DATA SHEET

M9514A and M9521A

AXIe 14-Slot Chassis and AXIe System Module

The M9514A AXIe chassis and M9521A AXIe System Module (ASM) are fully compatible with the AXIe 1.0 and 2.0 specifications. The chassis provides 13 instrument modules slots plus an AXIe system slot while the ASM is used with the chassis to provide the necessary system functions. The ASM provides Gigabit LAN and Gen 2 x8 PCIe® interfaces for connecting the chassis to an external controller. The chassis is designed to be easily maintained. The power supplies and fan trays can be removed while the chassis remains in the rack.

KEYSIGHT TECHNOLOGIES

Applications

- Aerospace and defense
- Computation
- Communications
- Electronics test
- Semiconductor testing
- High-energy physics

Features

- AXIe 1.0 (architecture) and 2.0 (software) compliant
- Available AXIe System Module with Gen 2 PCIe x8 and Gigabit LAN interfaces for connecting to host computer
- Keysight Technologies, Inc. exclusive, built-in MultiFrame synchronization for multi-chassis systems
- 62 differential local bus lines provide very large data path between adjacent modules
- High power with 200W cooling per slot
- Front and rear removable fan trays

Customer values

- AXIe chassis provides a high-performance platform to compliment PXI based systems
- The 14-slot chassis can accommodate more AXIe modules when the application requires a larger system
- With the innovative cooling design, no additional rack space is required to meet cooling specifications while providing adequate cooling for a large number of high-power modules
- The front panel x8 PCIe links on the ASM enable very large systems (up to three 14-slot AXIe chassis can be inter-connected) or allow AXIe and PXIe chassis to be combined in a single system

M9514A hardware overview

Backplane configuration

The AXIe backplane in the Keysight M9514A include all of the following AXIe backplane lines:

- Timing and triggering signals including: 100 MHz clock, 100 MHz PCIe clock (FCLK), point-to-point star trigger from the system slot (SYNC), bi-directional point-to-point star trigger (STRIG), and 12 signal parallel trigger bus (TRIG)
- Distributed PCIe data fabric (Gen 2 x4 to each slot)
- Distributed gigabit Ethernet LAN to each slot
- 62-pair local bus for adjacent module signaling or data transfer (AXIe only requires 18 pairs)
- DC power rail (nominally -52 VDC)
- Intelligent Platform Management Bus (IPMB) for chassis control, including module power-up

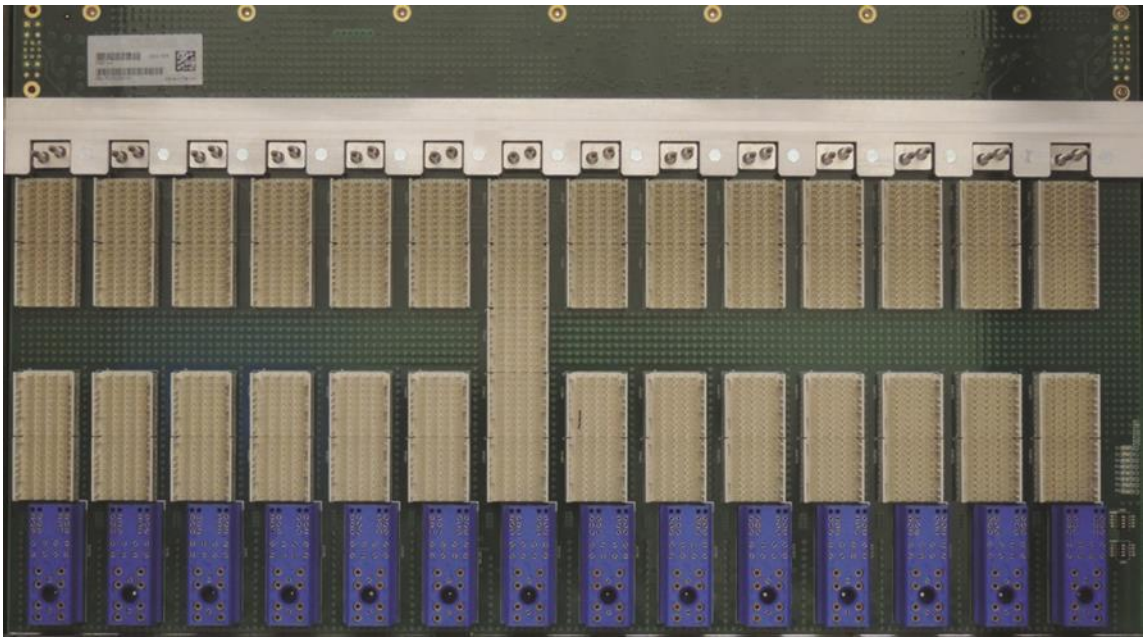


Figure 1. 14-slot AXIe backplane in the M9514A.

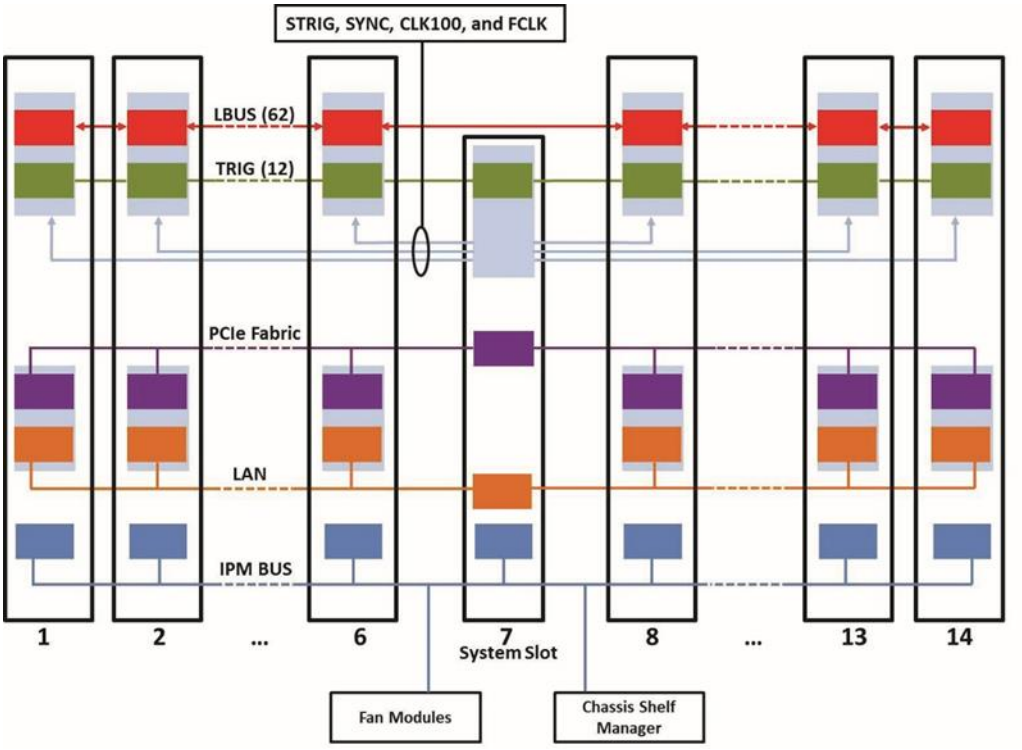


Figure 2. M9514A backplane block diagram.

Chassis shelf manager

The chassis shelf manager provides intelligent control of the M9514A including control of the chassis cooling fans and managing the chassis power-up sequence. This ensures there is sufficient power/ cooling for each module.

Innovative cooling

The AXIe chassis utilizes a “push-pull” cooling design that provides a high volume of cooling air with acoustical emissions which are lower than a chassis with only a push or pull design. Fans in the front of the chassis bring in cool air from outside the rack and fans in the back of chassis pull the warm air out. Auto-speed fans are used to ensure adequate cooling as module temperatures change.

Lower maintenance costs

The chassis were designed to reduce maintenance costs. In addition, the power supplies, air filters, and fan trays can be removed while the chassis is mounted in a rack, allowing the chassis to be serviced while keeping DUT cabling in place.

Figure 3. Rear view of M9514A AXIe chassis.

M9521A Hardware overview

The M9521A AXIe System Module (ASM) is installed in the system slot of the M9514A (slot 7). It provides the system communication and synchronization functions required in an AXIe chassis including:

- Trigger bus and clock routing
- Managing clocks, including internal or external reference sources

- Gigabit LAN switching with front panel RJ45 LAN connections (see module documentation to determine if a particular AXIe module is supported for LAN communications)
- AXIe Fabric 1 switching (Gen 2 x4 lanes to each module slot)

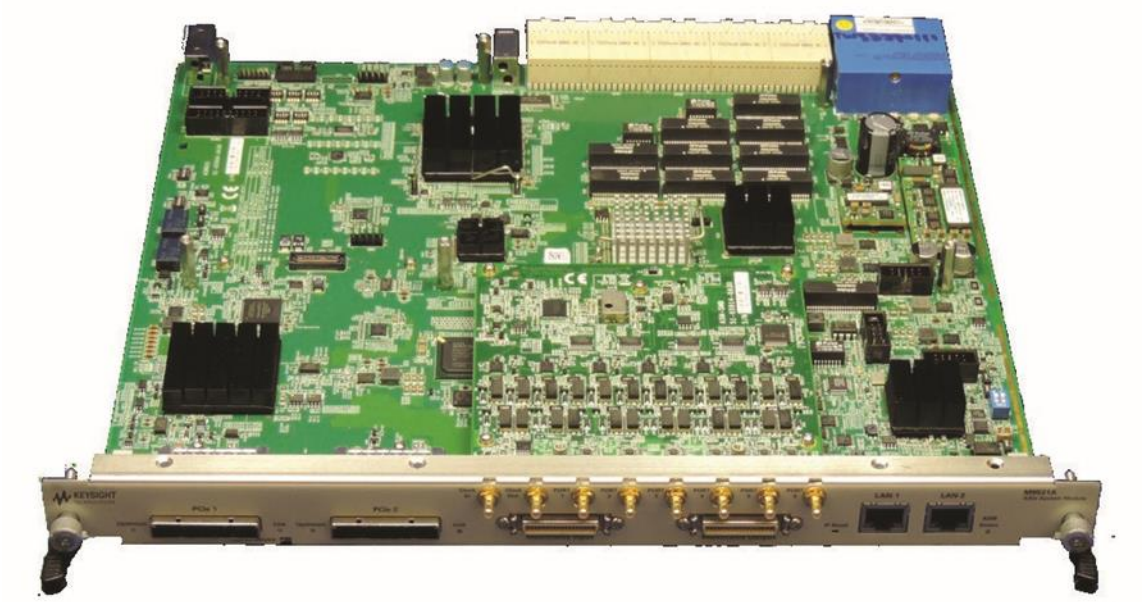


Figure 4. M9521A AXIe system module (shown with shield removed).

M9521A Hardware overview (continued)

In addition to the required AXIe functions, the system module also provides:

- Ability to synchronize multiple chassis with trigger and clocking signals (MultiFrame In/Out connectors)
- Six multi-purpose, synchronization and triggering ports (SMB)
- External 10 MHz reference clock input/output (SMB)
- Dual Gen 2x8 PCIe in interfaces for connecting the chassis to an external computer and other chassis (including PXIe

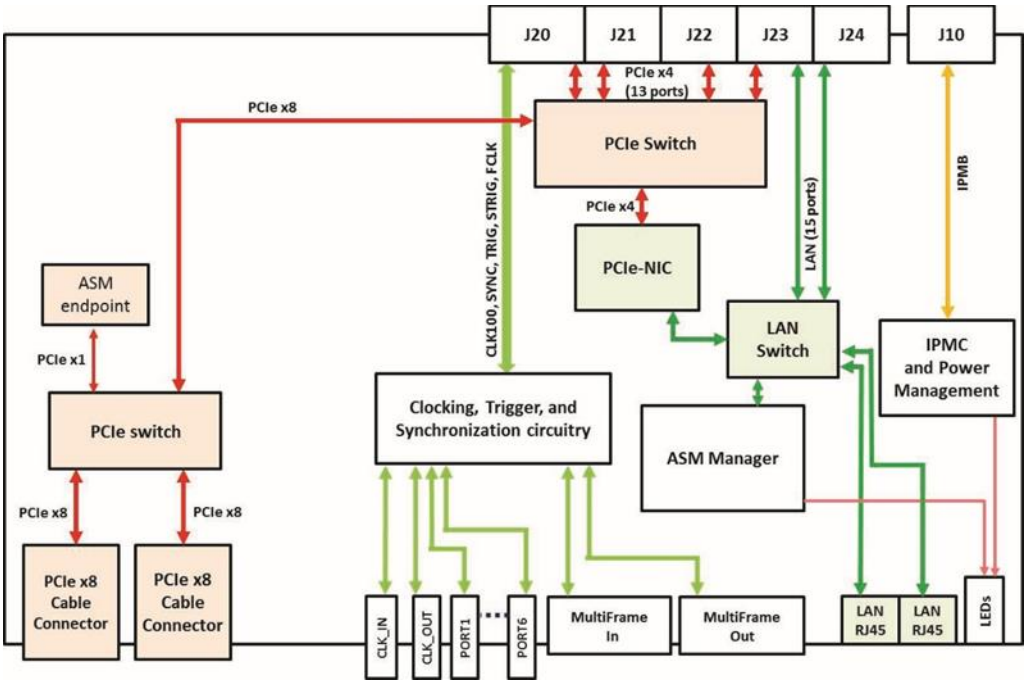


Figure 5. M9521A ASM block diagram.

Software platform

Drivers

The M9514A and M9521A chassis come complete with IVICOM, IVI-C, and LabVIEW drivers. Windows 7 and 8.1 operating systems are supported, and applications can be completed using many different software tools including LabVEW, LabWindows/ CVI, MATLAB, VEE, Visual Studio.NET (C/C++, C#, VB.NET).

Soft front panel

A soft front panel (SFP) interface is also provided to monitor and control the AXIe chassis and ASM. The chassis SFP provides monitoring for fans and temperature, a slot view, and chassis configuration/utilities. The SFP for the ASM includes configuration for triggering, I/O ports, system clocks, backplane sync, as well as system utilities including firmware upgrades and power-on states. The SFPs communicates to the chassis and ASM using IVI drivers.

Chassis and ASM web servers

Both chassis and ASM include a built-in web server for configuration, control, and monitoring. The web servers can be accessed by either LAN or PCIe. The M9514A chassis web page includes functions such as chassis information, LAN configuration, instrument module inventory, and chassis health (temperature, fan, power supply). The M9521A ASM web page provides ASM information, LAN and PCIe configuration, and firmware update capabilities.

www.keysight.com/find/m9514a

www.keysight.com/find/m9521a

Figure 7. M9514A and M9521A web pages.

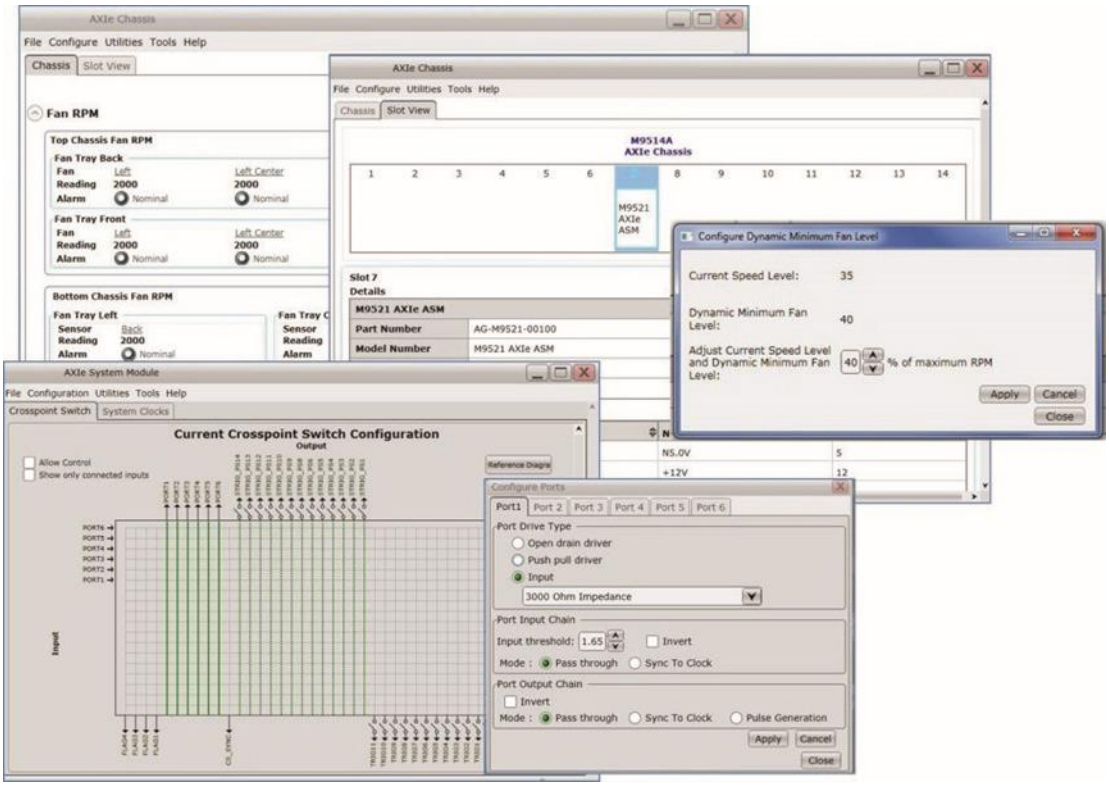


Figure 6. M9514A and M9521A soft front panels.

Technical Specifications and Characteristics

M9514A chassis characteristics standards compliance	
AXIe 1.0 Base Architecture Specification	
AdvancedTCA PICMG 3.0 R2.0 Specification	
Backplane	
Total slots	14
Instrument module slots	13
System module slot	1
Local bus lines	62 differential lines between each instrument module slot
PCIe data fabric	x4 Gen 2 to each module slot
Mechanical	
Size	482.6 mm W x 589.7 mm H x 579.1 mm D[1]
Weight (nom)	48.7 kg (107 lbs)[2]
M9514A clocks and triggers 100 MHz system clock (CLK100)	
Maximum slot-to-slot skew:	100 ps
AXIe SYNC	
Maximum slot-to-slot skew:	100 ps
AXIe star trigger (STRIG)	
Maximum slot-to-slot skew:	20 ps

1. From front handle to IEC 60309 AC power connector, Top Cover to Rubber Feet
2. Without modules

Technical Specifications and Characteristics (Continued)

M9514A power supply AC input	
Operating voltage range: Single phase or 3-phase delta 3-phase Wye	 200-240 VAC 200/415 VAC
Input frequency range:	50-60 Hz
Input current:	24 Arms
Overcurrent protection:	Auto recovery
Efficiency (typical):	85-93%
DC supply	
DC output	52 V
Total DC module power:	2800 W
Total maximum module current:	53.8 A
Load regulation:	2%
Max ripple and noise (20 MHzBW)	500 mV pk-pk
Chassis cooling and power dissipation	
Slot airflow direction:	Bottom to top
Chassis cooling intake:	Bottom-front of chassis
Chassis cooling exhaust:	Top-rear of chassis
Chassis cooling fans:	HIGH/AUTO speed selector Six 252.85 cfm fans in three front fan trays Ten 138.0 cfm fans in rear fan tray
Power dissipation, instrument slot:	200 W maximum
M9521A module characteristics	
Standards compliance:	AXIe 1.0 and 2.0 specifications
Module form factor:	1-slot AXIe
Size	30.48 mm W x 350.9 mm H x 292.4 mm D
Weight (nominal)	2.4 kg (5.3 lbs)
Chassis slot compatibility:	AXIe system module slot

Technical Specifications and Characteristics (Continued)

Front panel connectors:	
PCIe1	Upstream/downstream x8 Gen 2
PCIe2	Downstream x8 Gen 2
10 MHz REF clock IN/OUT	SMB (2)
MultiFrame	36-pin mini D (2)
Port1-Port6	SMB (6)
LAN 1/2	RJ45 (2) 10/100/1000 Base-T
AXIe backplane I/O	
PCIe fabric	x4 Gen 2 to each slot
Ethernet	10/100/1000 Base-T to each slot
Triggers	TRIG [0:11] and STRIG
Synchronization and control	CLK100, SYNC, FCLK, IPMB
M9521A DC power requirements	
DC current (max):	2.6 A @ -52V (nominal)
Power dissipation (max):	135W
M9521A clocks and triggers 100 MHz system clock (CLK100)	
Accuracy:	± 30 ppm
Duty cycle	45/55%
External REF clock in (SM)	
Input frequency:	10 MHz ± 100 ppm
Input level:	5V pk-pk, AC coupled
Minimum swing:	250mV
Input impedance:	50 ohm
External REF clock out (SMB)	
Output frequency:	10 MHz ± 30 ppm
Output level:	3.3V, AC coupled
Output impedance:	50 ohm

Not compatible with Keysight M9502A or M9505A AXIe chassis because these chassis do not have an AXIe compliant system slot.

Technical Specifications and Characteristics (Continued)

Input/output ports (SMB)	
Direction control:	Input, output, open-drain bi-directional (programmable)
Number of ports:	6
Output level:	3.3V CMOS
Output impedance (output mode):	50 ohm
Output impedance (open-drain mode):	316 ohms pulled up to 3.3 volts
Input level:	± 5V, programmable threshold
Input impedance (input mode)	50 ohm or 3 kohm (programmable)
Input impedance (open-drain mode)	3 kohm
Minimum swing:	250 mV

Environmental [3] [4] [5]
Operating and storage conditions

	Operating	Storage
Temperature:	0°C to 50°C	-25°C to 60°C
Altitude:	Up to 10,000 ft (3048m)	Up to 15,000 ft (4572m)
Humidity:	Type tested at 95%, +40°C (non-condensing)	
Vibration		
Operating random vibration:	Type tested at 5 to 500 Hz, 0.21 g rms	
Survival random vibration:	Type tested at 5 to 500 Hz, 2.09 g rms	

M9514A acoustical emissions (LWA db, ref 1pW)

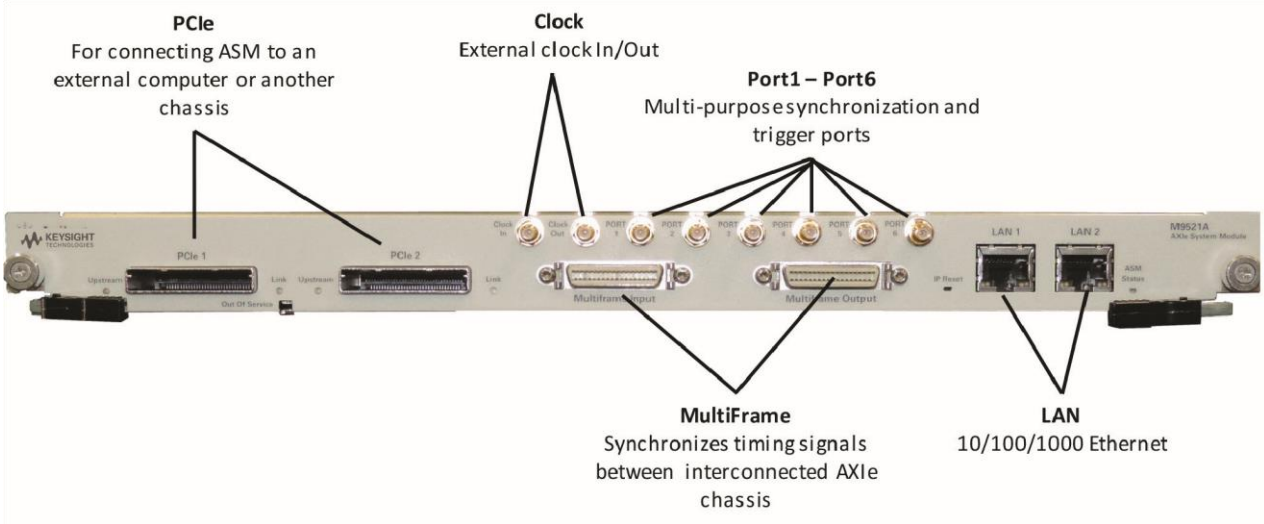
	Maximum	Nominal[6]
Sound pressure[7]	79 dBA	67 dBA
Sound power[8]	89 dBA	77 dBA

3. Characteristics apply to both M9514A and M9521A unless noted otherwise.
4. Samples of this product have been type tested in accordance with the Keysight Environmental Test Manual and verified to be robust against the environmental stresses of Storage, Transportation and End-use; those stresses include but are not limited to temperature, humidity, shock, vibration, altitude, and power line conditions.
5. Test methods are aligned with IEC 60069-2 and levels are similar ro MIL-PRF-28800F Class 3.
6. Empty chassis at 25°C ambient.
7. At operator position (LpA dB, ref 20µPa).
8. LwA dB, ref 1pW.

Technical Specifications and Characteristics (Continued)

Regulatory[9]
Safety
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 std no. 61010-1, 2nd Edition
EMC
Complies with European EMC directive 2004/108/EC
IEC/EN 61326-1
CISPR Pub 11 Group 1, class A
AS/NZS CISPR 11
ICES/NMB-001
This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB-001 du Canada

M9514A front panel



9. Characteristics apply to both M9514A and M9521A.

Configuration

M9514A AC power configuration

The M9514A has a flexible AC power subsystem that can be configured to meet the local power requirements and codes. The chassis can be powered from either single- or three-phase systems but AC power must be as follows:

- Single-phase: 200 – 240 VAC (line-line or line-neutral)
- Three-phase Wye with Neutral: 220/380 – 240/415 VAC (line-neutral/line-line). Line-line voltages greater than 415 VAC are not supported.
- Three-phase Delta or Wye (no neutral): 200 – 240 VAC (line-line)

The chassis is supplied with a male IEC 60309 3P+N+E connector and comes preconfigured for a 3-phase Wye with Neutral AC Mains. If a different AC Power line configuration is used, it may need to be re-configured. The following wiring methods are supported:

- Using an optional, pre-built power cable from Keysight (Y1235A – Y1238A)
- Creating your own power cable using a female IEC 60309 connector (not supplied) and the appropriate male plug
- Removing the male IEC 60309 connector and installing permanent AC wiring or hardwiring a custom AC power cable to the chassis.

See the M9514A Site Preparation and Installation Guide (literature no. M9514A-90007) for more details.

Recommended system configuration

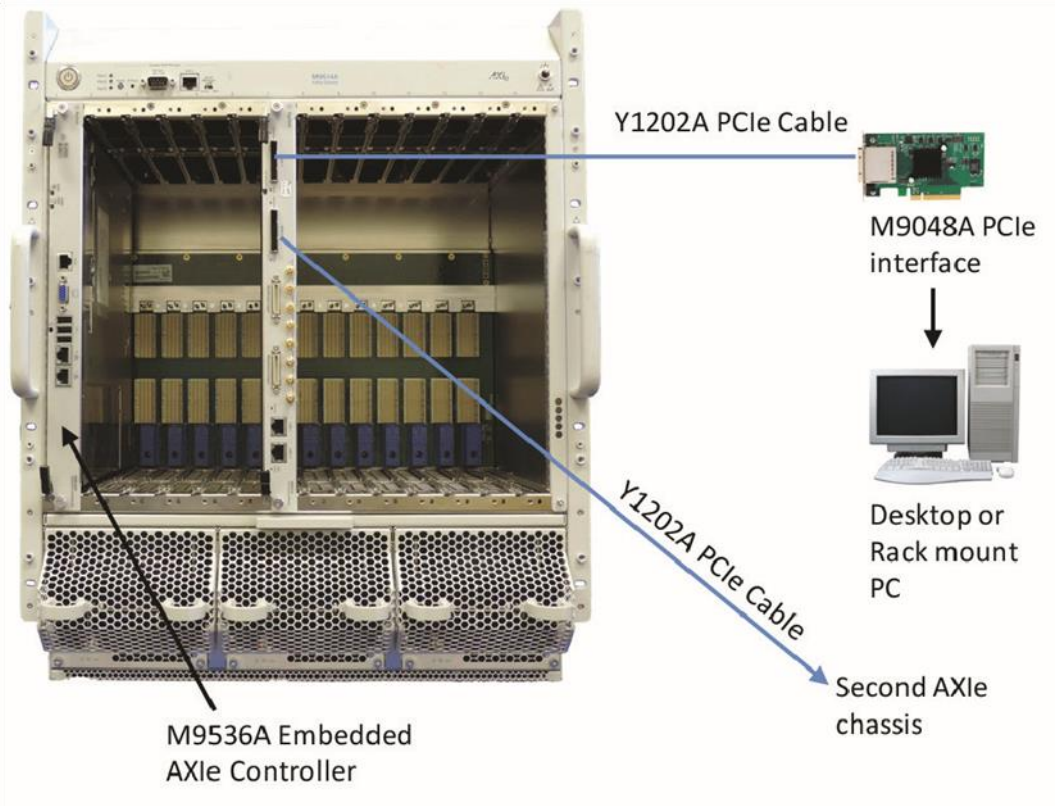


Figure 8. M9514A configuration.

Configure the Keysight M9514A AXIe chassis, as follows:

1. Include an AXIe System Module; the Keysight M9521A is recommended
2. If you are using PCIe to connect an external computer, configure the chassis connection to the host:
    - To ensure the computer will be able to communicate to the chassis and AXIe modules, see Keysight's tested computer list (5990-7362EN). It is recommended that the computer be configured with at least 8 GB of RAM and a 64-bit OS.
    - Select an appropriate PC interface card for the external computer; the Keysight M9048A is recommended.
    - Select an appropriate cable to connect the computer interface board to the AXIe system module; the Y1202A is recommended to connect the M9048A to the M9521A
3. If the M9536A embedded AXIe controller is used instead of an external computer, it can go into any slot other than slot 7 (it does not replace the ASM). The M9536A must have a BIOS revision of AG14 or greater and 64-bit Windows Embedded Standard 7 operating system (option M9536A-WE6).
4. Select a power cord if required (not required if the chassis is hard-wired)
5. Select rack mount rails and MultiFrame cables as required (check module documentation to determine if MultiFrame cables are supported).
6. Select Filler modules for empty slots

Multi-chassis configuration

Multiple M9514A chassis can be cascaded together using the PCIe connectors on the M9514A ASM. The host computer can be either external or embedded, but the M9536A is recommended. Up to three chassis can be connected together and a 64-bit OS and 8 GB RAM are required.

Power sequencing of multiple chassis can be managed automatically with RJ-45 cables (not included).

MultiFrame cables can be used if the AXIe modules being used support this feature. Otherwise, the chassis can be interconnected using the clock in/out and Port1 – Port6.

Hardware

Model	Description
M9514A	AXIe chassis: 14-slot[10]
M9514A-521	Include AXIe System Module (not installed)
M9521A	AXIe System Module: dual port x8 PCIe

Related products

Model	Description
M9536A	AXIe Embedded Controller
M9048A	PCIe desktop PC Adapter

10. Includes "Getting Started" guide, drivers, documentation, CD and Keysight I/O libraries. AXIe filler modules (Y1221A) and power cord must be ordered separately.

Accessories

Model	Description
Y1221A	AXIe Filler Module: Single Slot
Y1223A	AXIe MultiFrame cable: 0.5m length[11]
Y1224A	AXIe MultiFrame cable: 3m length[11]
Y1229A	Rail kit for M9514A AXIe Chassis
Y1234A	Protective cover for M9514A
Y1235A	Power Cable: 1-phase, No Neutral, 250VAC, NEMA
Y1238A	Power Cable: 3-phase, WYE with Neutral, 240/415VAC, Stripped End

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www.keysight.com/find/M9514A

11. Check module documentation to determine if MultiFrame cables are supported.

Learn more at: www.keysight.com

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