DATA SHEET

M9502A and M9505A
2- and 5-slot AXIe Chassis

PCIe Gen 2, 2 GB/s slot BW, up to 200 W/slot

Product Description

The Keysight Technologies, Inc. M9502A and M9505A AXIe chassis are fully compatible with the AXIe 1.0 specification. They provide 2 or 5 slots for AXIe instrument modules and have an embedded system module that does not take up an instrument slot. The embedded system module (ESM) provides Gigabit LAN and Gen 2 x8 PCIe® interfaces for connecting the chassis to an external controller. To minimize rack space, the instrument module slots are arranged horizontally. In addition, the chassis are designed to be easily maintained. Both the power supply and fan tray can be removed with modules installed 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 compliant
- Embedded system module with Gen 2 PCIe x8 and Gigabit LAN interfaces for connecting to host computer
- Keysight-exclusive, built-in inter-chassis 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-removable fan tray

Customer Values

- AXIe chassis provide a high-performance platform to compliment PXI-based systems
- The compact, 2-slot chassis is ideal for transportable applications, but is also rack-mountable
- The 5-slot chassis provides a cost-effective solution when more AXIe slots are required
- The embedded AXIe system module and horizontal module placement save rack space, requiring only 2U or 4U, depending on model
- With the innovative cooling design, no additional rack space is required to meet cooling specifications



Hardware



Compliance

The M9502A and M9505A chassis are fully compliant with the AXIe 1.0 specification. An additional half-height slot is built into the chassis and reserved for the embedded system module. This slot is not compatible with AXIe instrument modules or embedded computers. Embedded controllers must be installed in one of the instrument module slots.

Backplane configuration

The AXIe backplane in the Keysight M9502A and M9505A chassis 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 ESM
- (SYNC), bi-directional point-to-point star trigger
- (STRIG), and 12 signal parallel trigger bus (TRIG)
- Distributed PCIe Gen 2 data fabric from ESM (x4 to each slot) plus a secondary PCIe data fatbric
- 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 (normally 45-53 VDC)
- Intelligent Platform Management Bus (IPMB) for chassis control, including module power-up

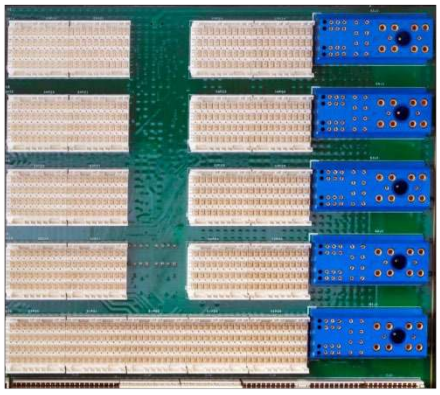


Figure 1. 5-slot AXIe backplane

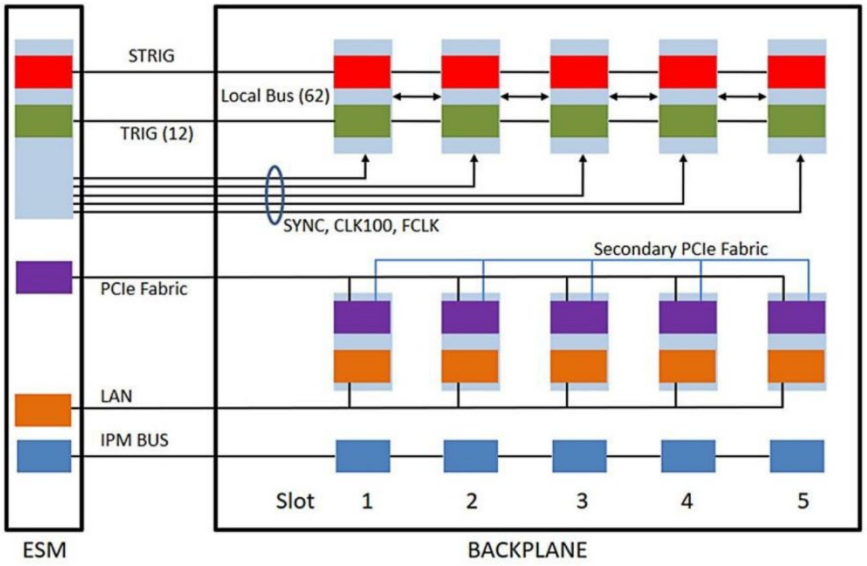


Figure 2. M9505A backplane block

Embedded system module (ESM)

Both the M9502A and M9505A chassis contain an embedded system module that does not take up an instrument slot. This module performs the chassis management functions contained in the AXIe specification, including:

- Managing trigger and clock busses
- Managing clocks, including internal or external reference sources
- Gigabit LAN switching with a front panel RJ45 LAN connection (see module documentation to determine if it is supported for LAN communications)
- AXIe Fabric 1 switching (Gen 2 x4 lanes to each module slot)
- Monitoring the health of the chassis subsystems and modules
- Controlling the chassis cooling fans, and managing the chassis power-up sequence



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

- Ability to synchronize multiple chassis with trigger and clocking signals (MultiFrame In/Out connectors)
- SMA connectors for external clock in/out and trigger in/out
- Gen 2 x8 PCIe cable connector for connecting the chassis to an external computer
- USB 2.0 option provides USB connectivity for some AXIe modules. Only supported on a limited set of Keysight modules. See module documentation to determine if it supported for USB control.

Innovative cooling

The AXIe chassis utilize a cooling design that does not require additional rack space to cool the modules. This allows the chassis to fit into 2U or 4U of rack space.

The cooling design uses auto-speed fans to pull in cool air. Air flows from right-to-left within the chassis. The ESM provides intelligent control of the power supplies and fans and ensures there is sufficient power/cooling for each module.

Lower maintenance costs

The chassis were designed to reduce maintenance costs. The innovative air-flow design does not require air filters to replace. In addition, the power supply and fans can be removed while the chassis is mounted in a rack, allowing the chassis to be serviced while keeping DUT cabling in place.

Software platform Drivers

The M9502A and M9505A chassis come complete with IVI- COM, IVI-C, and LabVIEW drivers. Windows 7, Windows 8.1, and Windows 10 operating systems are supported, and applications can be completed using many different software tools including LabVEW, LabWindows/CVI, MATLAB, VEE, VisualStudio.NET (C/C++, C#, VB.NET).

Chassis web server

Both AXIe chassis include a built-in Web server for configuration, control, and monitoring of the chassis. This Web server can be accessed by either LAN or PCIe. The following functions are provided:

- Chassis information
- Chassis LAN configuration
- Instrument module inventory
- Trigger routing setup
- Chassis health (temperature, fan, power supply)

Soft front panel

A soft front panel interface is also provided to monitor and control the AXIe chassis. It has some of the basic functionality of the chassis Web page and communicates to the chassis using the IVI drivers. The soft front panel has two screens: trigger routing and chassis monitor.

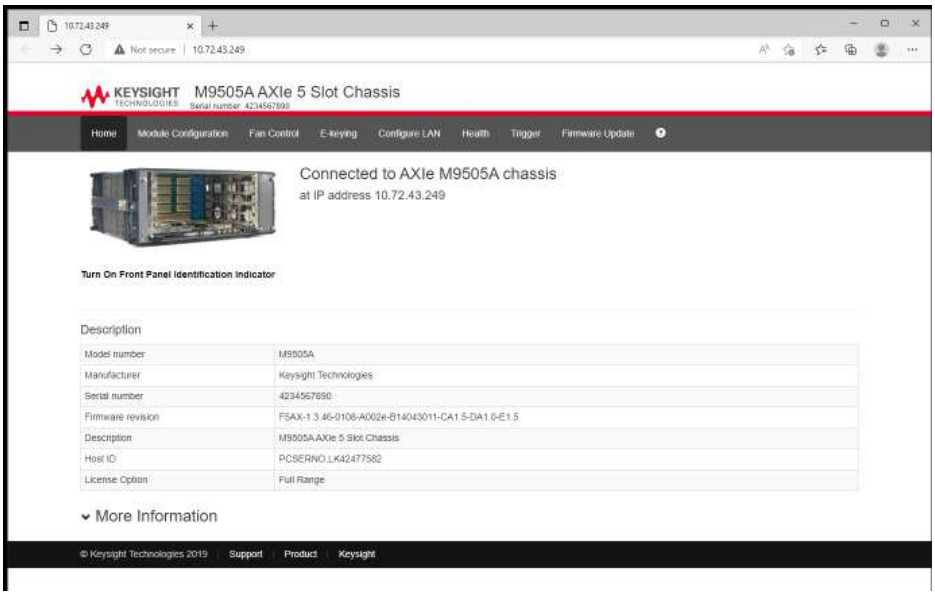


Figure 3. Chassis web page

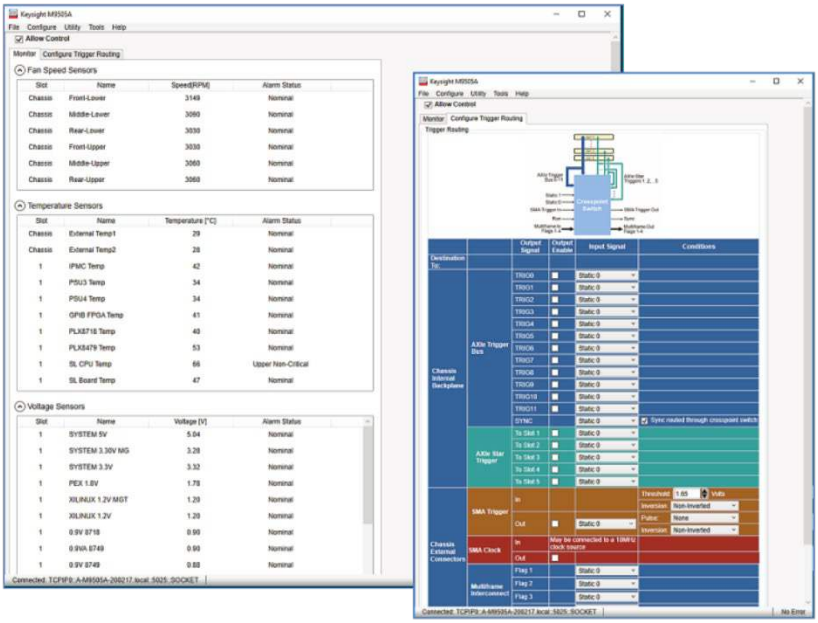


Figure 4. Chassis soft front panel interface

Technical Specifications and Characteristics

Chassis characteristics

Standards compliance
AXIe 1.0 Base Architecture specification

Backplane	M9502A	M9505A
Total slots	2	5
Instrument module slots	2	5
System module	Embedded	Embedded

Power supply characteristics		
AC input	**M9502A**	**M9505A**
Operating voltage range	100-240 VAC	100-240 VAC
Input frequency range	50-60 Hz	50-60 Hz
Input power consumption	800 VA	1280 VA
Overcurrent protection	Auto-recovery	Auto-recovery
Efficiency (typical)	85-90%	85-93%

DC supply					
Model	**DC output**	**Total DC module**	**Total max module**	**Load regulation**	**Maximum ripple and noise (20 MHz BW)**
M9502A	50 V	400 W	8 A	2%	1% pk-pk
M9505A	52 V	1000 W	19.2 A	2%	500 mV pk-pk

Chassis cooling and power dissipation	
Slot airflow direction	Right to left
Chassis cooling intake	Right side of chassis
Chassis cooling exhaust	Left side of chassis
Chassis cooling fans	
M9502A	Three 90.0 cfm fans on fan tray with HIGH/AUTO speed selector
M9505A	Six 90.0 cfm fans on fan tray with HIGH/AUTO speed selector
Power dissipation, instrument slot	200 W max

Mechanical characteristics

	Weight (nom) [1]	Size with bumpers	Size without bumpers
M9502A	7.7 kg (17 lbs)	462 mm W x 102 mm H x 414 mm D	432 mm W x 87 mm H x 414 mm D
M9505A	13.3 kg (29.3 lbs)	462 mm W x 193 mm H x 436 mm D	432 mm W x 177 mm H x 436 mm D

[1] Without modules

Clocks and triggers

100 MHz system clock (CLK100)	
Accuracy	±20 ppm
Duty cycle	45/55%
Maximum slot-to-slot skew	100 ps
External clock in (SMA)	
Input frequency	10 MHz ± 100 ppm
Input level	±5 V, AC coupled
Minimum swing	250 mV
External clock out (SMA)	
Output frequency	10 MHz
Output level	3.3 V CMOS
Output load	50 Ω
AXIe differential star trigger (STRIG)	
Maximum slot-to-slot skew	100 ps
External trigger out (SMA)	
Output level	3.3 V CMOS
Output load	50 Ω
External trigger in (SMA)	
Input level	±5 V, adjustable threshold
Input impedance	4 kΩ (pulled up to 2.5 V)
Minimum swing	250 mV

Environmental characteristics [1, 2]

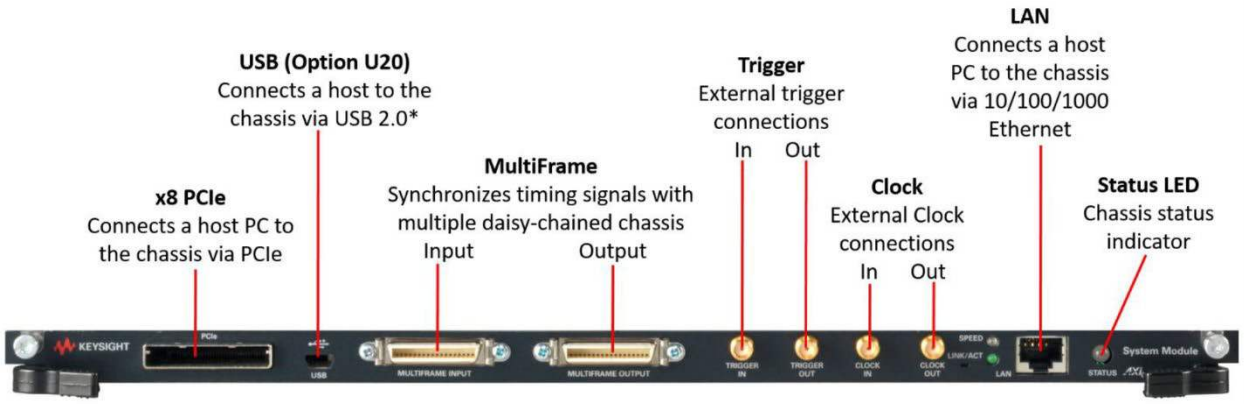
Operating and storage conditions		
	Operating	**Storage**
Temperature	0 ˚C to 50 ˚C	-25 ˚C to 60 ˚C
Maximum Relative Humidity (non-condensing) – Type tested	95%RH up to +40 ˚C decreases linearly to 45%RH at 50 °C [3]	95%RH up to +40 ˚C decreases linearly to 45%RH at 50 °C [3]
Altitude	up to 3000 meters	up to 4600 meters
Shock and 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		
Acoustical sound power (LWA dB, ref 1pW)		
	Worst case	**Normal operation (25˚C air intake)**
M9502A	74.3	55.2
M9505A	77.6	62.8

[1] 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.
[2] Test methods are aligned with IEC 60068-2 and levels are similar to MIL-PRF-28800F Class 3
[3] From 40 °C to 50 °C, the maximum % Relative Humidity follows the line of constant dew

Regulatory characteristics

Safety	Complies with the essential requirements of the European LVD Directive of the following standards (dates and editions are cited in the Declaration of Conformity): • IEC/EN 61010-1 • Canada: CSA C22.2 No. 61010-1 • USA: UL std no. 61010-1
Acoustic statement (European Machinery Directive)	Acoustic noise emission LpA < 70 dB Operator position Normal operation mode per ISO 7779
EMC	Complies with the essential requirements of the European EMC Directive and the UK Electromagnetic Compatibility Regulations 2016 as well as current editions of the following standards (dates and editions are cited in the Declaration of Conformity): • IEC/EN 61326-1 • CISPR Pub 11, Group 1, Class A Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments. • 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

ESM front panel connectors



* USB port is only supported for a very limited set of Keysight AXIe modules. Check module documentation.

Software

Model	Description
Supported operating systems	Microsoft Windows 7 (32/64-bit), Microsoft Windows 8 (32/64-bit), Microsoft Windows 10 (32/64-bit)
Standard compliant drivers	IVI-COM, IVI-C, LabVIEW, MATLAB
Supported application development environments (ADE)	Visual Studio (VB.NET, C#, C/C++), LabVIEW, LabWindows/CVI, VEE
Keysight IO Libraries	Version 2018 update 1 (or greater)

Definitions for Specifications

Specification

Warranted performance. Specifications include guardbands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions. All specifications and characteristics apply over the operating environment outlined in the “Environmental and Regulatory” section of this data sheet. In addition, the following conditions must be met:

- Instrument is within its calibration cycle if calibration is required.
- Instrument has been stored for a minimum of 1 hour within the operating temperature range prior to turn-on and after a 30 minute warm-up period.

Characteristics

Characteristics describe product performance that is useful in the application of the product, but that is not covered by the product warranty. Characteristics are often referred to as Typical or Nominal values.

Typical

Expected performance of an average unit when operated over a 20 to 30 °C temperature range. Typical performance is not warranted. The instrument must be within its calibration cycle if calibration is required.

Nominal

Nominal describes representative performance that is useful in the application of the product when operated over a 20 to 30 °C temperature range. Nominal performance is not warranted.

Additional information

All data are measured from multiple units at room temperature and are representative of product performance within the operating temperature range unless otherwise noted. The specifications contained in this document are subject to change.

Configuration

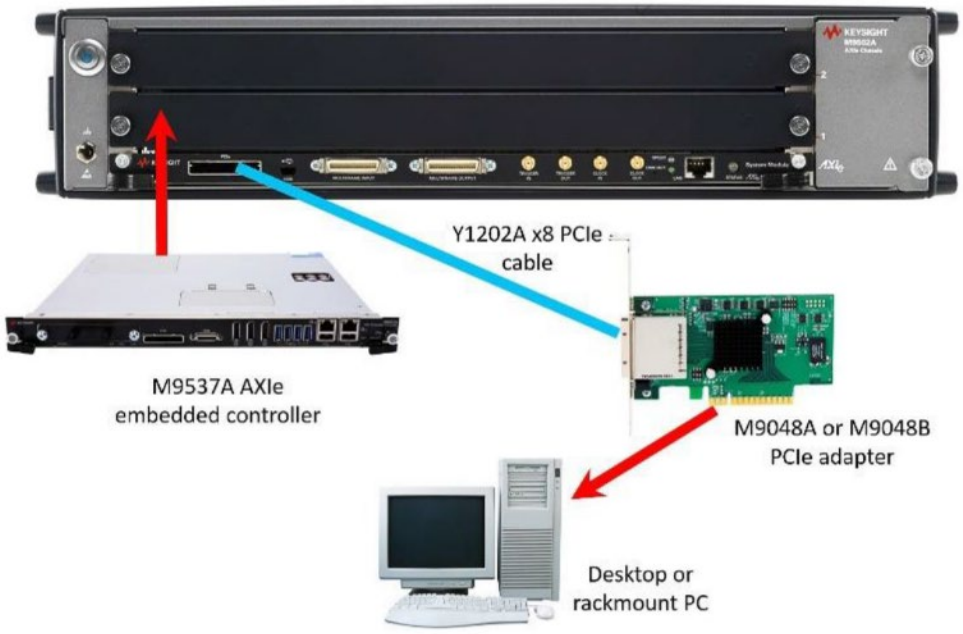


Figure 5. Configuration

Recommended Configuration

Configure the Keysight M9502A and M9505A AXIe chassis, as follows:

1. Configure the chassis connection to the host:
   - If you are using PCIe If you are using PCIe to connect an external computer, select an appropriate PC interface card; the Keysight M9048A is recommended
   - For a list of tested computers, see 5990-7632EN
   - If the AXIe modules support USB then you can use a USB cable to connect the AXIe chassis to the host. A PCIe interface cad/cable is not required
2. Select an appropriate cable to connect the computer to the system module; the Y1202A is recommended to connect the M9048B to the M9502A or M9505A
3. Select rack mount kit and MultiFrame cables if required
4. Each chassis comes with enough filler modules to fill all slots except one. Therefore, it is not necessary to order any.

Ordering Information

Model	Description
M9502A	AXIe chassis: 2-slot with embedded system
M9505A	AXIe chassis: 5-slot with embedded system
Opt 900-932	Optional power cords
Opt U20	ESM USB 2.0 [5] Includes USB cable

Accessories

Model	Description
Y1225A	Rack mount kit for M9502A
Y1226A	Rack mount kit for M9505A
Y1223A	AXIe MultiFrame cable: 0.5m [6]
Y1224A	AXIe MultiFrame cable: 3m [2]
Y1232A	Soft carry bag for M9502A
Y12 21A	Single slot AXIe filler module

Related Products

Model	Description
M9537A	Embedded AXIe PC controller
M9048A	PCIe desktop PC adapter: Gen 2, x8
Y1202A	PCIe cable: x8, 2.0 m (used with M9048A)

[5] USB port is only supported for a very limited set of Keysight AXIe modules. Check module documentation or go to: www.keysight.com/find/axie-chassisusb for compatibility information
[6] Check module documentation to see if MultiFrame cables are supported

Learn more at: www.keysight.com

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