Keysight PXIe Chassis Family

M9010A, M9018B, M9019A

Notices

Manual Part Number

M9019-90003

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To contact Keysight for sales and technical support, refer to the support links on the following Keysight websites:

www.keysight.com/find/M9010A

www.keysight.com/find/M9018B

www.keysight.com/find/M9019A

(product-specific information and support, software and documentation updates)

www.keysight.com/find/assist (worldwide contact information for repair and service)

Declaration of Conformity

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The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings or operating instructions in the product manuals violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability for the customer's failure to comply with these requirements.

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.

PXIe Chassis are for indoor use only.

Mains supply voltage fluctuations must not exceed ±10% of the nominal supply voltage.

Transient overvoltages typically present on the Mains supply (installation CAT II)

Do Not Operate in an Explosive Atmosphere

Do not operate 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 a 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 a 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 AXIe 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 and Regulatory 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:

Refer to manual for additional safety information.

Earth Ground.

Chassis Ground.

Alternating Current (AC).

Direct Current (DC).

Standby Power. Unit is not completely disconnected from AC mains when power switch is in standby position

Indicates that antistatic precautions should be taken.
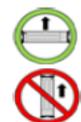
Operate the PXIe chassis in the horizontal orientation. Do NOT operate this chassis in the vertical orientation.

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.

CE

Notice for European Community: This product complies with the relevant European legal Directives: EMC Directive and Low Voltage Directive

The Regulatory Compliance Mark (RCM) mark is a registered trademark. This signifies compliance with the Australia EMC Framework regulations under the terms of the Radio Communication Act of 1992.

ICES/NMB-001

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

Cet appareil ISM est conforme a la norme NMB-001 du Canada.

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.

KC

MSIP-REM-Kst-xxxxxxx

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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This product complies with the WEEE Directive (2002/96/EC) marking requirement. The affixed product label (see below) indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category: With reference to the equipment types in the WEEE directive Annex 1, this product is classified as a "Monitoring and Control instrumentation" product.

Do not dispose in domestic household waste.

To return unwanted products, contact your local Keysight office for more information.

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3 Chassis and Host Controller Power Up or Down Sequence

4 Chassis Alarm Architecture

5 Power Supply Operation

6 Chassis Cooling and Rack Mounting

11 Chassis Maintenance

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1   Introduction to the PXIe Chassis

Keysight provides three PXIe chassis in the PXIe Chassis Family:

- M9010A – a Gen 3, 24 GB/s,10-Slot PXI chassis
  (www.keysight.com/find/M9010A)

- M9018B – a Gen 2, 8GB/s, 18-Slot PXI chassis
  (www.keysight.com/find/M9018B)

- M9019A – a Gen 3, 24 GB/s, 18-Slot PXI chassis
  (www.keysight.com/find/M9019A)

The PXIe chassis is the backbone of a PXIe system. These chassis have a high performance backplane providing PXI modules in the chassis the ability to communicate rapidly with one another and to PC. It also provides power and cooling for the modules.

The PXIe Chassis Family Driver supports five PXIe Chassis including the M9010A, M9018A, M9018B, M9019A, and M9043A. The M9018A is now discontinued, but still fully supported by the PXIe Chassis Family Driver. The M9018B is a drop-in replacement for the M9018A. The M9043A is only available as part of a Keysight solution. The M9043A has all the features of the M9019A plus an integrated High Frequency Reference clock. The High Frequency Reference clock features match those found in the M9300A, thus providing all the M9300A features without consuming a module slot.

NOTE	For information on using M9018A, refer to the user documentation available at www.keysight.com/find/M9018A. For information regarding using the PXIe Family Chassis Driver with the M9018A, see "Using the M9018A Chassis with the PXIe Chassis Family Driver" on page 28.

NOTE	It is assumed that you have turned on the chassis system, installed the Keysight IO Libraries Suite, the chassis drivers, and the chassis Soft Front Panel. The *Keysight PXIe Chassis Family Startup Guide* provides step-by-step guidance on turning on the chassis system.

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Key Chassis Features

The Keysight family of PXIe chassis is designed for easy integration into large systems containing multiple PXIe chassis and other, non-PXI instrumentation. The Keysight PXIe chassis have these key features:

- Up to 16 PXIe hybrid slots (the M9010A has 8 hybrid slots), 1 PXIe timing slot, and 1 PXIe system slot.
- 4U chassis with innovative cooling design.
- Ultra high performance PCIe interface
  - -- The M9010A has Gen 3 PCIe with a two-link (x8, x16) system slot and x8 links to the hybrid/timing slots.
  - -- The M918B provides configurable 2-Link (2x8) and 4-Link (4x4) plus M9021A configuration (1x8).
  - -- The M9019A provides Gen 3 PCIe 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 using rear panel RJ-45 connectors.
- Front panel external trigger input/output ports.
- One common driver supports IVI-C and IVI.NET for all three chassis (and the M9018A PXIe chassis).

Figure 1 shows a front view of the M9019A chassis. The M9018B chassis is similar; the M9010A chassis is similar but has ten slots.

Figure 1   Keysight M9019A PXIe Chassis Front and Side View (The other chassis are similar)

The following figure shows the M9019A chassis rear panel. The M9018B chassis rear panel is similar; the M9010A chassis has two fans.

Figure 2   Keysight M9019A PXIe Chassis Rear and Side View (The other chassis are similar)

Front Panel Trigger Ports

Two front panel SMB trigger connectors connect to the PXI [0:7] backplane trigger bus in Trigger Bus Segment 1 and 2 in the M9010A chassis and Trigger Bus Segments 1, 2 and 3 in the M9018B and M9019A chassis. For information on using these two trigger ports, see "Front Panel Trigger Ports" on page 89.

Figure 3   Chassis Front Panel Trigger Ports (M9019A shown)

NOTE	Make certain that your test system application is not running when you reconfigure these two trigger ports. Reconfiguring the ports may cause an unexpected pulse on the trigger port lines.

Interactive Block Diagram

An interactive Block Diagram exists for all three chassis. This Block Diagram is usable for training and understanding how the chassis works. You can download the block diagram from:

www.keysight.com/find/pxi-blockdiagram

The Block Diagram and other information is available on the individual the web pages of the three PXIe chassis:

www.keysight.com/find/M9010A

www.keysight.com/find/M9018B

www.keysight.com/find/M9019A

Chassis (Static) Block Diagram

Keysight PXIe Chassis Interactive Block Diagram

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Introduction
Place your mouse here to view information about this diagram.

Reset   ☐ Full screen   ☑ Enable popups

STEP 1: Select chassis to display
○ M9010A
○ M9018B
◉ 1x8 switch fabric (default)
○ 2x8 switch fabric
○ 4x4 switch fabric
◉ M9019A

STEP 2: Select your controller type
◉ Embedded controller
   ○ M9036A embedded controller
   ◉ M9037A embedded controller
○ PC (desktop or rackmount computer)

Keysight.com Links
Display links (may take a few seconds to display)

Backplane temperature sensors

PCIe Fabric	PCIe link speed and link width are encoded using line color and line width as shown.		x4	x8	x16
		Gen 2			Not supported
		Gen 3	Not supported		

Installs in Slot 1

XP4
M9037A
x8 XP3
x16 XP2
Slot 1

Embedded Controller

x16

PCIe Switch 1
x8 x8 x8 x8 x8   x1   x8 x8 x8

x8

PCIe Switch 2
x8 x8 x8 x8   x1   x8 x8 x8 x8 x8

PCIe to PCI Bridge

PCIe to PCI Bridge

Slot 2 Slot 3 Slot 4 Slot 5 Slot 6   Slot 7 Slot 8 Slot 9 Slot 10 Slot 11 Slot 12   Slot 13 Slot 14 Slot 15 Slot 16 Slot 17 Slot 18

Hybrid slot board types and pinouts

Show trigger signals
◉ Clear
○ PXI_TRIG[0:7]
○ PXI_STAR[0:16]
○ PXIe_DSTAR A/B/C[0:16]

PXIe_CLK100   PXIe_SYNC100   PXI_CLK10

Clock Generator
Sync Generator
100 MHz VCXO ÷10 10 MHz OUTPUT
PLL FEEDBACK   PLL
10 MHZ REF OUT (rear panel BNC)
PXI_CLK10_IN from System Timing Module
10 MHZ REF IN (rear panel BNC)
10 MHz INPUT

3.3V 5V 12V -12V
To module slots
5Vaux

Primary Power Module (PPM) ON
5Vaux

Power connector (rear panel)

INHIBIT/VOLTAGE MON (rear panel)

Monitor Processor
Fan Monitor and Control

Power Supply

Show controller software
◉ Clear
○ Connection Expert
○ Soft Front Panel
○ Development environments

Show chassis images
◉ Clear
○ Front view
○ Rear view

Show clocks
◉ Clear
○ PXI_CLK10
○ PXIe_CLK100
○ PXIe_SYNC100

Legend
○ Disabled radio
◉ buttons

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April 2018 M9019-90006

Adobe Reader X or later is required to view this diagram. This diagram cannot be viewed in a browser window.

Chassis EPROM

Chassis firmware (customer upgradeable) **Chassis Manager**
VCXO Input Select Chassis 10 MHz Correction Signal 10 MHz Input Select

INHIBIT (rear panel)

DEF (default)   MAN (manual)
Inhibit (low = off)

Power Manager

FAN (rear panel) HIGH ● AUTO ●

Fan 12V

Fan assembly

DB-9 Connector	
Pin	Signal
1	Logic ground
2	+5 VDC
3	Reserved
4	+3.3 VDC
5	Inhibit (active low)
6	+12 VDC
7	Reserved
8	-12 VDC
9	Logic ground

Figure 4   Chassis (Static) Block Diagram

Chassis Maintenance and Inspection

WARNING **These chassis are Safety Class 1 Products (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited. Inspect the protective conductor periodically to ensure that it is uninterrupted.**

- **No operator serviceable parts inside. Refer servicing to qualified personnel.**

- **To prevent electrical shock, do not remove covers.**

- **To prevent electrical shock, disconnect the chassis power cord before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.**

No periodic maintenance of the chassis is required. However, Keysight recommends monitoring the Primary Power Module (PPM) voltage rails, the chassis fan speeds, and the chassis firmware an ongoing basis:

- **Power supply voltages** —The power supply voltages (5 Vdc, 5 Vaux, 12 Vdc, and –12 Vdc) should all be within ±5% (10% for 3.3 Vdc) of their nominal values. Keysight recommends checking the power rails at least yearly. The power rails are accessible on the rear panel DB-9 connector. See "Measuring the Main Voltage Rails Directly" on page 54.

- **Fan speeds** —The chassis has fans located at the rear of the chassis. A low fan speed possibly indicates that a fan is wearing out or a fan blade is partially obstructed. Keysight recommends using the chassis Soft Front Panel to check the fan speeds yearly as well. See "Monitoring Chassis Fan Speeds" on page 67.

- **Chassis firmware** — Keysight recommends that you periodically check to see if there is a chassis firmware revision available that is later than your chassis firmware revision. If so, it is suggested that you download and install the latest firmware revision available as described in "Updating Chassis Firmware" on page 141.

If a power supply voltage is out of tolerance or a fan speed is low, see the *Keysight PXIe Family Chassis Service Guide* for diagnostic information and troubleshooting tips.

CAUTION   The weight of an empty M9018B or M9019A PXIe chassis (no modules installed in the chassis) is approximately 29.8 lbs (13.5 kg). Lift the chassis using a single side handle only when the total chassis weight (chassis plus installed modules) does not exceed 75 lbs (34.0 kg). Otherwise use both side handles to lift the chassis.

The M9010A chassis weighs 30.91 lbs (14.02 kg).

Installing modules in the chassis may increase its weight to a point where two people are required to lift the chassis. If two people are not available, use a mechanical lift to lift the chassis. The chassis should be transported using a rolling cart.

Static-safe Handling Procedures

Electrostatic discharge (ESD) can damage or destroy electronic components. Use a static-safe work station to perform at work on electronic assemblies. The figure shows a static-safe work station using two types of ESD protection:

- Conductive table-mat and wrist-strap combination

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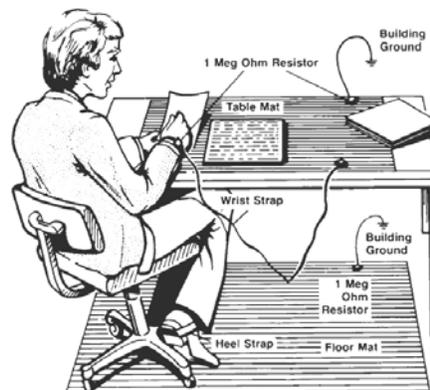
Both types, when used together, provide a significant level of ESD protection. Of the two, only the table-mat and wrist-strap combination provides adequate ESD protection when used alone. To ensure user safety, the static-safe accessories must provide at least 1 MΩ of isolation from ground.

WARNING   **DO NOT use these techniques for a static-safe work station when working on circuitry with a voltage potential greater than 500 volts.**

Terminology

The combination of the chassis, the host controller (and a PCIe cable if the host controller is a remote controller), and the chassis I/O software running on the host controller is referred to as a chassis system. The computer that controls the chassis is known as the host controller or system controller, and is shown at the top of the hierarchy in the following figure.
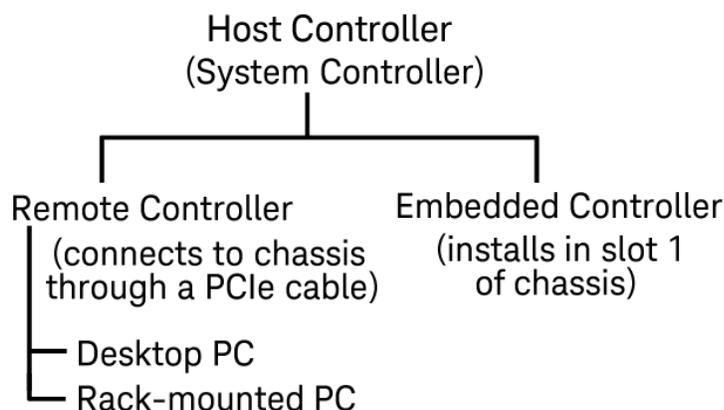
Figure 5   System Controller Types

The host controller can either be a remote controller or an embedded controller.

A **remote controller** can be a desktop PC or a rack mounted PC. The remote controller interfaces to the chassis with an M9048B or M9049A Host Adapter PCIe Interface modules (desktop adapter) installed in the PC, through a PCIe cable to an M9022A, M9023A, or M9024A PXIe System Interface Module installed in slot 1 of the chassis. The M9048A and M9021A can be used with the M9018A and M9018B chassis in Gen 2 mode.

An **embedded controller**, such as the Keysight M9037A Embedded Controller, is a small form-factor, Windows-based PC that is designed for installation in the system controller slot of the chassis (slot 1). An embedded controller consumes two or three expansion slots to the left of chassis slot 1.

NOTE	For a PC to serve as a remote controller, its BIOS must enumerate all the PCIe slots in the chassis. Many computers cannot enumerate a sufficient number of PCIe slots and may not work for your configuration.
	Keysight provides the document Tested PC and PXI/AXIe Chassis Configurations, which lists the embedded, desktop and rack-mounted PCs that have been verified to enumerate the PCIe slots in the PXIe chassis. Use this document, available under the Document Library tab at www.keysight.com/find/pxi-chassis, to guide your selection of remote controller PCs.

System or Cable Interface Modules

Make certain that you install the driver software for the M9022A, M9023A, or M9024A System Interface Modules. The M9021A Cable Interface module does not require a software driver.

NOTE	Keysight's M9021A Cable Interface module can operate only with the 1x8 switch fabric found on the M9018A and M9018B chassis. The M9021A *cannot* be used with the M9010A and M9019A chassis – use the M9022A, M9023A, or M9024A System Interface Modules with any Keysight PXIe chassis.

Using the M9021A PCIe Cable Interface Module with the M9018A/B

The M9021A PCIe Cable Interface module does not derive power from the chassis connector used by PXI embedded controllers. Instead, the modules use the top connector on the chassis backplane for its 3.3V and 12V power. However, a switch on the M9018A and M9018B chassis backplane must be set to supply those voltages to the connector.

The default position of the switch is to the left and does not supply the voltages to the connector. To use the M9021A Cable Interface module in Slot 1 of either chassis, you must move the slide switch to the right before installing the module.

Figure 6   M9018A/B Backplane Switch
Note: Setting this switch is not required for the M9022A, M9023A, or M9024A.

Installing PXI Modules in the Chassis

Recommended best practices to ensure proper and safe module operating conditions:

CAUTION | **PXI hardware does not support "hot-swap" (changing modules while the chassis is powered on) capabilities. Before installing or removing a module into/from the chassis, power off the chassis to prevent damage to modules.**

- Ensure proper chassis airflow is maintained
- Select a chassis that provides thermal protection if fans become inoperable or forced air cooling is obstructed
- Use slot blockers (Keysight Y1212A) and EMC filler panels (Keysight Y1213A) in empty module slots to ensure proper operating temperatures. The Keysight Y1214C Air Inlet kit (not for M9010A use) supplies additional cooling air from the front of the chassis. These accessories optimize module temperature performance and reliability of test system.
- Monitor the chassis temperatures and fan speeds to determine a balance of fan noise and cooling performance.
- Do not disable fans. Position chassis to allow plenty of space around chassis air intake and fan exhaust.
- Place the chassis in a horizontal position such as in a rack or on a bench.
- At environment temperatures above 45°C, set chassis fan speed to high.

The M9018B and M9019A chassis have multiple air intakes located at the lower sides, lower front, and chassis bottom. Do not block the air intakes or fan exhausts.

The M9010A chassis has two fans that pull air from the rear of the chassis and exhausts it out the front and top. Do not block the air intakes or fan exhausts.

WARNING | **Inserting modules into the chassis when it is in a vertical position increases the possibility of bending pins on the backplane and permanently damaging the chassis. It is recommended that you insert modules only with the chassis in a horizontal position, such as in a rack or on a bench. Once the modules are inserted and secured, the chassis may be used in a vertical position. However, before moving the chassis to the vertical position, install all the blanking plates to prevent debris falling onto the chassis and getting lodged in the backplane connectors.**

1 Make sure that the line cord is plugged in to establish earth ground and that the chassis power switch is Off.

2 Ensure that the **Fan** switch (on the chassis rear panel) is set to AUTO and the **Inhibit** switch is set to DEF. Use AUTO unless you have a specific application that requires HIGH.

Chassis Rear Panel Fan and Inhibit Switches

3 Position the chassis to provide ample space around the chassis fan intake and exhaust vents. Blockage by walls or obstructions affects the airflow needed for cooling. Place the chassis in a horizontal position such as in a rack or on a bench.

4 Before inserting a module into the chassis, back the mounting screws out to ensure that there is no interference between the screws and the mounting rails.

5 Holding the module by the injector/ejector handle, slide it into an available PXI (or hybrid) slot.

   a Install the module into the slot of the chassis by placing the module card edges into the front module guides (top and bottom).

   b Ensure that the injector/ejector handle is pushed down in the unlatched (downward) position. Slide the module to the rear of the chassis.

   c Slide the module completely into the chassis. When you begin to feel resistance, lift up on the injector/ejector handle to fully inject the module into the chassis.

6 Secure all modules to the chassis using the module mounting screws. Use a #1 Pozidriv® or a slotted screw driver and torque to 5Lb-In (0.57N-m). Performance may suffer if the screws are not tightened properly.

7 Verify that the PXI chassis fans are operable and free of dust and other contaminants that may restrict airflow.

8 Install filler panels and slot blockers after installing the modules. Missing filler panels or slot blockers may disrupt air circulation in the chassis. The left-most slot does not accept a slot blocker.

9 If you are using a PCIe Cable Interface, connect the Cable Interface in the chassis to the PC host per the instructions that came with the Cable Interface.

10 Power up the PXI chassis.

11 If you are using a remote PC, reboot the PC host.

Avoiding Bent Pins

The chassis backplane contains hundreds of pins. These pins mate with the sockets on the module when you slide the module into the chassis. When you first insert the module, you insert it between the top and bottom rails. As you slide the module in, the side of the connectors touch to further align the module's connector over the pins. The final push to insert the module seats the pins tightly in the connectors.

Be aware that misuse can result in bent pins. If a chassis backplane has a single bent pin, it is possible that scope of the damage is limited to one slot. However, a bent pin can touch an adjacent pin, causing an electrical short that further damages all slots in the chassis. The impact of a bent pin can range from none, to subtle, to severe. A bent pin can cause unpredictable behavior in the chassis and the instruments. It can be very difficult to determine the root cause of this erratic behavior.

Methods to avoid bent pins

- Insert modules in horizontal chassis

  Only insert modules in a chassis that is positioned horizontally, such as in a rack or on a bench. Do not stand the module on the floor and slide the modules in vertically. The mechanical engineering tolerances do not support quality alignment while the chassis is in the vertical position. Once the modules are secured and all blanking plates installed, the chassis can be used in a vertical position.

- Avoid open slots in a vertical chassis

  If a chassis is positioned vertically and slots are open, it is easy for debris to fall onto the connector pins. If the slots are open, avoid the vertical position even if it is temporary while deploying the chassis. It is easy for debris to fall in unnoticed and lodge into the connectors.

- Do not use force

  Use very gentle pressure when you slide in the modules. If there is an unusual restriction, pause and inspect. Pushing harder might bend a pin.

- Inspect before use

  Prior to sliding a module into a slot, inspect the end of the connector for damage. Look at the holes into which the pins insert to ensure that the holes are empty. Look for scratches or groves in the plastic connector that might cause misalignment or hint at past damage. If you find damage, repair it before use.

Although rare, it is possible to spread damage with the use of a single defective module. If you have a module with an undetected damaged connector and move it from slot to slot or from chassis to chassis, you might be damaging every slot you slide the module into. Once a chassis' pins are damaged in that slot, it is possible to damage a good module by sliding it into one of the damaged slots.

Periodic chassis inspection

Depending on your use, you might never need to examine a chassis backplane for bent pins. Perhaps you assemble a system once and then it is never subsequently modified. This type of use does not require inspection. However, if your chassis use pattern is to have modules inserted and removed on a regular basis, and if it is done by many different people, you might find it beneficial to periodically inspect all of your chassis backplanes.

How to inspect your chassis backplane for bent pins or debris

Remove all the modules from the chassis. Remove power. Move the chassis to a well-lit bench and stand the chassis on end so that light shines down onto the backplane. Visually inspect all the pins on the backplane. Verify the pins are in straight rows. Look for discoloration resulting from an electrical short.

Look for and remove debris laying in the backplane connectors.

What to do if you find a bent pin

Send the chassis in for repair.

Chassis Front Panel LEDs

The chassis contains three LEDs on its front panel to the left of the ON/Standby (power) push button, as shown in the following figure.
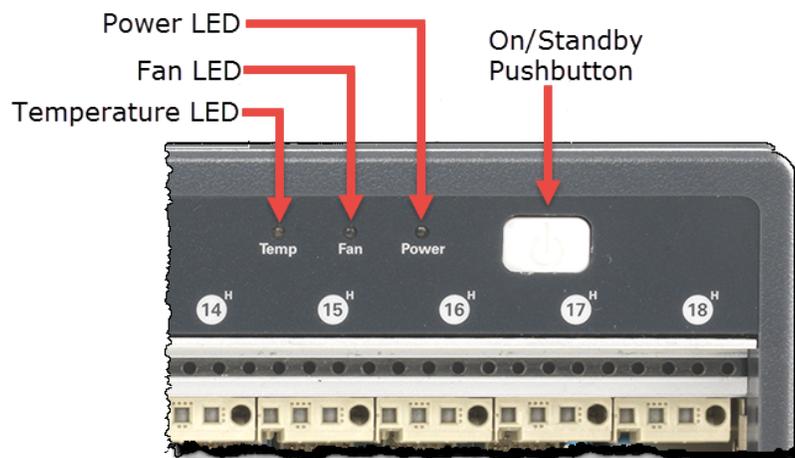
Figure 7   Chassis Front Panel LEDs

The front panel LEDs, depending on whether they are off, on continuously, or flashing, provide important information on the status of the chassis, and should be monitored regularly. The following table lists each LED and describes the information it provides.

The M9010A has a protective algorithm to monitor the AC input current and automatically power-off if the AC input current goes above 8.5A. When automatically powered-off, the chassis will continually blink the power LED 3 times.

Table 1   Chassis LEDs

LED (color)	Off	On Continuously	Flashing	All three LEDs flash
Temp LED (amber)	This LED is off if the chassis temperatures are OK. To allow you to validate that this LED is working, the LED is turned on for the first three seconds after the chassis is powered up.	This LED is never on continuously.	Indicates one or more temperature sensors is reporting a temperature above the limit, either the 70°C default limit or the user set limit. The limit, if changed, is reset back to 70°C at the next chassis power cycle. If the temperature condition causing the flashing to occur is no longer present, the Temperature LED will turn off, indicating that the chassis temperatures are OK.	All three LEDs on for 10 seconds and off for 1 second indicates that the Monitor Processor, which controls flashing of the LEDs, has been unable to communicate with the Chassis Manager. Refer to the *PXIe Chassis Family Service Guide* for troubleshooting information.
Fan LED (green)	Indicates that the chassis is turned off. See the *Keysight PXIe Chassis Family Service Guide* for details.	Indicates all fans are operating above the minimum limit RPM. The default minimum limit for the M9010A is 900 RPM and for the M9018B and M9019A is 1200 RPM. The fan speed minimum limit can be changed in the SFP or programmatically. The limit, if changed, is reset back to the default minimum limit RPM at the next chassis power cycle.	Indicates that one or more of the fans are operating below the minimum limit, either the default minimum limit RPM or, if changed, the user set minimum limit. If the fan speed condition causing the flashing to occur is no longer present, the Fan LED will return to on continuously.	The Soft Front Panel **Identify On** feature allows you to identify which chassis is connected to the SFP application. For example, if you have multiple M9019A chassis in a system with an SFP application running for each chassis, you can easily identify with chassis is connected to the application. When you click the **Identify On** check box, all three front panel LEDs (Fan, Temp, and Power) blink at a 7 to 10 second rate (50% duty cycle).
Power LED (blue)	Indicates that the chassis is turned off. If you attempt to turn the chassis on but the Power LED remains off, this can indicate several possible problems See the *Keysight PXIe Chassis Family Service Guide* for details.	Indicates all supply voltages are within their limits. Factory default limits are ±10% for 3.3V and ±5% for the other power supply voltages. The limits can be changed in the SFP or programmatically. The limits, if changed, are reset to factory default at the next chassis power cycle.	Indicates one or more of the four supply voltages are outside of their limits, either the factory default limits or, the user-set limits. Refer to the *Keysight PXIe Chassis Family Service Guide* for troubleshooting suggestions.If the power supply condition causing the flashing to occur is no longer present, the Power LED returns to continuously on state. See note above about the M9010A over-current protection	

Related Documentation

The documentation listed below can be found on the chassis web pages below.

- *Keysight PXIe Chassis Family Startup Guide*
- *Keysight PXIe Chassis Family User Guide*
- *Keysight M9019A PXIe Chassis Family Data Sheet*
- *Keysight M9022A/M9023A/M9024A PXIe System Interface Module Data Sheet*
- *Tested PC and PXI/AXIe Chassis Configurations*. This document lists the PCs that have been verified to work with the PXIe family of chassis.
- PXIe Chassis Block Diagram (see http://www.keysight.com/find/pxi-blockdiagram)
- *Multi-Chassis Designer Tool* (see http://www.keysight.com/find/pxie-multichassis)

For the latest versions of these documents, visit the Keysight chassis web sites:

www.keysight.com/find/M9010A

www.keysight.com/find/M9018B

www.keysight.com/find/M9019A

Product specifications, available accessories, firmware and software may change over time. Check the Keysight product websites above or at www.keysight.com/find/pxi-chassis for the latest updates to the product software, guides, help files and data sheets.

Using the M9018A Chassis with the PXIe Chassis Family Driver

The original M9018A PXIe chassis was provided with its own driver. This is called the legacy *AgM9018* driver (formerly *AgPxiPc* driver); the last version, released in 2015, was 1.5.80.1. The new M9018B, and the M9010A and M9019A PXIe chassis, are shipped with a new *PXIe Family Chassis* driver. This section describes how the M9018A and M9018B chassis inter-operate with the two different chassis drivers.

Figure 8   Keysight M9018A 18-slot PXIe Chassis

- The new M9018B PXIe chassis is a direct, drop-in replacement for the M9018A chassis and supports the legacy *AgM9018* driver. The *AgM9018* driver is also supplied as part of the *PXIe Chassis Family* driver.

- The first *PXIe Family Chassis* driver shipped in August 2016 and supports both the M9018A and the new M9018B chassis and the M9019A chassis. A newer version of the *PXIe Family Chassis* driver shipped in December 2016 and added support of the M9010A 10-slot chassis. The M9010A and M9019A chassis cannot use the legacy *AgM9018* Driver.

- Any application software created using the *AgM9018* driver will run without modification on the new M9018B chassis.

- The Soft Front Panel software installed as part of the new *PXIe Chassis Family* driver runs with all four chassis. You can run the legacy M9018A Soft Front Panel; it is located at:
  C: /Program Files (x86)/Agilent/M9018/bin/AgPXIChassisSFP.

- Your compiled M9018A application programs using the legacy *AgM9018* driver will work without recompiling because the legacy driver is included with the new *PXIe Chassis Family* driver.

- However, application software compiled to control the M9018A will not control the M9010A or M9019A chassis. To control these chassis, you must use the new 1.6.3.1 (or later) drivers. Application software compiled for the M9018A will control the M9018B but only for the M9018A features.

NOTE	Both the M9018A and M9018B support a Gen2 PCIe link speed. The M9010A and M9019A support a Gen3 PCIe link speed.

Additional changes from the M9018A to the M9018B

The following new features exist in the M9018B but not in the older M9018A:

- Replaceable Power Supply in the M9018A is not compatible with the M9018B or M9019A.
- The two front panel trigger ports (TRIG 1 and TRIG 2)
- Rear panel Power Sync feature.
- Manual control of the 10MHz Reference Clock.
- Reference Clock alarm for the clock phase lock loop transition to unlock.
- Monitoring of the +5V_STANDBY supply (also known as the 5Vaux supply).

Driver Behavior

The following behaviors describe what may happen when using an M9018B chassis with the *AgM9018* driver.

- When an M9018B is used with the legacy *AgM9018* driver (version 1.5.80.1) environment in Keysight's IO Libraries Suite Connection Expert Instrument View tab, it appears as an "M9018A." However, in the Connection Expert Chassis View tab, it shows as an "M9018B."
- When an M9018B is used with the older *AgM9018* driver (version 1.5.80.1) environment, the Host PC's Windows Device Manager lists the chassis as an "M9018A" instead of an "M9018B."
- Using the *PXIe Chassis Family* driver Fabric Configuration Utility, restores that same internal M9018B data field to its original factory value of M9018B.

You can observe that the M9018B is self identifying as an M9018A, if you run self-test and get the error 541, or if you run the SFP or IO Library Connection Expert and notice that the software is reporting the chassis as an M9018A.

Summary

The M9018B chassis may report as an "M9018A" in some situations, but that set of situations will change depending on the use of the *AgM9018* driver 1.5.80.1 vs the *PXIe Chassis Family* driver.

The new M9018B will work in environments as a drop in replacement for the M9018A running the *AgM9018* driver (version 1.5.80.1). When using the *AgM9018* driver, the M9018B will show up as an M9018A in the following situations:

- IO Libraries Connection Expert Instrument Tab

- Windows Device Manager

However, the M9018B will show up as an M9018B in IO Libraries Suite Connection Expert Chassis tab

If you use the *AgM9018* 1.5.80.1 version of the PXIe Fabric Configuration utility on the M9018B to change the fabric, it will have a side effect of also changing a data field inside the M9018B from M9018B to M9018A. After that change, the above mentioned screens will now contain M9018A instead of M9018B. This change will persist until the PXIe Fabric Configuration utility from the *PXIe Chassis Family* driver is used to change the fabric in the M9018B. If you don't need to change the fabric, but want to get the M9018B to self identify correctly, then change the fabric to something you don't want and then change it back to the fabric you want.

Chassis Related Products and Accessories

The following table lists products related to the PXIe family of chassis and chassis accessories. Information on these parts can be found by starting at www.keysight.com/find/pxi-chassis.

Table 2   Chassis Accessories

	Keysight Model Number	Description
Related Products	M9037A	PXIe Embedded Controller: Intel i7, 4 GB RAM, 240 GB SSD
	M9048A	PCIe Desktop Adapter, single port (x8), Gen 2
	M9048B	PCIe Host Adapter: single port (x8), Gen 3
	M9049A	PCIe Host Adapter: dual port (16), Gen 3
	M9021A	PCIe Cable Interface Module, single port (x8), Gen 2 (use with M9018A or M9018B only)
	M9022A	PXIe System Interface Module: single port (x8), Gen 3
	M9023A	PXIe high performance System Interface Module: dual port (x16) Gen 3
	M9024A	PXIe high performance System Interface Module with connectivity expansion: two gigabit LAN, two USB 3.0, four USB 2.0, GPIB
Accessories	Y1212A	Slot Blocker Kit (M9010A, M9018A/B, M9019A)
	Y1213A	PXI EMI Filler Panel Kit: 5 single-slot panels
	Y1214C	Air Inlet Module Kit (not for use with M9010A 10-Slot chassis)
	Y1215C	Flush mount rack kit (M9018A/B, M9019A)
	Y1216B	Recess mount rack kit (M9018A/B, M9019A)
	Y1217A	Rack mount rail kit (M9010A, M9018A/B, M9019A)
	Y1218A	Cable tray kit
	Y1270A	Front panel interfacing kit for 18-slot PXIe chassis
	Y1271A	Flush rack mount kit for M9010A chassis

2 PXIe Chassis Management Capabilities

Keysight's PXIe chassis provide extensive management capabilities to allow you to monitor and control many aspects of the chassis operation. For example, you can monitor the temperatures reported by the air flow temperature sensors using the Soft Front Panel (SFP). Furthermore, you can use the SFP to set a minimum temperature alarm threshold such that an alarm will be generated if the temperature of any temperature sensor exceeds the threshold.

In addition to using the SFP to monitor and control the chassis, you can develop programs to monitor and control the chassis. Keysight provides IVI (Interchangeable Virtual Instrument, see www.ivifoundation.org) drivers for the chassis. To support the most popular programming languages and development environments, Keysight offers both the IVI-C and IVI.NET drivers. There are no IVI.COM drivers. See the IVI Foundation website for a description of these drivers. Keysight also provides a LabVIEW driver for the chassis.

Keysight recommends that you use the Soft Front Panel to learn the chassis management capabilities. Because the programmatic capabilities largely parallel the capabilities provided by the SFP, learning the SFP first provides a basis for learning how the IVI.NET and IVI-C drivers interface to the chassis. In support of this approach, each chassis management capability is first described by a diagram showing how that chassis management capability is accessed using the SFP.

NOTE	Do not uninstall the **KtMPxiChassis IVI.NET Driver 1.x.xxx**, **KtMPxiChassis IVI-C Driver 1.x.xxx**, **KtMTrig IVI.NET Driver 1.x.xxx**, or **KtMTrig IVI-C Driver 1.x.xxx** files without also uninstalling the Keysight PXIe Chassis Family driver.

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Summary of Chassis Management Capabilities

The chassis provides the following management capabilities:

- Viewing the chassis hardware and firmware revision information

- Monitoring the fan speed. This monitoring capability includes the ability to set a fan speed threshold such that, if any fan speed falls below the threshold, an alarm is generated. If a fan stops completely, the chassis shuts down.

- Monitoring the chassis temperature sensors. This monitoring capability includes the ability to set a temperature threshold such that, if the temperature reported by any sensor rises above the threshold, an alarm is generated.

- Monitoring the Primary Power Module (PPM) rails: 3.3 Vdc, 5 Vdc, 12 Vdc, –12 Vdc and 5Vaux (5.0VSTAND-BY). This monitoring capability includes the ability to set upper and lower voltage limits around each voltage rail such that, if a voltage rail falls outside of its limits, an alarm is generated.

- Monitoring and manually selecting the 10 MHz reference clock source.

- Configuring the front panel external trigger ports (TRIG 1 and TRIG 2) inputs/outputs.

- Configuring and monitoring the parallel trigger bus signals in PXI-9 standard (not available in the Soft Front Panel, use the Keysight IO Libraries Suite).

- Executing a chassis self test.

Using the Soft Front Panel to Configure Chassis Parameters

In order to use the Soft Front Panel (SFP) to configure the chassis, the SFP **Allow Control** check box shown in the following image must be checked. This check box, which applies to all tabs of the SFP, is provided to prevent unintentional changing a chassis parameter.
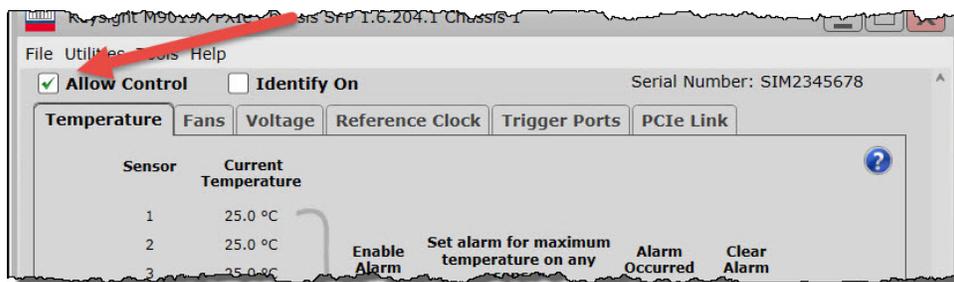
Figure 9   SFP **Allow Control** Check Box

The Chassis Alarm Architecture

The chassis provides eight alarms to assist you in monitoring the chassis. For example, you can set a temperature alarm threshold such that, if a chassis temperature sensor reports a temperature above the threshold, an alarm is generated. Alarms can be set and monitored using either the SFP or programmatically. The eight alarms are:

- Five voltage rails (+3.3 V, +5 V, +12 V, −12 V, 5.0V_STANDBY) either higher or lower than specified thresholds.

- Chassis air temperature higher than specified threshold.

- Fan Speed slower than specified threshold.

- 10 MHz Reference Clock changed.

NOTE   If a fan stops completely, the chassis shuts down.

Chapter 4, "Chassis Alarm Architecture" describes the chassis alarm architecture, including the functionality that is provided in hardware and the functionality that is provided in software. The chapter also describes how alarms operate if multiple processes are using the same alarm.

3 Chassis and Host Controller Power Up or Down Sequence

This chapter describes the chassis and host controller PC power up and power down sequences. In order for the chassis and the host controller PC to interoperate correctly, they must be powered up and down in specific sequences. Furthermore, the PC must be restarted in certain situations after the chassis is powered up. If these sequences are not followed, the PC may not be able to access the chassis or the modules in the chassis.

NOTE	The chassis has three power states: Powered up, powered down, and unplugged. When powered up, the chassis is fully operational. When powered down, the Primary Power Module (described in "Power Supply Operation" on page 49) is turned off, but 5 Vaux is available to the Monitor Processor and the modules. When unplugged, the chassis is completely unpowered. Unless otherwise stated, the chassis is presumed to be plugged in, and is changing power states between powered up and powered down.

NOTE	When you press the chassis power-on button, if the chassis does not power up and the front panel LEDs do not light, it is possible for the chassis to be in a safety shutdown state. Remove the chassis AC power cord from the chassis for one minute. Reconnect the power cord and turn on the chassis again. If it still does not power on, refer to the *Keysight PXIe Family Chassis Service Guide*.

In brief, the host controller PC should be off whenever the chassis is powering up or down. Because chassis modules are not hot-swappable, chassis modules should only be installed in or removed from the chassis when it is powered down.

The following description of power up and power down sequences apply only to using an external host controller PC. They do not apply to an embedded controller (such as the Keysight M9037A) installed in the chassis because the embedded controller and chassis are powered together.

Methods of powering up the chassis

The method of powering up the chassis depends on the position of the INHIBIT rear panel switch, which can be set to the DEF (default) position or to the MAN (manual) position. These two methods are shown on the interactive block diagram and work as follows:

- **INHIBIT switch in the DEF position** — In this position, the front panel power push button is used to switch the chassis between ON and Standby—hence, this push button is known as the ON/Standby push button. Using this push button requires that a module is installed in the system controller slot (slot 1). This can be a module such as the Keysight M9021A, M9022A, M9023A, M9024A PXIe System Interface Module or an embedded controller.

- **INHIBIT switch in the MAN position** — In this position, the Inhibit signal on the rear panel DB-9 connector controls chassis power. The chassis is powered up by applying a logic high signal (or allowing the pin to float) to the Inhibit signal. When the Inhibit signal is pulled to logic ground, the chassis is in Standby (off except for 5Vaux, an auxiliary power supply).

Keysight recommends leaving the INHIBIT switch in the DEF position when connecting the AC power cord to the chassis. After inserting the power AC power cord, then move the INHIBIT switch to the MAN position. Use of the ON/Standby push button to power up the chassis is assumed unless otherwise noted.
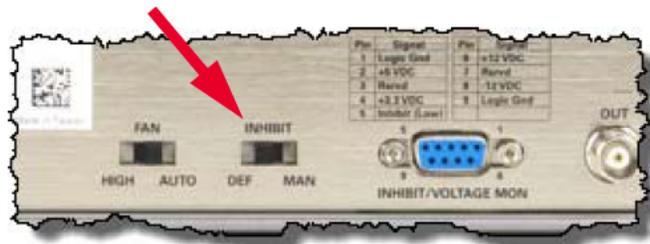
Figure 10   Chassis Rear Panel Inhibit Switch and DB-9 Connector

See "Power Sync and Other Features" on page 109 for information on the multiple chassis Power Sync feature.

Power Up Sequencing

When powering up the system, the chassis must be powered up first. After powering up the chassis, you should wait at least three seconds before turning on the PC. The chassis front panel temperature LED, which is on for three seconds after the chassis is powered up, provides a convenient way to measure this delay, as shown below.

Chassis power (High = powered up)

Chassis front panel temperature LED

The temperature LED, which is on for the first three seconds after the chassis is powered up, can be used as an indicator of when to turn on the PC – when the LED turns off, the PC can be turned on.

Remote Controller PC (High = turned on)

The chassis must be powered up before the PC is turned on to ensure that the PC BIOS will enumerate the chassis slots as the PC boots.

It is recommended that the PC be shut down before the chassis is powered down because many PCs don't have the capability to safely remove (eject) PCIe-connected devices. Therefore, powering-down the chassis first can disrupt operation of the PC.

Figure 11 Chassis and Remote Host PC Power Up / Power Down Sequence

NOTE	It is always advisable to boot the PC a second time to ensure that the PC properly enumerates all of the modules within the chassis.

Power Down Sequencing

The PC should be shut down before the chassis is powered down. This will prevent the chassis, as it is being powered down, from disrupting operation of the PC.

Performing a System Power Cycle

For a system with a remote controller PC, system restart or power cycle refers to the power sequence shown in the following image. The remote controller PC is turned off followed by the chassis being powered down for at least one second. The chassis is then powered up followed by turning on the PC.

NOTE: When the chassis is powered down using the front panel ON/Standby pushbutton or the **Inhibit** signal on the rear panel DB-9 connector, the chassis is still connected to AC power. Therefore, the 5Vaux (auxiliary) supply is powered, and is supplying power to components such as the Monitor Processor. The other chassis supplies (3.3v, 5V, 12V, and -12V) are not powered.
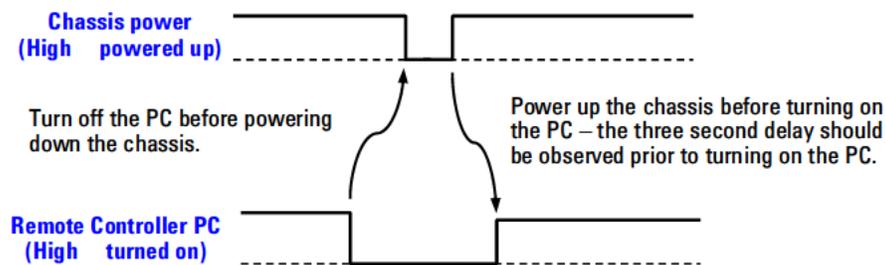
Figure 12   Power Sequence for a System Restart

If the chassis contains an embedded controller, a system power cycle consists simply of power cycling the chassis, which will also power cycle the embedded controller.

Performing a Chassis Hard Reset

A chassis hard reset refers to powering down the chassis and then disconnecting it from AC power. A hard reset is required in response to a few self test failures as described in "Self Test Codes and Messages" on page 146. As previously noted, when the chassis is connected to AC power, the 5Vaux supply is powered, and is supplying power to certain chassis components, such as the Monitor Processor. Performing a hard reset ensures that power is removed from all chassis components.

To perform a chassis hard reset, AC power must be removed from the chassis for a minimum of 30 seconds. This ensures that the 5Vaux supply is completely powered down. The entire sequence is shown in below image.
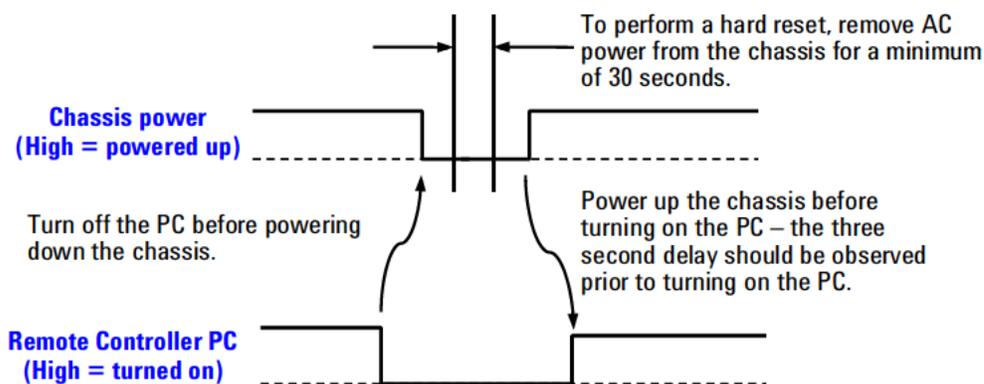
Figure 13   Power Sequence for a Chassis Hard Reset

In essence, a chassis hard reset is a system power cycle that includes unplugging the chassis from AC power after the chassis is powered down.

4 Chassis Alarm Architecture

The chassis provides eight alarms to assist you in monitoring the chassis. For example, you can set a temperature alarm threshold such that, if a chassis temperature sensor reports a temperature above the threshold, an alarm will be generated. Alarms can be set and monitored programmatically and by using the Soft Front Panel (SFP). The eight alarms are:

- Five voltage rails (+3.3 V, +5 V, +12 V, −12 V, 5.0V_STANDBY) are either lower than expected or higher than specified thresholds

- Chassis air temperature is higher than the specified threshold

- Fan Speed is slower than the specified threshold

- 10 MHz Reference Clock changed

Figure 14 on page 45 describes the chassis alarm architecture, including identifying the functionality that is provided in hardware and the functionality that is provided in software. The figure also describes how alarms operate if multiple processes are using the same alarm.

NOTE	The M9018B and the M9019A both have eight temperature sensors in the chassis. The M9010A has five temperature sensors.
	The M9018B and M9019A have a default minimum fan speed of 1200 RPM, but it is 900 RPM for the M9010A.

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Power-on Default Alarm Thresholds

This section summarizes the power-on default values of the chassis alarm thresholds as well as the valid range over which the alarm thresholds can be set.

The phrase "power-on default" means that, regardless of how the thresholds are changed while power is applied, the thresholds return to factory-defined default values when the chassis power is cycled. For example, if you use the SFP to set the Minimum Fan Speed Alarm Threshold to 500 RPM, this setting will not persist through a power cycle; the Minimum Fan Speed Alarm Threshold will be restored to the power-on default limit RPM value when the chassis is power cycled.

.

Table 3   Power-on Default Alarm Thresholds for the M9010A, M9018B, and M9019A Chassis

Threshold		Default Threshold	Settable Range
Minimum Fan Speed Alarm Threshold		900 RPM for M9010A. 1200 RPM for other.	1 to 10,000 RPM
Maximum Temperature Alarm Threshold		70 °C	1 to 70 °C
3.3V Rail	Upper Voltage Limit	3.630V (3.3V + 10%)	nominal value +0.01% up to nominal value + 20%
	Lower Voltage Limit	2.970V (3.3V - 10%)	nominal value -0.01% down to nominal value -20%
5V Rail[1]	Upper Voltage Limit	5.25V	nominal value +0.01% up to nominal value + 20%
	Lower Voltage Limit	4.75V	nominal value -0.01% down to nominal value - 20%
12V Rail	Upper Voltage Limit	12.6V	nominal value +0.01% up to nominal value +20%
	Lower Voltage Limit	11.4V	nominal value -0.01% down to nominal value -20%
–12V Rail	Upper Voltage Limit	-11.4V	nominal value +0.01% up to nominal value + 20%
	Lower Voltage Limit	-12.6V	nominal value -0.01% down to nominal value -20%
+5.0V$_{aux}$[2]	Upper Voltage Limit	5.25 V	nominal value +0.01% up to nominal value + 20%
	Lower Voltage Limit	4.75 V	nominal value -0.01% down to nominal value - 20%

[1] Note that the 5V rail initially has voltage limits of ±5% around the nominal value. However, the IVI driver will expand the 5V limits to ±10%. Because the PXIe chassis SFP uses the IVI.NET driver, the SFP also expands the 5V limits to ±10%

[2] In the PXIe Chassis Family Soft Front Panel, the +5V$_{aux}$ is shown as +5.0V_STANDBY.

Chassis Alarm Architecture

Alarm operation

The chassis has these eight alarms:
1. Fan speed alarm
2. Temperature alarm
3. +3.3V alarm
4. +5V alarm
5. +12V alarm
6. -12V alarm
7. 5Vaux alarm
8. 10 MHz reference clock changed alarm

Each alarm has an Alarm Set/Reset Latch ("latch") – please see the figure below for an example of one latch . Each of the eight latches is set if its associated alarm threshold is exceeded. In the case of the fan speed alarm, exceeded means that at least one fan speed is *lower* than the Minimum Fan Speed Alarm Threshold. Similarly, a power supply rail that has exceeded its alarm threshold means that its voltage is *outside* of the range defined by the upper and lower voltage limits.

Setting of the latches allows alarm conditions to be detected/captured in the absence of an operator. The latch OUT does not have a default value—if the SET input is true (for example, at power-on due to a fan speed being below the default Minimum Fan Speed Threshold of 1200 RPM), the fan alarm latch OUT will be set True at power-on.

Each latch can be reset (cleared) using its associated Clear Alarm button on the SFP. Reset on the SFP Utility dropdown menu will reset all eight latches. However, if any alarm threshold is still exceeded when the latch is reset, the latch will be immediately set true again.

If the latch output is True and if the SFP Alarm Enabled is true, Alarm Occurred will be lit on the SFP. Alarm Occurred is set false if Alarm Enabled is set false. However, setting Alarm Enabled false does not reset the latch—this can only be done using Clear Alarm or Reset. Likewise, changing the corresponding alarm threshold to a value such that the alarm limit is no longer being exceeded does not reset the latch.

Interactions between programs using the chassis alarms

It is important to understand how your IVI.NET or IVI-C program interacts with the SFP alarms -- or, for that matter, with any program(s) that use the alarms. Programs that are operating simultaneously need to share certain alarm resources. Each of the eight alarms has one instance of the Set/Reset Latch and each alarm has an OR gate feeding into the latch – these elements represent hardware in the chassis. For discussion purposes, the Fan Speed Alarm Set/Reset Latch will be used as an example. The chassis contains one Fan Speed Alarm Set/Reset Latch, which all processes share.

The elements which provide *inputs* to the yellow-colored hardware elements are also singular and shared. For example, there is only one Minimum Fan Speed Alarm Threshold. If the threshold is set using the SFP and is then set to a different value using the IVI.NET driver, the last-set threshold will be in effect.

NOTE: To keep the SFP in sync with any changes that have been made programmatically to their shared resources, the SFP polls the relevant chassis parameters and updates its display accordingly. For example, if your program changes the Minimum Fan Speed Alarm Threshold, the new value will be reflected on the SFP Configure Alarms tab (if the SFP is running, of course) within one second. If your application program is running in an environment where the SFP is also running and if chassis parameters are being changed using the SFP, your program can likewise poll the relevant parameters in order to detect if they have been changed by the SFP user.

Continuing with the fan alarm example, the two fan alarm resources that are not shared are Alarm Enabled and Alarm Occurred. Each process, including the SFP, will have its *own software version* of these two properties as shown in the figure below. This allows a process that is interested in the fan alarm to enable its version of fan alarm while another, disinterested process can disable its version of fan alarm. In the example below, there are three Alarm Occurred properties, one for the SFP and two representing user applications. While they share the output of the Set/Reset Latch, they each have their own Alarm Enabled signal and their own Alarm Occurred signal.

IMPORTANT: Even though the Alarm Enabled and Alarm Occurred properties are separate for each process, all processes share the same latch as shown below. This can lead to the situation where one process detects that its version of Alarm Occurred is true and then resets the shared latch (using the Clear Alarm call) *before* a second, also-interested process has read its version of Alarm Occurred. This can result in the second process missing its version of Alarm Occurred. Application developers should establish policies for accessing shared resources to avoid this situation.
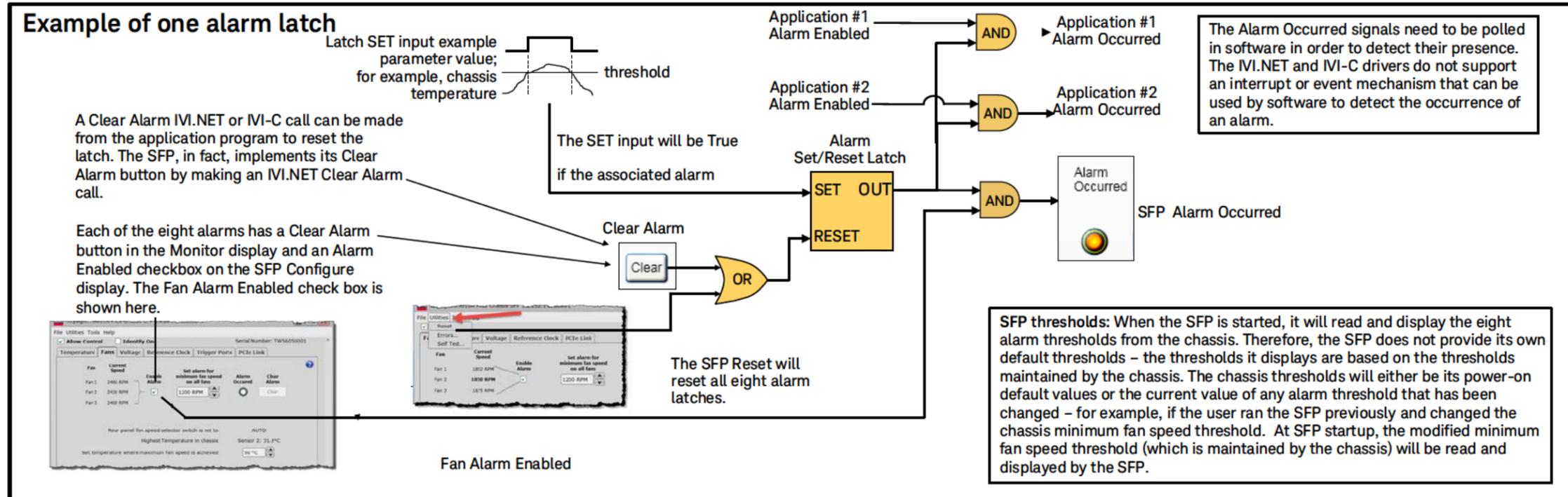
Figure 14   PXIe Chassis Family Alarm Architecture

Events Which Re-establish the Power-on Default Thresholds

The following events re-establish the chassis power-on default alarm thresholds:

- Cycling the chassis power
- Asserting a chassis reset using the Soft Front Panel **Utilities > Reset** menu
- Asserting a programmatic chassis reset using the IVI.NET, IVI-C or LabVIEW drivers

Relationship Between Alarm Occurred and the Front Panel LEDs

The fans, temperature sensors, and voltage rails have front panel LEDs associated with them. This section describes the relationship between each LED and its associated Alarm Occurred indicator.

The following image shows one example of an alarm latch and an LED.
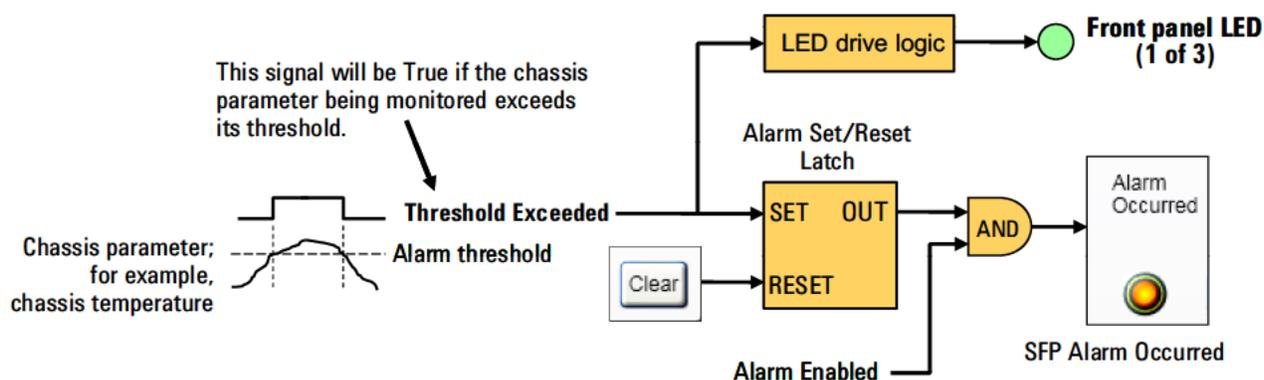
Figure 15   Example Alarm Latch and Front Panel LED

In this example, the Threshold Exceeded signal becomes True if the chassis parameter being monitored exceeds its threshold. For example, if a temperature sensor reports a temperature greater than the temperature threshold. A True value of Threshold Exceeded causes the following:

- The LED drive logic will flash the front panel LED, indicating that the parameter being monitored has exceeded its threshold.
- The Alarm Set/Reset Latch becomes set. If the Alarm Enabled is True, the SFP Alarm Occurred indicator will be illuminated.

If the parameter being monitored then returns to below its threshold (for example, the room temperature is lowered, causing the chassis temperature sensors to report lower temperatures), Threshold Exceeded goes False. This causes the LED to cease flashing. However, the alarm latch remains latched. This

can lead to the situation where Alarm Occurred (based on the latched signal) indicates an alarm condition, while the associated LED is not likewise indicating an alarm condition.

This situation simply means that the condition that caused the alarm is no longer present. While the alarm can be easily cleared by pressing the SFP Clear button, it is suggested that the cause of the alarm be explored. Although it can be difficult to determine the cause of a prior alarm, the SFP will often provide information regarding what might have caused the alarm. For example, the temperature threshold may be set too close to the temperature being reported by one of the chassis temperature sensors, which could cause intermittent setting of the temperature alarm latch. Possible next steps include determining if a module is running excessively hot, or adjusting the temperature threshold higher to provide additional margin.

Note that, while the front panel Temperature LED is off when temperatures are normal, the Fan and Power LEDs are on when their associated parameters are normal. In all cases, a flashing LED indicates that the associated parameter has exceeded its alarm threshold.

Soft Front Panel Alarm Thresholds

In Simulation Mode, the Soft Front Panel (SFP) default alarm thresholds are identical to the chassis alarm thresholds. However, in Simulation Mode, the alarms are not active. In Hardware Mode, however, the SFP reads and displays the chassis thresholds. In other words, the SFP does not provide its own default thresholds in Hardware Mode.

For example, assume that the SFP has been used to change the Minimum Fan Speed Threshold from 1200 RPM to 500 RPM followed by closing the SFP. When the SFP is started next, it will read the value of Minimum Fan Speed Threshold from the chassis (500 RPM, in this example), and display this value on the SFP as the Minimum Fan Speed Alarm Threshold.

Power cycling the chassis re-establishes all default values. Continuing with the previous example, the chassis Minimum Fan Speed Alarm Threshold is set back to its power-on default limit RPM by the power cycle. When the SFP next connects to the chassis, it will read this value from the chassis and display the default limit RPM as the Minimum Fan Speed Alarm Threshold. The default for the M9010A is 900 RPM. The default for the M9018B and M9019A is 1200 RPM.

| NOTE | In the description of each SFP alarm capability, the SFP alarm diagrams will show the chassis default alarm thresholds. This is because, as described above, the SFP reads and displays the chassis alarm thresholds. As long as the particular chassis alarm has not been changed earlier (for example, during a prior SFP session), the chassis power-on default alarm threshold will still be in effect and will be read and displayed by the SFP. |

5   Power Supply Operation

The Primary Power Module (PPM) provides the six voltage rails listed below. The name of each voltage rail as it appears on the chassis backplane connectors is shown in the second column. The image in the following section shows these voltage rails in a block diagram format, and describes the power available from each rail.

Note that two of the rails, 5 V_{aux} and Fan 12 Vdc, are active (powered) whenever the chassis is connected to AC power. The remaining rails are switched on or off either by the front panel power push button or by the **INHIBIT** signal on the rear panel DB-9 connector.

Table 4   Primary Power Module DC Voltage Rails

Voltage Rails	Backplane Name	Comments
3.3 Vdc	3.3V	This rail can be switched on/off, either by the front panel power push button or the INHIBIT signal on the rear panel DB-9 connector. [1]
5 Vdc	5V	The 5 Vdc rail connects to the 5V pins of the CompactPCI XP1 connector. A DC-to-DC converter generates this voltage rail from the 12 Vdc rail.[1]
	5V V_{I0}	The 5 Vdc rail also connects to the 5V V(I/O) pins of the CompactPCI XP1 connector.
12 Vdc	12V	This rail can be switched on/off, either by the front panel power push button or the INHIBIT signal on the rear panel DB-9 connector.[1]
–12 Vdc	–12V	This rail can be switched on/off, either by the front panel power push button or the INHIBIT signal on the rear panel DB-9 connector. [1]
5 Vdc auxiliary	5V$_{aux}$[2]	This rail provides standby power to the Monitor Processor and the modules, and is available anytime the chassis is connected to AC power.
Fan 12 Vdc	Fan 12V	This rail supplies the fan driver circuitry, and is not connected to the backplane and cannot be measured at the rear panel DB-9 connector. This power supply is active anytime the chassis is connected to AC power.

[1] The 3.3Vdc, 5Vdc, 12 Vdc, and the –12Vdc rails can be switched on/off, either by the front panel power push button or by the INHIBIT signal on the rear panel DB-9 connector. The 5V rail regulators is fed by the +12Vdc.

[2] In the PXIe Chassis Family Soft Front Panel, the +5Vaux is shown as +5.0V_STANDBY.

Power Supply Capacity

Figure 16 on page 51 shows the maximum power (in Watts) available from each Primary Power Module (PPM) Voltage Rail. The rails cannot provide their maximum power simultaneously to the modules in the chassis. Hence, trade offs are required to ensure that certain maximum power limits are not exceeded.

The total amount of power available from the PPM depends on the AC voltage. For example, for the M9019A chassis at low line AC (100/120V), the total power drawn from the PPM cannot exceed 650 W; at high line AC (220/240V), the total power drawn from the PPM cannot exceed 800 W.

Temperature Derating of the Primary Power Module

In general, the total power output of the PPM does not derate with temperature. However, the output current of each rail derates linearly with temperature and with altitude, as specified in the chassis data sheet. For more information on the latest power supply specifications and temperature derating information, see the chassis data sheet available at any of the chassis web pages.

www.keysight.com/find/M9010A

www.keysight.com/find/M9018B

www.keysight.com/find/M9019A

Power Calculator Spreadsheet

Power calculator spreadsheets are available on-line on the web pages of each PXIe chassis. These spreadsheets allow you to enter the following information and determine if the chassis will be operating within its power limits:

- The ambient temperature where the chassis will be operating. The ambient temperature affects the power available to the modules from the power supply, as noted in the previous section.

- The mains voltage of the chassis, either low line (100/120V) or high line (220/240V).

- The power consumed from each rail by each module.

- Operating Altitude

After the above information is entered, the spreadsheet indicates if any power supply limits are exceeded.

The Power Calculators are available at www.keysight.com/find/M9019A (for the M9018B and M9019A chassis) or www.keysight.com/find/M9010A for the M9010A chassis).
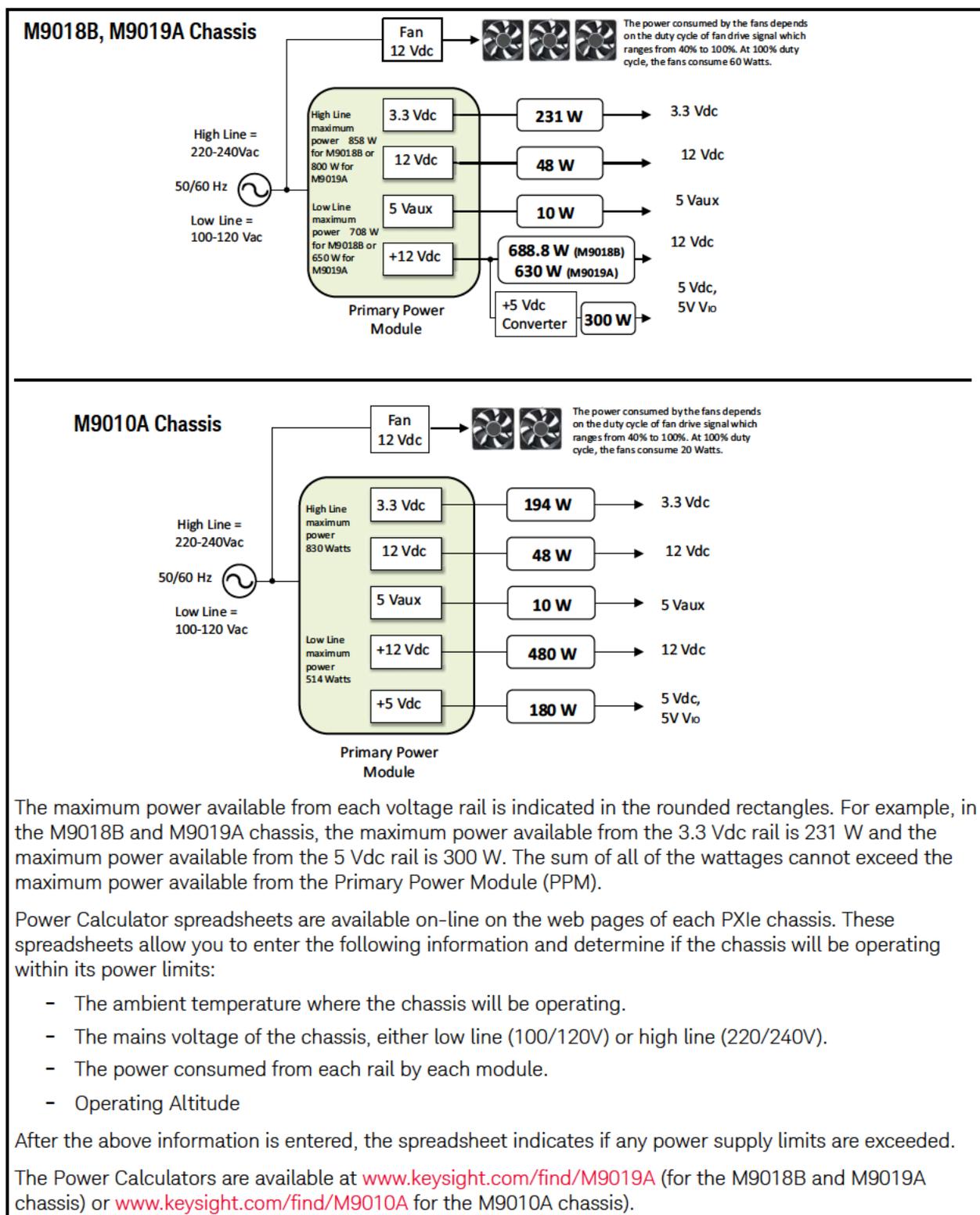
Figure 16   M9018B, M9019A, and M9010A PPM Block Diagrams and Power Ratings at 45 °C

The maximum power available from each voltage rail is indicated in the rounded rectangles. For example, in the M9018B and M9019A chassis, the maximum power available from the 3.3 Vdc rail is 231 W and the maximum power available from the 5 Vdc rail is 300 W. The sum of all of the wattages cannot exceed the maximum power available from the Primary Power Module (PPM).

Power Calculator spreadsheets are available on-line on the web pages of each PXIe chassis. These spreadsheets allow you to enter the following information and determine if the chassis will be operating within its power limits:

- The ambient temperature where the chassis will be operating.

- The mains voltage of the chassis, either low line (100/120V) or high line (220/240V).

- The power consumed from each rail by each module.

- Operating Altitude

After the above information is entered, the spreadsheet indicates if any power supply limits are exceeded.

The Power Calculators are available at www.keysight.com/find/M9019A (for the M9018B and M9019A chassis) or www.keysight.com/find/M9010A for the M9010A chassis).

Over Temperature Protection

The chassis is rated to perform from 0 to 55 °C. As long as the power limits are adhered to, an over temperature condition is unlikely to occur. The Primary Power Module (PPM) shuts down if its internal temperature exceeds 110 °C.

> **NOTE**
>
> If the chassis is operating within its normal ambient temperature range of 0-55° C and is operating within the power limits described previously, an over temperature condition is unlikely to occur. Therefore, if the chassis appears to be powered down (for example, based on the front panel LEDs being off), you should consider other possible causes prior to considering an over temperature condition. See the *Keysight PXIe Chassis Service Guide* for further information.
>
> Note that it is not possible to determine the temperature of the PPM based on the temperatures reported by the air flow exit temperature sensors. The PPM and the air flow exit temperature sensors have different ventilation air flows.

To recover from a suspected over temperature shutdown, the PPM internal temperature must be below 110 °C and the chassis must be power cycled. Power cycling of the chassis should be performed by detaching and re-attaching the power cord. Neither the front panel ON/OFF push button nor the Inhibit signal on the rear panel DB-9 connector will function if the PPM is shut down.

If the chassis is power cycled but does not resume operation, either the PPM was not at fault or the PPM internal temperature is still above 110 °C. Additional cooling time should be allowed followed by another power cycle to see if that resolves the problem.

Over-current Protection

The Primary Power Module (PPM) has over-current protection on its $5V_{aux}$, 12V, -12V, and 3.3V outputs.

An over-current condition results in the PPM outputs ($5V_{aux}$, +12V, -12V, and 3.3V) unable to sustain the output voltage within the specified range. When the output voltage drops below approximately 20% from nominal, the chassis PPM shuts down in order to protect the power supplies from damage. The over current protection on the +5 V DC-to-DC converter output is specified typically at 135% or greater and also results in the PPM shutting down.

The M9010A has a protective algorithm to monitor the AC input current and automatically power-off if the AC input current goes above 8.5A. When automatically powered-off, the chassis will continually blink the power LED 3 times.

To recover from an over-current fault, first eliminate the cause of the over-current. Then either reset the chassis (press the power button for at least five (5) seconds) or restart the chassis by cycling power.

Short Circuit Protection

A short circuit condition on any voltage rail will shut down the PPM.

To recover from an over-current fault, first eliminate the cause of the over-current. Then either reset the chassis (press the power button for at least five (5) seconds) or restart the chassis by cycling power.

Internal Fuses

Each PPM connects directly to AC power line and is protected by an internal fuse. These fuses are not customer-replaceable. Contact Keysight if you suspect a fuse is blown.

Internal Fans

Each PPM contains small internal fans that run constantly when the AC power line is connected. These small internal fans run even when the chassis is powered off. In a quite environment, the fans can be heard as a very faint noise. These fans are not visible. The fan speed is automatic and cannot be adjusted.

Front Panel Power LED

The chassis front panel Power LED is on if all voltage rails are within assigned limits. It flashes if one or more voltage rails are outside of their specified upper/lower voltage limits.

Additionally, in the M9010A chassis only, one additional event may cause the front panel Power LED to flash but will not trigger an alarm. This happens if the input current is between 8 A and 8.5 A.

Measuring the Main Voltage Rails Directly

The five main voltage rails can be measured on the DB-9 connector on the chassis rear panel using a digital multi-meter. The voltage rail pin assignments are shown in the following image.
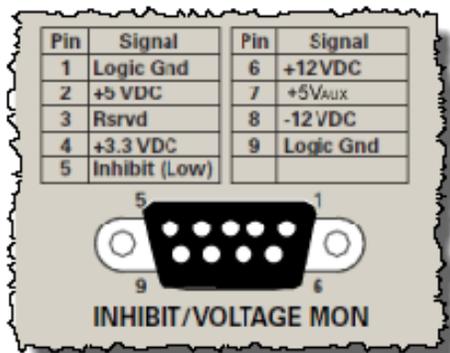
Figure 17   DB-9 Connector Pin-out from Chassis Rear Panel

Each voltage rail contains a current limiting resistor to prevent accidentally shorting the supplies

Monitoring the Power Supply Rails

The chassis allows you to monitor the following five power supply rails:

- +3.3V
- +5V
- +5V$_{aux}$ The 5 V$_{aux}$ cannot be monitored in the M9018A chassis SFP; it is monitored in the PXIe Chassis Family SFP for the M9010A, M9018B, and M9019A chassis. (Note: in the PXIe Chassis Family Soft Front Panel, the +5V$_{aux}$ is shown as +5.0V_STANDBY).
- +12V
- −12V

The SFP and the chassis drivers can set voltage limits around the rails such that an alarm will be generated if a rail voltage falls outside of the specified limits. The front panel Power LED provides collective information about all five rails.

NOTE   In rare cases where the 5V$_{aux}$ is loaded to the point where it deviates outside of the ±5% tolerance, it can cause the Power LED to blink. Check the voltage or alarm in the Soft Front Panel (in the PXIe Chassis Family SFP, this voltage is called the +5.0V_STANDBY).

Voltage Monitoring using the SFP and the Front Panel Power LED

The Output of a Comparator will be True if the power supply voltage is outside of its upper and lower voltage limits. This will set the corresponding Set/Reset Latch.

On: The five voltage rails are within their limits
Flashing: One or more voltage rails are outside of their upper/lower voltage limits. See text on previous page.

Front panel Power LED

The **Voltage** tab is used to set the Upper and Lower Voltage Limits for each of the five voltage rails.

The **Voltage Measured** column displays the current value of each supply. Each voltage rail has a Comparator and Voltage Alarm Set/Reset Latch ("latch") that detect and store the occurrence of an out of limit power supply condition. The voltage rail latch is set if the associated voltage rail is outside of its Upper/Lower Voltage Limits. Setting of the latch allows power supply issues to be detected/captured in the absence of an operator. The latch can be reset (cleared) using the corresponding Clear Alarm button, Reset on the Utility dropdown menu, or programmatically. However, if the voltage rail is still outside of its Upper/Lower Voltage Limits when the latch is cleared, the latch will immediately be set true again. If a latch is set and if the corresponding Alarm Enabled is True, Alarm Occurred will be True. Alarm Occurred is set False if Alarm Enabled is set False; however, setting Alarm Enabled False does not reset the latch. Likewise, changing the Upper/Lower Voltage Limits such that the voltage rail is within the limits does not reset the latch.

As described in the Keysight PXIe Chassis Family User Guide section **Relationship between Alarm Occurred and the front panel LEDs**, it is possible for Alarm Occurred to indicate an out of range voltage condition while the front panel Power LED indicates the voltages are normal. This situation can occur if a voltage rail momentarily exceeds its limits (which sets that particular latch) followed by the voltage rail changing such that the voltage rail is now within its limits — this will restore the Power LED to being on continuously (normal operation).

12V Upper Voltage Limit   For the 12V rail, the Upper Voltage Limit is more positive than the nominal voltage of 12V; for example, 11.4V.

-12V Lower Voltage Limit   For the 12V rail, the Lower Voltage Limit is more negative than the nominal voltage of 12V; for example, 12.6.

Figure 18   Using the Soft Front Panels to Monitor Chassis Power Supply Rails

Voltage Monitoring using the IVI-C Driver and C++

To show the parallels between the SFP capabilities and the programmatic capabilities, the IVI-C driver attributes and functions are overlaid next to their SFP counterparts.

It is important to understand how your program interacts with the SFP. If your program and the SFP (or, for that matter, any other program) are operating simultaneously, they will need to share certain chassis resources. Please see the diagram "Chassis Alarm Architecture" in the *PXIe Chassis Family User Guide* chapter "Overview of Chassis Management Capabilities" for a description of how the alarm resources are shared between multiple processes.

KtMPxiChassis_VoltageAlarmConfigure()

Configures the specified voltage alarm by allowing setting of Enabled, and the LowerLimit and UpperLimit voltage limits.

KTMPXICHASSIS_ATTR_VOLTAGE_RAIL_COUNT

The number of primary power supply voltage rails in the chassis. Count returns 4 for the M9018A chassis.

KtMPxiChassis_GetVoltageRailName()

Returns the power supply rail name for a given index, where index is a 1-based index into the collection of voltage rails. The Name properties returned for indices 1-4 are "VPLUS_3_3", "VPLUS_5_0", "VPLUS_12_0", and "VMINUS_12_0", respectively. The Name property, not the index, is used in the get_Item() calls.

KtMPxiChassis_VoltageAlarmClear()

Resets the specified voltage rail alarm set/reset latch. However, if the voltage rail is still outside of the upper or lower limits, the latch will be immediately set True again.

The desired upper voltage limit for the specified voltage rail. When a voltage rail exceeds its UpperLimit voltage and if Enabled is True for that rail, the voltage alarm Occurred property will be set True. Programming the UpperLimit voltage resets the Alarm Latch. However, if the UpperLimit voltage is still exceeded, the Alarm Latch will be set again.

KTMPXICHASSIS_ATTR_VOLTAGE_ALARM_UPPER_LIMIT

Returns the power supply voltage of the specified rail in volts, quantized to 1 mV.

KTMPXICHASSIS_ATTR_VOLTAGE

Returns the status of the the specified voltage alarm. If True, this indicates that the voltage is outside of the upper/lower limits. This is a per-application property and therefore the value reported programmatically may be different than the corresponding voltage Alarm Occurred status reported by the SFP.

KTMPXICHASSIS_ATTR_VOLTAGE_ALARM_OCCURRED

The nominal power supply voltage for the specified rail. The ExpectedVoltage properties for the four rails are 3.3, 5.0, 12.0 and -12.0 volts. For this example, the ExpectedVoltage is -12.0 volts.

KTMPXICHASSIS_ATTR_VOLTAGE_EXPECTED

12V Upper Voltage Limit For the 12V rail, the Upper Voltage Limit is more positive than the nominal voltage of 12V; for example, 11.4V.

-12V Lower Voltage Limit For the 12V rail, the Lower Voltage Limit is more negative than the nominal voltage of 12V; for example, 12.6.

KTMPXICHASSIS_ATTR_VOLTAGE_ALARM_LOWER_LIMIT

The desired lower voltage limit for the specified voltage rail. When a voltage rail falls below its LowerLimit voltage and if Enabled is True for that rail, the voltage alarm Occurred property will be set True. Programming the LowerLimit voltage resets the Alarm Latch. However, if the voltage rail still falls below its LowerLimit voltage, the Alarm Latch will be set again.

KTMPXICHASSIS_ATTR_VOLTAGE_ALARM_ENABLED

Enables or disables generation of an alarm due to the specified voltage rail being below the LowerLimit or above the UpperLimit. If the voltage rail is outside either limit, this will set the Alarm Set/Reset Latch True. If Enabled is True, Occurred will be set True. Enabled default value = True.

KtMPxiChassis_reset()

Clears all four voltage rail latches.

Figure 19 Voltage Monitoring Using the IVI-C Driver and C++

Voltage Monitoring using the IVI.NET Driver and C#
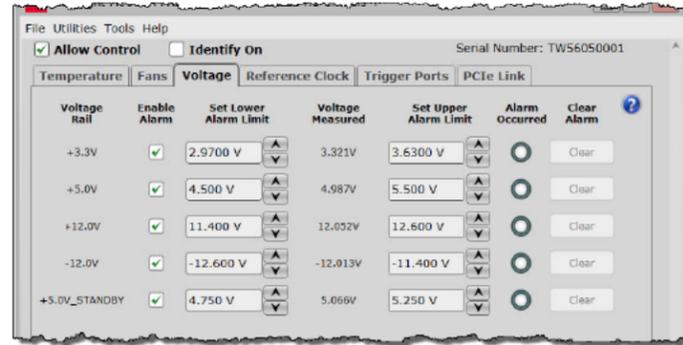
To show the parallels between the SFP capabilities and the programmatic capabilities, the IVI.NET driver properties and methods are overlaid next to their SFP counterparts.

It is important to understand how your program interacts with the SFP. If your program and the SFP (or, for that matter, any other program) are operating simultaneously, they will need to share certain chassis resources. Please see the diagram "Chassis Alarm Architecture" in the M9018A User Guide chapter "Overview of Chassis Management Capabilities" for a description of how the alarm resources are shared between multiple processes.

```
driver.VoltageRails["VPLUS_3_3"].Alarm.Configure (true, LowerLimit, upperLimit)
```

Configures the specified voltage alarm by allowing setting of Enabled, and the LowerLimit and UpperLimit voltage limits.

```
driver.VoltageRails.Count
```

The number of primary power supply voltage rails in the chassis. Count returns 4 for the chassis.

```
driver.VoltageRails.Name
```

Returns the power supply rail name for a given index, where index is a 1-based index into the collection of voltage rails. The Name properties returned for indices 1-4 are: "VPLUS_3_3", "VPLUS_5_0", "VPLUS_12_0", "VMINUS_12_0", and "V5.0_STANDBY". The Name property, not the index, is used in the get_item calls.

```
driver.VoltageRails["VPLUS_3_3"].Alarm.Clear
```

Resets the specified voltage rail alarm set/reset latch. However, if the voltage rail is still outside of the upper or lower limits, the latch will be immediately set True again.

The desired upper voltage limit for the specified voltage rail. When a voltage rail exceeds its UpperLimit voltage and if Enabled is True for that rail, the voltage alarm Occurred property will be set True. Programming the UpperLimit voltage resets the Alarm Latch. However, if the UpperLimit voltage is still exceeded, the Alarm Latch will be set again.

```
driver.VoltageRails["vplus_3_3"].Alarm.UpperLimit
```

Returns the pwer supply voltage of the specified rail in volts, quantitized to 1

```
driver.VoltageRails["VPLUS_3_3"].Voltage
```

Returns the status of the the specified voltage alarm. If True, this indicates that the voltage is outside of the upper/lower limits. This is a per-application property and therefore the value reported programmatically may be different than the corresponding voltage Alarm Occurred status reported by the SFP.

```
driver.VoltageRails["VPLUS_3_3"].Alarm.Occurred
```

The nominal power supply voltage for the specified rail. The ExpectedVoltage properties for the four rails are 3.3, 5.0, 12.0 and -12.0 volts. For this example, the ExpectedVoltage is -12.0 volts.

```
driver.VoltageRails["VPLUS_3_3"].ExpectedVoltage
```

12V Upper Voltage Limit For the 12V rail, the Upper Voltage Limit is more positive than the nominal voltage of 12V; for example, 11.4V.

-12V Lower Voltage Limit For the 12V rail, the Lower Voltage Limit is more negative than the nominal voltage of 12V; for example, 12.6.


```
driver.VoltageRails["VPLUS_3_3"].Alarm.LowerLimit
```

The desired lower voltage limit for the specified voltage rail. When a voltage rail falls below its LowerLimit voltage and if Enabled is True for that rail, that voltage alarm Occurred property will be set True. Programming the LowerLimit voltage resets the Alarm Latch. However, if the voltage rail still falls below its LowerLimit voltage, the Alarm Latch will be set again.

```
driver.VoltageRails["VPLUS_3_3"].Alarm.Enabled
```

Enables or disables generation of an alarm due to the specified voltage rail being below the LowerLimit or above the UpperLimit. If the voltage rail is outside either limit, this will set the Alarm Set/Reset Latch True. If Enabled is True, Occurred will be set True. Enabled default value   True.

```
driver.Utility.Reset()
```

Clears all four voltage rail latches.
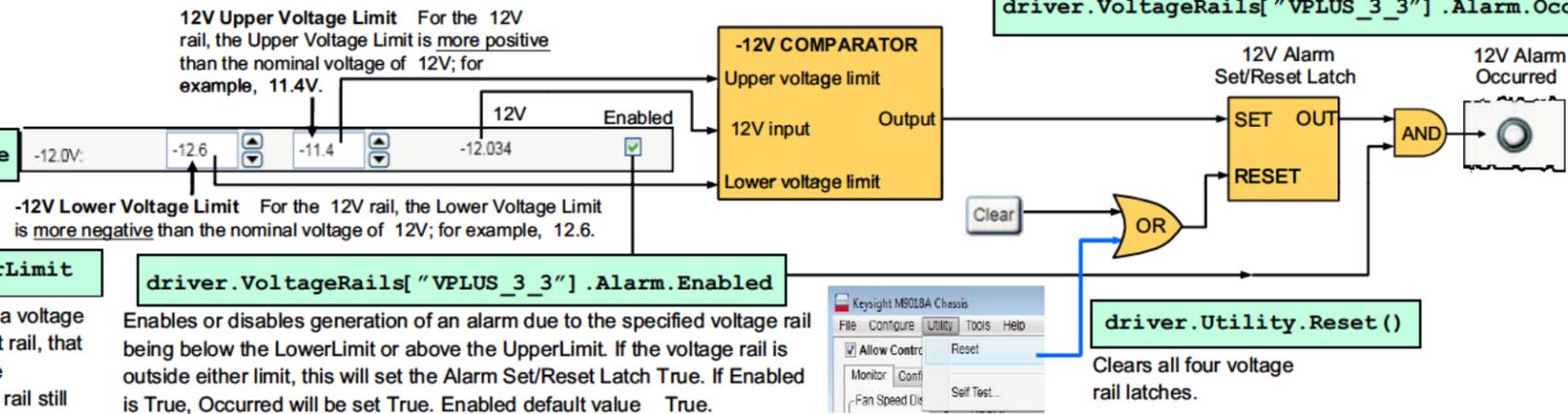
Figure 20   Voltage Monitoring Using the IVI.NET Driver and C#

6   Chassis Cooling and Rack Mounting

This chapter describes chassis cooling and rack mounting of the chassis. These topics are presented together so that chassis cooling can be considered when rack mounting the chassis.

Overview of chassis cooling

The key points regarding chassis cooling are:

- For the M9018B and M9019A, three 186 cubic feet per minute (CFM) fans, provide a total airflow of up to 558 CFM. These fans are mounted on the chassis rear panel and exhaust air out the rear of the chassis. The air intakes are in the front, sides and bottom of the chassis.

Figure 21   M9018B and M9019A Chassis Air Flow

The M9010A has two fans on the rear panel. They pull air from the rear panel and push air through the chassis.
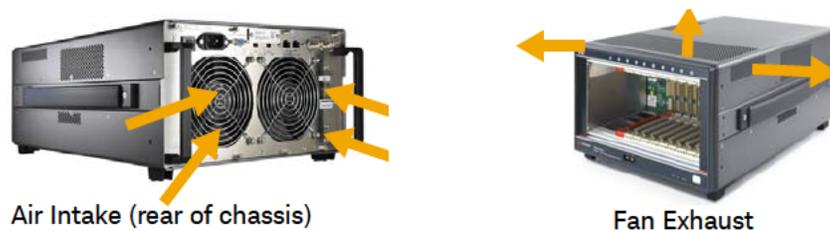
Figure 22   M9010A Chassis Air Flow

![KEYSIGHT TECHNOLOGIES]

- A minimum of 50 mm (2 inches) of clearance should be provided in the front, rear, top and sides of the chassis for ventilation. Depending on module power consumption, clearance may also be needed below the chassis to accommodate the air intakes on the bottom of the chassis. This is discussed further in the next section.

- The fans can either be set to operate at maximum speed, or can be set so that the fan speeds are a function of the chassis temperature. With the latter capability, you can specify the fan speed vs. temperature profile using either the Soft Front Panel (SFP) or programmatically using the IVI drivers.

NOTE	If a fan stops completely, the chassis shuts down. Determine th cause of the fan stopping (obstruction, fan failed etc.) and correct it before powering on the chassis.

- The M9018B and M9019A chassis have eight temperature sensors, and the M9010A has five sensors mounted to the top of the backplane to monitor the air flow temperature downstream from the modules. These temperatures can be read using the SFP or programmatically.

- Ensure that the chassis **Fan** switch (on the chassis rear panel) is set to AUTO and the **Inhibit** switch is set to DEF.

Chassis Rear Panel Fan and Inhibit Switches

- Position the chassis to provide ample space around the chassis fan intake and exhaust vents. Blockage by walls or obstructions affects the airflow needed for cooling.

Monitoring the Chassis Temperature

Keysight PXIe chassis allows you to monitor each of the air flow exit temperature sensors using either the SFP, the IVI drivers, or the LabVIEW driver. In addition, the SFP and IVI drivers can be used to set an upper temperature threshold such that an alarm will be generated if any temperature sensor reports a temperature above the specified threshold. The front panel Temperature LED also provides information about the chassis temperature.

The air flow exit chassis temperature sensors are located on the M9018B and M9019A chassis backplane as shown in the following image.
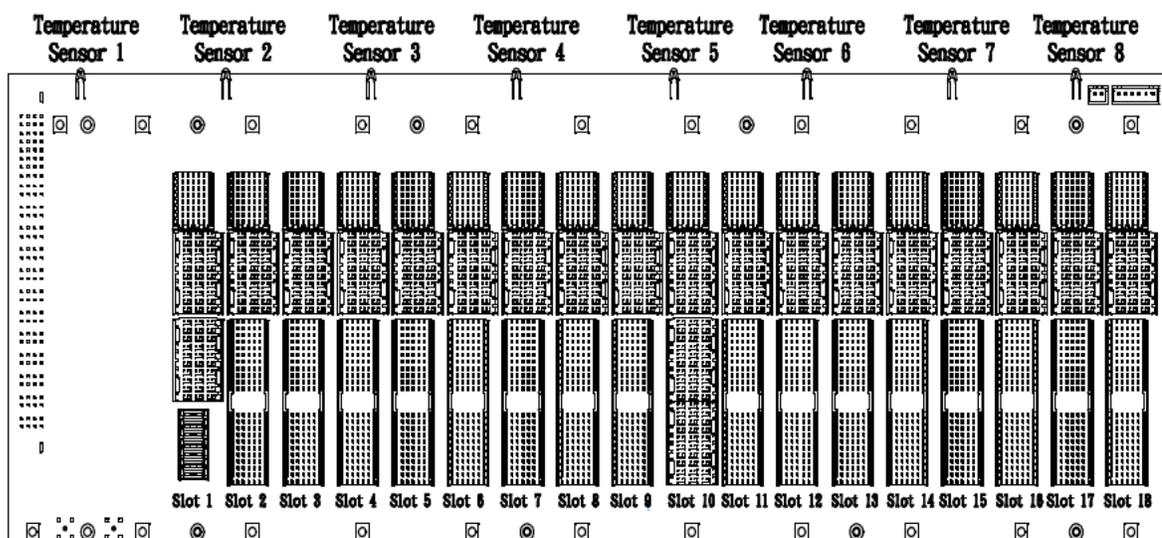
Figure 23   Temperature Sensor Locations in M9018B and M9019A Chassis.
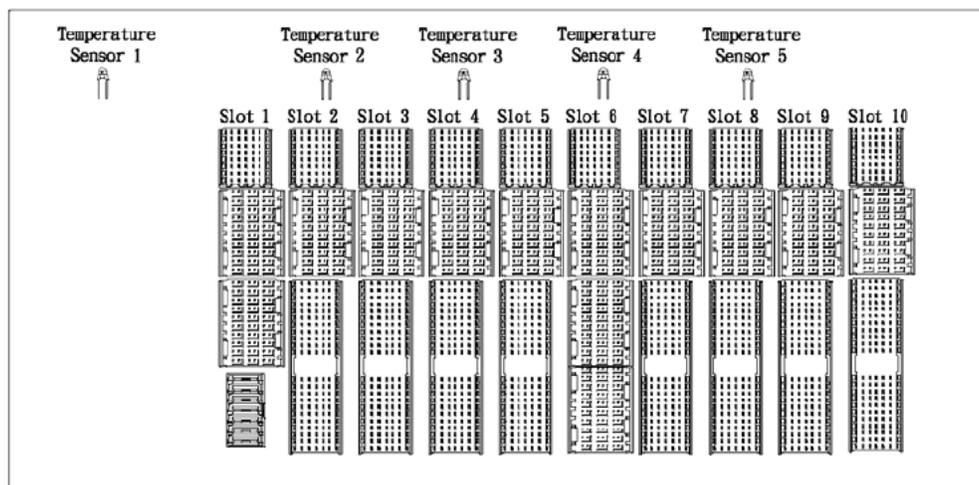
Figure 24   Temperature Sensor Locations in M9010A Chassis.

By knowing the location of the temperature sensors relative to the chassis slots, you can determine which modules are potentially contributing to excessive temperatures. To address this, you can take steps such as redistributing modules in the chassis or installing air inlet modules adjacent to high power modules to provide additional ventilation.

Use of the SFP, the front panel Temperature LED, and the IVI drivers to monitor the chassis temperature sensors is described in the following *Temperature Monitoring using the SFP and the Front Panel Temperature LED* diagram.

In the SFP, the Temperature tab allows monitoring the temperatures reported by the sensors. This tab also provides the temperature Alarm Occurred indicator and the Clear Alarm button.

Temperature Monitoring using the SFP and the Front Panel Temperature LED

The **Temperature** tab allows the temperatures reported by the chassis temperature sensors to be monitored. This tab also provides the temperature Alarm Occurred indicator and the Clear Alarm button.

Front panel Temperature LED

On: The LED is illuminated for 3 seconds at power on to permit verification that the LED and its drive circuitry are operational.

Off: All temperature sensors are < Maximum Temperature Alarm Threshold

Flashing: One or more temperature sensors are > Maximum Temperature Alarm Threshold

The Temperature Alarm Set/Reset Latch ("latch") is set if any temperature is above the user settable Maximum Temperature Alarm Threshold ("Max Temp Threshold"). Setting the latch allows temperature issues to be detected/captured in the absence of an operator. The latch does not have a default value if the SET input is true, for example, at power on due to a temperature sensor reporting a temperature above the default Max Temp Threshold (70 °C), the latch will be set True at power on.

The latch can be reset (cleared) using the **Clear Alarm** button, Reset on the Utility dropdown menu, or programmatically. However, if any temperature sensor is still reporting a temperature above the Max Temp Threshold when the latch is reset, the latch will be immediately set True again.

If the latch is set and if Alarm Enabled is True, Alarm Occurred will be True. Alarm Occurred is set False if Alarm Enabled is set False; however, setting Alarm Enabled False does not reset the latch. Likewise, changing the Max Temp Threshold to a temperature higher than all eight temperature sensors are currently reporting does not reset the latch.

As described in the Keysight PXIe Family Chassis User Guide section **Relationship between Alarm Occurred and the Front Panel LEDs**, it is possible for Alarm Occurred to indicate an over temperature condition while the front panel LED indicates the temperatures are normal. This situation can occur if a temperature sensor momentarily reports a temperature above Max Temp Threshold (which sets the latch) followed by the chassis temperature dropping such that all sensors now report temperatures below Max Temp Threshold this will turn the LED off (normal operation).

The **Temperature** tab is used to set the Max Temp Threshold and enable/disable the Temperature Alarm. The Max Temp Threshold can be set from 1 to 70 °C (33.8 to 158 °F) either by entering the value directly or by using the up/down arrow buttons. To aid in setting the Max Temp Threshold, the current value of the hottest temperature sensor is displayed.

Figure 25 Using the Soft Front Panel to monitor Chassis Temperature

Temperature Monitoring using the IVI-C Driver and C++

KtMPxi_GetTemperatureSensorName

Name() takes a temperature sensor index of 1 to 8 and returns the temperature sensor name. For example, the value returned for Name(5) is "TS5". A temperature sensor name, not an index, is required to obtain a sensor temperature, as shown below.

KTMPXICHASSIS_ATTR_TEMPERATURE

This attribute takes a temperature sensor name and r eturns the temperature of that sensor with 1 °C resolution.

Front panel Temperature LED

On: The LED is illuminated for 3 seconds at power on to permit verification that the LED and its drive circuitry are operational.

Off: All temperature sensors are < Maximum Temperature Alarm Threshold

Flashing: One or more temperature sensors are > Maximum Temperature Alarm Threshold

KTMPXICHASSIS_ATTR_TEMPERATURE_SENSOR_COUNT

Returns the number of temperature sensors. For the 18-slot chassis, Count = 8.

COMPARATOR

Compare all 8 temperature sensors to the Max Temp Threshold.

Output

True if any temperature sensor is above the Maximum Temperature Alarm Threshold

Temperature Sensor 1
Temperature Sensor 2
Temperature Sensor 3
Temperature Sensor 4
Temperature Sensor 5
Temperature Sensor 6
Temperature Sensor 7
Temperature Sensor 8

Max Temp Threshold

Max Temp Threshold

Temperature of any sensor

Output of Comparator

LED drive logic

Temperature Alarm Set/Reset Latch

SET OUT

RESET

AND

KTMPXICHASSIS_ATTR_TEMPERATURE_ALARM_OCCURRED

Returns the status of the temperature alarm. If True, this indicates that the Maximum Temperature Threshold has been exceeded. This is a per-application property and therefore the value reported programmatically may be different than the temperature Alarm Occurred status reported by the SFP.

Alarm Occurred

KtMPxi_TemperatureAlarmClear()

Clears the Temperature Alarm Latch

Clear

OR

Re-establishes all default values.

KtMPxi_reset()

The Temperature Alarm Set/Reset Latch ("latch") is set if any temperature goes above the user settable Maximum Tempperature Alarm Threshold (("Max Tempp Threshold")). Setting the latch allows temperature issues to be detected/captured in the absence of an operator. The latch does not have a default state if the SET input is true, for example, at power on due to a temperature sensor reporting a temperature above the default Max Temp Threshold (70 ° C), the latch will be set True at power on.

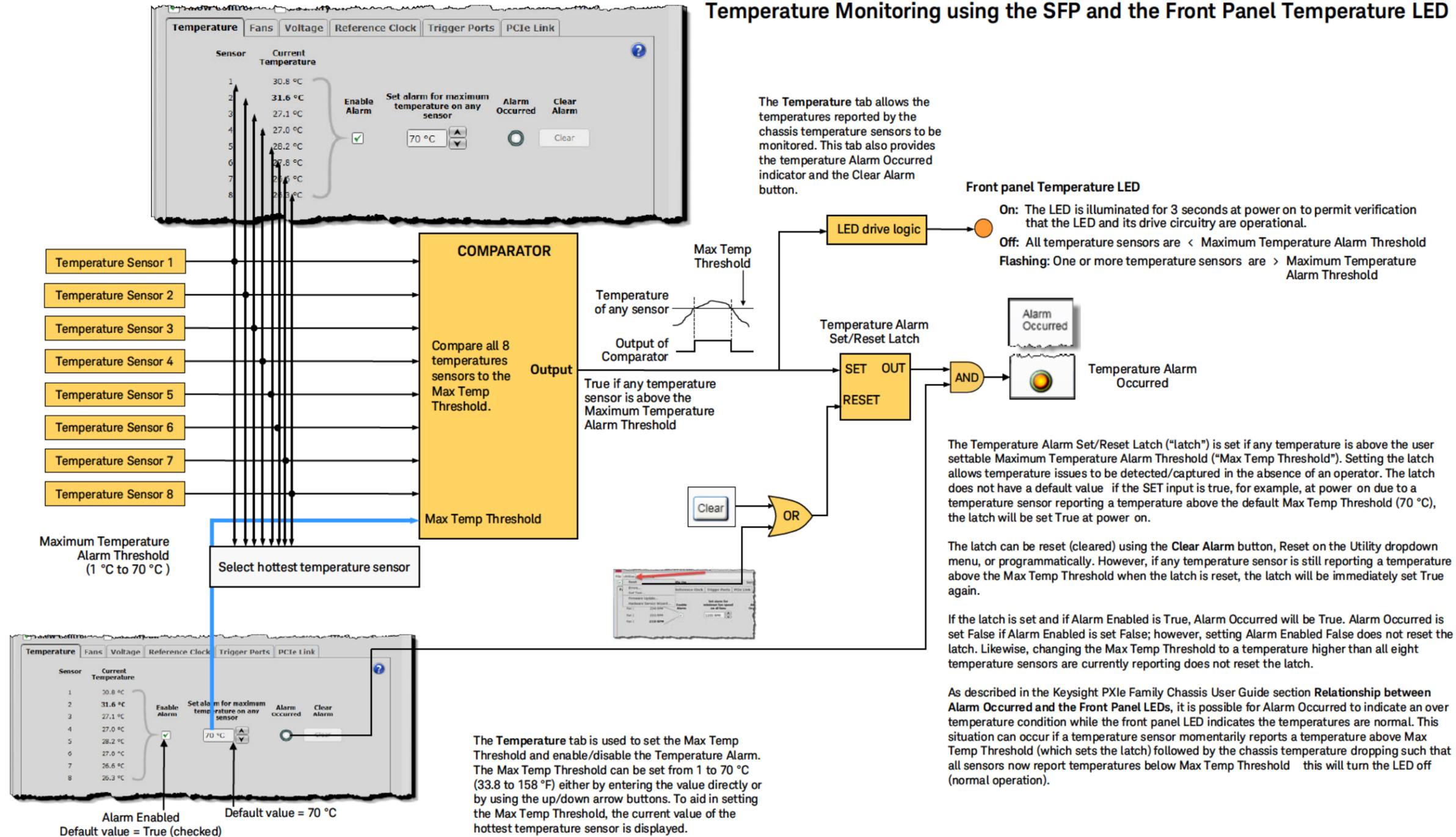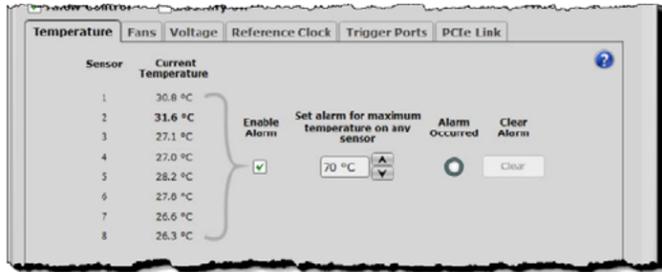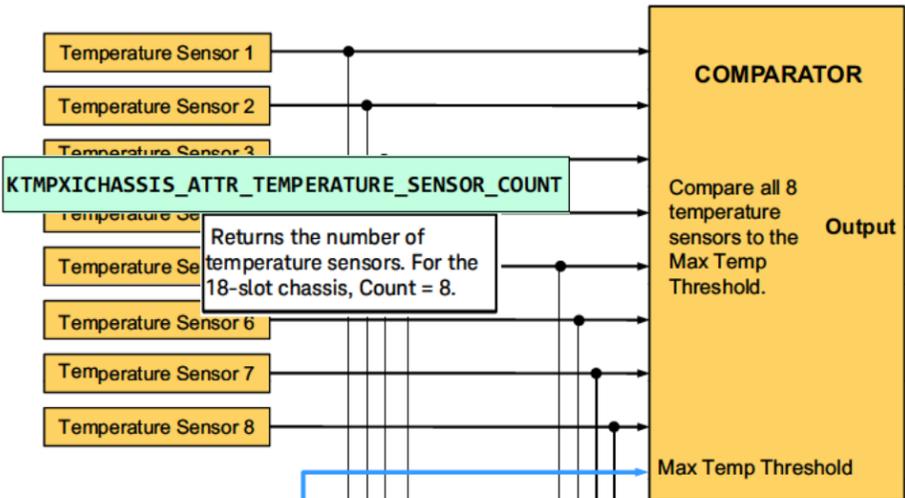The latch can be reset (cleared) using the Clear Alarm button, Reset on the Utility dropdown menu, or programmatically. However, if any temperature sensor is still reporting a temperature above the Max Temp Threshold when the latch is reset, the latch will be immediately set True again.

If the latch is set and if Alarm Enabled is True, Alarm Occurred will be True. Alarm Occurred is held False if Alarm Enabled is set False; however, setting Alarm Enabled False does not reset the latch. Changing the Max Temp Threshold to a temperature higher than all eight temperature sensors are currently reporting resets the latch.

KTMPXICHASSIS_ATTR_TEMPERATURE_ALARM_MAX_TEMPERATURE

Sets the Maximum Temperature Alarm Threshold from 1 °C to 70 °C

KTMPXICHASSIS_ATTR_TEMPERATURE_ALARM_ENABLED

Used to enable or disable the temperature sensors alarm.

Alarm Enabled
Default value = True (checked)

Default value = 70 °C

KtMPxi_TemperatureAlarmConfigure()

Configures the temperature alarm behavior by allowing setting of both the Maximum Temperature Alarm Threshold (MaxTemperature) and the Enabled property.

To show the parallels between the SFP capabilities and the programmatic capabilities, the IVI-C driver attributes and functions are overlaid next to their SFP counterparts.

It is important to understand how your program interacts with the SFP. If your program and the SFP (or, for that matter, any other program) are operating simultaneously, they will need to share certain chassis resources. Please see the diagram "Chassis Alarm Architecture" in the *PXIe Chassis Family User Guide* chapter "Overview of Chassis Management Capabilities" for a description of how the alarm resources are shared between multiple processes.

Figure 26   Temperature Monitoring using the IVI-C Driver and C++

Temperature Monitoring using the IVI.NET Driver and C#

`driver.TemperatureSensors.Name()`

Names of the temperature sensors are "TS1", "TS2", ... "TS<count>"

`driver.TemperatureSensors["TS3"].Temperature`

This property takes a temperature sensor name and returns the temperature of that sensor.

Front panel Temperature LED

On: The LED is illuminated for 3 seconds at power on to permit verification that the LED and its drive circuitry are operational.

Off: All temperature sensors are < Maximum Temperature Alarm Threshold

Flashing: One or more temperature sensors are > Maximum Temperature Alarm Threshold
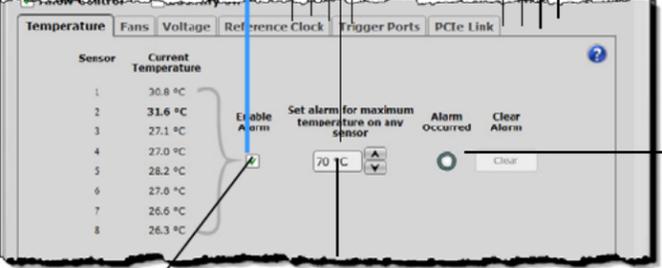
LED drive logic

Temperature Sensor 1
Temperature Sensor 2
Temperature Sensor 3

`driver.TemperatureSensors.Count`

Returns the number of temperature sensors. For the 18-slot chassis, Count = 8.

Temperature

Temperature Sensor 6
Temperature Sensor 7
Temperature Sensor 8

COMPARATOR

Compare all 8 temperature sensors to the Max Temp Threshold.

Output

Max Temp Threshold

Max Temp Threshold

Temperature of any sensor

Output of Comparator

True if any temperature sensor is above the Maximum Temperature Alarm Threshold

Temperature Alarm Set/Reset Latch

SET OUT

RESET

AND

Alarm Occurred

`driver.TemperatureSensors.Alarm.Occurred`

Returns the status of the temperature alarm. If True, this indicates that the Max Temperature Threshold has been exceeded. This is a per-application property and therefore the value reported programmatically may be different than the temperature Alarm Occurred status reported by the SFP.

`driver.TemperatureSensors.Alarm.Clear()`

Clears the Temperature Alarm Latch

Clear

OR

Re-establishes all default values.

`driver.Utility.Reset()`

The Temperature Alarm Set/Reset Latch ("latch") is set if any temperature goes above the user settable Maximum Temperature Alarm Threshold (("Max Temp Threshold")). Setting the latch allows temperature issues to be detected/captured in the absence of an operator. The latch does not have a default state if the SET input is true, for example, at power on due to a temperature sensor reporting a temperature above the default Max Temp Threshold (70 °C), the latch will be set True at power on.
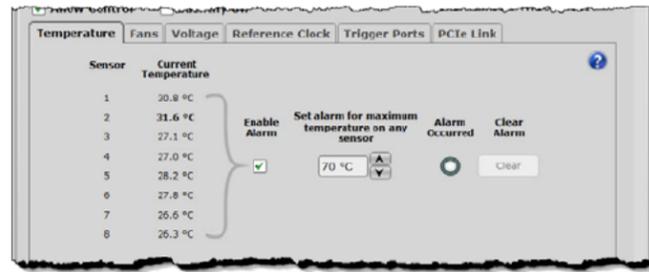
The latch can be reset (cleared) using the Clear Alarm button, Reset on the Utility dropdown menu, or programmatically. However, if any temperature sensor is still reporting a temperature above the Max Temp Threshold when the latch is reset, the latch will be immediately set True again.

If the latch is set and if Alarm Enabled is True, Alarm Occurred will be True. Alarm Occurred is held False if Alarm Enabled is set False; however, setting Alarm Enabled False does not reset the latch. Changing the Max Temp Threshold to a temperature higher than all eight temperature sensors are currently reporting resets the latch.

`driver.TemperatureSensors.Alarm.MaxTemperature`

Sets the Maximum Temperature Alarm Threshold from 1 °C to 70 °C

`driver.TemperatureSensors.Alarm.Enabled`

Used to enable or disable the temperature sensor alarm.

Alarm Enabled
Default value = True (checked)

Default value = 70 °C

`driver.TemperatureSensors.Alarm.Configure()`

Configures the temperature alarm behavior by allowing setting of both the Maximum Temperature Alarm Threshold (MaxTemperature) property and the Enabled property.

To show the parallels between the SFP capabilities and the programmatic capabilities, the IVI-COM driver properties and methods are overlaid next to their SFP counterparts.

It is important to understand how your program interacts with the SFP. If your program and the SFP (or, for that matter, any other program) are operating simultaneously, they will need to share certain chassis resources. See the diagram "Chassis Alarm Architecture" in the M9018A User Guide chapter "Overview of Chassis Management Capabilities" for a description of how the alarm resources are shared between multiple processes.
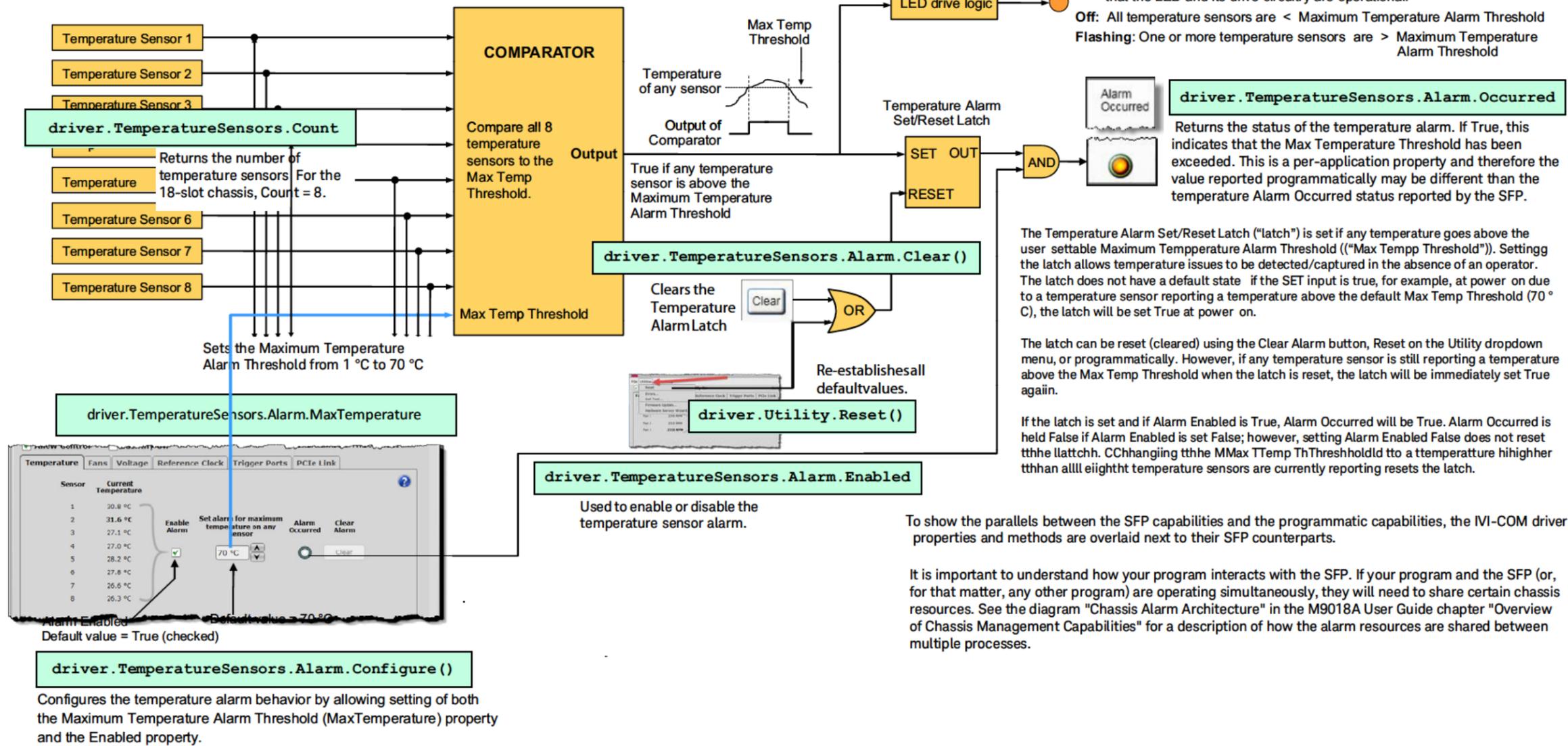
Figure 27 Temperature Monitoring using the IVI.NET Driver and C#

Monitoring Chassis Fan Speeds

Both the M9018B and M9019A chassis contains three fans that are mounted on the chassis rear panel and provide cooling for the chassis; the M9010A chassis has two fans. The chassis allows you to monitor the speed of each fan in revolutions per minute (RPM). You can also set a minimum fan speed threshold such that, if any fan speed falls below this threshold, a fan speed alarm is generated.

These monitoring capabilities are available using the Soft Front Panel (SFP) and programmatically using the chassis drivers. In addition, the front panel Fan LED provides information on fan speeds. Use of the SFP, the front panel Fan LED, and the IVI drivers to monitor the chassis temperature sensors are described in the following SFP and the front panel Fan LED diagram.

Setting the Fan Speed vs. Chassis Temperature Profile

The chassis allows you to control the fan speed vs. temperature profile. This is done by specifying a chassis temperature at which the three fans will operate at maximum speed. Maximum speed is achieved by the chassis supplying a drive voltage to the fans with a 100% duty cycle.

For temperatures below the specified chassis temperature, the duty cycle of the fan drive voltage will be less than 100%, which reduces the fan speed and the fan noise. The reduction in fan speed is proportional to how far the chassis temperature is below the specified chassis temperature. To ensure adequate cooling at any temperature, the drive voltage to the fan will never drop below 40% duty cycle.

These fan speed vs. chassis temperature profile can be set using both the SFP and programmatically, as described in the following diagram

Default Minimum Fan Speed Threshold Limit

The M9010A has a default minimum fan speed limit of 900 RPM. The M9018B and M9019A have a default minimum fan speed limit of 1200 RPM. These default limits are applied on chassis power on. The following diagrams apply to both types of chassis, but the examples show the default minimum fan speed of 1200 RPM for the M9018B and M9019A.

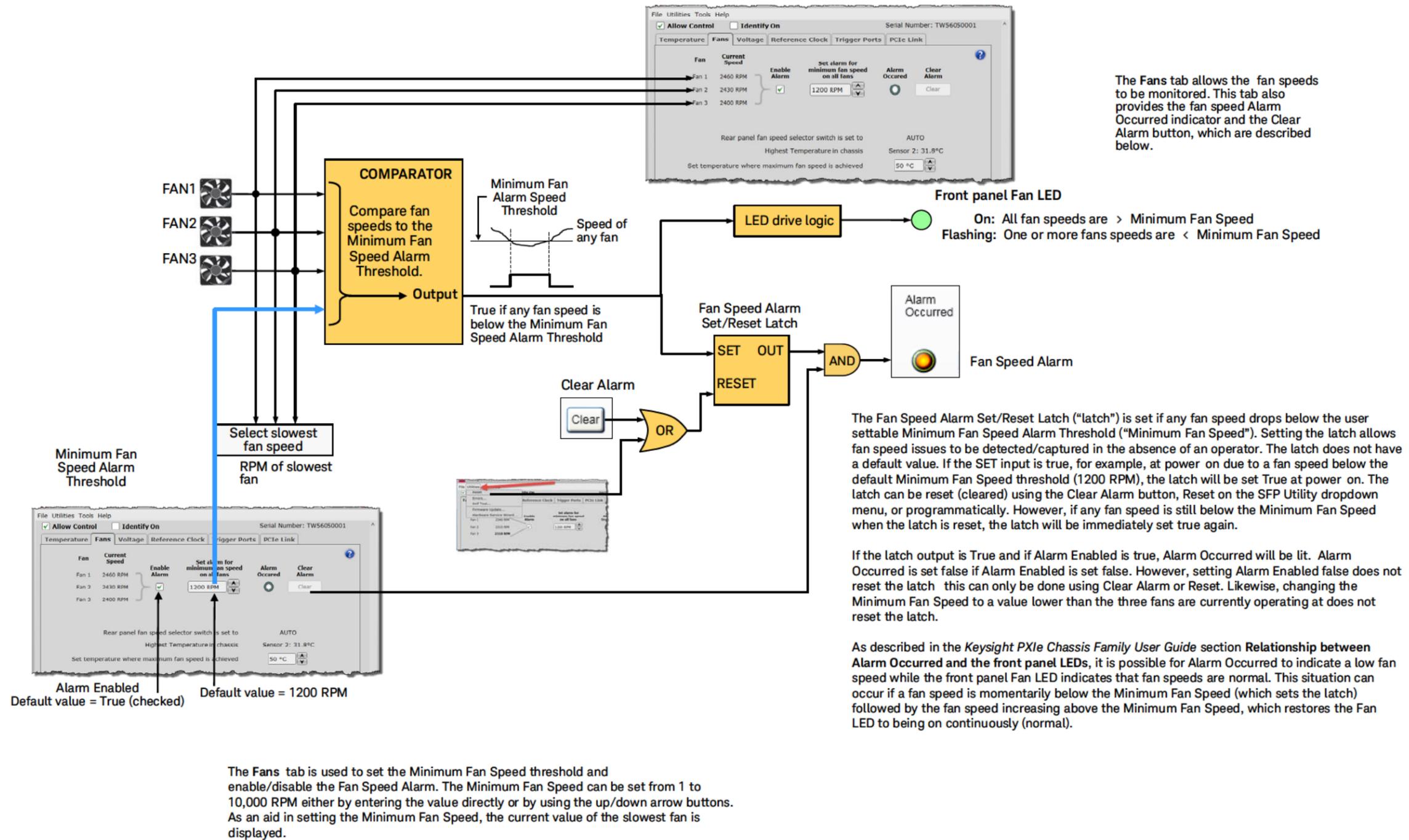# Fan Speed Monitoring using the SFP and the Front Panel Fan LED

The **Fans** tab allows the fan speeds to be monitored. This tab also provides the fan speed Alarm Occurred indicator and the Clear Alarm button, which are described below.

Front panel Fan LED

On: All fan speeds are > Minimum Fan Speed
Flashing: One or more fans speeds are < Minimum Fan Speed

The Fan Speed Alarm Set/Reset Latch ("latch") is set if any fan speed drops below the user settable Minimum Fan Speed Alarm Threshold ("Minimum Fan Speed"). Setting the latch allows fan speed issues to be detected/captured in the absence of an operator. The latch does not have a default value. If the SET input is true, for example, at power on due to a fan speed below the default Minimum Fan Speed threshold (1200 RPM), the latch will be set True at power on. The latch can be reset (cleared) using the Clear Alarm button, Reset on the SFP Utility dropdown menu, or programmatically. However, if any fan speed is still below the Minimum Fan Speed when the latch is reset, the latch will be immediately set true again.

If the latch output is True and if Alarm Enabled is true, Alarm Occurred will be lit. Alarm Occurred is set false if Alarm Enabled is set false. However, setting Alarm Enabled false does not reset the latch this can only be done using Clear Alarm or Reset. Likewise, changing the Minimum Fan Speed to a value lower than the three fans are currently operating at does not reset the latch.

As described in the *Keysight PXIe Chassis Family User Guide* section **Relationship between Alarm Occurred and the front panel LEDs**, it is possible for Alarm Occurred to indicate a low speed while the front panel Fan LED indicates that fan speeds are normal. This situation can occur if a fan speed is momentarily below the Minimum Fan Speed (which sets the latch) followed by the fan speed increasing above the Minimum Fan Speed, which restores the Fan LED to being on continuously (normal).

The **Fans** tab is used to set the Minimum Fan Speed threshold and enable/disable the Fan Speed Alarm. The Minimum Fan Speed can be set from 1 to 10,000 RPM either by entering the value directly or by using the up/down arrow buttons. As an aid in setting the Minimum Fan Speed, the current value of the slowest fan is displayed.

Figure 28   Using the Soft Front Panel to Monitor the Chassis Fan Speed
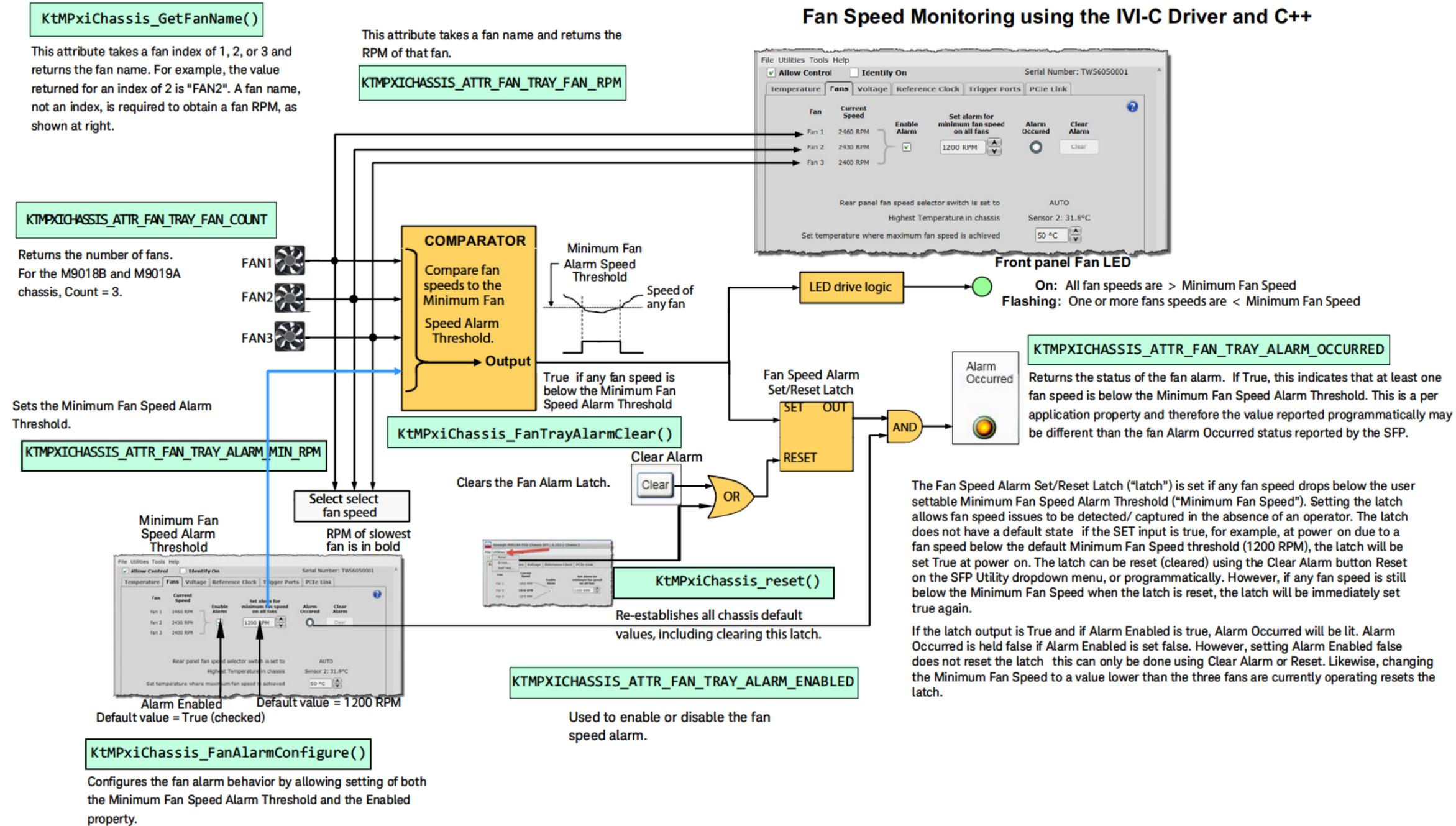
Figure 29 Chassis Fan Speed Monitoring using the IVI-C Driver and C++
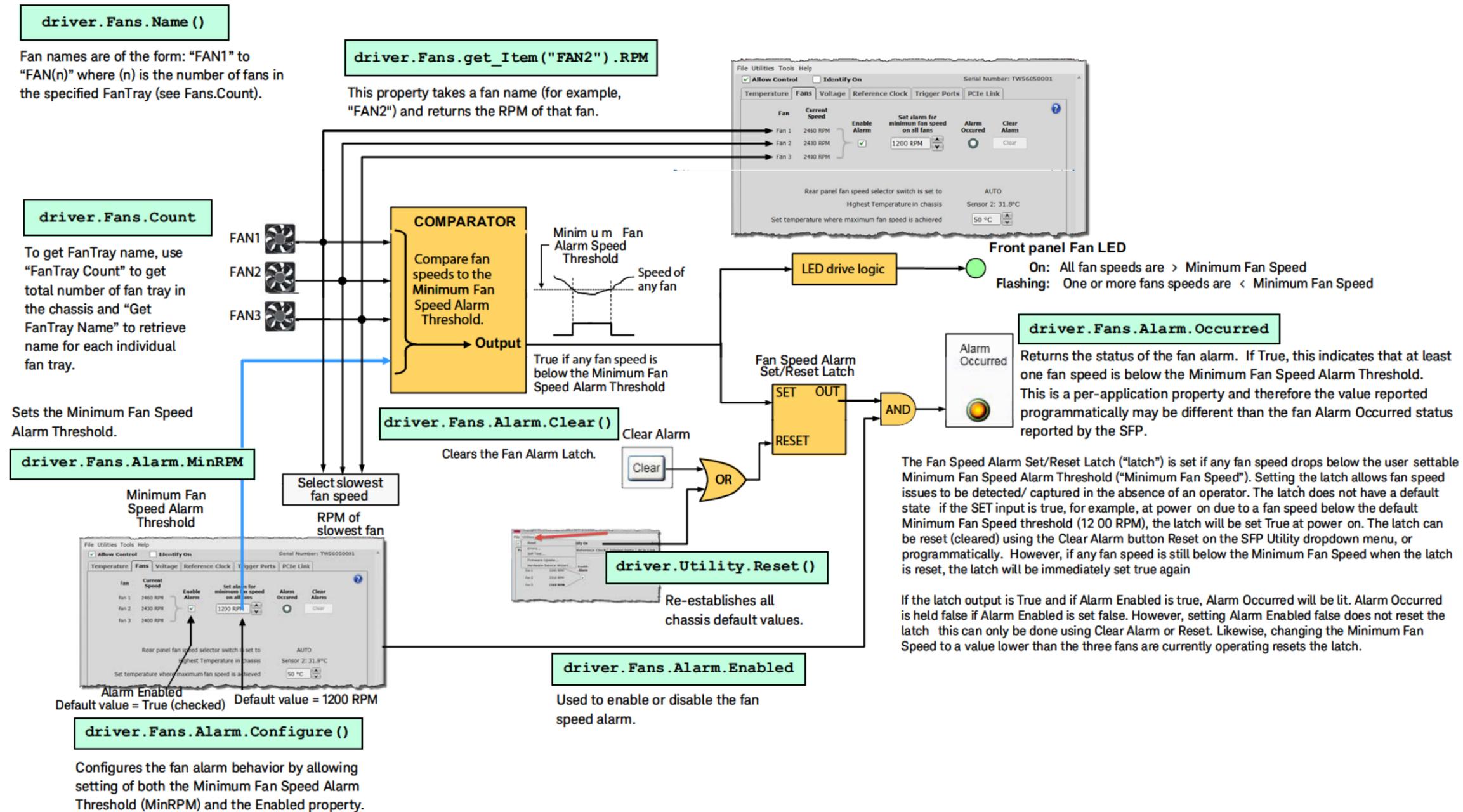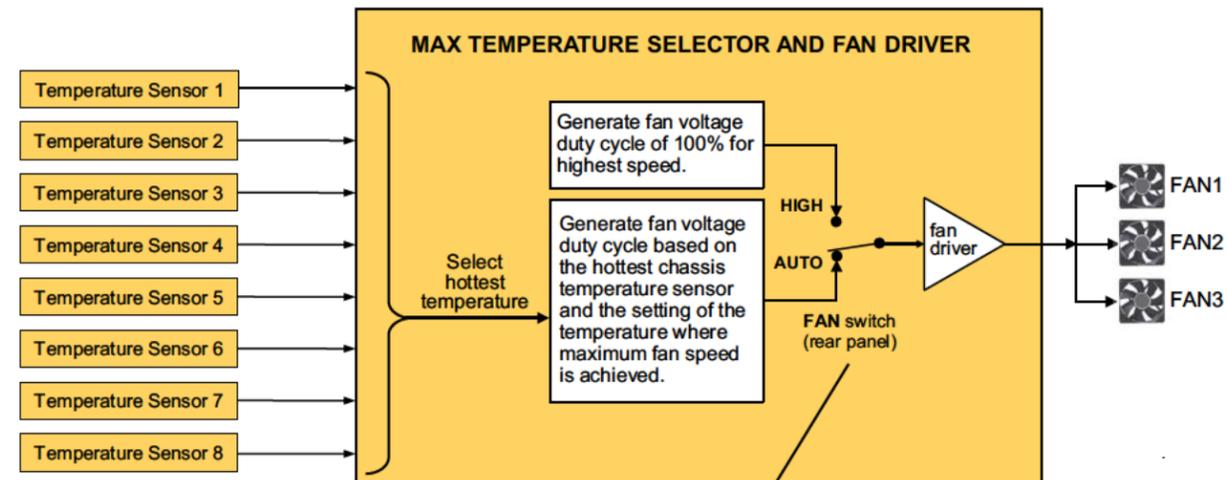
Fan Speed Monitoring using the IVI.NETDriver and C#

`driver.Fans.Name()`
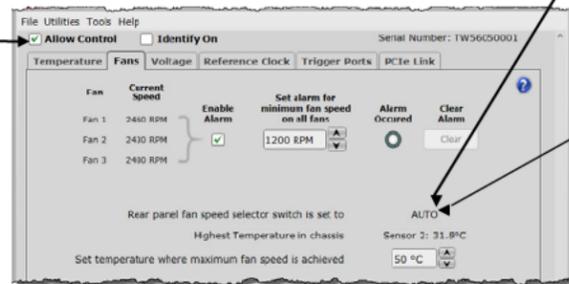
Fan names are of the form: "FAN1" to "FAN(n)" where (n) is the number of fans in the specified FanTray (see Fans.Count).

`driver.Fans.get_Item("FAN2").RPM`

This property takes a fan name (for example, "FAN2") and returns the RPM of that fan.

`driver.Fans.Count`

To get FanTray name, use "FanTray Count" to get total number of fan tray in the chassis and "Get FanTray Name" to retrieve name for each individual fan tray.

Sets the Minimum Fan Speed Alarm Threshold.

`driver.Fans.Alarm.MinRPM`

Minimum Fan Speed Alarm Threshold

COMPARATOR

Compare fan speeds to the **Minimum Fan Speed Alarm Threshold.**

→ Output

True if any fan speed is below the Minimum Fan Speed Alarm Threshold

Minimum Fan Alarm Speed Threshold

Speed of any fan

FAN1
FAN2
FAN3

Select slowest fan speed

RPM of slowest fan

`driver.Fans.Alarm.Clear()`

Clears the Fan Alarm Latch.

Clear Alarm

Clear

OR

Alarm Enabled
Default value = True (checked)

Default value = 1200 RPM

`driver.Fans.Alarm.Configure()`

Configures the fan alarm behavior by allowing setting of both the Minimum Fan Speed Alarm Threshold (MinRPM) and the Enabled property.

LED drive logic

Front panel Fan LED

On: All fan speeds are > Minimum Fan Speed
Flashing: One or more fans speeds are < Minimum Fan Speed

Fan Speed Alarm Set/Reset Latch

SET   OUT

RESET

AND

Alarm Occurred

`driver.Utility.Reset()`

Re-establishes all chassis default values.

`driver.Fans.Alarm.Enabled`

Used to enable or disable the fan speed alarm.

`driver.Fans.Alarm.Occurred`

Returns the status of the fan alarm. If True, this indicates that at least one fan speed is below the Minimum Fan Speed Alarm Threshold. This is a per-application property and therefore the value reported programmatically may be different than the fan Alarm Occurred status reported by the SFP.

The Fan Speed Alarm Set/Reset Latch ("latch") is set if any fan speed drops below the user settable Minimum Fan Speed Alarm Threshold ("Minimum Fan Speed"). Setting the latch allows fan speed issues to be detected/ captured in the absence of an operator. The latch does not have a default state if the SET input is true, for example, at power on due to a fan speed below the default Minimum Fan Speed threshold (12 00 RPM), the latch will be set True at power on. The latch can be reset (cleared) using the Clear Alarm button Reset on the SFP Utility dropdown menu, or programmatically. However, if any fan speed is still below the Minimum Fan Speed when the latch is reset, the latch will be immediately set true again

If the latch output is True and if Alarm Enabled is true, Alarm Occurred will be lit. Alarm Occurred is held false if Alarm Enabled is set false. However, setting Alarm Enabled false does not reset the latch this can only be done using Clear Alarm or Reset. Likewise, changing the Minimum Fan Speed to a value lower than the three fans are currently operating resets the latch.

Figure 30   Chassis Fan Speed Monitoring using the IVI.NET Driver and C#

Setting the Temperature at which the Maximum Fan Speed is Achieved using the SFP

MAX TEMPERATURE SELECTOR AND FAN DRIVER

Temperature Sensor 1
Temperature Sensor 2
Temperature Sensor 3
Temperature Sensor 4
Temperature Sensor 5
Temperature Sensor 6
Temperature Sensor 7
Temperature Sensor 8

Select hottest temperature

Generate fan voltage duty cycle of 100% for highest speed.

Generate fan voltage duty cycle based on the hottest chassis temperature sensor and the setting of the temperature where maximum fan speed is achieved.

HIGH
AUTO

fan driver

FAN1
FAN2
FAN3

FAN switch (rear panel)

The **Allow Control** check box must be checked in order to use the functionality described on this diagram.

File Utilities Tools Help
Allow Control   Identify On   Serial Number: TW56C50001
Temperature Fans Voltage Reference Clock Trigger Ports PCIe Link

Fan | Current Speed | Enable Alarm | Set alarm for minimum fan speed on all fans | Alarm Occurred | Clear Alarm
Fan 1 3460 RPM
Fan 2 2430 RPM   ☑   1200 RPM   Clear
Fan 3 2400 RPM

Rear panel fan speed selector switch is set to   AUTO
Highest Temperature in chassis   Sensor 2: 31.8°C
Set temperature where maximum fan speed is achieved   50 °C

This field displays the position of the Fan Speed Selector Switch. This switch is on the rear panel and is labeled **FAN**.

The dialog is used to set the Temperature (°C) parameter where maximum fan speed is achieved. This parameter will be referred to by its IVI.NET driver name, MaxRPMTemperature. At SFP startup, the SFP reads the chassis value of MaxRPMTemperature and inserts that value here. The chassis default value is 50 °C.

Lowest MaxRPMTemperature setting = 25 °C

25 °C: Temperature at which the maximum fan RPM is achieved

0 °C: Temperature where the fan speeds begin ramping up from 40% duty cycle for the 25 °C lowest MaxRPMTemperature

Fan voltage duty cycle (100 90 80 70 60 50 40 30 20 10 0)

Highest temperature (°C) reported by the eight backplane temperature sensors (0 5 10 15 20 25 30 35 40 45 50 55 60 65 70)

Default MaxRPMTemperature setting = 50 °C

50 °C: Temperature at which the maximum fan RPM is achieved

25 °C

25 °C: Temperature where the fan speeds begin ramping up from 40% duty cycle for the 50 °C default MaxRPMtemperature

Fan voltage duty cycle (100 90 80 70 60 50 40 30 20 10 0)

Highest temperature (°C) reported by the eight backplane temperature sensors (0 5 10 15 20 25 30 35 40 45 50 55 60 65 70)

Highest MaxRPMTemperature setting = 65 °C

65 °C: Temperature at which the maximum fan RPM is achieved

25 °C

40 °C: Temperature where the fan speeds begin ramping up from 40% duty cycle for the 65 °C highest MaxRPMtemperature

Fan voltage duty cycle (100 90 80 70 60 50 40 30 20 10 0)

Highest temperature (°C) reported by the eight backplane temperature sensors (0 5 10 15 20 25 30 35 40 45 50 55 60 65 70)

The PXIe chassis controls the speed of its three fans by varying the duty cycle of the drive voltage to the fans. When the rear panel **FAN** switch (referred to as the "Fan Speed Selector Switch") is set to **HIGH**, the fan voltage duty cycle is set to 100%, which generates the highest fan speeds and the best chassis cooling — however, this also generates the most fan noise.

When the Fan Speed Selector Switch is set to **AUTO**, the speed of the three fans is controlled based on the temperature of the chassis *and* the setting of the SFP parameter "Temperature (°C) where maximum fan speed achieved" shown above (which will be referred to by its IVI.NET driver name for brevity, "MaxRPMTemperature"). MaxRPMTemperature specifies the chassis temperature where the maximum (100% duty cycle) fan speed is achieved, and is set using the Configure Fan Control dialog — this dialog is opened from the SFP **Configure** pull down menu. The hottest temperature reported by the eight temperature sensors is used to control the fan speed as shown in the block diagram. MaxRPMTemperature can be set from 25 °C (right top curve) to 65 °C (right bottom curve) in 1 °C increments either by entering the value directly or by using the up/down arrow buttons. The default MaxRPMtemperature parameter is 50 °C (right middle curve).

Regardless of the MaxRPMTemperature that is set, the fan speeds begin ramping up at 25 °C *below* MaxRPMTemperature. For example, if MaxRPMTemperature is set to 65 °C (bottom curve), the fan speed begins ramping up at 25 °C below this temperature, or at 40 °C. At 65 °C, the fan voltage duty cycle will be 100% (maximum fan speed).

Note that the chassis doesn't attempt to maintain its temperature at a particular temperature although it is expected that, in most cases, the chassis temperature will stabilize before MaxRPMTemperature is reached. To maximize cooling, MaxRPMTemperature should be set lower while, to minimize fan noise, MaxRPMTemperature should be set higher.
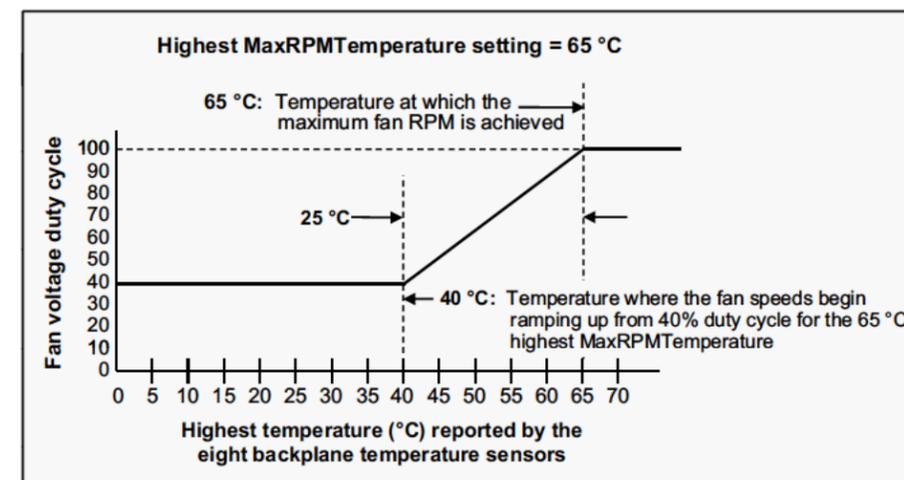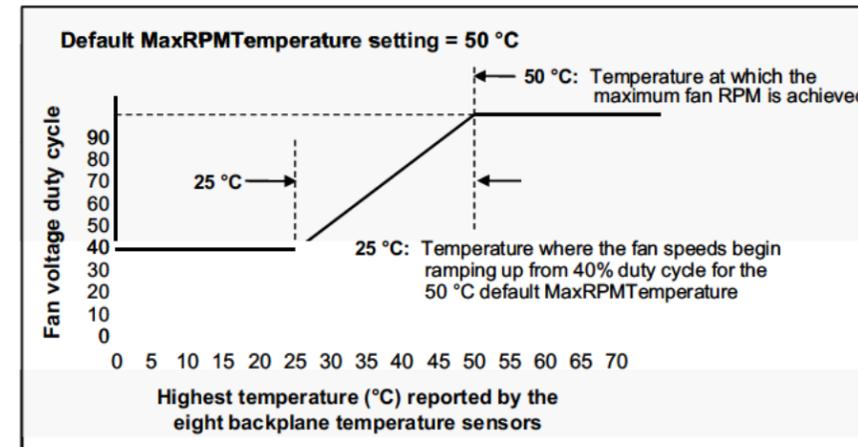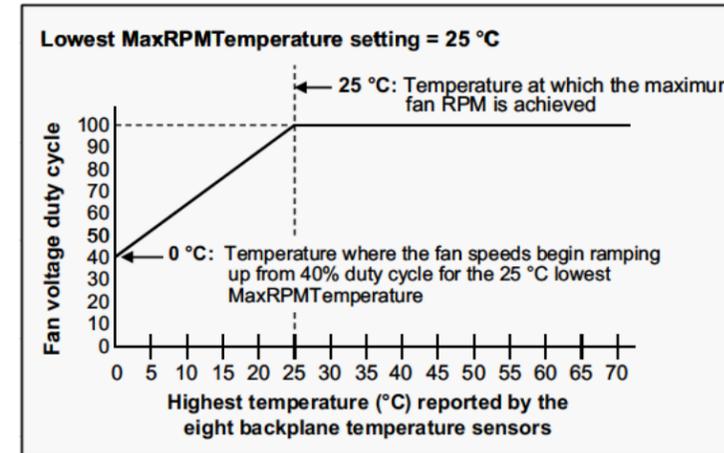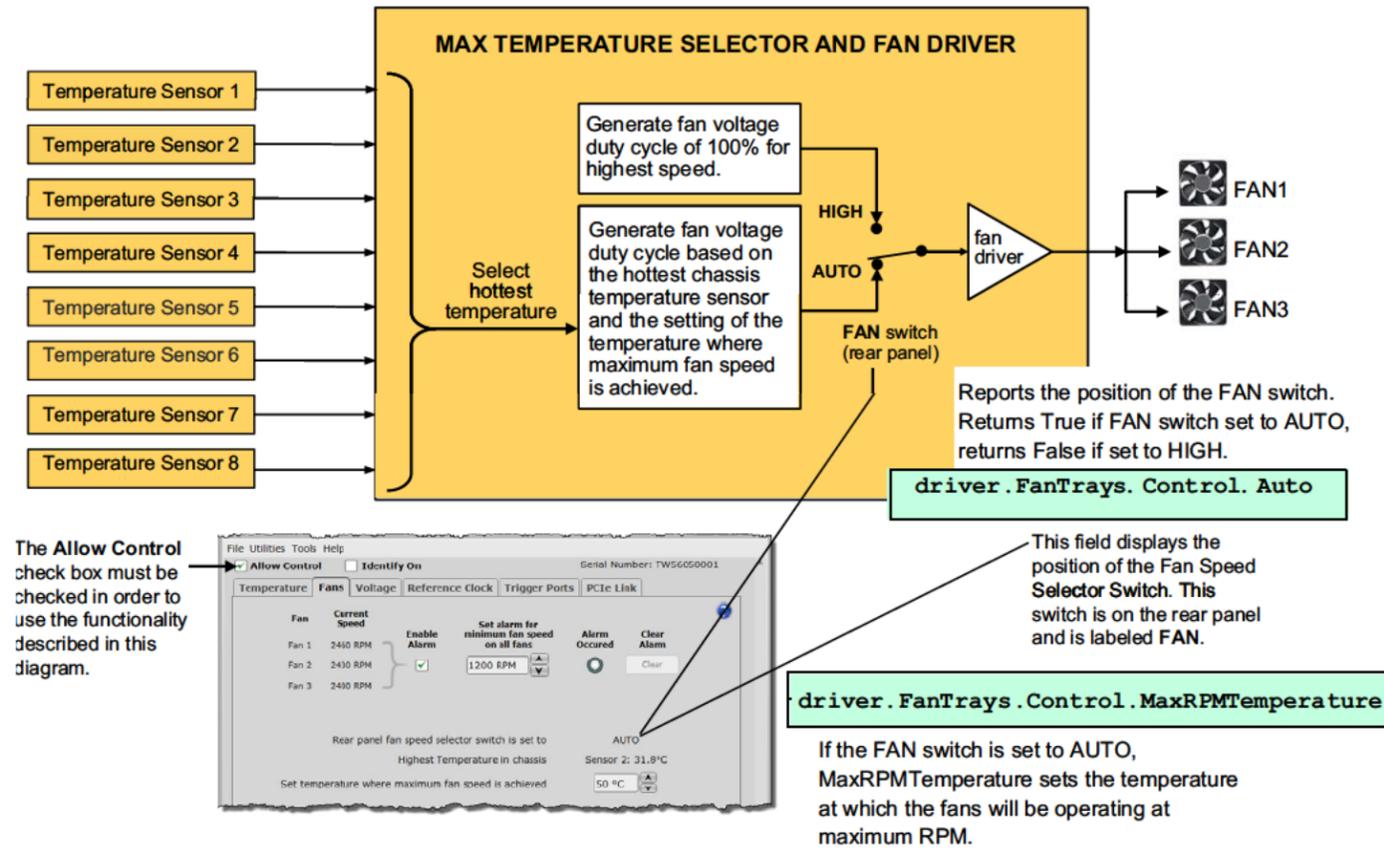
Figure 31   Using the Soft Front Panel to Set the Chassis Temperature for Maximum Fan Speed

Setting the Temperature at which the Maximum Fan Speed is Achieved using the IVI-C Driver and C++

MAX TEMPERATURE SELECTOR AND FAN DRIVER

Temperature Sensor 1
Temperature Sensor 2
Temperature Sensor 3
Temperature Sensor 4
Temperature Sensor 5
Temperature Sensor 6
Temperature Sensor 7
Temperature Sensor 8

Select hottest temperature

Generate fan voltage duty cycle of 100% for highest speed.

Generate fan voltage duty cycle based on the hottest chassis temperature sensor and the setting of the temperature where maximum fan speed is achieved.

HIGH
AUTO

FAN switch (rear panel)

fan driver

FAN1
FAN2
FAN3

Reports the position of the FAN switch. Returns True if the FAN switch is set to AUTO, returns False if set to HIGH.

KTMPXICHASSIS_ATTR_FAN_CONTROL_AUTO

The Allow Control check box must be checked in order to use the functionality described on this diagram.

This field displays the position of the Fan Speed Selector Switch. This switch is on the chassis rear panel and is labeled FAN.

If the FAN switch is set to AUTO, this attribute sets the temperature at which the fans will be operating at maximum RPM.

KTMPXICHASSIS_ATTR_FAN_CONTROL_MAX_RPM_TEMPERATURE

The PXIe chassis control the speed of its three fans by varying the duty cycle of the drive voltage to the fans. When the rear panel **FAN** switch (referred to as the "Fan Speed Selector Switch") is set to **HIGH**, the fan voltage duty cycle is set to 100%, which generates the highest fan speeds and the best chassis cooling   however, this also generates the most fan noise.

When the Fan Speed Selector Switch is set to **AUTO**, the speed of the three fans is controlled based on the temperature of the chassis *and* the setting of the SFP parameter "Temperature (°C) where maximum fan speed achieved" shown above (which will be referred to by its IVI COM driver name for brevity, "MaxRPMTemperature"). MaxRPMTemperature specifies the chassis temperature where the maximum (100% duty cycle) fan speed is achieved, and is set using the Configure Fan Control dialog   this dialog is opened from the SFP **Configure** pull down menu. The hottest temperature reported by the eight temperature sensors is used to control the fan speed as shown in the block diagram. MaxRPMTemperature can be set from 25 °C (right top curve) to **65** °C (right bottom curve) in 1 °C increments either by entering the value directly or by using the up/down arrow buttons. The default MaxRPMTemperature parameter is 50 °C (right middle curve).

Regardless of the MaxRPMTemperature that is set, the fan speeds begin ramping up at 25 °C *below* MaxRPMTemperature. For example, if MaxRPMTemperature is set to 65 °C (bottom curve), the fan speed begins ramping up at 25 °C below this temperature, or at 40 °C. At 65 °C, the fan voltage duty cycle will be 100% (maximum fan speed).

Note that the chassis doesn't attempt to maintain its temperature at a particular temperature although it is expected that, in most cases, the chassis **temperature will stabilize before MaxRPMTemperature is reached**. **To maximize cooling, MaxRPMT**emperature should be set **lower** while, to minimize fan noise, MaxRPMTemperature should be set **higher**.

Lowest MaxRPMTemperature setting = 25 °C

25 °C: Temperature at which the maximum fan RPM is achieved

0 °C: Temperature where the fan speeds begin ramping up from 40% duty cycle for the 25 °C lowest MaxRPMTemperature

Fan voltage duty cycle

Highest temperature (°C) reported by the eight backplane temperature sensors

Default MaxRPMTemperature setting = 50 °C

50 °C: Temperature at which the maximum fan RPM is achieved

25 °C

25 °C: Temperature where the fan speeds begin ramping up from 40% duty cycle for the 50 °C default MaxRPMTemperature

Fan voltage duty cycle

Highest temperature (°C) reported by the eight backplane temperature sensors

Highest MaxRPMTemperature setting = 65 °C

65 °C: Temperature at which the maximum fan RPM is achieved

25 °C

40 °C: Temperature where the fan speeds begin ramping up from 40% duty cycle for the 65 °C highest MaxRPMTemperature

Fan voltage duty cycle

Highest temperature (°C) reported by the eight backplane temperature sensors

Figure 32 Setting the temperature for Maximum Fan Speed using the IVI-C Driver and C++

Setting the Temperature at which the Maximum Fan Speed is Achieved using the IVI.NET Driver and C#

MAX TEMPERATURE SELECTOR AND FAN DRIVER

Temperature Sensor 1
Temperature Sensor 2
Temperature Sensor 3
Temperature Sensor 4
Temperature Sensor 5
Temperature Sensor 6
Temperature Sensor 7
Temperature Sensor 8

Select hottest temperature

Generate fan voltage duty cycle of 100% for highest speed.

Generate fan voltage duty cycle based on the hottest chassis temperature sensor and the setting of the temperature where maximum fan speed is achieved.

HIGH
AUTO
fan driver
FAN1
FAN2
FAN3

FAN switch (rear panel)

Reports the position of the FAN switch. Returns True if FAN switch set to AUTO, returns False if set to HIGH.

`driver.FanTrays.Control.Auto`

This field displays the position of the Fan Speed Selector Switch. This switch is on the rear panel and is labeled **FAN**.

The **Allow Control** check box must be checked in order to use the functionality described in this diagram.

`driver.FanTrays.Control.MaxRPMTemperature`

If the FAN switch is set to AUTO, MaxRPMTemperature sets the temperature at which the fans will be operating at maximum RPM.

Lowest MaxRPMTemperature setting = 25 °C

25 °C: Temperature at which the maximum fan RPM is achieved

0 °C: Temperature where the fan speeds begin ramping up from 40% duty cycle for the 25 °C lowest MaxRPMTemperature

Fan voltage duty cycle — Highest temperature (°C) reported by the eight backplane temperature sensors

Default MaxRPMTemperature setting = 50 °C

50 °C: Temperature at which the maximum fan RPM is achieved

25 °C: Temperature where the fan speeds begin ramping up from 40% duty cycle for the 50 °C default MaxRPMTemperature

Fan voltage duty cycle — Highest temperature (°C) reported by the eight backplane temperature sensors

Highest MaxRPMTemperature setting = 65 °C

65 °C: Temperature at which the maximum fan RPM is achieved

40 °C: Temperature where the fan speeds begin ramping up from 40% duty cycle for the 65 °C highest MaxRPMTemperature

Fan voltage duty cycle — Highest temperature (°C) reported by the eight backplane temperature sensors

The PXIe chassis controls the speed of its fans by varying the duty cycle of the drive voltage to the fans. When the rear panel **FAN** switch (referred to as the "Fan Speed Selector Switch") is set to **HIGH**, the fan voltage duty cycle is set to 100%, which generates the highest fan speeds and the best chassis cooling however, this also generates the most fan noise.

When the Fan Speed Selector Switch is set to **AUTO**, the speed of the three fans is controlled based on the temperature of the chassis *and* the setting of the SFP parameter "Temperature (°C) where maximum fan speed achieved" shown above (which will be referred to by its IVI COM driver name for brevity, "MaxRPMTemperature"). MaxRPMTemperature specifies the chassis temperature where the maximum (100% duty cycle) fan speed is achieved, and is set using the Configure Fan Control dialog this dialog is opened from the SFP **Configure** pull down menu. The hottest temperature reported by the eight temperature sensors is used to control the fan speed as shown in the block diagram. MaxRPMTemperature can be set from 25 °C (right top curve) to 65 °C (right bottom curve) in 1 °C increments either by entering the value directly or by using the up/down arrow buttons. The default MaxRPMTemperature parameter is 50 °C (right middle curve).

Regardless of the MaxRPMTemperature that is set, the fan speeds begin ramping up at 25 °C *below* MaxRPMTemperature. For example, if MaxRPMTemperature is set to 65 °C (bottom curve), the fan speed begins ramping up at 25 °C below this temperature, or at 40 °C. At 65 °C, the fan voltage duty cycle will be 100% (maximum fan speed).

Note that the chassis does not attempt to maintain its temperature at a particular temperature although it is expected that, in most cases, the chassis **temperature will stabilize before MaxRPMTemperature is reached.** To maximize cooling, MaxRPMTemperature should be set lower while, to minimize fan noise, MaxRPMTemperature should be set higher.
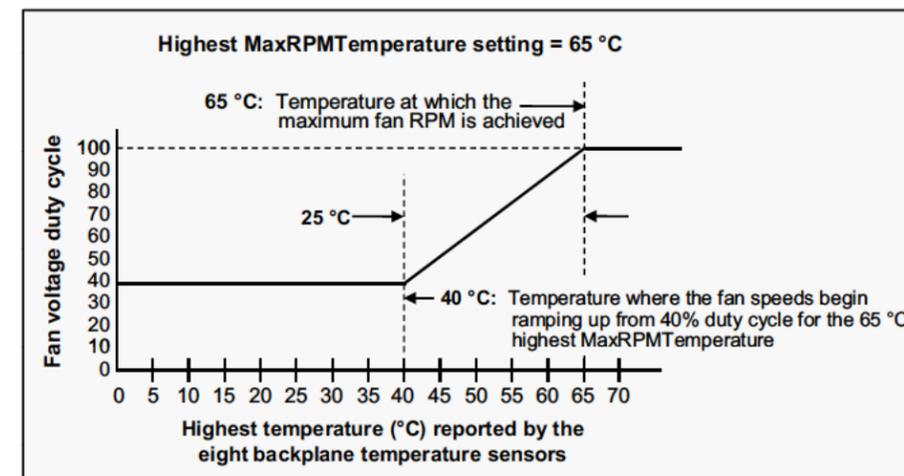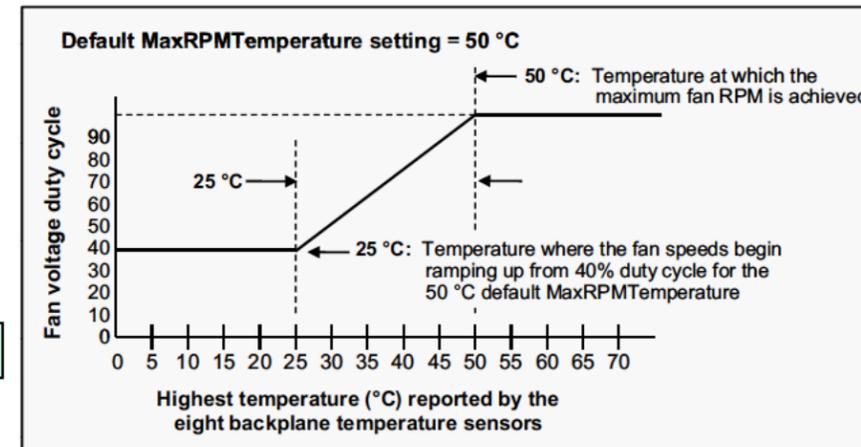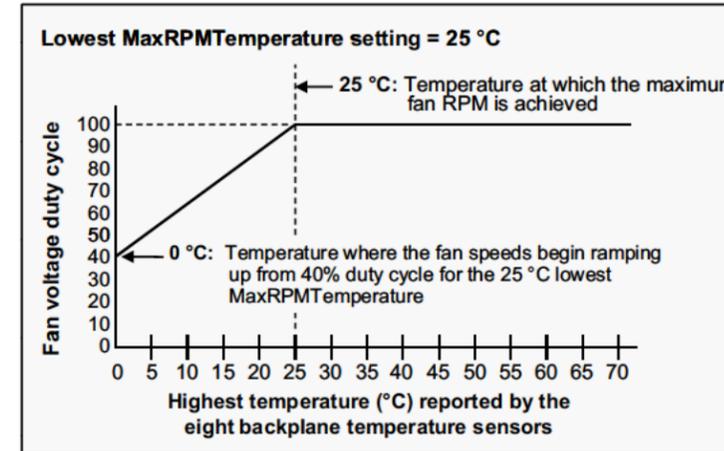
Figure 33   Setting the temperature for Maximum Fan Speed using the IV.NET Driver and C#

Rack Mounting the Chassis

CAUTION	- In handling the chassis in preparation for rack mounting, do not stand the chassis on its side; the side handles can cause the chassis to tip over.
	- Depending on the power consumed by the chassis, a 1U space may be required below the chassis to ensure adequate ventilation for cooling. Be sure to provide this space if required as described in this section.

Refer to "Rack Mount Accessory Kits" on page 76 for a list of available rack mount kits for the PXIe chassis. To rack mount the chassis, follow these guideline

- The heaviest instrument or chassis should always be mounted in the bottom of the rack.

- Always begin installing chassis at the bottom of the rack and working up. This maintains a lower center of gravity and reduces the likelihood of the rack tipping.

- Anti-tipping feet, if available with the rack, should always be extended.

- For maximum cooling and optimum rack thermal efficiency, place the chassis with the greatest power consumption towards the top of the rack. This promotes efficient cooling since heat rises. When placed nearer to the top of the rack, higher power chassis will not unnecessarily heat other chassis. However, in doing this, do not violate the guideline that the heaviest chassis be placed at the bottom of the rack.

- As described in "Power Supply Capacity" on page 50, the maximum power that can be supplied to the modules is 800 watts. If your modules are consuming the maximum power, 1U of space is required for ventilation below the chassis when you rack mount it.

CAUTION	The weight of an empty M9018B or M9019A PXIe chassis (no modules installed in the chassis) is approximately 29.8 lbs (13.5 kg). Lift the chassis using a single side handle only when the total chassis weight (chassis plus installed modules) does not exceed 75 lbs (34.0 kg). Otherwise use both side handles to lift the chassis.
	The M9010A chassis weighs 30.91 lbs (14.02 kg).
	Installing modules in the chassis may increase its weight to a point where two people are required to lift the chassis. If two people are not available, use a mechanical lift to lift the chassis. The chassis should be transported using a rolling cart.

Rack Mount Accessory Kits

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

For the M9018B and M9019A chassis:

- **Y1215C Flush Mount Rack Kit**: 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**: 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 Rail Kit**: 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**: 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.

For the M9010A chassis:

- **Y1271A Flush Mount Rack Kit:** 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.

7   10 MHz Reference Clock Source

PXIe Chassis timing is based on a 10 MHz reference clock. The 10 MHz Reference Clock can originate from any of the three sources listed below. These sources are listed in low to high precedence order if multiple 10 MHz reference clock sources are available:

- Chassis internal 10 MHz clock

- Rear panel 10 MHz clock (connected to the chassis through a BNC connector)

- System timing slot (slot 10) 10 MHz clock

For example, if both a rear panel 10 MHz clock and a system timing slot 10 MHz clock are provided, the system timing slot 10 MHz clock will be used by the chassis to generate its internal timing signals. There are no means to override this order of precedence; for example, there are no means to select the rear panel 10 MHz clock if a system timing module (in slot10) clock is present. The module in the system timing slot would need to be removed from the chassis in order to activate selection of the rear panel 10 MHz clock.

> **NOTE** The chassis references either the rear panel 10 MHz clock or the system timing slot 10 MHz clock as long as the clock frequency remains within the specification range of ±100 ppm. The chassis clocks are undefined if the reference clock is outside of this range.

The following Using the SFP to Monitor the 10 MHz Reference diagram shows how to monitor the 10 MHz clock.

> **NOTE** On the M9010A chassis, if you use a Reference Clock signal with an amplitude of < 500mVpp, the Reference Clock alarm may repeatedly trigger even after clearing it. The chassis PLL may be locked to the Reference Clock signal but the signal may have excessive jitter. If this situation occurs, you need to increase the clock signal amplitude.

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10 MHz Reference Clock Source

10 MHz Reference Clock Source Monitoring Using the SFP

Clock Selector

Selects chassis reference clock based on order of precedence. Also detects change in clock source

Internal 10 MHz clock →

External 10 MHz clock (if available) →

System timing slot 10 MHz clock →

Clock Output → Chassis 10 MHz reference clock

Clock Source Change → Momentarily True when the 10 MHz reference clock source changes

The Reference Clock tab allows the source of the 10 MHz reference clock to be monitored. This tab also provides the 10 MHz reference clock source change Alarm Occurred indicator and the Clear Alarm button, which are described below.

10 MHz Reference Clock Source Change Alarm Set/Reset Latch

SET OUT

Alarm Occurred

AND

10 MHz Reference Clock Source Change Alarm

The order of clock precedence is as follows:

1. Chassis internal 10 MHz clock
2. Rear panel external 10 MHz clock
3. System timing slot (slot 10) 10 MHz clock

A clock source with a higher number supersedes a clock source with a lower number if both are present. For example, if both a rear panel 10 MHz clock (#2) and a system timing slot 10 MHz clock (#3) are provided, the system timing slot 10 MHz clock (#3) will be used by the chassis as its reference clock to generate its internal timing signals.

Clear

Clear Alarm

OR

The 10 MHz Reference Clock Source Change Alarm Set/Reset Latch ("latch") is set whenever the source of the 10 MHz reference clock changes. Setting the latch allows a clock source change to be detected/captured in the absence of an operator. The latch is reset (cleared) at power on. The latch can also be reset using the Clear Alarm button, Reset on the SFP Utility dropdown menu, or programmatically.

If the latch output is True and if Alarm Enabled is true, Alarm Occurred will be True. Alarm Occurred is set False if Alarm Enabled is set False. However, setting Alarm Enabled False does not reset the latch   this can only be done using Clear Alarm, Reset on the SFP Utility dropdown menu, or programmatically.

Alarm Enabled
Default value = True (checked)

Figure 34   Using the Soft Front Panel to Monitor the 10 MHz Clock Reference

10 MHz Reference Clock Source Monitoring using IVI-C and C++

KTMPXICHASSIS_ATTR_REFCLK_SOURCE

Returns the current the 10 MHz reference clock source. The three possible returned values are:
- AGM9018_VAL_REF_CLOCK_SOURCE_INTERNAL
- AGM9018_VAL_REF_CLOCK_SOURCE_EXTERNAL
- AGM9018_VAL_REF_CLOCK_SOURCE_TIMING_MODULE

Clock Selector

Selects chassis reference clock based on order of precedence. Also detects change in clock source

Internal 10 MHz clock

External 10 MHz clock (if available)

System timing slot 10 MHz clock (if available)

Clock Output

Chassis 10 MHz reference clock

Momentarily True when the 10 MHz reference clock source changes

Phase Locked

10 MHz Reference Clock Source Change Alarm Set/Reset Latch

SET OUT

RESET

AND

Alarm Occurred

KTMPXICHASSIS_ATTR_REFCLK_ALARM_OCCURRED

Returns the status of the alarm. If True, this indicates that the 10 MHz reference clock source has changed. This is a per-application property and therefore may be different than the SFP Alarm Occurred indicator.

The order of clock precedence is as follows:
1. Chassis internal 10 MHz clock
2. Rear panel external 10 MHz clock
3. System timing slot (slot 10) 10 MHz clock

A clock source with a higher number supersedes a clock source with a lower number if both are present. For example, if both a rear panel 10 MHz clock (#2) and a system timing slot 10 MHz clock (#3) are provided, the system timing slot 10 MHz clock (#3) will be used by the chassis as its reference clock to generate its internal timing signals.

KtMPxiChassis_RefClkAlarmClear()

Clears the 10 MHz Reference Clock Source Change Alarm Latch

Clear

OR

Clear Alarm

The 10 MHz Reference Phase Locked Alarm Set/Reset Latch ("latch") is set whenever the source of the 10 MHz reference clock changes. Setting the latch allows a phase lock change to be detected/captured in the absence of an operator. The latch is reset (cleared) at power on. The latch can also be reset using the Clear Alarm button, Reset on the SFP Utility dropdown menu, or programmatically.

If the latch output is True and if Alarm Enabled is true, Alarm Occurred will be True. Alarm Occurred is set False if Alarm Enabled is set False. However, setting Alarm Enabled False does not reset the latch   this can only be done using Clear Alarm, Reset on the SFP Utility dropdown menu, or programmatically.

KtMPxiChassis_reset()

Re-establishes all chassis default values, including clearing this latch.

KTMPXICHASSIS_ATTR_REFCLK_ALARM_ENABLED

Used to enable or disable the 10 MHz reference clock source change alarm

Alarm Enabled Default value = True (checked)

Figure 35   10 MHz Reference Clock Source Monitoring using IVI-C and C++

10 MHz Reference Clock Source Monitoring using IVI.NET and C#

driver.ReferenceClock.Source

Returns the current 10 MHz reference clock source. The three possible returned values are:
AgM9018RefClockSourceInternal
AgM9018RefClockSourceExternal
AgM9018RefClockSourceTimingModule

Clock Selector

Selects chassis reference clock based on order of precedence. Also detects change in clock source

Internal 10 MHz clock

External 10 MHz clock (if available)

System timing slot 10 MHz clock (if available)

Clock Output

Chassis 10 MHz reference clock

Phase Locked

Momentarily True when the 10 MHz reference clock source changes

10 MHz Reference Clock Source Change Alarm Set/Reset Latch

SET OUT

RESET

AND

Alarm Occurred

driver.ReferenceClock.Occurred

Returns the status of the alarm. If True, this indicates that the 10 MHz reference clock source has changed. This is a per-application property and therefore may be different than the SFP Alarm Occurred indicator.

The order of clock precedence is as follows:

1. Chassis internal 10 MHz clock
2. Rear panel 10 MHz clock
3. System timing slot (slot 10) 10 MHz clock

A clock source with a higher number supersedes a clock source with a lower number if both are present. For example, if both a rear panel 10 MHz clock (#2) and a system timing slot 10 MHz clock (#3) are provided, the system timing slot 10 MHz clock (#3) will be used by the chassis as its reference clock to generate its internal timing signals.

driver.ReferenceClock.Alarm.Clear()

Clears the 10 MHz Reference Clock Source Change Alarm Latch

Clear

Clear Alarm

OR

The 10 MHz Reference Phase Locked Alarm Set/Reset Latch ("latch") is set whenever the source of the 10 MHz reference clock changes. Setting the latch allows a phase locked change to be detected/captured in the absence of an operator. The latch is reset (cleared) at power on. The latch can also be reset using the Clear Alarm button or Reset on the SFP Utility dropdown menu.

If the latch output is True and if Alarm Enabled is true, Alarm Occurred will be lit. Alarm Occurred is set false if Alarm Enabled is set false. However, setting Alarm Enabled false does not reset the latch — this can only be done using Clear Alarm or Reset.

driver.Utility.Reset()

Re-establishes all chassis default values, including clearing this latch.

driver.ReferenceClock.Alarm.Enabled

Used to enable or disable the 10 MHz reference clock source change alarm

Alarm Enabled
Default value = True (checked)

Figure 36 10 MHz Reference Clock Source Monitoring using IVI.NET and C#

8   Configuring the PXI Trigger Bus

Trigger management provides a systematic way for multiple applications to share the eight PXIe backplane trigger lines without interfering with each other. See the **CAUTION** below.

A generic trigger utility, **KtMtrig** (see page 101), is installed as part of the *PXI Chassis Family Driver* for programmatic control of trigger management. It is a "wrapper" around the PXI-9 Trigger Manager DLL specified in the PXI-9 Trigger Management Specification. This is managed by the PXI Systems Alliance.

PXI-9-compliant trigger managers provide a way for applications, including Keysight Connection Expert (part of the IO Libraries Suite), to dynamically query to see if a trigger line is reserved, and if not, reserve it for use by that application. In this way, multiple applications can coordinate their use of the shared chassis trigger resources. It is the application programmer's responsibility to ensure that all applications requiring trigger resources secure reservations and routes for each client, and while in use, configure the instrument module drivers properly so that only a single trigger source is driving any configured trigger line.

Many chassis backplane trigger lines don't span the entire backplane, but instead are split into two or three Trigger Bus Segments. Chassis with a segmented trigger bus support the ability to route a trigger line from one segment to another. This may be necessary if an application operates modules in slots residing in multiple trigger bus segments. Trigger management provides a way for applications to manage both trigger reservations and routes between trigger bus segments.

CAUTION
- Ensure all your applications acquire trigger reservations prior to asserting trigger events on a trigger line.

- Trigger signals can be generated by multiple modules, but when multiple signals are placed on a trigger line simultaneously, it can result in hardware damage. The user is responsible to ensure that multiple modules do not assert triggers onto the same trigger line.

- When a trigger route is created in the chassis, the chassis hardware drives the trigger line in the destination segment of the route. Hardware damage can occur if modules in that destination segment attempt to drive that same trigger line.

- The PXI-9-compatible chassis trigger manager makes it possible to recover trigger reservations from other clients. Improper use of this feature may take trigger lines away from client applications that are depending on them.

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> **NOTE** Clients must also free their trigger resources when complete to make them available again for use by other applications.

Chassis Trigger Lines

A PXI chassis backplane includes repeaters to route a trigger line across a bus segment boundary. When the repeater is activated, via configuration, it relays trigger signals asserted in the source trigger bus segment to the destination trigger bus segment. The repeaters relay trigger signals between bus segments in either direction, but not both directions at the same time (on a single trigger line) – so one repeater allows a signal to be routed from bus segment 1 to bus segment 2, and another repeater is used to route the other direction from bus segment 2 to bus segment 1.

Viewing chassis trigger routes and reservations graphically can be done using the Keysight IO Libraries Suit Connection Expert which provides the Chassis Triggers View.
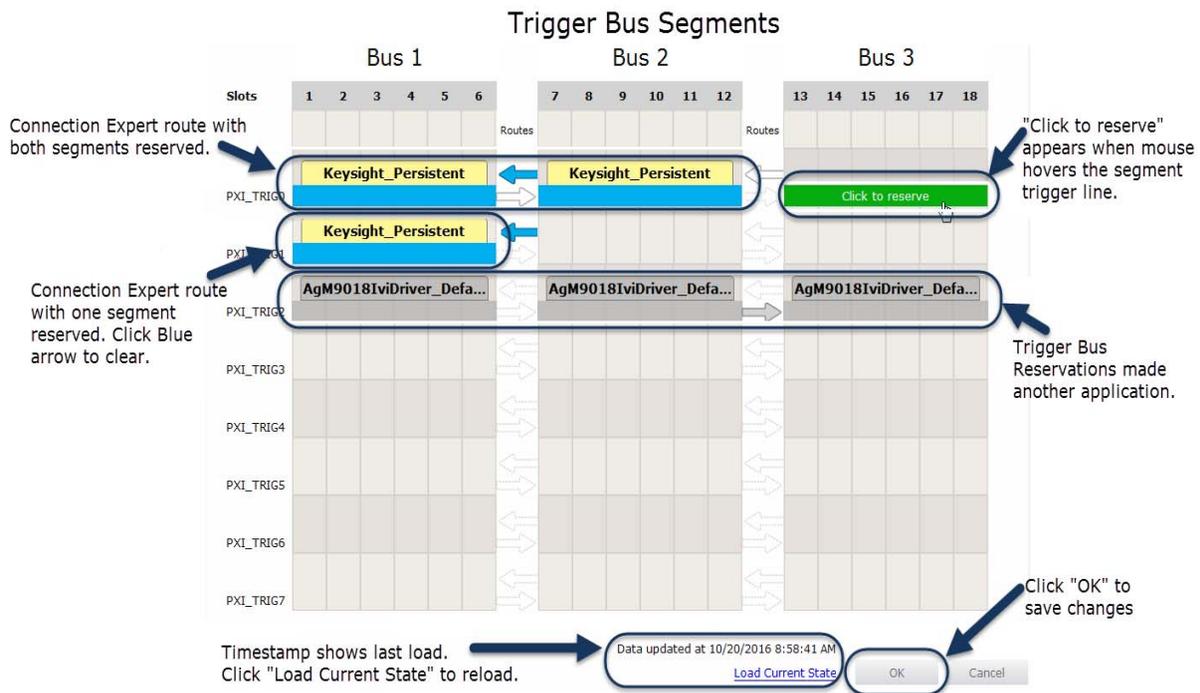
Figure 37   Keysight IO Libraries Connection Expert Chassis Triggers View (M9018B and M9019A)

Trigger Bus Segments

The PXI chassis trigger bus consists of eight trigger lines spanning the chassis backplane connectors.

- For the M9010A, the trigger lines are divided into two trigger bus segments, labeled Segment 1 and Segment 2. Segment 1 covers chassis slots 1 through 5 and Segment 2 covers slots 6 through 10.

- For the M9018B and M9019A, the trigger lines are divided into three trigger bus segments, numbered 1 through 3. Segment 1 covers chassis slots 1 through 6, Segment 2 covers slots 7 through 12, and Segment 3 covers slots 13 through 18.

By default, when you power-on the chassis, these trigger bus segments are isolated from one another. Only the modules inside a given segment are able to detect a trigger signal originating from another module in that same segment.

CAUTION Attempting to drive a trigger bus line from two different trigger bus segments may damage the trigger bridges between the segments.

Trigger Line Reservations and Routing

Trigger Reservations: PXI chassis have trigger lines that are available to all of the cards in a chassis. Sometimes, applications may need to reserve one or more of the trigger lines, permanently or for a fixed time, for use by that application only. This is a **trigger reservation**. Applications must heed the trigger reservations made by other clients and avoid operating them.

Trigger Routes: Trigger lines in bus segments are independent unless the trigger lines are explicitly connected between segments. This connection is a **trigger route**. For each trigger line in a segment, you can enable buffers that to allow a trigger signal on that line to flow out of one segment and into an adjacent segment. A Trigger Route always has a source segment and a destination segment.

Three trigger bus segments provide eight possible VALID trigger bus routes that can be configured on any one trigger line. The following graphic shows all eight trigger lines; each line is showing a different route so that all eight may be seen. Any of these combinations can be applied to each of the eight trigger lines PXI_TRIG[0:7].
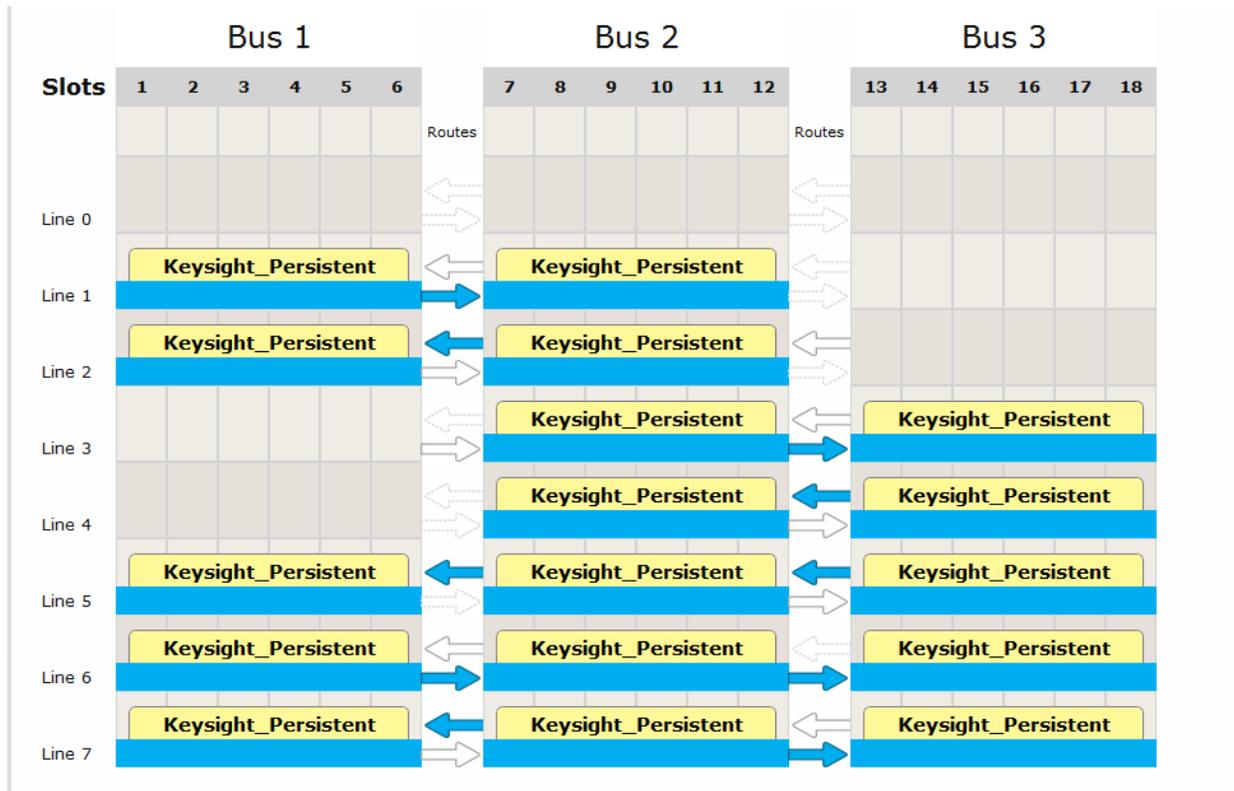
Figure 38   Example Showing the Eight Different Triggering Bus Routes

An example of an *invalid* Trigger Bus Route would be if the same trigger line in both Segment 1 and Segment 3 tried to drive that Trigger Line line in Segment 2.

> **NOTE**   In the PXIe Family Chassis driver Soft Front Panel, trigger reservations and trigger routes are not configurable. To configure the Trigger Bus, use either the KtMTrig Trigger IVI driver or the IO Libraries Suite Connection Expert. Connection Expert makes Persistent Trigger Reservations with the Client ID of *Keysight_Persistent* for a Graphical User Interface control.
>
> In past driver releases, chassis trigger routes were configurable with the old, AgM9018 chassis driver for the M9018A. It automatically made volatile Trigger Reservations with the Client ID of *AgM9018IviDriver_DefaultClient*.

> **NOTE**   We strongly recommend that you make Trigger Bus Reservations before you actually use the Trigger Lines in your application programs.

Some multi-slot PXI instruments, such as the Keysight M9381A PXIe Vector Signal Generator, use peer-to-peer (module-to-module) triggering to function. If you install these modules on the same trigger bus segment, no routes are needed. But if you install them on different trigger bus segments, you must configure trigger routes.

Persistent Versus Volatile Reservations

Volatile (dynamic) **reservations** will not persist through restarting (rebooting) the host controller or the chassis. The PXIe Family Chassis Driver KtMTrig utility creates volatile reservations and routes.

Persistent reservations, except in certain cases of conflicting reservations; Persistent (or Static) reservations persist through restarting the host controller or the chassis. Keysight IO Libraries Suite Connection Expert creates persistent reservations and routes.

You can interactively create or remove persistent trigger reservations and routes in Connection Expert's Chassis Triggers view. No changes are actually made to the system until you click **ACCEPT**.

When you click **ACCEPT**, your changes are communicated to the underlying Trigger Manager and thus to the chassis. At the same time, your changes are also saved as persistent reservations. This means that they will be automatically restored following a system restart (PC reboot or chassis power cycle).

Example: Persistent Versus Volatile Reservations

Suppose your system includes the reservations and routes shown below. The *Keysight Persistent* reservations were made in the IO Libraries Suite Connection Expert, and therefore they are Persistent reservations. The *AgM9018IviDriver_DefaultClient* reservations were made programmatically and are therefore volatile.
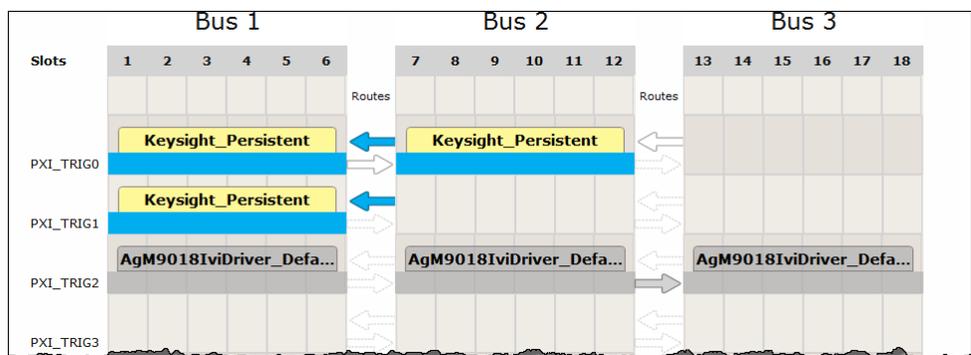
Figure 39   Trigger Routing with Persistent and Volatile Routing

Close Connection Expert and reboot your PC. Then you restart Connection Expert, and check the Trigger Routing, you see the following:
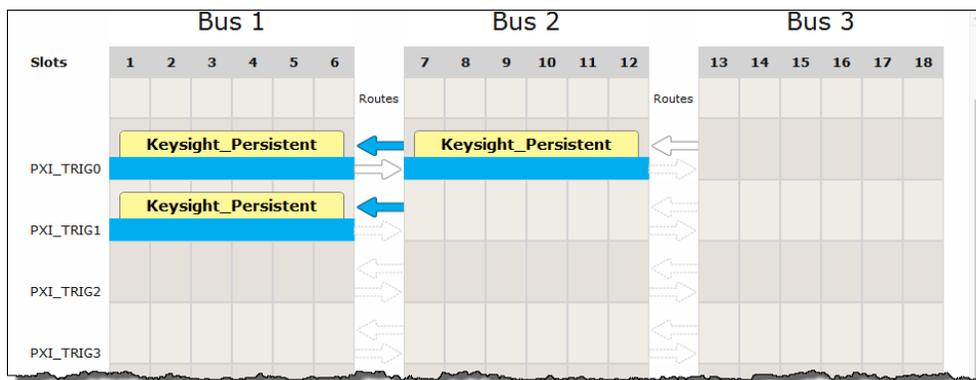
Figure 40   Trigger Routing after Reboot

The persistent reservations are still present (have persisted) after the reboot. The volatile reservations are gone, and those trigger lines are available for new reservations.

Configuring PXI Trigger Bus Connections

Volatile routes and reservations are made programmatically using the PXIe Family Chassis Driver KtMTrig IVI driver. For information on using the KtMTrig IVI driver, see the KtMTrig Help file:

Windows **Start** button **> All Programs > Keysight > KtMTrig Help**

Persistent routes and reservations can only be made through the Keysight Connection Expert Chassis Triggers view. For detailed information on using Connection Expert and the Chassis Triggers view, see the Keysight IO Libraries help file.

Front Panel Trigger Ports

In addition to the eight PXI trigger bus lines, the M9010A, M9018B and M9019A chassis have two front panel 50 Ω SMB trigger connectors that you can assign to any of the eight trigger lines of the PXI_TRIG [0:7] trigger bus.

These SMB trigger ports should be managed similarly to how PXI modules assert or receive triggers on the trigger bus (see "Trigger Bus Segments" on page 85).

Figure 41   Chassis Front Panel Trigger Ports (M9019A chassis shown)

> **NOTE**
> Make certain that your test application is not running when you reconfigure these two trigger ports. Reconfiguring the ports from input ports to output ports may cause unexpected noise on the trigger port lines at the moment you make the change.

The M9010A 10-slot chassis backplane has two Trigger Bus Segments which are numbered 1 and 2.

The M9018B and M9019A 18-slot chassis backplanes have three Trigger Bus Segments which are numbered 1, 2, and 3.

Each front panel Trigger Port can be configured as Input or Output.

Trigger Port capability as a function of the firmware version

The front panel trigger port capability depends on the version of Trigger Bridge firmware installed in your chassis. The Trigger Bridge firmware version 0, from the 2017 firmware package, has less capability than the later version found in the 2018 firmware package. See "Updating Chassis Firmware" for instructions on looking up your firmware version and updating the firmware.

You can also determine which version you have by looking at your SFP Trigger Ports tab. If the tab looks like the tab shown in the following example for the M9019A, you have version 0.
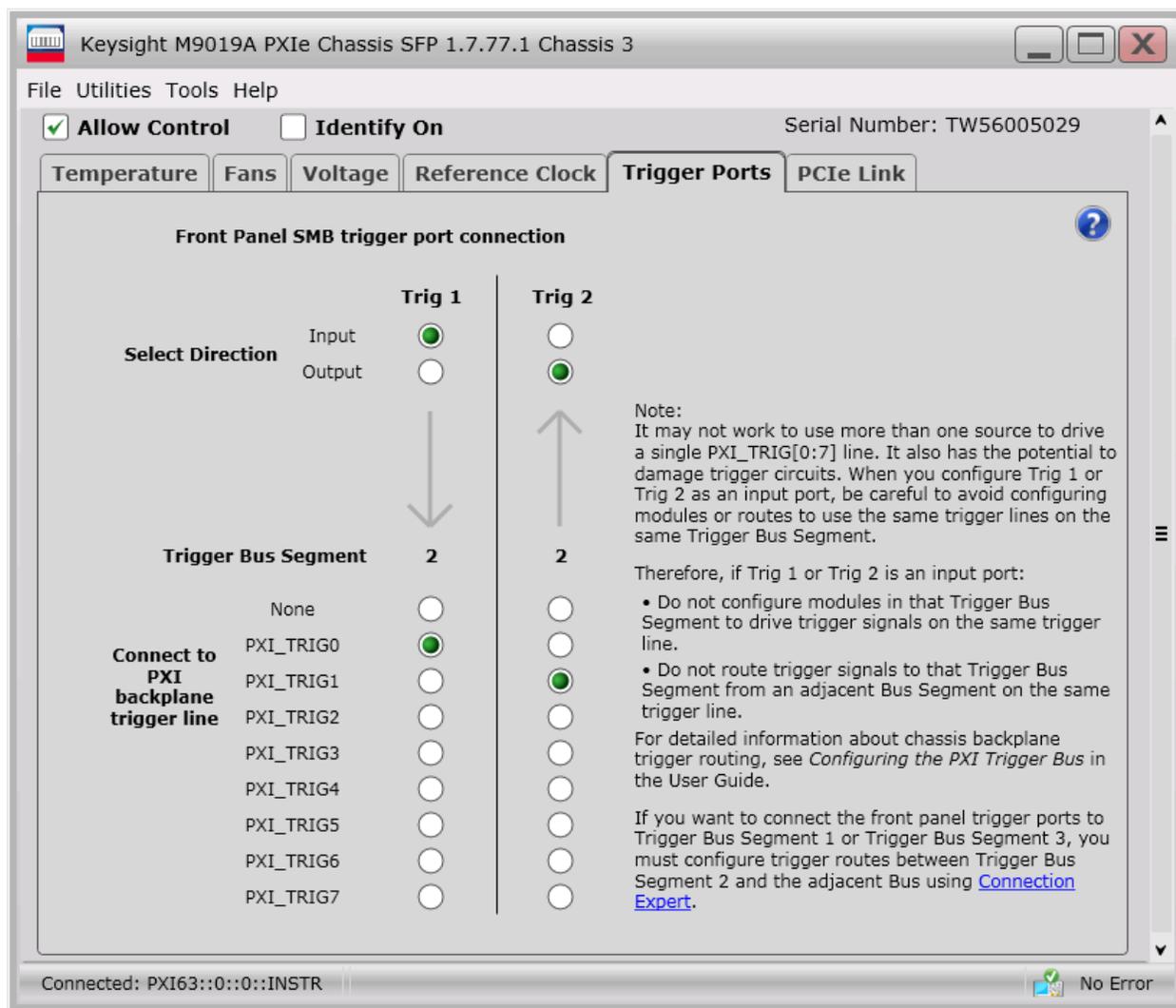
Figure 42   M9019A SFP Trigger Ports when using Trigger Bridge firmware version 0.

Notice that with version 0, when the front panel trigger port is set to Input, the front panel trigger port can only connect to a single PXI_TRIG line on trigger bus segment 2. Also, with version 0, when the front panel trigger port is set to Output, the front panel trigger port can only source the trigger signal from a single PXI_TRIG line on trigger bus segment 2.

For the M9010A, the front panel trigger ports connect to trigger bus segment 1.

If your SFP Trigger tab looks like the example shown in the following figure, you have a later firmware version that provides the increased capability.
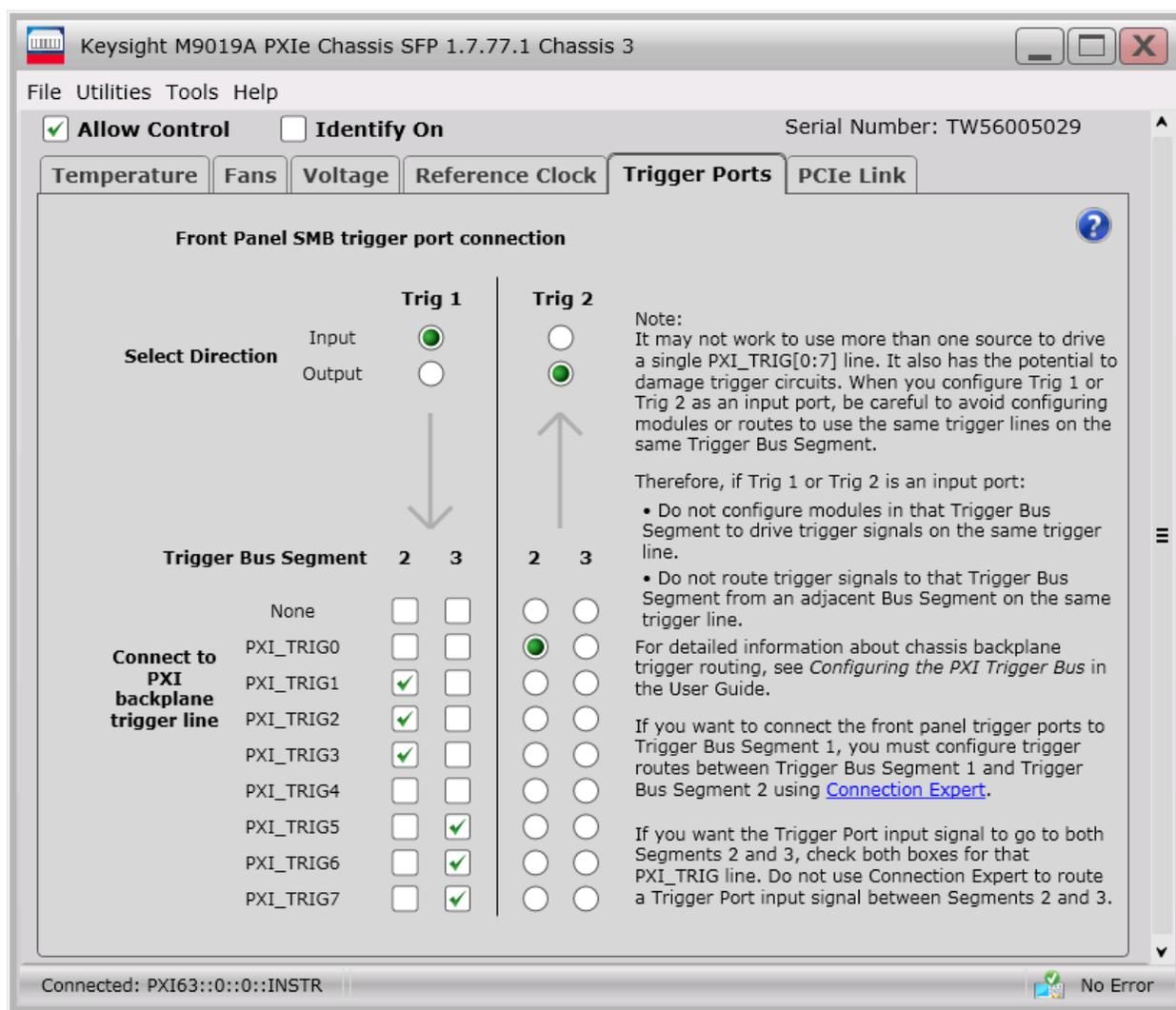
Figure 43 M9019A SFP Trigger Ports when using Trigger Bridge firmware after version 0.

Notice that with the later version, when the front panel trigger port is set to Input, the front panel trigger port can connect to any and all PXI_TRIG lines on either trigger bus segments 2 or 3 (or both). Also, with the later version, when the front panel trigger port is set to Output, the front panel trigger port can source the trigger signal from a single PXI_TRIG line on either trigger bus segment 2 or 3.

The above description applies to both the M9018B and the M9019A, but with the M9010A trigger bus segments 1 and 2 are used, instead of trigger bus segments 2 and 3.

Trigger Port capability using Trigger Bridge 2018 firmware

The remainder of this chapter describes the front panel trigger port capability when using the Trigger Bridge firmware from the 2018 firmware package. If you need this capability and your chassis does not have the right firmware you can update the firmware by downloading the 2018 firmware package from Keysight. Please see "Updating Chassis Firmware" for instructions.

The M9010A 10-slot chassis backplane has two Trigger Bus Segments, which are numbered 1 and 2. The M9010A front panel Trigger Ports can be configured to connect to both segments using the SFP Trigger Ports screen or by using an IVI software application.

The M9018B and M9019A 18-slot chassis backplanes have three Trigger Bus Segments, which are numbered 1, 2, and 3. The front panel Trigger Ports can be configured to connect to segments 2 and 3 using the SFP Trigger Ports screen or by using an IVI software application.

Each front panel Trigger Port can be configured as an Input or an Output. When configured as an Input, the incoming signal can be copied to multiple PXI_TRIG[0:7] lines on both Trigger Bus Segments. When a front panel trigger port is configured as an Output, the outgoing signal can sourced from only a single PXI_TRIG[0:7] line from a single Trigger Bus Segment.
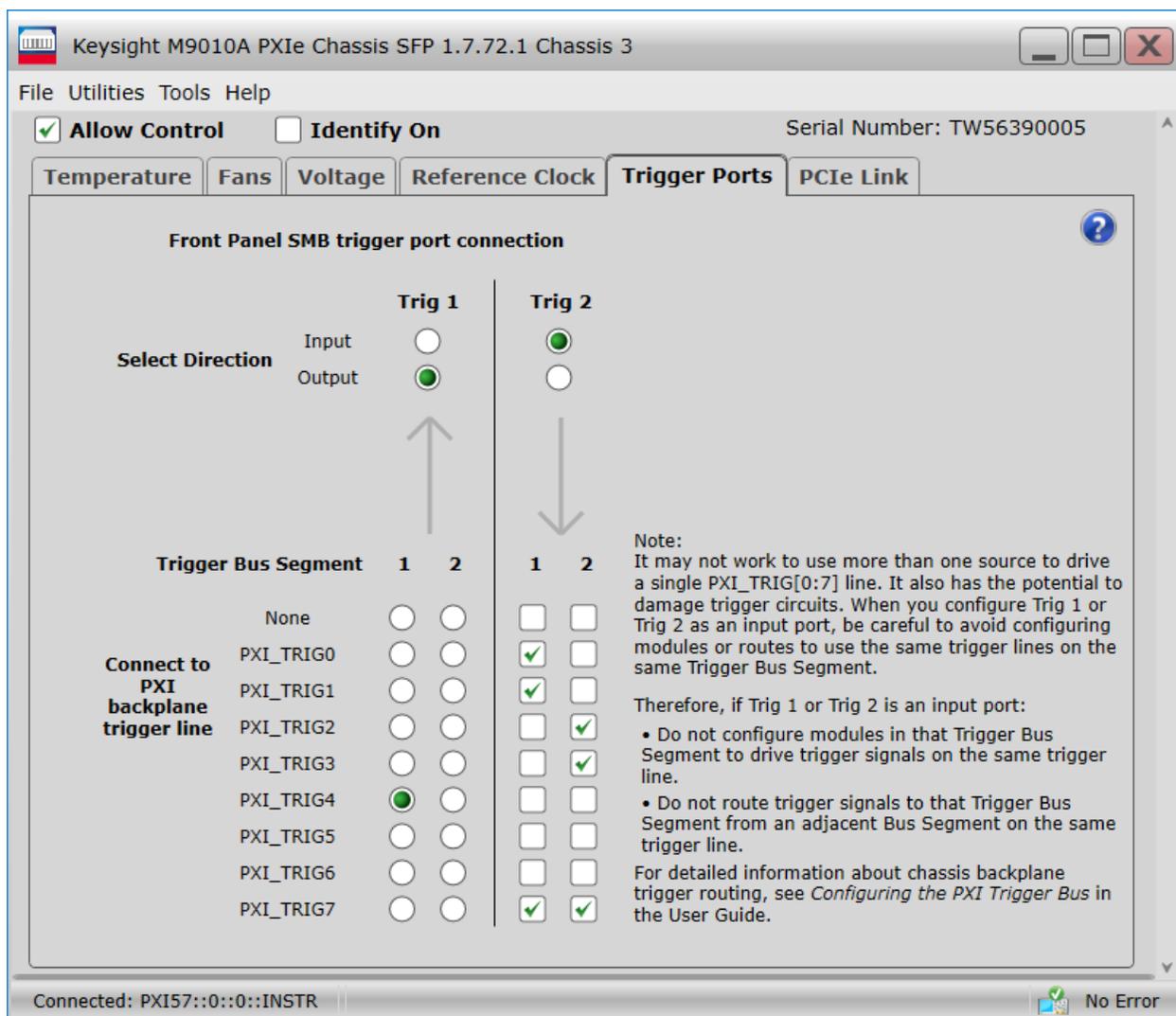
Figure 44   M9010A SFP example configuration of the front panel Trigger Ports.

The preceding figure shows Trig Port 1 as an Output from PXI_TRIG4 on Trigger Bus Segment 1 and Trig Port 2 as an Input to multiple PXI_TRIG lines on both Segment 1 and 2.
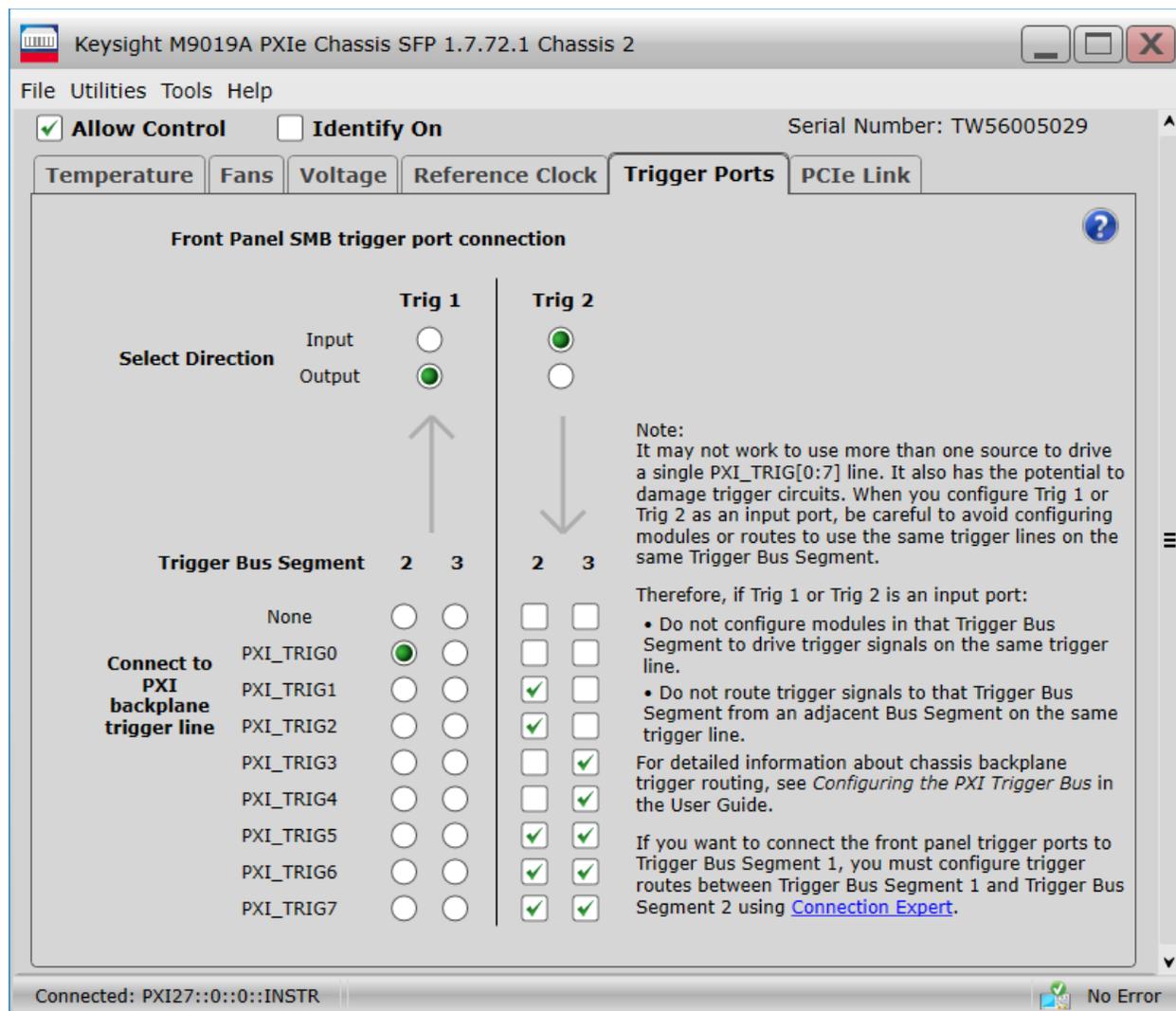
Figure 45   M9019A SFP example configuration of the front panel Trigger Ports.

The preceding figure shows Trig Port 1 as an Output from PXI_TRIG0 on Trigger Bus Segment 2 and Trig Port 2 as an Input to multiple PXI_TRIG lines on both Segment 2 and 3.

There can be only one source for a Trigger Signal.

CAUTION   When configuring either Trig 1 or Trig 2 as an Input Port:

- Do not configure PXI or PXIe modules in the same Trigger Bus segment to generate trigger signals on the same trigger line.

- Do not route trigger signals <u>from</u> another Trigger Bus segment <u>to</u> the segment connected to Trig 1 and Trig 2 on the same trigger line.
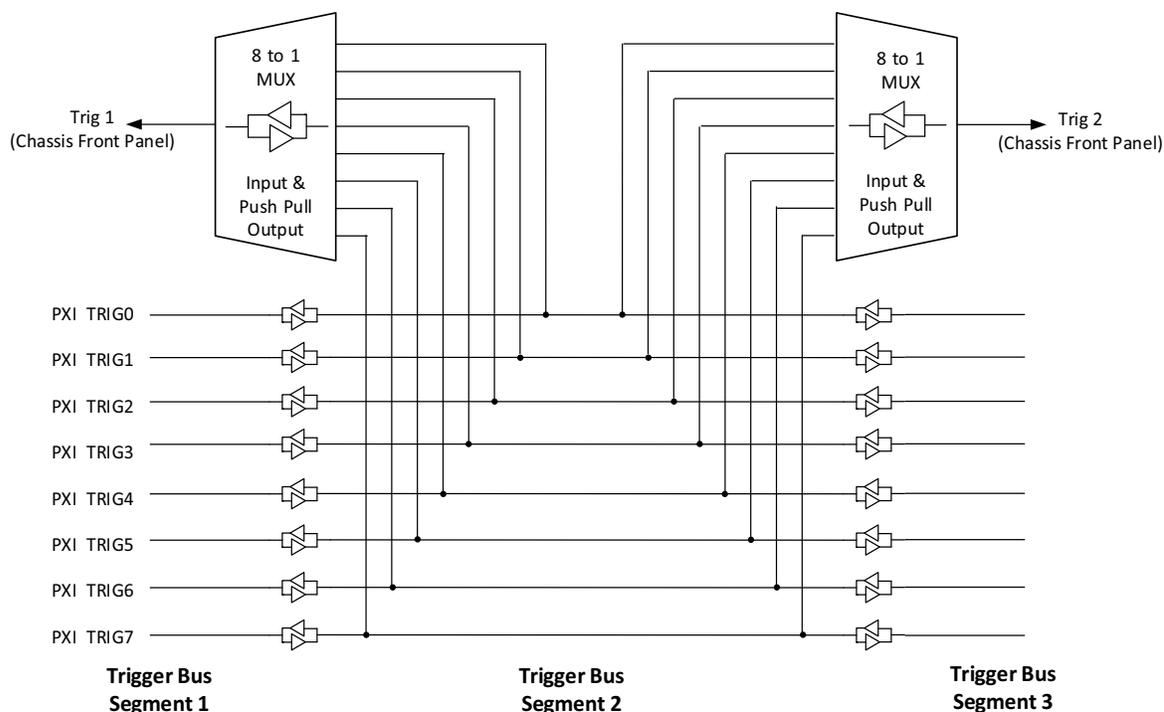
Figure 46 Wiring diagram illustration of an example front panel Trigger Port configuration.

The preceding figure illustrates a possible front panel Trigger Port configuration using a wiring diagram. In this configuration, both Trigger Ports are connected to Trigger Bus Segment 2.

The ports are always enabled; changing the drive type takes effect immediately. Because it is possible that a configuration change can cause a signal to be placed on a trigger line, it is recommended that you deactivate your test system when making front panel Trigger Port configuration changes.

When the Trigger Port is set to Input, the default configuration is "none" for the connection to PXI_TRIG[0:7] trigger signal lines.

When the front panel Trigger Port is set to Output, it is of type Push-Pull Output.

For the M9018B and M9019A, if you want to connect the front panel trigger ports to Trigger Bus Segment 1, you must use Connection Expert to configure trigger routes between Trigger Bus Segment 1 and Trigger Bus Segment 2.

Front Panel Trigger Port Configuration Guidelines

1 **You may not configure more than one source for a trigger signal on a single trigger line.**

2 **If you want the Trigger Port input signal to go to both segments, check both boxes.**

Note: The SFP Trigger Ports GUI and the IVI API do not enforce these guidelines. However, if you ignore the guidelines, your trigger signal application might not work.

1) You may not configure more than one source for a trigger signal on a single trigger line.

Configuring more than one source for a trigger signal on a single trigger line can damage trigger circuits and also block the generation of a trigger signal. When you configure Trig 1 or Trig 2 as an input port, be careful to avoid configuring modules or routes to use the same trigger lines on the same Trigger Bus Segment.

If you configure Trig 1 or Trig 2 as an input port, follow these guidelines:

- Do not configure modules in that Trigger Bus Segment to drive trigger signals on the same trigger line.

- Do not route trigger signals to that Trigger Bus Segment from an adjacent Bus Segment on the same trigger line.

2) If you want the Trigger Port input signal to go to both segments, check both boxes.

For Trigger Bridge firmware after version 0, be aware that if you want the input Trigger Signal to go to both Bus Segments, you must check both boxes; you cannot route the signal between segments. This guideline applies to Front Panel Trigger Ports configured as Input and is not applicable to Trigger Ports that are configured as Output. This guideline is not enforced by the SFP or by the IVI API.

See examples on the following pages.

The following figure is a section of the SFP Trigger Ports tab, showing both boxes checked so that the front panel Trig 1 signal arrives on PXI_TRI0 on both Trigger Bus Segments 2 and 3.
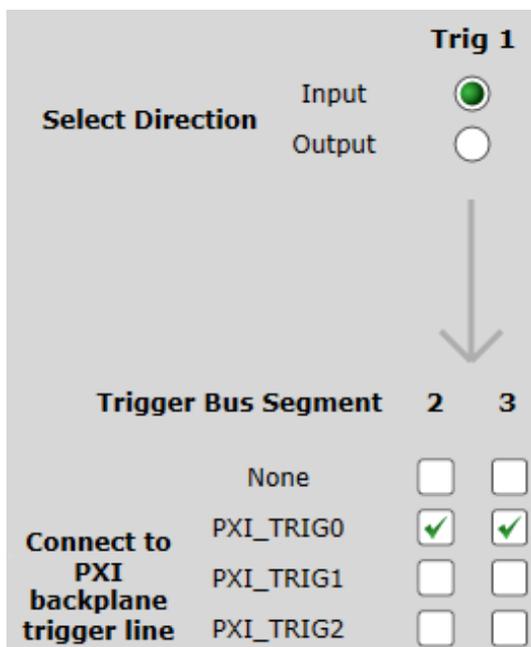
Figure 47   M9019A SFP example configuration of Trig 1 to PXI_TRIG0 on Segment 2 and 3.

You cannot use a route to propagate the Input Trigger signal between Bus Segments 2 and 3. If you configure a route, the Front Panel Trigger Input trigger signal is silently disabled.

When Trig 1 is configured as Input, you can select the set of PXI_TRIG[0:7] lines that receive the incoming signal. This set can include all the PXI_TRIG[0] through PXI_TRIG[7] on both Segments 2 and 3. The following figure shows a portion of the SFP Trigger Ports tab, where the configuration of front panel Trig 1 goes to all possible locations:
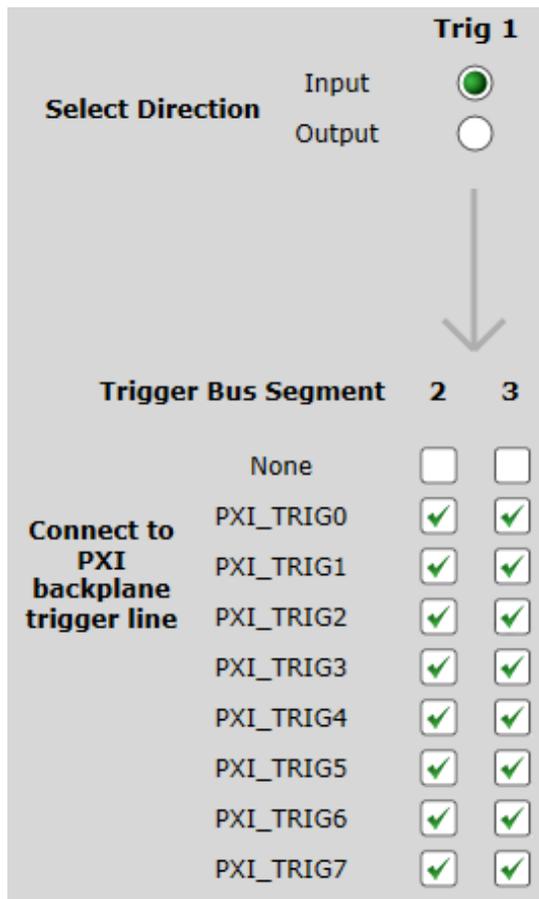
Figure 48   M9019A SFP example Trig 1 connected to all PXI_TRIG lines on Segments 2 and 3.

The following figure shows a simpler configuration, in which only PXI-TRIG0 on Trigger Bus Segment 3 receives the incoming Trigger Port signal:
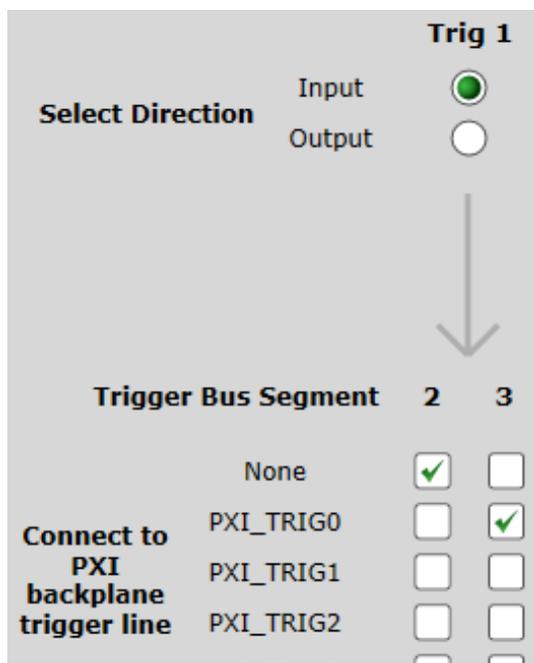
Figure 49   M9019A SFP example with Trig 1 only connected to PXI_TRIG0 on Segment 3..

This configuration is silently ignored in situations where you also configure a route on the same trigger line from Trigger Bus Segment 3 to Trigger Bus Segment 2, as shown in the following example of the Connection Expert Chassis Trigger tab:
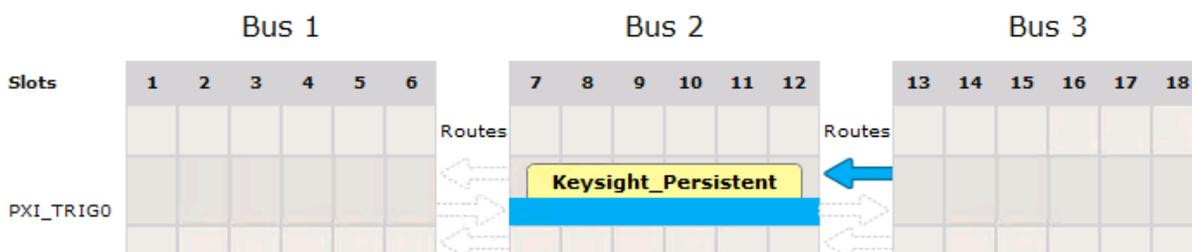
Figure 50   Connection Expert example showing a route on PXI_TRIG0 from Segment 3 to Segment 2.

If you have a route from Trigger Bus Segment 3, you cannot configure a Front Panel Trigger Port signal on that trigger line on Bus Segment 3. If you attempt such a configuration, the check box specification shown above is silently ignored and the input trigger signal is not copied to PXI TRIG0 Bus Segment 3.

This configuration limitation applies to both directions between Bus 2 and Bus 3. If you want an input trigger signal to go to both segments, you must check both boxes. You cannot route the signal between Segment 2 and Segment 3.

This configuration limitation applies to both the GUI and programing interface using IVI.

The M9018B and the M9019A chassis have three Trigger Bus Segments, which are numbered 1, 2, and 3. However, the M9010A 10-slot chassis has two Trigger Bus Segments, which are numbered 1 and 2. With the M9010A, if you want an input trigger signal to go to both Segments 1 and 2, then you must check both boxes. You cannot route them between Segments 1 and 2.

Using KtMTrig Trigger Manager IVI Driver

Trigger management provides a systematic way for multiple applications to share the eight PXIe backplane trigger lines without interfering with each other.

A generic trigger utility, **KtMtrig**, is installed as part of the *PXI Chassis Family Driver* for programmatic control of trigger management. It is a "wrapper" around the PXI-9 Trigger Manager DLL, which is defined by the PXI-9 Trigger Management Specification managed by the PXI Systems Alliance.

When you install the *PXI Chassis Family Driver*, it installs two additional KtMTrig drivers: IVI-C KtMTrig and IVI.NET KtMTrig. These drivers are installed in the following locations:

> **C:/Program File > IVI Foundation > IVI > Drivers > KtMTrig** (for IVI-C Driver)
> **C:/Program File > IVI Foundation > IVI > Microsoft.NET > Framework32 > v4.0.30319 >**
>   **Keysight.KtMTrig x.x.x** (for IVI.NET Driver)

> **C:/Program File(x86) > IVI Foundation > IVI > Drivers > KtMTrig (for IVI-C Driver)**
> **C:/Program File(x86) > IVI Foundation > IVI > Microsoft.NET > Framework32 >**
>   **v4.0.30319 > Keysight.KtMTrig x.x.x** (for IVI.NET Driver)

Installation Requirements

Supported Operating Systems:

- Windows 7 32-bit, 64-bit
- Windows 8 32-bit, 64-bit
- Windows 10 32-bit, 64-bit

Shared Components

Before this driver can be installed, your computer must already have:

- IVI Shared Components Version: 2.3.0 or newer installed
- IVI.NET Shared Components Version: 1.1.2 or newer installed

The IVI Shared Components installers are available from:
http://www.ivifoundation.org/shared_components/Default.aspx

VISA.NET

Any compliant implementation is acceptable. Typically, VISA.NET is installed with VISA and other I/O library modules. The latest version of Keysight's IO Libraries Suite is recommended and includes VISA.NET. Download the latest version from:
http://www.keysight.com/find/iosuite

Uninstall

This driver can be uninstalled like any other software from the Control Panel "Programs and Features" dialog.

The IVI Shared Components may also be uninstalled like any other software from the Control Panel "Programs and Features" dialog. All IVI drivers require the IVI Shared Components to function. To completely remove IVI components from your computer, uninstall all drivers and then uninstall the IVI Shared Components.

| **NOTE** | Do not uninstall the **KtMPxiChassis IVI.NET Driver 1.x.xxx**, **KtMPxiChassis IVI-C Driver 1.x.xxx**, **KtMTrig IVI.NET Driver 1.x.xxx**, or **KtMTrig IVI-C Driver 1.x.xxx** files without also uninstalling the Keysight PXIe Chassis Family driver. |

Configuring the PXI Trigger Bus using the IVI-C Driver and C++

This diagram shows the eight combinations of trigger bus segment connections between the three trigger bus segments. Any combination can be applied to each of the eight PXI_TRIG lines.
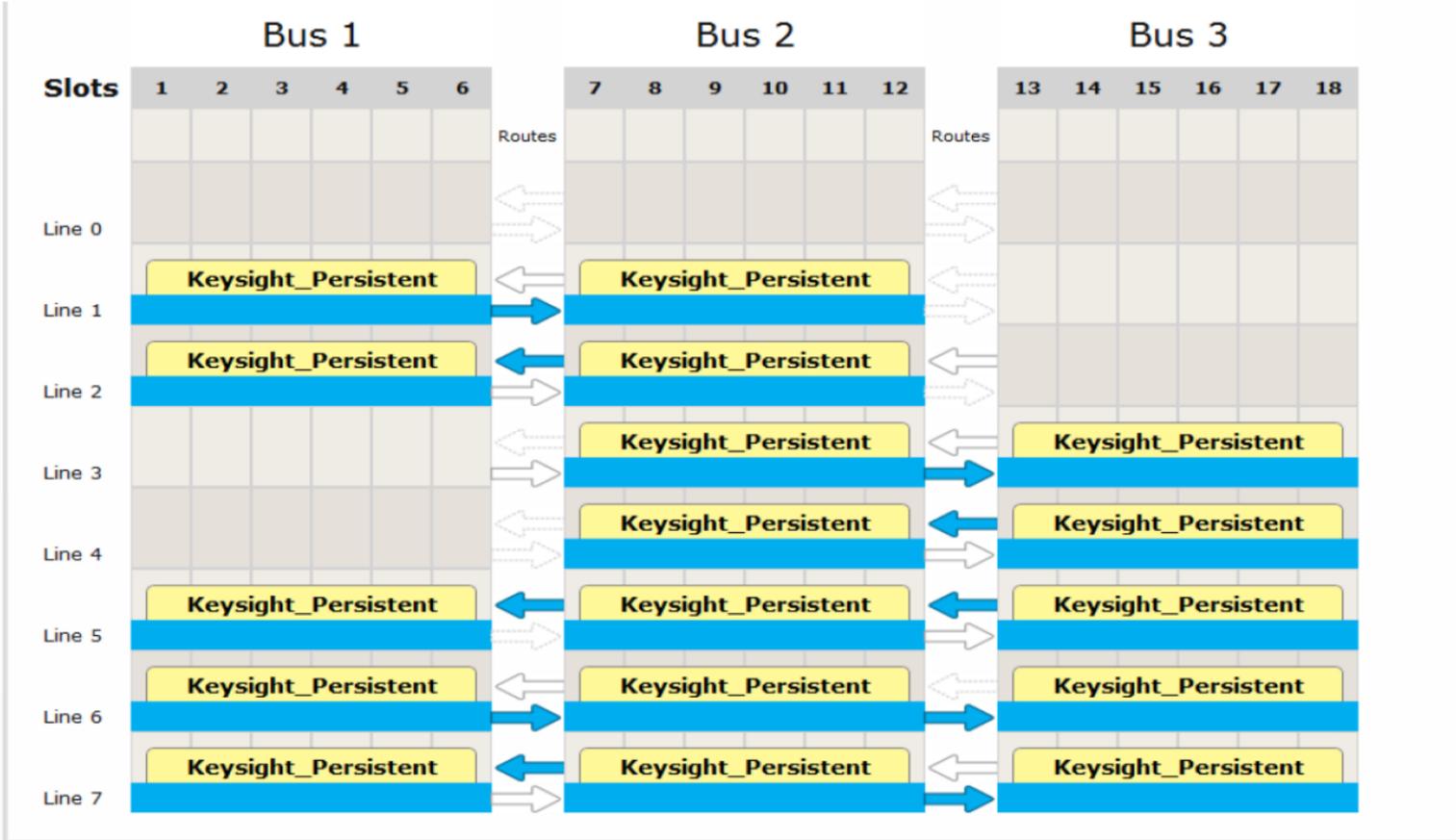
KtMTrig_SetReservation() reserves a single bus segment on the given trigger line. Setting the reservation reserves that line for the client's exclusive use.
KtMTrig_ClearReservation() clears the segment.

KtMTrig_SetTriggerPathBetweenSlots() creates both the Reservation and the Route. KtMTrig_ClearTriggerPathBetweenSlots() unroutes the trigger line and clears both the source and destination segments previously reserved.

Figure 51   Configuring the PXIe Chassis Trigger Bus Using the IVI-C Driver and C++

Configuring the PXI Trigger Bus using the IVI.NET Driver and C#

This diagram shows the eight combinations of trigger bus segment connections between the three trigger bus segments. Any combination can be applied to each of the eight PXI_TRIG. lines.

Figure 52   Configuring the PXIe Chassis Trigger Bus Using the IVI.NET Driver and C#

9   Multiple Chassis Operation

You can use multiple chassis configurations to increase the number of chassis, measurement modules, or switching modules; The only practical limit to the number of chassis you can connect is determined by the number of PCIe addresses your host computer can enumerate. For more information, refer to Keysight's PXIe/AXIe Chassis Designer. The link to this tool is available from the Windows Start button menu:
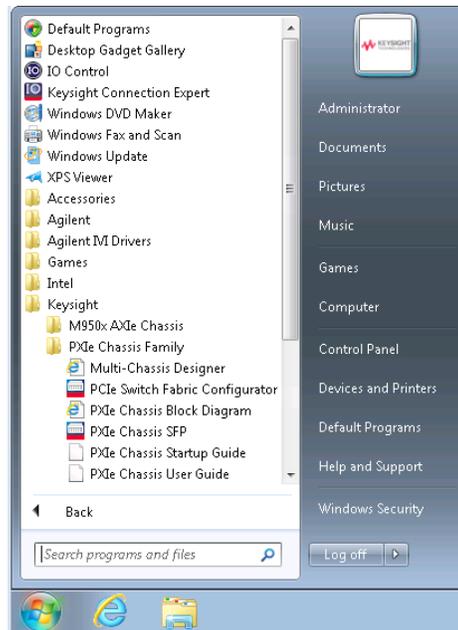
Figure 53   Accessing the Multi-Chassis Designer

It is also available at: www.keysight.com/find/pxie-multichassis.

Multiple chassis systems require careful consideration of several factors, including:

- Host controller and chassis Power Sync (power-on and power-down considerations). This is the primary subject of this chapter.

- Time base and triggering for each chassis operates independent of the other chassis. However, you can tie the time bases together using the reference clock output and input, and with M9018B/M9019A/M9010A, you can bridge triggers using the front panel trigger ports

- PCIe connectivity between the host controller (either external or embedded) and the chassis system control modules.

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Multiple Chassis Power Sync

Power Sync allows multiple chassis configurations to be powered on and off like a single chassis. A single power button push on any chassis turns on or off all chassis in the right sequence. For example, with an embedded host controller, Power Sync ensures that all downstream chassis are powered up before the embedded controller is turned on. On power down, it ensures that the embedded controller is turned off before all downstream chassis are turned off.

With an external host, Power Sync allows all chassis to be powered on or off by the external host automatically. When an external host is powered on, it prevents power button pushes on any chassis from turning off any chassis to avoid system software crashes

Table 5 Keysight PXIe Chassis Supporting Power Sync Capabilities

Product Type	Keysight Product Model Numbers
PXIe Chassis	M9010A, M9018B, M9019A
Desktop PC, Host cable card	M9049A PCIe High Performance Host Adapter
PXIe cable cards	M9022A PXIe System Interface Module M9023A PXIe High Performance System Interface Module M9024A PXIe High Performance System Interface Module with Connectivity
PXIe controllers	M9037A PXIe High Performance Embedded Controller

Synchronized chassis power coordination requires additional cabling. Two RJ45 connectors on the chassis rear panel provide this coordination. Multiple PXI chassis may be connected together for power sync purposes. All of the chassis listed in Table 5, "Keysight PXIe Chassis Supporting Power Sync Capabilities," on page 106 have Power Sync connectors on their rear panels.
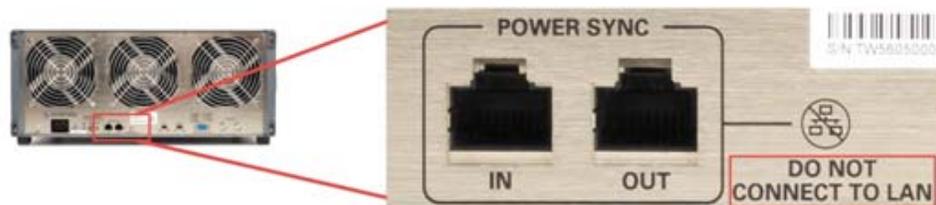
Figure 54 Multiple Chassis Power Sync Connectors

When multiple chassis are connected together in this way, pressing the power button on any chassis causes all connected chassis to power on. Pushing the power button on any connected chassis turns all other chassis off, subject to the conditions specified in the Table 6 on page 110.

NOTE	Up to four chassis may be connected together for the power sync feature to work.

CAUTION	Connect the cables only when all chassis are powered off to eliminate power mismatched states. If the chassis become out of sync, power all chassis down by holding the power button down for five seconds minimum. If that doesn't work, remove AC power from all chassis and then restart the chassis.

CAUTION	These RJ45 connectors are for multi-chassis power-up synchronization only. Do not connect cables to a corporate or local LAN to these connectors.

NOTE	In a multiple chassis system, the time base and triggering for each chassis operates independent of the other chassis. For more information, refer to Keysight's Multiple PXIe and AXIe Chassis Configuration tool. This tool is available on-line at: www.keysight.com/find/pxie-multichassis.

Power Sync Cabling

When connected via the RJ-45 connectors, the power button on any chassis may be used to power up or power down the entire system.

If you are using an external host controller, it should remain turned off until <u>all</u> chassis are powered on and enumerated all slots.

Each cable used for multiple chassis power-up synchronization purposes should not exceed 2 meters in length. Straight CAT5 or better cables are required.
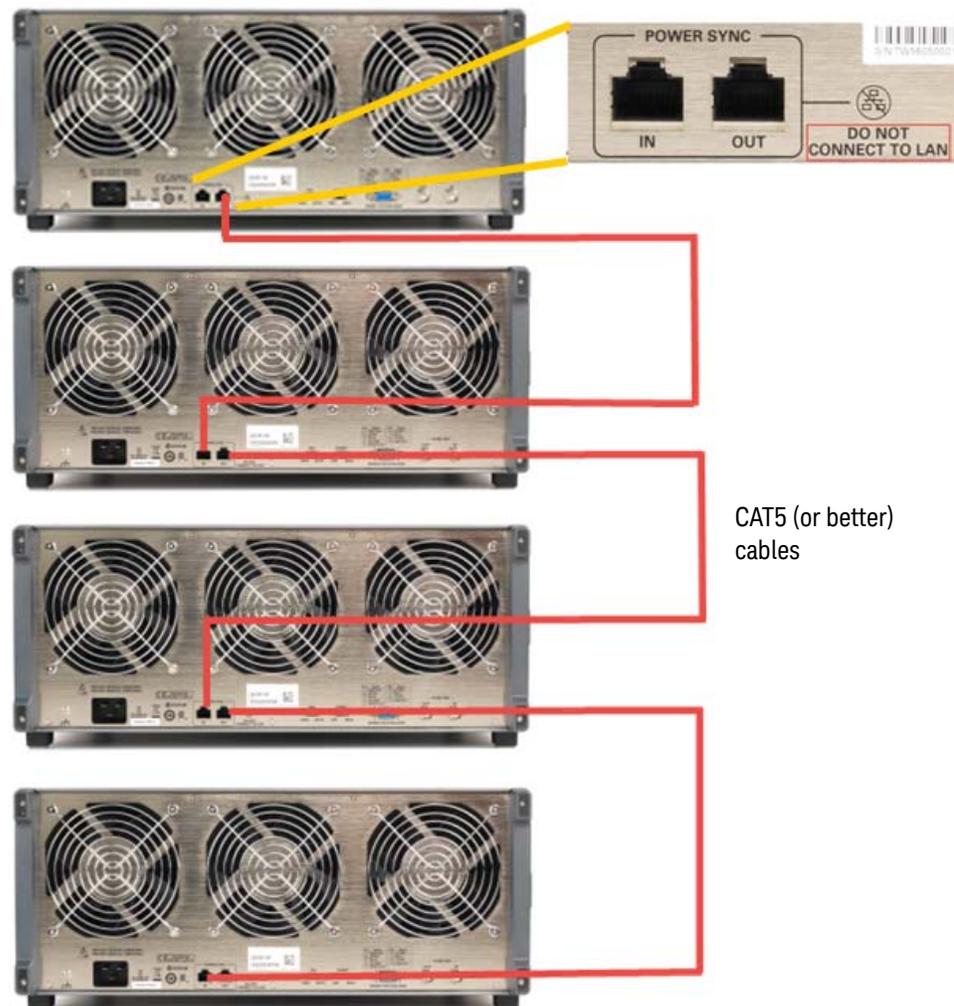
Figure 55   Connection Sequence for Multiple Chassis Power Synchronization

Power Sync and Other Features

Chassis Rear Panel Inhibit Switch

When set to **MAN**ual, the power sync feature is disabled. Chassis are only controllable by the **Inhibit** signal on the rear panel DB-9 connector. If the **Inhibit** switch is set to **MAN**ual, and there is nothing connected to the DB-9 connector, the chassis will always be powered on.

Figure 56   Rear Panel Inhibit Switch and DB-9 Connector

Wake on LAN Signal

If you have an embedded controller (such as the Keysight M9037A) with the Wake-on-LAN feature, it can be used to power up all connected chassis.

Wake on PCIe

The M9018B, M9019A, and M9010A chassis assert the PCIe WAKE signal on the cable when they power on. This signal propagates through the PCIe cable to the host controller. If the host controller has Wake on PCIe enabled, turning on these chassis will also result in the host controller turning on. If this behavior is not desired, look into your host controller BIOS to disable the Wake on PCIe function.

Remote Power On with M9022A, M9023A, M9024A

If Remote Power On is enabled in the Keysight M902x System Modules, then turning on the external host PC will turn on the chassis.

Remote Host Power On Switch:
Left means Enabled
Right means Disabled
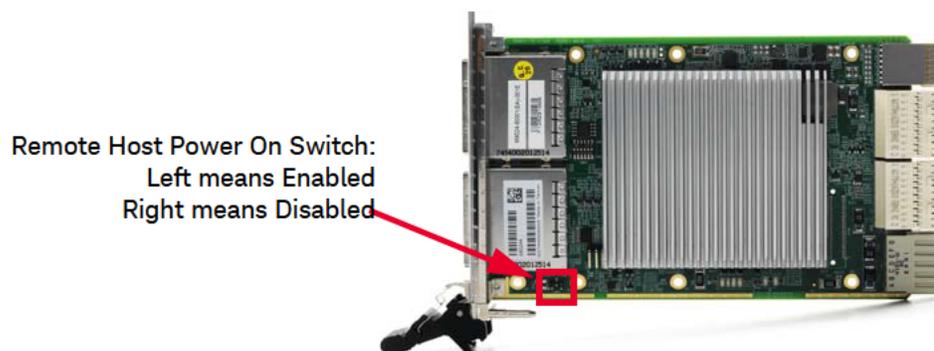
Figure 57   Remote Power On Switch for M902x System Modules

Power Sync with Multiple PXIe Chassis

Table 6 Power Sync Operation with Multiple PXIe Chassis

Minimum chassis firmware revision: MAX10 v3.11 M9037A Controller BIOS: AG10, BMC: 1v8c	Power Sync Connected and Copper PCIe Cables	Power Sync Connected and Active Optical PCIe Cables
Chassis Turn On		
M9037A (Host chassis power button push)	✅	✅
M9037A (Any downstream chassis power button push)	✅	✅
M9037A (WOL)	✅	✅
M9037A (AC-On)	✅	✅
External Host PC (Remote Power On Enabled on M902xA)	✅[1]	✅[2]
External Host PC (Remote Power On Disabled on M902xA)	✅[3]	✅[3]
External Host PC (Wake on PCIe enabled on the host)	✅[4]	✅[5]
Chassis Turn Off		
M9037A (Host chassis power button push)	✅	✅
M9037A (Any downstream chassis power button push)	✅	✅
M9037A (Windows shutdown)	✅	✅
External Host PC (Remote Power On Enabled on M902xA)	✅[6]	✅[7]
External Host PC (Remote Power On Disabled on M902xA)	✅[8]	✅[8]

✅ = Supported action; ❌ = Not supported or Not applicable.

1. Turning PC on turns on all chassis. When the chassis are turned on, a power button push on any chassis will not turn off chassis until the remote host has turned off. Depending on the host controller's power on delay, an additional reboot may be necessary in order to enumerate all chassis and modules.

2. All chassis must be turned on, with a power button push on any chassis, before the remote host PC is turned on. When all chassis are turned on, a power button push on any chassis will not turn off any chassis until the remote host has turned off.

3. All chassis must be turned on, with a power button push on any chassis, before the remote host PC is turned on. When the chassis are turned on, a power button push on any chassis will immediately turn off all chassis even if the remote host is still powered on.

4. Turning on any chassis will turn on the external host PC if Wake on PCIe is enabled on the external host PC BIOS.

5. Turning on any chassis will not turn on the external host PC. The external host PC will have to be turned on manually after all chassis have powered up.

6. If the chassis were turned on remotely by the external host PC, then turning off the external host PC will turn off all chassis. However, if the chassis were turned on with the chassis power button before the external host PC was powered up, then they will remain turned on after the external host PC has turned off. In both cases, a power button push on any chassis will not turn off the chassis until the PC is turned off.

7. Turning off the external host PC will not turn off all chassis. A power button push is required on any chassis to turn off all chassis. However, all chassis will remain on after a power button push, until the external host PC is turned off.

8. Turning off the external host PC will not turn off all chassis. A power button push on any chassis is required to turn off all chassis. Upon a power button push on any chassis, all chassis will immediately turn off even if the remote host is still powered on.

Connect Multiple PXIe or AXIe Chassis Together with a Single Controller?

The Keysight Multi-Chassis Designer helps you design a system consisting of up to four PXIe and AXIe chassis. These chassis may be connected to either an embedded controller (installed in the chassis) or an external PC connected by cable(s) to the chassis. The Multi-Chassis Designer allows you to interactively specify your system parameters, and then it designs a multi-chassis system according to your specifications. Once the design is presented, optionally select different components to further optimize the design to meet your specific requirements.

Download the Multi-Chassis Designer as a .zip file. After saving the file to your desired folder, unzip the file to obtain the Multi-Chassis Designer PDF file. The PDF file requires Adobe Reader X or later. Once the Multi-Chassis Designer is open, Keysight begin by placing your mouse over the **Introduction** rounded rectangle in the upper-right corner.

10 PCIe Link Configuration

The PCIe Link configuration is fixed in both the M9010A and M9019A PXIe Chassis at 2 Link x8 x16 Gen 3 speed. You cannot change or modify the PCIe Link Configuration on these two chassis.

On the M9018B, the PCIe Link is configurable as either 2-Link (1x8), 2-Link (2x8), or 4-Link (4x4).

View the PCIe link configuration from the Soft Front Panel tab as follows:
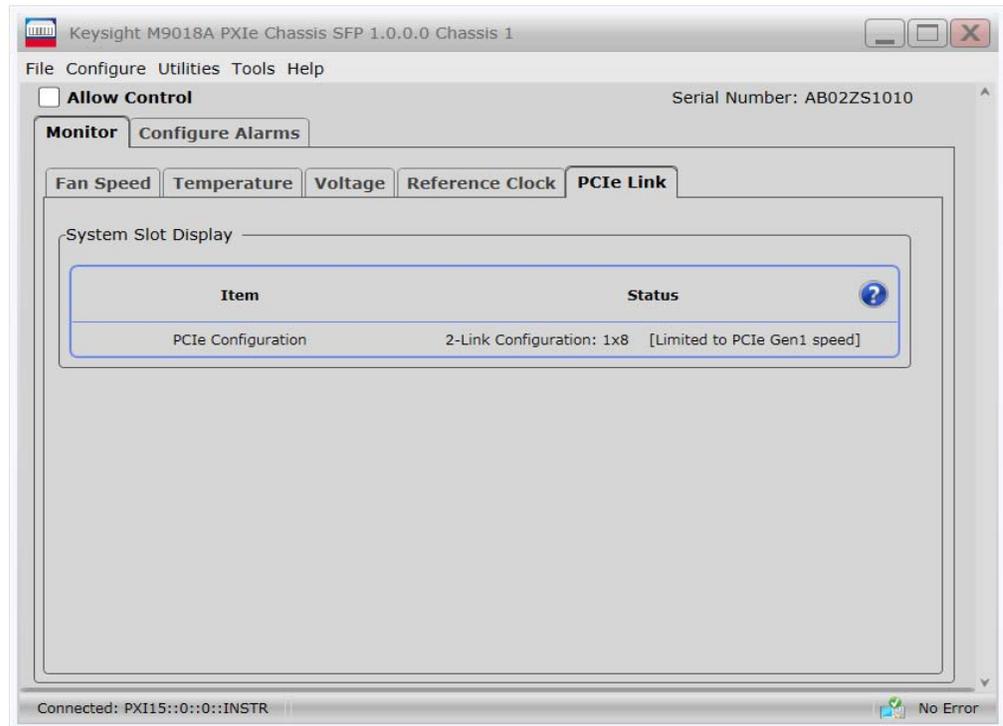
Figure 58   M9018A and M9018B Soft Front Panel PCIeLink Tab
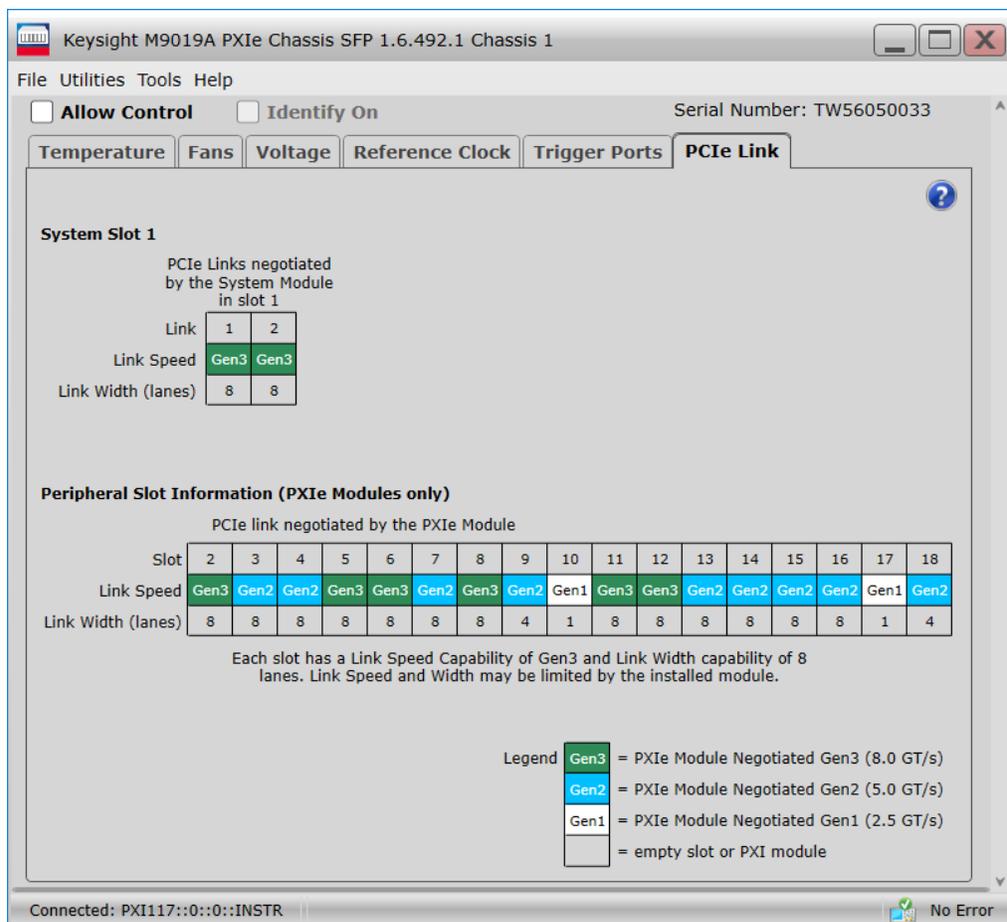
Figure 59 M9010A and M9019A Soft Front Panel PCIe Link Tab

Changing and Restoring the M9018 PCIe Switch Fabric Configuration

NOTE	The PCIe Switch Fabric Configurator tool is for use only on the M9018A and M9018B chassis. It will not run on the M9010A and M9019A chassis.

PCIe link configuration refers to how the chassis PCIe Switch Fabric is configured to connect PCI Express signals between slot 1, the system controller slot, and the other chassis slots. For a review of the supported PCIe link configurations, please see the "Interactive Block Diagram" on page 14. The check boxes in the upper left corner of the block diagram can be used to view each PCIe link configuration.

As shown on the block diagram, the M9018B chassis ships from the factory in "2-Link Configuration: 1x8". This configuration, referred to as "1x8", provides one x8 PCIe link from the system controller slot to the PCIe Switch Fabric. Use the 1x8 configuration when using the M9021A PCIe Cable Interface module connected to an external controller using a PCIe host adapter such as the M9048A. This link can be routed by the PCIe Switch Fabric to the chassis slots as either x4 or x8 links as shown on the block diagram.

The other supported PCIe link configurations are:

- **2-Link Configuration:** 2x8 — Referred to as "2x8", this configuration provides two x8 links from the system controller slot to the PCIe Switch Fabric. Link 2 can be routed by the PCIe Switch Fabric to slots 2-9, while Link 1 can be routed to slots 10-18.

- **4-Link Configuration:** 4x4 — Referred to as "4x4", this configuration provides four x4 links from the system controller slot to the PCIe Switch Fabric. Link 1 can be routed by the PCIe Switch Fabric to slots 10-14, Link 2 can be routed to slots 15-18, Link 3 can be routed to slots 2-5, and Link 4 can be routed to slots 6-9.

Figure 60 shows that part of the block diagram that relates to the PCIe link configurations. The chassis provides storage for two configurations, referred to as the User Configuration and the Base Configuration. The Base Configuration is 1x8 and is set at the factory. It is read-only and cannot be changed. The User Configuration can be set by the user to either 2x8 or 4x4. This is done by using the **PCIe Switch Fabric Configurator** ("**Configurator**") program.
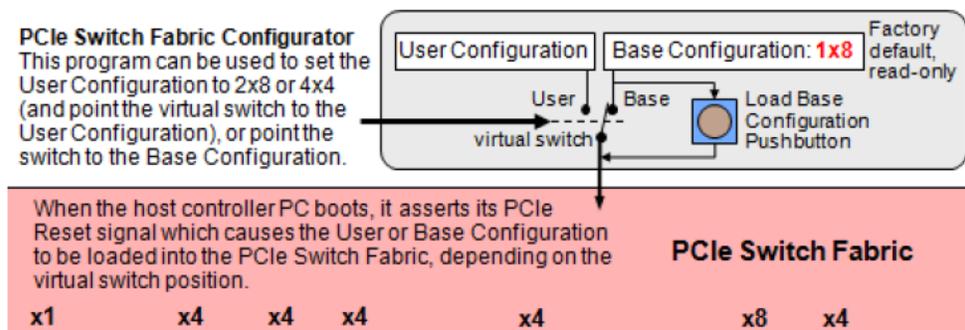
Figure 60   User and Base Configurations

The virtual switch shown in Figure 60 determines which configuration is loaded into the PCIe Switch Fabric. As shipped from the factory, the virtual switch is set to the Base position, and the Base Configuration is set to 1x8. This ensures that the factory default PCIe link configuration is 1x8. Figure 61 shows that the first-ever PCIe Reset signal received by the chassis from the host PC loads the 1x8 configuration into the PCIe Switch Fabric.
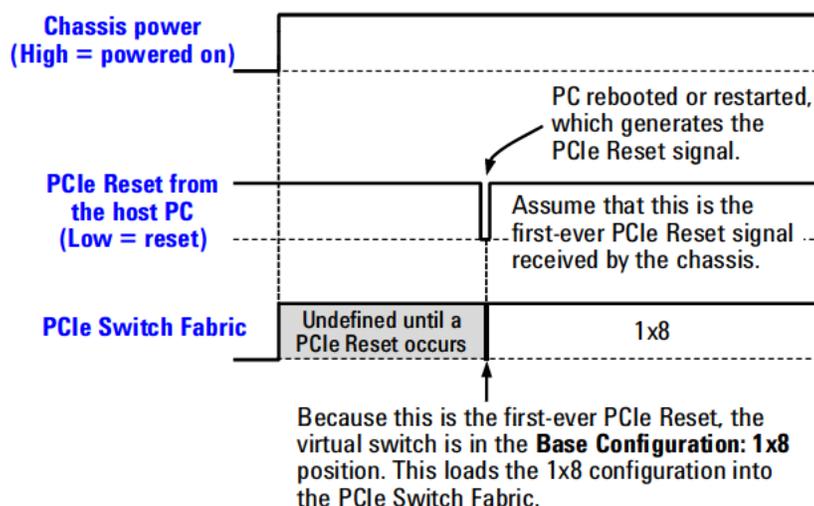
Figure 61   The first-ever PCIe Reset signal loads the 1x8 PCIe Switch Fabric

Note that the PCIe Switch Fabric is undefined between the times when the chassis is powered on and when the PCIe Reset signal occurs.

The position of the virtual switch depends on the selection you make using the **Configurator** program. Because the virtual switch position is stored in chassis non-volatile memory, the switch position persists through chassis power cycles.

Selecting a Link Configuration

CAUTION	Changing the PCIe fabric to one that is incompatible with your system controller can result in you no longer being able to connect with your M9018 chassis from your controller. Refer to the Additional Fabric Information section below for information on correcting this situation.

Use Table 7 to determine the fabric link settings for a single chassis or for a master chassis (a master chassis cascades from its peripheral slot(s) to one or more secondary chassis). Use Table 8 for the fabric link settings for secondary chassis.

NOTE	If you are using the M9018A/B in a multiple chassis arrangement, make certain you have the latest chassis firmware (with fabric links) installed. Chassis firmware updates are available at: www.keysight.com/find/M9018A.

Table 7   Single or Master Chassis Fabric Link Settings

Single Chassis or Master Chassis Configuration	1x8 (Factory Default) Link	1x8 (Gen 1) Link	2x8 Link	4x4 Link
External controller connected to an M9021A module installed in slot 1.	✓ See Note 3			
M9036A or M9037A PCIe Embedded Controller in slot 1.	See Note 1		✓ See Note 2	✓
Other non-Keysight Embedded Controller in slot 1.	See Note 1		See Note 4	✓

(see next page for notes)

Note 1:

- The 1x8 (Factory Default) fabric is the default fabric you will boot with when the M9018A/B PCIe fabric base configuration reset button is pressed at boot.

- Although all PXI System Modules can function using the 1x8 (Factory Default) fabric, it is not recommended for normal use with System Modules other than the M9021A due to better performance with the other fabrics, and the possibility of PXI Standard compliance issues with other system modules.

Note 2:

- The M9018A/B 2x8 fabric is recommended when using the Keysight M9036A or M9037A Controller for performance reasons because x8 connectivity is facilitated to the x8 slots of the M9018A/B chassis (slots 2, 6, 11, and 15).

Note 3:

- An M9021A will function with either the 1x8 (Factory Default) fabric, or the 1x8 (Gen1) fabric. However, using the 1x8 (Factory Default) fabric is capable of better Gen2 PCIe performance and is preferred for all cases when the M9018 chassis is NOT a secondary chassis cascaded from another M9018 Chassis peripheral slot.

Note 4:

- Some non-Keysight system modules and embedded controllers cannot operate with the M9018A/B configured to the 2x8 fabric, and therefore, this fabric is normally NOT recommended for non-Keysight system modules.

Table 8   Secondary Chassis Fabric Link Settings

Secondary Chassis Configuration	1x8 (Factory Default) Link	1x8 (Gen 1) Link	2x8 Link	4x4 Link
M9021A Cable Interface card in slot 1 of the second M9018A/B chassis connected to the PCI ExpressCard port of a M9036A or PCIe cable port on an M9037A embedded controller in the master M9018A/B chassis.	✓			
M9021A Cable Interface card in slot 1 of the second M9018A/B chassis cascaded from a M9021A card in a peripheral slot of the master M9018A/B chassis.		✓ See Note 5		

Note 5:

- In M9018 Cascaded systems where an M9021A interface is used at each end of the connecting PCIe cable, the 1x8 (Gen 1) fabric is used in the secondary M9018 chassis to ensure PCIe signal fidelity. Note: this configuration is not supported with the M9037A Embedded Controller.

- See the *Keysight PXIe/AXIe Multi-Chassis Designer* for details on use of this fabric and the configuration of M9021A modules for Cascading M9018 chassis.

- Configure an M9018 chassis for the Gen 1 fabric by first connecting it directly to a controller (remote PC or M9036) and using the M9018 fabric configuration tool to set this fabric.

Additional Fabric Information

- When using 2x8 or 4x4 links, there are two performance gains that are really slot independent but imply slot performance. By creating two links (2x8) into the system instead of four (4x4), you get a wider communication link back to the host controller. This means that we do not explicitly impose restriction on a x8 module's bandwidth if it were available. A x8 module would connect at x8 in the four M9018A/B slots that support x8 lane width.

- If you accidentally reconfigure the chassis fabric to an invalid configuration, use another system module that is compliant with this M9018A/B fabric to allow you to operate the M9018A/B PCIe Fabric Configurator to restore the M9018A/B fabric back to a usable fabric. Alternately, use the M9018A/B Load Base Configuration Pushbutton to restore the default 1x8 fabric to allow you to again operate the M9018A/B chassis.

For example, on earlier M9018A driver releases, if you are using the M9021A interface card, and you then accidentally reconfigure the M9018A/B fabric to 4x4 fabric, you will then find after a reboot that you can no longer see the M9018A/B chassis instrument via the Keysight M9021A interface.

To restore an M9018A/B configuration that will work with the M9021A interface, you can do one of two things:

- Reboot with a slot 1 System Module that functions with the M9018A/B 4x4 fabric, and then run the PCIe Fabric Configurator to restore the original M9018A/B 1x8 fabric. Then reboot with the M9021A cable interface.

- Refer to "Restoring the Factory Default 1x8 Base Configuration" on page 131 to restore the default M9018A/B fabric. (Note: this procedure requires disassembly of the M9018A/B casing.)

NOTE   When using the M9021A 1-link Cable Interface card and either of the new Rev 2 PCIe fabrics (2x8 or 4x4 Rev2), Connection Expert shows the M9018A/B chassis as an instrument but does not identify the M9018A/B as a Chassis with slots.

You can identify this is the situation by starting the M9018A/B Soft Front Panel and noting on the bottom of the 1st panel that the fabric is 2x8 or 4x4 (not the 1x8 default fabric).

If this is the case, then use the PCIe Switch Fabric Configurator utility to configure the default 1x8 fabric. Reboot the chassis. The chassis should properly identify in Connection Expert, and modules should be presented in their proper slots.

Using the PCIe Switch Fabric Configurator program

If your chassis is in its factory default configuration (1x8) and your system controller slot module uses the 1x8 configuration, there is no need to use the **Configurator** program to change the PCIe link configuration. The Keysight M9021A Cable Interface module, for example, uses the 1x8 configuration. Because 1x8 is the factory default PCIe link configuration, this module will work with the chassis without changing its configuration.

The M9036A or M9037A Embedded Controller will operate with any PCIe Switch Fabric: 1x8, 2x8, or 4x4. You should use the **Configurator** program to change the PCIe Switch Fabric from 1x8 to 2x8 or 4x4, depending on your application.

NOTE   Using the Configurator program requires that the host controller PC recognizes the presence of the chassis as evidenced by "Keysight Technologies M9018" being displayed in Connection Expert. If your chassis is not displayed by Connection Expert, you won't be able to use the Configurator program to change the PCIe link configuration.

If your chassis is configured for a fabric other than the 1x8 fabric and you are using the M9021A PCIe Cable Interface module, you may lose PCIe connectivity to the internal M9018A/B chassis device. With the Keysight M9018A/B chassis driver releases prior to revision 1.4.xx.xx, only the 1x8 fabric placed the internal M9018A/B PCIe device in Link 1, thus, for the earlier 2x8 and 4x4 fabrics the M9021A could not access the internal M9018A/B device through its single PCIe link. Chassis PCIe fabrics installed after the M9018A/B driver revision 1.4.xx.xx and later always place the M9018A/B device on Link 1 so these later fabrics allow M9021A users to use the Configurator program even on 2x8 and 4x4 fabrics.

Fabric installed from M9018A PXIe Chassis Driver version:	PCIe Switch Fabric Configurator program can function using these fabrics through an M9021A Cable Interface module.		
	1x8	2x8	4x4
< 1.4.xx.xx	Yes	No	No
≥ 1.4.xx.xx	Yes	Yes	Yes

After using Connection Expert to verify the presence of the M9018A/B chassis, close the Connection Expert, the NI MAX tool, and any other M9018A/B program (such as Soft Front Panel) prior to running the Configurator program.

CAUTION   The following procedure assumes that the chassis is currently operating with the 1x8 configuration and that the PCIe link configuration is being changed from 1x8 to 2x8. It is further assumed that you have a system module other than the M9021A in use or ready to install in the system controller slot—for example, the Keysight M9036A embedded controller.

After the PCIe link configuration is changed from 1x8 to 2x8, host controllers using the M9021A will no longer be able to properly communicate to the chassis through an M9021A PCIe Cable Interface module. Only perform the procedure in this section if you have a module that supports 2x8 ready to install in slot 1.

If, while performing this procedure, communications is lost with the chassis and cannot be re-established through your 2x8 module, you can restore the default 1x8 configuration by performing the procedure described in "Restoring the Factory Default 1x8 Base Configuration" on page 131.

Before describing how to use the **Configurator** to change from 1x8 to 2x8, let's look at the timing of the change as shown in Figure 62. The time line repeats the first-ever PCIe Reset from Figure 62 (which loads 1x8 into the PCIe Switch Fabric), and then adds use of the **Configurator** to change the configuration to 2x8.
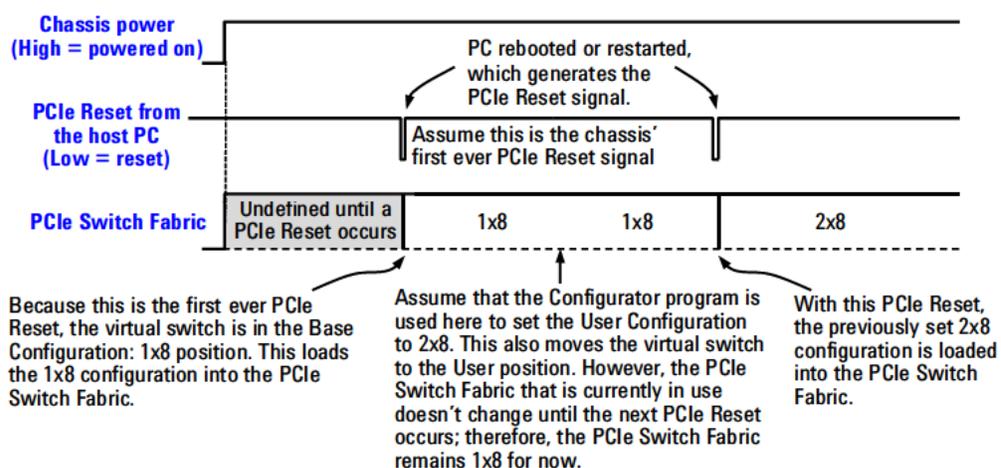
Figure 62   Using the **Configurator** program to set the 2x8 configuration

The time line shows use of the **Configurator** to set the User Configuration to 2x8. When 2x8 is selected, the **Configurator** program moves the virtual switch to the User Position.

However, the PCIe Switch Fabric doesn't change from 1x8 to 2x8 until the *next* PCIe Reset occurs. PCIe Reset occurs when the host PC is either rebooted or restarted. Until a PCIe Reset occurs, the PCIe Switch Fabric will remain 1x8, and normal communications with the chassis can continue.

The fact that the PCIe Switch Fabric doesn't change until a PCIe Reset occurs provides the option shown in Figure 63. Between the period when the **Configurator** is used to select the next configuration (2x8, in this case) and when the PCIe Reset occurs, it is possible to use the **Configurator** again to re-select the original configuration (1x8, in this case). Then, when PCIe Reset occurs, the PCIe Switch Fabric will remain 1x8. This is useful in case you realize, for example, that your slot 1 system controller card is not compatible with the PCIe link configuration that you've just selected.

PC rebooted or restarted, which generates the PCIe Reset signal.

PCIe Reset from the host PC (Low = reset)

PCIe Switch Fabric   1x8   1x8   1x8   1x8

Assume that the Configurator program is used here to set the User Configuration to 2x8. However, the PCIe Switch Fabric that is currently in use won't change until the next PCIe Reset occurs; therefore, the PCIe Switch Fabric will remain 1x8 for now.

Assume that you realize here that you want to retain the 1x8 configuration. You can use the Configurator to re-program the User Configuration to 1x8, which will replace the pending 2x8 configuration.

When you bring up the Configurator to make this change, the Configurator will report that the current PCIe Switch Fabric is 1x8 (because the PCIe Reset signal has yet to occur, meaning that the pending 2x8 configuration has yet to be loaded into the PCIe Switch Fabric). However, you will still need to program the 1x8 configuration in order to replace the pending 2x8 configuration. If you inadvertently conclude, based on the PCIe Switch Fabric being 1x8, that you don't need to re-program the 1x8 configuration, the pending 2x8 configuration will take affect at the next PCIe Reset signal.

With this PCIe Reset, the most recently set User Configuration (1x8, in this case) will be loaded into the PCIe Switch Fabric. Therefore, there will be no change in the PCIe Switch Fabric from the original 1x8 configuration.

Figure 63   Re-selecting the original PCIe link configuration prior to a PCIe Reset will retain the original configuration

Now let's describe how to use the **Configurator** program to select the 2x8 configuration. The **Configurator** program is installed as part of the M9018A/B software installation process described in the M9018A/B Startup Guide.

CAUTION

As described earlier, if you are using the M9021A PCIe Cable Interface module and if you change the PCIe link configuration from 1x8 to 2x8 on older versions of the M9018A/B fabrics, the host controller PC will no longer be able to communicate to the chassis through the M9021A module. Change only to the 2x8 configuration (or the 4x4 configuration) if you have a module that supports the target PCIe link configuration, such as the M9036A or M9037A embedded controller.

CAUTION

Once the configuration process begins, it is very important that the process be allowed to run to completion. Any interruption of the configuration process will leave the chassis PCIe Switch Fabric in an indeterminate state, and will require multiple power cycles of the chassis and multiple reboots of the computer to restore operation (which will be to the 1x8 factory default PCIe Switch Fabric). To ensure that the configuration process runs to completion, perform the following:

1 If you are using a laptop PC, attach the AC power adapter to ensure that you will not experience a low battery shutdown.

2 Ensure your Windows power management Sleep and Hibernate modes are not configured to power down the host PC during the configuration process which can take several minutes.

3 Do not turn the PC nor the chassis off while configuration of the switch fabric is underway.

4 Do not terminate the Configurator program while it is configuring the switch fabric.

5 Do not operate the Keysight Configuration Expert (part of IO Libraries), the NI MAX tool, nor run any M9018A/B application (IVI, Soft Front Panel, etc.) while performing a fabric update.

If the configuration process is interrupted, see "Restoring operation after an interruption of the configuration process" on page 130 for information on how to restore your chassis to an operating state.

To select the 2x8 configuration, perform the following steps:

1   The **PCIe Switch Fabric Configurator** utility program is available from the Windows **Start** button; select **All Programs > Keysight > PXIe Chassis Family > PCIe Switch Fabric Configurator**. This opens the dialog shown in Figure 64.

NOTE   On older systems, an older version of the Configurator utility can be found in one of the following locations, depending on your Windows operating system:

Program Files > Agilent > M9018 > bin > PCIeFabric.exe

Program Files (x86) > Agilent > M9018 > bin > PCIeFabric.exe
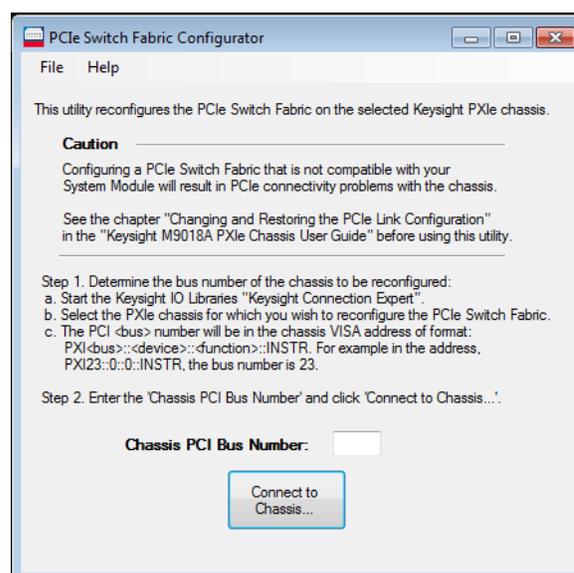
Figure 64   **Configurator** startup dialog

2   Enter your chassis PCI bus number in the **Chassis PCI Bus number** field. As noted in the dialog, the chassis PCI bus number is displayed in Connection Expert. Click **Connect to Chassis...** after entering the PCI bus number.

NOTE   Make certain that Connection Expert is closed prior to selecting the fabric in the next step.

3   The **Fabric Configurator** selection dialog is displayed next as shown in Figure 65. To change to the 2x8 PCIe link configuration, use the Fabric Configuration pull down menu to select **2-Link Configuration: 2x8**, and then click **Start Reconfiguration**.
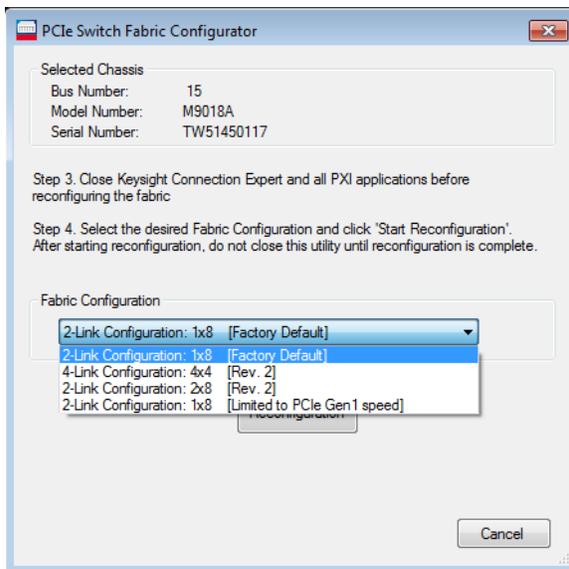
Figure 65   Fabric Configuration selection dialog

NOTE	Newer fabric versions that are available on newer driver versions of the M9018A/B software installations have appended "[Rev.⟨n⟩]" to indicate the version number of that fabric.

While the reconfiguration is in progress, the progress indicator shown in Figure 66 will be displayed. It is very important that the **Configurator** program not be terminated or otherwise interrupted during the reconfiguration.
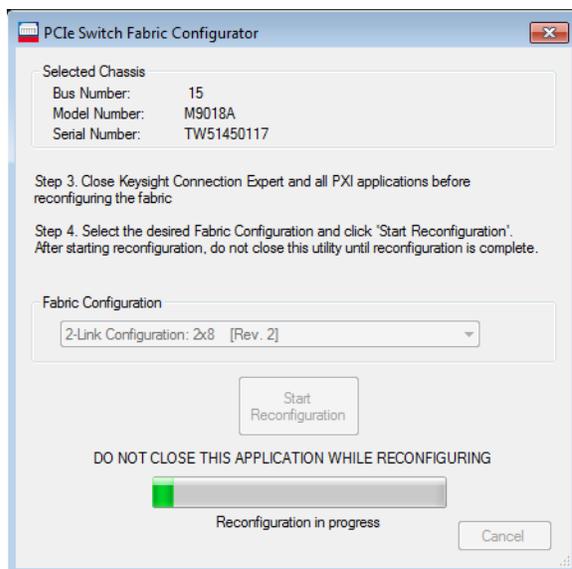
Figure 66   Configurator progress indicator

If the reconfiguration successfully completes, the Configurator displays a "Reconfiguration Complete" box:
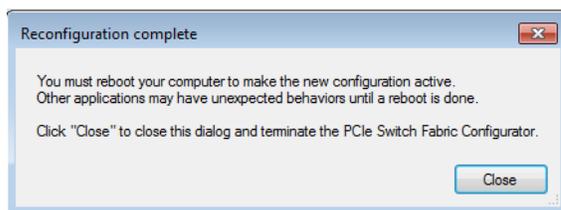
Figure 67   Dialog if reconfiguration is successful

At this point, the virtual switch shown in Figure 60 on page 116 is in the User position and the User Configuration has been set to 2x8. However, the 2x8 configuration has not yet been loaded into the PCIe Switch Fabric. As noted above, you must reboot your computer in order for the 2x8 configuration to become active, as shown in Figure 61 on page 116. It is not necessary to power cycle the chassis.

If the reconfiguration is not successful, the **Configurator** will present you with several options as described in "Reconfiguration failure" on page 130.

ASIDE: Self test operation, which is described in the next chapter, will detect the post-configuration need to reboot your computer, and will generate the following error message if self test is run at this point. This is basically a restatement of the need shown in Figure 62 on page 122 to reboot your computer in order to load the just-selected PCIe Switch Fabric.
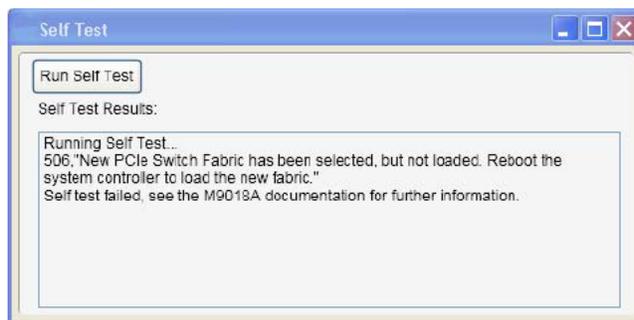
Figure 68   If self test is run prior to rebooting your computer, it will detect that the computer needs to be rebooted

The 2x8 PCIe link configuration that has been installed will persist across a chassis power cycle as shown in Figure 69. However, as usual, the PCIe Switch Fabric will be undefined until a PCIe Reset occurs.
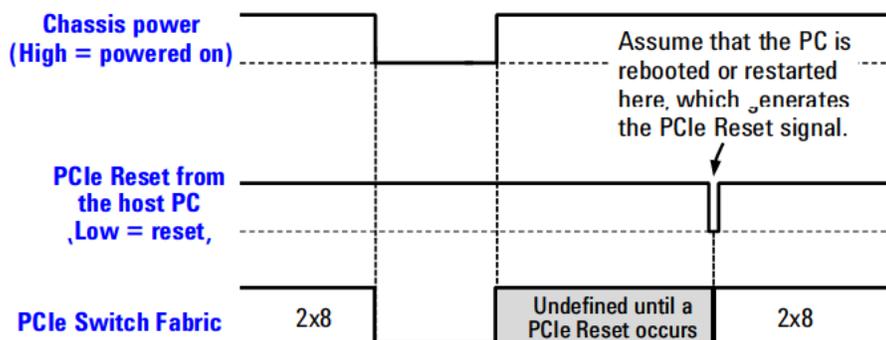
This diagram shows the status of the PCIe Switch Fabric across a chassis power cycle. In this example, the PCIe Switch Fabric is set to 2x8. When the chassis is powered down and powered back up, the PCIe Switch Fabric is, as usual, undefined until a PCIe Reset signal occurs.

When PCIe Reset occurs, the configured 2x8 PCIe fabric is loaded.

Figure 69   Persistence of the PCIe link configuration across a power cycle

Configuring the chassis to run at Gen 1 speeds

At times it may be necessary to run the Keysight M9018A/B chassis at Gen 1 speeds (also known as Safe Mode as the bit error rate of a questionable PCIe connection goes down with the slower data rate of Gen 1). To do this you must run the PCIe Fabric Configurator program:

1 The **PCIe Switch Fabric Configurator** utility program is available from the Windows **Start** button; select **All Programs > Keysight > M9018 > PCIe Switch Fabric Configurator**.

2 Follow the instructions to enter the chassis bus number. (See also Figure 64)

3 In the fabric configurator drop down box, select:
   `2-link Configuration 1x8 [Limited to PCIe Gen1 Speed]`
   (see Figure 70)

4 Press the **Start Reconfiguration** button.

5 Allow the configuration process to complete. Follow all instructions on the display.

6 Cycle the chassis power.
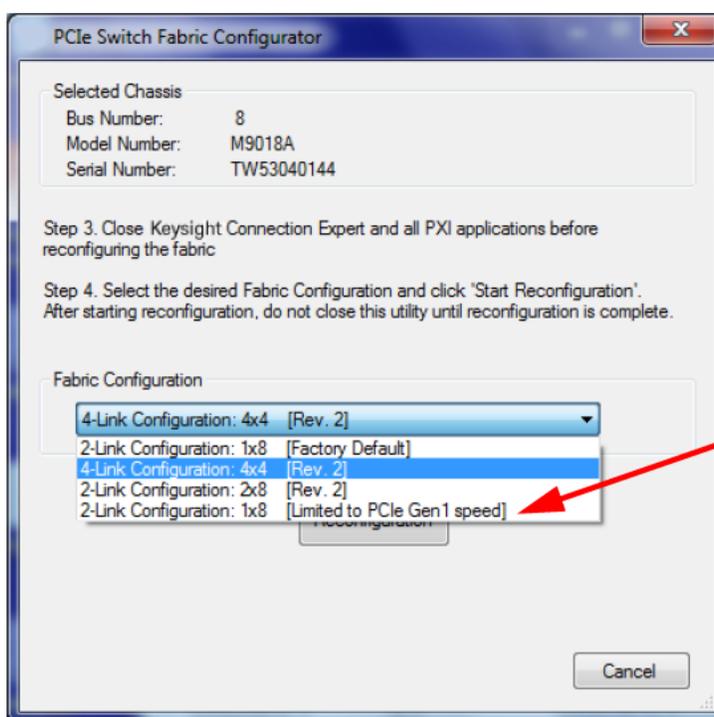
Figure 70 PCI Configurator for Gen1 speeds

Reconfiguration failure

If the reconfiguration fails for any reason, the **Configurator** displays an error message.

Click **Retry** to attempt to program the previously-selected switch fabric. Click **Ignore** if, instead of attempting to program the previously-selected configuration, you want to restore the 1x8 factory default configuration. Both of these operations will bring up the **Configurator** progress indicator shown in Figure 66 on page 127. If reconfiguration is successful, the selected configuration will become active after the next boot.

Clicking **Abort** terminates all attempts to program a configuration and the chassis defaults back to 1x8, which becomes active after the next boot. If self test is run following the boot, code 537 and message "`Error detected during PCIe Switch Fabric configuration. Base (factory default) PCIe Switch Fabric was re-selected.`" will be returned. This code/message indicates that the initial reconfiguration failed, and that the 1x8 Base Configuration was automatically re-selected. Once the default fabric has been restored, you may attempt to reconfigure the fabric again. If you continue to get the failure message, contact Keysight support.

Restoring operation after an interruption of the configuration process

This section lists the steps that are needed if the configuration process is interrupted—for example, if the chassis is powered down during the configuration process. These steps are based on using Keysight IO Libraries Suite 16.1 (or later), and will restore the PCIe Switch Fabric to the 1x8 factory default configuration.

> **NOTE**
>
> An important aspect of programming the PCIe Switch Fabric is that, as the fabric is being programmed, the virtual switch shown in Figure 60 on page 116 is set to point to the 1x8 Base Configuration. If programming of the fabric (for example, to the 2x8 configuration) is successful, the virtual switch is then set to the Base Configuration, which contains the 2x8 fabric. When the PC is booted next, the 2x8 Base Configuration will be loaded into the PCIe Switch Fabric as shown in Figure 62 on page 122.
>
> If programming of the 2x8 (or 4x4) configuration is interrupted, the fabric being stored in the Base Configuration will likely be incomplete. However, the virtual switch is set to the 1x8 Base Configuration during the programming (and therefore remains set there after the interruption) will allow the 1x8 configuration to be loaded at the next PC boot. When the chassis driver communicates to the chassis after the boot (for example, when the SFP is brought up), the driver will detect that the PCIe programming was interrupted, and will perform several additional steps to instantiate 1x8 as the current chassis configuration.

The following steps to restore 1x8 assume a remote controller PC, not an embedded controller. If you have an embedded controller, steps 1-4 can be combined into these steps: Power down your chassis, wait one second, and power up your chassis.

1 Shut down your PC.

2 Power down your chassis and wait one second.

3 Power up your chassis and wait three seconds.

4 Turn on your PC.

5 After Windows is up, start Connection Expert, and verify that the chassis is displayed. If Connection Expert isn't able to display the chassis, you will need to perform the recovery operation described in "Restoring the Factory Default 1x8 Base Configuration" on page 131.

6 Start the chassis SFP by clicking the Connection Expert **Start SFP** button. This allows the chassis driver to perform the steps necessary to instantiate 1x8 as the current chassis configuration.

7 From the SFP and for informational purposes, perform a chassis self test. Self test should display codes 506 and 537 (and possibly error code 509). For the messages associated with these codes, see "Self Test Codes and Messages" on page 146.

8 Restart your PC.

9 Start the SFP, rerun self test, and verify that codes 506 and 507 are not reported.

At this point, the PCIe Switch Fabric will be the 1x8 configuration. If desired, the **Configurator** program can be run again to select another configuration.

Restoring the Factory Default 1x8 Base Configuration

Assume that your PCIe Switch Fabric is currently set to a 2x8, and that you have an embedded controller that is using the 2x8 configuration. Assume furthermore that you want to reconfigure the chassis to work with the M9021A Cable Interface module. In this case, you would run the **Configurator** on the embedded controller to select the 1x8 configuration.

If, for any reason, you are not able to run the **Configurator** program on the embedded controller in order to select 1x8, the chassis allows you to preemptively restore the 1x8 Base Configuration. The preemptive restoration requires pressing a pushbutton internal to the chassis while, at the same time, restarting the host controller PC to generate the PCIe Reset signal.

For an embedded controller PC, it is typically straightforward to restart the PC while simultaneously pressing the chassis internal pushbutton because you're only interacting with one device, the chassis. For a remote controller PC that may

be several feet from the chassis, the task of restarting the PC while simultaneously pressing the chassis internal pushbutton may be best accomplished with an assistant.

WARNING **Restoring the M9018A chassis PCIe switch fabric to its factory default configuration requires pressing a pushbutton internal to the chassis while the chassis is powered up. Only qualified, service-trained personnel shall be allowed to remove the instrument cover and actuate the pushbutton while the instrument is energized. High current and high energy source connectors are proximate to the pushbutton which could cause potential burns if short circuited.**

To restore the Base Configuration, perform the following steps for either an "M9018A Chassis Only" (below) or an "M9018B Chassis Only" on page 135

M9018A Chassis Only

1 Turn the chassis off and unplug the chassis from AC power.

2 Remove the chassis top cover as follows:

   a Remove the two rear feet of the chassis by using a Torx T8 screwdriver. Each of the two rear feet has two Torx screws.

   b Next, remove the 14 screws holding the top cover in place using a #2 Phillips screwdriver. There are 5 screws on each side of the cover, two on top of the cover near the front panel, and two in the back of the chassis that screw into the chassis rear panel.

   c After the screws are removed, lift up the rear of the chassis cover about 12 mm (.5 inches) and slide the cover back off of the chassis. Place the cover in a location away from the chassis.

3 On the M9018A chassis, locate the Load Base Configuration Pushbutton at the top of the backplane behind the three-wide expansion slot to the left of slot 1—see Figure 71.
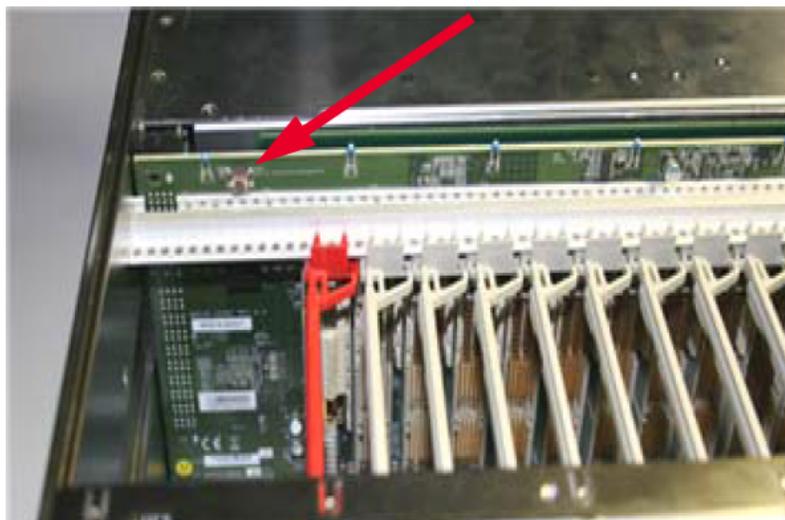
Figure 71   Load Base Configuration Pushbutton (M9018A only)

4 If you have an **embedded controller**, perform the following steps (for an external controller, proceed to step 5):

a Re-connect the chassis power cord to AC power.

b Press and hold the Load Base Configuration Pushbutton *before* powering up the chassis.

WARNING	**In the next step, you'll power up the chassis. In doing so, ensure that no contact is made with anything in the chassis other than the pushbutton. Ensure that no metallic object, such as a ring or a watchband, contacts any chassis components.**

c Power up the chassis while continuing to press the pushbutton. As the embedded controller powers up, the PCIe Reset signal is generated.

d After the embedded controller has restarted as indicated by the appearance of the Windows OS start screen, release the Load Base

Configuration Pushbutton. At this point, the Base Configuration (1x8) has been loaded into the PCIe Switch Fabric.

e Continue onto step 6.

5 If you have an **external** (remote) controller PC, perform the following steps:

WARNING **In the next step, you'll power up the chassis. In doing so, ensure that no contact is made with anything in the chassis other than the pushbutton. Ensure that no metallic object, such as a ring or a watchband, contacts any chassis components.**

a Re-connect the chassis power cord to AC power and power up the chassis.

b Press the Load Base Configuration Pushbutton and then, while continuing to press the pushbutton, restart the remote controller PC. As noted earlier, this may be best accomplished with an assistant.

c After the remote controller PC has restarted as indicated by the appearance of the Windows OS start screen, release the Load Base Configuration Pushbutton. At this point, the Base Configuration (1x8) has been loaded into the PCIe Switch Fabric.

6 While the Base Configuration: 1x8 has now been loaded into the PCIe Switch Fabric, the virtual switch is still set to the 2x8 position—use of the pushbutton doesn't affect the position of the virtual switch. In order to re-position the switch to the Base position, chassis software needs to be run. This is most easily accomplished by bringing up the SFP. In running the SFP, the IVI driver used by the SFP will detect that the Load Base Configuration Pushbutton has been used, and will reposition the virtual switch to the Base Configuration position. The PCIe Link Configuration display on the SFP **Monitor** tab will now show "2-Link Configuration: 1x8 (Factory Default]".

7 Power down the chassis and unplug the chassis from AC power.

8 Re-install the chassis top cover by performing steps a-c (in step 2) in reverse order, ensuring that all screws are reinserted.

9 Re-connect the power cord to AC power and power-up the chassis.

M9018B Chassis Only

> **NOTE** Follow all instructions. Make certain that you reset the fabric switch to the DOWN position when you are finished. Failure to do creates an infinite loop of overwriting the fabric configuration each time the chassis is started.

1 Turn the chassis off and unplug the chassis from AC power.

2 If you have an **embedded controller**, perform the following steps (for an external controller, proceed to step 3):

    a Remove the embedded controller from the chassis.

    b On the M9018B chassis, locate the Load Base Configuration switch on the backplane just to the left of slot 1. It is the second switch from the left. See Figure 72 below.
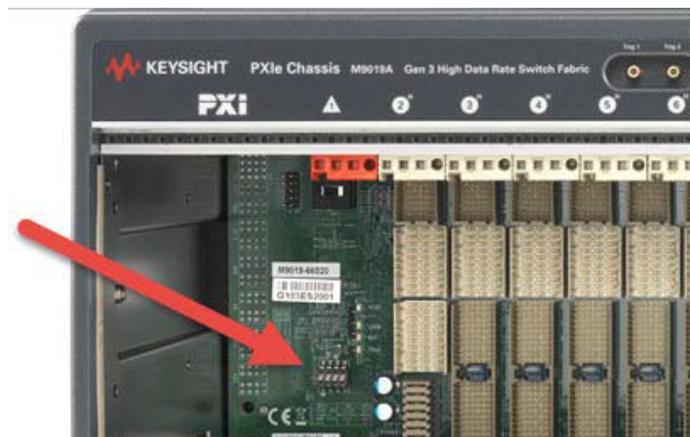
Figure 72 Fabric Reset Switch on M9018B (second switch from left)

    c Flip the Fabric configuration switch to the UP position.

    d Reinstall the embedded controller in the chassis.

    e Power up the chassis.

    f Wait until the embedded controller has completely restarted as indicated by the appearance of the Windows OS start screen. At this point, the Base Configuration (1x8) has been loaded into the PCIe Switch Fabric.

    g Shut down Windows on the controller to power down the chassis. Remove the controller from the chassis, **reset the Fabric configuration switch to the DOWN (default) position**.

    h Re-install the embedded controller.

    i Re-connect the power cord to AC power and power-up the chassis.

3 If you have an **external** (remote) controller PC, perform the following steps:

a Remove any system or cable interface module from Slot 1 in the chassis.

b On the M9018B chassis, locate the Load Base Configuration switch on the backplane just to the left of slot 1. It is the second switch from the left. See Figure 72 on page 135.

c Flip the Fabric configuration switch to the UP position.

d Reinstall the system or cable interface module from Slot 1 in the chassis. Connect the system module to the host PC with a PCIe cable.

e Power up the chassis.

f Power on the host PC. Wait until the host PC has completely restarted as indicated by the appearance of the Windows OS start screen. At this point, the Base Configuration (1x8) has been loaded into the PCIe Switch Fabric.

g Shut down the PC. Power down the chassis. Remove the system module from the chassis, **reset the Fabric configuration switch to the DOWN (default) position**.

h Reinstall the system module into the chassis

i Power up the chassis, power up the host PC.

4 While the Base Configuration 1x8 has now been loaded into the PCIe Switch Fabric, the virtual switch is still set to the 2x8 position. In order to re-position the virtual switch to the Base position, chassis software needs to be run. This is most easily accomplished by bringing up the SFP. In running the SFP, the IVI driver used by the SFP will detect that the Load Base Configuration Pushbutton has been used, and will reposition the virtual switch to the Base Configuration position. The PCIe Link Configuration display on the SFP **Monitor** tab will now show "2-Link Configuration: 1x8 (Factory Default]".

Figure 73 on page 137 shows the complete time line for preemptively restoring the factory default 1x8 Base Configuration.
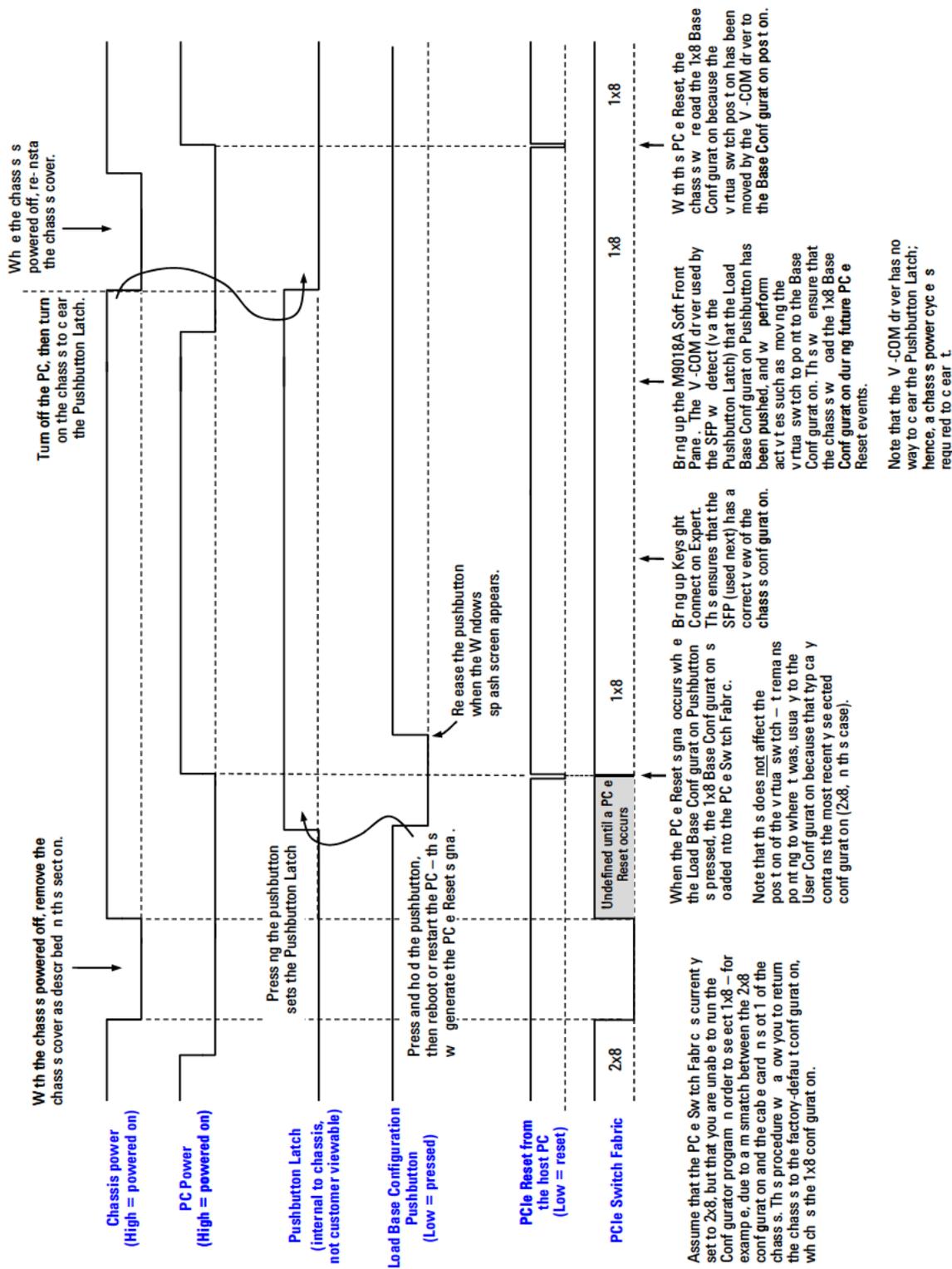
Figure 73   Time line for preemptive restoration of 1x8

11 Chassis Maintenance

No periodic maintenance of the chassis is required. However, Keysight recommends monitoring the Primary Power Module (PPM) voltage rails, the chassis fan speeds, and the chassis firmware at least yearly:

–   **Power supply voltages** — All PPM voltages should all be within ±5% of their nominal values. The PPM rails are accessible on the rear panel DB-9 connector. See "Measuring the Main Voltage Rails Directly" on page 54.

–   **Fan speeds** — A low chassis fan speed possibly indicates that a fan is wearing out or a fan blade is partially obstructed. See "Monitoring Chassis Fan Speeds" on page 67.

–   **Chassis firmware** — Keysight recommends that you periodically check to see if there is a chassis firmware revision available that is later than your current chassis firmware revision. If so, you should download and install the latest firmware revision available as described in "Updating Chassis Firmware" on page 141.

If a power supply voltage is out of tolerance or a fan speed is low, see the *Keysight PXIe Family Chassis Service Guide* for diagnostic information.

WARNING   **These chassis are Safety Class 1 products (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited. Inspect the protective conductor periodically to ensure that it is uninterrupted.**

-   **No operator serviceable parts inside. Refer servicing to qualified personnel.**

-   **To prevent electrical shock, do not remove covers.**

-   **To prevent electrical shock, disconnect the chassis power cord before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.**

-   **Cleaning connectors with alcohol shall only be done with the chassis power cord removed and in a well-ventilated area. Allow all residual alcohol moisture to evaporate, and fumes to dissipate prior to energizing the chassis.**

KEYSIGHT
TECHNOLOGIES

Chassis Firmware and Revision

This chapter describes how to use the PXIe Chassis SFP and IVI drivers to view the chassis revision information. The revision number of the chassis firmware is included in this information. The chassis firmware is shown within the Chassis Manager block diagram (see "Interactive Block Diagram" on page 14) and controls much of chassis operation. This chapter also describes how to update the chassis firmware.

Viewing the Chassis Revision Information Using the SFP

Bring up the SFP About dialog from the SFP menu bar by clicking Help > About. This will display the dialog in the following image.
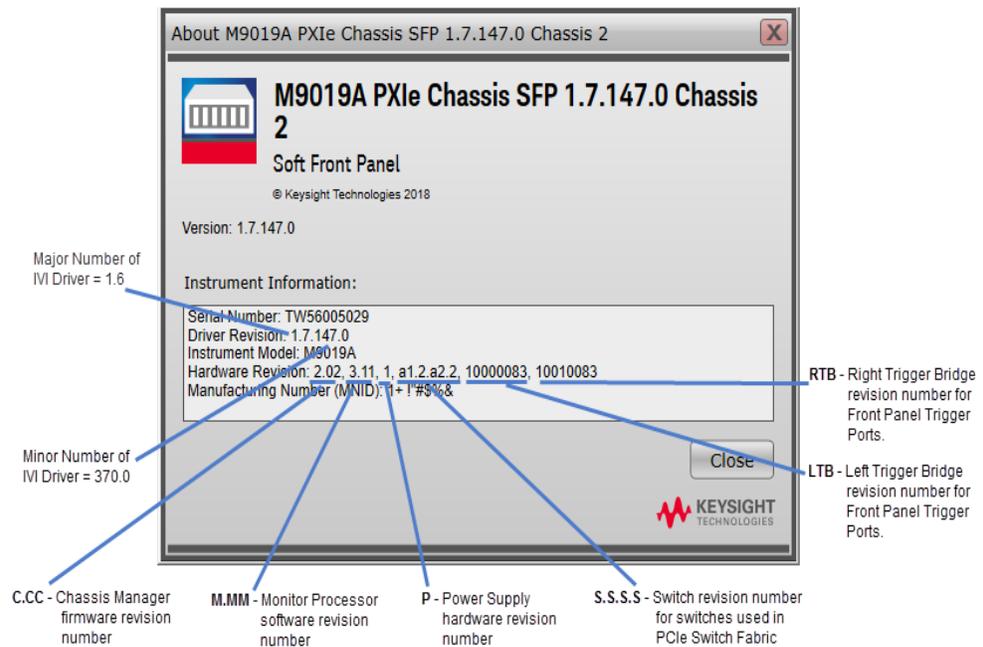
Figure 74   Chassis Firmware Shown in the Soft Front Panel (M9019A shown)

The row, labeled Hardware Revision, contains version numbers representing chassis firmware components. The Chassis Manager revision is the first number listed. Information on upgrading chassis firmware is provided below.

Viewing the Chassis Revision Information Using the IVI Drivers

The chassis revision string can be viewed using the IVI.NET and IVI-C drivers as follows:

IVI.NET: Use the Instrument Firmware Revision property.

IVI-C: Use the KTMPXICHASSSIS_ATTR_INSTRUMENT_FIRMWARE_REVISION attribute**.**

Updating Chassis Firmware

To determine if there is a later revision of chassis firmware available, perform the following steps:

1 Go to any of the chassis websites and click the **Visit Technical Support** tab.

www.keysight.com/find/M9010A

www.keysight.com/find/M9018B

www.keysight.com/find/M9019A

2 Under **Technical Support**, click the **Drivers, Firmware & Software** tab. If there are chassis firmware updates available, they will be listed under this tab, and can be viewed by clicking **Firmware Update** under **Refine the List.**

3 Compare your chassis firmware revision number to the list of chassis firmware revision numbers that are available. If there are later revisions available, Keysight recommends installing the latest version.

To install the latest chassis firmware, perform these steps:

1 Click the link to the latest (or desired) firmware update and follow the instructions provided to download and install the firmware on your chassis.

2 Power cycle the chassis after the firmware installation is complete, and verify that your host controller PC can communicate to the chassis.

Chassis Backplane Switches

On the M9010A, M9018B, and M9019A chassis, just to the left of slot 1 (see Figure 75 below), is a bank of four switches. The default setting for all four switches is in the down position. For a detailed explanation of these switches, refer to the Keysight *PXIe Chassis Family Service Guide*.

NOTE	These switches are for Keysight authorized service personnel only.
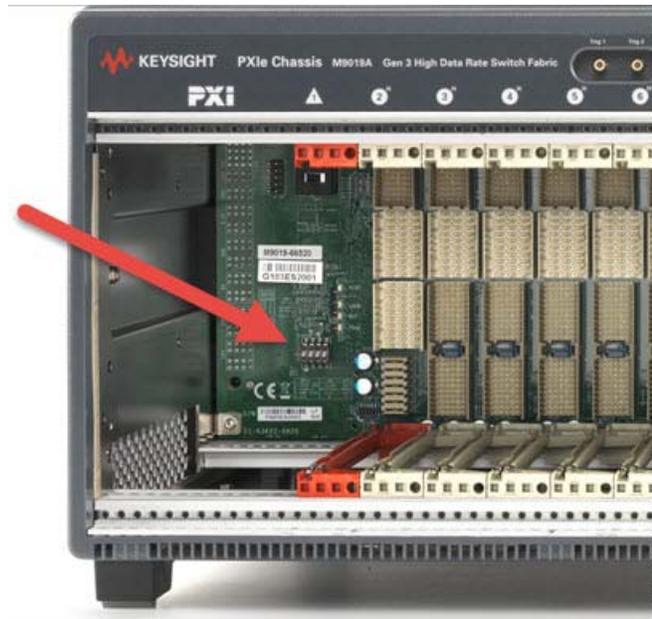
Figure 75   PXIe Chassis Backplane Switches

Here is a brief description of the switches (numbered left to right):

Switch # 1: FPGA image. This selects the chassis FPGA endpoint image. Golden image (switch up) causes the chassis to boot to its failsafe image. The Default, down, position causes the chassis to boot with its normal image.

Switch # 2: Fabric Selection Switch. This switch selects the PCIe fabric mode.

- On the M9010A and M9019A chassis: RST/Safe means that Gen 1-limited fabric is selected on all slots and links. NORMal is Gen 3 mode.

- On the M9018B chassis, RST/Safe is used for an emergency reset to the 1x8 Gen 2. This is similar to the fabric pushbutton on the M9018A chassis. For additional information, refer to "Restoring the Factory Default 1x8 Base Configuration" on page 131.

Switch # 3: Pwr Sync.This switch enables or disables the multiple chassis Power Sync feature. Note, this switch should always be left in the DOWN position. For more information on the Power Sync feature, see "Power Sync with Multiple PXIe Chassis" on page 110.

Switch # 4: Not used. This switch is reserved for future use.

Performing a Chassis Self Test

This section describes how to perform a chassis self test and lists the codes and messages generated by self test. For detailed information on the self test messages and how to use the self test results to troubleshoot issues with the chassis, see the **Troubleshooting Based on the Self Test Results** chapter in the *Keysight PXIe Chassis Service Guide.*

Performing Self Test using the Soft Front Panel

Self test can be initiated from the SFP or programmatically using the IVI or LabVIEW drivers.The following image shows how to initiate self test from the PXIe chassis Soft Front Panel (SFP). Note that the Allow Control check box must be checked in order to perform a self test.
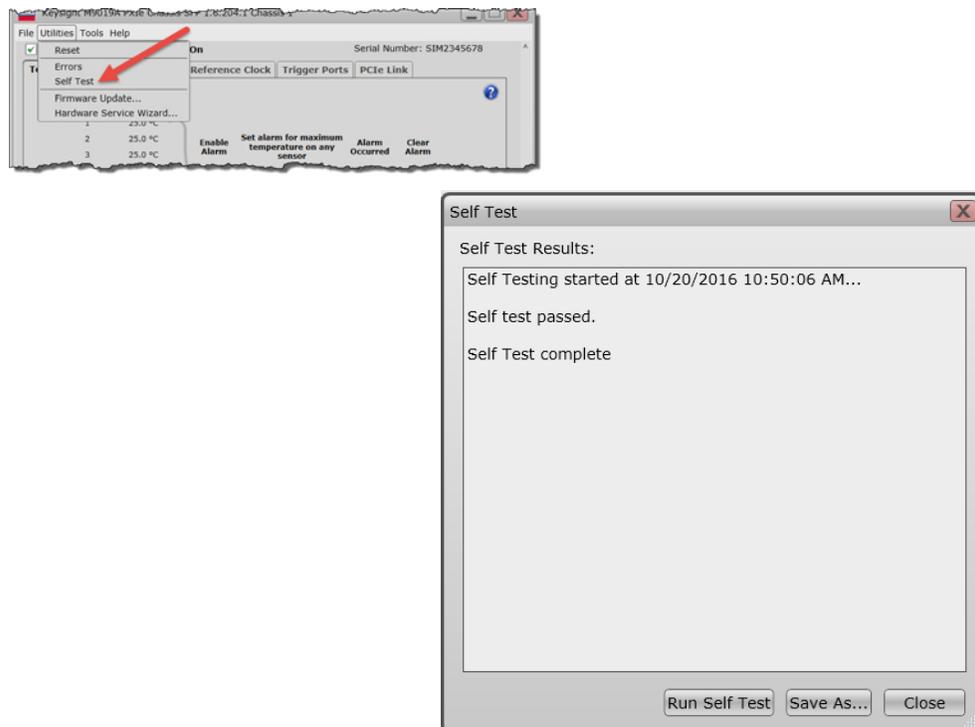
Figure 76   Running the Chassis Self Test from the Soft Front Panel

Performing Self Test using the IVI Drivers

The programmatic execution of self test is performed in a similar manner to the SFP implementation of self test. In fact, the process by which the SFP reads the self test results is the same process that would be followed by an application program.

Refer to the IVI help system for information on performing self test programmatically. As noted above, executing self test programmatically is very similar to the SFP implementation of self test.

Self Test Codes and Messages

The self test codes and messages are listed below. The messages are grouped into low numbered codes (starting at 1) and high numbered codes (starting at 500). Low-numbered codes generally indicate a situation where service is required. High-numbered codes indicate situations that you can often resolve yourself. For details on these groups, the meaning of each message and possible actions to take in response to the messages, refer to *Keysight PXIe Chassis Service Guide*.

Table 9 Low-numbered self test codes

Test Code	Error
1	"Chassis Monitor processor is not responsive."
2	Unused
3	"Unable to operate IO channel that allows PCIe Switch Fabric reconfiguration."
4	"Unable to operate IO channel to PXI Trigger routing buffers."
5	"Unable to operate IO channel to chassis EPROM."
6	"Error writing to the chassis EPROM. Reinstall chassis PCIe Switch Fabric."
7	"One or more chassis fans operating outside valid RPM range."
8	"Chassis fan 1 in fan tray 1 operating outside valid RPM range"
9	"Chassis fan 2 in fan tray 1 operating outside valid RPM range."
10	"Chassis fan 3 in fan tray 1 operating outside valid RPM range."
11	"Chassis fan speed selector switch is in HIGH position, but one or more fans not operating at maximum speed."
12	"Chassis fans are operating at dissimilar speeds."
13	"Chassis fan AUTO speed control is not functioning properly."
14	"IO failure during self test. If problem persists, contact Keysight Technical Support."
15	unused
16	unused
17	"Reading from non-volatile chassis memory failed."
18	"Corrupt serial number in non-volatile memory."
19	"Chassis self-test cache memory inaccessible."
20	"Failed to recover to the Base (factory default) PCIe Switch Fabric during initialization."

Table 10 High-numbered self test codes

Test Code	Error
500	"Chassis Manager operating on backup (read-only) firmware image. See Keysight Technical Support."
501	"Chassis Manager firmware was updated since power-up. Power cycle the chassis and reboot system controller."
502	"Chassis memory structure corrupted. Run IVI driver (or SFP utility) Reset command, and then rerun self test to validate."
503	"Previous reset operation found chassis memory structure corrupted, chassis memory was re-initialized."
504	"PCI Configuration Space Header corrupted. Power cycle the chassis and reboot the system controller."
505	"Unable to operate IO channel to Chassis Manager. Check PCIe connection."
506	"New PCIe Switch Fabric has been selected, but not loaded. Reboot the system controller to load the new fabric."
507	"Previous PCIe Switch Fabric update failed. Restoring Base (factory default) PCIe Switch Fabric."
508	"PCIe Switch Fabric currently in use is of a type that is not recognized by this version of chassis driver software. Consider updating your chassis driver software to a newer version."
509	"Chassis EPROM checksum failure. Reinstall PCIe Switch Fabric."
510	"Chassis EPROM does not match currently installed PCIe Switch Fabric. Reinstall PCIe Switch Fabric."
511	unused
507	"Previous PCIe Switch Fabric update failed. Restoring Base (factory default) PCIe Switch Fabric."
508	"PCIe Switch Fabric currently in use is of a type that is not recognized by this version of chassis driver software. Consider updating your chassis driver software to a newer version."
509	"Chassis EPROM checksum failure. Reinstall PCIe Switch Fabric."
510	"Chassis EPROM does not match currently installed PCIe Switch Fabric. Reinstall PCIe Switch Fabric."
511	unused
512	"Non-volatile memory failure during PCIe Switch Fabric install/repair operations. Reinstall PCIe Switch Fabric."
513	"Chassis driver's built-in PCIe Switch Fabric cache has an older fabric revision than the PCIe Switch Fabric currently in use. Consider updating your chassis driver software to a newer version."
514	"Chassis driver's built-in PCIe Switch Fabric cache has newer fabric than the PCIe Switch Fabric currently in use. Consider updating your chassis to your driver's newer fabric."
515	"PCIe Switch Fabric chip loaded with wrong image for that chip. Reinstall PCIe Switch Fabric."
516	"PCIe switch fabric chips loaded with mismatching Type code. Reinstall PCIe switch Fabric."
517	"PCIe switch fabric chips loaded with mismatching Revision code. Reinstall PCIe Switch Fabric."

Table 10 High-numbered self test codes (continued)

518	"PCIe switch fabric chips loaded with unexpected Revision. Reinstall PCIe Switch Fabric."
519	"One or more chassis temperatures operating outside valid range."
520	"Chassis temperature sensor 1 operating outside valid range."
521	"Chassis temperature sensor 2 operating outside valid range."
522	"Chassis temperature sensor 3 operating outside valid range."
523	"Chassis temperature sensor 4 operating outside valid range."
524	"Chassis temperature sensor 5 operating outside valid range."
525	"Chassis temperature sensor 6 operating outside valid range."
526	"Chassis temperature sensor 7 operating outside valid range."
527	"Chassis temperature sensor 8 operating outside valid range."
528	"One or more voltage rails operating outside valid range."
529	"3.3V voltage rail operating outside valid range."
530	"5V voltage rail operating outside valid range."
531	"-12V voltage rail operating outside valid range."
532	"+12V voltage rail operating outside valid range."
533	"5V auxiliary voltage supply operating outside valid range."
534	"Non-volatile self test memory cache size is invalid. Cache repaired, please rerun self test to validate repair."
535	"Non-volatile self test memory cache checksum failure. Cache repaired, please rerun self test to validate repair."
536	"Non-volatile self test memory problem required re-initializing the memory."
537	"Error detected during PCIe Switch Fabric configuration. Base (factory default) PCIe Switch Fabric was re-selected."
538	"Load Base Configuration Pushbutton press was latched. Power cycle chassis to clear latch, and then reboot the system controller."
539	"Currently loaded PCIe Switch Fabric has no revision information."
540	"Chassis Manager operating on backup (read-only) firmware image. DIP switch 1 is flipped to on."
541	Known chassis NV memory access issue, you must power cycle to restore proper chassis operation.
542	M9018B is self identifying as an M9018A. Fix by running PCIe Switch Fabric Configuration utility.
543	Previous firmware update on Chassis Manager Firmware is not complete, please rerun firmware update again to complete the operation.

Table 10 High-numbered self test codes (continued)

544	Previous firmware update on Chassis Manager Firmware is not complete, please rerun firmware update again to complete the operation.
545	Previous firmware update on Chassis Manager Firmware is not complete, please rerun firmware update again to complete the operation.
546	Previous firmware update on PCIe Switches is not complete, please rerun firmware update again to complete the operation.
547	Previous firmware update on Trigger CPLD is not complete, please rerun firmware update again to complete the operation.
548	Error found while reading dirty byte.
549	Chassis Manager operating on Gen 1 fabric switch image. DIP switch 2 is flipped to on.
550	Monitor Process Software is operating on backup (read-only) firmware image. See Keysight Technical Support.
999	"Too many self-test codes generated, aborting."

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