

Startup Guide

Keysight M9502A 2-Slot and  
M9505A 5-Slot AXIe Chassis





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1400 Fountaingrove Parkway  
Santa Rosa, CA 95403 USA

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[www.keysight.com/find/assist](http://www.keysight.com/find/assist) (world-wide contact information for repair and service)

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## General

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

### Before Applying Power

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

### Ground the Instrument

Keysight chassis' are provided with a grounding-type power plug. The instrument chassis and cover must be connected to an electrical ground to minimize shock hazard. The ground pin must be firmly connected to an electrical ground (safety ground) terminal at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

### Do Not Operate in an Explosive Atmosphere

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

### Do Not Operate Near Flammable Liquids

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

### Cleaning

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

### Do Not Remove Instrument Cover

Only qualified, service-trained personnel who are aware of the hazards involved should remove instrument covers. Always disconnect the power cable and any external circuits before removing the instrument cover.

### Keep away from live circuits

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

### DO NOT operate damaged equipment

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

### DO NOT block the primary disconnect

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

### Do Not Modify the Instrument

Do not install substitute parts or perform any unauthorized modification to the product. Return the product to an Keysight Sales and Service Office to ensure that safety features are maintained.

### In Case of Damage

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

## CAUTION

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

Do NOT operate with empty slots: To ensure proper cooling and avoid damaging equipment, fill each empty slot with an AXle 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  
CAT III  
CAT IV

IEC Measurement Category I, II, III, or 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.



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



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## ICES/NMB-001

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



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



South Korean Class A EMC Declaration. This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.

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Do not dispose in domestic household waste.

To return unwanted products, contact your local Keysight office, or see [www.keysight.com/environment/product](http://www.keysight.com/environment/product) for more information.





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## Introduction

The Keysight M9502A (2-slot) and M9505A (5-slot) AXIe chassis are modular instrument chassis fully compatible with the AXIe 1.0 specification. They allow multiple application-specific instrument modules to share a common chassis frame, power supply, cooling system, PCI Express (PCIe) Gen 2 data bus, Gigabit LAN hub, local bus for module-to-module signaling, and host PC connections. Multiple chassis may be interconnected for scalability, a feature Keysight calls MultiFrame. The full rack chassis provides two or five general purpose peripheral slots that accept 1U AXIe instrument modules. Each module slot has a Gen 2 x4 link (maximum of 2 GB/s data rate per module) to the chassis primary data 'fabric' hub—a x8 PCIe switch and data bus.

Both chassis include a half-height Embedded System Module (ESM), which is a system module which manages chassis functions. The ESM provides all ATCA (Advanced Telecommunications Computing Architecture) shelf manager functions, plus these AXIe extensions:

- provides host PC connectivity (Gen 2 PCIe x8 and/or Ethernet)
- sources timing signals (CLK100, SYNC and FCLK)
- routes STRIG (Star Trigger) to instruments through the backplane
- routes trigger signals through an external parallel trigger bus
- provides backplane PCIe and Ethernet communication between modules

### NOTE

This version of the M9505A/M9502A Startup Guide supports and describes features of the chassis firmware revision 1.3.23 (and later). This version of firmware adds features that were not available in previous firmware versions. Refer to the M9502A/M9505A User Guide for detailed information. These features include, but are not limited to:

- Support for E-Keying
- Fan speed adjustable from 35 to 100 (previously it was 8 to 15)
- Ability to force the ESM to PCIe Gen 1 speeds

To identify the chassis firmware revision, see “[Launch the Chassis Web Interface from Keysight Connection Expert](#)” on page 26.

To update chassis firmware, refer to the Keysight AXIe chassis web pages:  
[www.keysight.com/find/M9502A](http://www.keysight.com/find/M9502A) or [www.keysight.com/find/M9505A](http://www.keysight.com/find/M9505A)

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Other than a Power button and instrument status light, 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 M9536A) or *remote* (a rackmount, desktop, or laptop PC).

The shared Gen 2 x8 PCIe interface from the ESM to an external host PC provides up to a 4 GB/s data rate shared among installed modules.

**NOTE**

In order for a computer to serve as a host PC, its BIOS must support enumeration of the 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/axie-chassis](http://www.keysight.com/find/axie-chassis).

For general host PC requirements, such as operating system and RAM requirements, please refer to “[System Requirements](#)” on page 21.

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For the ESM and for each other installed modules, appropriate control software and instrument drivers must be installed on the host PC.

**This Startup Guide** provides the basics to get you started with your AXIe chassis, including:

- A high-level overview of the 2-slot and 5-slot AXIe chassis and basic nomenclature
- Unpacking the contents and planning your installation
- Connecting to a host PC
- Loading software
- Verifying basic chassis operation

**Detailed instructions** for installation, configuration, operation, troubleshooting and service can be found in the *M9502A/M9505A AXIe Chassis User Guide*, provided in PDF format on the *Software and Product Information CD* that came with your chassis.

**NOTE**

**IMPORTANT: The installation and setup information in this manual is generic.** Some AXIe modules and systems 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.

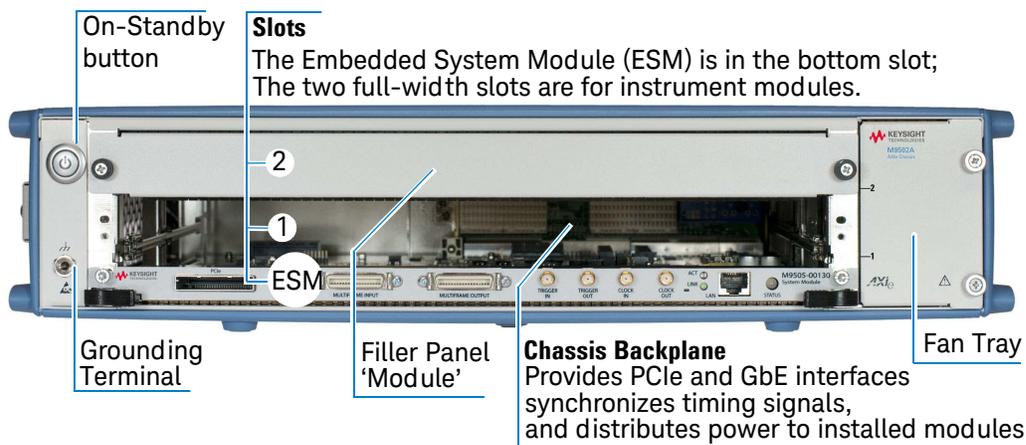
For example, installation of the Keysight IO Libraries (“[Step 5: Install IO Libraries Suite and Connect to the Web Interface](#)” in this manual) is not required for all AXIe systems.

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## M9502A 2-Slot AXIe Chassis at a Glance

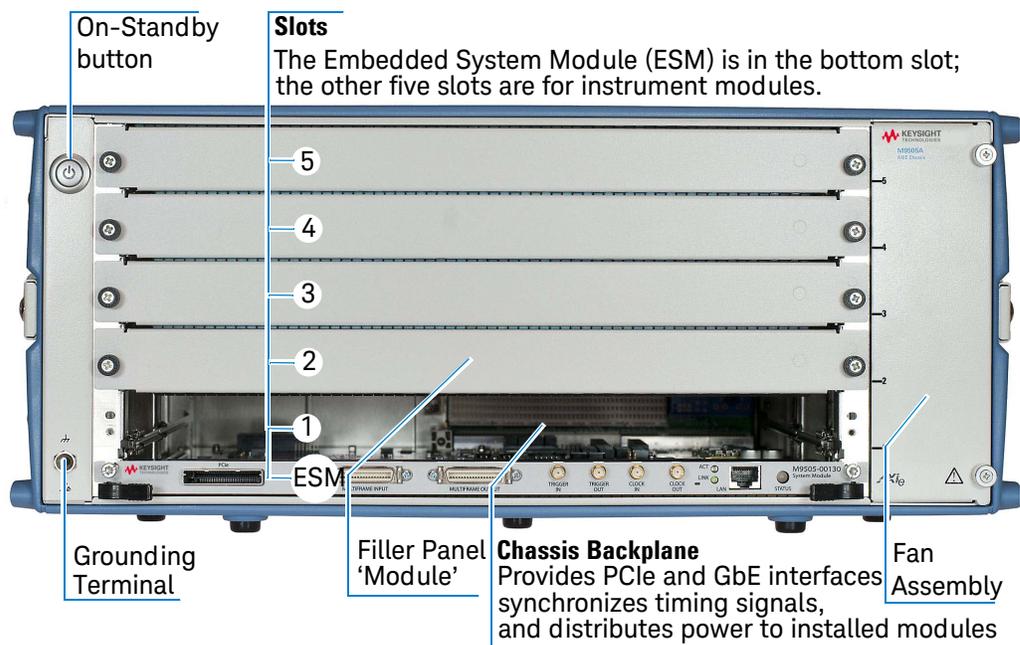
Designed for portable or small system testing, the M9502A is shipped with bumpers and a carry handle installed for benchtop use (these remove for rack mounting), Slot 1 open and a filler panel module installed in Slot 2. The front panel is shown below:

Front Panel

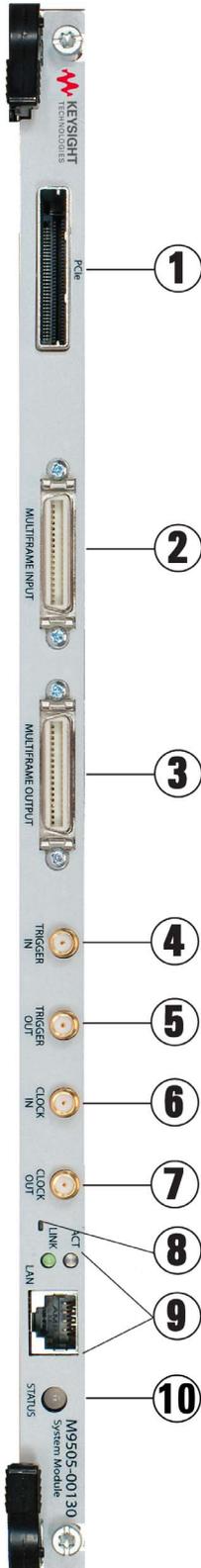


## M9505A 5-Slot AXIe Chassis at a Glance

The M9505A is shipped with bumpers and two carry handles installed for benchtop use (these remove for rack mounting), Slot 1 open and filler panel modules installed in Slots 2 through 5. The front panel is shown below:



## AXIe Embedded System Module (ESM)



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

- 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
- synchronizes timing across all modules through the Trigger Bus, using an internal or external clock source

### ESM Front Panel

|    |                   |   |
|----|-------------------|---|
| 1  | PCIe              | Connects a remote host PC to the chassis via PCIe. Gen 2 compliant PCIe x8 connector.   |
| 2  | MULTIFRAME INPUT  | Synchronizes timing signals with multiple daisy-chained chassis (either 2-slot or 5-slot). 36-pin mini D connectors use accessory Keysight cables.  |
| 3  | MULTIFRAME OUTPUT | Gets timing signals from the previous chassis.  |
| 4  | TRIGGER IN        | Provides timing signals to the next chassis. If this chassis is at the head of the chain, it becomes the master, using an internal or external clock to send timing signals to other chassis in the chain.  |
| 5  | TRIGGER OUT       | External trigger connections. SMA connectors with ESD suppression.  |
| 6  | CLOCK IN          | Accepts an external trigger. Adjustable threshold input range -5V to +5V, 250 mV minimum swing.   |
| 7  | CLOCK OUT         | Extends the parallel trigger bus to external instruments. 3.3V CMOS, 50Ω line drive, 3-state.   |
| 8  | RESET             | External clock connections. SMA connectors with ESD suppression.  |
| 9  | LAN               | Accepts an externally sourced timing input. Input range -5V to +5V, AC coupled, unterminated, 100 mV minimum swing.   |
| 10 | STATUS Light      | Extends the internal clock source to external instruments. 3.3V CMOS, 50Ω line drive, 3-state.  |
| 9  | LAN               | Reset chassis. Insert a small pin, hold until Status light turns amber, remove pin.   |
| 9  | LAN               | Connects the host PC to the chassis, RJ45 connector. Tri-rate 10/100/1000 Base-T, auto crossover. Green LINK light and amber ACT light indicate power and port activity. An embedded controller module does not use this port; it communicates with the ESM through the chassis backplane. The LAN port is for communication with the AXIe chassis, not individual modules. |
| 10 | STATUS Light      | The status indicator light is a bi-color LED. Green indicates normal operation. Red indicates a power-up error. Both lights on (amber) indicates the chassis is powered on and booting.   |

## AXle Embedded System Module (ESM) Option U20 with USB



The Option U20 ESM provides the same features as the standard ESM and adds a USB 2.0 port\*.

### NOTE

The USB port is supported only for specific Keysight AXle modules and software. Refer to the documentation for the supported modules and software for USB use and operating instructions.

This USB port provides the following features:

- It enables using the AXle chassis and the supported USB compatible AXle modules and software with any host controller that has a USB 2.0 port.
- Either the USB port or the PCIe port may be used -- but not both simultaneously. To change connectivity between USB and PCIe, power down the chassis and host PC. Connect either a USB or PCIe cable, but not both. Power up the system.
- USB provides easy PC connectivity and uses less expensive and longer cables than PCIe. USB is physically hot pluggable, however you must restart the software controlling the module(s) when a USB connectivity change is made. You do not need to reboot the chassis or host PC.
- USB provides control for the chassis and the Keysight Logic Analysis and Protocol Test Modules but not other AXle modules. USB-compatible and PCIe compatible modules cannot be used at the same time. If you are controlling an AXle module via USB, you must change cable connections and reboot the host PC before controlling an AXle module via PCIe.

### STOP!

**IMPORTANT: The installation and setup information in this manual is generic.**

The USB port is supported only through specific Keysight software applications and modules such as the Keysight logic and protocol analyzer software and modules. These AXle systems that use the USB port may require a different installation and setup procedure than described in this manual. Refer to the installation documentation supplied with your AXle module or system for detailed installation information.

### CAUTION

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

\* The USB port requires AXle chassis firmware 1.3.37 or later. Refer to M9502A/M9505A User Guide.

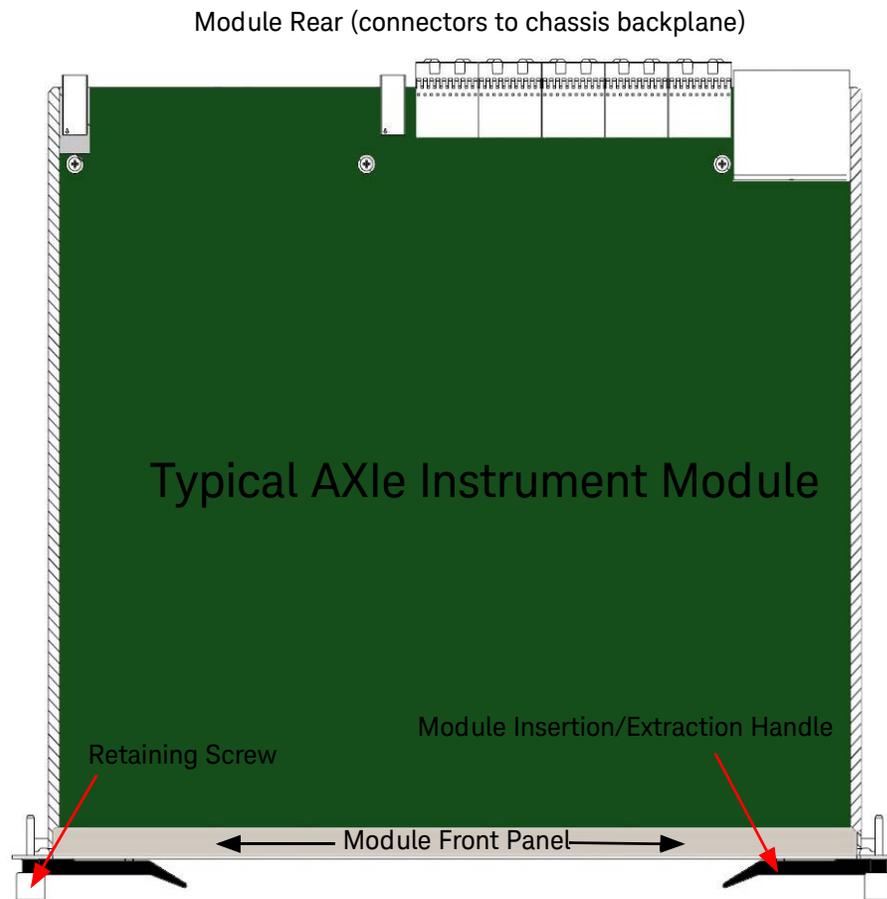
## AXle Instrument Modules

The chassis slots accept AXle instrument modules. These may comprise one or more instruments for signal injection, data acquisition, and measurement. They can be installed in any available AXle slot.

There are two special types of instrument modules which, if used, are most typically installed in slot 1 (consult the module vendor for specific slot placement requirements).

- An instrument hub module – a specialty instrument module which also acts as a hub for a secondary vendor-defined data fabric.
- An *embedded controller module* – this is a host PC with a form factor and backplane connections specifically designed for an AXle chassis such as the Keysight M9536A. It uses the chassis backplane for PCIe and LAN connection to the ESM.

The drawing below illustrates the AXle 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.

## AXIe System Block Diagram

A block diagram of a M9505A 5-slot AXIe chassis system is presented on [page 9](#), showing the chassis and the host PC. The key points regarding this diagram are:

- The diagram shows the two host PC interfaces to the chassis: (1) The PCIe interface and (2) the LAN interface. The PCIe interface signals are routed through the chassis PCIe Switch to the slot x4 PCIe signals. The LAN interface signals are routed through the LAN Switch to the slot Gb Ethernet signals. The PCIe interface signals can also be routed to the slot Gb signals (through the network interface card and the LAN Switch). However, the LAN interface signals cannot be routed to the slot x4 PCIe signals.
- The network interface card (NIC) is an Intel 82573L 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 82573L NIC will appear to Windows as a locally-installed device. While Windows Vista and Windows 7 provide the necessary Intel NIC driver, Windows XP does not natively include the required Intel NIC driver. If you're using the PCIe interface on Windows XP and you see the **Found New Hardware Wizard** shown on the block diagram, you'll need to install the Intel PROWin32.exe network driver as described in ["Step 5: Install IO Libraries Suite and Connect to the Web Interface"](#) on [page 21](#) in this guide.

- 
- Either the M9045 PCIe ExpressCard Adapter or the M9048 PCIe Desktop Adapter are installed in the host PC to provide a PCIe interface. The M9045 PCIe Express Card Adapter is used in laptop computers and the M9048 PCIe Desktop Adapter is used in desktop or rack-mount computers. A PCIe cable connects the adapter to the AXIe chassis. For LAN access, a standard Ethernet cable is used to connect between the host PC and the chassis.
  - 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 a soft front panel (SFP). The SFP runs on the host PC and provides the same monitor and control functionality as the Web Interface.
  - Keysight provides two host PC drivers for the AXIe chassis:
    - 1 AgM950x** – Also known as the *sensor driver*, this driver interfaces to chassis sensor functionality such as the voltage threshold sensors.
    - 2 AgM950xSC** – Also known as the *trigger driver*, this driver interfaces to chassis functionality such as the trigger subsystem Crosspoint Switch.

For further information on these drivers, please see the *User Guide*.

- The chassis contains firmware that is customer upgradeable. To determine the current version of your chassis firmware and to check if a later version is available, go to the website below for your product, then click the tabs/links indicated:

**M9502A:** [www.keysight.com/find/M9502A](http://www.keysight.com/find/M9502A), then **Technical Support > Drivers & Software > Firmware Update**

**M9505A:** [www.keysight.com/find/M9505A](http://www.keysight.com/find/M9505A), then **Technical Support > Drivers & Software > Firmware Update**

The **Firmware Update** web page also describes how to download and install the chassis firmware.



## Performing the Startup Steps

The remainder of this Startup Guide describes how to unpack and inspect the chassis, connect it to a host PC, power-up the chassis and verify basic operation. It is not necessary to install modules or device drivers to do this.

**Exception:** If you decide to use an embedded controller module, such as Keysight's M9536A, as your Host PC, you will need to install it before proceeding to Step 3. Module installation instructions are in the *User Guide*.

Keysight recommends you follow these steps in preparing and turning on the chassis:

Step 1: Unpack and Inspect the Chassis

Step 2: Verify Shipment Contents

Step 3: Power-Up and Power-Down

Step 4: Set Up the Host PC

Step 5: Install IO Libraries Suite and Connect to the Web Interface

Step 6: Install the Chassis Software

Step 7: Next Steps

In Step 7, you will download the *M9502A/M9505A AXIe Chassis User Guide*. Continue with the User Guide to complete installation, learn the chassis's features and operation, and access service information.

### NOTE

**IMPORTANT:** The installation and setup information in this manual is generic. Some AXIe modules and systems 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.

For example, installation of the Keysight IO Libraries (“[Step 5: Install IO Libraries Suite and Connect to the Web Interface](#)” in this manual) is not required for all AXIe systems.

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## Step 1: Unpack and Inspect the Chassis

### CAUTION

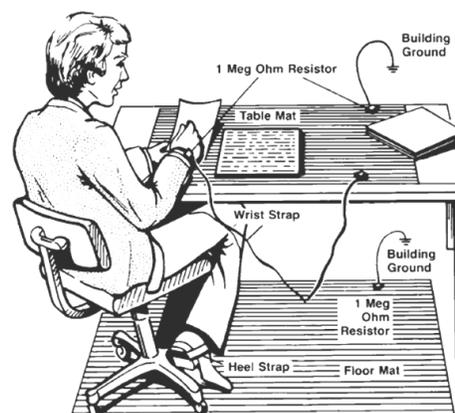
Keysight's AXIe chassis and instrument modules are shipped in materials which prevent static electricity damage. These instruments should only be removed from the packaging in an anti-static area ensuring that correct anti-static precautions are taken. Store all modules in anti-static envelopes when not installed.

### ESD

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

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

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



### Inspect for damage

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

To find warranty information on your M9502A or M9505A AXIe chassis, go to [www.keysight.com/find/warranty](http://www.keysight.com/find/warranty) and enter your model number (M9502A or M9505A) in the **Product Number** field, and enter the serial number from the chassis rear panel in the **Serial No.** field.

### CAUTION

To avoid damage when handling the AXIe chassis and modules, do not touch exposed connector pins.

## If You Should Need to Return the Chassis for Service

Should you need to return the chassis for service, follow these steps:

- 1** Review the warranty information for your product.
- 2** Contact Keysight to obtain a Return Material Authorization (RMA) and return address. If you need assistance finding Keysight contact information go to [www.keysight.com/find/assist](http://www.keysight.com/find/assist) (worldwide contact information for repair and service) or refer to the Support information on the product web page at [www.keysight.com/find/axie-chassis](http://www.keysight.com/find/axie-chassis).
- 3** Write the following information on a tag and attach it to the malfunctioning equipment.
  - Name and return address of owner. A Post Office box is not acceptable as a return address.
  - Product model number (for example, M9502A)
  - Product serial number (for example, TWxxxxxxxx). The serial number label is located on the chassis back panel. The serial number can also be read via LAN interface, but only after the software is installed.
  - *Completely describe the failure and service required.* Provide as much detail as possible about your chassis and host PC configuration, the nature of the problem and the conditions under which it occurred.
- 4** Carefully pack the chassis in its original ESD bag and packing carton. If the original carton is not available, use bubble wrap or packing peanuts and place the instrument in a sealed container and mark the container “FRAGILE”.
- 5** On the shipping label, write ATTENTION REPAIR DEPARTMENT and the RMA number.

**NOTE**

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

---

## Step 2: Verify Shipment Contents

Your shipment should include the following:

**Chassis** The Keysight chassis that you ordered. Any AXIe modules you may have ordered from Keysight do not come pre-installed; they will be in separate shipments.

**Chassis Power Cord** For country of destination.

**Startup Guide** This document, *AXIe Chassis*, in print.

**CD #1** *Keysight M9502A and M9505A AXIe Chassis Software and Product Information*. This CD covers both the 2-slot and 5-slot AXIe chassis, and includes:

- Keysight M9502A/M9505A AXIe Chassis Startup Guide

This document (printable PDF).

- *Keysight M9502A/M9505A AXIe Chassis User Guide*

A complete guide for chassis installation, configuration, operation, troubleshooting and service (printable PDF).

- *Keysight M9502A/M9505A Data Sheet*.

The Data Sheet contains complete physical and electrical specifications for the chassis (printable PDF).

- Chassis device drivers
- Help files for the Keysight M9502A/M9505A IVI-COM/C AgM950x and AgM950xSC device drivers (CHM files)
- Help file for the Keysight M9502A/M9505A LabVIEW G device drivers (CHM file)

The interactive help provides instruction for programming the chassis using National Instruments Labview.

- Chassis soft front panel (SFP) and its help file

**CD #2** *Keysight IO Libraries Suite 16.x, Keysight Automation Ready CD*

This Keysight utility provides for communication with and control of the chassis from a Windows-based host PC.

Product specifications, available accessories, firmware and software may change over time. Please check the Keysight website at [www.keysight.com/find/axie-chassis](http://www.keysight.com/find/axie-chassis) for the latest updates to the product software, guides, data sheet and help files.

## Step 3: 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)

### ON/STANDBY Switch

The chassis' button on the front of the chassis is the **ON/STANDBY** switch, lit when the chassis is ON:



**STANDBY**  
(off if power is disconnected  
or breaker is open)



**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 (not depressed) position, 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. Fans may operate.

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

## To Power Up the Chassis

**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.

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

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

The **STATUS** light on the ESM will cycle as follows:

- 1 Light off - with button in **STANDBY** mode
- 2 Amber, steady - after pressing switch, ESM is performing a power-on self-test
- 3 Green, blinking - for a few seconds after POST
- 4 Green, steady - successful chassis power-up is complete



If the chassis does not power up to a steady green Status light, or powers up to a steady red light as shown below, the chassis has a failure and requires service.



## To Power Down the Chassis

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

### CAUTION

If you are using an embedded controller such as the Keysight M9536A, always shut down the Windows operating system before pressing the chassis **ON/STANDBY** switch.

### 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.

## Step 4: Set Up the Host PC

Communication with the Embedded System Module (ESM) and installed instrument modules requires a *host PC*, a Windows based computer that may be:

**Embedded (takes up slot one in the chassis).** An AXIe embedded PC (also commonly called an *embedded controller module*) allows for mainframe portability and stand-alone test system operation. PCIe and LAN connections from PC to ESM are made directly at the chassis backplane.

### NOTE

If you decide to use an embedded controller module as your host PC, you will need to install at least that module in the chassis before proceeding with this section. See the *M9502A/M9505A AXIe Chassis User Guide* for complete module installation instructions.

**A separate rack-mounted or desktop PC.** To use the chassis PCIe data transfer capabilities, this host PC must have an available PCIe x8 slot and BIOS support for proper enumeration of devices on the PCIe bus. PCIe connection from host PC to ESM requires a PCIe adapter card and cable. Keysight recommends use of a PC, card and cable tested with the AXIe mainframe; a current list can be found at [www.keysight.com/find/axie-chassis](http://www.keysight.com/find/axie-chassis).

**A laptop PC.** To use the chassis PCIe data transfer capabilities, this PC must have an ExpressCard slot and support proper enumeration of devices on the PCIe bus. PCIe connection from laptop to ESM requires an ExpressCard PCIe cable adapter and cable. Keysight recommends use of a laptop, card and cable tested with the AXIe mainframe; a current list can be found at [www.keysight.com/find/axie-chassis](http://www.keysight.com/find/axie-chassis).

### NOTE

To ensure proper system operation, you should use an approved (embedded, rackmount, desktop or laptop) host computer along with an approved PCIe adaptor 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 [www.keysight.com/find/axie-chassis](http://www.keysight.com/find/axie-chassis). For the recommended PCIe host adapter cards and cables, see [page 18](#).

General controller requirements (such as operating system and RAM) are listed in “[System Requirements](#)” on [page 21](#).

### CAUTION

You should not enable the Microsoft Windows sleep or hibernate modes on the host PC. The controller may not have proper chassis enumeration when it wakes up and unpredictable operation may result.

## Hardware Connections to the Host PC

### CAUTION

Except where noted, connections between the host PC and the chassis Embedded System Module (ESM) should be made with both the PC and chassis powered off.

---

Physical connections to the host PC may include monitor, mouse, and keyboard; LAN and/or PCIe (to the AXIe chassis); and corporate LAN. Make the following connections as needed.

### For Local Control

If you need local access to the host PC, connect a monitor, mouse, and keyboard.

### For Remote Control

If you need remote desktop access to the host PC, connect a cable from the PC to your corporate LAN, using Gigabit Ethernet cable.

### From AXIe Chassis to the Host PC

The connection between the chassis and the host PC may vary depending on whether you're performing chassis turn-on or using the chassis in production:

- **Turn-on:** Keysight recommends that you make a LAN-only connection to the chassis for initial turn-on – this is the simplest connection and doesn't require installation of a PCIe adapter card in the host PC. The host PC can either be connected directly to the ESM with a crossover Gigabit Ethernet cable, or can be connected through your network with a straight Ethernet cable.
- **Production:** The production connection between the host PC and the chassis depends on your application. For LAN instrument modules or LXI instrument support, connect the host PC to the ESM directly with a crossover Gigabit Ethernet cable, or through your network with a straight cable.

If you're using PCIe modules in the chassis, use the chassis PCIe interface. This will require installing a PCIe adapter card in the host PC. As described in section [“AXIe System Block Diagram”](#) on page 7, the PCIe interface may be used to access both the slot PCIe interfaces and the slot Gb interfaces. However, the chassis LAN interface cannot access the slot PCIe interfaces.

For PCIe cable recommendations, see [“Specific PCIe Adapter and Cable Recommendations”](#) on page 18. The PCIe adapter card will likely require that you load its device driver for your Windows environment, perhaps before installing the adapter card. Follow the adapter vendor's installation instructions.

**NOTE**

As shown on the AXle system block diagram, an Intel network interface card (NIC) is connected to the PCIe switch in the chassis. The NIC will appear to the PC as if it is installed in the PC itself. Therefore, an Intel network driver must be installed on the PC in order for PCIe interface communications through the NIC to work. This driver is not automatically installed for Windows XP Operating systems. Refer to [“Install Intel Network Driver on Windows XP, if Needed”](#) on page 24 for installation information.

The chassis supports hybrid operation with both types of modules (PCIe and LAN) installed in the chassis. If needed or desired for flexibility, make both PCIe and Ethernet connections.

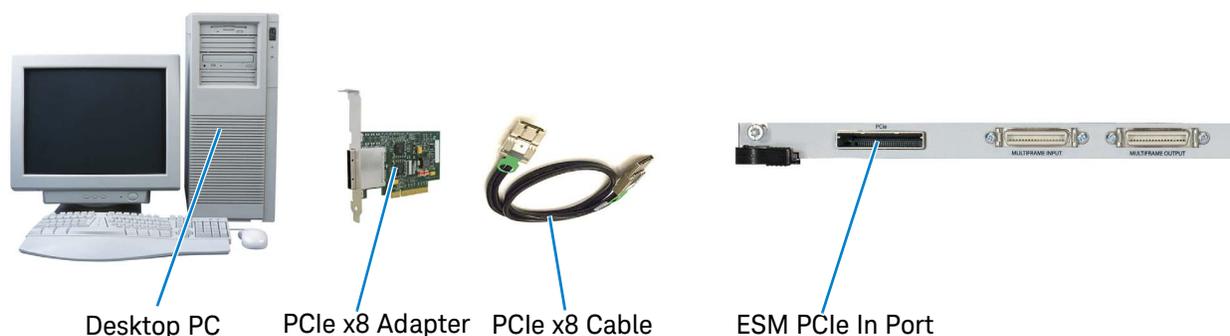
### Specific PCIe Adapter and Cable Recommendations

**If Using an Embedded Controller** This PC (such as the Keysight M9536A) communicates with the ESM through the backplane; external PCIe and Ethernet connections from embedded controller to chassis are not required.

**NOTE**

With the Keysight M9536A Embedded Controller installed in the AXle chassis, the x8 PCIe connection on the ESM module is disabled. However, the PCIe cable detect mechanism may reset the hardware when attaching a PCIe cable. This hardware reset may change the LAN (TCPIP) address.

**If Using a Desktop or Rackmount PC** Install a compatible PCIe Cable Adapter in the PC. Connect the adapter to the ESM PCIe port.



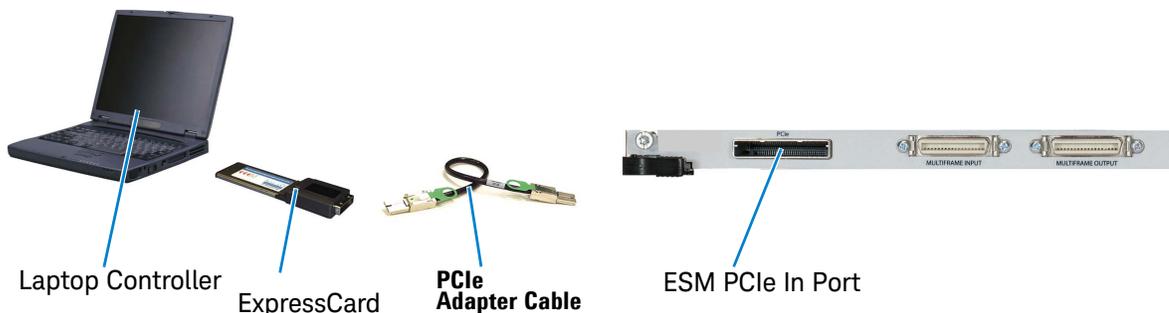
The following *desktop* PCIe adapter card and cable are recommended:

Keysight M9048

Keysight Y1202A (2 meters)

## Step 4: Set Up the Host PC

**If Using a Laptop PC** Install a compatible PCIe ExpressCard Adapter in the laptop PC. Connect the adapter to the ESM on the AXIe chassis.



The following *laptop* PCIe adapter card and cable are recommended:

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Keysight M9045

Keysight Y1200A (2 meters)

---

## Connection Examples

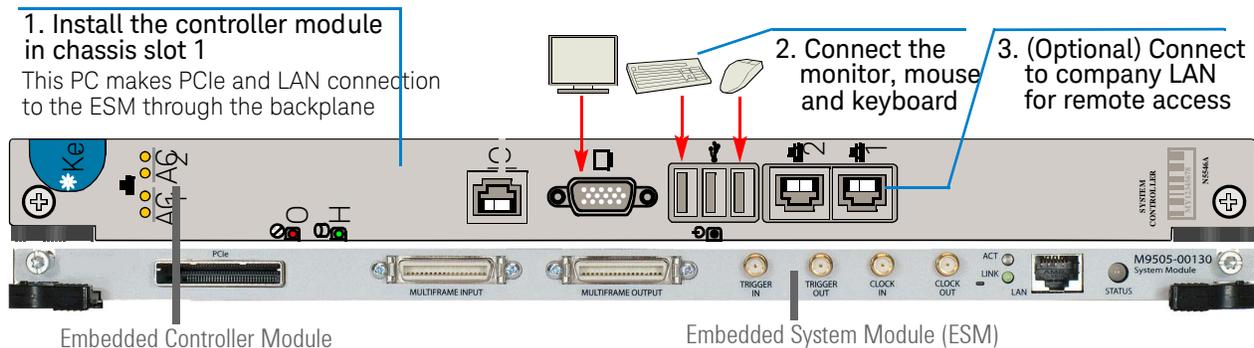
### Example A: Connecting an Embedded Controller

1. Install the controller module in chassis slot 1

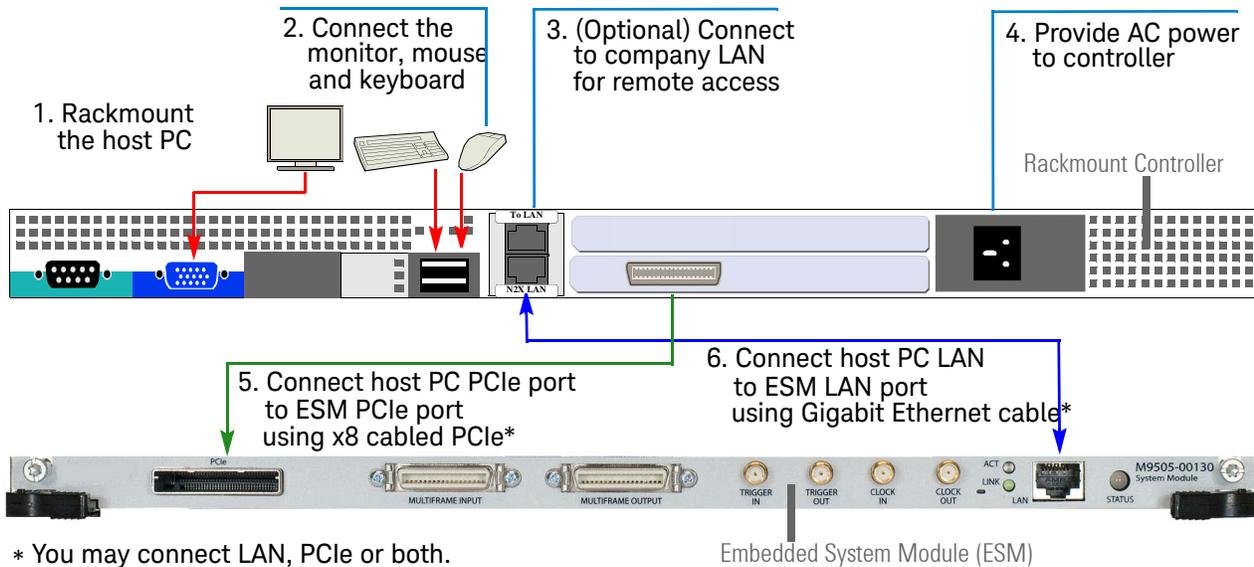
This PC makes PCIe and LAN connection to the ESM through the backplane

2. Connect the monitor, mouse and keyboard

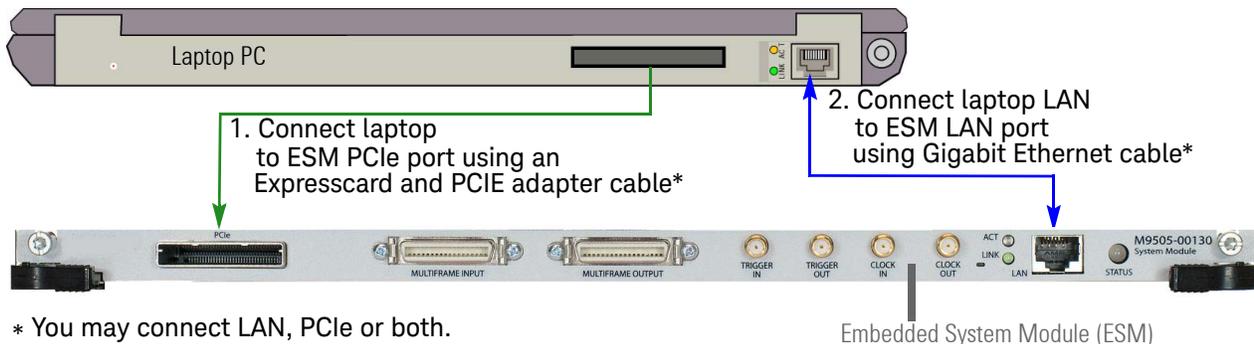
3. (Optional) Connect to company LAN for remote access



**Example B: Connecting a Separate, Rackmounted Host PC (desktop PC is similar)**



**Example C: Connecting a Laptop PC**



## Step 5: Install IO Libraries Suite and Connect to the Web Interface

This step describes how to install the Keysight IO Libraries Suite and verify that the chassis can be found by Keysight Connection Expert, which is part of IO Libraries Suite.

### NOTE

**IMPORTANT:** The installation and setup information in this manual is generic. Some AXIe modules and systems 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.

For example, installation of the Keysight IO Libraries is not required for all AXIe systems.

---

As described in section [AXIe System Block Diagram](#) on page 7, you can use either the Web Interface or the soft front panel (SFP) to monitor and control the chassis. In this step, the Web Interface is used to verify that the host PC can communicate to the chassis. Using the SFP to monitor and control the chassis is described in the *M9502A/M9505A AXIe Chassis User Guide*.

### System Requirements

To install and run the required software (Microsoft .NET, Keysight IO Libraries version 16.x, and chassis device drivers), the host PC will need:

|                                  |  |   |
|----------------------------------|--|---|
| <b>Operating System</b>          | Windows XP with SP3                            | Windows Vista or Windows 7, 32 or 64-bit                              |
| <b>Browser</b>                   | Microsoft Internet Explorer 6                  |   |
| <b>Minimum RAM</b>               | 256 MB (Windows XP)<br>1 GB (Vista, Windows 7) | 4 GB  |
| <b>Available Hard Disk Space</b> | 1.5 GB   |   |
| <b>Graphics</b>                  | SVGA, 800x600, 256 color                       | Support for DirectX 9 graphics with 128MB graphics memory recommended |

## Installing the Keysight IO Libraries Suite

Note that IO Libraries Suite version 16.0 or later is required to access the chassis features. We recommend that you always use the latest version of Keysight IO Libraries.

### NOTE

Only one installation of the Keysight IO Libraries Suite is required on the host PC. This installation is used by both the M950x software that is installed in the next section as well as the drivers associated with each module that you install in the chassis.

---

### NOTE

Two libraries, **IVI Shared Components** and **VISA Shared Components**, are required by the IO Libraries Suite. If these libraries are not already installed on your controller, the IO Libraries Suite installer will install them. If **IVI Shared Components** and **VISA Shared Components** are already installed, the IO Libraries Suite installer will upgrade these libraries to the latest version, if necessary, using the same installation location used by the previous version.

---

- 1 Insert the *Keysight IO Libraries Suite 16.x, Keysight Automation Ready CD* into the optical drive of your PC.
- 2 Wait a few seconds for the auto-run window to appear. If the auto-run window does not appear automatically,
  - Click **Start > Run...**
  - Type:  
`<drive>:Autorun\IOLibraries.hta`  
where <drive> is your optical drive letter.
- 3 Follow the installer prompts to install the Keysight IO Libraries Suite.

### NOTE

The latest version can be downloaded from: [www.keysight.com/find/iosuite](http://www.keysight.com/find/iosuite).

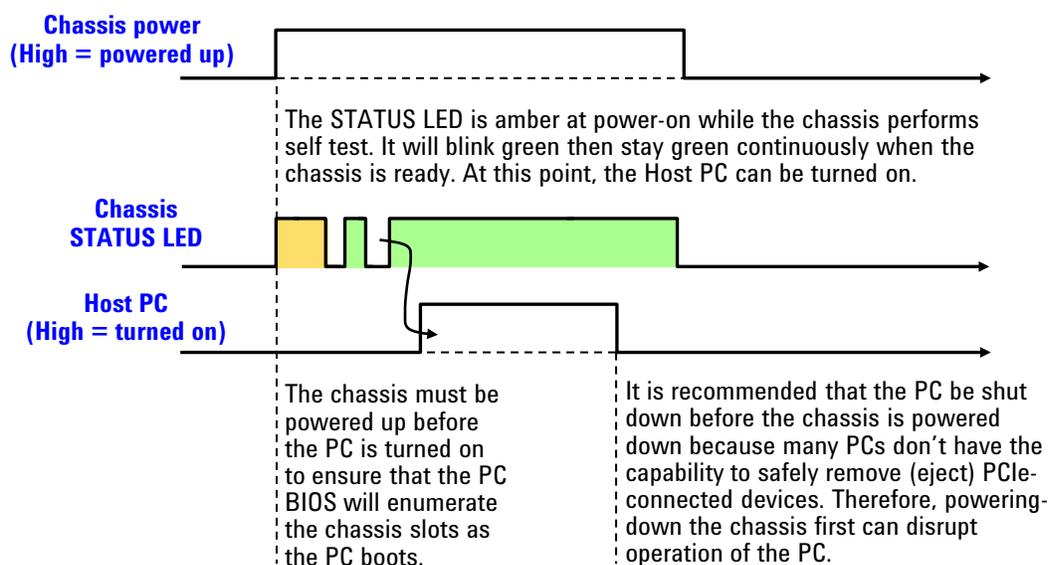
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## Turning on the Chassis

In powering the chassis up or down, please follow the steps listed in “[Step 3: Power-Up and Power-Down](#)” on page 14 and the sequences shown below.

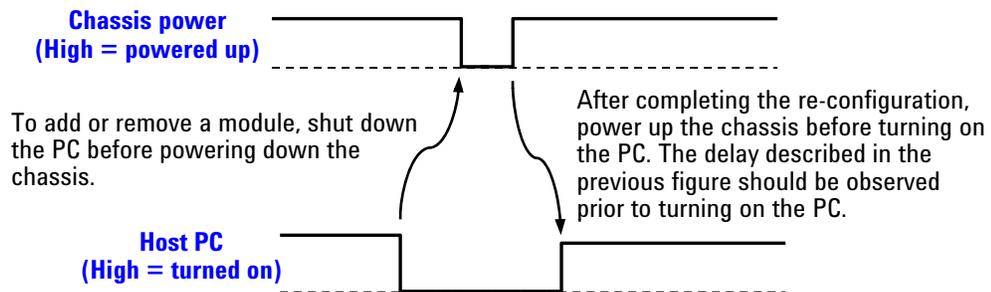
### CAUTION

The chassis and host PC must be powered up and down in the following sequence. The chassis should be powered up first, which will initiate its built-in self test. During self test, the chassis STATUS LED will be amber. The STATUS LED will blink green and then stay green continuously when the ESM is ready. The ESM then powers up each module slot. The PC should be turned on only after all installed modules have performed their initialization—see your module documentation for initialization information.



In brief, the host PC must be off whenever the chassis is powered up or down. The power sequencing shown above doesn't apply to an embedded controller (because an embedded controller and chassis are powered simultaneously).

In the figure below, the previous diagram is applied to the situation where the chassis configuration is changed. Because modules are not hot-swappable, the chassis must be powered down before modules are added or removed. As you can see, the host PC is shut down before the chassis is powered down, and then the PC is turned on after the chassis is powered up.



There are other situations where a host controller restart may need to be performed, including:

- When Windows detects the presence of a new module (that is a new module was added to the chassis without powering down the PC)
- When Keysight Connection Expert fails to detect the presence of the chassis
- Whenever you detect or suspect that the host PC has an incorrect view of how the chassis is configured

## Install Intel Network Driver on Windows XP, if Needed

As described in the section “AXIe System Block Diagram” on page 7, the chassis contains an Intel 82573L NIC as a PCIe endpoint. This NIC will appear to Windows as a device installed directly in the host PC. While Windows Vista and Windows 7 provide the necessary Intel NIC driver, Windows XP does not natively include the NIC driver and you will be prompted to install it during the driver installation. If you are using the chassis on Windows XP and if you see the dialog partially shown below, you’ll need to install the Intel PROWin32.exe network driver.



To install the Intel PROWin32.exe driver, perform the following steps:

- 1 Run the PROWin32.exe installation program from either:
  - Program Files/Keysight/M950x/Network Driver/Windows XP**  
(for 32-bit Windows XP systems)
- 2 After driver installation is complete, restart your PC. The Ethernet Controller **Found New Hardware Dialog** should no longer appear.

## Using Keysight Connection Expert to Confirm Connection to the Chassis

This section describes use of Keysight Connection Expert to confirm that the host PC can connect to the chassis. Keysight Connection Expert is installed during the installation of Keysight IO Libraries Suite.

### NOTE

This section assumes Keysight IO Libraries Suite version 16.2 is installed. Earlier versions of IO Libraries Suite behaved differently. Always use the latest version of Keysight IO Libraries Suite.

---

### NOTE

Keysight Connection Expert will use either the LAN interface or the PCIe interface to connect to the chassis, whichever interface is cabled between the host PC and the chassis. Both of these interfaces will appear under the LAN category in Keysight Connection Expert. The listing of the PCIe interface under the LAN category is due to the presence of the Intel 82573L NIC as a chassis PCIe endpoint.

---

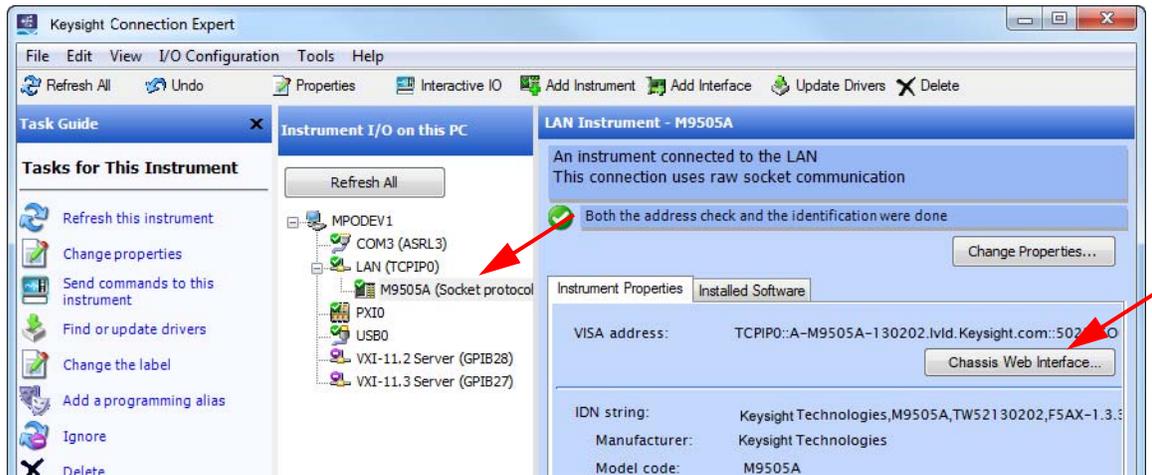
### NOTE

The section “[Host PC/Chassis Interface Topics](#)” on page 29 includes a number of interface topics that may be of assistance in establishing a connection between the host PC and the chassis.

---

- 1 Launch *Keysight Connection Expert* using one of these methods:
  - If you allowed the Automation Ready CD to place an icon on your desktop, double-click the icon to launch the program.
  - From the Windows Start menu, select **All Programs\Keysight IO Libraries Suite\Keysight Connection Expert** to launch the program.
  - From a Command Prompt window, type:  
`<c>:\Program Files\Keysight\IO Libraries Suite\KeysightConnectionExpert.exe`  
to launch the program.

The **Keysight Connection Expert** window displays:



- 2 The **Instrument I/O on this PC** pane shows instrument connections on your PC. Note that the AXIe chassis (M9502A in this screen capture) is listed under the PXIO Interface and the LAN (TCPIP0) interface. You may need to manually add it to the LAN interface.

## Launch the Chassis Web Interface from Keysight Connection Expert

This section describes how to launch and use the chassis Web Interface. Note that the Chassis Web Interface can be accessed over LAN or PCIe, whichever interface is connected. Note also that the chassis soft front panel (SFP) provides many of the same capabilities as the Web Interface. However, using the Web Interface requires only a browser on the host PC, whereas using the SFP requires installing the AXIe chassis software (which includes the SFP) on the host PC.

- 1 To launch the Chassis Web Interface, click the **Chassis Web Interface...** button. The Web Interface will be displayed in a new window:

### NOTE

If IO Libraries Suite is not installed, access to the Web interface is through your browser using the default local 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.

The home page displays information about your chassis and the connection to the chassis. Click the **Advanced Information** button to view additional information.

Step 5: Install IO Libraries Suite and Connect to the Web Interface

Support | Products |

**KEYSIGHT TECHNOLOGIES** M9505A AXle 5 Slot Chassis

Welcome to your **Web-Enabled M9505A AXle 5 Slot Chassis**

Information about this Web-Enabled M9505A:

|                            |   |
|----------------------------|---|
| Instrument:                | M9505A  |
| Serial Number:             | A987EA1030  |
| Description:               | M9505A AXle 5 Slot Chassis                        |
| DNS Hostname:              | A-M9505A-EA1030                                   |
| IP Address:                | 156.140.92.134                                    |
| mDNS Hostname:             | A-M9505A-EA1030.local                             |
| mDNS Instrument Name:      | Keysight M9505A AXle 5 Slot Chassis - A987EA1030  |
| VISA TCPIP Connect String: | TCPIP::156.140.92.134::5025::SOCKET               |
| Firmware Revision:         | F5AX-1.3.38-0108-A002e-B12062214-CA1.2-DA1.0-E1.4 |

Chassis Firmware Version →

Turn On Front Panel Identification Indicator

Advanced information about this Web-Enabled M9505A

|                           |                          |
|---------------------------|--------------------------|
| Ethernet (MAC) Address:   | 00:18:49:00:F9:C8        |
| IP Address Configuration: | Automatic                |
| Subnet Mask:              | 255.255.248.0            |
| Default Gateway:          | 156.140.88.1             |
| DNS Servers:              | 156.140.2.12 156.140.2.8 |

Use the navigation bar on the left to access your M9505A and related information.

**AXle** AdvancedTCA® with extensions for instrumentation and test

The six buttons at left are the Web Interface’s menu: At right is a brief description of what you can do on each page.



**Home Page** - View General Information about the chassis, such as product identification, firmware version and LAN parameters.



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



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



**Trigger Routing Page** - Configure static trigger routing from all chassis-based sources to the backplane and external connectors.



**Chassis Health Page** - Displays PSU voltages, fan speeds and temperature. Provides detailed event alarms for the chassis and any installed Intelligent Platform Management Bus (IPMB)-equipped instrument modules.



**Help Page** - General help topics and context-based help for the current page.

The *M9502A/M9505A User Guide* has a chapter covering the Web Interface, with examples showing all parameters you can view or configure.

## Step 6: Install the Chassis Software

You can monitor and control the chassis entirely from the Web Interface. To use the chassis SFP to monitor and control the chassis, and to develop programs to control the chassis, you will need to install the chassis software (IVI or LabVIEW) appropriate for your programming environment. To do so:

- 1 Insert the *AXIe Chassis Software and Product Information* CD in the host PC. If you do not have the CD, you can download the most recent version at [www.keysight.com/find/axie-chassis](http://www.keysight.com/find/axie-chassis).
- 2 Click the **Install Driver Software** button and follow the browser prompts to install the drivers you will need.

The *User Guide* describes how to bring up the SFP and how to get started with programming the chassis.

## Step 7: Next steps

Now that you have completed basic Startup, Keysight recommends you access and read the *User Guide*. To do so:

- 1 Insert the *M9502-10001 AXIe Chassis Software and Product Information* CD in the host PC.

When the Software and Product Information CD screen loads, note that the chassis literature is listed at center. You may access all chassis documentation—both CD-based and via Internet links—from the links in this screen.

- 2 Click the **User Guide** link to access the document.

## Host PC/Chassis Interface Topics

This section lists a number of host PC/chassis interface topics that may be of assistance in establishing a connection between the host PC and the chassis. Unless otherwise noted, these topics relate to interfacing to the chassis components themselves, such as the ESM, not to modules in the chassis slots.

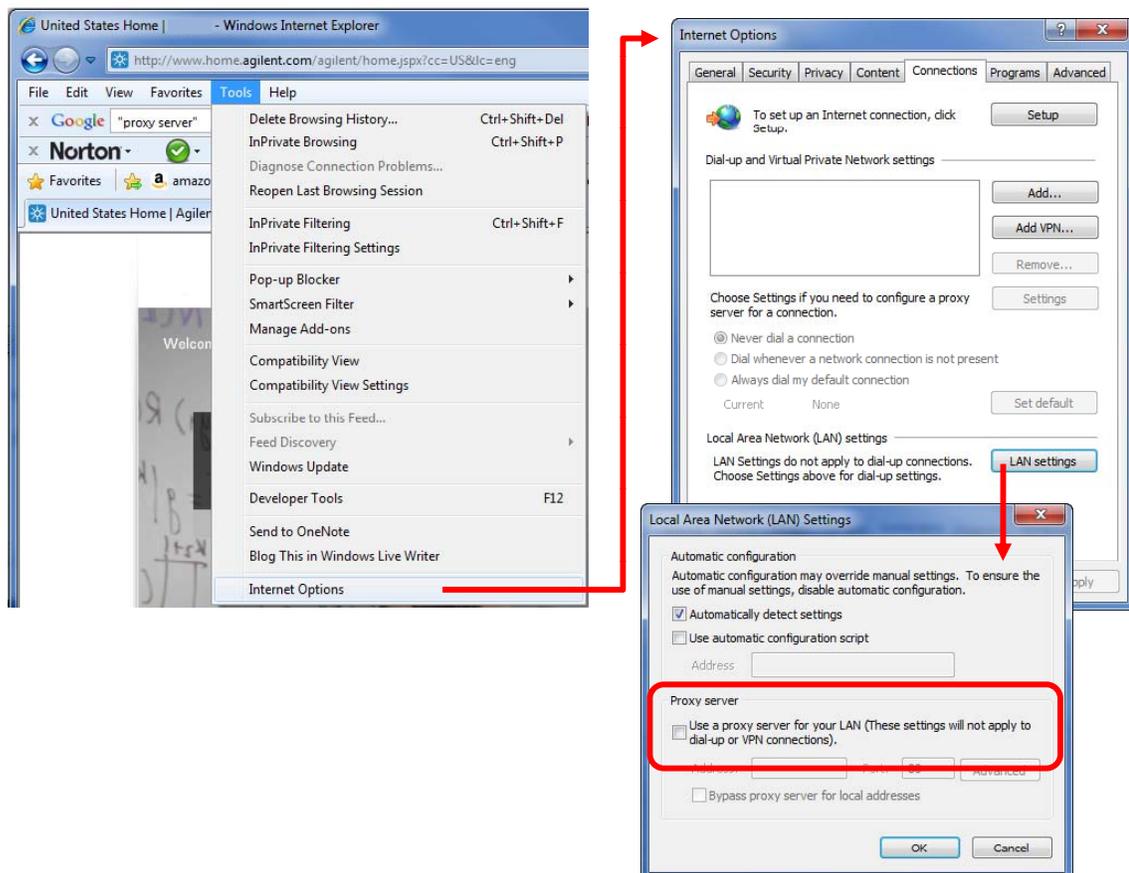
### NOTE

The LAN connection to the ESM provides communication to the chassis only -- chassis firmware updates, using the web interface to monitor and control the chassis, etc. It does not provide communication with individual AXIe modules. Use the PCIe connection to control individual AXIe modules.

- 1 Chassis communications over PCIe uses the TCP/IP network protocol because the chassis PCIe endpoint is an Intel 82573L NIC. Therefore, when accessed over PCIe, the AXIe chassis will appear as a LAN device in Keysight

Connection Expert. When accessed over LAN, the AXIe chassis will, as expected, also appear as a LAN device in Keysight Connection Expert.

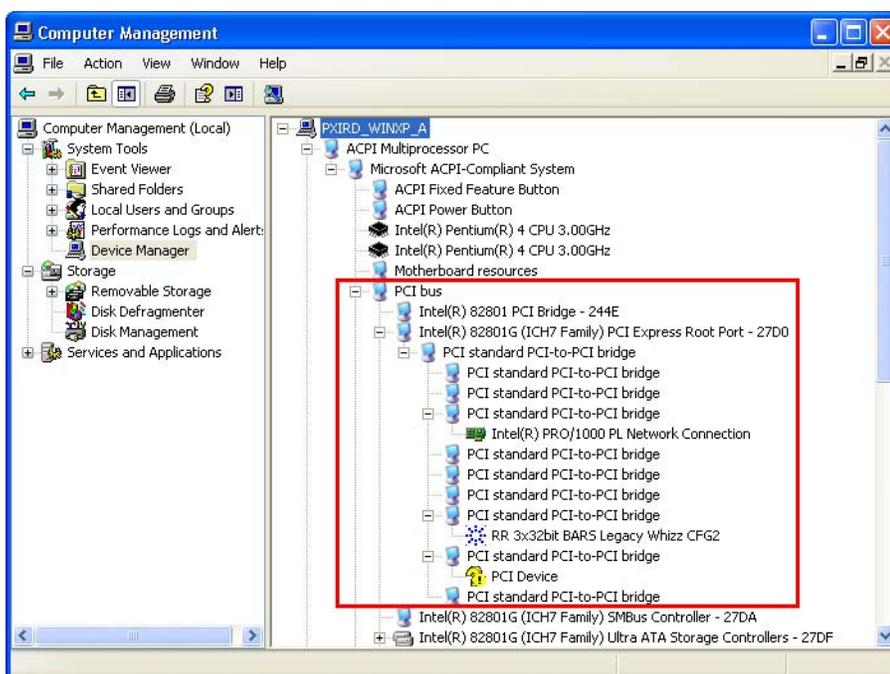
- 2 Modules installed in the chassis slots that use the PCIe interface will be displayed by Keysight Connection Expert under the PXIO label, not under the LAN label.
- 3 For a PCIe connection to the chassis, a private IP address beginning with 169.254 will be assigned. If a direct LAN connection is made from the host PC to the chassis, a private IP address beginning with 169.254 will likewise be assigned.
- 4 The LAN port is used for controlling and monitoring the chassis (i.e., monitoring chassis temperatures, monitoring/setting chassis fan speeds, and setting chassis routing). It is not intended for controlling AXIe modules. The PCIe port is provided for module data transfer and control.
- 5 If you have established a direct LAN connection to the chassis (establishing, for example, a private IP address of 169.254.1.0) and if your browser is configured to use a proxy server, your browser may not be able to display the chassis Web Interface. The example figure below shows how to bring up the **LAN Settings** dialog (in Internet Explorer 8) that is used to configure proxy server settings.



- 6 PCIe is logically an extension of the host PC backplane. If the PCIe interface is used to connect to the chassis, the chassis Intel 82573L NIC will appear to Windows as if it is installed directly in the PC. While Windows Vista and Windows 7 provide the necessary Intel NIC driver, Windows XP does not natively include the required Intel NIC driver.

If you're using the PCIe interface on Windows XP and if the **Found New Hardware Wizard** dialog appears indicating that an "Ethernet Controller" needs software installed, you'll need to install the Intel PROWin32.exe network driver as described in ["Install Intel Network Driver on Windows XP, if Needed"](#) on page 24.

- 7 The example window below shows the Device Manager view of the PCI bus for an M9502A chassis that contains one recognized PCIe module (the Keysight module), one unrecognized PCIe module ("PCI Device"), plus the Intel NIC. This window was displayed by selecting **Devices by connection** under the Device Manager **View** drop down menu. This information can be useful in both verifying connection to the chassis (the Intel NIC) and verifying connection to the modules installed in the chassis.



- 8 If the chassis is connected only to LAN, the chassis will attempt to obtain an IP address using DHCP.
- 9 If both PCIe and LAN are connected to the chassis, the LAN VISA resource name is used to connect to the chassis.
- 10 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.

- 11 If you have connected to the chassis using PCIe and/or LAN, and want to visually confirm that you are, in fact, interfacing to the chassis that you believe you are interfacing to, you can click the **Turn on Front Panel Identification Indicator** link on the Web Interface home page as highlighted below. This will flash the STATUS LED of the chassis you are interfacing to.



## Safety-Related Specifications

This section (next page) provides a partial set of safety-related specifications for the Keysight M9502A and M9505A AXLe chassis. Complete specifications are included in the Keysight *M9502A/M9505A Data Sheet*.

## Regulatory

### Safety

Conforms to the following: Complies with European Low Voltage Directive 2006/95/EC  
 - IEC/EN 61010-1, 2nd edition  
 - Canada: CSA-C22.2 NO. 61010-1-04 USA:/UL 61010-1:2004

### EMC

Conforms to the following: Complies with European EMC Directive 2004/108/EC  
 - IEC/EN 61326-1 ICES/NMB-001  
 - CISPR Pub 11 Group 1, class A AS/NZS CISPR 11

## Operating Conditions

| Temperature | Humidity                                   | Altitude          |
|-------------|--|-------------------|
| 0°C to 50°C | Type tested at 95%, +40°C (non-condensing) | up to 3000 meters |

## Chassis Weight

| Chassis | Weight (as shipped, no modules) | Weight (maximum, all slots filled) |
|---------|---------------------------------|------------------------------------|
| M9502A  | 7.7 kg                          | 15.7 kg                            |
| M9505A  | 13.3 kg                         | 33.3 kg                            |

## AC Power Supply Requirements

|                          | M9502A        |            | M9505A (Serial Number TW51150212 and earlier) |            | M9505A (Serial Number TW51160201 and later) |
|--------------------------|---------------|------------|---|------------|---|
| Operating voltage range: | 100-120VAC    | 200-240VAC | 100-120VAC                                    | 200-240VAC | 100-240VAC                                  |
| Input frequency range:   | 50-60 Hz      | 50-60 Hz   | 50-60 Hz                                      | 50-60 Hz   | 50-60 Hz                                    |
| Input power consumption: | 800 VA        | 800 VA     | 865 VA  | 1350 VA    | 1280VA                                      |
| Overcurrent protection:  | auto recovery |            | auto recovery                                 |            | auto recovery                               |
| Efficiency (typical):    | 85-90%        |            | 85-93%  |            | 85-93%                                      |

## Chassis Power Dissipation

| Airflow                                | Direction                      |
|--|--------------------------------|
| Slot airflow direction                 | Right to left                  |
| Chassis cooling intake                 | Right side of chassis          |
| Chassis cooling exhaust                | Left side of chassis           |
| Power dissipation, per instrument slot | 200W maximum * see table below |

## DC Power Supply Output

|                | M9502A | M9505A<br>(Serial Number TW51150212 and earlier)   | M9505A<br>(Serial Number TW51160201 and later) |
|----------------|--------|--|--|
| DC Output      | 50V    | 52V  | 52V  |
| Total DC Power | 520W   | 100VAC - 120VAC: 680 W<br>200VAC - 240VAC: 1020 W* | 100-240VAC: 1020W*                             |

\* M9505A configurations that consume more than 850W (200-240V) or 400W (100-120V) total power across all 5 slots may experience occasional system reset if installed in environments prone to line voltage dropouts in excess of 20ms. In such an event, the PC controlling the chassis will require a restart or reboot. To avoid system resets due to line dropouts, use an uninterruptable power supply.

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