

M9010A 10-slot PXIe Chassis

PCIe Gen 3, 3U, 24 GB/s



Introduction

The Keysight Technologies, Inc. M9010A PXIe 10-slot Gen 3 chassis delivers flexibility, compatibility, and performance in a smaller form-factor ideal for bench-top applications. With 8 PXIe hybrid slots, it gives the system designer flexibility to mix and match the number and location of PXIe and hybrid-compatible modules. The ultra-high performance, PCIe® switch fabric can operate up to Gen 3 providing up to 24 GB/s of system data bandwidth. The new cooling design provides exceptional per-slot cooling while producing much less fan noise. It is also designed for easy maintenance and has features for combining multiple chassis together or integrating with other non-PXI instrumentation.



Key Features

- 8 PXIe hybrid slots, 1 PXIe timing slot, and 1 PXIe system slot
- Powerful cooling with low fan noise
- Ultra-high performance Gen 3 PCIe switching with a two-link (x8, x16) system slot and x8 links to the hybrid/timing slots
- High data bandwidth (maximum 24 GB/s system and 8 GB/s slot-to-slot)
- Multi-chassis power-sequencing and front panel external trigger inputs/outputs
- Specified up to 55 °C and 10,000 ft operating conditions

Hardware Overview



Backplane Configuration

The M9010A PXIe chassis provides 8 hybrid-compatible slots for flexibility and compatibility. It utilizes a single PCI segment with PCIe-to-PCI bridge (Figure 1) for the hybrid slots. The PXIe slots are also organized into two trigger bus segments with configurable interconnections between segments. Two front panel trigger ports (SMB) are connected to the PXI (0:7) trigger bus. This enables easy integration with non-PXI instruments.

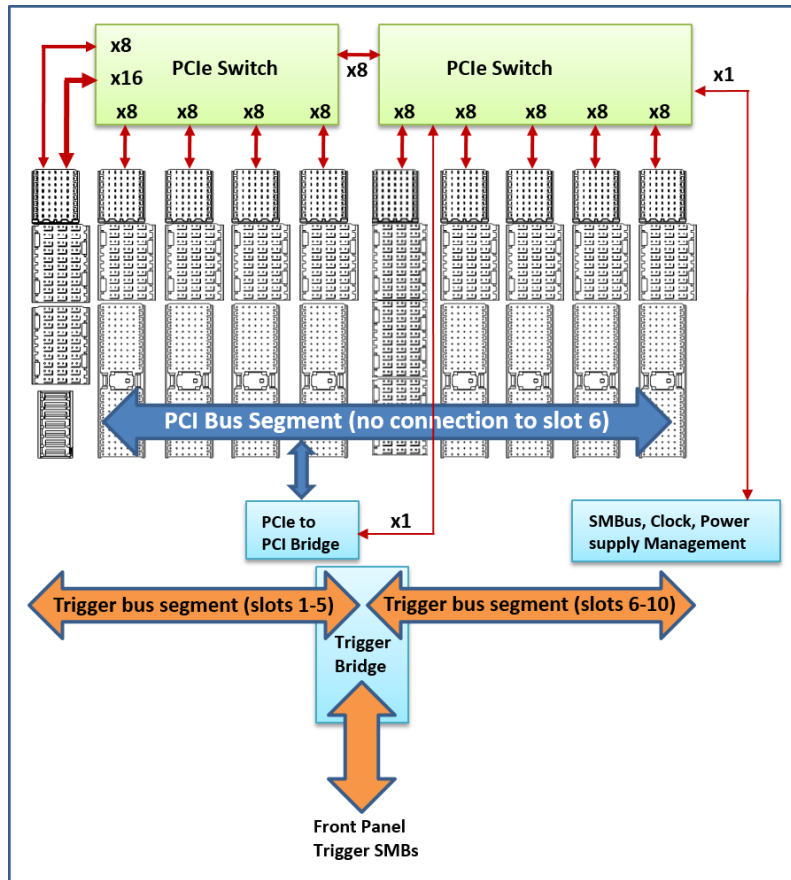


Figure 1. Backplane configuration diagram of the M9010A PXIe 10-slot chassis.

Ultra-High Performance PCIe Fabric

The M9010A PXIe chassis is built around an ultra-high performance PCIe switch fabric that operates at up to Gen 3 speeds. All of the PXIe peripheral slots have a x8 PCIe link providing a maximum data bandwidth of 8 GB/s each. The two-link system slot has a maximum data bandwidth of 24 GB/s when all 24 PCIe lanes are utilized. When combined with the M9023A PXIe system module, M9049A PCIe adapter, and an external PC with a Gen 3 x16 PCIe slot, up to 16 GB/s of data bandwidth can be achieved between the PC and PXIe chassis.

The advanced switch fabric also allows for peer-to-peer communications. Any peripheral slot can communicate with any other peripheral slot without utilizing the system slot PCIe links. The PCIe switches have a large crossbar capacity, allowing flexible placement of peer-to-peer modules without impacting data bandwidth.

Innovative Cooling

The M9010A has been optimized for both module cooling and acoustical fan noise resulting in a lower-level of fan noise when high-performance PXIe modules are used. It utilizes auto-speed fans and internal temperatures sensors to give the user complete control over module temperatures. Unlike many other PXIe chassis, the fan-speed is controlled using temperature sensors located on the top of the backplane, in the path of the module cooling air exhaust. This enables the M9010A fans to react to actual changes in module temperatures, instead of ambient air temperature readings. This results in lower module operating temperatures when the AUTO fan setting is used. When the HIGH fan setting is used, the acoustical emissions are much lower than the typical PXIe chassis.

System Monitoring

The M9010A PXIe chassis has a complete set of system monitoring functions for power rail voltages, module exhaust temperatures, and fan speeds. For temperature measurements, the chassis utilizes 6 temperature sensors located on the top of the backplane, in the path of the module exhaust. Chassis operating conditions can be monitored via a software API or the soft front panel interface.

A DB-9 connector is also available at the rear of the chassis for remote inhibit and power rail monitoring. The chassis has configurable alarms that can be monitored via front panel LEDs, soft front panel interface, or software API.

Easy system expansion

When connecting multiple PXIe chassis together, the power-sequencing becomes very important especially when an embedded controller is used. The M9010A PXIe chassis has special features built-in to make this easy. Cat 5 cables with RJ-45 connectors are used to interconnect the chassis. In a multi-chassis configuration, a user can press a single chassis power button to enable all chassis in the system to power-up. If an embedded controller is being used, its chassis will automatically be powered up last. This provides a consistent, repeatable power-up sequence.

The M9010A also has two front panel trigger SMBs which can be used for input/output triggers. These trigger ports connect to the PXIe backplane making it easy to connect triggers between multiple chassis or non-PXIe instruments.

Software Platform

Drivers and Trigger Manager

The M9010A PXIe chassis comes complete with IVI, NET, IVI-C, and LabVIEW drivers. Windows 7, 8.1, and 10 operating systems are supported, and applications can be created using a variety of software tools including LabVIEW, LabWindows/CVI, MATLAB, VEE, Visual Basic, VisualStudio.NET (C/C++, C#, VB.NET).

Soft Front Panel Interface and Trigger Manager

A soft front panel (SFP) interface (Figure 2) and PXIe-9 compliant trigger bus manager are provided with the M9010A chassis. The SFP can be used to monitor and control the PXIe chassis and has the following functions:

- Configure fan control front panel trigger ports
- Monitor chassis fan speed, chassis temperatures, rail voltages, and PCIe links
- Configure alarms for fan speed, temperature, rail voltage, reference clock
- Run chassis self-test and update chassis firmware
- Review chassis information

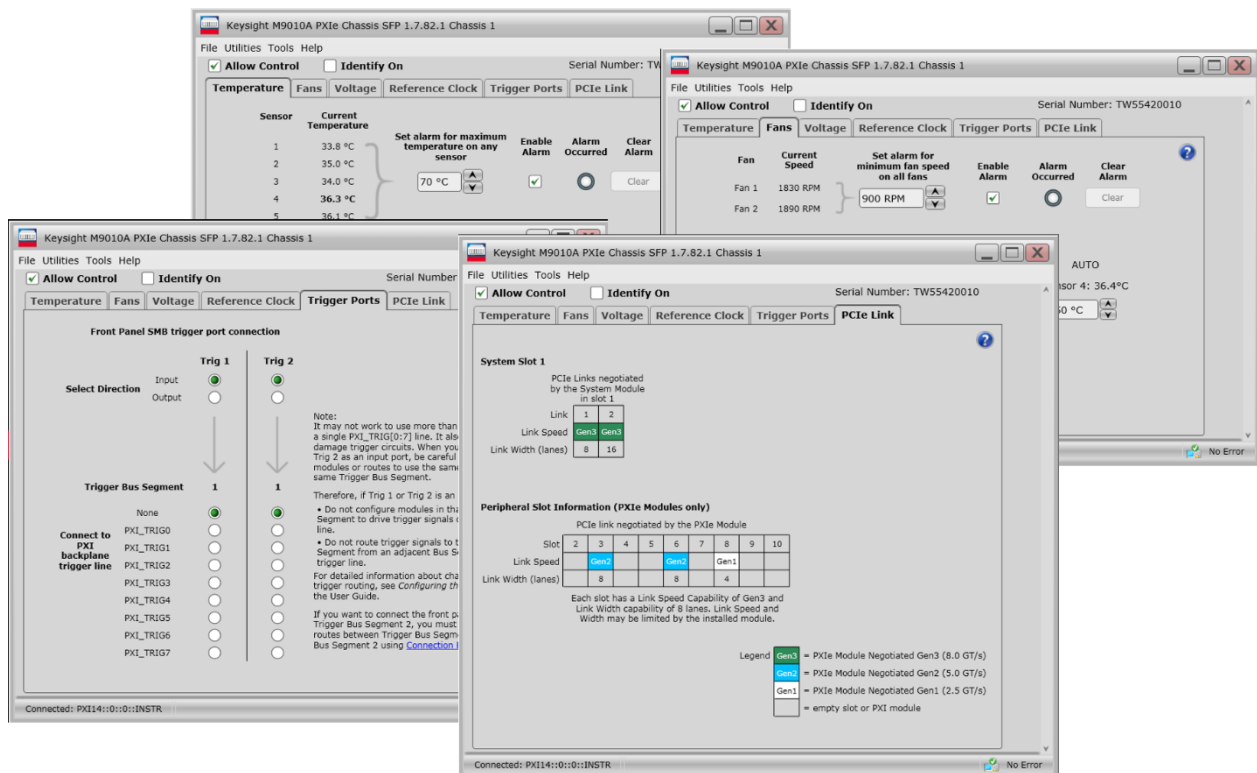


Figure 2. Soft front panel

Technical Specifications and Characteristics

General Chassis Characteristics	
Standards Compliance	
- PXI-5 PXI Express Hardware Specification	
- PXI-1 Hardware Specification Rev 2.2	
- PICMG EXP.0 R2.0 Specification	
Backplane	
Module Size	3U
Total Slots	10
Hybrid Compatible Slots	8
PXIe System Slot	1 (with three system expansion slots)
PXIe Timing Slot	1 (also accepts PXIe module)
System Slot Link Configuration (fixed)	2-Link (x8, x16)
Backplane speed	PCIe revision 3.0 (gen 3)
Module Compatibility	PXIe, PXI-Hybrid, PXI-1 (J1 only), and cPCI (J1 only)
Mechanical	
Size	322.5mm W x 194.8mm H x 552.5mm D (with feet installed)
	322.5mm W x 177.8mm H x 552.5mm D (with feet removed)
Weight (without modules)	14.02 kg (30.91 lbs)

Power Supply Characteristics				
AC Input				
Operating voltage/power (low-line) ¹		100/120 V, 735 W (maximum)		
Operating voltage/power (high-line) ¹		220/240 V, 1300 W (maximum)		
Input frequency range		50/60 Hz		
Over current protection		Internal fuse in line		
Available DC Output Power (for peripheral module slots) ²				
220-240 V input:		830 W		
100-120 V input:		470 W		
DC Supplies	Maximum Current ³		Load Regulation	Maximum ripple and noise (20 MHz BW)
	45 °C, <10kft	50 °C, 10kft		
+3.3 V	58.8 A	48.8 A	5%	1.5% (pk-pk)
+5 V	36 A	31.5 A	5%	1% (pk-pk)
+12 V	40 A	35 A	5%	1% (pk-pk)
-12 V	4 A	3.5 A	5%	1% (pk-pk)
5 V _{AUX}	2 A	2 A	5%	50 mV (pk-pk)

¹Auto switching between high line and low line

²No derating required for temperature or altitude

³The total power supplied for all rails must not exceed 470 W (100-120 V) or 830 W (200-240 V).

Backplane Pin Current Capacity

Slot	+3.3 V	+5 V	+12 V	- 12 V	5 V _{AUX}
System controller slot	9 A	9 A	11 A	0 A	1 A
System timing/PXle slot	6 A	0 A	4 A	0 A	1 A
PXle hybrid slot	6 A	6 A	4 A	1 A	1 A

Chassis Cooling and Power Dissipation Characteristics

Slot airflow direction	Bottom of module to top of module
Chassis cooling intake	Rear of chassis
Chassis cooling exhaust	Front top of chassis
Chassis cooling fans	Two 120 cfm fans on rear panel with HIGH/AUTO speed selector
Power dissipation, system slot	140 W max
Power dissipation, user slot	42 W max ¹
Power dissipation, timing slot	42 W max ¹

DC Supply Protection

Over-current protection	Power supply is shut down when the output voltage drops to approximately 20% from nominal
Over-voltage protection	3.3 V maximum output = 5.96V 5 V maximum output = 9.0 V 12 V maximum output = 15.6 V



¹Maximum per slot power dissipation at 55°C with 15°C temperature rise; requires: a) that the chassis top is not blocked (1U rack space above or sitting on bench and b) a slot blocker is installed in each empty slot. Module cooling can be impacted by each module's resistance to air flow.

Clocks and Triggers	
10 MHz System Clock (PXI_CLK10)	
Maximum slot-to-slot skew	200 ps
Accuracy	30 ppm
Output amplitude (10 MHz REF Out BNC)	1 V pk-pk \pm 20% square-wave into 50 Ω 2 V pk-pk unloaded
Output impedance (10 MHz REF Out BNC)	50 Ω \pm 5 Ω
100 MHz system clock (PXIe_CLK100)	
Maximum slot-to-slot skew	125 ps
Accuracy	30 ppm
100 MHz SYNC (PXIe_SYNC100)	
Maximum slot-to-slot skew	125 ps
Accuracy	30 ppm
External 10 MHz clock source input requirements	
Frequency input	10 MHz \pm 100 PPM
Input signal (10 MHz REF In BNC)	100 mVPP to 5 VPP (square-wave or sine-wave)
Input signal (PXI timing slot PXI_CLK10_IN)	5 V or 3.3 V TTL signal
PXI star trigger	
Maximum slot-to-slot skew	250 ps
PXI differential star triggers	
Maximum slot-to-slot skew	150 ps
Maximum differential skew	25 ps
Front panel triggers (trig 1 and trig 2 SMBs)	
Direction control	Input or output (configurable)
Output level	3.3 V CMOS (TTL compatible, 5 V tolerant)
Output impedance	50 Ω (typ)
Output trigger source	PXI_Trig0 - PXI_Trig7 (Segment 1)
Input level	3.3 V CMOS (TTL compatible, 5 V tolerant)
Input impedance	3 k Ω (typ)
Input trigger destination	PXI_Trig0 - PXI_Trig7 (Segment 1)
Input threshold	1.65 V (typ)
Minimum swing	250 mV (typ)
Minimum pulse width	100 ns (typ)

Environmental Characteristics^{1,2}

Operating and Storage Conditions	Operating	Storage
Temperature	0°C to 55°C	-40°C to 70°C
Altitude	Up to 10,000 ft (3048 m)	Up to 15,000 ft (4572 m)
Maximum Relative Humidity (non-condensing):	Type tested, 95%RH up to 40°C, decreases linearly to 40%RH at 55°C ³	
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 emissions (referenced to 1 pW)	Auto fan (25°C ambient)	High fan
Sound pressure level ⁴	42 dBA	58 dBA
Sound power	50 dBA	66 dBA

¹Samples 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.

²Test Methods are aligned with IEC 60068-2 and levels are similar to MIL-PRF-28800F Class 3

³From 40°C to 55°C, the maximum % Relative Humidity follows the line of constant dew point.

⁴At operator position

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):
<ul style="list-style-type: none"> • 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 European EMC Directive of the following standards (dates and editions are cited in the Declaration of Conformity):
<ul style="list-style-type: none"> • 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

Definitions for specifications

Specification (spec)

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 (typ)

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 (nom)

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 data contained in this document is subject to change.

M9010A Rack Mounting and Configuration

Rack Mounting

The Y1271A rack mount accessory kit can be used to mount the M9010A chassis in the center of the rack and has cable access ports on both sides of the chassis. Brushes are included to control air flow through these ports. The rackmount kit also allows the chassis to be flush or recess-mounted. Rack rails are required. Order the Y1217A if using a Keysight rack.

Recommended Configuration

Configure the Keysight M9010A PXIe chassis as follows:

- Select a PXIe system module or embedded controller (the Keysight M9022A/M9023A and M9037A are recommended)
- If an external computer is being used, select an appropriate PC interface card (the Keysight M9048B/M9049A are recommended)
- Select an appropriate cable to connect the computer interface board to the chassis interface (the Y1202A is recommended to connect the M9048B and M9022A)
- Install a slot-blocker into each empty slot (Y1212A) and cover them with blank panels.
- Select accessories as required

Multi-chassis configuration

The M9010A can be used in multi-chassis configurations with other PXIe chassis (including the M9018B and M9019A PXIe 18-slot chassis) and AXIe Chassis (such as M9502A/M9505A). The number of chassis that can be interconnected depends on the controller and operating system used. See [Tested PC and PXI/AXIe Chassis Configurations \(5990-7632EN\) Technical Overview](#) for more details.

Many different topologies are possible including cascade and star. Two examples are shown in figures 3 and 4.

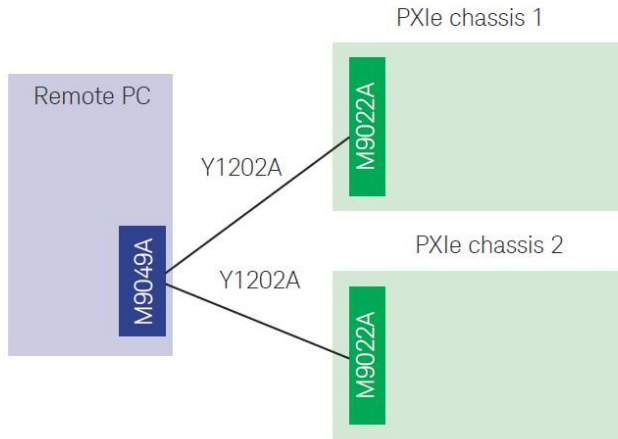


Figure 3. Star configuration using the M9049A for x8 connections from a remote PC to two chassis. Chassis types can be mixed AXIe and PXIe

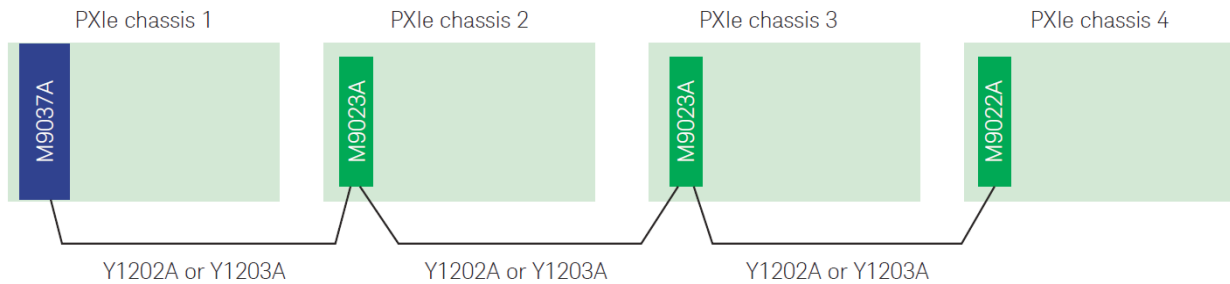


Figure 4. Cascade configuration using the M9037A with the M9022A for x8 connections from the embedded PC and multiple PXIe chassis (up to a total of four).

For more detailed configuration information, go to www.keysight.com/find/pxie-multichassis

Ordering Information

Software

Supported Software Components	
Operating systems	Microsoft Windows 7 (32/64-bit), Microsoft Windows 8 (32/64-bit), Microsoft Windows 10 (32/64-bit)
Standard compliant drivers	IVI.NET, IVI-C, LabVIEW, MATLAB
Application development environments (ADE)	Visual Studio (VB.NET, C#, C/C++), LabVIEW, LabWindows/CVI, VEE
Keysight IO libraries	Version 2018 update 1 (or greater)

Hardware

Model	Description
M9010A	PXIe chassis: 10-slot, Gen 3, 3U, 24 GB/s Includes standard (non-EMC) PXI filler panels
Accessories	
Y1212A	Slot blocker kit: 5 single-slot
Y1213A	PXI EMC filler panel kit: 5 single-slot
Y1217B	Rack mount rail kit
Y1271A	M9010A rack mount kit
Related Products	
M9037A	PXIe embedded controller: Intel i7, 4 GB RAM, 240 GB SSD
M9048B and M9049A	PCIe host adapter: Gen 3, x8 or x16
M9022A and M9023A	PXIe system module: Gen 3, x8 or x16
M9024A	PXIe system module with connectivity expansion: two gigabit LAN, two USB 3.0, four USB 2.0, GPIB

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