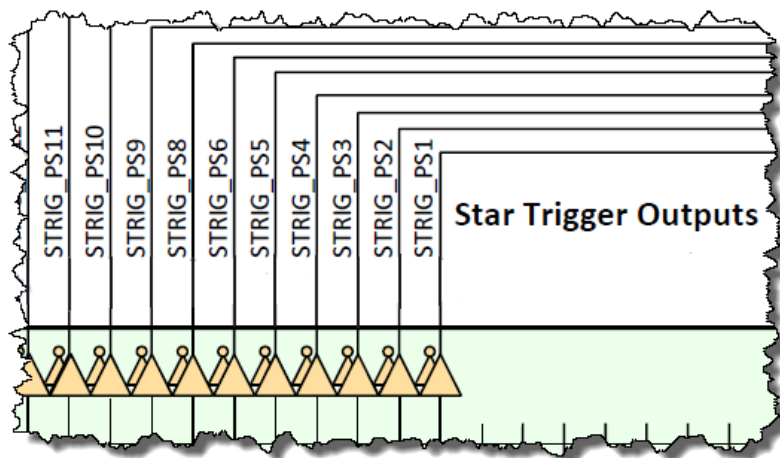
Figure 23   Inverting Trigger Bus Lines
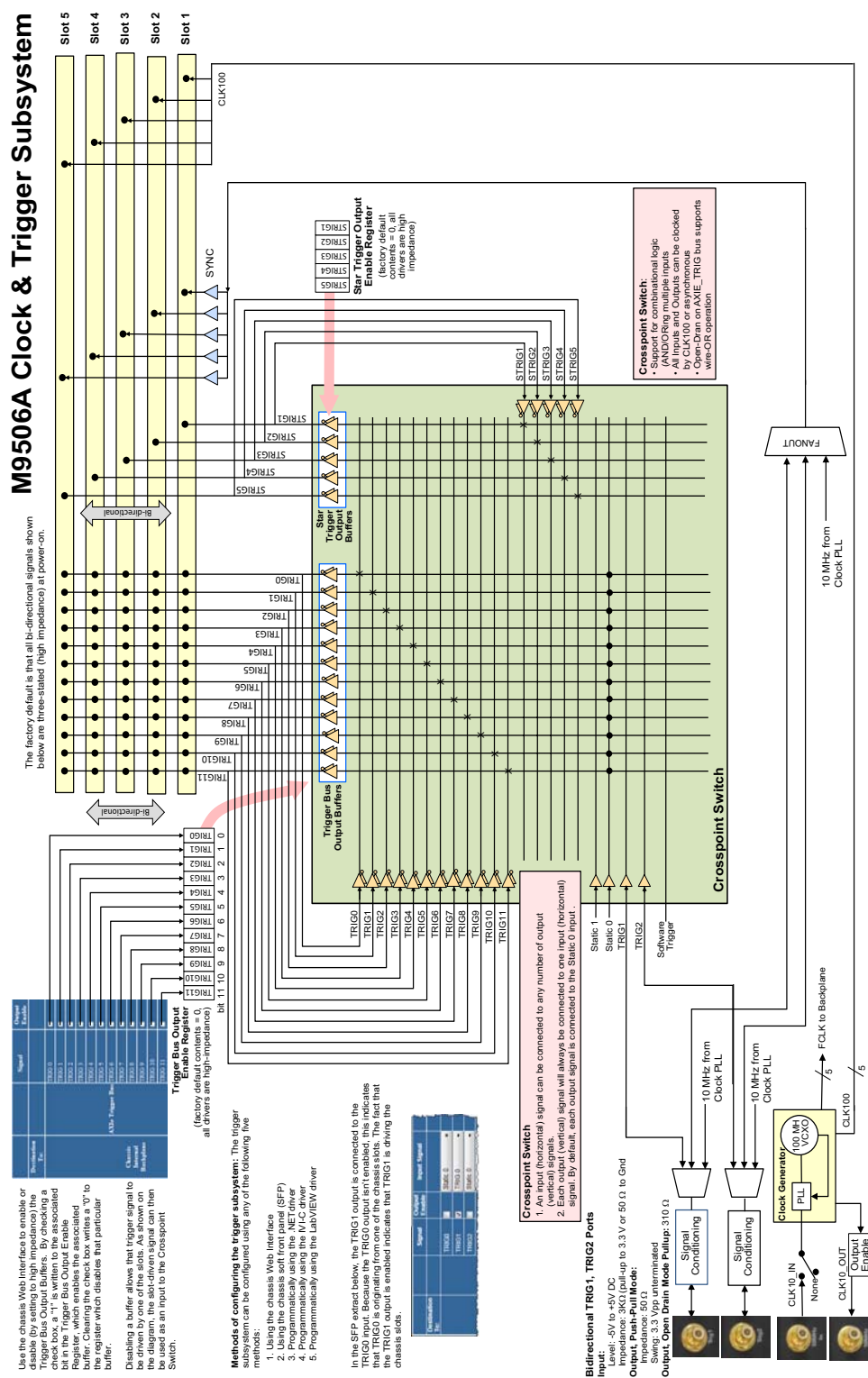
Figure 24   Trigger Bus Subsystem

The following table provides a brief description of the timing and synchronization interface signals available on the ESM:

FCLK	The 100 MHz PCIe Reference clock to chassis backplane
CLK10_IN	10 MHz clock Input to the ESM front panel
CLK10_OUT	10 MHz clock Output from the ESM front panel
CLK100	The primary chassis clock. AXIe specifications require slot-to-slot skew to be less than 100 ps.
SYNC	The trigger/clock synchronization signal. Slot-to-slot skew is less than 100 ps.
TRIG[0:11]	Standard trigger lines to each backplane slot
STRIG[1:4]	Provides direct triggering between the ESM slot and each of the other instrument slots (no fanout). Slot-to-slot skew is less than 20 ps.

Available Clocks

Clock Outputs   The Embedded System Module (ESM) generates a 100 MHz instrument clock signal from its clock bus. This signal is:

- Star distributed to all instrument slots as **CLK100**
- Provided to the ESM's front panel SMB connector **CLOCK OUT**, as a 10 MHz external reference clock (3.3V CMOS, 50Ω)

A separate 100 MHz distributed PCIe fabric reference clock (**FCLK**) is provided from the ESM to all instrument slots.

Clock Sources   There are two sources for the clock bus in a given chassis: the default internal source and the external **10MHz Clock In** (SMB connector on ESM front panel). Clock detection logic is automatic, and the input source is chosen in the following priority order, depending on whether the external clock input is sensed:

1 The local 100 MHz clock oscillator within the ESM

2 A 10 MHz external reference clock (**CLOCK IN**) applied at the ESM's front panel SMB connector

Clock Bus Diagram   The clock resources are illustrated below.
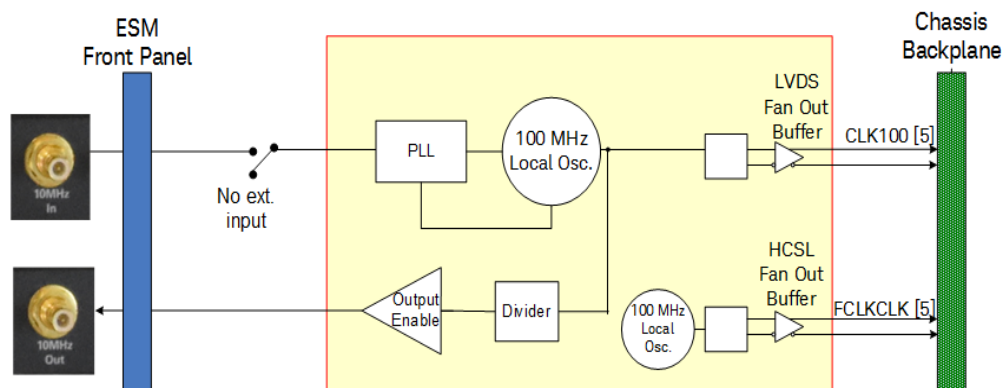
Selecting a Clock Bus Source

By default, the ESM's internal clock bus is driven by the internal 100 MHz clock oscillator.

To use 10 MHz CLOCK IN   Connect a 10 MHz external reference clock source to drive the ESM **10MHZ In** front panel SMB connector.

1   The chassis recognizes an external clock signal with these characteristics:

- AC coupled, -5V to +5V input

- 250 mV minimum swing

- frequency 10 MHz ±100 ppm

2   The chassis automatically selects **CLOCK IN** if sensed.

To use 10 MHz CLOCK OUT   You can extend the clock bus output to instruments external to the AXIe chassis or chassis system.

The **10 MHz** output is synchronous with the internal **CLK100** signal.

1   Connect the external instrument's clock input to the ESM's front panel SMB **10 MHz OUT** connector.

2   The 10 MHz Output must be enabled.

Triggering

This section introduces the trigger bus resources and some of the many ways you may use them. Any AXIe instrument module can be triggered:

- internally, based on its own automation or signals from DUT connected directly to it
- through an externally applied trigger
- through the chassis backplane

Through the Crosspoint Switch, the AXIe chassis allows you to trigger instruments—singly, in groups, or all instruments in the chassis—from different signal sources. The diagram below shows how the triggering resources are derived.
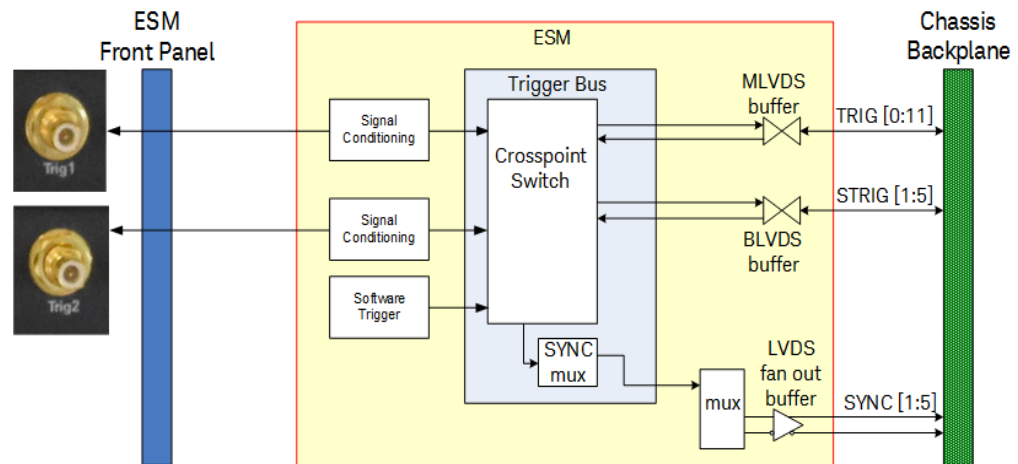
The primary trigger resource is the Crosspoint Switch. It allows any trigger input to be connected to any trigger output.

Trigger Inputs   There are many inputs to the Crosspoint Switch. Any input can be connected to one or more trigger outputs. The inputs include:

- External trigger ports **TRIG1** and **TRIG2** applied at the ESM's front panel SMB connectors. Input characteristics: 3.3V CMOS drive, 100 mV minimum swing, 50 Ω output termination.
- Any of the **TRIG[0:11]** signals. As these 12 lines are bidirectional, any AXIe module can source a trigger via the backplane. TRIG bus resources are allocated through E-Keying on the parallel trigger bus between two adjacent modules if they are designed for E-Keying (see "Electronic Keying (E-Keying)" on page 97).
- Any of the five **STRIG** signals. As these lines are bidirectional, any AXIe module can source a trigger via the backplane using them.
- Software Trigger. A trigger signal generated on the ESM by driver software can be sourced to any of the trigger lines.

Trigger Outputs   From the diagram above, note that the Crosspoint Switch can output trigger signals to any of the following:

- External trigger ports **TRIG1** and **TRIG2** driven from the ESM's front panel SMB connectors to external instruments. Drive characteristics: Push-Pull mode: 50 Ω, 3.3 Vdc CMOS drive. Open Drain mode: pull-up to 3.3 Vdc through 318 Ω.

- Any of the **TRIG[0:11]** signals. As these 12 lines are bi-directional, any AXIe module can source a trigger via the backplane. TRIG bus resources are allocated through E-Keying on the parallel trigger bus between two adjacent modules if they are designed for E-Keying (see "Electronic Keying (E-Keying)" on page 97).

- Any of the five **STRIG** signals. As these lines are bidirectional, any AXIe module can source a trigger via the backplane using them.

- **SYNC** provides a trigger signal output at the next rising edge of **CLK100** after the source trigger is received. This creates highly synchronous applications by triggering multiple instruments both simultaneously and in sync with the reference clock.The **SYNC** and **CLK100** lines use fan out buffers and are trace length matched.

Each type of trigger output signal is explored in detail, after a closer look at the Crosspoint Switch.

External Trigger Signal Conditioning

The following figure shows the external signal conditioning for the TRIG1 and TRIG2 ESM SMB connectors. They are identical. Red lines and text in the table below, indicate the Open Drain mode for Trigger Output and 50 Ω to Ground for Trigger Input. The following specifications apply to both TRIG1 and TRIG2:
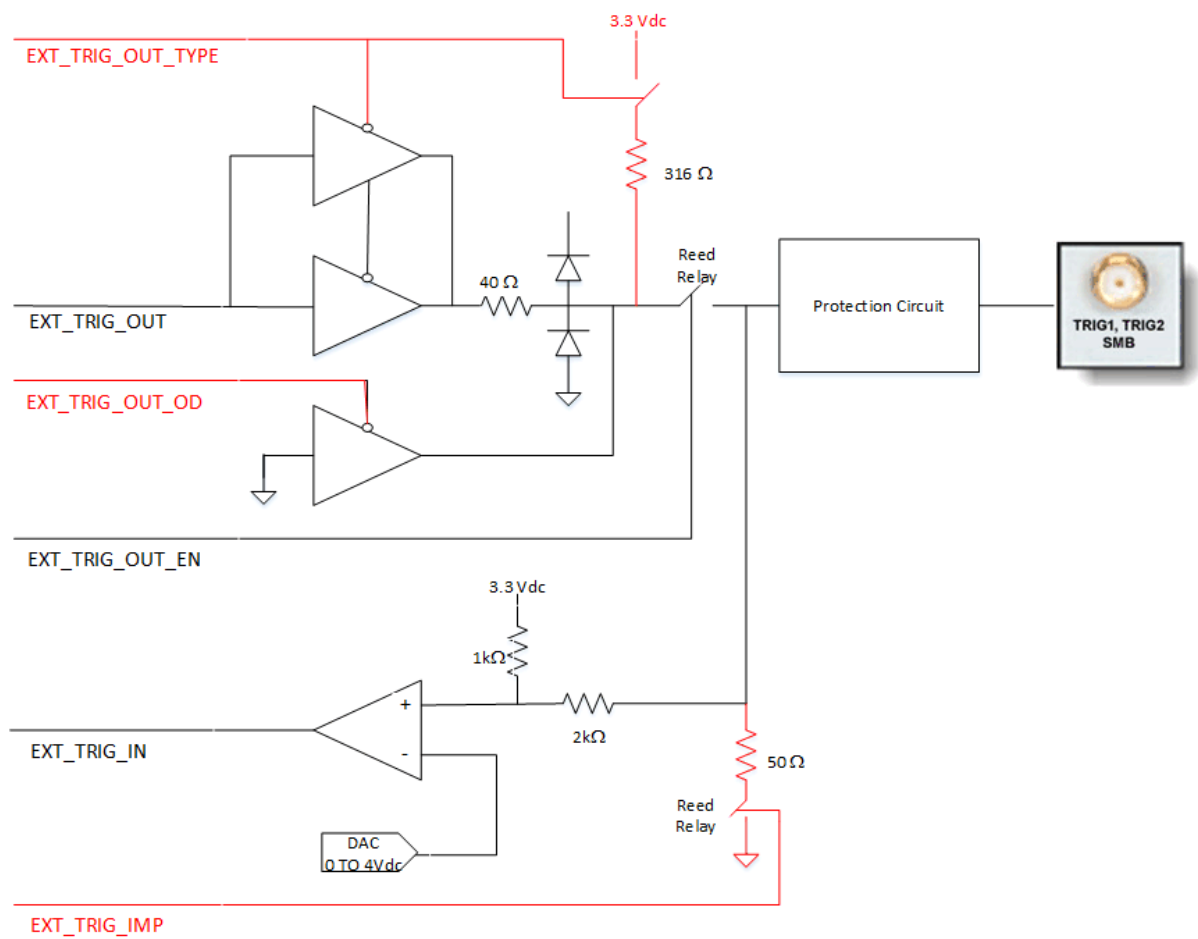
Figure 25 TRIG1 and **TRIG2** Signal Conditioning

Output Mode	
Push Pull Mode	Output Impedance = 50 Ω
	Output Swing = 3.3 V Unterminated
	Output Coupling = DC
Open Drain Mode	316 Ω pulled up to 3.3 V
Input Mode	
Input Impedance	3kΩ to 3.3 Vdc or 50 Ω to GND
Input coupling	DC
Input Level	$\pm$5 V programmable threshold
Programmable Threshold	~3 mV step size

The Crosspoint Switch

The M9506A ESM's Crosspoint Switch, shown in the block diagram on , provides the flexibility of routing many trigger signal events from AXIe instrument modules, external trigger, or a software-generated trigger to different destinations. You can enable and assign any of the input *sources* for any or all of signal *destinations* (trigger/timing resources). You can also source a logical 0 or 1 to force any destination low or high.

The M9506A Soft Front Panels are a good way to start learning about the Crosspoint Switch. This utility offers basic switch control and other basic M9506A operations, such as running Self-Test. After the chassis drivers are installed, either SFP can be started from the Start menu as follows:

> **Start > Keysight > AXIe Chassis Monitor SFP**

> **Start > Keysight > AXIe Chassis Trigger SFP**

Outputs   Each of the Crosspoint Switch outputs (see the **Trigger Subsystem** and block diagram beginning on) can be enabled and driven independently. An output must be enabled before it can be used as an output.

Inputs   Any of the Crosspoint Switch inputs (see the **Trigger Subsystem** and block diagram beginning on) can be assigned to any output, except that you cannot assign the same input as the output. If multiple input sources are specified for an output line, the sources are logically ORed together to produce the signal on that output line.

The default input for all outputs is "Static 0". If you don't specify the input signal for a specific output signal, the input signal will be logic 0 by default for that output signal.

Connecting an Input to an Output in the Crosspoint Switch

This section describes how to programmatically connect one or more Crosspoint Switch inputs to an output. In the M9506A Soft Front Panel, this is shown symbolically as a "dot" connecting the desired input to the output. In the example diagram below, the dot shows the input signal.
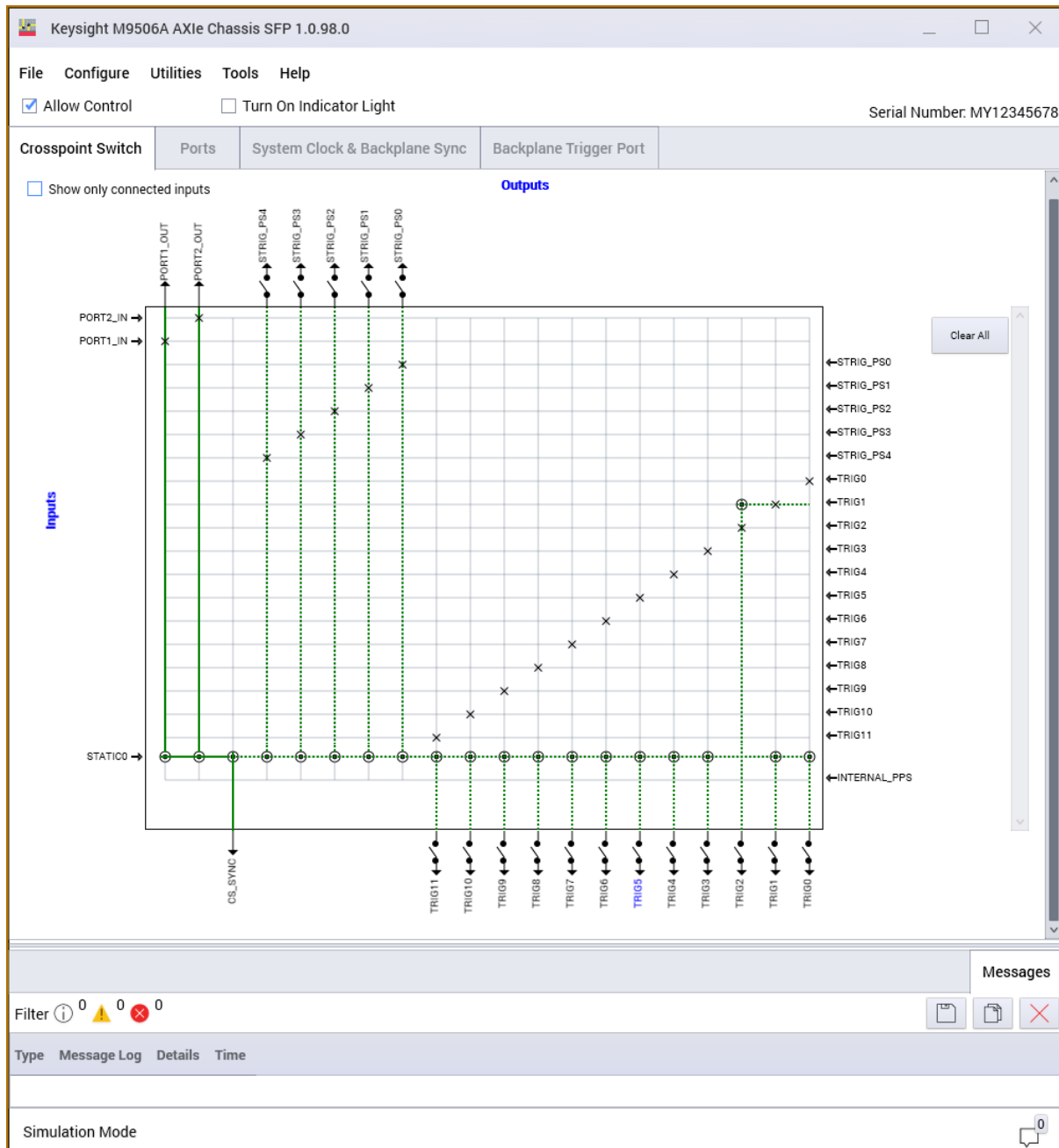
Figure 26   Trigger Soft Front Panel Crosspoint Switch

Monitoring Crosspoint Switch Outputs

Each of the Crosspoint Switch outputs (see Figure 26) can be enabled and driven independently. An output must be enabled before it can be used as an output.

Monitoring Crosspoint Switch Inputs

Any of the Crosspoint Switch inputs (see Figure 26) can be assigned to any output, except that you cannot assign the same input as the output. The X's on the Crosspoint Switch diagram indicate disallowed connections.

The default input for all outputs is "Static 0". If you don't specify the input signal for a specific output signal, the input signal will be logic 0 by default for that output signal.

OR-ing and AND-ing of Input Signals

When multiple Crosspoint Switch input signals are connected to a single output line, the signals are logically ORed together to produce the signal on that output line. That is, when **any** of the inputs are logic "1", the output will be logic "1". The truth table for a two-input OR gate is shown below.

Input A	Input B	Output
0	0	0
1	0	1
0	1	1
1	1	1

By inverting both inputs and the output of an OR gate, the equivalent of an AND gate is achieved, even though the Crosspoint Switch is still performing an OR function internally. That is, when **all** inputs are logic "1", the output will be logic "1". The truth table for a two-input AND gate is shown below.
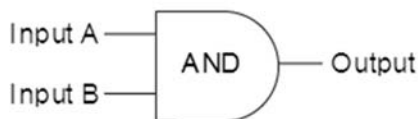
Input A	Input B	Output
0	0	0
1	0	0
0	1	0
1	1	1

The table below shows how inverting the inputs and outputs of an OR gate produces the truth table of an AND gate.

Inverted Input A	Inverted Input B	ORed Result	Inverted ORed Result
$\overline{0} = 1$	$\overline{0} = 1$	1	$\overline{1} = 0$
$\overline{1} = 0$	$\overline{0} = 1$	1	$\overline{1} = 0$
$\overline{0} = 1$	$\overline{1} = 0$	1	$\overline{1} = 0$
$\overline{1} = 0$	$\overline{1} = 0$	0	$\overline{0} = 1$

PCIe and LAN Switching (Data Transfer)

Data Channels Explained

The AXIe chassis provides four paths for communication and data transfer to and from installed modules:

- Gigabit (Gb) Ethernet
- PCIe
- Thunderbolt 3

Gigabit (Gb) Ethernet   This is a star-distributed 1 Gb Ethernet:

- From the LAN switch in the ESM—the base channel hub—to each slot.
- From the LAN switch in the ESM to the RJ45 front panel LAN connection; 10/100/1000BASE-TX.

PCIe   This is the high speed primary data path:

- From the PCIe switch in the ESM—the fabric 1 hub—four lanes to each instrument slot through the backplane defined as PCIe x16.
- From the PCIe switch in the ESM to two PCIe x8 front panel connections.

Thunderbolt 3   Thunderbolt 3 provides one PCIe interface using a USB-C Connector. The ESM front panel PCIe ports are disabled when using the Thunderbolt port.

Maximizing Data Upload Speeds

The maximum data bandwidth to each slot is dictated by the x16 connection.

You will typically achieve higher PCIe data throughput to a remote (desktop or rackmount) host PC than to an embedded controller.

- Using a high speed rackmount or desktop PC and one or two x8 cables, the primary data fabric utilizes a x8 or x16 connection between the ESM and the host PC. The ESM's PCIe switch can achieve Gen3 upload speeds when transferring data to the host from multiple modules simultaneously.
- If an embedded controller is installed in the chassis, the ESM front panel PCIe x8 connections become downstream facing and can connect to other chassis. The embedded controller uses its backplane PCIe x16 link to link the ESM PCIe switch.

Thunderbolt, PCIe, or LAN?

You can establish communication between the chassis and host PC over a PCIe, Thunderbolt, or LAN connection. In practice, the choice is usually driven by the interface(s) on your modules. For example, if you have a module with a PCIe interface, you'll want to establish a PCIe connection to the chassis.

Thunderbolt   Thunderbolt 3 with USB-C Thunderbolt 3 provides bi-directional, four lanes of PCIe Gen 3[*]. The ESM front panel PCIe ports are disabled when using the Thunderbolt port.

PCIe Connection Only   You may connect the ESM to the host PC using only a PCIe cable. This allows both the base (LAN) channel and fabric 1 data channels. Base channel communication between PC, ESM and any LAN capable installed instruments are made through the PCIe connection. A PCIe to LAN switch in the ESM manages the base channel communication to the slots; it is seen as a network interface device by Windows Device Manager.

LAN Connection Only   You may connect ESM to host PC using only a LAN cable. You will have base channel communication only and significantly less data throughput than when using PCIe.

Hybrid Operation   You may connect both LAN and PCIe cables from ESM to host PC. This provides the most operational flexibility and some data throughput advantages over using only PCIe. The ESM front panel PCIe ports are disabled when using the Thunderbolt port.

---

[*] Thunderbolt 3 also provides eight lanes of DisplayPort 1.2 and native USB 3.1. However, these features are not supported on the M9506A ESM.

Electronic Keying (E-Keying)

Electronic keying is one of several capabilities AXIe inherits from the AdvancedTCA architecture. Like ATCA, AXIe promotes a fabric independent (also known as fabric-agnostic) backplane with respect to local bus connectivity.

Each module plugged into a chassis may provide various communication protocols and hardware signaling that connect to pins on the backplane that link adjacent modules together. In general, the backplane itself does not provide internal buffering, so a link connection between two adjacent modules is simply a wired connection, either configured point to point or tied together on a common bus. This allows different modules in the system to establish their own link protocols provided a connection path exists.

This flexibility frees the chassis configuration from dictating signal levels and protocols involved with any particular link. However, this flexibility presents a challenge – how to know whether the endpoints of a link are compatible or not.

NOTE	If you have modules in your system that are E-Keying compatible, refer to the documentation provided with your modules for detailed installation information.

E-Keying is a process in which compatible matches over links between different modules are identified and enabled to be used. The E-Keying process is handled by the chassis shelf manager. Each module in the chassis runs a Intelligent Platform Manager Controller (IPMC). These IPMCs interface with the shelf manager and each other using the Intelligent Platform Management Bus (IPMB). IPMB is basically a side channel protocol built on top of I2C that connects all modules in a chassis together. See the graphic below.
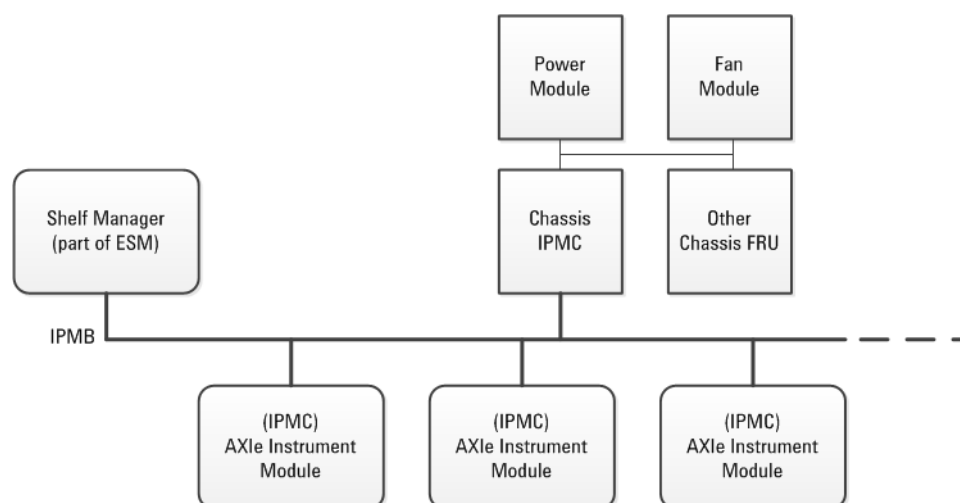
The shelf manager has two primary roles:

- Manage the inventory and infrastructure of a chassis by communicating with IPMCs in the chassis:

  -- Power requirements of the modules and managing the power module.

  -- Chassis cooling control of the fan module.

  -- Individual Field Replaceable Unit (FRU)[*] inventory located in non-volatile memory that tracks ATCA and AXIe attributes from each module.

  -- E-Keying interconnection resources among modules.

  -- Point-to-point (P2P) connections for base, fabric, and update channel interfaces. P2P connections are predominately what AXIe is concerned with.

  -- Bussed resources for clock and metallic test bus (in ATCA).

- External connectivity to a system manager, using an IPMI connection over Ethernet using a RMCP protocol.

E-Keying Process

When the chassis powers on, the first step the shelf manager does in point-to-point (P2P) E-Keying is read the backplane P2P connectivity records from the chassis modules. These connectivity records specify the P2P interconnections the backplane routes between specific slots and specific channels on each slot.

Next, for each board loaded in the chassis, the shelf manager reads each board's Field Replaceable Unit (FRU) table for the P2P connections that board makes to the backplane. The shelf manager builds up a connection inventory of all the potential links a particular board can implement. This list is later used to examine the potential logical links each board has to other boards. Each potential link end has a link descriptor that identifies the following information:

- P2P interface on the backplane and a channel number within that interface

- The ports on a given channel that are involved with this link. This may include sets of differential signal pairs.

- Finally, the link type which identifies the specification entity, such as PICMG 3.x, AXIe 1.0, or other specification that fully describes the link classification. The link type may also be an OEM-defined value using a 128-bit Globally Universal Identifier (GUID); each card may support up to 15 different GUIDs.

---

* A field replaceable unit is a part that may be removed from a system and exchanged with another part or returned to a factory for service. Examples of FRUs may be a module card in a chassis slot, a fan tray, a power supply, and the chassis frame.

The shelf manager goes through the backplane connection possibilities, identifying each end of a P2P connection and searches for a compatible link descriptors. If a pair of ends match, such as both ends are PCIe Express x4, then the shelf manager issues a "Set Port State (enable)" command to each board for that link. For the matches that are not found, the shelf manager issues a "Set Port State (disable)" command to ensure that incompatible link connections are kept off.

As a final note, the shelf manager is truly agnostic about specific details of a link protocol. This permits new protocols to be added without modification to the chassis.

For additional information on E-Keying, refer to the AdvancedTCA specification (http://www.picmg.org) and the AXIe specification (http://www.axiestandard.org).

Chassis Inhibit and Voltage Monitoring

The method of powering up the chassis depends on the position of the **INHIBIT** rear panel switch, which can be set to the **DEF** (default) position or to the **MAN** (manual) position. These two methods work as follows:

– **INHIBIT** switch in the **DEF** position — In this position, the ESM front panel power push button switches the chassis between ON and Standby—hence, this push button is known as the ON/Standby push button.

– **INHIBIT** switch in the **MAN** position — In this position, the Inhibit signal (pin 5 on the rear panel DB-9 connector) controls chassis power. The chassis is powered up by applying a logic high signal to the Inhibit pin. When the Inhibit pin (pin 5) is pulled low, the chassis is in Standby.
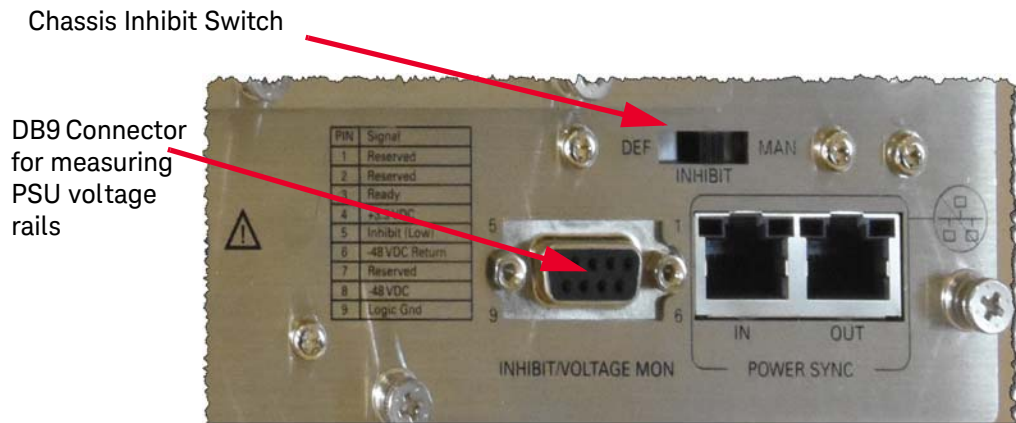
Figure 27   Chassis Power Inhibit Switch, DB9 Connector, Power Sync Connectors

If you're using the Inhibit input signal on the rear panel INHIBIT/VOLTAGE MON DB-9 connector and if this signal doesn't power up the chassis, check the voltage that is being applied to the Inhibit signal. This signal is active low, meaning that a 0 VDC signal inhibits operation of the PSUs and the chassis is in Standby mode. A logic high turns on the PSUs. Use a DMM to verify that the signal you're providing to the Inhibit input on the DB-9 connector is truly switching between logic high and low.

Because there is an internal pull-up resistor on the Inhibit signal, an open circuit (no signal connected) on the Inhibit signal will also turn on the power supply. This means that, if the INHIBIT switch is set to the MAN position and if no signal is connected to the Inhibit input signal, the chassis will power up as soon as AC power is applied.

NOTE   Power Sync and the two connectors are described in "Multi-Chassis Power Sync" on page 114.

Using the M9506A AXIe Zone 3 Area

The AXIe Zone 3 allows for cable access through the rear of the chassis, custom analog backplanes between modules, etc. Keysight's M9506A AXIe chassis allows full access to Zone 3 for all five chassis slots.

NOTE	Most AXIe chassis and AXIe modules do not provide ZONE 3 access. Use caution when designing modules that require Zone 3 access.

Zone 3 Filler Panels
(remove from rear of chassis)
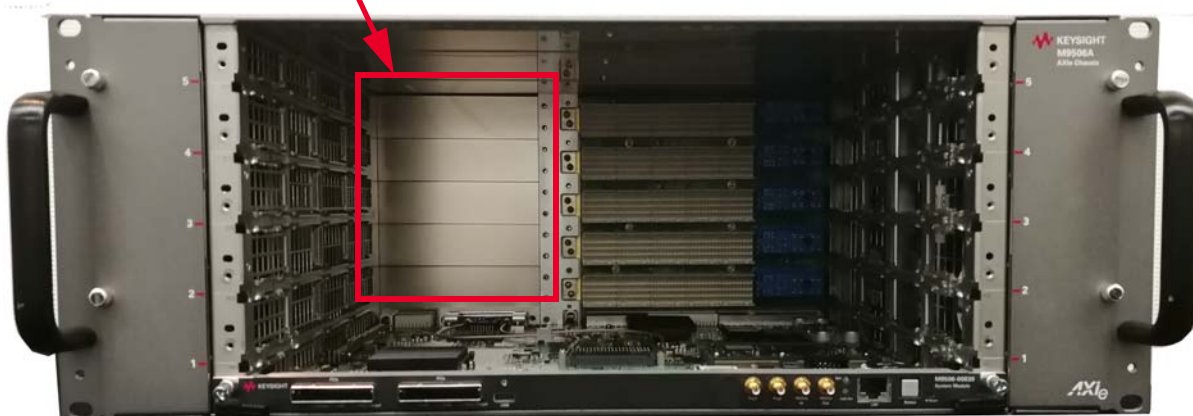
Figure 28   M9506A AXIe Zone 3 from the chassis front

Removing the Zone 3 Filler Panels

To access the Zone 3 Filler Panels, first remove the rear panel Zone 3 Access Cover. Refer to Figure 29 on page 102.

Then, remove individual Slot 2, 3, 4 and 5 Zone 3 Slot Filler Panels. See Figure 30 on page 102. This provides an open area of approximately 139.4 mm wide x 114.9 mm high x 170.6 mm deep for cables, custom backplane, etc.

To remove the Slot 1 (bottom) Zone 3 Filler Panel, you need to remove the M9506A Power Supply Tray. See Figure 31. Removing the Slot 1 (bottom) Zone 3 Filler Panel provides a small, additional space for Slot 1 cables, custom backplane, etc. Loosen the nine screws and then slide out the Power Supply Tray.

CAUTION	For proper chassis and module cooling, all unused Zone 3 slots must have the Zone 3 Filler Panels in place.

CAUTION To prevent possible injury or damage, always replace the Zone 3 access cover after installing custom backplanes, cables, etc.

Zone 3 Access Cover

Loosen six screws to remove the Zone 3 access cover
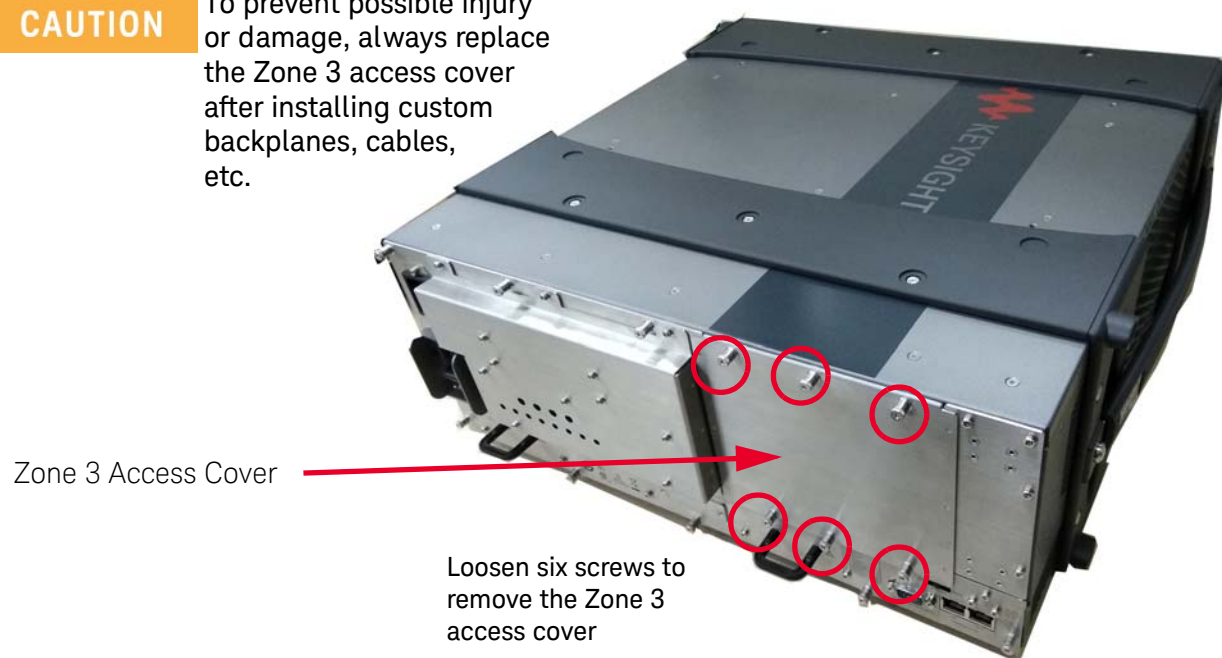
Figure 29　M9506A Rear Panel Zone 3 Access Cover

Zone 3 Filler Panels.

To remove a panel, remove the three Torx T10 screws securing the panel.

Zone 3 Cooling Fan
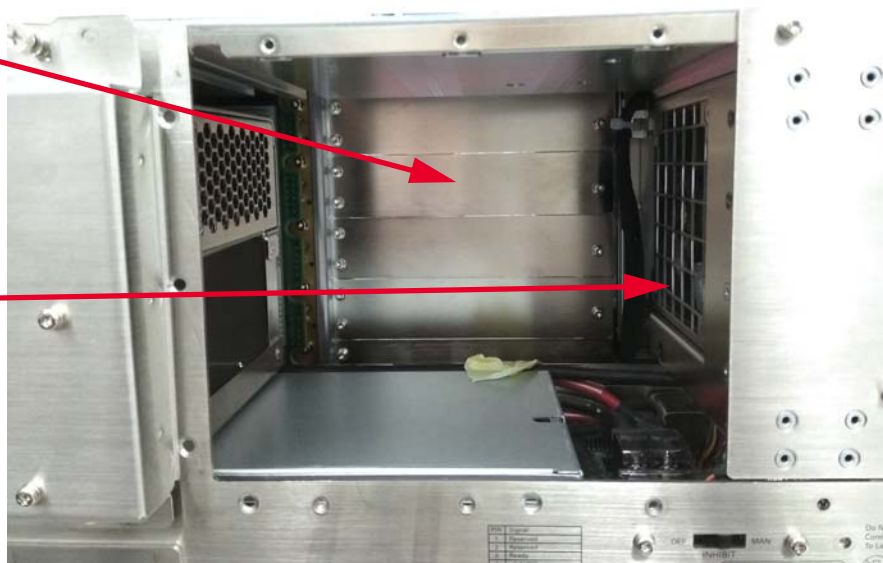
Figure 30　M9506A AXIe Zone 3 Filler Panels viewed from the rear of the chassis

Loosen nine screws
to remove the power
supply
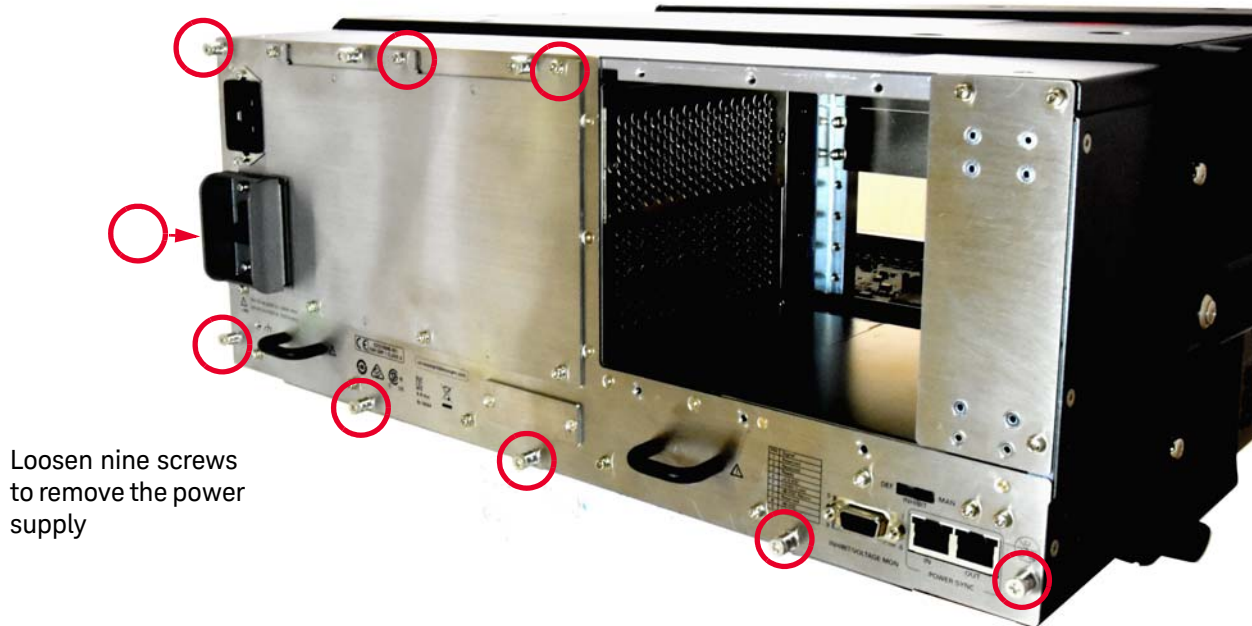
Figure 31   Loosen nine screws to remove Power Supply Tray for access to Slot 1 Zone 3 access cover
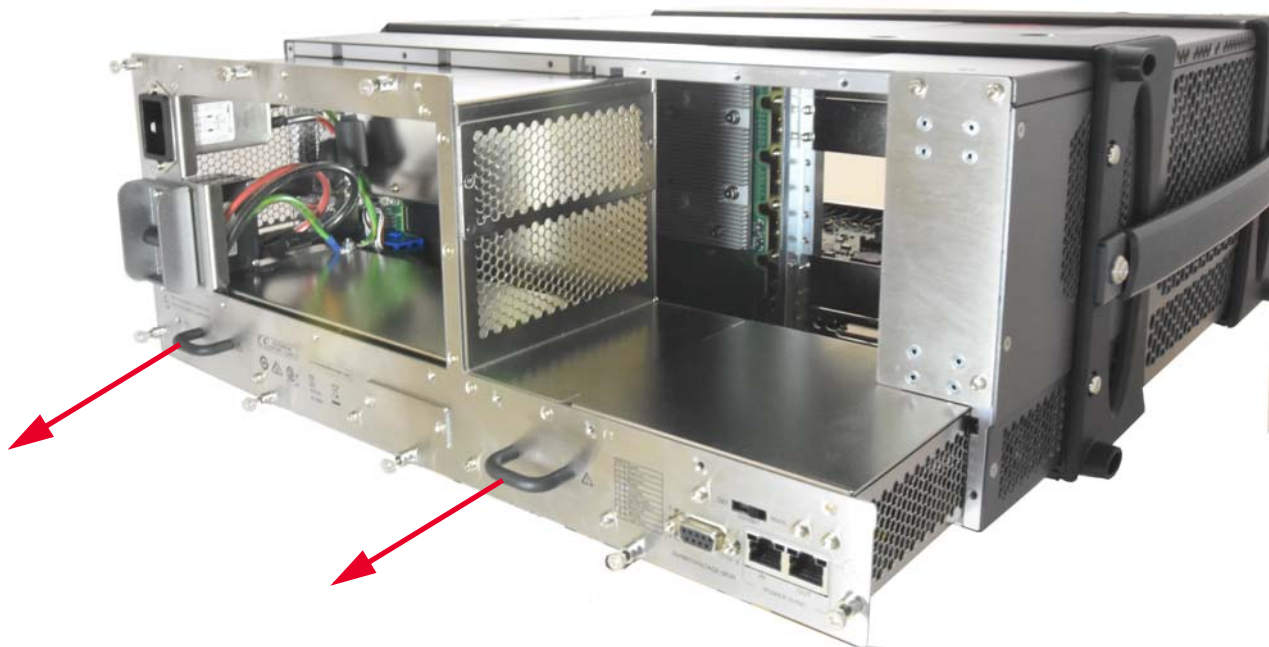
Figure 32   Pull Out the Power Supply Tray to Access Slot 1 Zone 3 Filler Panel

6 Multiple Chassis Operation

There are several possible ways to configure multiple M9506A 5-Slot AXIe chassis systems. You can also combine AXIe and PXIe chassis (such as the M9019A PXIe chassis) into multiple chassis configurations. You can use multiple chassis configurations to increase the number of chassis and measurement or switching modules; the only practical limit to the number of chassis you can connect is determined by the number of PCIe slots your host computer can enumerate. For more information, refer to Keysight's *Multiple PXIe and AXIe Chassis Configuration Tool*. This tool is available from the Windows Start button menu.

It is also available on-line at: www.keysight.com/find/pxie-multichassis

NOTE	To ensure proper system operation, use an approved (embedded, rack mount, or desktop) host computer along with an approved PCIe adapter and cable. While you may use other controllers, the approved computers have verified hardware support for PCIe x8 and their BIOS can properly enumerate multiple instruments on the shared PCIe bus.
	Keysight provides a list of tested host PCs at PC Tested Configurations with PXIe/AXIe Chassis - Technical Overview. For the recommended PCIe host adapter cards and cables.

Multiple chassis systems require careful consideration of several factors, including:

- Host controller and chassis Power Sync (power-on and power-down considerations). This is the primary subject of this chapter.

- Time base and triggering for each chassis operates independent of the other chassis.

- PCIe connectivity between the host controller (either external or embedded) and the chassis ESM.

> **NOTE**   The M9506A ESM Thunderbolt 3 port does not support multiple chassis connections.

How does a Multi-Chassis System Differ from a MultiFrame System?

> **NOTE**   Keysight's MultiFrame feature is <u>not</u> available on the M9506A 5-Slot AXIe Chassis. MultiFrame is supported on the Keysight M9502A, M9505A, and M9514A AXIe chassis.

In both multi-chassis and MultiFrame systems, all chassis are controlled by a single controller. The differences between the two system types are:

- In a multi-chassis system, the time base and triggering for each chassis operates independently from the other chassis. You can use this type of configuration to increase the number of chassis/modules that do not require a common time base or cross triggering between chassis. For more information, refer to Keysight's Multiple PXIe and AXIe Chassis Configuration tool. This tool is available on line at: www.keysight.com/find/pxie-multichassis.

- MultiFrame is a Keysight feature by which multiple instruments in two or more chassis are interconnected to appear as one integral instrument to the user. In a MultiFrame system, special cabling connects the time base and triggering of the master chassis to all daisy-chained slave chassis.

Accordingly, there are two aspects of multiple chassis operation that need to be considered separately:

- The first is the PCIe connectivity between the chassis and the host controller. This is handled via PCIe cabling between the ESM modules. In practice, the potential combinations of instruments which can share synchronization and triggering are numerous. The only practical limit to the number of chassis you can connect is determined by the number of PCIe slots your host computer can enumerate.

- The second is the synchronization and timing of clock and trigger signals between the AXIe chassis. Use MultiFrame chassis configurations to increase the number of measurement modules which use a common time base or cross triggering to achieve correlation.

Also:

- The host PC's BIOS must support enumeration of PCIe slots in the AXIe chassis; many computers are not capable of enumerating a sufficient number of PCIe slots to ensure that slots in all chassis are enumerated. Keysight maintains a document listing the integrated, rack mount, desktop and laptop computers that have been verified to properly enumerate PCIe devices in the AXIe chassis. Please check the Keysight website at: PC Tested Configurations with PXIe/AXIe Chassis - Technical Overview for the latest updates to the product software, guides, data sheet and help files.

- Always power up the last chassis in the series (subordinate 2 in the following diagrams), wait for its ESM's Status light to stop blinking, then turn on the next chassis in the series and wait for its Status light to stop blinking. Finally turn on the Master Chassis. Wait for its Status light to stop blinking before turning on the Host PC.

Connect Multiple AXIe or PXIe Chassis to a Single Controller

The Keysight *Multiple PXIe and AXIe Chassis Configuration Tool* helps you design a system consisting of up to four AXIe and PXIe chassis. These chassis may be connected to either an embedded controller (installed in the chassis) or an external PC connected by cable(s) to the chassis. The *Multiple PXIe and AXIe Chassis Configuration Tool* allows you to interactively specify your system parameters, and then it designs a multi-chassis system according to your specifications. Once the design is presented, optionally select different components to further optimize the design to meet your specific requirements.

General Multi-Chassis Configurations

The following pages present six typical scenarios of multi-chassis operation. The first uses an external host controller with an M9049A Remote PC PCIe Host Desktop Adapter to two M9506A chassis. The second shows PCIe connectors from the Master chassis ESM to the subordinate chassis ESM. The third configuration demonstrates the highest performance with two M9506A chassis connected to and external controller.The fourth example demonstrates the use of an embedded controller such as the Keysight M9537A. The M9536A Embedded Controller is not supported for multiple chassis configurations.

All example configurations show multiple M9506A chassis. Other combinations are possible such as one M9506A Master chassis to a Keysight M9505A 5-slot or M9502A 2-slot AXIe Subordinate chassis. The M9502A and M9505A chassis do not support daisy-chaining the PCIe connections. You can also connect PXIe chassis.

| **NOTE** | The Thunderbolt 3 connection does not support multiple chassis. |

External PC to Two M9506A Chassis

The following two diagrams illustrate connecting two M9506A chassis to an external controller. Both connections provide x8 speed from the PC to the either chassis. There is no distinct advantage of to either connection, but might simply depend on chassis installation locations.
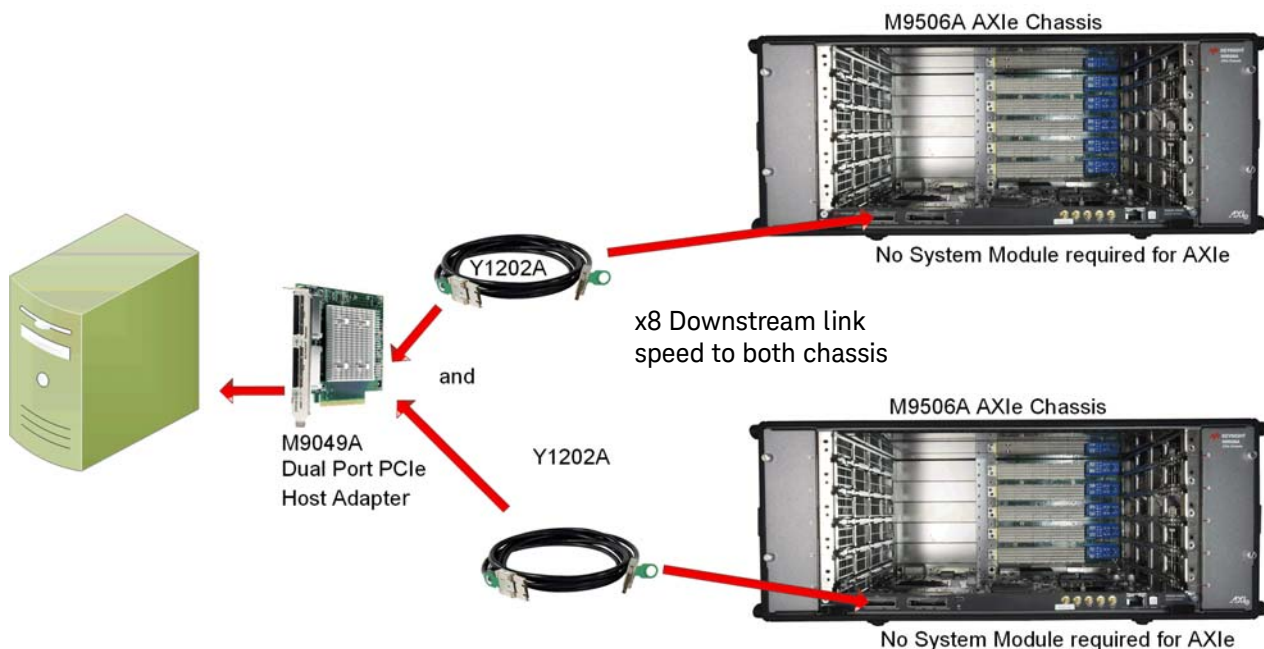
Figure 33   External PC to two M9506A AXIe Chassis
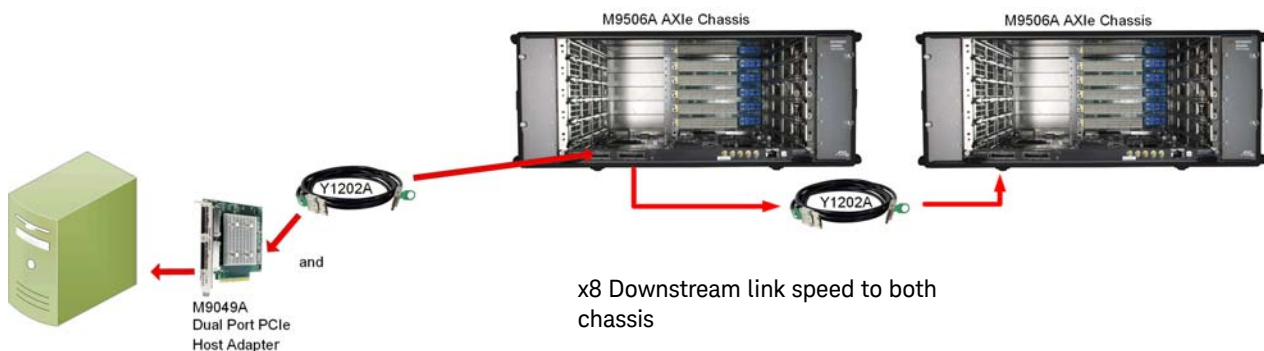
Figure 34   Embedded PC to two Cascaded M9506A AXIe Chassis

External PC to Two Chassis Configuration

The most simple multi-chassis 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 PXIe chassis or the M9506A AXIe chassis.
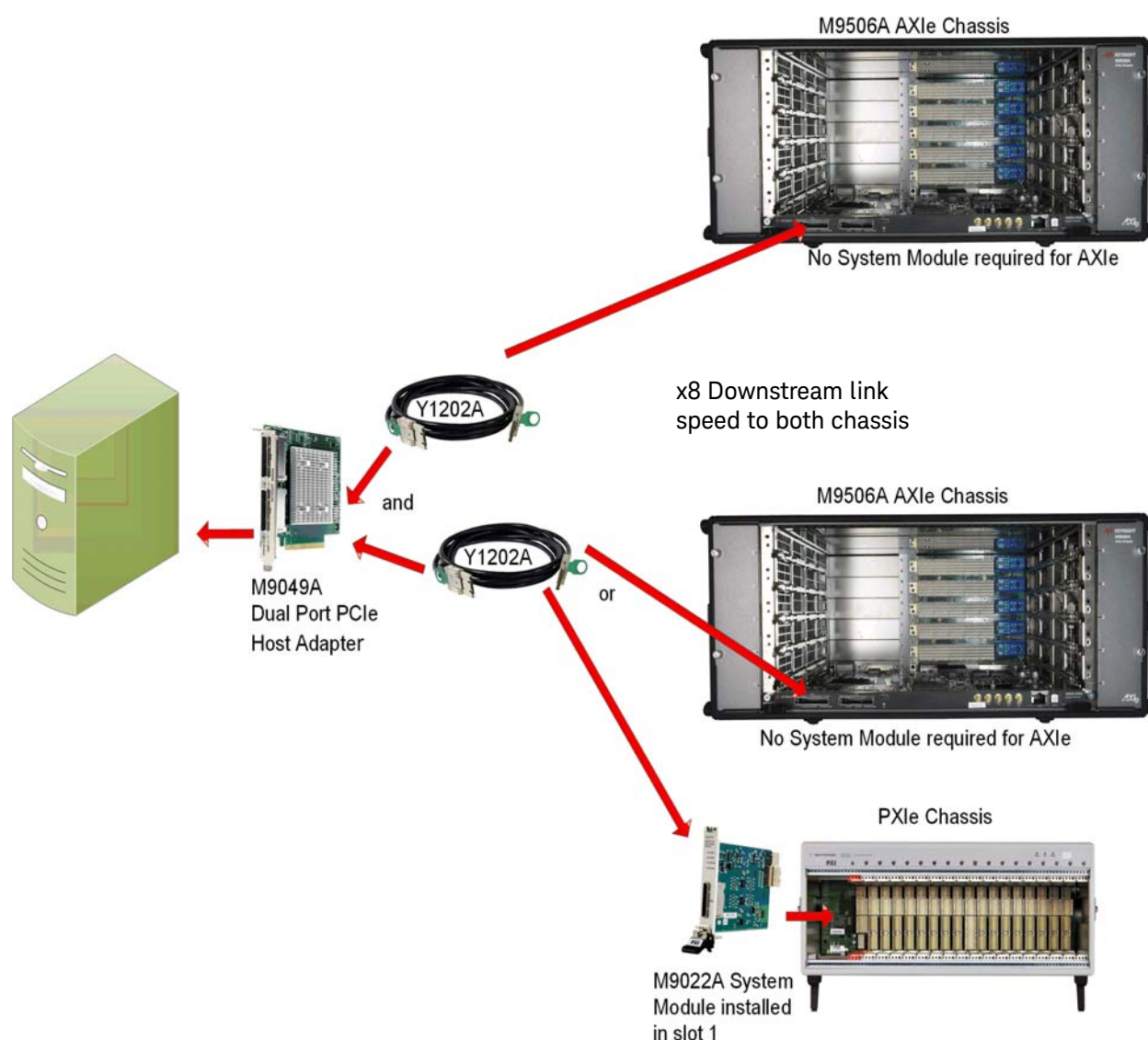
Figure 35 Simple two chassis configuration. Both connections are x8. Second chassis could be PXIe.

Multiple Chassis with an M9537A Embedded AXIe Controller

The M9537A Embedded AXIe Controller contains a x8, Gen 3 PCIe port that can connect to other chassis. The M9537A supports two AXIe chassis, the chassis housing the M9537A and a second chassis. This connection provides x16 downstream links to the second chassis.

x16 Downstream link speed to 2nd chassis
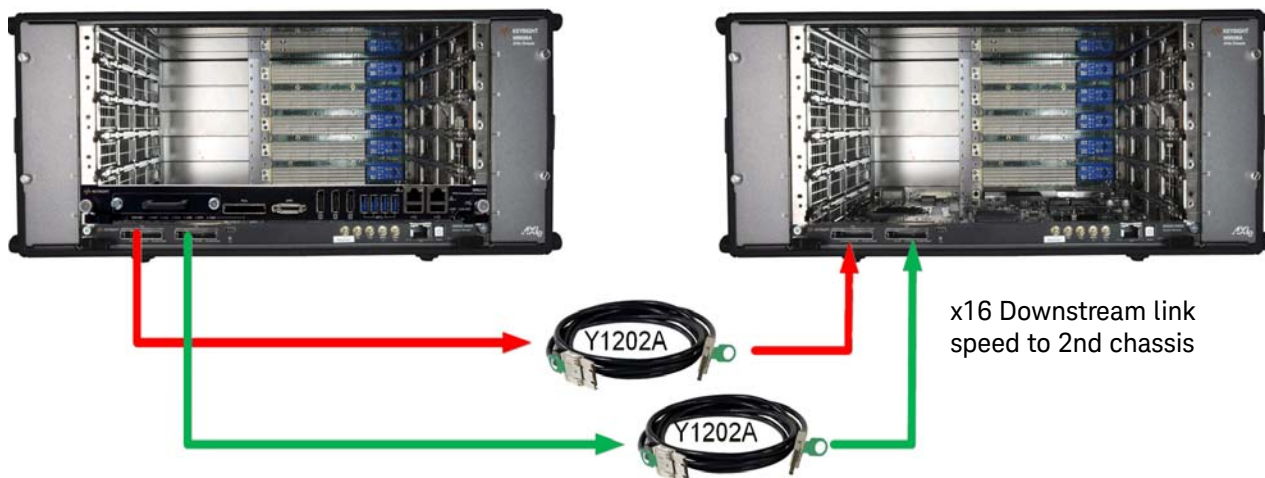
Figure 36   Two M9506A chassis using an M9537A Embedded Controller.

Figure 37 below illustrates three M9506A AXIe chassis with one M9537A Embedded Controller.

x8 Downstream link speed to 2nd and 3rd chassis.
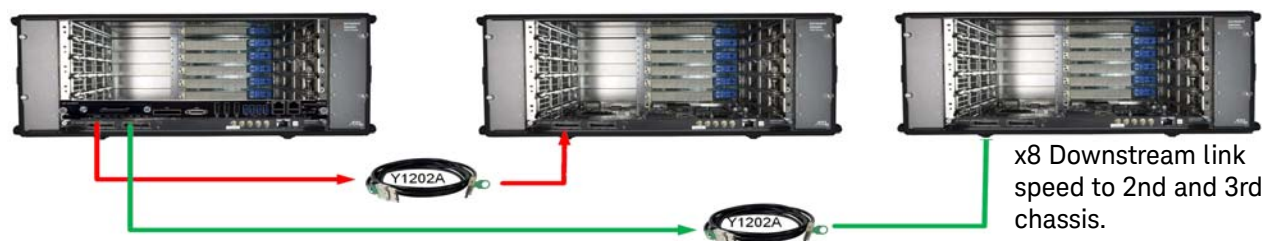
Figure 37   Three M9506A chassis using an M9537A Embedded Controller

Figure 38 below shows one method of controlling four M9506A chassis from the M9537A AXIe Embedded Controller. In this configuration, one chassis connects to the M9537A Controller's PCIe port, the other two connect to the ESM's PCIe ports.
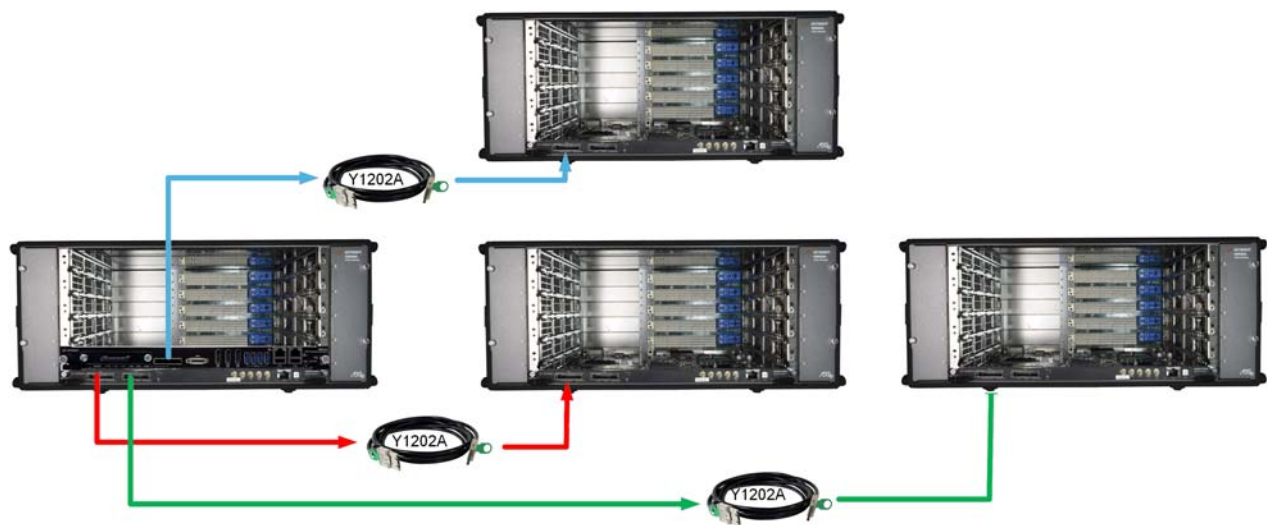
Figure 38 Four M9506A chassis using an M9537A Embedded Controller

Multi-Chassis Power Sync

Power Sync allows multi-chassis configurations to be powered on and off like a single chassis. A single power button push on any chassis turns on or off all chassis in the correct sequence. For example, with an embedded host controller, Power Sync ensures that all downstream chassis are powered up before the embedded controller chassis is turned on. On power down, it ensures that the embedded controller chassis is turned off before all downstream chassis are turned off.

With an external host PC, Power Sync allows all chassis to be powered on or off by the external host automatically. When an external host is powered on, it prevents power button pushes on any chassis from turning off any chassis.

Table 1   Keysight Chassis Supporting Power Sync Capabilities

Product Type	Keysight Product Model Numbers
AXIe Chassis	M9506A 5-Slot AXIe Chassis
AXIe Embedded Controllers	M9537A AXIe High Performance Embedded Controller
PXIe Chassis	M9010A, M9018B, or M9019A PXIe Chassis (M9018A PXIe chassis is not supported)
Desktop PC, Host cable card	M9049A PCIe High Performance Host Adapter card
PXIe cable cards	M9022A PXIe System Interface Module M9023A PXIe High Performance System Interface Module M9024A PXIe High Performance System Interface Module with Connectivity

Synchronized chassis power coordination requires additional cabling. Two RJ45 connectors on the chassis rear panel provide this coordination. Multiple chassis may be connected together for power sync purposes. All of the chassis listed in Table 1 above have Power Sync connectors on their rear panels.

Power Sync RJ45
Connectors
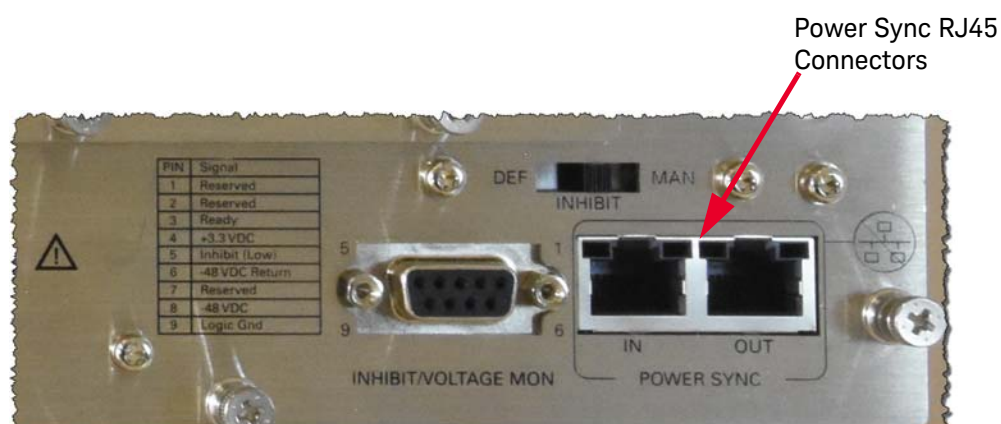
Figure 39   Chassis Power Inhibit Switch, DB9 Connector, Power Sync Connectors

When multiple chassis are connected together in this way, pressing the power button on any chassis causes all connected chassis to power on. Pushing the power button on any connected chassis turns all other chassis off.

NOTE	Up to four chassis may be connected together for the power sync feature to work.

CAUTION	Connect the cables only when all chassis are powered off to eliminate power mismatched states. If the chassis become out of sync, power all chassis down by holding the power button down for five seconds minimum. If that doesn't work, remove AC power form all chassis and then restart the chassis.

CAUTION	These RJ45 connectors are for multi-chassis power-up synchronization only. Do not connect cables to a corporate or local LAN to these connectors.

NOTE	In a multi-chassis system, the time base and triggering for each chassis operates independent of the other chassis. For more information, refer to Keysight's *Multiple PXIe and AXIe Chassis Configuration Tool.* This tool is available on-line at: www.keysight.com/find/pxie-multichassis.

Power Sync Cabling

When connected via the RJ-45 connectors, the power button on any chassis may be used to power up or power down the entire system.

If you are using an external host controller, it should remain turned off until <u>all</u> chassis are powered on and enumerated all slots.

Each cable used for multiple chassis power-up synchronization purposes should not exceed 2 meters in length. Straight CAT5 or better cables are required.

CAT5 or better cables
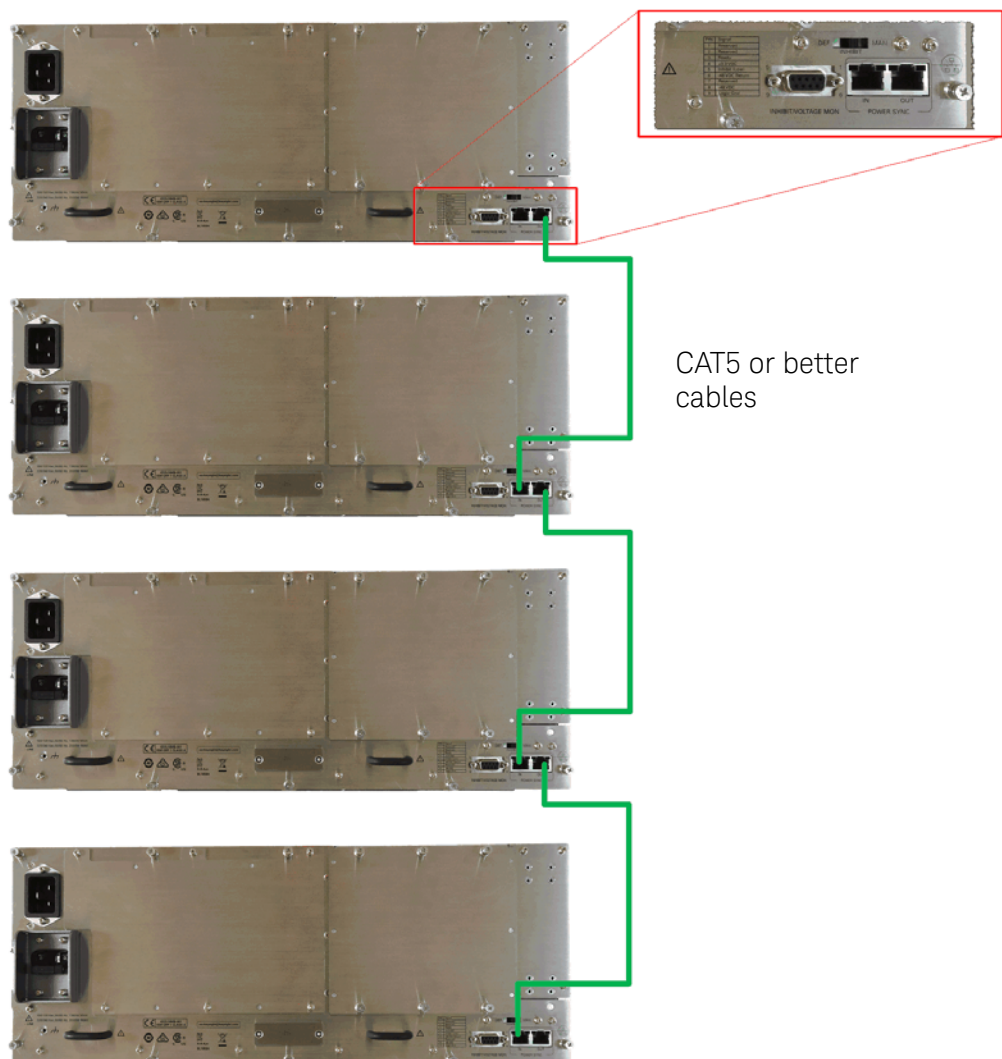
Figure 40   Connection Sequence for Multiple Chassis Power Synchronization

Chassis Inhibit

Chassis Rear Panel Chassis Inhibit Switch

When set to **MAN**ual, the power sync feature is disabled. Chassis are controllable by the **Inhibit** signal on the rear panel DB-9 connector. See also "Chassis Inhibit and Voltage Monitoring" on page 100

Chassis Inhibit Switch   Power Sync Connectors
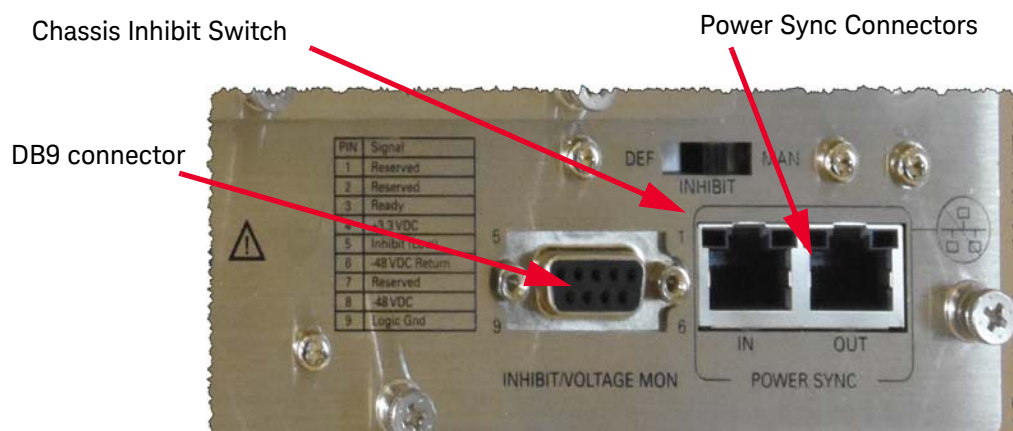
DB9 connector

Figure 41   Chassis Power Inhibit Switch, DB9 Connector, Power Sync Connectors

> **NOTE**
>
> Keysight recommends leaving the **INHIBIT** switch in the **DEF** position when connecting the AC power cord to the chassis. After inserting the power AC power cord, then move the **INHIBIT** switch to the **MAN** position.

7   For Module Developers

This chapter provides a detailed look at the AXIe chassis backplane and connectors, provided as a quick reference for AXIe module developers.

Module Types

The AXIe chassis provide a wealth of options for high speed, low voltage differential (LVDS) signaling. Whether you can develop individual instrument modules or modular instrumentation sets, communication between modules may travel across the backplane.

Depending on your application, you have the flexibility to create a variety of module types.

- Instrument Module: An instrument module can go in any slot and will typically use the AXIe trigger bus resources. It will not typically use the local bus unless it is part of an instrumentation set.

- Instrumentation Sets: AXIe provides the opportunity for you to create scalable, modular measurement and test systems which can occupy two or more chassis slots.

    - If you create a two-module instrumentation set intended to occupy adjacent slots, you can utilize up to 62 LVDS backplane local bus lines. This set could be designed to function in any two adjacent slots of the M9506A.

    - You can also create instrumentation sets with up to five AXIe modules,and may implement backplane features and specify module placement as required.

    - Your multiple module instrumentation set can include an instrument hub module installed in slot 1. That hub may use AXIe trigger bus features, communicate between adjacent modules using the local bus, and provide the hub for a secondary x4 backplane data fabric to slots 2 through 5.

ATCA and AXIe Requirements

The Keysight AXIe (ATCA eXtensions for Instrumentation) chassis backplanes used in the M9506A comply with the AXIe 1.0 Base Architecture Specification. AXIe 1.0 is based on AdvancedTCA® (ATCA) architecture, expanded with several *eXtensions*, all of which will remain electrically compatible with standard ATCA blades. These modifications provide timing, triggering, local bus signaling and data transport features.

Keysight provides this chapter as a quick backplane reference for developers of AXIe instrument and instrument hub modules. It gives a brief explanation of how the M9506A chassis implement AXIe features, and provides signal connection pin assignments for module backplane connectors.

> **NOTE**
>
> This summary of AXIe requirements is <u>not</u> intended to replace the applicable module design standards, which specify mechanical, electrical, and logical interfaces between module and chassis. AXIe modules must comply with:
>
> - AXIe 1.0 Base Architecture Specification, available at http://www.axiestandard.org
> - AdvancedTCA® PICMG 3.0® Specification, available at http://www.picmg.org

Most ATCA modules should be able to work in an AXIe environment. Conversely, developers should design AXIe modules to be compatible in an ATCA environment.

ATCA Requirements and Exceptions for AXIe 1.0

Mechanical   AXIe modules must meet all ATCA mechanical requirements for modules.

Exception: AXIe 1.0 chassis do not accommodate rear transition modules (RTM).

Hardware Platform (shelf) Management   AXIe modules must incorporate the ATCA hardware platform management features.

Exceptions:

- AXIe uses an intelligent platform bus (IPMB) for platform management communication between the intelligent FRUs (for example: shelf manager, module IPMC) in a chassis. This IPMB conforms to the ATCA requirements for IPMB-0, but with no IPMB redundancy.

- AXIe modules are not required to support the complete hot swap capabilities of ATCA. However, the module's FRUs are required to support all of the operational states required for ATCA front boards.

- AXIe modules are not required to have the handle switches that sense the module's insertion and impending removal from the chassis nor the blue hot-swap LEDs.
- AXIe modules do not implement ATCA electronic keying, metallic test bus, and ringing bus.

Power Distribution   Dual power supplies are provided to each slot. AXIe Modules may use either or both supply feeds, and must be able to operate over a range from –53VDC to –45VDC.

Data Transport   AXIe modules must comply with all ATCA requirements for Zone 2 base and fabric interfaces.

Exceptions:

- AXIe modules only implement a single base interface channel (LAN channel 1).
- AXIe modules may connect to data fabric channel 1 or channel 2, or both.
- Data fabric channel 1, if used by the AXIe module, must implement a PCIe connection, operated from the supplied 100MHz reference clock (FCLK).
- Data fabric channel 2, if used by the AXIe module, may implement proprietary protocols.
- AXIe modules may connect to any of the CLK100, SYNC or STRIG signal pairs, any of the 12 AXIe TRIG pairs, and any number of available pairs on either or both local bus ports.

Synchronization Clock   AXIe backplanes maintain the bused topology of most Synchronization Clock signals, and devices implement the same MLVDS signaling levels as ATCA. The following table provides a brief description of the timing interface signals:

Clock Signal	Description
FCLK	100 MHz PCIe Reference Clock
CLK100	Functions as the chassis clock. Slot-to-Slot skew must be less than 100 pS.
SYNC	Trigger/Clock synchronization signal. Slot-to-Slot skew must be less than 100 pS.
STRIG	Direct connection for triggering between the system slot and instrument slots, Less than 20 pS skew is allowed.

Exceptions:

- AXIe architecture expands the use of the ATCA Synchronization Clock Interface. The signals and connector pin assignments for AXIe modules differ from ATCA.

No Update Channel Interface

Exception:

- – The AXIe architecture does not implement the ATCA Update Channel Interface. AXIe backplanes implement a single bused MLVDS topology for the signals connecting to those Zone 2 connector contacts, and devices implement different signaling schemes as defined in the AXIe specification. AXIe modules must implement electronic keying appropriate to prevent incompatible connections between AXIe and ATCA devices installed in either system environment.

AXIe Extensions to AdvancedTCA®

AXIe expands the ATCA specification with several *eXtensions*, Zone 2 customizations which include:

- - The AXIe *timing interface*, providing for specific clock distribution and signaling between the ESM and instrument slots 1 through 5. This interface includes timing resources SYNC, CLK100, and STRIG. See "Clocks and Triggering" on page 84 for a complete functional description of these timing resources.

- - A 12 pair MLVDS *trigger bus*, TRIG[0,11], bused across all slots (the ESM slot and instrument slots 1 through 5). See "Triggering" on page 88.

- - A 62 pair *local bus* for signaling between adjacent instrument slots.

- - The *data transport fabric*, Single Star x16 PCIe Gen 3 fabric:

  - – Channel 1 connects the ESM slot in a star configuration to provide an x16 link to each instrument slot

  - – Uses a distributed PCIe fabric reference clock (FCLK) driven from the ESM

- - AXIe chassis implement an extended set of electronic keying records to assure consistent use of AXIe-defined backplane fabrics and resources.

In the AXIe chassis, the ESM acts as logical slot 1 for base fabric signaling (LAN) and channel 1 data fabric signaling (PCIe) signaling in addition to shelf management.

Chassis Backplane Connections

M9506A Backplane

The photo below reveals the M9506A backplane, with modules removed from all slots. The backplane provides connectors P20 through P24 and J10. Connector designations are shown for instrument slot 1.

A typical module connector layout is illustrated below the backplane photo, with the mating connectors J20 through J24 and P10.

AXIe Module Rear (mating) Edge
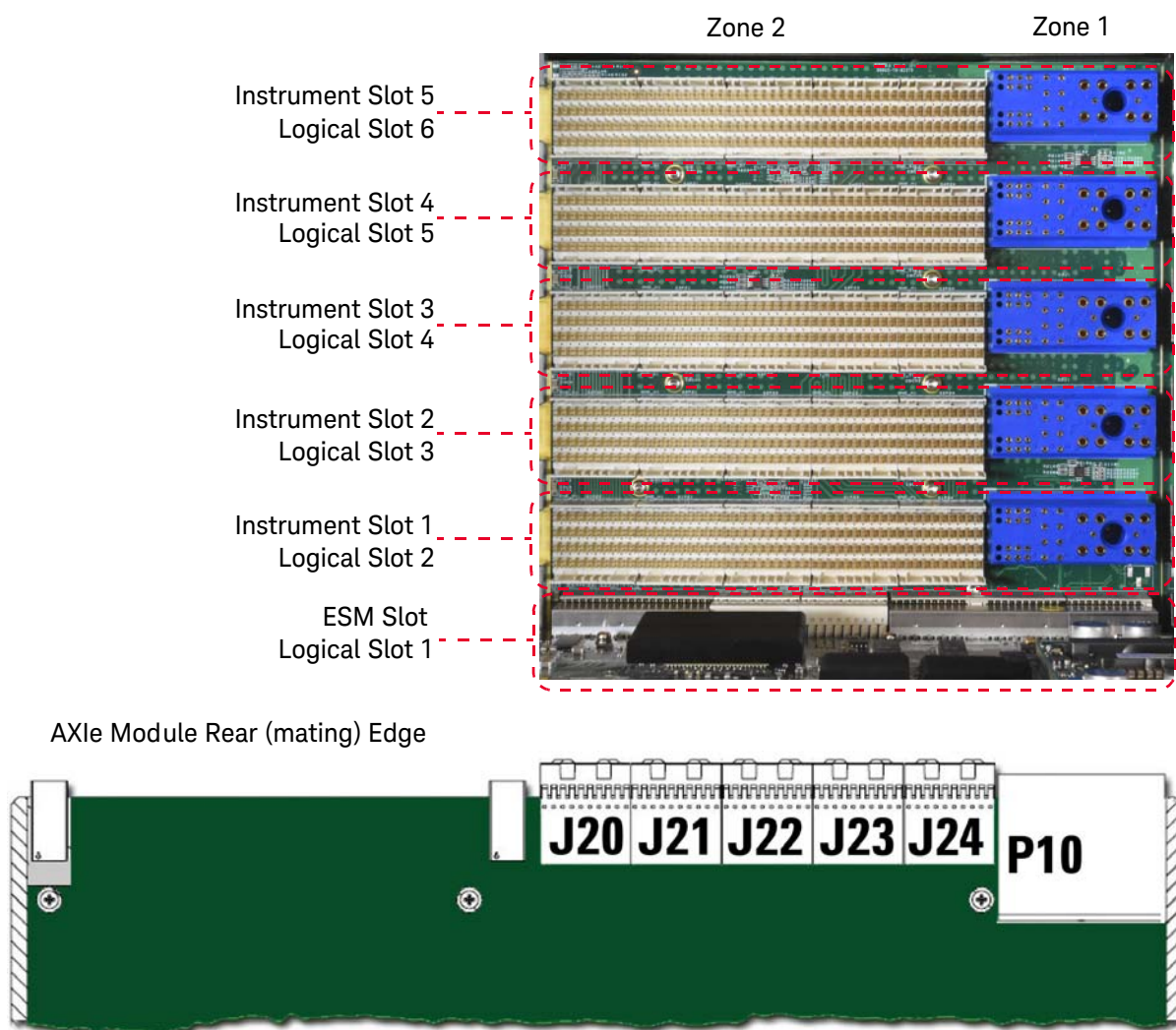
Depending on module type, you may implement all or none of J20–J24. You will always need connector P10 to power the module.

Zone 1 Connector Layout

The blue jack at far right in each slot is J10, the AXIe Zone 1 backplane connector. Through J10, the chassis distributes power feeds and provides shelf management. AXIe modules should be capable of operating normally from either feed, over a range from –53V to –45V. Your module must provide mating connector P10.

The photo below shows slot 1 from the M9506A, normal chassis orientation. The pin layout for J10 (all slots) is illustrated below the photo.

Zone 1 Backplane Connector J10

Hardware   Unused   Power Supplies
Management   Contacts   and mating contacts
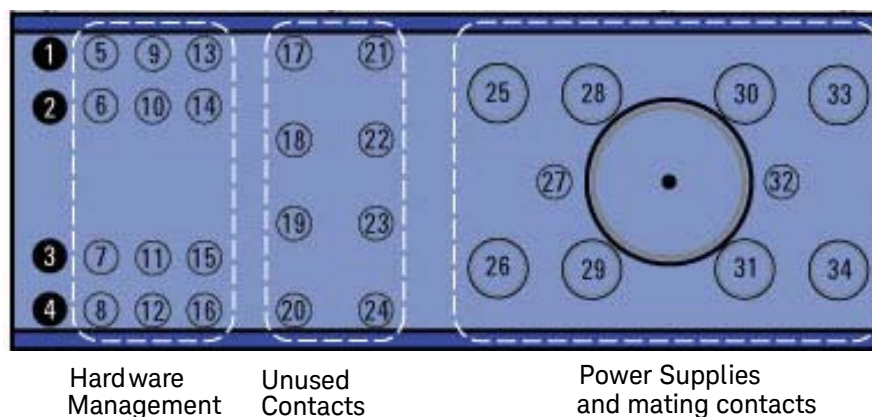
Zone 1 Connector Usage

Zone 1 provides these connections to each module slot:

- Dual redundant –48 VDC power supplies, per the ATCA specification.

- Hardware management circuits. including the Intelligent Platform Management Bus (IPMB) and Hardware Addressing (HA), per the ATCA specification.

- Metallic test and ringing generator buses are *not* provided in AXIe 1.0. Connector J10 will physically accommodate P10 pins 17-24 from a legacy ATCA module, but with no functionality.

Complete circuit definitions and design specifications can be found in the ATCA 3.0 base specification. Pin assignments are listed on the following page.

Zone 1 Pin Assignments

The Zone 1 pin assignments and circuit definitions for backplane connector J10 and module connector P10 are listed below:

Power Circuit Contacts for J10/P10

Contact Number	ATCA Designation	Description
25	SHELF_GND	Connection to Shelf Ground and safety ground
26	LOGIC_GND	Ground reference and return for Front Board-to-Front Board logic signals
27	ENABLE_B	Short pin for power sequencing, Feed B, tied to VRTN_B on backplanes
28	VRTN_A	–48 v return, Feed A
29	VRTN_A	–48 v return, Feed B
30	EARLY_A	–48 v input, Feed A pre-charge
31	EARLY_B	–48 v input, Feed B pre-charge
32	ENABLE_A	Short pin for power sequencing, Feed A, tied to VRTN_A on backplanes
33	–48V_A	–48 v input, Feed A, uses ENABLE_A to enable converters
34	–48V_B	–48 v input, Feed B, uses ENABLE_B to enable converters

Legacy ATCA Test Circuit Pins for J10/P10

Contact Number	ATCA Designation	Description
17	MT1_TIP	
18	MT2_TIP	
19	–RING_A	These backplane J10 contacts will physically accept pins from ATCA
20	–RING_B	modules, but do not provide ATCA metallic test and ringing generator bus
21	MT1_RING	circuits.
22	MT2_RING	
23	RRTN_A	
24	RRTN_B	

Hardware Management Circuit Contacts for J10/P10

Contact Number	ATCA Designation	Description
1-4		Reserved, do not connect
5	HA0	Hardware address bit 0
6	HA1	Hardware address bit 1
7	HA2	Hardware address bit 2
8	HA3	Hardware address bit 3
9	HA4	Hardware address bit 4
10	HA5	Hardware address bit 5
11	HA6	Hardware address bit 6
12	HA7/P	Hardware address bit 7 (odd parity bit)
13	SCL_A	IPMB clock, Port A
14	SDA_A	IPMB data, Port A
15	SCL_B	IPMB clock, Port B
16	SDA_B	IPMB data, Port B

Zone 2 Connector Layout

The Zone 2 connectors provide pins for up to 200 differential signaling pairs per slot (40 pairs per connector), although most slots and many modules will not feature all these connectors.

Zone 2 provides the signal connections for the data transport fabric and AXIe extensions, using P20 through P24; the white plugs in each instrument slot For complete backplane photos, see "M9506A Backplane" on page 124.

Each Zone 2 plug provides 40 differential signal contact pairs with ground in 10 columns, four pairs to a column. The pin layout for P20 (typical for all Zone 2 connectors) is illustrated below the slot photo.
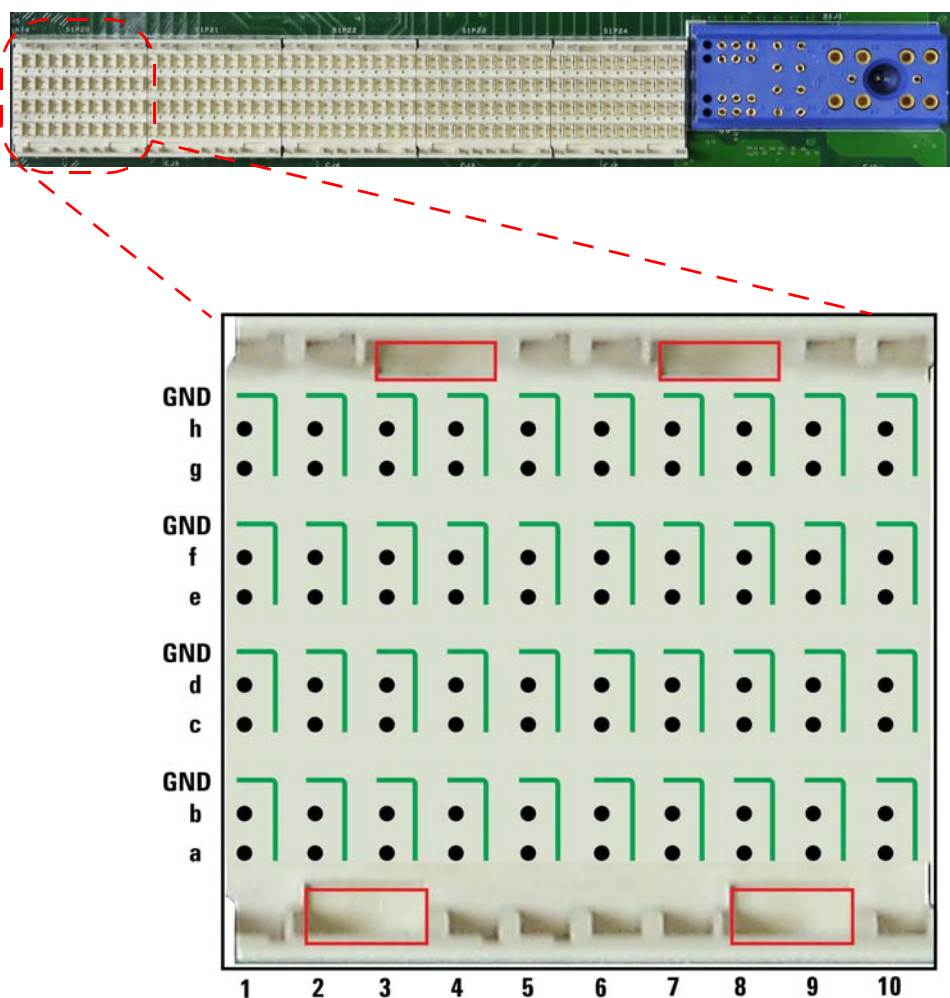
These plugs use male contacts; the mating module connectors J20 through J24 use female contacts. Note the areas shown with red boxes; these are for alignment/keying.

Zone 2 Connector Usage

Your module may implement any or none of the Zone 2 connectors. If you want:

- to utilize the AXIe trigger, timing, data, and local bus (22 pair) features in your module, load connectors J20 and J23.

- to expand the local bus up to 62 pair, load connectors J24 and J21.

- to complete a five-slot star hub for data fabric channel 2—used in instrument hub modules only—load connector J22.

The table below provides a locational map linking each AXIe Zone 2 interface type (function) with its backplane connectors

Interface Type	Interface	Number of Signal Pairs	Chassis Backplane Connector
Trigger Bus	TRIG[0,11]	12	P20
Timing Bus	STRIG, SYNC, CLK100 and FCLK	4	P20
Local Bus	pairs 0 through 7	8	P20
	pairs 8 through 17	10	P23
	pairs 18 through 37	20	P24
	pairs 38 through 41	4	P20
	pairs 42 through 61	20	P21
Fabric Channel 3 (PCIe x16)		4	P22
Fabric Channel 4 (PCIe x16)		4	P22
Fabric Channel 5		4	P22
Fabric Channel 6		4	P22
Fabric Channel 7		4	P22
Base Channel		4	P23
Fabric Channel 1 (PCIe x4)	from ESM star hub	4	P23
Fabric Channel 2 (PCIe x8)		4	P23

Complete circuit definitions and design specifications can be found in the ATCA and AXIe specifications. Pin assignments are listed on the following page.

Zone 2 Pin Assignments

The Zone 2 pin assignments and circuit definitions for connector pairs P20/J20 through P24/J24 are listed below. For the local bus assignments:

- Pin designations beginning with LBL connect to the adjacent lower slot
- Pin designations beginning with LBR connect to the adjacent upper slot

P20/J20

Row	Interface	Instrument Slot 1-5 (Logical Slot 2-6)							
		ab		cd		ef		gh	
1	Trigger	TRIG[0]+	TRIG[0]–	TRIG[1]+	TRIG[1]–	TRIG[2]+	TRIG[2]–	TRIG[3]+	TRIG[3]–
2	Trigger	TRIG[4]+	TRIG[4]–	TRIG[5]+	TRIG[5]–	TRIG[6]+	TRIG[6]–	FCLK+	FCLK–
3	Trigger	TRIG[7]+	TRIG[7]–	TRIG[8]+	TRIG[8]–	TRIG[9]+	TRIG[9]–	TRIG[0]+	TRIG[0]–
4	Timing	TRIG[11]+	TRIG[11]–	STRIG+	STRIG–	SYNC100+	SYNC100–	CLK100+	CLK100–
5		LBL[0]+	LBL[0]–	LBL[1]+	LBL[1]–	LBR[0]+	LBR[0]–	LBR[1]+	LBR[1]–
6		LBL[2]+	LBL[2]–	LBL[3]+	LBL[3]–	LBR[2]+	LBR[2]–	LBR[3]+	LBR[3]–
7	Local Bus	LBL[4]+	LBL[4]–	LBL[5]+	LBL[5]–	LBR[4]+	LBR[4]–	LBR[5]+	LBR[5]–
8		LBL[6]+	LBL[6–	LBL[7]+	LBL[7]–	LBR[6]+	LBR[6–	LBR[7]+	LBR[7]–
9		LBL[38]+	LBL[38]–	LBL[39]+	LBL[39]–	LBR[38]+	LBR[38]–	LBR[39]+	LBR[39]–
10		LBL[40]+	LBL[40]–	LBL[41]+	LBL[41]–	LBR[40]+	LBR[40]–	LBR[41]+	LBR[41]–

P21/J21

Row	Interface	Instrument Slot 1-5 (Logical Slot 2-6)							
		ab		cd		ef		gh	
1		LBL[42]+	LBL[42]–	LBL[43]+	LBL[43]–	LBR[42]+	LBR[42]–	LBR[43]+	LBR[43]–
2		LBL[44]+	LBL[44]–	LBL[45]+	LBL[45]–	LBR[44]+	LBR[44]–	LBR[45]+	LBR[45]–
3		LBL[46]+	LBL[46]–	LBL[47]+	LBL[47]–	LBR[46]+	LBR[46]–	LBR[47]+	LBR[47]–
4	Add for	LBL[48]+	LBL[48]–	LBL[49]+	LBL[49]–	LBR[48]+	LBR[48]–	LBR[49]+	LBR[49]–
5	62-Pair	LBL[50]+	LBL[50]–	LBL[51]+	LBL[51]–	LBR[50]+	LBR[50]–	LBR[51]+	LBR[51]–
6	Local Bus	LBL[52]+	LBL[52]–	LBL[53]+	LBL[53]–	LBR[52]+	LBR[52]–	LBR[53]+	LBR[53]–
7		LBL[54]+	LBL[54]–	LBL[55]+	LBL[55]–	LBR[54]+	LBR[54]–	LBR[55]+	LBR[55]–
8		LBL[56]+	LBL[56]–	LBL[57]+	LBL[57]–	LBR[56]+	LBR[56]–	LBR[57]+	LBR[57]–
9		LBL[58]+	LBL[58]–	LBL[59]+	LBL[59]–	LBR[58]+	LBR[58]–	LBR[59]+	LBR[59]–
10		LBL[60]+	LBL[60]–	LBL[61]+	LBL[61]–	LBR[60]+	LBR[60]–	LBR[61]+	LBR[61]–

P22/J22

Row	Interface	Instrument Slot 1-5 (Logical Slot 2-6)							
		ab		cd		ef		gh	
1	Fabric	TX2[7]+	TX2[7]–	RX2[7]+	RX2[7]–	TX3[7]+	TX3[7]–	RX3[7]+	RX3[7]–
2	Channel 7	TX0[7]+	TX0[7]–	RX0[7]+	RX0[7]–	TX1[7]+	TX1[7]–	RX1[7]+	RX1[7]–
3	Fabric	TX2[6]+	TX2[6]–	RX2[6]+	RX2[6]–	TX3[6]+	TX3[6]–	RX3[6]+	RX3[6]–
4	Channel 6	TX0[6]+	TX2[6]–	RX0[6]+	RX0[6]–	TX1[6]+	TX1[6]–	RX1[6]+	RX1[6]–
5	Fabric	TX2[5]+	TX2[5]–	RX2[5]+	RX2[5]–	TX3[5]+	TX3[5]–	RX3[5]+	RX3[5]–
6	Channel 5	TX0[5]+	TX0[5]–	RX0[5]+	RX0[5]–	TX1[5]+	TX1[5]–	RX1[5]+	RX1[5]–
7	Fabric	TX2[4]+	TX2[4]–	RX2[4]+	RX2[4]–	TX3[4]+	TX3[4]–	RX3[4]+	RX3[4]–
8	Channel 4	TX0[4]+	TX2[4]–	RX0[4]+	RX0[4]–	TX1[4]+	TX1[4]–	RX1[4]+	RX1[4]–
9	Fabric	TX2[3]+	TX2[3]–	RX2[3]+	RX2[3]–	TX3[3]+	TX3[3]–	RX3[3]+	RX3[3]–
10	Channel 3	TX0[3]+	TX0[3]–	RX0[3]+	RX0[3]–	TX1[3]+	TX1[3]–	RX1[3]+	RX1[3]–

P23/J23

Row	Interface	Instrument Slot 1-5 (Logical Slot 2-6)							
		ab		cd		ef		gh	
1	Fabric	TX2[2]+	TX2[2]–	RX2[2]+	RX2[2]–	TX3[2]+	TX3[2]–	RX3[2]+	RX3[2]–
2	Channel 2	TX0[2]+	TX0[2]–	RX0[2]+	RX0[2]–	TX1[2]+	TX1[2]–	RX1[2]+	RX1[2]–
3	Fabric	TX2[1]+	TX2[1]–	RX2[1]+	RX2[1]–	TX3[1]+	TX3[1]–	RX3[1]+	RX3[1]–
4	Channel 1	TX0[1]+	TX0[1]–	RX0[1]+	RX0[1]–	TX1[1]+	TX1[1]–	RX1[1]+	RX1[1]–
5	Base Channel 1	BI_DA1+ (Tx1+)	BI_DA1– (Tx1–)	BI_DB1+ (Rx1+)	BI_DB1– (Rx1–)	BI_DC1+	BI_DC1–	BI_DD1+	BI_DD1–
6		LBL[8]+	LBL[8]–	LBL[9]+	LBL[9]–	LBR[8]+	LBR[8]–	LBR[9]+	LBR[9]–
7		LBL[10]+	LBL[10]–	LBL[11]+	LBL[11]–	LBR[10]+	LBR[10]–	LBR[11]+	LBR[11]–
8	Local Bus	LBL[12]+	LBL[12–	LBL[13]+	LBL[13]–	LBR[12]+	LBR[12–	LBR[13]+	LBR[13]–
9		LBL[14]+	LBL[14]–	LBL[15]+	LBL[15]–	LBR[14]+	LBR[14]–	LBR[15]+	LBR[15]–
10		LBL[16]+	LBL[16]–	LBL[17]+	LBL[17]–	LBR[16]+	LBR[16]–	LBR[17]+	LBR[17]–

P24/J24

Row	Interface	Instrument Slot 1-5 (Logical Slot 2-6)							
		ab		cd		ef		gh	
1		LBL[18]+	LBL[18]–	LBL[19]+	LBL[19]–	LBR[18]+	LBR[18]–	LBR[19]+	LBR[19]–
2		LBL[20]+	LBL[20]–	LBL[21]+	LBL[21]–	LBR[20]+	LBR[20]–	LBR[21]+	LBR[21]–
3		LBL[22]+	LBL[22]–	LBL[23]+	LBL[23]–	LBR[22]+	LBR[22]–	LBR[23]+	LBR[23]–
4	Add for	LBL[24]+	LBL[24]–	LBL[25]+	LBL[25]–	LBR[24]+	LBR[24]–	LBR[25]+	LBR[25]–
5	42-Pair	LBL[26]+	LBL[26]–	LBL[27]+	LBL[27]–	LBR[26]+	LBR[26]–	LBR[27]+	LBR[27]–
6	Local Bus	LBL[28]+	LBL[28]–	LBL[29]+	LBL[29]–	LBR[28]+	LBR[28]–	LBR[29]+	LBR[29]–
7		LBL[30]+	LBL[30]–	LBL[31]+	LBL[31]–	LBR[30]+	LBR[30]–	LBR[31]+	LBR[31]–
8		LBL[32]+	LBL[32]–	LBL[33]+	LBL[33]–	LBR[32]+	LBR[32]–	LBR[33]+	LBR[33]–
9		LBL[34]+	LBL[34]–	LBL[35]+	LBL[35]–	LBR[34]+	LBR[34]–	LBR[35]+	LBR[35]–
10		LBL[36]+	LBL[36]–	LBL[37]+	LBL[37]–	LBR[36]+	LBR[36]–	LBR[37]+	LBR[37]–

8 Troubleshooting and Service

This chapter provides instructions for updating the chassis firmware, troubleshooting problems with your AXIe chassis, a list of user-replaceable parts, and instructions for parts replacement.

To contact Keysight for sales and technical support, refer to support links on the following Keysight websites: http://www.keysight.com/find/M9506A http://www.keysight.com/find/assist (worldwide contact information for repair and service)."

WARNING   **The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources while it is being opened.**

WARNING   **If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.**

WARNING   **These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.**

KEYSIGHT
TECHNOLOGIES

WARNING To prevent electrical shock, disconnect the Keysight Technologies Model M9506A from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.

WARNING The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch (disconnecting device).

WARNING The power cord is connected to internal capacitors that may remain live for 5 seconds after disconnecting the plug from its power supply.

NOTE If returning the chassis or any component of the chassis (for example, the ESM or a power supply module), use the original Keysight packaging or compatible.

Updating the Chassis Firmware

The current version of your chassis' firmware is listed on the Home Page of the web interface (see "Web Interface Home Page" on page 58). You can update the AXIe chassis firmware to take advantage of refinements and added features as they become available. To check if a later version is available, go to the website below for your product, then click the tabs/links indicated:

www.keysight.com/find/M9506A, then **Technical Support > Drivers & Software > Firmware Update**

Revision String Numbering Format

The chassis firmware revision string is organized in the following format:

<Chassis Class>.<Firmware Version>-<Chassis Component>-<Axxxx>[-<Bxxxx>]...

Where: **<Chassis Class>** is:

F6AX Identifies an M9506A 5 slot AXIe chassis

<Firmware Version> is structured as: **<major>.<minor>.<build>**

<major> Identifies the major release number.
<minor> Identifies the minor release number.
<build> Identifies a build number.

<Chassis Component> is a four digit number, <xxxx>

Where <xxxx> is a hexadecimal value identifying the backplane firmware revision. While it is possible to move an ESM from one chassis to another, the revision of the target chassis may not reside at the same revision level installed on the ESM (and its previous chassis). It is important to review the revision string after relocation to verify that the complete revision string is current. If not up-to-date, run through the firmware update process.

<Axxxx>; **<Bxxxx>...**

<xxxx> is a hexadecimal value for the firmware component. The actual content of these components is for Keysight internal use only.

A firmware version example: **F6AX-1.0.09-0007-A009-B0609-C05-UpdateFW**

This example shows a chassis with firmware revision 1.0.09. The backplane revision is 0007 and component A is at revision 009, component B is at revision 0609 and component C is at revision 05. Refer to the *M9506A AXIe Chassis Firmware Update Guide* for specific details regarding updating the chassis firmware.

ESM and Chassis Self–Test

The ESM supports two types of self-test:

- Power-on Self-Test (POST) – This test happens on the Shelf Manager as soon as the chassis powers up. As noted, this type of self-test is referred to as "POST".

- After-POST self-test – This test is initiated by the user either via the SFP or programmatically using the Self-Test IVI call: **KtMAXIeMon.Utility.SelfTest("TestResult","TestMessage");**.

Unless noted otherwise, references to "self-test" always refers to the self test that is either initiated from the SFP or initiated programmatically. The phrase "self-test" does not refer to POST.

The front panel Status LED shows the following LED states:

- OFF - standby

- Green (blinking) - ESM/Shelf Manager is booting up and waiting for modules to be ready for enumeration

- Green (solid) - power up complete and ready for enumeration

- Red - failure/service required.

The power on self-test (POST) routines are automatically executed at power on. If POST passes, the status LED will be solid green. If POST fails, the status LED continues blinking green.

If POST passed (the Status LED is green), and then self-test is subsequently run and fails, the Status LED begins blinking green. Similarly, if POST failed (Status LED blinking green), but then if self-test is subsequently run and passes, the Status LED turns solid Green.

Regardless of what causes the Status LED to blink green (a POST failure or a failure during running of self-test), it will turn solid green again if Self-Test is run and passes.

Self-test runs a series of tests and any failure generates an error consisting of an error code (**TestResult**) and error message (**TestMessage**).

A single Self-Test error queue in the ESM holds both the power-on self-test errors and the user-initiated self-test errors. Power-on Self-Test error messages are identified by the "(POST)" prefix; user-initiated self-test messages do not have a prefix.

Running the user-initiated self-test (either from the Soft Front Panel or programmatically) preserves any unread power-on test messages in the queue, but erases any other (user-initiated) unread messages before running the tests.

You can use the Soft Front Panel or the IVI Self-TestErrorQuery call to view the errors.

When you open the Soft Front Panel's Self-Test dialog box, any previous results are automatically displayed. If you then click the **Run Self-Test** button, the new self-test results are displayed below any previous results.

Refer to Chapter 8, Troubleshooting and Service on page 131 and Appendix A, Self-Test Error Codes on page 149 for detailed information.

Refer to "Self-Test Error Codes" on page 149 for a list of Error Codes.

Self-Test IVI-C Driver Calls

KtMAXIeTRIG.Utility.SelfTest or **KtMAXIeMON.Utility.SelfTest** performs an instrument self test, waits for it to complete, and queries the instrument for any results.

Troubleshooting

The Keysight M9506A AXIe Chassis is typically used as part of a complex test *system*, where system refers to the complete hardware/software system including:

- One or more AXIe or PXIe chassis with installed application modules
- Connections from modules to devices under test (DUT)
- A host PC running Keysight Connection Expert software, chassis and module device drivers, and programming environment software
- LAN connection from the Host PC to Chassis Web Interface software
- A compatible PCIe host cable adapter installed and configured in the PC
- Compatible PCIe and LAN interface cables

Troubleshooting that complete test system is beyond the scope of this chapter. Keysight recommends that to properly isolate complex operational problems, you take all routine steps to rule out a host software or connectivity issue.

You may also wish to physically isolate the chassis from your DUT or installed modules, to distinguish a module hardware issue from a chassis hardware issue. As a temporary measure, you may (with the chassis powered down) partially remove a module without disturbing DUT connections, by removing it far enough to disengage it from the chassis backplane.

Keysight recommends returning a failing chassis to Keysight Service. They will inspect, test and replace failed components, then retest the chassis.

In general, the AXIe chassis has three major subsystems that can be replaced:
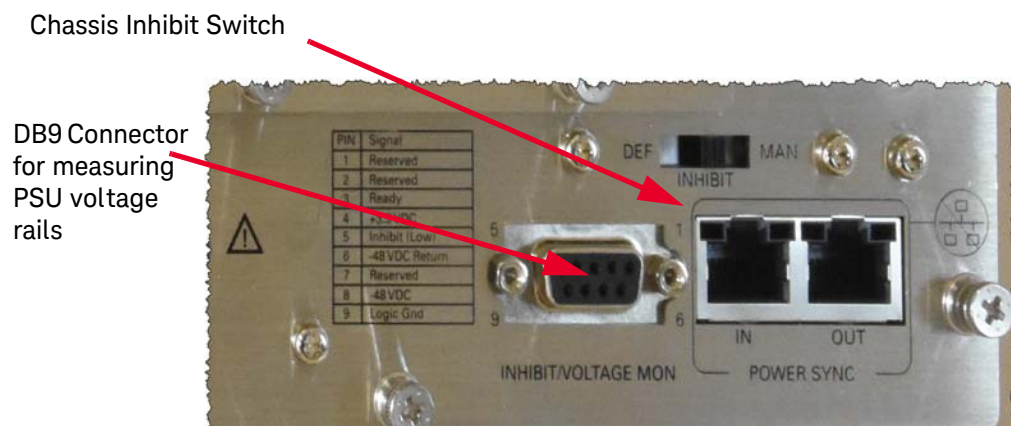
- Fan Trays
- Power Supply Unit (PSU)
- Embedded System Module (ESM)

This chapter assumes you can identify a suspected faulty subsystem, or have access to known good replacement subsystems you can swap to help isolate a hardware problem. Detailed step-by-step instructions are provided for fan trays, PSU, and ESM replacement.

Chassis Inhibit/Voltage Monitoring

The method of powering up the chassis depends on the position of the **INHIBIT** rear panel switch, which can be set to the **DEF** (DEFault) position or to the **MAN** (MANual) position). These two methods work as follows:

– **INHIBIT** switch in the **DEF** position – In this position, the front panel power push button is used to switch the chassis between ON and Standby—hence, this push button is known as the ON/Standby push button.

– **INHIBIT** switch in the **MAN** position – In this position, the Inhibit signal (pin 5 on the rear panel DB-9 connector) controls chassis power. The chassis is powered up by applying a logic high signal to the Inhibit pin. When the Inhibit pin (pin 5) is pulled low, the chassis is in Standby.

Figure 42   Chassis Power Inhibit Switch, DB9 Connector, Power Sync Connectors

NOTE	Keysight recommends leaving the **INHIBIT** switch in the **DEF** position when connecting the AC power cord to the chassis. After inserting the power AC power cord, then move the **INHIBIT** switch to the **MAN** position.

CAUTION	The RJ45 connectors are for multi-chassis power-up synchronization. Do not connect LAN cables to these connectors and to your corporate LAN. Refer to "Multi-Chassis Power Sync" on page 114 for detailed information.

If you're using the Inhibit input signal on the rear panel **INHIBIT/VOLTAGE MON** DB-9 connector and if this signal doesn't power up the chassis, check the voltage that is being applied to the Inhibit signal. This signal is active low, meaning that a 0 VDC signal inhibits operation of the PSUs and the chassis is in

Standby mode. A logic high turns on the PSUs. Use a DMM to verify that the signal you're providing to the Inhibit input on the DB-9 connector is truly switching between logic high and low.

Because there is an internal pull-up resistor on the Inhibit signal, an open circuit (no signal connected) on the Inhibit signal will also turn on the power supply. This means that, if the **INHIBIT** switch is set to the **MAN** position and if no signal is connected to the Inhibit input signal, the chassis will power up as soon as AC power is applied.

Measuring the Voltage Rails

The two power supply voltage rails (3.3V and –48V) can be measured on the DB-9 connector on the chassis rear panel using a digital multi-meter. Each voltage rail contains a current limiting resistor to prevent accidentally shorting the supplies during measurements.The two power supply rails should be within ±5% of their nominal values. Keysight recommends checking the power rails at least yearly using the chassis soft front panel (SFP) or programmatically. In addition, the power rails are accessible on the rear panel DB-9 connector, and can be checked with a DMM.

CAUTION	The PSUs contain no customer-serviceable parts such as fuses. If a PSU fails, it must be replaced as a complete unit. Replacement of the power supply is described in "To Replace the Power Supply Unit" on page 144.

WARNING	No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers. Servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.

Normal Chassis Operating Behavior

When the chassis is new and operating properly, familiarize yourself with its expected normal power-up and power-down behavior. This behavior involves these observable components:

- Power switch (on the ESM, mechanical feel and status indicator light)
- Rear panel circuit breaker (mechanical feel and resulting relay activation)
- PSU fan operation
- Chassis fan operation

- Web Interface Fan Control page (fan speeds, fan settings, fan/cooling system status, backplane and slot temperatures)

1 **OFF:** With the chassis plugged into a correct power main, the rear panel circuit breaker open (OFF) and the front panel switch off (flush with chassis), all chassis lights should be extinguished.

2 **BREAKER CLOSED:** Close the circuit breaker (ON). You should observe:
   - The breaker handle engages with a solid click, overcoming slight spring pressure.
   - After a slight delay, you may hear a softer click; this is a relay closing in the PSU. You may not hear this relay close, due to PSU fan noise.
   - The front panel power switch may light briefly, then extinguish.
   - The two PSU fans will initially spin up to maximum speed, then gradually step down in speed (4-5 distinct steps) to idle over two seconds. These fans should remain on at idle with the breaker closed.

3 **ON:** Press the ON/STANDBY switch (turn the chassis ON). You should observe:
   - Momentarily press the power switch and status indicator will light.
   - The PSU fans will increase to and remain at high speed.
   - The ESM front panel STATUS light will cycle as follows:
   - Flashing green - ESM is booting; for about 20 seconds
   - Flashing green - briefly
   - Steady green - booted
   - Steady red - the ESM has detected failure and requires service.

4 **STANDBY:** Press the ON/STANDBY switch again. You should observe:
   - Monitor the status light, it should extinguish.
   - The ESM front panel STATUS light will extinguish.
   - The chassis fans will turn off.
   - The PSU fans will slowly drop in speed, while continuing to cool the PSU from operating temperature to standby temperature.
   - Once the PSU cools down, the PSU fans will return to a steady idle speed.

5 OFF: Open the circuit breaker (OFF). You should observe:

- The breaker handle releases spring pressure.

- After a slight delay, you should hear a soft click; this is a relay opening in the PSU. You may not hear this relay open, due to PSU fan noise.

- The PSU fans will turn off.

Chassis Hardware Troubleshooting

Chassis Fans

The M9506A AXIe chassis has two fan trays, one on the left and one on the right, of the chassis. The left Fan tray has six fans providing air to the chassis slots and one fan for the Zone 3 area. The right fan tray has six fans. These fans are observable from outside the chassis by looking in the side vents. Additionally, the power supply has one fan. Refer to Chapter 3, Navigating the Web Interface on page 55 for information on determining the fan speed.

If module loads are kept within the 300 W per slot rating and adequate ventilation is provided around the chassis, the chassis fans are designed to automatically cool the chassis. If the chassis powers up properly, the fans should be turning at all times, with speed in proportional to thermal load.

There are a few reasons you may suspect a fan tray failure:

- One or more fans does not turn.

- A fan makes excessive bearing noise.

- You observe reduced speed for one or more fans relative to the others.

- One or more fans do not behave as described in "Normal Chassis Operating Behavior" on page 138.

- You experience an overheat condition, whether detected by the chassis Health Monitor, module monitoring software or other means.

In the event you experience unacceptably high chassis or module operating temperatures or other indications of fan failure, follow the procedure below.

To Check Chassis Fan Operation   In the event you experience unacceptably high chassis or module operating temperatures, or other indications of fan failure, follow the procedure below.

1 Visually check that all chassis fans are turning. Visually inspect both the PSU and chassis fans through the side of the chassis. If any fans are not turning, check for and remove obstructions. If there is evidence of excessive buildup on the fan blades, remove the fan tray to clean and reinsert it (see page 146), and recheck. If any fans still do not turn, replace the fan tray.

2 Using the Web Interface, access the Fan Control page.

-- All fan speeds should be about the same. Visually identify any that turn more slowly than the group. Any large deviation may indicate reveal early signs of fan failure.

-- You may set a higher fan speed to see if the fans are responsive.

3 For fan noise problems, identify which fans are noisy or not turning properly by visually inspecting both the PSU and chassis fans through the side of the chassis.

4 For all routine chassis fan failures, replace the fan tray assembly (see "To Replace the Fan Trays" on page 146). For PSU fan failures, replace the PSU (see "To Replace the Power Supply Unit" on page 144).

If the fans are operating correctly and you still have high temperatures, reduce your chassis load or troubleshoot installed modules.

Power Supply Unit (PSU)

The PSUs are self regulating, constant voltage supplies that shut themselves down (or not power up at all) if they are out of spec.

The PSU operation is binary. If the supply is delivering voltage within a very wide range, it will turn on its output and power up the chassis. You can then view PSU voltages using the Web Interface. If the system does not power up, it likely has failed and should be replaced (see "To Replace the Power Supply Unit" on page 144).

Embedded System Module (ESM)

If, upon power up, the ESM does not boot to a steady green STATUS light, replace the ESM (see "To Replace the Embedded System Module" on page 148).

If replacing the PSU or ESM does not correct an operating problem, and the ESM still fails to boot to a steady green STATUS light, the problem is in the remainder of the chassis; replace it.

To Reset ESM DIP Switches   The ESM has several sets of dual in-line package (dip) switches. Should you believe any of these may have been changed, you may verify and reset them to their correct positions; see photo and table below.

> **NOTE**
>
> All but one of these switches are reserved for factory testing purposes or reserved for future use and should not be changed. The only exception is **SW56** which is used to configure the PCIe settings as shown in the following table.
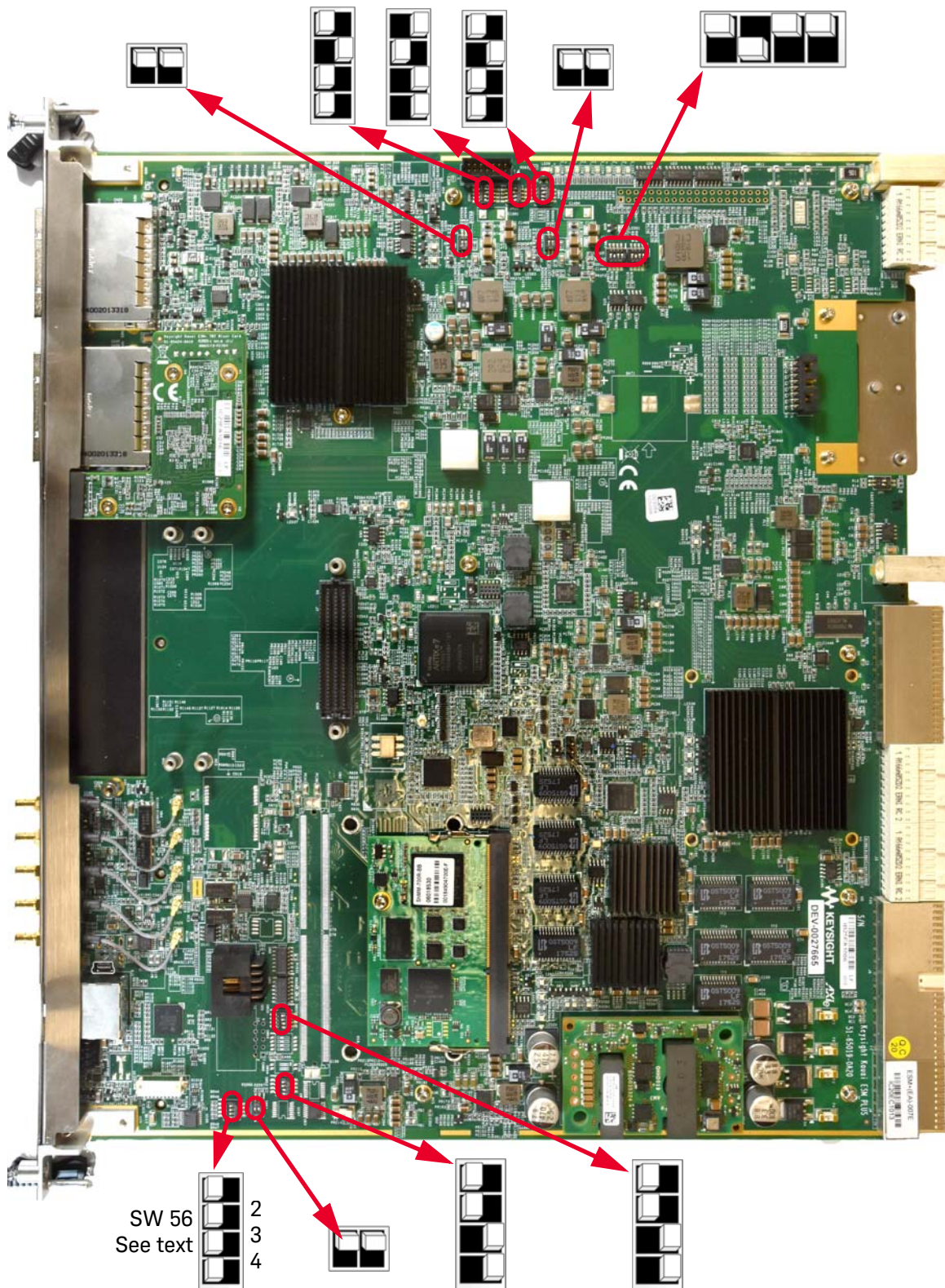
Figure 43   Factory Default ESM Switch Settings

SW 56
See text

2
3
4

SW56 Switch Positions

SW56 Switch	Definition	Description
1	Cable Port Mode OFF (default) = Merged X16 Mode ON = Unmerged both ports are X8 Mode	Controls the PCIe front panel cable ports. Either both ports are single X8 ports or they can be merged to a single X16 port (default).
2	Do not change	
3	PCIe or TBT Selection OFF (default) = Cable Port PCIe On = Thunderbolt PCIe	Determines the PCIe mode–either PCIe cable or Thunderbolt.
4	Remote Chassis Shut Off OFF (default) = Do not wait ON = Wait	When the chassis power button is pushed, the chassis waits for the Remote HOST PCIe to turn off before shutting down modules and chassis.

To Replace the Power Supply Unit

PSU replacement should be performed at a static-safe work station (see"ESD Precautions" on page 20), preferably on the bench. While it is possible—given adequate room for access—to perform this job with the chassis rackmounted, extra caution must be taken to avoid damage to the chassis' back panel wiring or loss of small parts.

To Remove the PSU from the M9506A

Tools needed: Flat Blade Screwdriver.

1 Power down and disconnect the power cord from the chassis.

2 If the chassis is rack-mounted, remove it from the rack.

3 Remove the nine round head screws from the perimeter of the rear panel, as shown below. Do not remove the screws holding the circuit breaker to the rear panel.

4 Carefully slide the PSU out of the chassis.
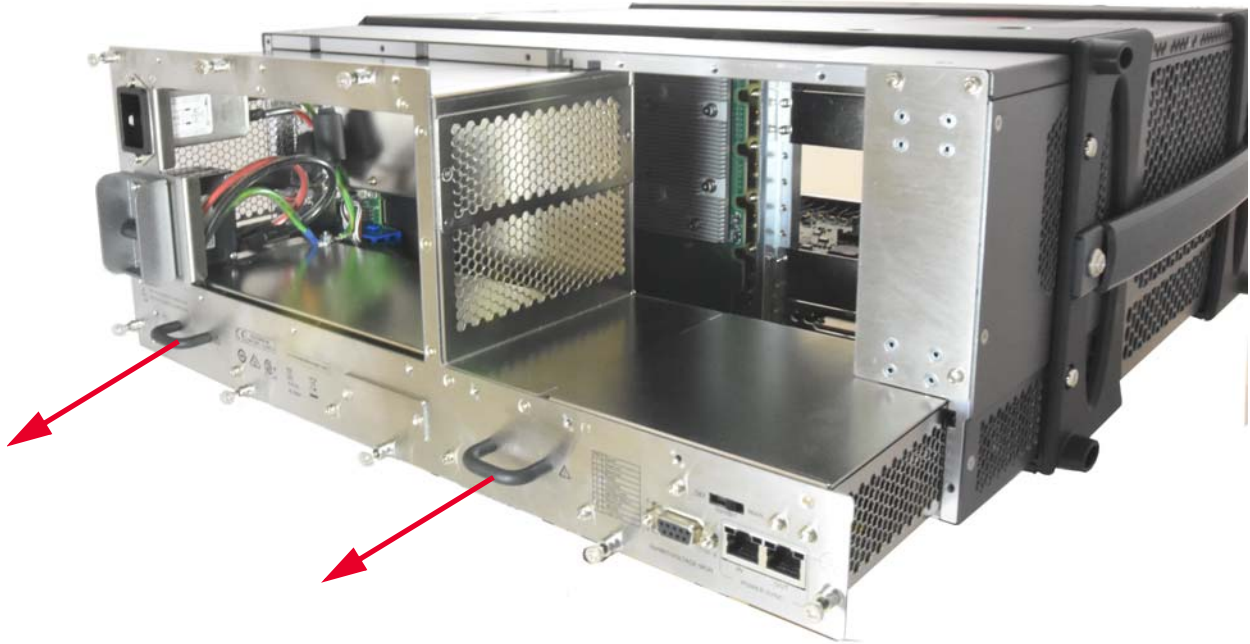
5 The complete PSU can then be removed.

6 To install the replacement PSU, reverse these steps.

To Replace the Fan Trays

The chassis has two fan trays (plus one fan in the power supply). Both fan trays are removable from the chassis front panel. If the chassis is rack mounted, you do not need to remove the chassis from the rack.

1 Power down and unplug the AXIe chassis.

2 Fully loosen the captive retaining screws on the front panel of the fan tray.

CAUTION	Ensure you fully loosened the captive retaining screws before trying to extract the fan tray. If you attempt to pull the fan tray out by the screws with these screws still engaged, damage could result.

3 Grasp the fan tray by the two captive retaining screws, and slide it out of the chassis.

4 To install the fan tray, reverse these steps.

To Replace the Embedded System Module

Remove and reinstall the ESM exactly like an application module, except that it can only fit in the bottom half-height slot. See "Installing and Removing AXIe Modules" on page 31 for instructions.

A   Self-Test Error Codes

Keysight's M9506A AXIe chassis can run a series of self-tests to indicate that the hardware is functioning normally. The self-tests are run automatically when the chassis is powered on and may be invoked via IVI function calls (see the IVI-C and IVI .NET help files), the chassis web page, or from the chassis Soft Front Panel interface).

You should access the appropriate web page and/or the Soft Front Panel interface to get a list of pass/failed error codes.

M9506A Monitor Self-Test Error Codes

Codes	Error Messages	Remarks
Codes 1 - 99 : Serious error codes		
1	(POST) <error from /tmp/messages> "All power on self-test(POST) errors will be using code 1"	
Codes 100 - 199 : Fan		
100	Error: fan tray not present. | Fan may be defective, see Service Guide. |	
101	Error: RPM () of the front fan in the front left fan tray is equal to or below Lower Critical/ Non-Recoverable threshold (RPM). | Fan may be defective, See Service Guide. |	
102	Error: RPM () of the left top middle fan in fan tray is equal to or below Lower Critical/ Non-Recoverable threshold (RPM). | Fan may be defective, See Service Guide. |	
103	Error: RPM () of the left top back fan in fan tray is equal to or below Lower Critical/ Non-Recoverable threshold (RPM). | Fan may be defective, See Service Guide. |	
104	Error: RPM () of the left bottom front fan in fan tray is equal to or below Lower Critical/ Non-Recoverable threshold (RPM). | Fan may be defective, See Service Guide. |	
105	Error: RPM () of the left bottom middle fan in fan tray is equal to or below Lower Critical/ Non-Recoverable threshold (RPM). | Fan may be defective, See Service Guide. |	
106	Error: RPM () of the left bottom back fan in fan tray is equal to or below Lower Critical/ Non-Recoverable threshold (RPM). | Fan may be defective, See Service Guide. |	
107	Error: RPM () of the right top front fan in fan tray is equal to or below Lower Critical/ Non-Recoverable threshold (RPM). | Fan may be defective, See Service Guide. |	
108	Error: RPM () of the right top middle fan in fan tray is equal to or below Lower Critical/ Non-Recoverable threshold (RPM). | Fan may be defective, See Service Guide. |	
109	Error: RPM () of the right top back fan in fan tray is equal to or below Lower Critical/ Non-Recoverable threshold (RPM). | Fan may be defective, See Service Guide. |	
110	Error: RPM () of the right bottom front fan in fan tray is equal to or below Lower Critical/ Non-Recoverable threshold (RPM). | Fan may be defective, See Service Guide. |	

111	Error: RPM () of the right bottom middle fan in fan tray is equal to or below Lower Critical/ Non-Recoverable threshold (RPM).	Fan may be defective, See Service Guide.	
112	Error: RPM () of the right bottom back fan in fan tray is equal to or below Lower Critical/ Non-Recoverable threshold (RPM).	Fan may be defective, See Service Guide.	
113	Error: RPM () of the left zone 3 fan in fan tray is equal to or below Lower Critical/ Non-Recoverable threshold (RPM).	Fan may be defective, See Service Guide.	
114	Warning: Fan tray at address 0xc0: revision != expected .	Fan may be defective, see Service Guide.	
Codes 200 - 299 : Sensors (temperature, voltage, current)	
201	Error: Temperature (degrees C) of the Embedded System Module near Artix FPGA is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (degrees C).	See Service Guide.	
202	Error: Temperature (degrees C) of the Embedded System Module PEX8734 PCIe switch is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (degrees C).	See Service Guide.	
203	Error: Temperature (degrees C) of the Embedded System Module near Artix FPGA is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (degrees C).	See Service Guide.	
204	Error: Temperature (degrees C) of the Embedded System Module PEX8749 PCIe switch is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (degrees C).	See Service Guide.	
205	Error: Temperature (degrees C) of backplane board between slot 4 and 5 is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (degrees C).	See Service Guide.	
206	Error: Temperature (degrees C) of backplane board between slot 1 and 2 is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (degrees C).	See Service Guide.	
207	Error: Temperature (degrees C) of backplane board between slot 3 and 4 is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (degrees C).	See Service Guide.	
208	Error: Temperature (degrees C) of mezzanine board PEX8796 PCIe switch is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (degrees C).	See Service Guide.	
209	Error: Temperature (degrees C) of power board is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (degrees C).	See Service Guide.	

210	Error: Temperature (degrees C) of power supply unit is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (degrees C). | Power supply may be defective, see Service Guide. |	
220	Error: Output voltage (VDC) of general 1.8V supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (V). | See Service Guide. |	
221	Error: Output voltage (VDC) of Artix FPGA 1.8V supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (V). | See Service Guide. |	
222	Error: Output voltage (VDC) of PEX8749 PCIe switch 1.8V Supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (V). | See Service Guide. |	
223	Error: Output voltage (VAC) of PEX8734 PCIe switch 1.8V Supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (V). | See Service Guide. |	
224	Error: Output voltage (VAC) of Thunderbolt 5V supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (V). | See Service Guide. |	
225	Error: Output voltage (VAC) of Artix FPGA 1.2V supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (V). | See Service Guide. |	
226	Error: Output voltage (VDC) of USB 5V supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (V). | See Service Guide. |	
227	Error: Output voltage (VDC) of Artix FPGA 2.5V supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (V). | See Service Guide. |	
228	Error: Output voltage (VAC) of VSC7512 and VSC8514 2.5V supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (V). | See Service Guide. |	
229	Error: Output voltage (VAC) of Artix FPGA 1.0V supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (V). | See Service Guide. |	
230	Error: Output voltage (VAC) of VSC7512 LAN switch 1.0V supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (A). | See Service Guide. |	
231	Error: Output voltage (VDC) of PEX8749 PCIe switch 0.9V Supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (A). | See Service Guide. |	
232	Error: Output voltage (VDC) of PEX8749 PCIe switch 0.9V Supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (A). | See Service Guide. |	

233	Error: Output voltage (VAC) of PEX8734 PCIe switch 0.9V Supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (A). | See Service Guide. |	
234	Error: Output voltage (VAC) of PEX8734 PCIe switch 0.9V Supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (A). | See Service Guide. |	
235	Error: Output voltage (VAC) of 3.3V Standby supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (A). | See Service Guide. |	
236	Error: Output voltage (VDC) of General 3.3V supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (A). | See Service Guide. |	
237	Error: Output voltage (VDC) of General 5V supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (A). | See Service Guide. |	
238	Error: Output voltage (VAC) of Main 12V supply is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (A). | See Service Guide. |	
239	Error: Output voltage (VAC) of power supply unit is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (A). | Power supply may be defective, see Service Guide. |	
240	Error: Input voltage (VAC) of power supply unit is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (A). | Power supply may be defective, see Service Guide. |	
260	Error: Output current (A) of power supply unit is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (A). | Power supply may be defective, see Service Guide. |	
Codes 300 - 399 : Modules Sensors (temperature, voltage, current)		
301	Error: Module Temperature Sensor - at slot value (degrees C) is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (degrees C). ||	
302	Error: Module Voltage Sensor - at slot value (V) is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (V). ||	
303	Error: Module Current Sensor - at slot value (A) is equal to or below/above Lower/Upper Upper Critical/ Non-Recoverable threshold (A). ||	
Codes 400 - 499 : Modules FRU status		
401	Error: FRU# 0x82 at slot 1 is not activated. Current State: Previous State:. | See Service Guide. |	

402	Error: FRU# 0x84 at slot 2 is not activated. Current State: Previous State:. | See Service Guide. |	
403	Error: FRU# 0x86 at slot 3 is not activated. Current State: Previous State:. | See Service Guide. |	
404	Error: FRU# 0x88 at slot 4 is not activated. Current State: Previous State:. | See Service Guide. |	
405	Error: FRU# 0x8A at slot 5 is not activated. Current State: Previous State:. | See Service Guide. |	
415	Error: FRU# 0xC0 at slot 0 is not activated. Current State: Previous State:. | See Service Guide. |	
420	Error: FRU# 0x12 at slot 0 is not activated. Current State: Previous State:. | See Service Guide. |	
421	Error: FRU# 0x20 at slot 0 is not activated. Current State: Previous State:. | See Service Guide. |	

M9506A Trigger Self–Test Error Codes

Codes	Error Messages	Test Description & Remarks
Codes 500 - 599 : i2c tests		
500	Error: I2C devices not found. | See Service Guide. | (U155, PCA9555, 0x20), (U145, PCA9535, 0x22), (U184, PCA9534, 0x23), (U64, Artix, 0x2A), (BU1, TM4C123GH6ZRB, 0x3C), (U53, AT24C64, 0x54), (U153, PCA9546A, 0x70), (U160, PCA9543, 0x72), (U11, PEX8749, 0x38), (U84, PEX8734, 0x5D), (PSU, MCU, 0x46), (PEM-U3, AT24C64, 0x53), (PEM-U7, MAX10, 0x2B), (MEZZ-U203, AT24C256, 0x55), (U195, TCA9535, 0x26)	
Codes 600 - 699 : AHI tests		
600	Error: atb-protocol-agent not started. | See Service Guide. | U64, Crosspoint switch, 0x2A	
601	Error: Crosspoint switch revision cannot be read. Crosspoint switch revision: | See Service Guide. | U64, Crosspoint switch, 0x2A	
602	Error: Fail to write to Trig0 Register. | See Service Guide. | U64, Crosspoint switch, 0x2A	
603	Error: Fail to revert Trig0 back to original value. Current value: . | See Service Guide. | U64, Crosspoint switch, 0x2A	
Codes 700 - 799 : Revision check		
700	Error: Revision not match (found:, expected:) | See Service Guide. |	
701	Error: Revision not match (found:, expected:). | See Service Guide. |	
702	Error: Revision not match (found:, expected:). | See Service Guide. |	
Codes 800 - 899 : PCIe Fabric tests		
800	Error: Unable to read link speed. | See Service Guide.	
801	Error: Unable to read link width. | See Service Guide.	
802	Error: Link speed and width doesn't match expected value - Expected Speed: , Expected Width: | See Service Guide.	
803	Warning: Safe mode Gen 1 detected. | See Service Guide.	

Glossary

Many of the terms in this manual and glossary are AXIe®, ATCA® or PICMG® specific. Refer to the relevant specifications for more detail on these terms.

ADB-6100AX   Apple Desktop Bus (ADB) is an obsolete bit-serial computer bus for connecting low-speed devices (mouse, keyboard, etc.) to a computer.

ATCA®   Advanced Telecommunication Computing Architecture® (also known as AdvancedTCA) is a PCI Industrial Computing Manufacturers Group (PICMG) specification. See AXIe below.

AXIe®   AdvancedTCA eXtensions for Instrumentation is a platform for general purpose modular instrumentation. It is an open industry standard aimed at test equipment and instrumentation. It builds on the experience of VXIbus, PXI and LXI technologies.

Base Channel   Supports a 10/100/1000 Base-T LAN port on the backplane of the AXIe shelf.

BMC   Baseboard Management Controller

BMR-H8S   Board Management Reference design for AdvancedTCA®

ESD   Electrostatic Discharge. See "ESD Precautions" on page 20

FRU   Field Replaceable Unit. A unit (such as a module or power supply) that the user can replace in the field. Many FRUs are not hot swappable.

GbE   Gigabit Ethernet. Ethernet at a rate of 1 gigabit per second.

GUID   globally unique identifier is a unique identifier number used in computer software.The term GUID also is used for Microsoft's implementation of the Universally Unique IDentifier (UUID). The value of a GUID is represented as a 32-character hexadecimal string, and is usually stored as a 128-bit integer

HPM   Hardware Platform Management. PICMG specification that defines an open mechanism to upgrade the resident management software and firmware.

IPMB   Intelligent Platform Management Bus. Based on the I^2C (also known as Inter IC, IIC or I2C) bus, the IPMB interface provide communication between components on a PC chassis; it is an internal chassis bus that also connects to the external chassis through a bridge chip.

KEYSIGHT
TECHNOLOGIES

IPMC **Intelligent Platform Management Interface.** It is used to monitor system health and manage the computer system.

IPMI Intelligent Platform Management Interface

KCS Keyboard Style Controller

LPC Low Pin count. An interface specification for legacy I/O. Allows legacy I/O of motherboard components, such a Super I/O chip, to migrate from the ISA/X bus to the new LPC interface while retaining software compatibility. It runs at the PCI 33MhZ clock making LPC much faster than the older ISA running with an 8MHz clock.

Multiple Chassis In a multiple chassis system, multiple chassis are controlled by a single controller, and the time base and triggering for each chassis operates independently from the other chassis. You can use the multiple chassis configuration to increase the number of chassis/modules that do not require a common time base or cross triggering between chassis. For more information, refer to Keysight's Multiple PXIe and AXIe Chassis Configuration tool. This tool is available on line at: www.keysight.com/find/pxie-multichassis.

OEM Original Equipment Manufacturer.

PCI Peripheral Component Interface bus. A standard for connecting hardware in a computer.

PCI-E PCI Express. Peripheral Component Interface Express (or PCIe) A standard to replace PCI.

PICMG® PCI Industrial Computer Manufacturers Group. PICMG is a consortium of hundreds of companies that develop open specifications for high performance telecommunications and industrial computing applications.

SATA Serial ATA or Serial Advanced Technology Attachment. A computer bus interface for connecting host adapters to mass storage devices (hard drives, etc.) This standard is also known as EIDE.

SerDes Serializer/Deserializer. Two blocks used in high speed communications to compensate for limited throughput. They convert data between serial and parallel interfaces.

Super I/O A class of ICs that combines interfaces for a variety of low-bandwidth devices such as serial ports, keyboard and mouse, temperature and fan speed monitoring, etc.

TPM Trusted Platform Module. An IC designed by the Trusted Computing Group (TCG) for storing passwords, encryption keys, digital certificates, etc.

UXGA   Abbreviation for Ultra eXtended Graphics Array referring to a standard monitor resolution of 1600×1200 pixels.

Glossary

+

Index

KEYSIGHT
TECHNOLOGIES