

# M9018B and M9019A 18-slot PXIe Chassis

PCIe Gen 2, 8 GB/s or PCIe Gen 3, 24 GB/s



# Introduction

The Keysight Technologies, Inc. M9018B and M9019A PXIe 18-slot chassis deliver the flexibility, compatibility, and performance required for demanding applications. With 16 PXIe hybrid slots, they give the system designer more flexibility to mix and match the number and location of PXIe and hybrid-compatible modules. Choose between the high-performance PCIe® Gen 2 and ultra-high performance, Gen 3 models to meet your application's requirements. Both models include the same innovative cooling design which allows the chassis to fit into 4U of rack space. They are also designed for easy integration into large systems containing multiple PXIe chassis and other non-PXI instrumentation.



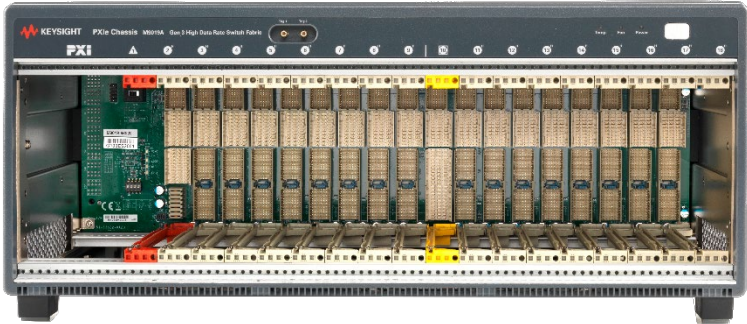
## Key features

- 16 PXIe hybrid slots, 1 PXIe timing slot, and 1 PXIe system slot
- 4U chassis with innovative cooling design
- Choose between Gen 3 and Gen 2 PCIe performance levels:
  - Gen 2: M9018B high performance backplane with configurable two- and four- link system slot (2x8 or 4x4) and mix of x4 and x8 hybrid/timing slots
  - Gen 3: M9019A ultra high-performance backplane (maximum 24 GB/s system and 8 GB/s slot-to-slot) with a two-link (x8, x16) system slot and x8 links to the hybrid/timing slots
- 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 M9018B and M9019A PXIe chassis provide 16 hybrid-compatible slots for the ultimate in flexibility and compatibility.



The PCIe switch fabric for the hybrid slots is broken into two segments, each serviced by its own PCIe-to-PCI bridge (Figures 1 and 2). The PXIe slots are also organized into three 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.

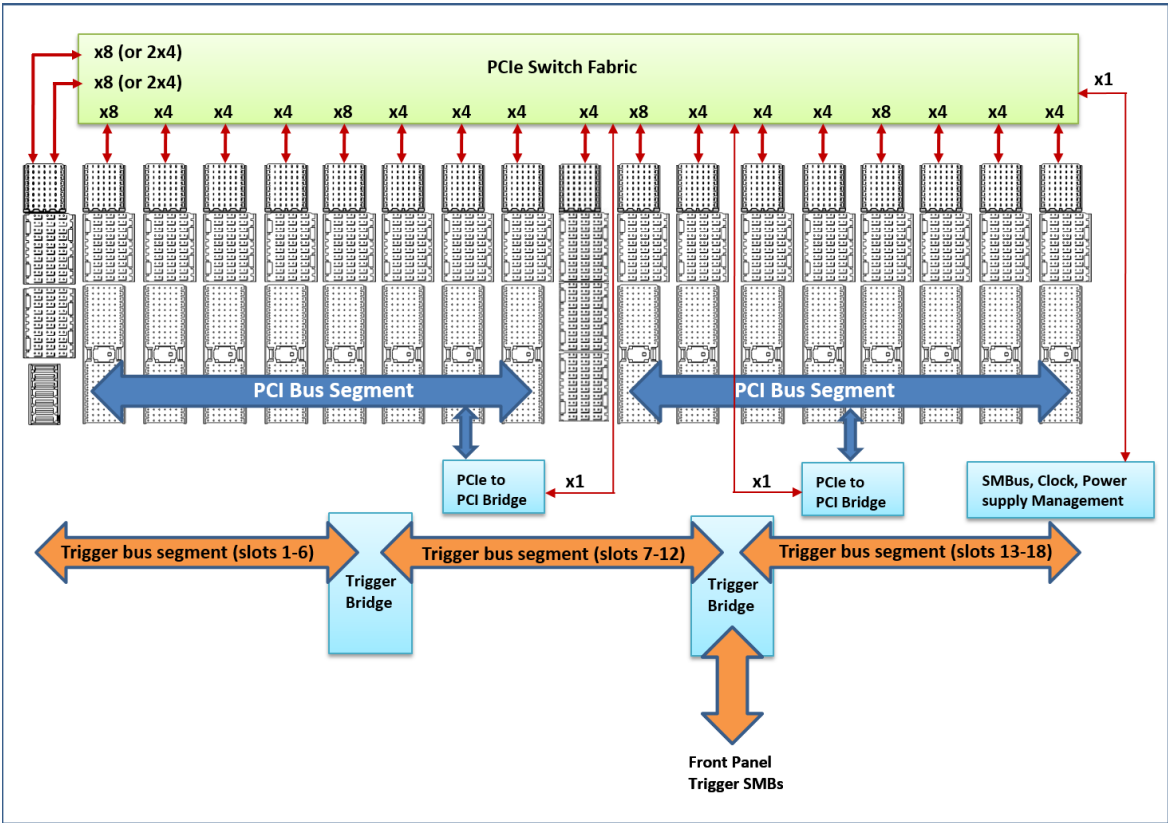


Figure 1. Backplane configuration diagram of the M9018B PXIe 18-slot chassis.

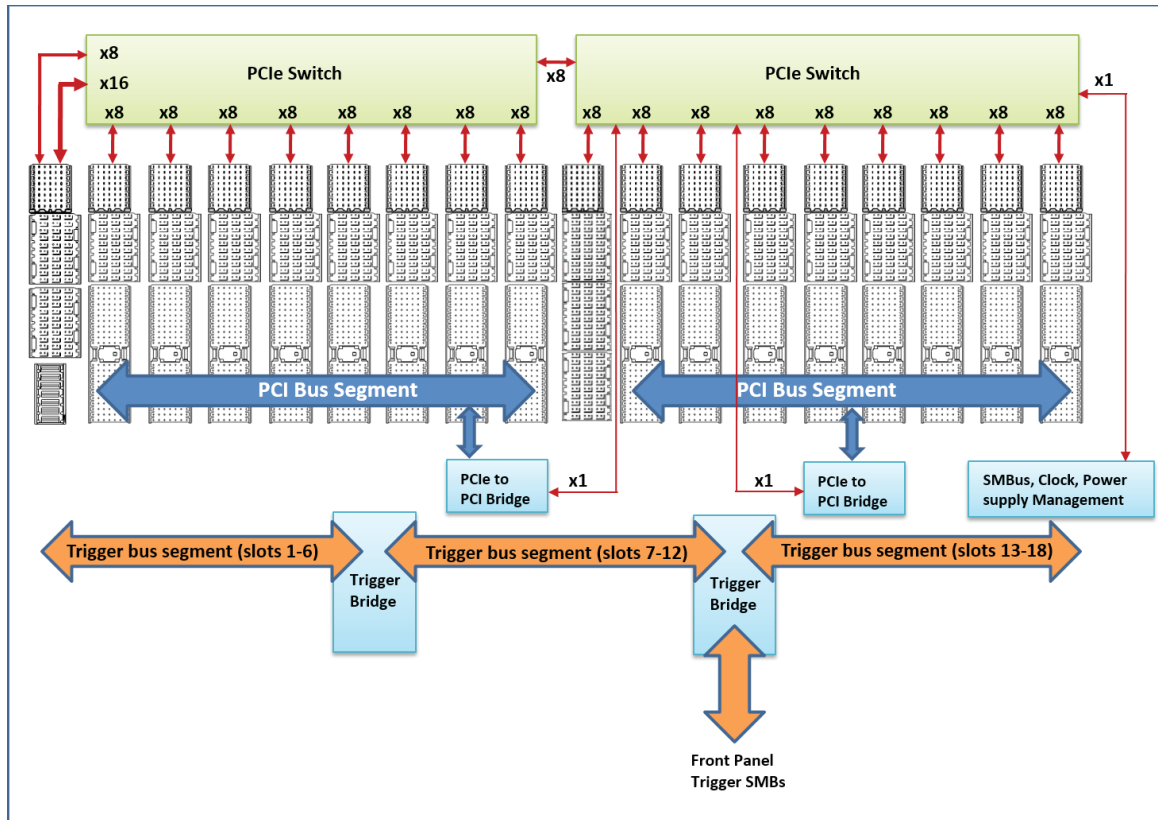


Figure 2. Backplane configuration diagram of the M9019A PXle 18-slot chassis.

## High performance PCIe fabric

The M9018B PXle chassis utilizes a high performance, configurable PCIe switch fabric that operates at Gen 2 speeds. The system slot can be changed between a 2-link (2x8) or 4-link (4x4) configuration. A 2-link configuration, optimized for the M9021A PCIe cable interface, is also provided (a 2x8, 2-link configuration, with link 2 inactive). Four of the PXle peripheral slots have a x8 PCIe link providing a maximum data bandwidth of 4 GB/s. The 12 remaining peripheral slots have a x4 PCIe link providing a maximum data bandwidth of 2 GB/s. The system slot has a maximum data bandwidth of 8 GB/s when all 16 PCIe lanes are utilized.

The M9019A PXle chassis is built around an ultra-high performance PCIe switch fabric that operates at up to Gen 3 speeds. All the PXle peripheral slots have a x8 PCIe link providing a maximum data bandwidth of 8 GB/s each. The two-link system slot (x8 + x16) has a maximum data bandwidth of 24 GB/s when all 24 PCIe lanes are utilized. When combined with the M9023A PXle 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 PXle chassis.

## Innovative cooling

The M9018B and M9019A PXIe chassis utilize an innovative cooling design that allow them to fit into 4U of rack space. This represents a 20 percent reduction in occupied rack space, compared to typical PXI chassis which requires 5U or more for airflow. This space can be utilized for an external 1U controller via PCIe cable, resulting in a system that requires no more rack space than other chassis with an embedded PC controller.

The innovative design includes auto-speed fans to expel hot air out the back panel allowing other instruments with bottom air intakes to be placed directly above the chassis. Cool air is pulled into the chassis from the front, sides, and bottom of the chassis. Unlike many PXIe chassis, the fan-speed is controlled by using temperature sensors located on the top of the backplane, in the path of the module exhaust. This enables the fans in the chassis to react to actual changes in module temperatures, instead of ambient air temperature readings used by the typical PXIe chassis. This results in lower module operating temperatures when the auto fan setting is used.

Keysight's exclusive air-inlet modules (Figure 3) can also be used to supply even more cool air from the front of the chassis and direct it to other slots. Given the air outside the rack is generally cooler than the air inside the rack, this results in more efficient cooling of the PXIe modules. This option enables the system designer to decide how to best cool the chassis, providing more design flexibility than other PXIe chassis.



Figure 3. Y1214C Air Inlet Kit

## Lower maintenance costs

The M9018B and M9019A PXIe chassis were designed to reduce maintenance costs. There are no air filters to maintain, and the power supply and fans can be removed while the chassis is mounted in a rack. This enables the chassis to be serviced, while keeping DUT cabling and modules in place.



## System monitoring

The M9018B and M9019A PXIe chassis have a complete set of system monitoring functions for power rail voltages, module exhaust temperatures, and fan speeds. For temperature measurements, the chassis utilizes eight 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.

## Designed for large systems

When connecting multiple PXIe chassis together, the power-sequencing becomes very important especially when an embedded controller is used. The M9018B and M9019A PXIe chassis have 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.

Both chassis also have two front panel trigger SMBs which can be used for input/output triggers. These trigger ports connect to the PXIe backplane adding configuration flexibility to the system when non-PXIe instruments are used or when a PXIe instrument being used can only receive triggers over the PXIe backplane.

## Software Platform

### Drivers and trigger manager

The M9018B and M9019A PXIe chassis come 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 4) and PXIe-9 compliant trigger bus manager are provided with the 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

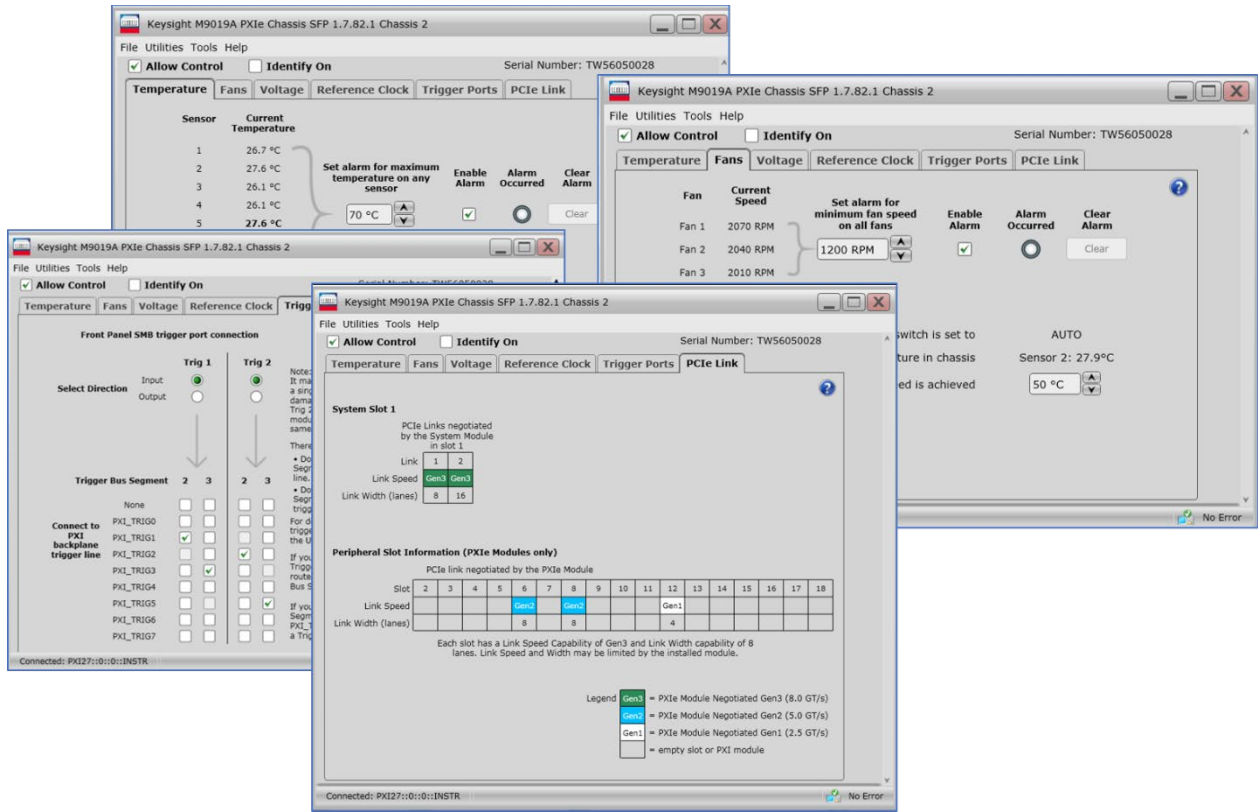


Figure 4. Soft front panel

# 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	18
Hybrid Compatible Slots	16
PXle System Slot	1 (with three system expansion slots)
PXle Timing Slot	1 (also accepts PXle module)
Module Compatibility	PXle, PXI-Hybrid, PXI-1 (J1 only), and PCI (J1 only)

### System slot link configuration

M9018B (configurable)	2-Link (2x8) and 4-Link (4x4) plus M9021A configuration (1x8)
M9019A (fixed)	2-Link (x8, x16)

### Backplane speed

M9018B	PCIe revision 2.0 (gen 2)
M9019A	PCIe revision 3.0 (gen 3)

### Mechanical

Size	444.4 mm W x 194.8 mm H x 466 mm D (with feet installed)
	444.4 mm W x 177.8 mm H x 466 mm D (with feet removed)
	4U x 1 rack width
Weight (without modules)	13.5 kg (29.8 lbs.)

## Power supply characteristics

### AC input

Operating voltage/power (low-line) <sup>1</sup>	100/120 V, 1200 W (maximum)
Operating voltage/power (high-line) <sup>1</sup>	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) <sup>2</sup>	M9018B	M9019A
220 to 240 V input	858 W	800 W
100 to 120 V input	708 W	650 W

1. Auto switching between high line and low line.
2. No derating required for temperature or altitude.



### Power supply characteristics, continued

DC supplies	M9018B maximum current <sup>1</sup>		M9019A maximum current <sup>3</sup>		Load regulation	Maximum ripple and noise (20 MHz BW)
	45 °C, < 10kft	50 °C, 10kft	45 °C, < 10kft	50 °C, 10kft		
+3.3 V	70 A	67 A	70 A	67 A	5%	1.5% (pk-pk)
+5 V	60 A <sup>2</sup>	52.5 A <sup>2</sup>	60 A <sup>4</sup>	52.5 A <sup>4</sup>	5%	1% (pk-pk)
+12 V	57.4 A <sup>2</sup>	49.9 A <sup>2</sup>	52.5 A <sup>4</sup>	45 A <sup>4</sup>	5%	1% (pk-pk)
-12 V	4 A	4 A	4 A	4 A	5%	1% (pk-pk)
5 V <sub>AUX</sub>	2 A	2 A	2 A	2 A	5%	50 mV (pk-pk)

### Backplane pin current capacity (nom)

Slot	+3.3 V	+5 V	+12 V	- 12 V	5 V <sub>AUX</sub>
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 / 6 A <sup>5</sup>	1 A	1 A

### Chassis cooling and power dissipation characteristics

Slot airflow direction	Bottom of module to top of module
Chassis cooling intake	Bottom of front bezel, side panels, and bottom panel of chassis
Chassis cooling exhaust	Rear of chassis
Chassis cooling fans	Three 186 cfm fans on rear panel with HIGH/AUTO speed selector
Power dissipation, system slot	140 W max
Power dissipation, user slot	42 W max <sup>6</sup>
Power dissipation, timing slot	42 W max <sup>6</sup>

### 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 = 5.96 V
	5 V maximum output = 6.0 V
	12 V maximum output = 15.6 V

1. The total power supplied for all rails must not exceed 708 W (100 to 120 V) or 858 W (200 to 240 V).
2. The total power supplied for 5 V and 12 V rails must not exceed 689 W at 45 °C < 10kft, or 599 W at 50 °C, 10kft.
3. The total power supplied for all rails must not exceed 650 W (100 to 120 V) or 800 W (200 to 240 V).
4. The total power supplied for 5 V and 12 V rails must not exceed 630 W at 45 °C < 10kft, or 540 W at 50 °C, 10kft
5. Backplane current capacity for 12 V supply is dependent on the backplane connector used on the PXle module. A maximum current of 6 A is allowed only if the PXle module being used has an XJ4 connector manufactured by ERNI (PN 214443). Otherwise, the maximum current allowed is 4 A.
6. Maximum per slot power dissipation at 55 °C with 15 °C temperature rise; requires: a) that the chassis, bottom is not blocked (1U rack space below or sitting on bench with feet extended) OR b) two air inlet modules in slots 9, 10, or 11, and a slot blocker in empty controller slots. Module cooling can be impacted by each module's resistance to air flow.

## Clocks and trigger characteristics

<b>10 MHz system clock (PXI_CLK10) (typ)</b>	
Maximum slot-to-slot skew	155 ps
Accuracy	30 ppm
Output amplitude (10 MHz REF Out BNC)	1 V pk-pk $\pm$ 20% square-wave into 50 $\Omega$
	2 V pk-pk unloaded
Output impedance (10 MHz REF Out BNC)	50 $\Omega$ $\pm$ 5 $\Omega$
<b>100 MHz system clock (PXIe_CLK100) (typ)</b>	
Maximum slot-to-slot skew	125 ps
Accuracy	30 ppm
<b>100 MHz SYNC (PXIe_SYNC100) (typ)</b>	
Maximum slot-to-slot skew	125 ps
Accuracy	30 ppm
<b>External 10 MHz clock source input requirements (nom)</b>	
Frequency input	10 MHz $\pm$ 100 PPM
Input signal (10 MHz REF in BNC)	100 mVPP to 5 VPP (square-wave or sinewave)
Input signal (PXI timing slot PXI_CLK10_IN)	5 V or 3.3 V TTL signal
<b>PXI star trigger (typ)</b>	
Maximum slot-to-slot skew	250 ps
<b>PXI differential star triggers (typ)</b>	
Maximum slot-to-slot skew	150 ps
Maximum differential skew	25 ps
<b>Front panel triggers (trig 1 and trig 2 SMBs) (nom)</b>	
Direction control	Input or output (configurable)
Output level	3.3 V CMOS (TTL compatible, 5 V tolerant)
Output impedance	50 $\Omega$ (typ)
Output trigger source	PXI_Trig0 - PXI_Trig7 (Segment 2 or 3)
Input level	3.3 V CMOS (TTL compatible, 5 V tolerant)
Input impedance	3 k $\Omega$ (typ)
Input trigger destination	PXI_Trig0 - PXI_Trig7 (Segment 2 or 3)
Input threshold	1.65 V (typ)
Minimum swing	250 mV (typ)
Minimum pulse width	100 ns (typ)



# Environmental Characteristics <sup>1,2</sup>

Operating and storage conditions	Operating	Storage
Temperature	0 °C to 55 °C	-40 °C to 70 °C
Altitude	Up to 9,482 ft (3000 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 <sup>3</sup>	
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	
Functional shock	Type tested at half-sine, 30 g, 11 ms	
Bench handling	Type tested per MIL-PRF-28800F	
Acoustical emissions (referenced to 1 pW)	Auto fan (25 °C ambient)	High fan
Sound pressure level <sup>4</sup>	53 dBA	69 dBA
Sound power	59 dBA	77 dBA

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 like MIL-PRF-28800F Class 3.
3. From 40 °C to 55 °C, the maximum % Relative Humidity follows the line of constant dew point.
4. At 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):

- 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):

- 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

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## 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.

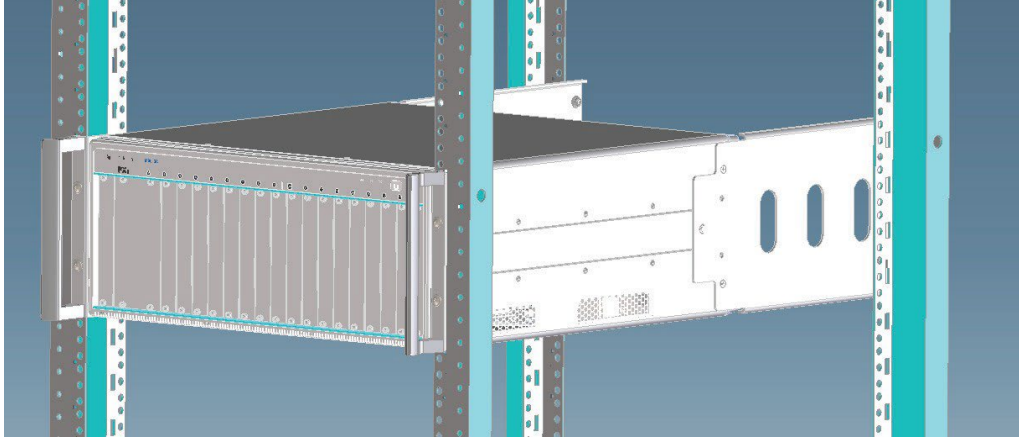
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# M9018B/M9019A Rack Mounting and Configuration

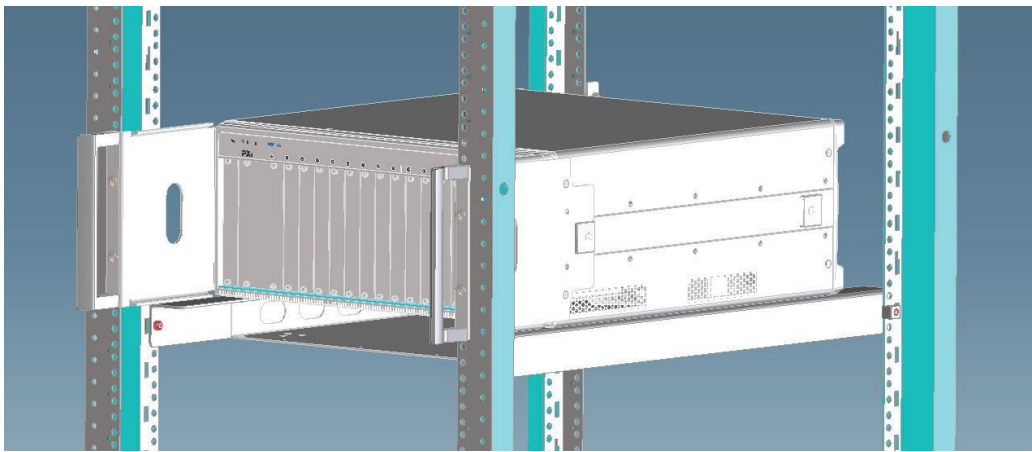
## Rack mounting

The M9018B and M9019A rack mount accessory kits provide system design flexibility. The following kits can be mix-and-matched to suit the needs of a given application:

- Y1215C Flush mount rack kit (Figure 5): Complete kit including rack flanges, handles, and attachment hardware. The kit suspends the chassis in a Keysight rack using only 4U of rack space. Rack rails may be needed in a non-Keysight rack.
- Y1216B Recess mount rack kit (Figure 6): Complete recess-mount kit including rack flanges, handles, and attachment hardware. The kit recesses the chassis by 4 inches and suspends the chassis in a Keysight rack using only 4U of rack space. Rack rails may be needed in a non-Keysight rack.
- Y1217A Rack mount rail kit (Figure 6): This optional kit provides additional stability to the chassis when rack mounted. When using rails, the chassis will require 5U of rack space. Rails may not fit in a non-Keysight rack.
- Y1218A Cable tray kit (Figure 6): Adds a 1U high cable tray to the chassis and includes cable tray, feet for using the chassis/tray on a table, and attachment hardware.



**Figure 5.** M9018B and M9019A chassis suspended in a rack using the Y1215C.



**Figure 6.** M9018B and M9019A chassis rack-mounted using the Y1216A, Y1217A, and Y1218A.

**Note:** Rack mounting the M9018B and M9019A may require two people if rails are not used. Care must also be taken to ensure the chassis receives sufficient cooling air. See the chassis cooling characteristics in this data sheet for more details.

## Recommended configuration

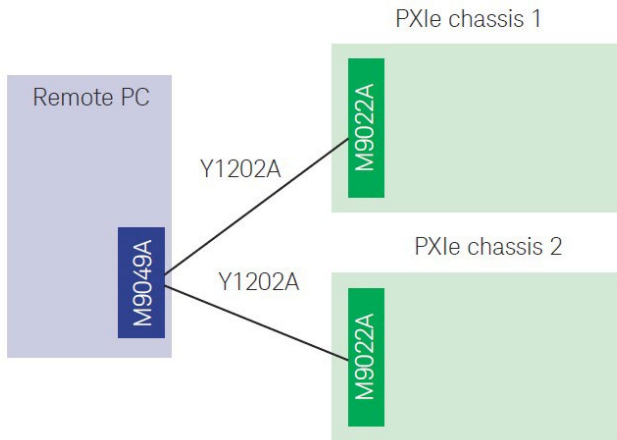
Configure the Keysight M9018B and M9019A PXIe chassis as follows:

- 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 other accessories as required.

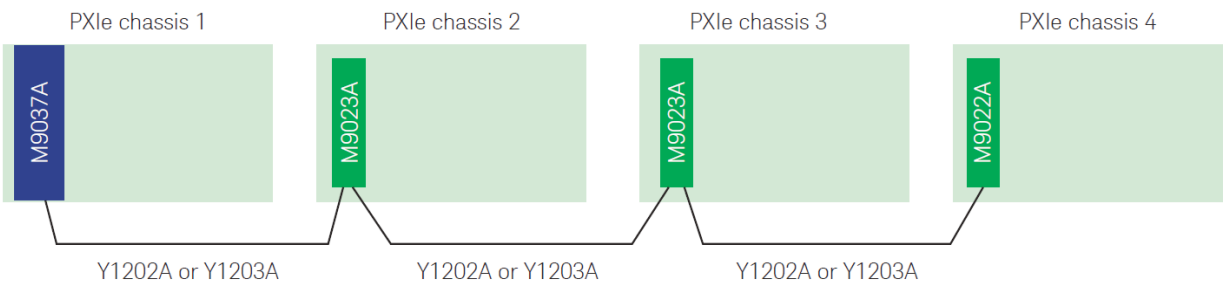
## Multi-chassis configuration

The M9018B and M9019A can be used in multi-chassis configurations with other PXIe chassis (including the M9010A PXIe 10-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 7 and 8.



**Figure 7.** Star configuration using the M9049A for x8 connections from a remote PC to two chassis. Chassis types can be mixed AXIe and PXIe.



**Figure 8.** 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](http://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
M9018B	PXIe chassis: 18-slot, Gen 2, 3U, 8 GB/s
M9019A	PXIe chassis: 18-slot, Gen 3, 3U, 24 GB/s Both include standard (non-EMC) PXI filler panels
Accessories	
Y1212A	Slot blocker kit: 5 single-slot
Y1213A	PXI EMC filler panel kit: 5 single-slot
Y1214C	Air inlet module kit (includes controller slot blocker)
Y1215C	Flush mount rack kit
Y1216B	Recess mount rack kit
Y1217A	Rack mount rail kit
Y1218A	Cable tray 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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