Keysight M9393A PXIe Performance Vector Signal Analyzer

![Keysight Technologies logo]

KEYSIGHT
TECHNOLOGIES

Notices

Copyright Notices

Manual Part Number

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Regulatory Compliance

This product has been designed and tested in accordance with accepted industry standards, and has been supplied in a safe condition. To review the Declaration of Conformity, go to http://www.keysight.com/go/conformity

Warranty

Technology Licenses

U.S. Government Rights

Safety Notices

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like 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 notice denotes a hazard. It calls attention to an operating procedure, practice, or the like 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.

The following safety precautions should be observed before using this product and any associated instrumentation. This product is intended for use by qualified personnel who recognize

shock hazards and are familiar with the safety precautions required to avoid possible injury. Read and follow all installation, operation, and maintenance information carefully before using the product.

If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.

The types of product users are:

- Responsible body is the individual or group responsible for the use and maintenance of equipment, for ensuring that the equipment is operated within its specifications and operating limits, and for ensuring operators are adequately trained.
- Operators use the product for its intended function. They must be trained in electrical safety procedures and proper use of the instrument.They must be protected from electric shock and contact with hazardous live circuits.
- Maintenance personnel perform routine procedures on the product to keep it operating properly (for example, setting the line voltage or replacing consumable materials). Maintenance procedures are described in the user documentation.The procedures explicitly state if the operator may perform them. Otherwise,they should be performed only by service personnel.
- Service personnel are trained to work on live circuits, perform safe installations, and repair products.Only properly trained service personnel may perform installation and service procedures.

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 lifespans, 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 chassis.

Keysight products are designed for use with electrical signals that are rated Measurement Category I and Measurement Category II, as described in the International Electro-technical Commission (IEC) Standard IEC 60664. Most measurement, control, and data I/O signals are Measurement Category I and must not be directly connected to mains voltage or to voltage sources with high transient over-voltages. Measurement Category II connections require protection for high transient over-voltages often associated with local AC mains connections.Assume all measurement, control, and data I/O connections are for connection to Category I sources unless otherwise marked or described in the user documentation.

Exercise extreme caution when a shock hazard is present. Lethal voltage may be present on cable connector jacks or test fixtures. The American National Standards Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30V RMS, 42.4V peak, or 60VDC are present. A good safety practice is to expect that hazardous voltage is present in any unknown circuit before measuring.

Operators of this product must be protected from electric shock at all times. The responsible body must ensure that operators are prevented access and/or insulated from every connection point. In some cases, connections must be exposed to potential human contact. Product operators in these circumstances must be trained to protect themselves from the risk of electric shock. If the circuit is capable of operating at or above 1000V,

no conductive part of the circuit may be exposed.

Do not connect switching cards directly to unlimited power circuits. They are intended to be used with impedance-limited sources. NEVER connect switching cards directly to AC mains. When connecting sources to switching cards, install protective devices to limit fault current and voltage to the card.

Before operating an instrument, ensure that the line cord is connected to a properly grounded power receptacle. Inspect the connecting cables, test leads, and jumpers for possible wear, cracks, or breaks before each use.

When installing equipment where access to the main power cord is restricted, such as rack mounting, a separate main input power disconnect device must be provided in close proximity to the equipment and within easy reach of the operator.

For maximum safety, do not touch the product, test cables, or any other instruments while power is applied to the circuit under test. ALWAYS remove power from the entire test system and discharge any capacitors before: connecting or disconnecting cables or jumpers, installing or removing switching cards, or making internal changes, such as installing or removing jumpers.

Do not touch any object that could provide a current path to the common side of the circuit under test or power line (earth) ground. Always make measurements with dry hands while standing on a dry, insulated surface capable of withstanding the voltage being measured.

The instrument and accessories must be used in accordance with its specifications and operating instructions, or the safety of the equipment may be impaired.

Do not exceed the maximum signal levels of the instruments and accessories, as defined in the specifications and operating information,and as shown on the instrument or test fixture panels, or switching card.

When fuses are used in a product, replace with the same type and rating for continued protection against fire hazard.

Chassis connections must only be used as shield connections for measuring circuits, NOT as safety earth ground connections.

If you are using a test fixture, keep the lid closed while power is applied to the device under test. Safe operation requires the use of a lid interlock.

Instrumentation and accessories shall not be connected to humans.

Before performing any maintenance, disconnect the line cord and all test cables.

To maintain protection from electric shock and fire, replacement components in mains circuits - including the power transformer, test leads, and input jacks - must be purchased from Keysight. Standard fuses with applicable national safety approvals may be used if the rating and type are the same. Other components that are not safety related may be purchased from other suppliers as long as they are equivalent to the original component (note that selected parts should be purchased only through Keysight to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call an Keysight office for information.

<div style="background:red; color:white; font-weight:bold; display:inline-block; padding:4px;">WARNING</div>

No operator serviceable parts inside.Refer servicing to qualified personnel. To prevent electrical shock do not remove covers. For continued protection against fire hazard, replace fuse with same type and rating.

PRODUCT MARKINGS:

The CE mark is a registered trademark of the European Community.

Australian Communication and Media Authority mark to indicate regulatory compliance as a registered supplier.

**ICES/NMB-001
ISM GRP.1 CLASS A**

This symbol indicates product compliance with the Canadian Interference-Causing Equipment Standard (ICES-001). It also identifies the product is an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 4).

KCC-REM-KST-BLMxxxxx

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.

A 급 기기 (업무용 방송통신기자재)
이 기기는 업무용 (A 급) 전자파적합기
기로서 판 매자 또는 사용자는 이 점을 주
의하시기 바라 며 , 가정외의 지역에서
사용하는 것을 목적으 로 합니다.

This product complies with the WEEE Directive marketing requirement. The affixed product label (above) 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 "Monitoring and Control instrumentation" product. Do not dispose in domestic household waste. To return unwanted products, contact your local Keysight office, or for more information see http://about. keysight.com/en/companyinfo/environment /takeback.shtml

This symbol indicates the instrument is sensitive to electrostatic discharge (ESD). ESD can damage the highly sensitive components in your instrument. ESD damage is most likely to occur as the module is being installed or when cables are connected or disconnected. Protect the circuits from ESD damage by wearing a grounding strap that provides a high resistance path to ground. Alternatively, ground yourself to discharge any builtup static charge by touching the outer shell of any grounded instrument chassis before touching the port connectors.

This symbol on an instrument means caution, risk of danger. You should refer to the operating instructions located in the user documentation in all cases where the symbol is marked on the instrument.

This symbol indicates 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 the product.

Contents

Keysight M9393A PXIe Performance Vector Signal Analyzer

M9393A Introduction

The scope of this Startup Guide is to detail the processes of receiving and installing the modules and cables that compose the Keysight M9393A PXIe Performance Vector Signal Analyzer. Additionally, installing the required software is documented. If you have any questions after reviewing this information, please contact your local Keysight Technologies Inc. representative or contact us through our website at www.keysight.com/find/M9393A.

> **NOTE** Keysight Technologies is changing the color of the front panel of its products. During the transition to new colors, you might receive modules that do not match the pictures in the documentation. These products work the same as they did before the color change and no action is required.

Follow the Startup Sequence

> **WARNING** Closely follow the startup process flow in this document. Deviating from the sequence can cause unpredictable system behavior, damage your system, and may cause personal injury.

Step 1: Unpack, Inspect, and Verify Shipment

Step 2: Download the latest version of Startup Guide

Step 3: Install Module

Step 4: Install Drivers and Software

Step 5: Verify Operation with the Soft Front Panel (SFP)

Step 6: Make a Measurement

Step 7: Installation Complete.
Proceed to program your product through the API.
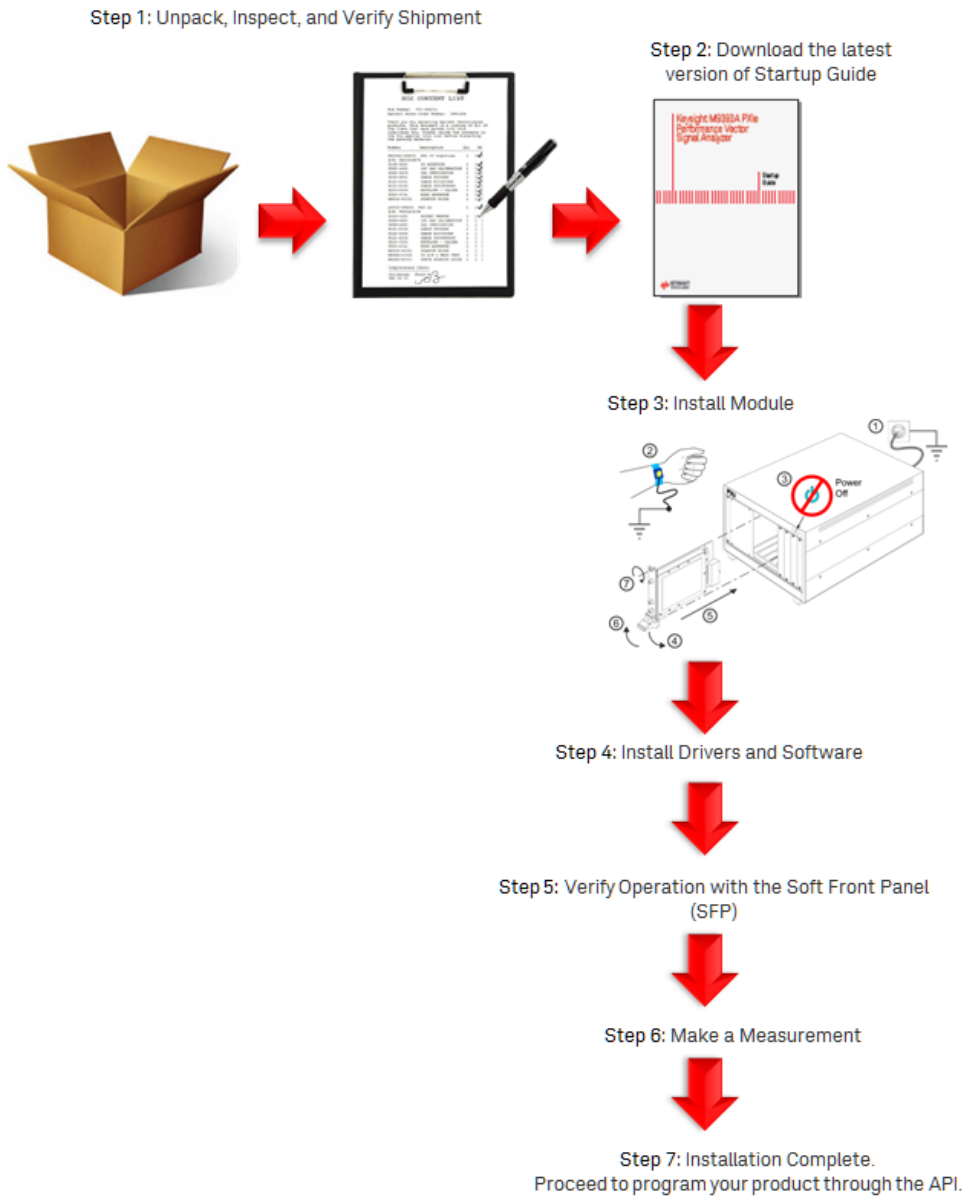
Related Documentation

To access documentation related to the Keysight M9393A PXIe Performance Vector Signal Analyzer, use one of the following methods:

- If the product software is installed on your PC, the related documents are also available in the software installation directory. Refer the table below.

Document	Description	Default Location on 64-bit Windows system	Format
Startup Guide	Includes procedures to help you to unpack, inspect, install (software and hardware), perform instrument connections, verify operability, and troubleshoot your product. Also includes an annotated block diagram.	C:\Program Files (x86)\Keysight\M9393\Help\M9393_StartupGuide.pdf	PDF
Programming Guide	Shows you how to use Visual Studio 2010 with the .NET Framework to write IVI-COM Console Applications in Visual C#.	C:\Program Files (x86)\Keysight\M9393\Help\M9393_ProgrammingGuide.pdf	PDF
IVI Driver reference (help system)	Provides detailed documentation of the IVI-COM and IVI-C driver API functions, as well as information to help you get started with using the IVI drivers in your application development environment.	C:\Program Files (x86)\Keysight\M9393\Help\AgM9393.chm	CHM (Microsoft Help Format)

Document	Description	Default Location on 64-bit Windows system	Format
Soft Front Panel (SFP) help system	Provides product introduction, tour of the SFP user interface, how-to procedures (for example, configuration, self test, operational check), and troubleshooting.	C:\Program Files (x86) \Keysight\M9393\Help\M9393_SFP_Help.chm	CHM (Microsoft Help Format)
Data Sheet	In addition to a detailed product introduction, the data sheet supplies full product specifications.	C:\Program Files (x86) \Keysight\M9393\Help\M9393_DataSheet.pdf	PDF
LabVIEW Driver Reference	Provides detailed documentation of the LabVIEW G Driver API functions.	C:\Program Files (x86) \Keysight\M9393\Help\AgM9393_LabVIEW_Help.chm	CHM (Microsoft Help Format)
Software Release Notes	Includes recent changes, enhancements, and bug fixes in the current release.	C:\Program Files (x86) \Keysight\M9393\Help\M9393_SoftwareReleaseNotes. pdf	PDF

NOTE Alternatively, you can find these documents under: *Start > All Programs > Keysight > M9393.*

- To understand the available user documentation in context to your workflow, click here.
- To find the very latest versions of the user documentation, go to the product web site (www.keysight.com/find/M9393A) and download the files from the Manuals support page (go to Document Library > Manuals):
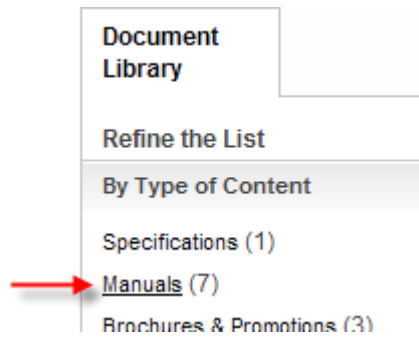
> **NOTE** Depending upon your order, you may find the following product documentation useful.

Additional Related Documentation

Document	Description	Location
PXIe Chassis Startup Guide	Provides installation and startup information for the Keysight PXIe Chassis.	www.keysight.com /find/pxie-chassis
M9036A PXIe Embedded Controller Startup Guide (optional)	Provides installation and startup information for the M9036A PXIe Embedded Controller.	www.keysight.com /find/M9036A
M9037A PXIe Embedded Controller Startup Guide (optional)	Provides unpacking, installation and beginning usage information for the M9037A PXIe Embedded Controller.	www.keysight.com /find/M9037A
M9021A PCIe Cable Interface Module Installation Guide (optional)	Provides installation details for the M9021A Gen 2, x8 PCIe cable interface module.	www.keysight.com /find/M9021A
Multiple PXIe and AXIe Chassis System Configuration Tool	This interactive tool helps you to configure and install PXIe and AXIe multiple chassis systems.	www.keysight.com /find/pxie- multichassis
M9381A PXIe Vector Signal Generator Documents	Provides Startup, LabVIEW Driver, and Data sheet information of M9381 PXIe Vector Signal Generator.	www.keysight.com /find/M9381
M9169E PXIe Switchable-Input Programmable Step Attenuator Module Documents	Provide Technical Overview document and Service Guide.	http://www. keysight.com/find /M9169E

Documentation Access

Access to all DOCUMENTATION noted below
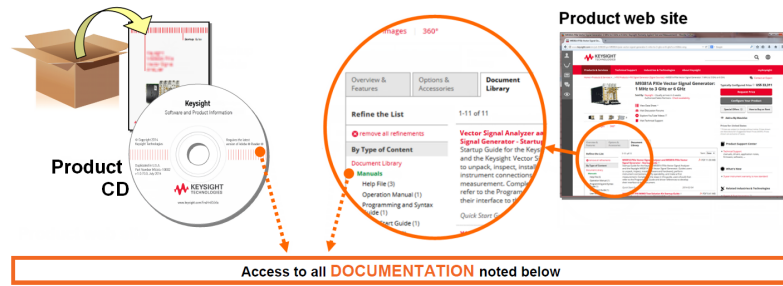
Startup Guide
- Unpack product
- Verify shipment
- Install software
- Install hardware
- Verify operation
- Troubleshooting

Data Sheet
- Product description
- Technical specifications

Programming Guide
- Product intro
- Programming Procedures
- Sample Programs

Soft Front Panel (SFP) user interface
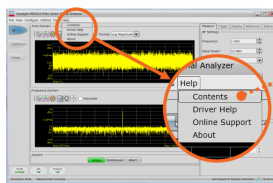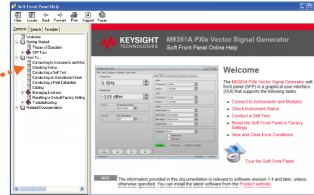
SFP help system
- Theory of operation
- Block diagram
- Configuration
- Self test
- Operational check
- Field calibration
- Troubleshooting

Visual Studio
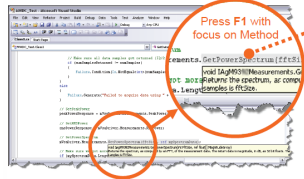
IVI Driver help system
- IVI-COM and IVI-C driver reference
- Sample programs

LabVIEW
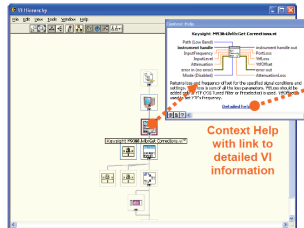
LabVIEW Driver help system
- LabVIEW driver reference
- Sample programs
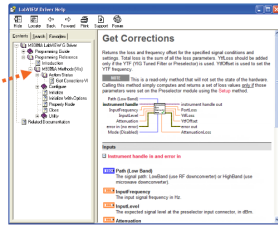
Items You Will Need

To complete the startup process and begin using the instrument, you will need the following items:

- Pozidriv P1 or slotted screwdriver to secure the modules into the chassis.
- Adjustable torque wrench (at minimum, accommodate an 8 Lb-In [0.904 Nm] torque on SMA connectors).

- If your configuration contains an embedded controller, such as the M9036A or M9037A:

    - Monitor with M9036A - Use the DVI-to-VGA adaptor (an accessory to the M9036A) if necessary

    - Monitor with M9037A - Use the Display Port to VGA adaptor (an accessory to the M9037A) if necessary

    - USB compatible keyboard

    - USB compatible mouse

- A USB flash drive. Download the installer files to a computer, transfer the installer files to a USB flash drive, and install the software from the USB flash drive.

- A high-quality SMA (male) to SMA (male) cable at least 10 inches (25.4 cm) long. This cable is used in Step 6: Make a Measurement. If you are using a signal generator other than the Keysight M9381A PXIe Vector Signal Generator the cable end at the signal generator RF Output may be different.

Step 1: Unpack, Inspect, and Verify Shipment

Unpack and Inspect the Modules

CAUTION   The modules are shipped in materials which prevent damage from static. The module should only be removed from the packaging in an anti-static area ensuring that correct anti-static precautions are taken. Store all modules in anti-static envelopes when not in use.

ESD
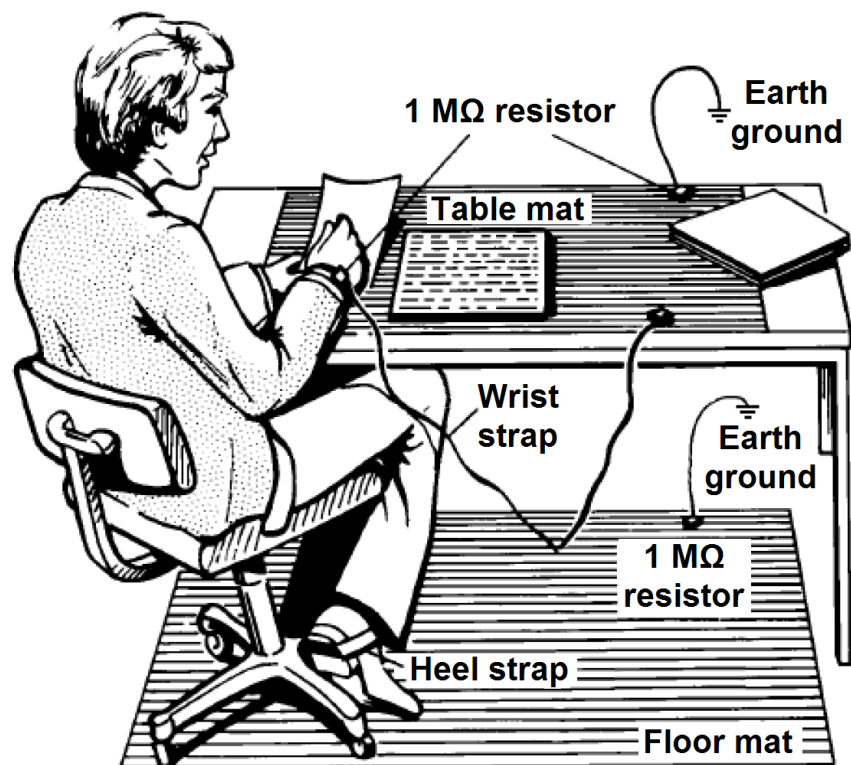
Electrostatic discharge (ESD) can damage or destroy electronic components. Use a static-safe work station to perform all work on electronic assemblies. The figure (left) shows a static-safe work station using two types of ESD protection: conductive table-mat and wrist-strap combination, and conductive 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.

Inspect for Damage

After unpacking an instrument, inspect it for any shipping damage. Report any damage to the shipping agent immediately, as such damage is not covered by the warranty (see warranty information at beginning of this document).

CAUTION   To avoid damage when handling a module, do not touch exposed connector pins.

NOTE   See www.keysight.com/find/tips for information on preventing damage to your Keysight equipment.

Return an Instrument for Service

Should it become necessary to return an instrument for repair or service, follow the steps below:

NOTE   All component modules for an M9380A, M9381A, M9391A, or M9393A instrument are factory tested, aligned, calibrated and shipped as a "bundle". It is important that you maintain the bundle when installing modules or returning an instrument for repair.

1. Review the warranty information shipped with your product.

2. Contact Keysight to obtain a Return Material Authorization (RMA) and return address. For assistance finding contact information, go to www.keysight.com /find/assist.

3. Write the following information on a tag and attach it to the malfunctioning equipment:

   a. Name and address of owner. A P.O. box is not acceptable as a return address.

   b. Description of failure or service required.

4. Pack the instrument in its original packaging. Include all cables. If the original packaging material is not available, use anti-static bubble wrap or packing peanuts and place the instrument in a sealed container and mark the container "FRAGILE".

5. On the shipping label, write ATTENTION REPAIR DEPARTMENT and the RMA number.

NOTE   In your correspondence, refer to the modules by serial number and the instrument by model number.

Verify M9393A Shipment Contents and Model Options

The Keysight M9393A PXIe Performance Vector Signal Analyzer is housed in a PXIe chassis. The minimum Vector Signal Analyzer consists of the software, chassis, a Keysight M9365A PXIe Downconverter, a Keysight M9214A PXIe IF Digitizer, a Keysight M9308A PXIe Synthesizer, and optionally a Keysight M9300A PXIe Frequency Reference. The M9300A may be used in this and other configurations. You may also configure the Keysight M9380A PXIe CW Source, the Keysight M9381A PXIe Vector Signal Generator and the Keysight M9391A PXIe Vector Signal Analyzer in the same chassis and also use the same. The M9169E Programmable Attenuator module is recommended for configuration for frequency extension (3.6 GHz to 50 GHz).

Qty	Keysight Part Number	Description
1	M9393-90013	Keysight M9393A PXIe Performance Vector Signal Analyzer Flyer
1	5023-1450	Wrench, socket,extension, 5/16 inch, SMA
1	5002-3361	Cable removal tool, SMB/SMP/MMCX
1	5972-3335	PXI Modular Product Startup Quick Reference
1	5061-7383	South Korean Class A EMC Declaration
1	9320-6698	China RoHS Addendum for Vector Signal Analyzer
1	M9300A	Keysight M9300A PXIe Frequency Reference Option M9393A-300
1	M9308A	Keysight M9308A PXIe Synthesizer
1	M9365A	Keysight M9365A PXIe Downconverter
1	M9214A	Keysight M9214A PXIe IF Digitizer
1	1250-3807	Adapter, T-type, SMB (male) - SMB (male) - SMB (female)
1	8121-2063	Cable, coaxial, BNC (male) - SMB (female) 1200 mm
1	8120-5091	Cable, coaxial, SMB (female) - SMB (female) 120 mm
1	8121-2169	Cable, coaxial, SMB (female) - SMB (female) 165 mm
1	8121-2174	Cable, coaxial SMB (female) - SMB (female) 255 mm

Qty	Keysight Part Number	Description
1	8121-2723	Cable, coaxial, SMB (female) - SMP (female) 150 mm
1	8121-2554	Cable, coaxial, SMP (female) - SMP (female) 150 mm
1	8121-2636	Cable, coaxial, SMB (female) - SMP (female) 240 mm
1	M9365-20039	Cable, semi-rigid, SMA (male) - SMA (male)
1	M9365-20040	Cable, semi-rigid, SMA (male) - SMP (male)

> **NOTE** The product software and documents are available for downloading at the Keysight M9393A PXIe Performance Vector Signal Analyzer website at www.keysight.com/find/M9393A.

> **NOTE** The M9169E Programmable Attenuator needs to be ordered separately for extended frequency mode.

The following cables have been included for extended frequency range operation (options M9393A-FRX and M9393A-FRZ) .

Qty	Keysight Part Number	Description
1	M9393-20001	Cable, semi-rigid, SMA (male) - SMA (male)
1	M9393-20002	Cable, semi-rigid, SMA (male) - SMA (male)
1	M9393-20003	Cable, semi-rigid, SMA (male) - SMA (male)

Model – Option List for M9393A

M9393A Option	Description
M9393A	PXIe Vector Signal Analyzer - comprised of: M9308A PXIe Synthesizer, M9365A PXIe Downconverter and M9214A PXIe IF Digitizer
M9393A-300	Adds M9300A PXIe Frequency Reference (required for warranted specifications)
M9393A-F08	Frequency range, 9 kHz to 8.4 GHz

M9393A Option	Description
M9393A-F14	Frequency range, 9 kHz to 14 GHz
M9393A-F18	Frequency range, 9 kHz to 18 GHz
M9393A-F27	Frequency range, 9 kHz to 27 GHz
M9393A-FRX*	Frequency range extension, 3.6 GHz to 50 GHz
M9393A-B04	Analysis bandwidth, 40 MHz
M9393A-B10	Analysis bandwidth, 100 MHz
M9393A-B16	Analysis bandwidth, 160 MHz
M9393A-WB1	Wideband IF output
M9393A-M01	Memory, 128 MSa
M9393A-M05	Memory, 512 MSa
M9393A-M10	Memory, 1024 MSa
M9393A-P08	Preamplifier, 8.4 GHz
M9393A-P14	Preamplifier, 14 GHz
M9393A-P18	Preamplifier, 18 GHz
	Preamplifier, 27 GHz

Keysight M9393A PXIe Performance Vector Signal Analyzer

M9393A Option	Description
M9393A-P27	
M9393A-UNZ	Fast tuning
M9393A-UK6	Commercial calibration certificate with test data

* Option M9393A-FRX requires option M9393A-F27. M9393A-FRX is subject to US export restriction. For customers in export restricted countries, option M9393A-FRZ frequency range extension, 3.6 GHz to 43.5 GHz, is available.

Step 2: Download the Latest Documentation

Ensure that you have the latest version of this document, the M9393A Startup Guide. Download this and other M9393A documents from http://www.keysight.com/find/M9393A-techsupport.

Step 3: Install the PXIe Modules

Proceed through this section in the following order:

1. Review Before Installing PXIe Modules to understand installation guidelines and precautions.
2. Prepare the PXIe chassis for the installation process.
3. Install the controller (embedded or external).
4. Install the modules.
5. Cable the instruments.
6. Install slot blockers and filler panels in the empty PXIe chassis slots.
7. Power up the chassis.

Before Installing the PXIe Modules

Precautions

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

> **NOTE** All component modules for an M9381A, M9391A or M9393A instrument are factory tested, aligned, calibrated and shipped as a "bundle". It is important that you maintain the bundle when installing modules or returning an instrument for repair.

Best Practices

The following are the recommended best practices to ensure proper and safe module operating conditions:

- Ensure proper chassis air flow is maintained.
- Select a chassis that provides thermal protection if fans become inoperable or forced air cooling is obstructed.
- Use slot blockers (Keysight model Y1212A, 5 per kit) and EMC filler panels in empty module slots to ensure proper operating temperatures. Keysight chassis and slot blockers optimize module temperature performance and reliability of test.
- Set chassis fans to high or auto. Do not disable fans.
- Position chassis to allow plenty of space around chassis air intake and fan exhaust.
- At environment temperatures above 45 °C, set chassis fan speed to high.

Chassis Air Flow

Air Intake   Fan Exhaust

The Keysight chassis has multilple air intakes. They are located at the lower sides, lower front and bottom of the chassis.

Cable and Connector Care

When you need to disconnect push-on cables from the module front panel connectors, use the Keysight Cable Removal Tool (PN 5002-3361) provided in your Keysight PXIe instrument's ship kit.

To avoid damage to the cables or connectors, pull the cable straight away from the connector. Do not use the tool as a pry bar.

Prepare the PXIe Chassis

1. Make sure that the line cord is plugged into a grounded outlet to establish earth ground.
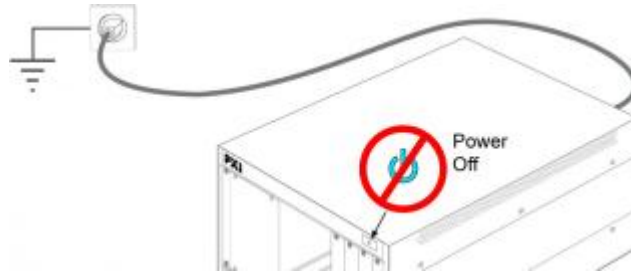
2. Make sure the chassis power switch is Off.

3. If the chassis has multiple fan speed settings, ensure that the fan switch is set to AUTO and the inhibit switch is set to DEF.

4. Position the chassis to provide ample space between the chassis fan intake and exhaust vents. Blockage by walls or obstructions affects the air flow needed for cooling.

5. 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.

6. Make sure the PXIe chassis fans are operable and free of dust and other contaminants that may restrict airflow.

For additional information about setting up the Keysight PXIe chassis, refer to the respective chassis documentation and the getting started video at http://youtu.be /Yr1OK2_tbLE.

Install the Controller

Use the appropriate instructions below for installing the embedded controller (Keysight models M9036A or M9037A) or remote controller (Keysight M9021A Cable Interface with M9045B adapter for laptop PC or M9048A adapter for desktop PC).

CAUTION   Do not power up the controller until instructed to do so later in this document.

Embedded Controller
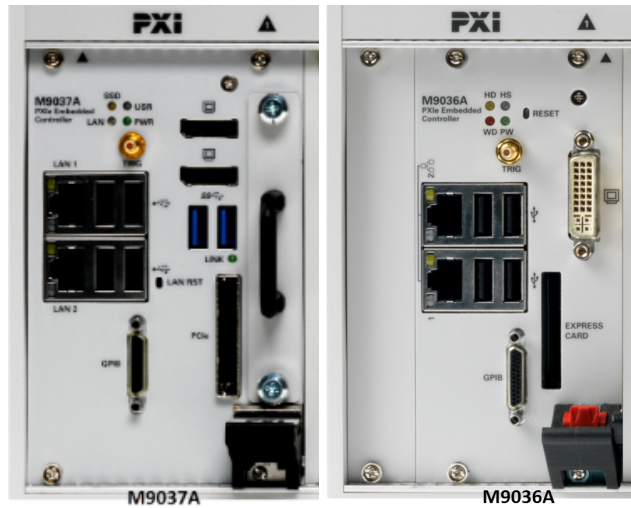
M9037A M9036A

If your configuration contains a Keysight M9036A or M9037A Embedded Controller, follow the procedure below.

(For additional detail, refer to instructions in the M9036A Startup Guide or the M9037A Startup Guide.)

1. Remove the M9036A or M9037A module from its ESD protective bag. Observe ESD precautions.

2. Install the embedded controller in Slot 1 (see ▲1 icon above the slot) in the chassis.
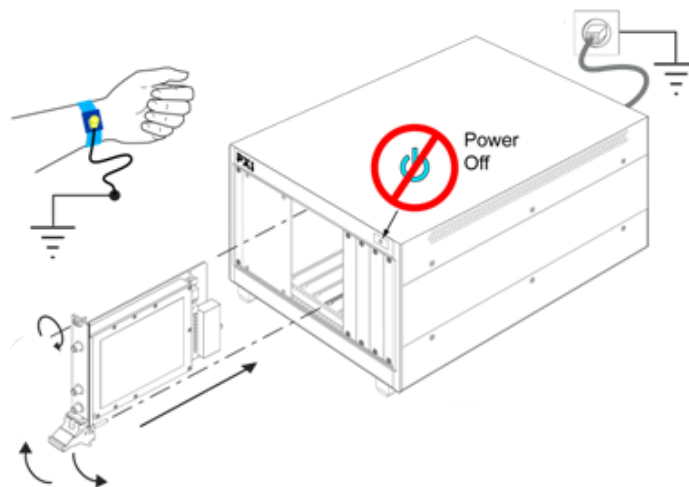
NOTE   Generic module installation shown. It may reflect your module's actual size and chassis placement.

a. While holding the module by the injector/ejector handle and making sure the injector/ejector handle is pushed down in the unlatched (downward) position, slide the controller module into chassis, using the slot guides (top and bottom).

b. Sliding the module into position, when you begin to feel resistance, pull up on the injector/ejector handle to fully inject the module into the chassis backplane connectors.

c. Tighten the module retaining screws (top and bottom) and torque them to 5 Lb-In (0.57 N-m).

3. If you have an M9036A or M9037A controller, install a blank Y1213A filler panel in the empty slot to the left of the controller.

4. Connect peripherals (mouse, keyboard, and monitor).

Remote Controller

If your configuration contains a Keysight M9021A Cable Interface Module, follow the procedure below. For additional information about installing the M9021A, refer to the M9021A Installation Guide or the getting started video at http://youtu.be /Yr1OK2_tbLE.

> **NOTE** The following procedure addresses using the M9021A as a cabled PCIe interface between the Keysight PXIe chassis and an external host computer. However, if you intend to use an M9021A module to control a subordinate downstream chassis or RAID configuration:
>
> - Install the M9021A in an x8 hybrid slot in the PXIe chassis (Keysight chassis slots 2, 6, 11, or 15).
>
> - Reverse the switch settings from those noted in this procedure: On the M9021A module, set both S301 switches to "Host" and set the S201 rocker switch to the left-hand position. On the chassis backplane, set the controller slot power-supply switch to the left.

1. Locate slot 1 in the chassis. It has the icon ( ) above it.

2. Set the chassis controller slot power supply switch to the right-hand position. This provides power to slot 1 for the benefit of the M9021A card.

Slide this switch to the right to power the M9021A Cable Interface Module
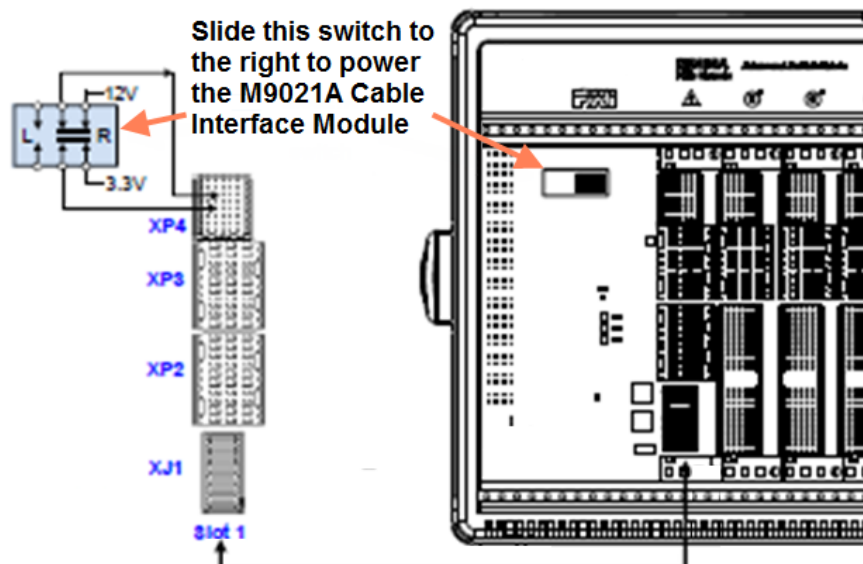
3. Remove the M9021A module from its protect bag. Observe ESD precautions.

4. On the M9021A module, set both S301 switches to the "Host" (right-hand) position and set the S201 rocker switch to the left-hand position. Refer to the following figure for M9021A switch locations and positions.
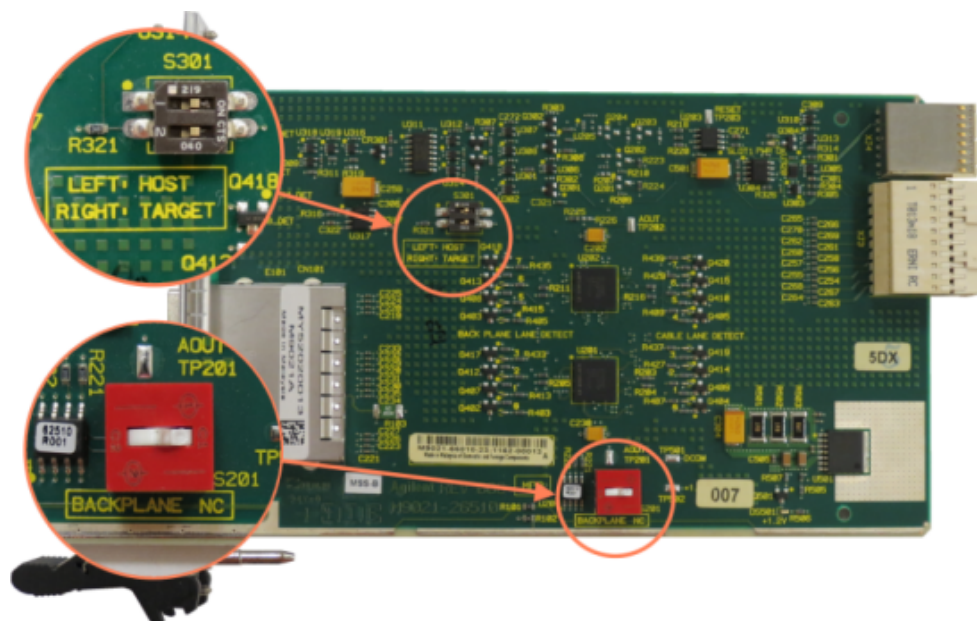
5. Install the M9021A Cable Interface Module into the chassis:

   a. While holding the module by the injector/ejector handle and making sure the injector/ejector handle is pushed down in the unlatched (downward) position, slide the M9021A module into chassis, using the slot guides (top and bottom).

   b. Sliding the module into position, when you begin to feel resistance, pull up on the injector/ejector handle to fully inject the module into the chassis backplane connectors.

c. Tighten the module retaining screws (top and bottom) and torque them to 5 Lb-In (0.57 N-m).

6. Connect the M9021A to your laptop or desktop PC.

   a. If you are using a laptop as a controller, connect to your M9021A using the following components:

   M9045B PCIe ExpressCard adaptor: Gen 1 → Y1200B PCIe cable: x4 to x8 2.0 m → M9021A PXIe cable interface
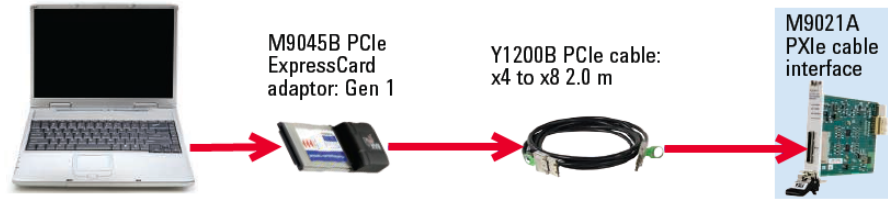
   b. If you are using a desktop PC as a controller, connect to the M9021A using the following components:

   M9048A PCIe adaptor → Y1202A PCIe cable → M9021A PXIe cable interface
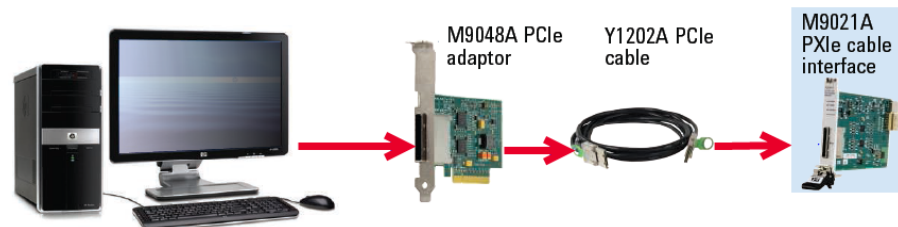
Install the PXIe Modules

Recommended Module Positions in Chassis Slots

Keep in mind the following points while installing the modules in the slots of Keysight PXIe Chassis:

- Place the M9214A IF Digitizer in an x8 slot (slot 6) for optimum performance. Slots 2, 11, and 15 are also x8 slots. For further details on x8 slots, see www.keysight.com/find/pxie-chassis.

- Place the M9300A Reference in Slot 10 (the timing slot).

- The M9308A Synthesizer must be adjacent to (and to the left of) the M9365A Downconverter.

- To extend the frequency range to 50 GHz, it is recommended to use the M9169E Programmable Attenuator module to provide range control for higher power signals up to +30 dBm and automated field alignments and self-test. The M9169E Programmable Attenuator module occupies two slots and must be installed adjacent to and to the right of the M9365A Downconverter module. Suggested configurations are as follows to maintain M9214A in x8 slot and M9300A in timing slot:

Slot Number		Module
Config. A	Config. B	
2	11	M9214A
3	12	M9308A
4-5	13-14	M9365A
6-7	15-16	M9169E
10	10	M9300A

- The M9393A wideband IF output can be directly accessed for up to 800 MHz of bandwidth by bypassing the IF Conditioning/Filtering path of the M9365A Downconverter module and installing an external digitizer, such as M9202A to sample the wider bandwidth IF signal. The wideband digitizer, M9202A, must be installed in an x8 slot of the Keysight chassis. The M9214A Digitizer, which has a maximum of 160 MHz bandwidth, is bypassed in the suggested configuration, but must remain installed in the chassis.

- The images below show the recommended slot usage for multi-channel chassis.

Two instruments in a Keysight chassis
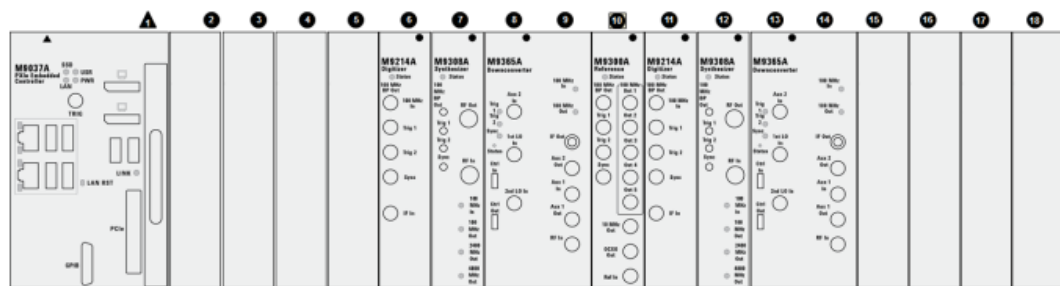
Three instruments in a Keysight chassis
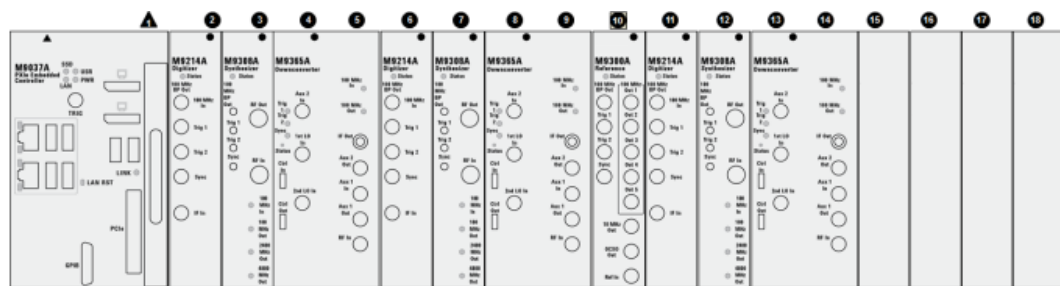
Four instruments in a Keysight chassis
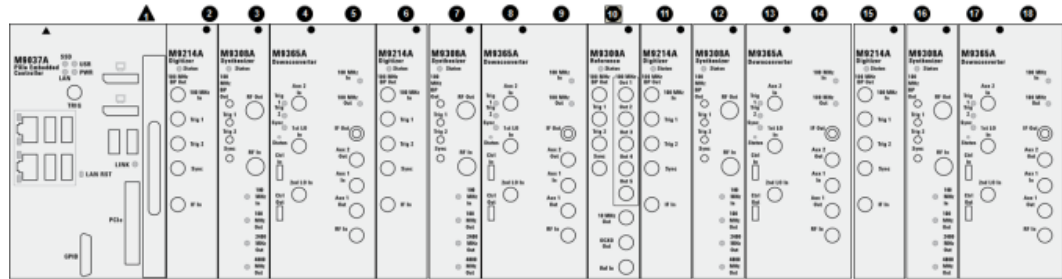
Procedure for Installing Modules

Plan your module positions. Install the left-most module first and then continue installing modules from left to right according to the following photo.

When installing each module:

1. While holding the module by the injector/ejector handle and making sure the injector/ejector handle is pushed down in the unlatched (downward) position, slide the module into chassis, using the slot guides (top and bottom).

2. Sliding the module into position, when you begin to feel resistance, pull up on the injector/ejector handle to fully inject the module into the chassis backplane connectors.

3. Tighten the module retaining screws (top and bottom) and torque them to 5 Lb-In (0.57 N–m).
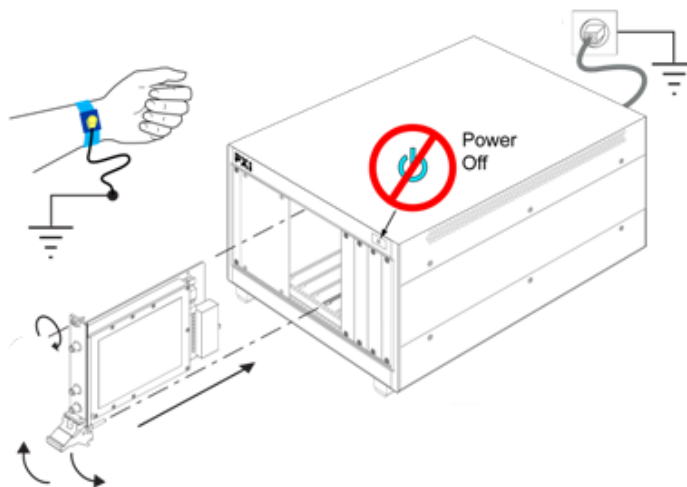
NOTE	Generic module installation shown. It may reflect your module's actual size and chassis placement.

Important: Install the modules in the exact order.

Cable the Instruments

Cabling Introduction

Before you cable the modules, see the following links for the front panel descriptions of the modules:

- M9300A module: see M9300A Front Panel Connectors
- M9308A module: see M9308A Front Panel Connectors
- M9365A module: see M9365A Front Panel Connectors
- M9214A module: see M9214A Front Panel Connectors

The images below show the recommended cabling arrangement for M9393A in a Keysight PXIe chassis.

Single instrument in a Keysight chassis
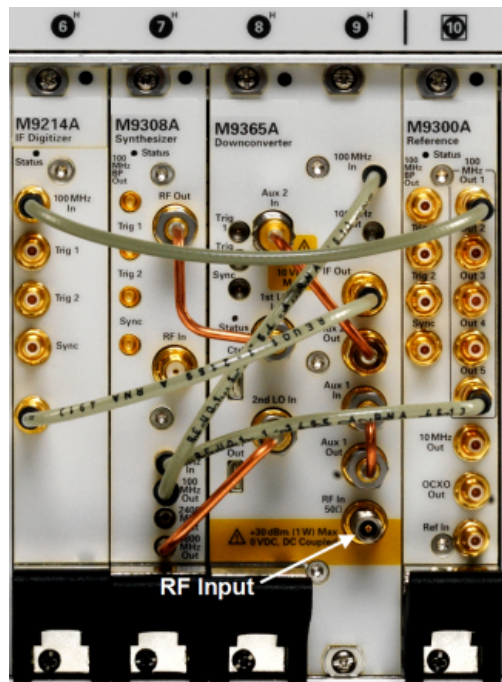
Single instrument with tee in a Keysight chassis
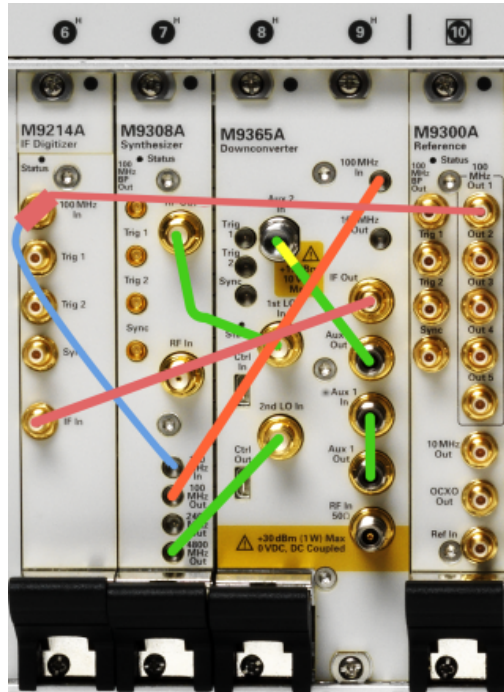
In the images above, you see two different routings of the 100 MHz Reference signal. The cabling on the left can be used for up to three M9393A instruments in one chassis. If you choose to install four M9393A instruments in one chassis, you may share the 100 MHz signal by using a tee at the 100 MHz In connector of the M9214A. The image below show the recommended distribution of the 100 MHz reference for multi-channel chassis. For the recommended slot usage for multi-channel chassis, refer to Install the PXIe Modules.
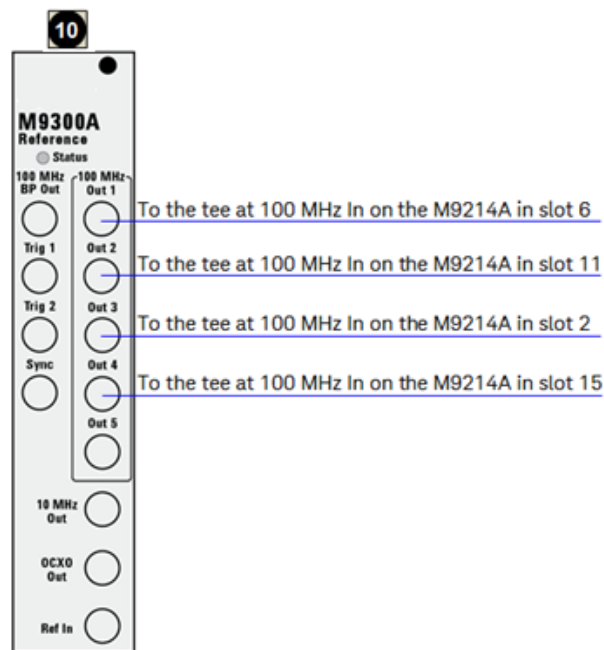
M9393A Cable and Module Table (Listed in the recommended installation order)

Part Number	Connection	Cable Description
M9365-20039	M9308A RF Out to M9365A 1st LO In	Cable, semi-rigid, SMA (male) - SMA (male)
M9365-20040	M9308A 4800 MHz Out to M9365A 2nd LO In	Cable, semi-rigid, SMA (male) - SMP (male)
1250-3807	M9214A 100 MHz In, left side of Tee to M9300A 100 MHz Out, right side to M9308A 100 MHz In	Adapter, T-type, SMB (male) - SMB (male) - SMB (female)
8121-2174	M9300A 100 MHz Out to M9214A 100 MHz In	Cable, coaxial, SMB (female) - SMB (female) 255 mm
8121-2169	M9365A IF Out to M9214A IF In	Cable, coaxial, SMB (female) - SMB (female) 165 mm
8121-2723	M9300A 100 MHz Out to M9308A 100 MHz In	Cable, coaxial, SMB (female) - SMP (female) 150 mm
8121-2554	M9308A 100 MHz Out to M9365A 100 MHz In	Cable, coaxial, SMP (female) - SMP (female) 150 mm
M9365-20042	M9365A Aux 2 Out to M9365A Aux 2 In	Cable, semi-rigid, SMA (male) - SMA (male) installed
M9365-20043	M9365A Aux 1 Out to M9365A Aux In	Cable, semi-rigid, SMA (male) - SMA (male) installed
8120-5091	Alternate for 8121-2175	Cable, coaxial, SMB (female) - SMB (female) 120 mm
8121-2636	Alternate for 8121-2495	Cable, coaxial, SMB (female) - SMP (female) 240 mm
8121-2063*	This cable can be used to direct an external reference into the M9300A Ref In connector.	Cable, coaxial, BNC (male) - SMB (female) 1200 mm

* This component is not shown in the cabling diagram, but is included in the M9393A shipment.

Cabling for Extended Frequency Mode – 3.6 GHz to 50 GHz

To extend the frequency range to 50 GHz, a special cabling configuration is required. It is recommended to use the M9169E Programmable Attenuator module in this configuration to provide range control and automated field alignments and self-test. The RF signal is applied to the Aux 2 In connector on the M9365A Downconverter directly or through the M9169E Programmable Attenuator.

NOTE	
	1. Option M9393A-FRX (frequency range extension, 3.6 GHz to 50 GHz) is required to operate in this mode.
	2. Option M9393A-F27 (frequency range, 9kHz to 27 GHz) is a prerequisite for Option FRX.

Cabling with the M9169E (Recommended)

The M9169E Programmable Attenuator is a switchable-input programmable attenuator module that enables adjustable power range control for higher power signals up to +30 dBm. Additionally it automates switching of the internal M9393A calibrator signal (from Aux 1 Out connector on M9365A Downconverter) to run field alignments and self-test, improving amplitude accuracy. For the suggested module positioning in the Keysight PXIe chassis, refer to Install the PXIe Modules.

Connect the cables as shown in the image below.
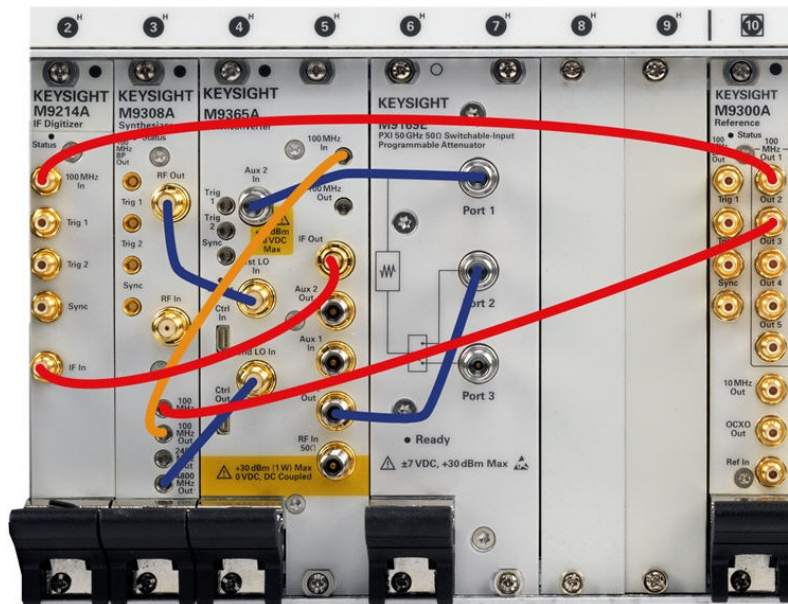
The user input signal is connected to Port 3 on the M9169E.

Following are the cabling requirements:

Connection	Cable Type
M9169E Port 1 to M9365A Aux 2 In	M9393-20001

Connection	Cable Type
M9365A Aux 1 Out to M9365A Port 2	M9393-20002

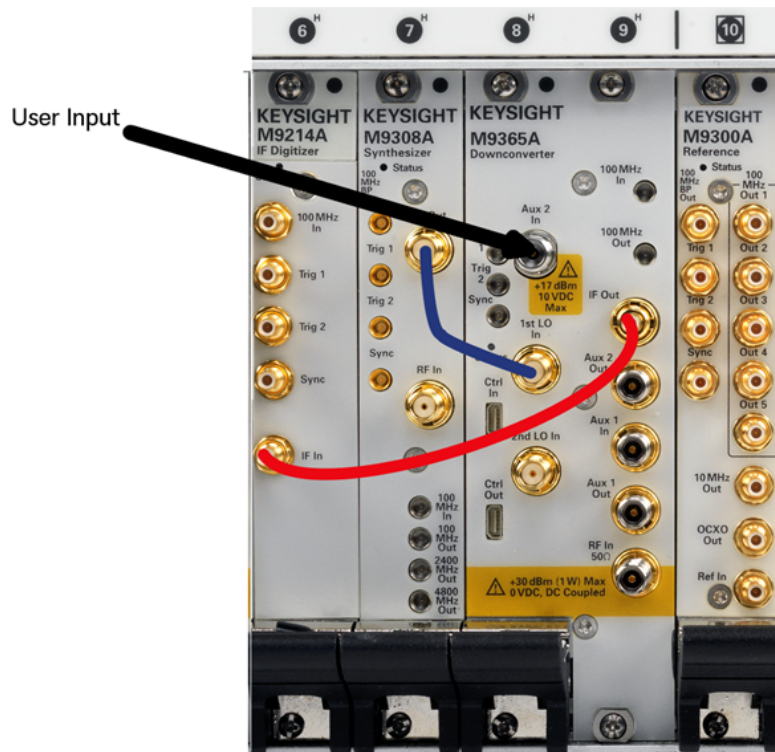**NOTE** When operating in this configuration, the following restrictions apply:

- You cannot analyze signals below 3.6 GHz.

- Attenuators and preamplifiers in the M9365A Downconverter module are bypassed. Attenuation is only provided through the M9169E.

To connect to the M9393A Soft Front Panel, select the M9169E module from the list of available modules in the Connect to Instrument dialog. For more information, refer to the *M9393A Soft Front Panel Help*.

Cabling without M9169E

To analyze signals with the extended frequency range (from 3.6 GHz to 50 GHz), without using M9169E Programmable Attenuator, connect the RF input signal directly to the Aux 2 In connector on the M9365A Downconverter module. In this configuration the RF input signal power should not exceed –14 dB. Cabling should be connected as shown below (for illustrative purpose only; not all the cables have been shown):

As shown above, the following cables in the M9365A Downconverter module (as in standard 9 kHz to 27 GHz frequency range) have been removed:

- Aux 1 Out to Aux 1 In

- Aux 2 Out to Aux 2 In

The RF input signal is connected directly to the Aux 2 In connector. Also, refer to the *M9393A Soft Front Panel Help* for more information.

NOTE When operating in this configuration, the following restrictions apply:

- You cannot analyze signals below 3.6 GHz.

- No signal conditioning (attenuators and preamplifiers) in the M9365A Downconverter module is accessible.

- You must recable the module to run field alignments and self-test. For conducting field alignments and self-test, disconnect the RF input signal from Aux 2 In connector and connect cable (M9393-20003) from Aux 1 Out to Aux 2 In connectors. See the image below.
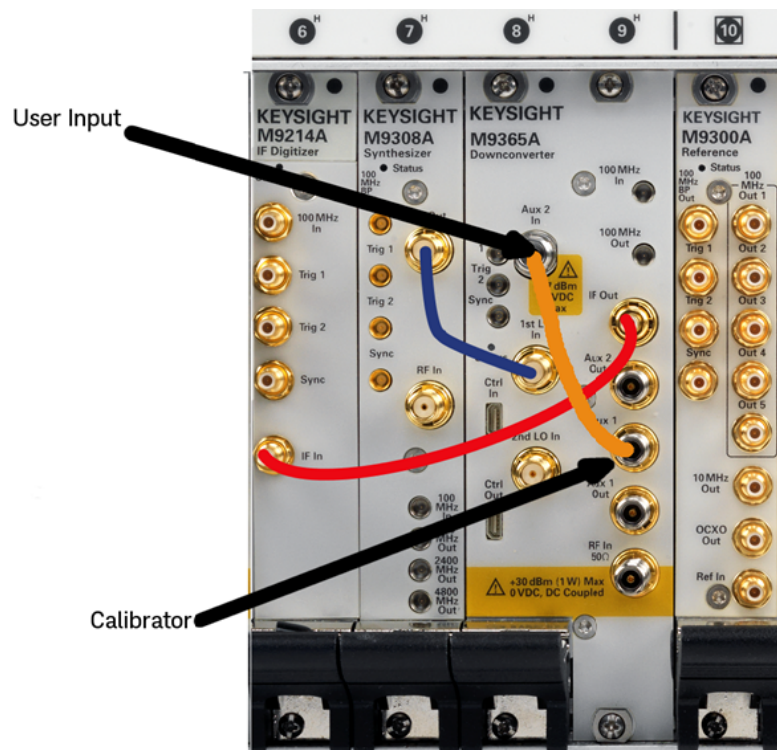
Cabling for Wideband IF

The M9393A wideband IF output can be directly accessed for up to 800 MHz of bandwidth by bypassing the IF Conditioning/Filtering path of the M9365A Downconverter module. To use this capability, the following is required:

- M9393A-WB1 option

- An external digitizer, such as M9202A. M9203A, or M9703A to sample the wider bandwidth IF signal

Higher IF bandwidths are not achievable using the M9214A Digitizer bundled with the M9393A instrument. Hence, the M9214A Digitizer, which has a maximum of 160 MHz bandwidth, is bypassed in the suggested configuration, but must remain installed in the chassis.

In the suggested configuration:

- The wideband digitizer used is the M9202A, which is installed in an x8 slot of the Keysight chassis.

- The 100 MHz Out connector on the M9300A module is connected to the M9202A Ref In connector of the M9202A Wideband Digitizer module.

- The IF Out connector on the M9365A Downconverter module is connected to the Input connector of the M9202A Wideband Digitizer module.

Following are the cabling requirements for the suggested configuration:

Connection	Cable Type
M9300 100 MHz Out to M9202A REF IN	SMB to MMCX
M9365A IF Out to M9202A INPUT IN	SMB to SMA

See the suggested cabling arrangement in the image below (for illustrative purpose only; not all the cables have been shown):
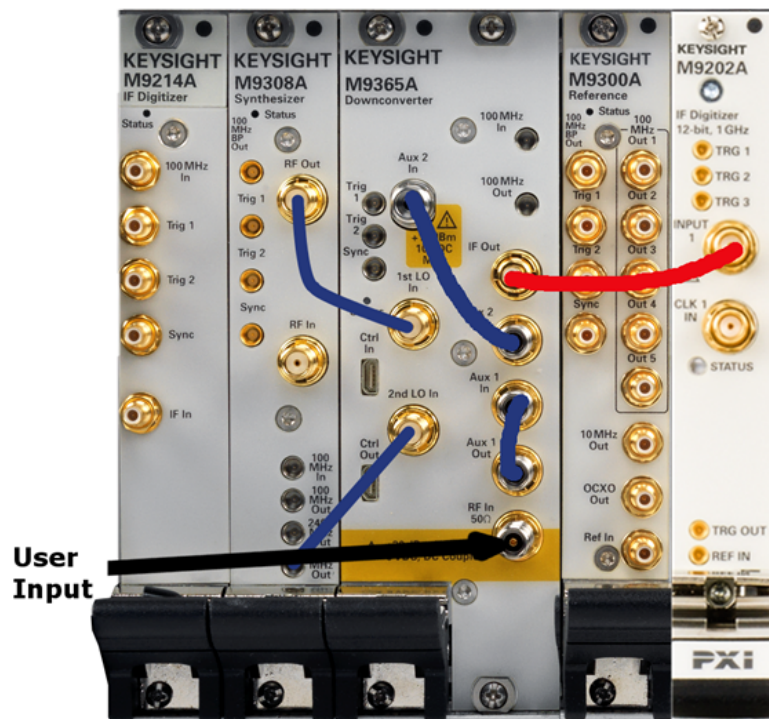
When using the above configuration, do not run single alignments that require a Digitizer. Otherwise, an error is generated. Running an alignment group runs just the alignments that do not require a Digitizer. Alignments in the group that require a Digitizer are skipped.

Data streaming can be accomplished using an external Digitizer which supports this capability and is controlled independently of the M9393A.

NOTE	The wideband configuration is not calibrated.

NOTE	When performing data streaming using M9202A Wideband Digitizer in a chassis containing the M9037 Embedded Controller, MD1 High-Speed Digitizer Driver version 1.14 must be installed after the M9393A and M9392A Drivers have been installed.

Cabling for Multi-Channel Configurations

Cables for a multi-channel configuration do not have to be the same length, but reconfiguration calibration is required. M9393A configurations may be altered to include or remove the tee adapter for 100 MHz reference signal distribution, but reconfiguration calibration must be run after any change.

Install Slot Blockers and Filler Panels

To assure proper operating temperatures, install slot blockers (Keysight model Y1212A, 5 per kit) and EMC filler panels (Keysight model Y1213A, 5 per kit) in empty module slots.

Power up the Chassis

CAUTION	If you are using a remote controller, you must power up the chassis BEFORE you power up the PC. When you power down your configuration, shut down the PC BEFORE you power down the chassis.

Step 4: Install the Software

Requirements

System	Requirements
Operating system	Windows 7 (32-bit and 64-bit), Windows Embedded Standard 7, Windows 10 (32-bit and 64-bit)
Processor speed	1 GHz 32-bit (x86), 1 GHz 64-bit (x64), no support for Itanium64
Available memory	4 GB minimum (8 GB recommended for 64-bit operating systems)
Available disk space 3	1.5 GB available hard disk space (includes 1 GB for Microsoft .NET Framework 4.5.2, and 100 MB for Keysight IO Libraries Suite)
Video	Support for DirectX 9 graphics with 128 MB graphics memory recommended (Super VGA is supported)
Browser	Microsoft Internet Explorer 7.0 or greater
Hardware	Requirements
Controllers	A PXI or PXI Express embedded controller or remote controller (external PC connected to the chassis by a PCI-to-PXI interface) is required.
Embedded controller	Keysight M9036A or M9037A or an embedded controller that meets the following requirements: - PXIe system controller (PXI-1 embedded controllers are not compatible) - Utilize a 2x8, or 4x4, PXIe system slot link configuration. - Run one of the operating systems listed in System Requirements (above).
Remote controller	(Keysight chassis only) A PC running one of the operating systems listed in System Requirements above and a Keysight M9021A Cable Interface x8 with one of the following PC interface options: - Keysight M9045B PCIe ExpressCard Adaptor x1, with cable (for a laptop PC) - Keysight M9048A PCIe Desktop Adaptor x8, with cable (for desktop PCs)

> **NOTE** Due to the Microsoft end of support for Windows XP, M9393A is not supported on Windows XP. At the time of release, there were no known major problems running on Windows XP. However if you encounter an issue unique to Windows XP, Keysight may not attempt to address the issue.

Software Installation

Install the software in the order indicated in the following table into the embedded controller, or PC if your configuration contains an M9021A PXIe Cable Interface.

Restart your controller when prompted by the respective software installer.

> **CAUTION** If you are using a remote controller, use this sequence to restart the PC and chassis:
> 1) Shut down the PC. 2) Power down the chassis. 3) Power up the chassis. 4) Power up the PC.

Order	Software	Install from...
1 *	Keysight IO Libraries Suite version 2019 U1 or newer; includes Keysight Connection Expert	www.keysight.com/find /iosuite
2 *	PXIe Chassis Drivers	www.keysight.com/find /pxie-chassis
3 **	Keysight 89600 VSA Software (optional, install before M9393A software). The minimum version is 17.21.117.0 or newer.	www.keysight.com/find /89600
4	M9393A PXIe Vector Signal Analyzer (version 1.0 or newer) Install version 2.0 for extended frequency mode (option M9393A-FRX) and wideband IF (option M9393A-WB1).	www.keysight.com/find /M9393A-driver
5	Keysight X-Series Measurement Applications for Modular Instruments (optional)	www.keysight.com/find /M90XA
6	M9392A PXIe Vector Signal Analyzer Driver for Data Streaming using M9202A Wideband Digitizer	www.keysight.com/find /M9392A-driver

Additionally, install MD1 High-Speed Digitizer Driver version 1.14 for Data Streaming using M9202A IF Digitizer when M9037A Embedded Controller is being used (http://www.keysight.com/main/software.jspx?ckey=2000051)

* Software that is already installed if you ordered the M9036A or M9037A Embedded Controller.

** If you install or upgrade the Keysight 89600 VSA Software after installing the M9393A drivers, you need to run the 89600 VSA Integration utility. Go to Start > All Programs > Keysight > M9393 > 89600 VSA Integration.

| NOTE | The Keysight Instrument Control DVD, which includes the IO Libraries Suite software, is no longer shipped with Keysight instruments. If you require a Keysight Instrument Control DVD, it can be ordered by contacting your local Keysight Customer Contact Center. |

Step 5: Verify Operation of the Keysight M9393A PXIe Vector Signal Analyzer

In this step you will verify correct operation of the Keysight M9393A PXIe Performance Vector Signal Analyzer. Before running a Self Test assure that all required software is installed, the chassis is powered on, and all cabling is correct. See Cable the Instruments for proper cabling.

The first step in this process is to conduct a Self Test of the ›M9393A.

1. Open the M9393A SFP by selecting Start > All Programs > Keysight› M9393 > M9393 SFP.

2. Upon opening the SFP, you are presented with the "Connect to Instrument" dialog. Use Control/Select to select all of the modules that are components of the M9393A and press Connect. For example:
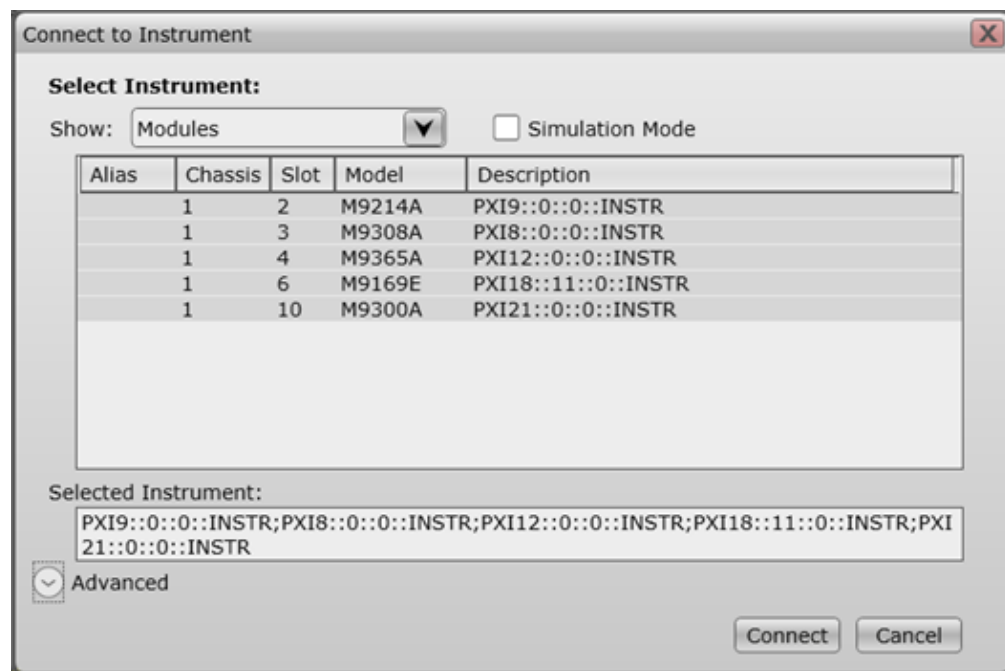
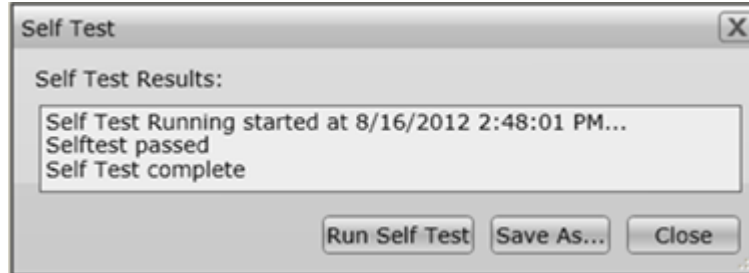| NOTE | If not all modules and their slot locations are visible in the SFP "Connect to Instrument" dialog, close the SFP and see Communications on the following page. After running Keysight Connection Expert, you may restart the SFP. |

3. Check the front panel Status LEDs. See Status LED States.

4. Conduct a Self Test (Utilities > Self Test... > Run Self Test).
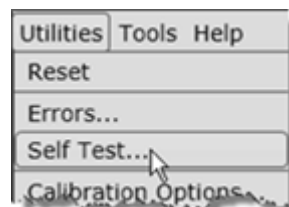
NOTE For extended frequency ranges, when Aux 2 In connector of the M9365A module is the main input connector, connect a cable from Aux 1 Out to Aux 2 In before running a self test. This is required for tests that use the M9365A Downconverter's calibrator as a signal source.

If the Self Test passes (see results below), go to Step 6: Make a Measurement.

```
Self Test                                          [X]

Self Test Results:

Self Test Running started at 8/16/2012 2:48:01 PM...
Selftest passed
Self Test complete

              [Run Self Test] [Save As...] [Close]
```

CAUTION Make sure no signal is present at the RF Input of the Keysight M9365A PXIe Downconverter when doing a Self Test. If a signal is present, it may result in a false failure.

NOTE If the M9393A Self Test fails, it indicates which module is likely to need service. However, you must return all modules (except the M9300A) and all cables. See Return an Instrument for Service.

NOTE When wideband IF is enabled, many self tests are unavailable and are not run, especially those that require data measured by the Digitizer module.

Communications

If you are unable to communicate with the Keysight M9393A PXIe Performance Vector Signal Analyzer verify that the following installations are correct:

- Keysight IO Libraries Suite
- M9393A SFP program
- Module and chassis drivers
- System Interface Card, cable and PC PXIe card connections, if you are using an external host PC

If not all modules and their slot locations are visible in the SFP "Connect to Instrument" dialog:

1. Close the SFP.

2. Start Keysight Connection Expert, by selecting Start > All Programs > Keysight Connection Expert. If any or all modules and their slot locations are still not visible, select Refresh All.

3. Restart the SFP.
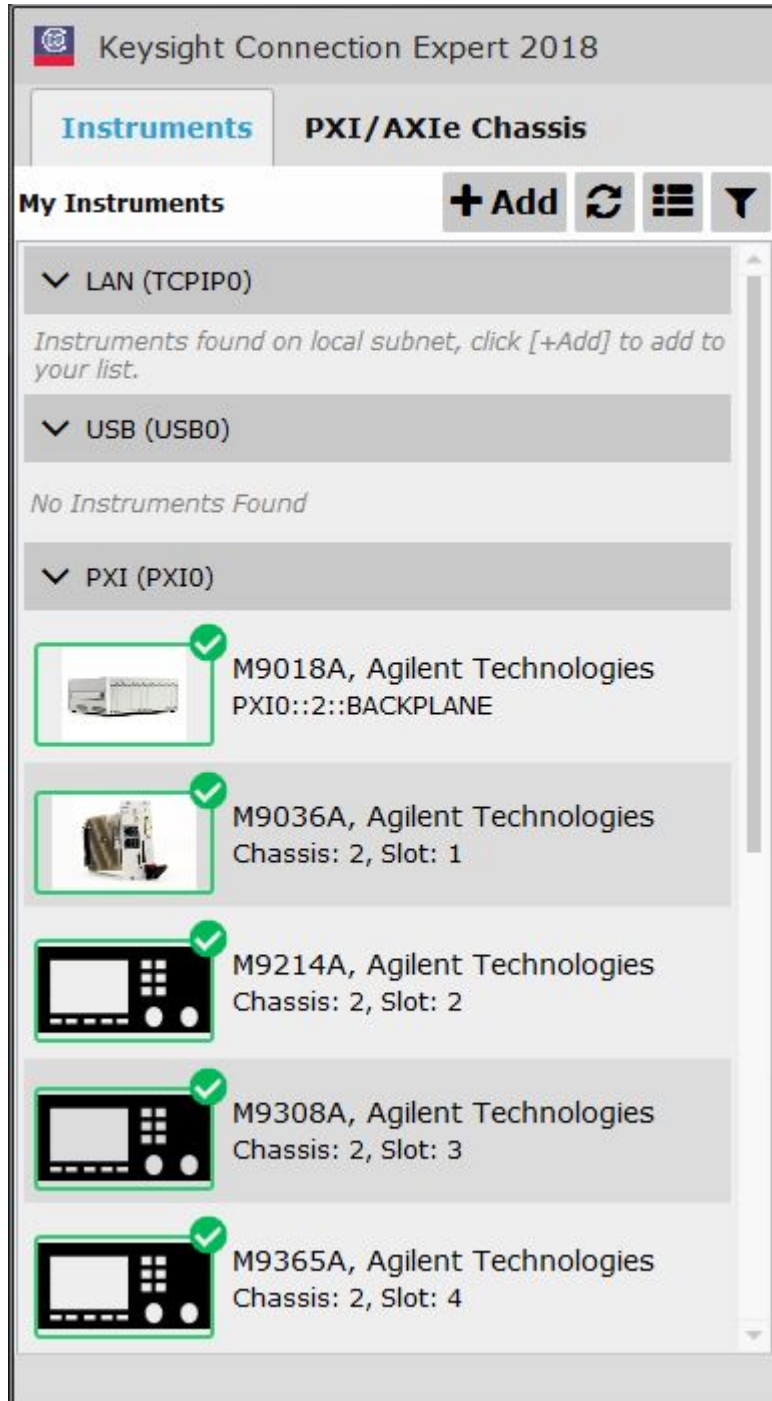
Status LED States

Module	Green	Orange	Red	Off
M9300A	The Soft Front Panel has initialized the connection to the module.	n/a	Indicates that the VCXO is unlocked.	- Not connected by the SFP.

| Module	Green	Orange	Red	Off	
					- Failure in the power supplies. Module hardware health can't be determined until the power supply failure is resolved.
M9308A	The Soft Front Panel has initialized the connection to the module.	Tuning is in progress, or the M9308A is unlocked from the reference.	n/a		- Not connected by the SFP. - Failure in the power supplies. Module hardware health can't be determined until the power supply failure is resolved.
M9214A	The Soft Front Panel has initialized the connection to the module.	Missing 100 MHz Reference.	n/a		- Not connected by the SFP. - Failure in the power supplies. Module hardware health can't be determined until the power supply failure is resolved.
M9365A	The Soft Front Panel has initialized the connection to the module.	Missing 100 MHz Reference.	n/a		- Not connected by the SFP. - Failure in the power supplies. Module hardware health can't be determined until the power supply failure is resolved.

Step 6: Make a Measurement

After verifying operation of the Keysight M9393A PXIe Performance Vector Signal Analyzer in Step 5 you are ready to make a measurement.

> **NOTE** The following measurement uses a Keysight M9381A PXIe Vector Signal Generator to generate the 2 GHz signal that will be displayed by the M9393A. You may substitute any frequency appropriate signal generator to create the signal.

1. The first step in this process is to open the SFP of the M9381A and theM9393A.

    a. Open the M9381A SFP by selecting Start > All Programs > Keysight > M938x > M9381 SFP.

    b. Open the M9393A SFP by selecting Start > All Programs > Keysight > M9393 > M9393 SFP.

    c. For each SFP, you are presented with the "Connect to Instrument" dialog. Use Ctrl/Select to select all of the modules that are components of the >M9381A and the M9393A and press Connect.

2. Connect a high quality SMA (male) to SMA (male) cable between the RF Out connector on the Keysight M9310A PXIe Source Output and the RF In connector on the M9365A.

3. Torque the connectors to 8 Lb-In (0.904 Nm).

4. On the M9381A SFP make the following settings:

    a. Frequency: 2 GHz

    b. Amplitude: –10 dBm
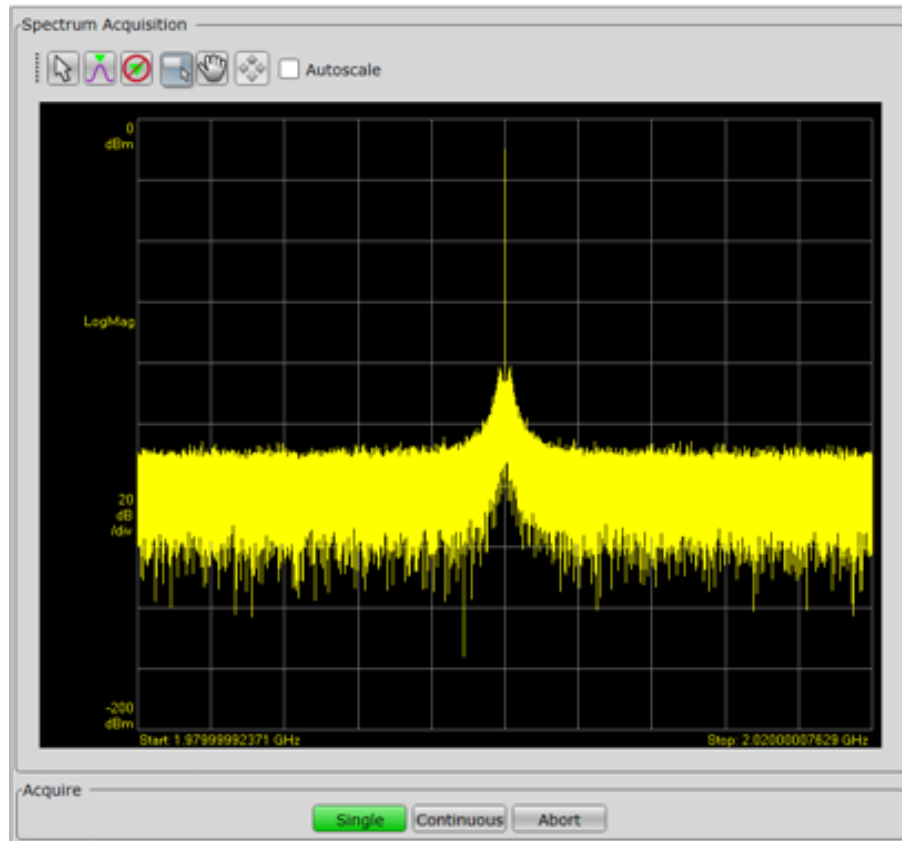
    c. RF On: checked

    d. ALC On: checked.
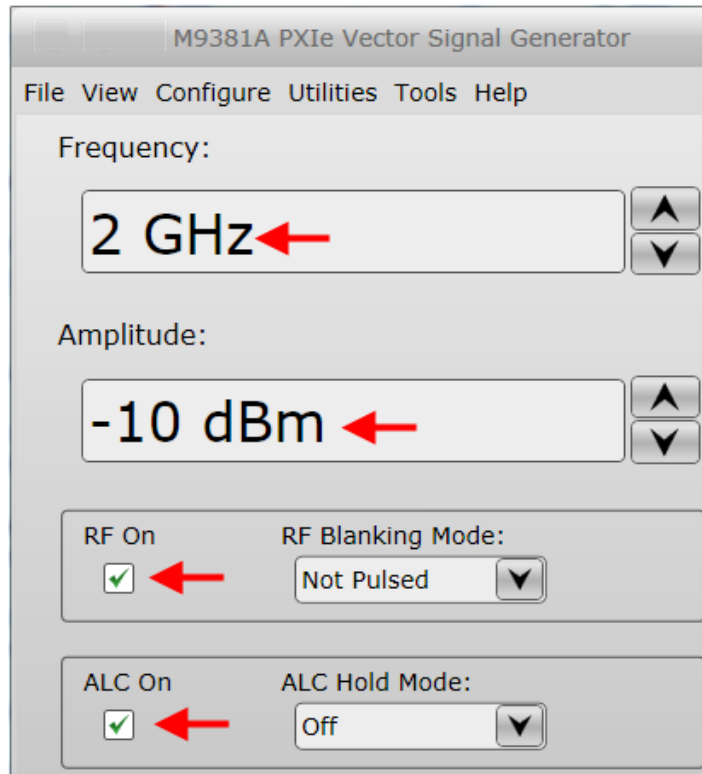
5. On the M9393A SFP Measure Tab, make the following settings:

   a. Frequency: 2 GHz

   b. Input Power: –10 dBm

   c. Acquisition: Spectrum
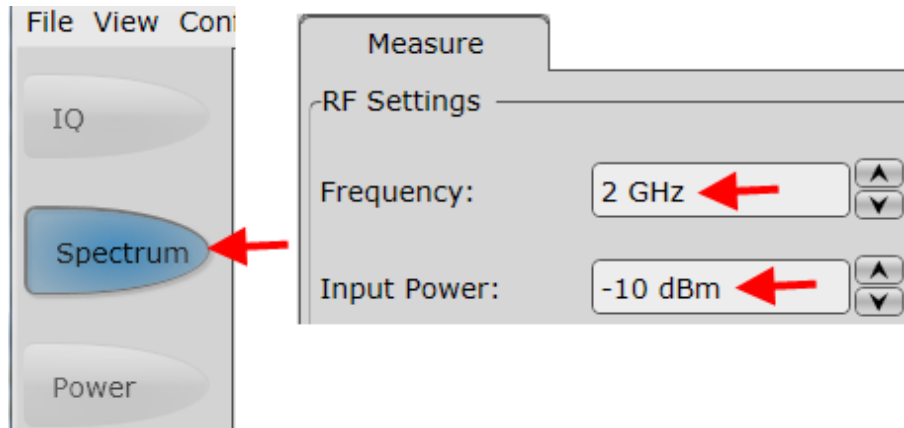
6. Below the display, select Continuous for a sustained sweep of the analyzer.
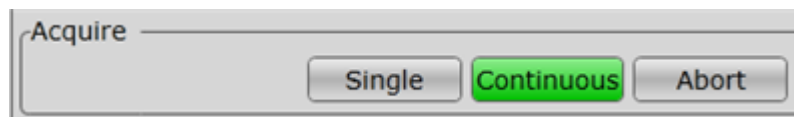
You should see the following display on your M9393A SFP. The frequency of the signal is 2 GHz and the amplitude is -10 dBm.

7. Proceed to Step 7: Installation is Complete.

Step 7: Installation is Complete

Proceed to program your product by means of the applications programming interface (API) for the supplied drivers.

API Overview

Keysight's IVI drivers simplify the creation and maintenance of instrument control applications in a variety of development environments; they allow programmatic control of instrumentation while providing a greater degree of instrument interchangeability and code reuse. IVI drivers currently come in two basic types: IVI-COM and IVI-C. Although the functionality offered by both types of drivers is often very similar, the fundamental differences in interface technology results in a very different end-user experience. The IVI drivers support compiling application programs for 32- or 64-bit platforms.

Supported ADEs (application development environments) Arguably the most important consideration in comparing IVI-COM and IVI-C drivers is the end user experience in various ADEs. Since IVI-COM drivers are based on Microsoft COM technology, it's not surprising that IVI-COM drivers offer the richest user experience in Microsoft ADEs. Users working in Visual C++, Visual C#, Visual Basic.NET, and Visual Basic 6 enjoy a host of features, such as object browsers, IntelliSense, and context-sensitive help.

When you install the product software, the IVI driver files are installed in the standard IVI Foundation directories (for example, C:\Program Files\IVI Foundation\IVI\Drivers\). Example programs are provided to demonstrate most driver functionality (for example, C:\Program Files\IVI Foundation\IVI\Drivers\\Examples). The reference material for the driver functions (a Microsoft HTML Help .chm file) is installed with the IVI driver and is available for Microsoft Visual Studio's IntelliSense context linking. In addition, you can directly access the .chm file (AgM9393.chm) from this Start menu location: Start > All Programs > Keysight Instrument Drivers > IVI-COM-C-Drivers > AgM9393 VSA.

Keysight M9393A PXIe Performance Vector Signal Analyzer

M9393A Specifications

The Data Sheet for the Keysight M9393A PXIe Performance Vector Signal Analyzer is included on the Keysight M9393A VSA Software and Product Information CD that came with your module. This document contains specification information. To find the latest update, go to http://literature.cdn.keysight.com/litweb/pdf/5991-4538EN.pdf.

M9393A Block Diagram
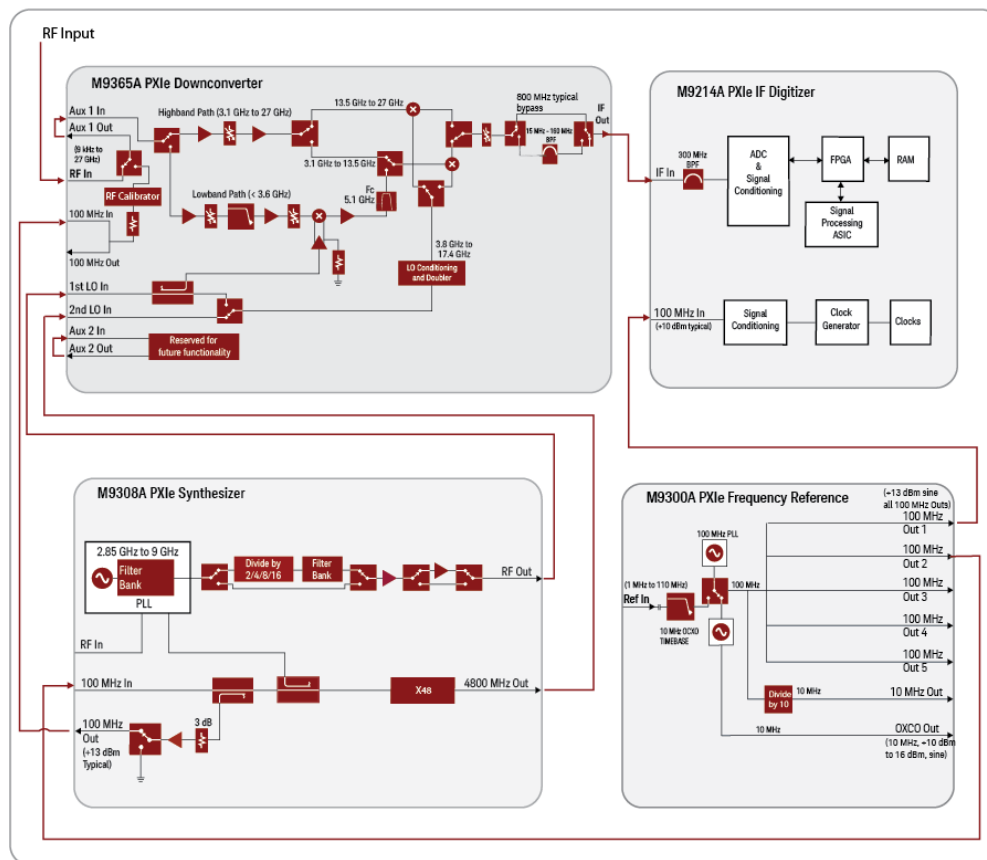
M9393A Block Diagram Reference Tables

- M9393A Block Diagram Reference Table for M9300A
- M9393A Block Diagram Reference Table for M9308A
- M9393A Block Diagram Reference Table for M9365A
- M9393A Block Diagram Reference Table for M9214A

M9393A Block Diagram Reference Table for M9300A

M9300A PXIe Reference Operation

Input	Connector	Output
From: External Reference Frequency: 1 MHz to 110 MHz Input Level: -5 dBm to +20 dBm	Ref In	
100 MHz Out 1-5		Frequency: 100 MHz

Input	Connector	Output
	Output level:>+12 dBm sine (+13 dBm typical)	
10 MHz Out	Output level: 3.3 Vpp square (1.65 v into 50 Ω)	
OCXO Out	Frequency: 10 MHz, AC coupled , 50 Ω source. Output level: +10 dBm to +16 dBm, from 10 MHz OCXO.	
Sync	This connector is intended for future use.	
Sine or square wave -2 V to +5 V max into 50 Ω, +16 dBm max @ 0 VDC into 50 Ω	Trigger 1 & 2	3.3 V into 50 Ω
From : Chassis back plane board Frequency: 100 MHz	100 MHz BP Out	Frequency: 100 MHz Output level: +10 dBm

M9393A Block Diagram Reference Table for M9308A

M9308A PXIe Synthesizer Operation

Input	Connector	Output
Chassis back plane board	100 MHz BP Out	Frequency: 100 MHz Output level: >+10 dBm
Sine or square wave -2 V to +5 V max into 50 Ω, +16 dBm max @ 0 VDC into 50 Ω	Trigger 1 & 2	3.3 V into 50 Ω
Sync	This connector is intended for future use.	
Frequency: 100 MHz, Amplitude: >+12 dBm @100 Hz: -130 dBc/Hz @1 kHz: -160 dBc/Hz	100 MHz In	

Input	Connector	Output
100 MHz Out	+12 dBm (typical)	
RF Out	178 MHz to 13.7 GHz	
2400 MHz Out	2400 MHz	
4800 MHz Out	4800 MHz	
This connector is intended for future use.	RF In	

M9393A Block Diagram Reference Table for M9365A

M9365A PXIe Downconverter Operation

Input	Connector	Output
100 MHz	Frequency: 100 MHz Output level: >+10 dBm	
Sine or square wave -2 V to +5 V max into 50 Ω, +16 dBm max @ 0 VDC into 50 Ω	Trigger 1 & 2	3.3 V into 50 Ω
Sync	This connector is intended for future use.	
Frequency: 100 MHz, Amplitude: >+12 dBm @100 Hz: -130 dBc/Hz @1 kHz: -160 dBc/Hz	100 MHz In	
IF Out	200 MHz to 2300 MHz	
Aux 1, 2 Out	Aux 1 Out is an SMA coaxial female connector that directs the signal to the Aux 1 In connector for frequency range, 9 kHz to 27 GHz. Aux 2 Out is an SMA coaxial female connector that directs the signal to the Aux 2 In connector for frequency range, 9 kHz to 27 GHz.	
Aux 1, 2 In		

Input	Connector	Output
	Aux 1 In is an SMA coaxial female connector that accepts the signal from the Aux 1 Out connector for frequency range, 9 kHz to 27 GHz. Aux 2 In is an SMA coaxial female connector that accepts the signal from the Aux 2 Out connector for frequency range, 9 kHz to 27 GHz. For extended frequency mode (3.6 GHz to 50 GHz), this connector: - Accepts input from Port 1 of the M9169E Programmable Attenuator module. - Accepts user input directly when not using the M9169E module.	
Maximum input power 30 dBm	RF In	
178 MHz to 13.7 GHz	1st LO In	
4800 MHz	2nd LO In	

M9393A Block Diagram Reference Table for M9214A

M9214A PXIe IF Digitizer Operation

Input	Connector	Output
Sine or square wave -2 V to +5 V max into 50 Ω, +16 dBm max @ 0 VDC into 50 Ω	Trigger 1 & 2	3.3 V into 50 Ω
Sync	This connector is intended for future use.	
Frequency: 100 MHz, Amplitude: >+12 dBm	100 MHz In	
321 MHz	IF In	

Module Front Panel Features

- M9300A PXIe Frequency Reference Front Panel Features
- M9308A PXIe Microwave Synthesizer Front Panel Features
- M9365A PXIe Microwave Downconverter Front Panel Features
- M9214A PXIe IF Digitizer Front Panel Feature

M9300A Front Panel Connectors

For parameter limits and specifications on the M9300A, see Block Diagram Reference Table for M9300A.

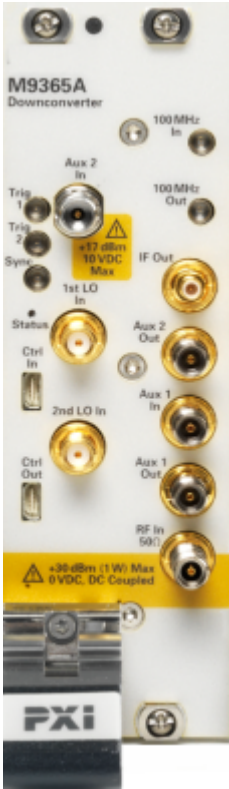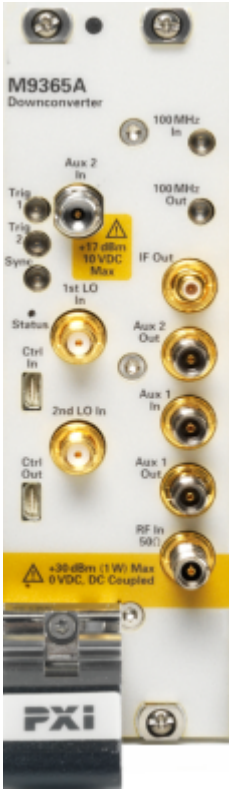|	Connector	Description
	100 MHz BP Out	This SMB male connector outputs a 100 MHz signal from the chassis backplane board. This output is enabled through the SFP.
	100 MHz Out 1 through Out 5	Each of these SMB male connectors may output a 100 MHz reference and clock signal.
	Trig 1	This connector is intended for future use.
	Trig 2	This connector provides a programmable output trigger.
	Sync	This connector is intended for future use.
	10 MHz Out	This SMB male connector provides a 10 MHz signal. This output is enabled through the SFP.
	OCXO Out	This SMB male connector provides a 10 MHz signal from the 10 MHz OCXO timebase. This output is enabled through the SFP.
	Ref In	This SMB male connector inputs a 1 MHz to 110 MHz reference signal. The connector is AC coupled and terminated into 50 Ω.

M9308A Front Panel Connectors

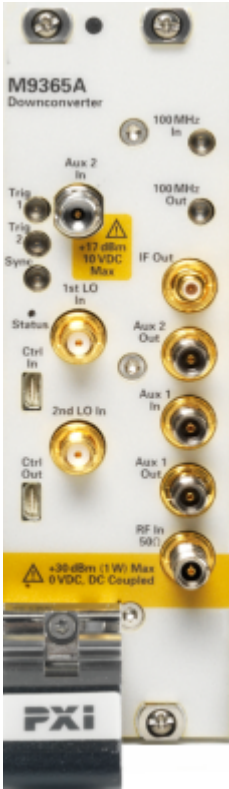For parameter limits and specifications on the M9308A connectors, see M9393A Block Diagram Reference Table for M9308A.

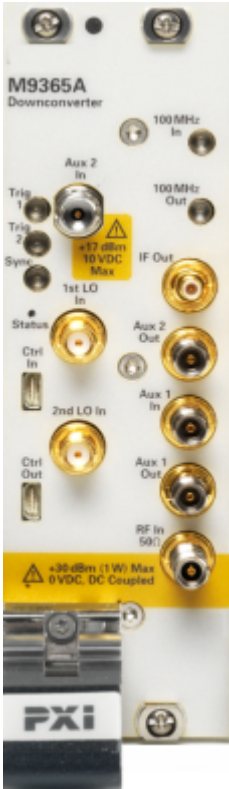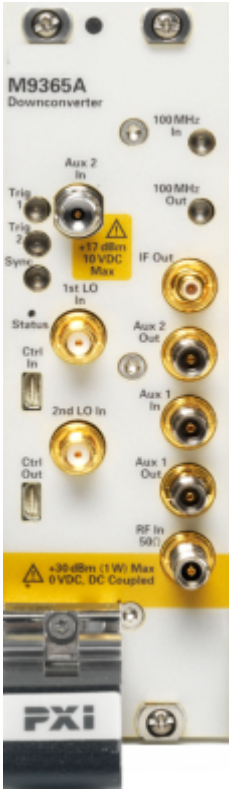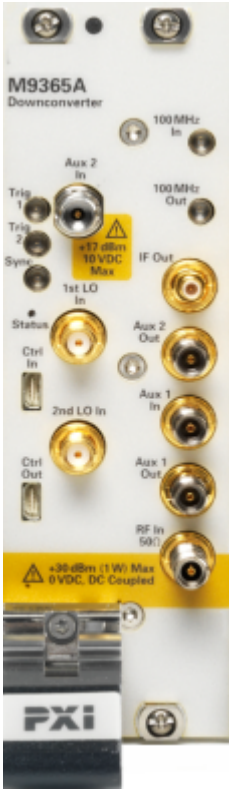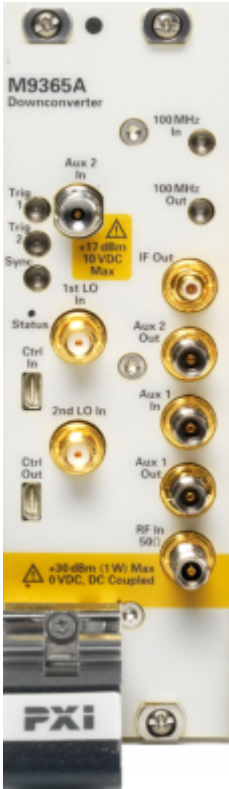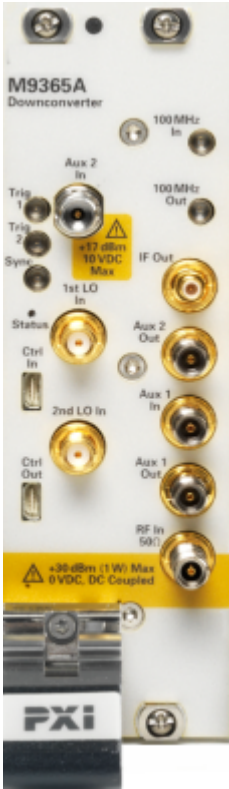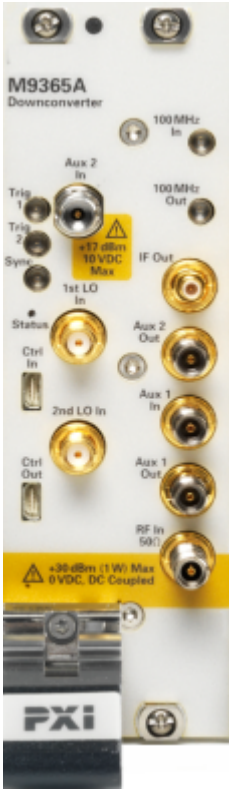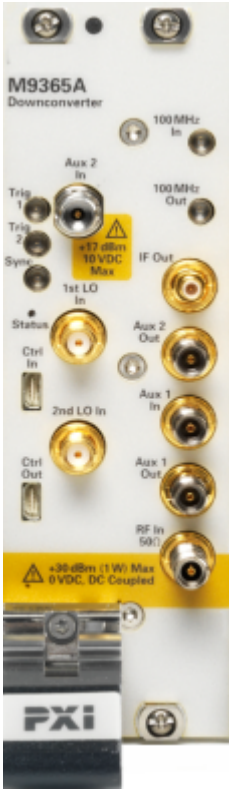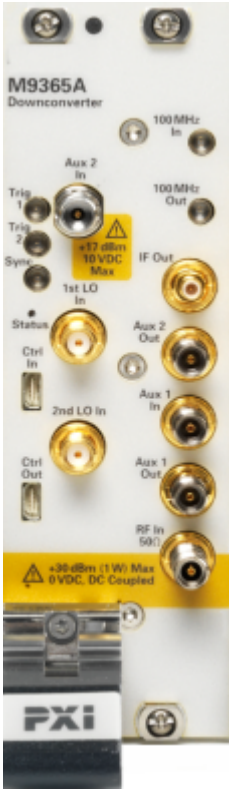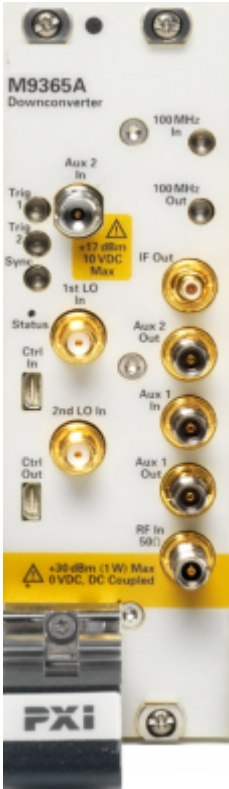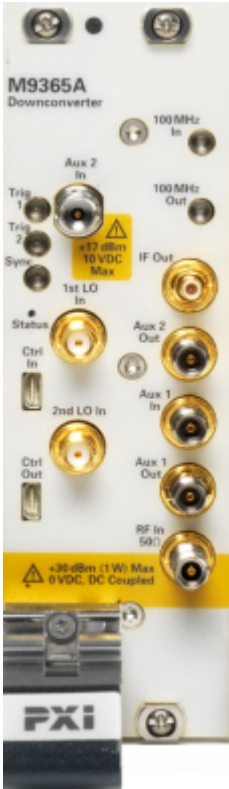| Connector	Description
100 MHz BP Out	This SMP male connector outputs a 100 MHz signal from the chassis backplane board. This output is enabled through the SFP.
Trig 1	This connector is intended for future use.
Trig 2	This connector is intended for future use.
Sync	This connector is intended for future use.
100 MHz In	This SMP male connector inputs a 100 MHz reference signal from the 100 MHz Out connector of the Keysight M9300A PXIe Frequency Reference.
100 MHz Out	This SMP male connector outputs the 100 MHz In signal to the Keysight M9365A PXIe Downconverter 100 MHz In connector.
2400 MHz Out	This connector is intended for future use.
4800 MHz Out	This SMP male connector outputs a 4800 MHz signal to the M9365A 2nd LO In.
RF In	This connector is intended for future use.
RF Out	This SMA female connector outputs a signal to the Keysight M9365A PXIe Downconverter 1st LO In connector.

M9365A Front Panel Connectors

For parameter limits and specifications on the M9365A connectors, see M9393A Block Diagram Reference Table for M9365A.

	Connector	Description
	Trig 1	This connector is intended for future use.
	Trig 2	This connector is intended for future use.
	Sync	This connector is intended for future use.
	100 MHz In	This SMP male connector inputs a 100 MHz reference signal from the 100 MHz Out connector of the Keysight M9308A PXIe Synthesizer.
	100 MHz Out	This SMP male connector is not used in this configuration.
	IF Out	This SMB male connector sends the IF signal to the M9214A IF Input.
	RF In	This 3.5mm female connector inputs a modulated RF signal of 100 kHz to 27 GHz.
	Aux 1 Out	This 3.5mm coaxial female connector directs the signal to the Aux 1 In connector for frequency range, 9 kHz to 27 GHz.
	Aux 1 In	This 3.5mm coaxial female connector accepts the signal from the Aux 1 Out connector for frequency range, 9 kHz to 27 GHz..
	Aux 2 Out	This 3.5mm coaxial female connector directs the signal to the Aux 2 In connector for frequency range, 9 kHz to 27 GHz.
	Aux 2 In	This 2.4mm coaxial female connector accepts the signal from the Aux 2 Out connector for frequency range, 9 kHz to 27 GHz. For extended frequency mode (3.6 GHz to 50 GHz), this connector: - Accepts input from Port 1 of the M9169E Programmable Attenuator module. - Accepts user input directly when not using the M9169E module.
	1st LO In	This connector accepts the RF Out signal from the M9308A.
	2nd LO In	This connector accepts the 4800 MHz Out signal from the M9308A.

| Connector	Description
Ctrl In	This connector is intended for future use.
Ctrl Out	This connector is intended for future use.

M9214A Front Panel Connectors

For parameter limits and specifications on the M9214A connectors, see M9393A Block Diagram Reference Table for M9214A .

	Connector	Description
	100 MHz In	This SMB male connector inputs a 100 MHz reference signal from the 100 MHz Out connector of the Keysight M9300A PXIe Frequency Reference.
	Trig 1	External Trigger Input.
	Trig 2	Trigger Received Output.
	Sync	This connector is intended for future use.
	IF In	This SMB male connector accepts the IF Input from the M9365A IF Out connector.

Extended Frequency Range (3.6 GHz - 50 GHz) - Block Diagram

Keysight M9393A PXIe Performance Vector Signal Analyzer
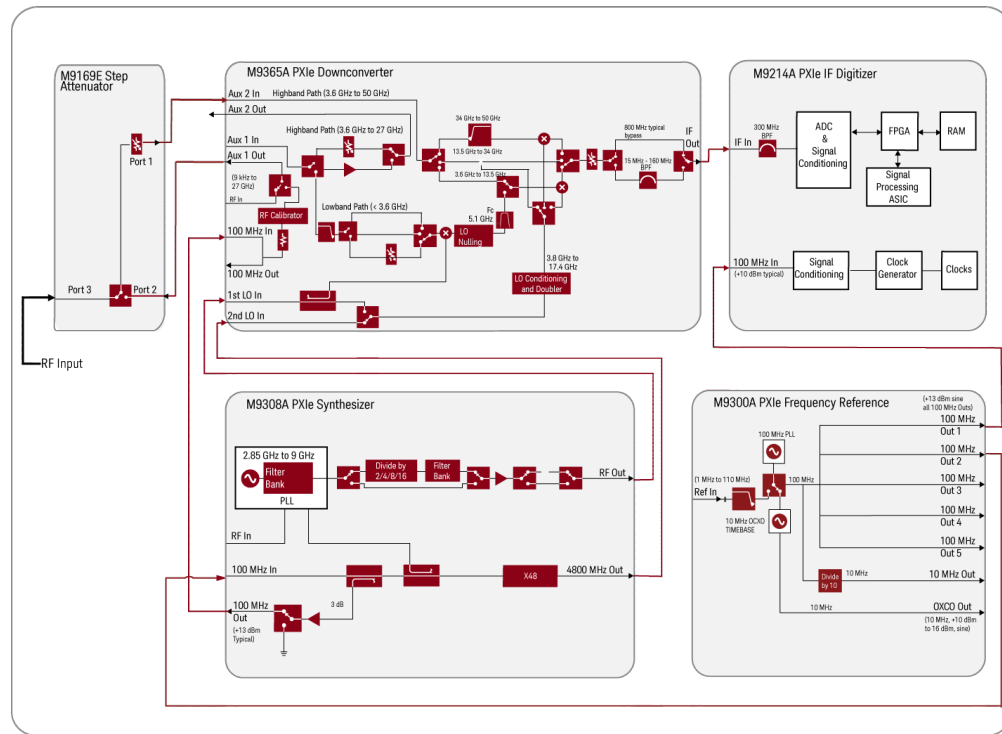
Sharing the M9300A Frequency Reference

The M9300A Frequency Reference module can be shared by the M9393A as well as the M9380A, M9381A and M9391A. If you connect to a hardware configuration that includes a currently connected M9300A (either independently or as part of another hardware configuration) the latest instance of the SFP will take control of the M9300A. You will see no warning or error message.

CAUTION   While the M9300A module is being shared, any of the configurations that share this reference can control it fully, including setting the reference to use an external frequency reference source. If the external frequency reference setting does not match that of the supplied frequency, the reference will be unlocked, as expected. However, only the instance of the SFP that creates the reference unlock condition can correct the problem. This is done by either correcting the frequency or by setting the reference back to internal, so that a subsequent instance will not take control of the reference module unintentionally.

CAUTION   The Reference module can also be shared among multiple measurement applications, such as the Keysight 89600 VSA software. The Reference module must be initialized before use, so including it in all configurations allows applications to be started in any order. However, when sharing a module the user interface of some applications may not reflect M9300A settings made by other applications. For example, the Keysight 89600 software can control the Reference module internal/external setting, but the changes made by other applications will not be reflected in the Keysight 89600.

NOTE   FPGA updates are not allowed on a Keysight M9300A PXIe Frequency Reference while it is being shared. To perform M9300A FPGA updates, reserve the Reference.

Reserving the Reference for a Configuration

If you are running a test in the background with a certain M9300A setting and then connect a hardware configuration that also contains the same M9300A, you may alter the test setup that is already running.
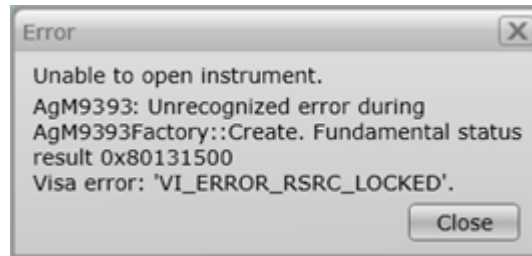
If you would prefer to keep the reference control with the first instance of the hardware configuration so that a subsequent instance will not take control of the reference module unintentionally:

1. On the SFP Connect to Instrument screen, click the Advanced control to open the Options: dialog.
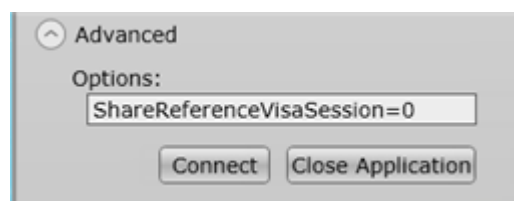
2. Type the following string: `ShareReferenceVisaSession=0`

This configuration will retain control of the M9300A if you try to open a new configuration. If you connect a new configuration, that includes the same M9300A, you will see the following error:

```
Error                                              [X]

Unable to open instrument.
AgM9393: Unrecognized error during
AgM9393Factory::Create. Fundamental status
result 0x80131500
Visa error: 'VI_ERROR_RSRC_LOCKED'.

                                          [ Close ]
```

CAUTION If an existing instance of the SFP is connected to the reference module in a shared (default) mode, and you try to connect a second instance of the SFP to the same reference with ShareReferenceVisaSession=0 Advanced Option, you will get the resource locked error shown above.

Keysight 89600 Vector Signal Analysis Software for M9393A

Overview

One of the components of Keysight M9393A PXIe Performance Vector Signal Analyzer software installation is the M9393A hardware extension for Keysight 89600 VSA software. A hardware extension is a set of files that provides an interface between the 89600 VSA software and the acquisition hardware. The hardware extension files, as well as the 89600 VSA Integration Utility, are installed along with other M9393A program files during the M9393A driver installation process. If a compatible version of 89600 VSA software is detected during the installation process, the Integration Utility puts a copy of the M9393A hardware extension files into the associated 89600 installation location. Each compatible version of 89600 VSA software must have a copy of the M9393A hardware extension files in its installation location.

> **NOTE** If the Keysight 89600 VSA software is installed after the M9393A drivers, you need to run the 89600 VSA Integration Utility to install the M9393A hardware extension. Go to **Start > All Programs > Keysight > M9393 > 89600 VSA Integration**.

A hardware extension implements several COM interfaces. The interfaces have methods for acquiring (connecting to) measurement hardware, setting acquisition parameters, controlling VSA hardware settings, acquiring measurement data, and querying hardware status. The M9393A hardware extension maps M9393A interface methods to COM interface methods for supported 89600 VSA functionalities.

The M9393A hardware extension enables 89600 VSA software to detect the presence of M9393A modules and to configure an M9393A VSA instrument from these modules based on a set of rules. As with other 89600 VSA supported instruments, an M9393A VSA can be configured via the 89600 VSA's New Hardware Configuration dialog.

To use the Keysight 89600 VSA Software measurement capabilities, you must first create a connection between the measurement software and the hardware configuration that is your M9393A Vector Signal Analyzer.

> **NOTE** The minimum required version of Keysight 89600 VSA software is 17.21.117.0. You can find this online at www.keysight.com/find/89600.

Procedure for a Single Channel Configuration

This procedure is for setting up and configuring a single channel system. To set up and configure multiple channel systems:

See "Procedure for a Two Channel Configuration"

See "Procedure for a Three or Four Channel Configuration"

To create a new M9393A instrument, use the Keysight 89600 VSA Software and follow these steps:

1. Open the "New Hardware Configuration" window in the Keysight 89600 VSA software by selecting: Utilities > Hardware > Configurations from the menu bar.
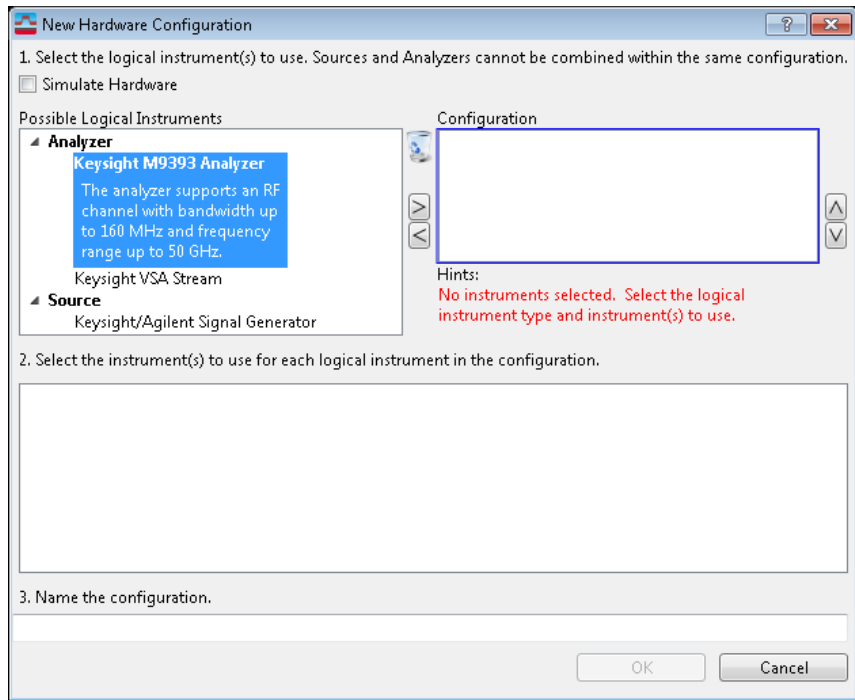   When you hover over the last element in this sequence you will see a listing of the relevant configurations. Click on the "Add New Hardware" icon .
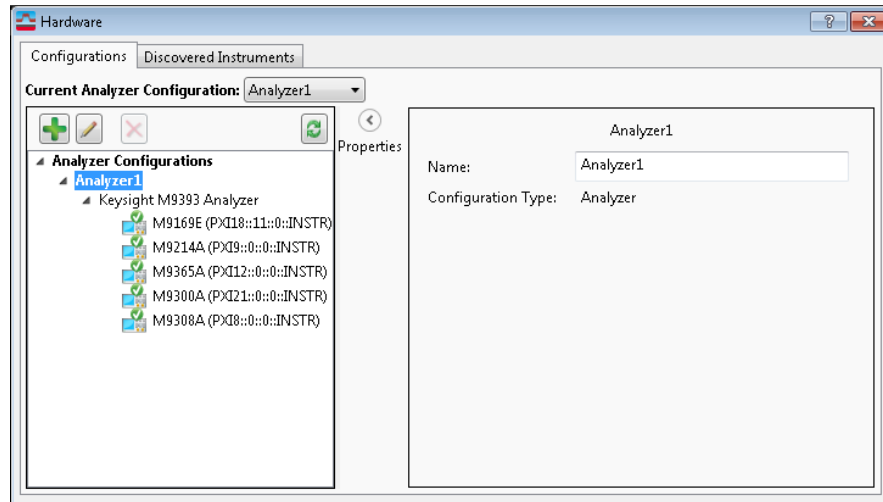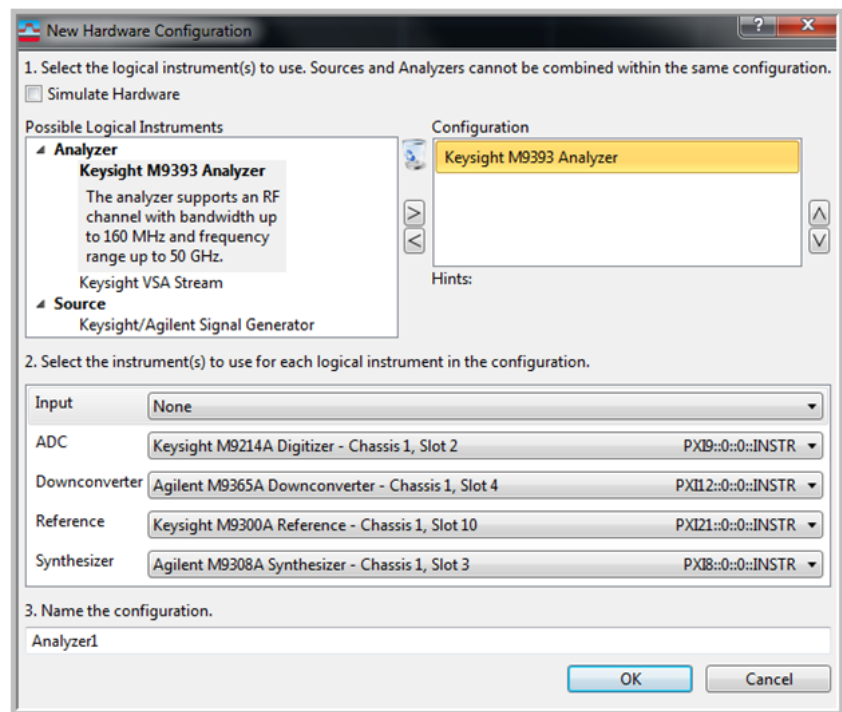

2. In the "New Hardware Configuration" window:
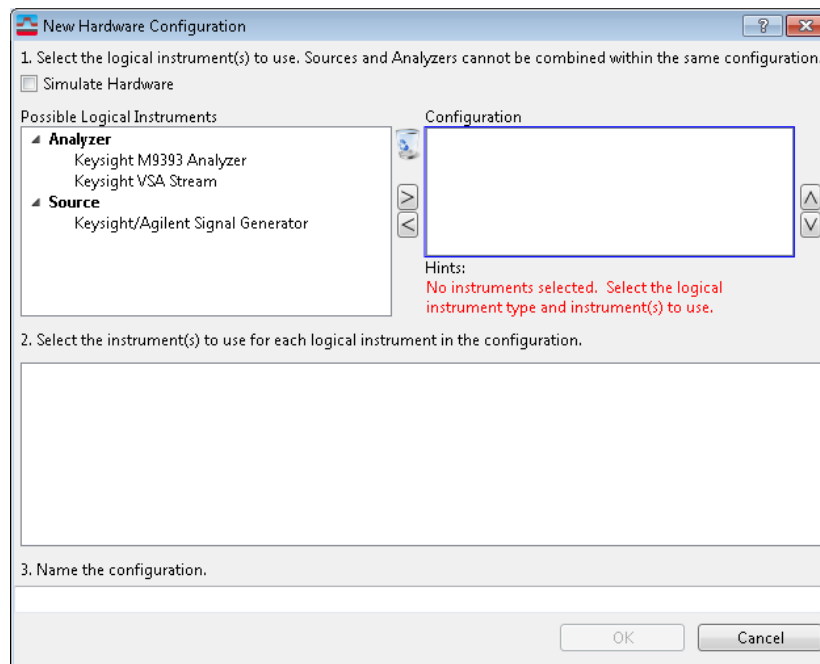
   a. Select the Keysight M9393A Analyzer entry and click on the icon to copy the entry to the "Configuration" window.

b. Configure the new M9393A instrument by selecting the modules identified by their VISA address in the "2. Select the instrument(s) to use for each logical instrument in the configuration" section.

c. Name the new configuration in the "3. Name the configuration" section. The default name "Analyzer1" may be changed. Use a meaningful name for later identification.

d. Save the new configuration by clicking the OK button.

Refer to the Keysight 89600 Vector Signal Analysis Software for further details about making measurements with your Keysight M9393A PXIe Performance Vector Signal Analyzer.

|	
NOTE	As a best practice, after setting up an M9393A measurement, perform a Disconnect/Restart (**Control > Disconnect** and then **Restart**). If there is an unlocked Frequency Reference or Digitizer 100 MHz clock missing condition, the M9214A Digitizer status LED will turn to Red and the INT REF indicator at the bottom of the display will indicate "UNLOCKED" or "Waiting for Frequency Reference Lock". At this point, troubleshoot the instrument cabling. Perform a Disconnect/Restart again to verify that the frequency reference is present. Whether the problem is a broken 100 MHz clock path or an invalid External Reference (either not present or mismatched frequency), the reference status and measurement status messages are the same – "UNLOCKED" reference and "Waiting for frequency reference" measurement status. However, if the external reference signal (not the 100 MHz clock) is invalid, as soon as the signal becomes valid, measurement will resume; whereas in the 100 MHz clock signal case, you must **Disconnect** from the hardware and then reconnect (**Restart**) to start the measurement again.

Extended Frequency Range Operation

To connect to your M9393A with frequency range extension (3.6 GHz to 50 GHz) option, the 89600 VSA software supports two hardware configurations (with and without the M9169E Step Attenuator). The detailed information for configuring these arrangements is available at Cabling for Extended Frequency Range. In 89600 VSA, perform the following steps to achieve higher frequency ranges:

- When using the M9169E Step Attenuator (recommended configuration)

1. Set the Input field to Keysight M9169E Attenuator in the New Hardware Configuration dialog. See Step 2 in the above procedure.
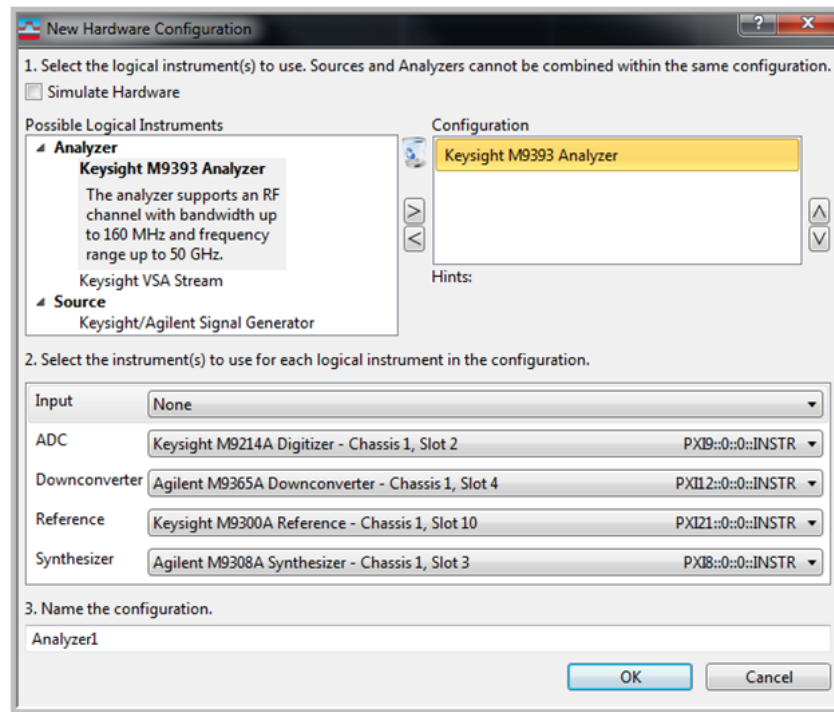
- When the RF signal is applied directly to the Aux 2 In connector of the M9365A Downconverter module without introducing the M9169E Step Attenuator
  1. Set the Input field to None in the New Hardware Configuration dialog. See Step 2 in the above procedure.
  2. Select Input > Extensions. Select the Aux2In input extension.
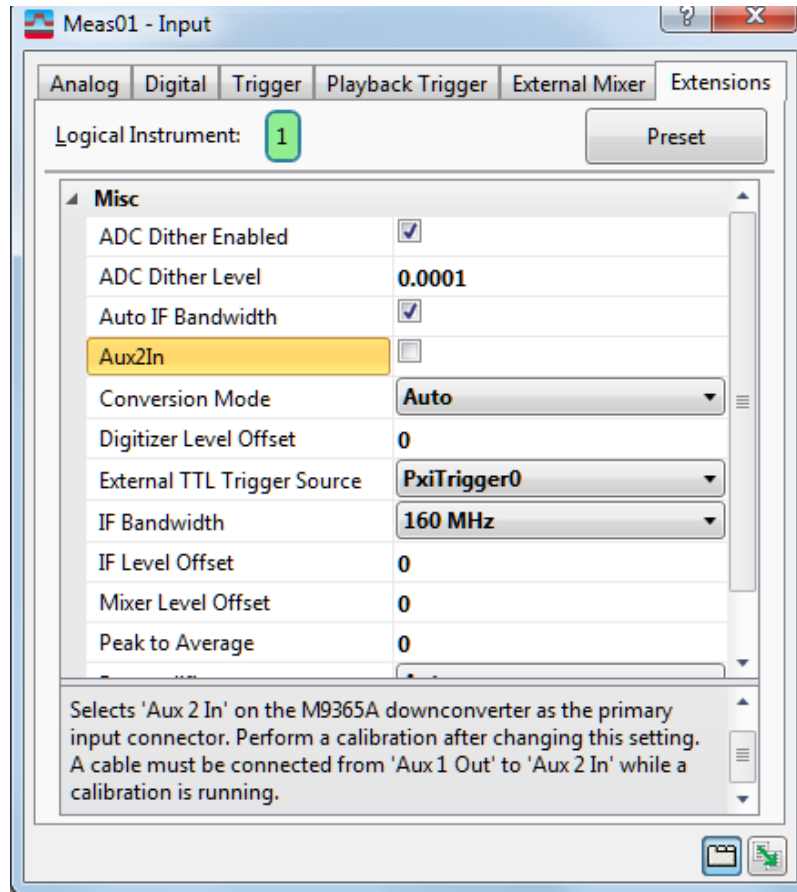
NOTE It is recommended to save the setup as a .setx file after configuring the Aux2In input extension in 89600 VSA. By doing this, there is no need to configure the Aux2In input extension again when you want to work in the extended frequency mode (without using the M9169E Programmable Attenuator) following a Preset All or switching back to the same M9393A hardware configuration after working with another one. Simply, recall the setup by selecting File > Recall > Recall Setup. This will automatically enable the Aux2In input extension in your 89600 VSA environment.

In 89600 VSA, while the permissible values for the Range parameter (Input > Analog > Range) can vary from -50 dBm to +30 dBm for 9 kHz to 27 GHz frequency range, the following are the ranges when operating in the extended frequency mode:

- When using M9169E Programmable Attenuator - [-14, +30] dBm
- When applying the RF input directly to the Aux2In connector without using M9169E – [-14, -14] dBm

Parameter Control and Input Extensions

The Keysight 89600 role allows the VSA software to set the following parameters:

- Expected Input Power (Range)
- Center Frequency

- Bandwidth
- Acquisition Time
- Trigger Style (Free Run, External, IF Mag)
- Trigger Delay
- Trigger Slope
- Trigger Level

Extensions

Input extensions are the hardware configuration and setup parameters that apply to the Keysight 89600 VSA software with M9393A. To modify a hardware parameter, open the input extension dialog (Input > Extensions tab), click the parameter name and specify the value. For True/False values, a selected check box sets the value to True. A cleared check box sets the value to False.

Extensions:
- ADC Dither Enabled
- ADC Dither Level
- Auto IF Bandwidth
- Aux2In
- Conversion Mode
- Digitizer Level Offset
- External TTL Trigger Source
- IF Bandwidth
- IF Level Offset
- Mixer Level Offset
- Peak to Average
- Preamplifier
- RF Attenuator Mode
- Trigger Termination
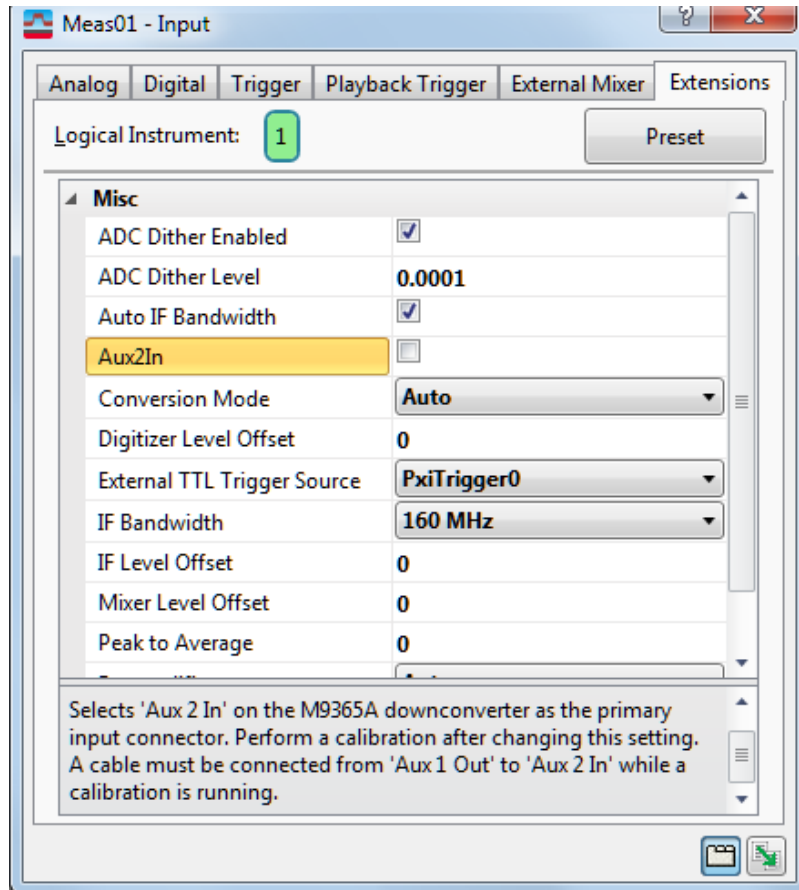
> **NOTE** For additional information on each extension item, highlight the item and a summary is displayed near the bottom of the extension dialog box.

Running Calibration on the M9393A from the 89600 VSA Software

It is possible to run calibrations on the M9393A VSA from the 89600 VSA software when the two are correctly configured. The calibration path in the 89600 VSA software is Utilities > Calibration.
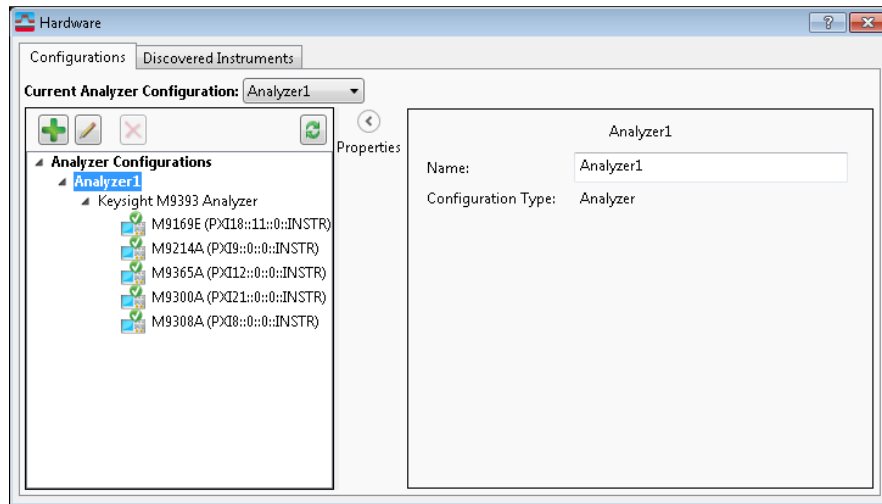
> **CAUTION**
> – Before running a calibration on the M9393A, it is important to make sure that there is no RF signal connected to the RF In connector of the M9365A Downconverter module in the M9393A instrument. A signal present at the RF Input connector of the M9365A Downconverter can result in an unsuccessful calibration of the M9393A instrument.
>
> – For extended frequency range configuration without M9169E, remember to connect cable between Aux 1 Out and Aux 2 In connectors before running calibration.

Procedure for a Two Channel Configuration

To create a new M9393A instrument, use the Keysight 89600 VSA Software and follow these steps:

1. Open the New Hardware Configuration window in the Keysight 89600 VSA software by selecting: Utilities > Hardware > Configurations from the menu bar. When you hover over the last element in this sequence you will see a listing of the relevant configurations. Click Add New Hardware .
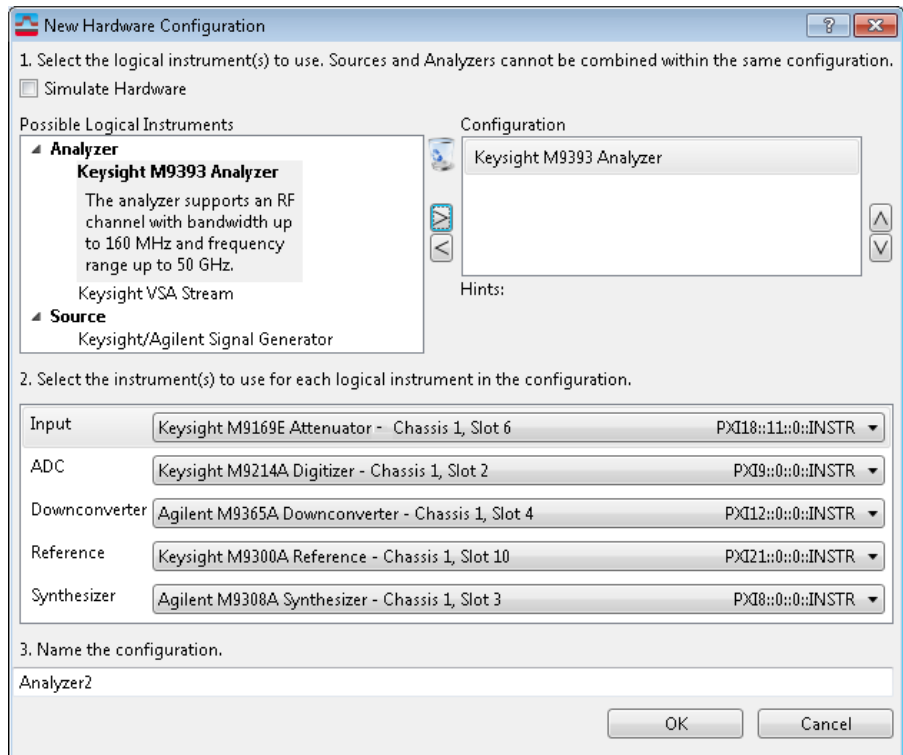

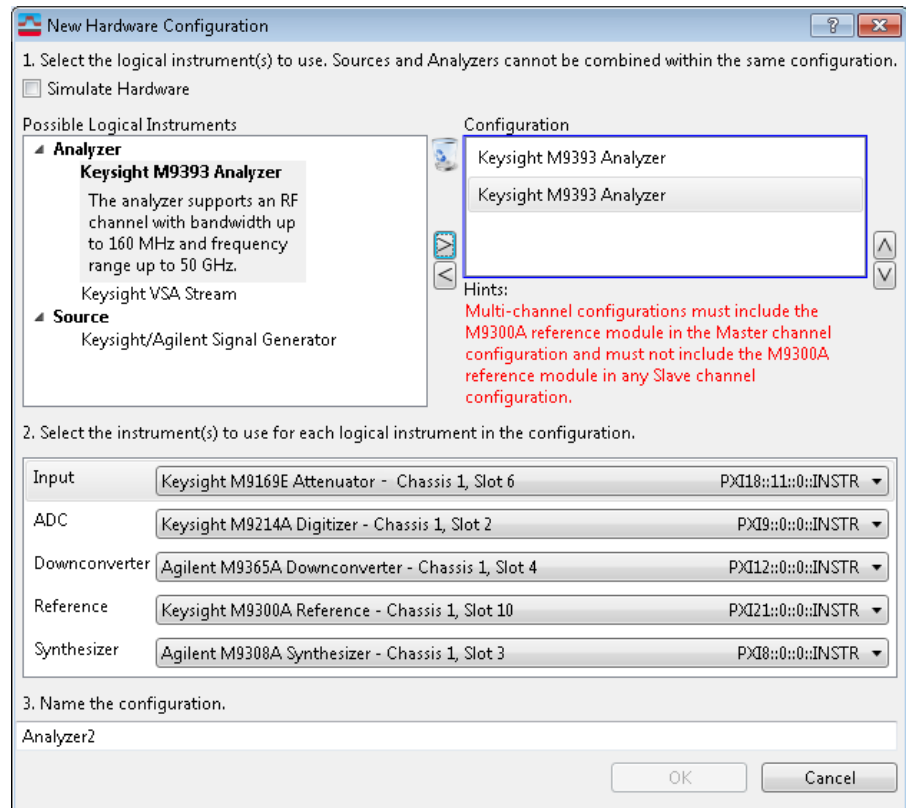2. In the New Hardware Configuration window,
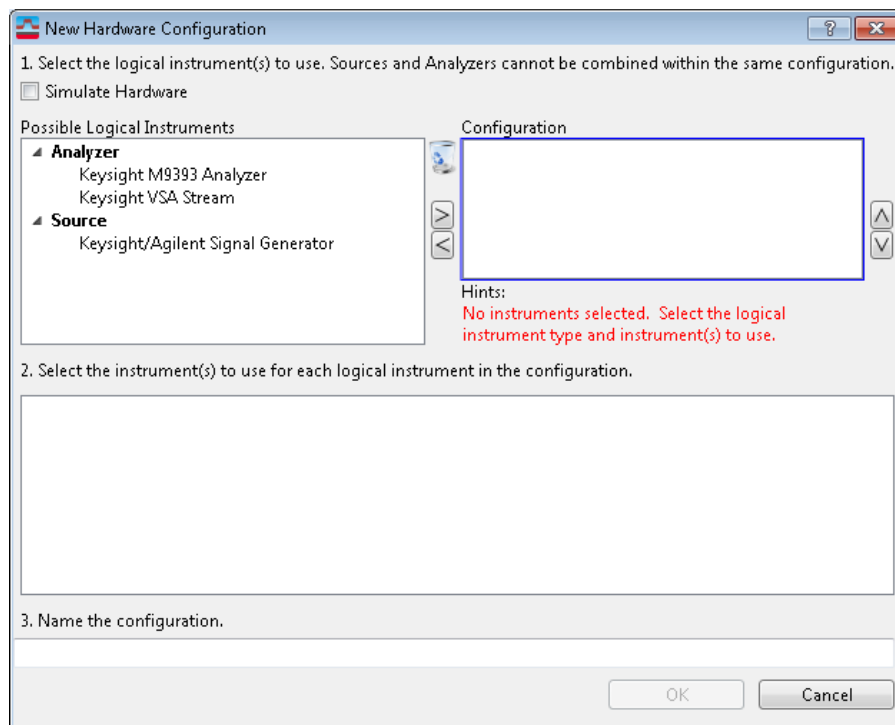
a. Select the Keysight M9393A Analyzer (Modules) entry and click the icon to copy the entry to the Configuration window.
To create a second channel, select the Keysight M9393A Analyzer (Modules) entry, and click the icon again to copy another entry to the Configuration window (as shown in 2b).
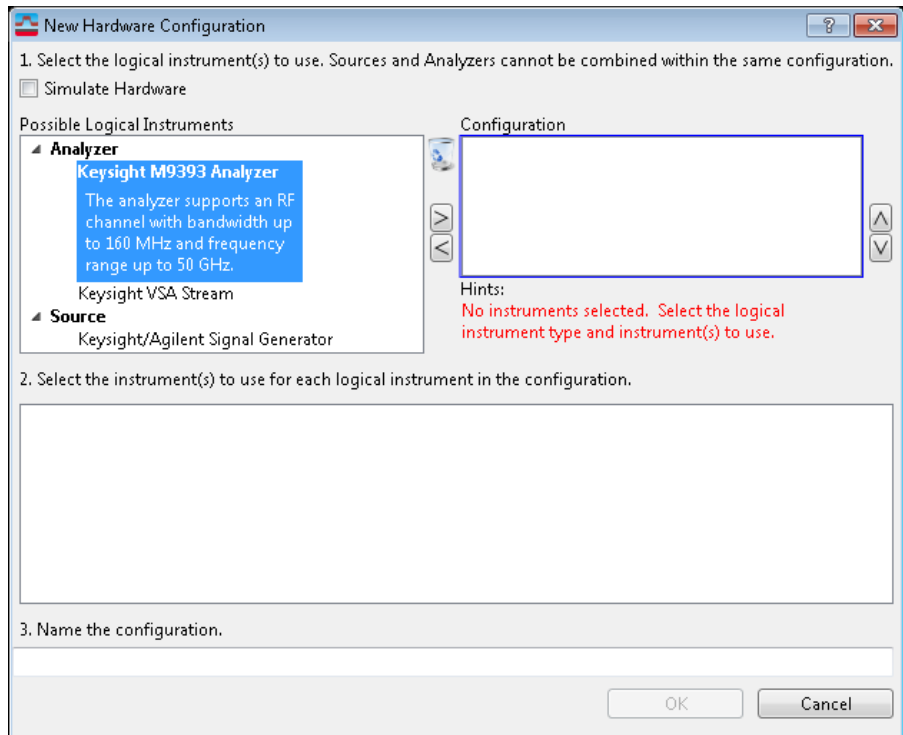
b. Configure the new M9393A (Modules) instrument by selecting the modules identified by their VISA address in the "2. Select the instrument(s) to use for each logical instrument in the configuration" section.

In the image below, the modules associated with the first channel are shown in slots 2, 4, 10, and 3. The reference module is in slot 10 of the first channel, making this channel the master. All other channels will have "None" selected for the reference.

To configure the second channel, select it in the configuration window as shown in the next image. Configure the modules by selecting the next higher slot number offered, and set the Reference to "None" as shown in the next three images.
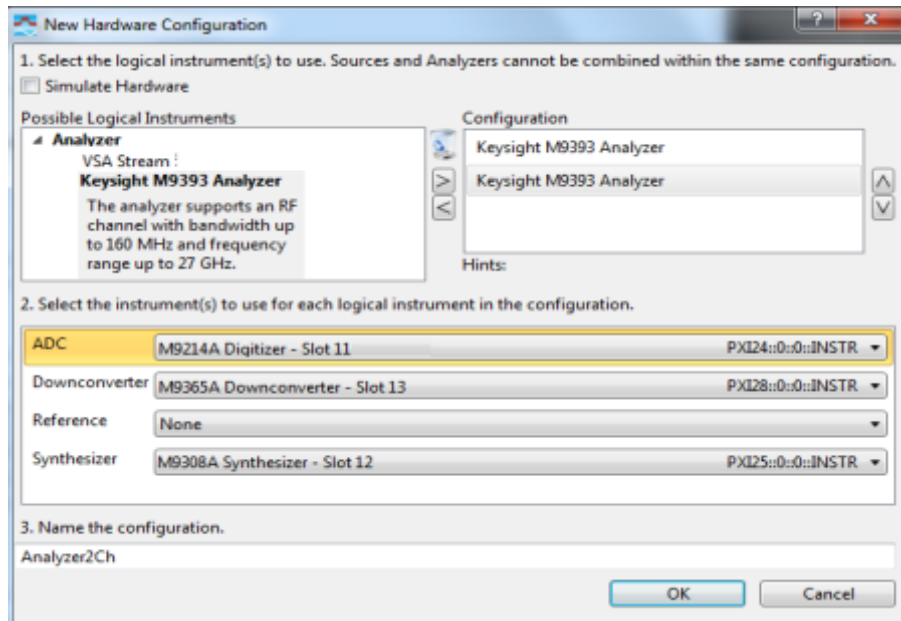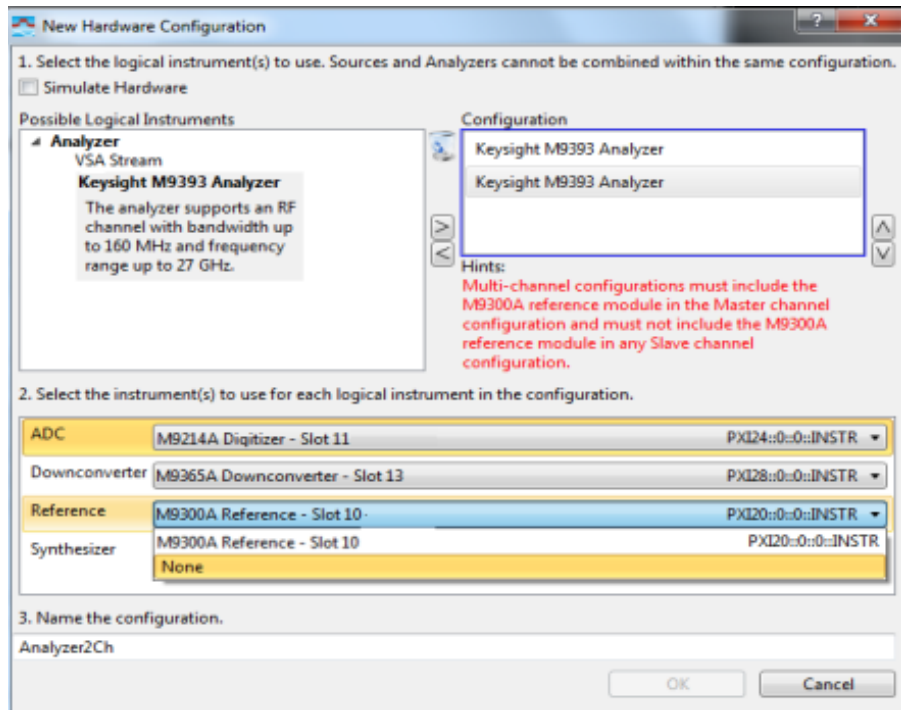
c. Name the new configuration in the "3. Name the configuration" section. The default name "Analyzer1" may be changed. Use a meaningful name for later identification.

d. Save the new configuration by clicking the OK button.

e. Having been saved, the new configuration can be reloaded in the future.

NOTE As a best practice, after setting up an M9393A measurement, perform a Disconnect/Restart (**Control > Disconnect** and then **Restart**). If there is an unlocked Frequency Reference or Digitizer 100 MHz clock missing condition,

the M9214A Digitizer status LED will turn to Red and the INT REF indicator at the bottom of the display will indicate "UNLOCKED" or "Waiting for Frequency Reference Lock". At this point, troubleshoot the instrument cabling. Perform a Disconnect/Restart again to verify that the frequency reference is present. Whether the problem is a broken 100 MHz clock path or an invalid External Reference (either not present or mismatched frequency), the reference status and measurement status messages are the same - "UNLOCKED" reference and "Waiting for frequency reference" measurement status. However, if the external reference signal (not the 100 MHz clock) is invalid, as soon as the signal becomes valid, measurement will resume; whereas in the 100 MHz clock signal case, you must **Disconnect** from the hardware and then reconnect (**Restart**) to start the measurement again.

Procedure for Configuring PXIe Backplane Bus Triggers

For the two channel configuration of modules, the master digitizer has been installed in Slot 2 (which is in Bus 1) and Channel 2 digitizer is in Slot 11 (which is Bus 2). Since sync signals must cross bus boundaries, it is necessary to configure the chassis triggers in Keysight Connection Expert as follows:
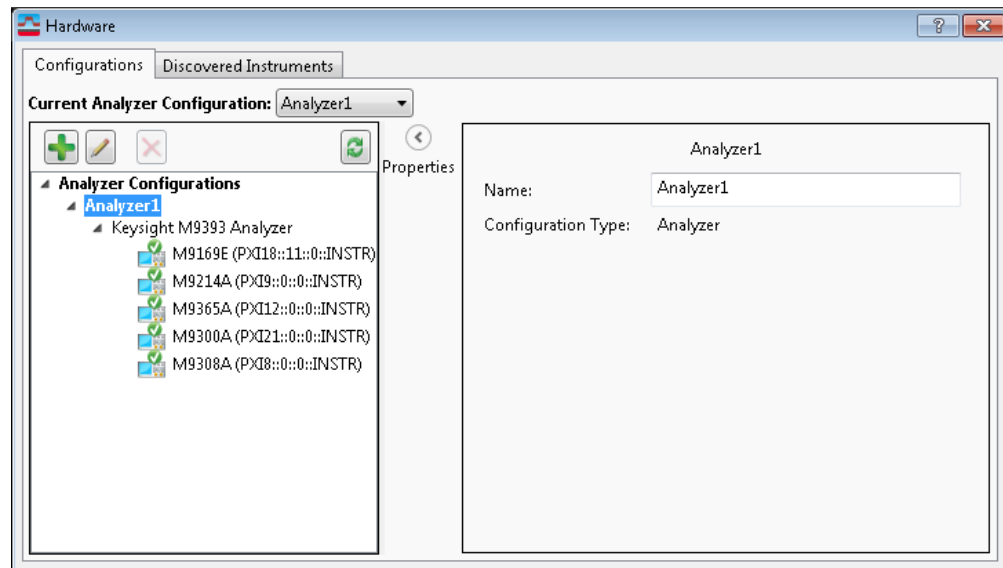
1. Click the PXI_TRIG1 row in Bus 2 to route the master in Bus 1 to Bus 2 .

2. Use the left to right arrow "→" to set the direction of flow and create the route from Bus 1 to Bus 2.

3. Click the PXI_TRIG2 row in Bus 1 to route the slave group sync.

4. Use the right to left arrow "←" to set the direction of flow and create the route from Bus 2 to Bus 1.
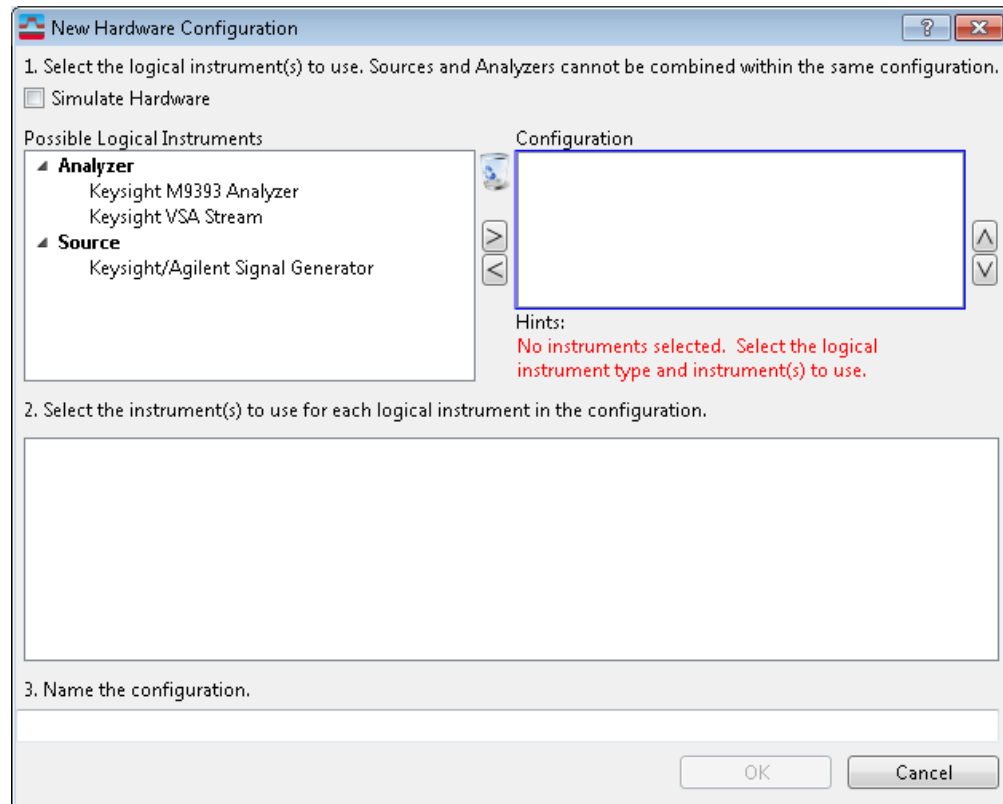
5. Click OK.
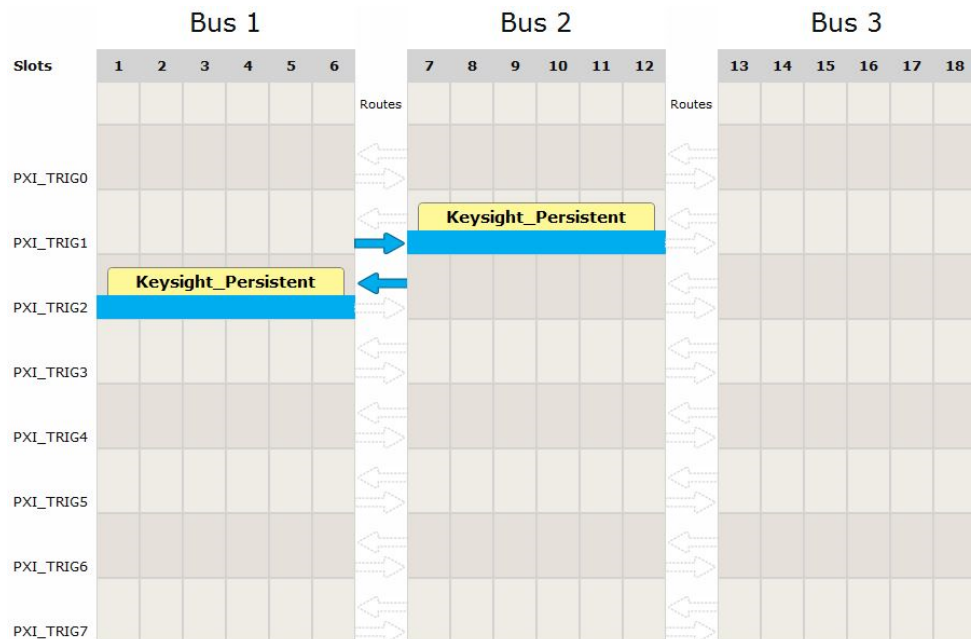
Procedure for a Three or Four Channel Configuration

To create a new M9393A instrument, use the Keysight 89600 VSA Software and follow these steps:

1. Open the New Hardware Configuration window in the Keysight 89600 VSA software by selecting: Utilities > Hardware > Configurations from the menu bar. When you hover over the last element in this sequence you will see a listing of the relevant configurations. Click Add New Hardware ⊕ .

2. In the New Hardware Configuration window,

a. Select the Keysight M9393A Analyzer (modules) entry and click on the ▷ icon to copy the entry to the Configuration window.

To create multiple channels, select the Keysight M9393A Analyzer (modules) entry, and click on the ▷ icon to copy the entry to the Configuration window two more times for a three channel system, and three more times for a four channel system (as shown in 2b).

b. Configure the new M9393A (modules) instrument by selecting the modules identified by their VISA address in the "2. Select the instrument(s) to use for each logical instrument in the configuration" section.

In the image below, the modules associated with the first channel are shown in slots 2, 4, 10, and 3. The reference module is in slot 10 of the first channel, making this channel the master. All other channels will have "None" selected for the reference .

To configure the second channel, select it in the configuration window as shown in the next image. Configure the modules by selecting the next higher slot number offered, and set the Reference to "None."

New Hardware Configuration

1. Select the logical instrument(s) to use. Sources and Analyzers cannot be combined within the same configuration.

☐ Simulate Hardware

Possible Logical Instruments

▲ **Analyzer**
    VSA Stream
    Keysight M9393 Analyzer
        The analyzer supports an RF channel with bandwidth up to 160 MHz and frequency range up to 27 GHz.

Configuration

Keysight M9393 Analyzer
Keysight M9393 Analyzer
Keysight M9393 Analyzer
Keysight M9393 Analyzer

Hints:
Multi-channel configurations must include the M9300A reference module in the Master channel configuration and must not include the M9300A reference module in any Slave channel configuration.

2. Select the instrument(s) to use for each logical instrument in the configuration.

ADC	Agilent M9214A Digitizer - Slot 6	PXI13::0::0::INSTR ▼
Downconverter	Agilent M9365A Downconverter - Slot 8	PXI10::0::0::INSTR ▼
Reference	None	▼
Synthesizer	Agilent M9308A Synthesizer - Slot 7	PXI14::0::0::INSTR ▼

3. Name the configuration.

Analyzer2

OK   Cancel

To configure the third channel, select it in the configuration window as shown in the next image. Configure the modules by selecting the next higher slot number offered, and set the Reference to "None." If this is a three channel system, stop here.

Keysight M9393A PXIe Performance Vector Signal Analyzer
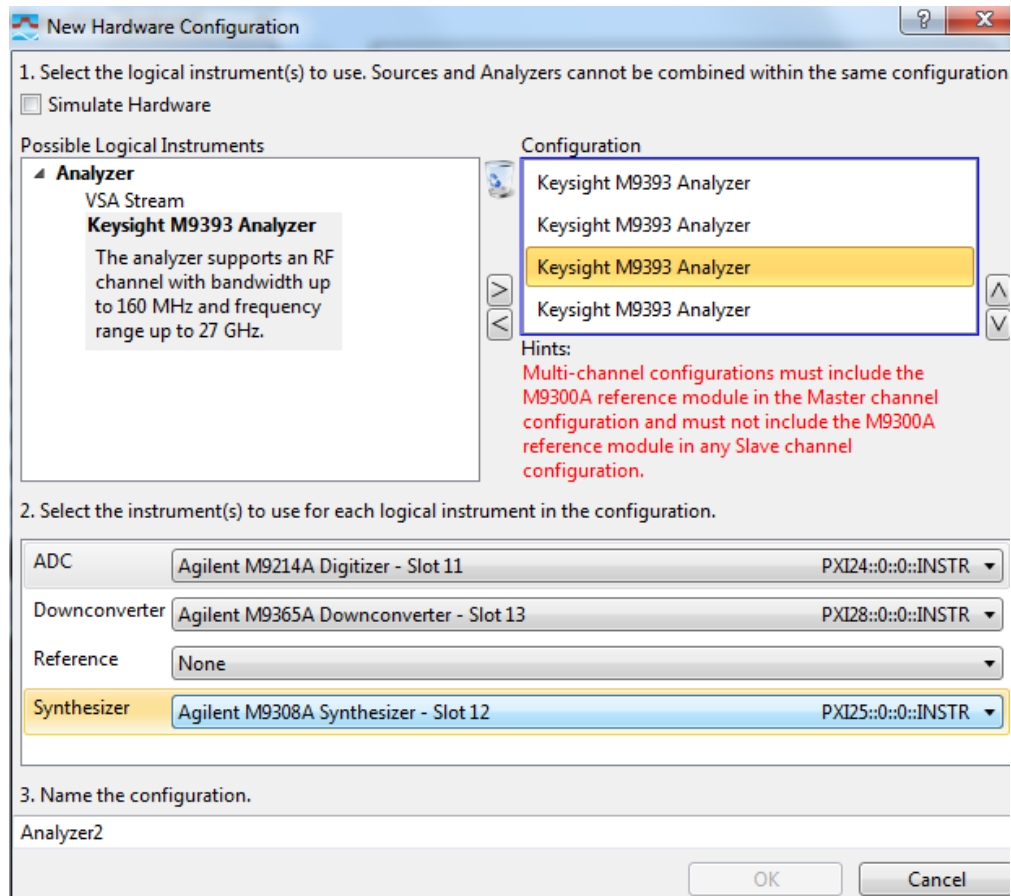
To configure the fourth channel, select it in the configuration window as shown in the next image. Configure the modules by selecting the next higher slot number offered, and set the Reference to "None."
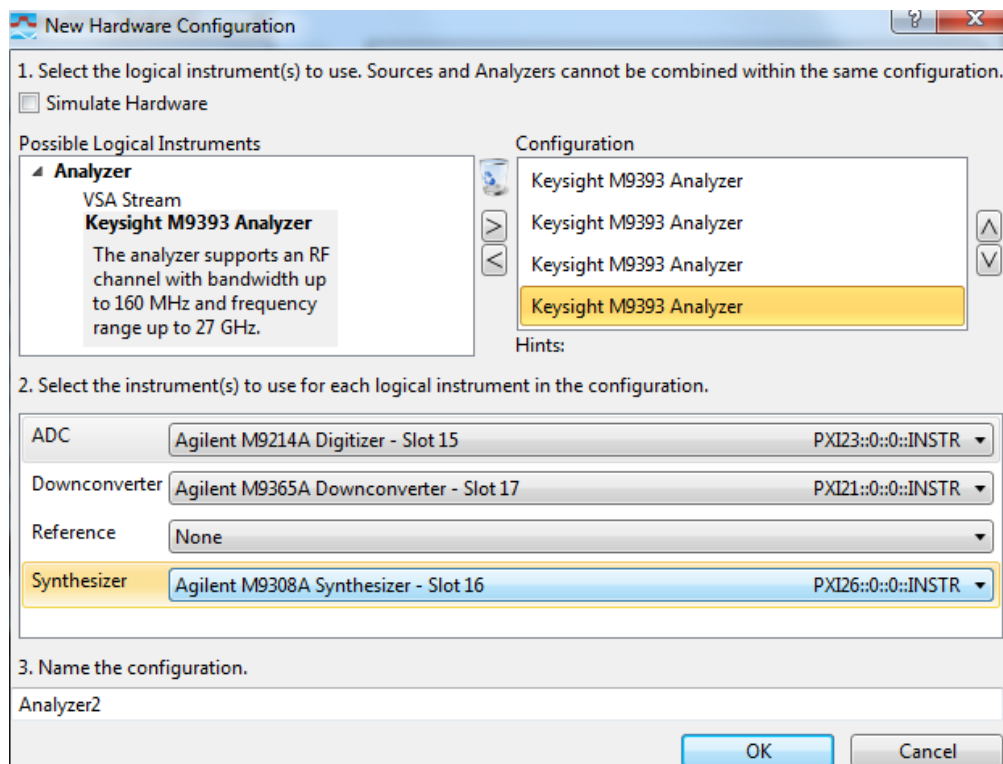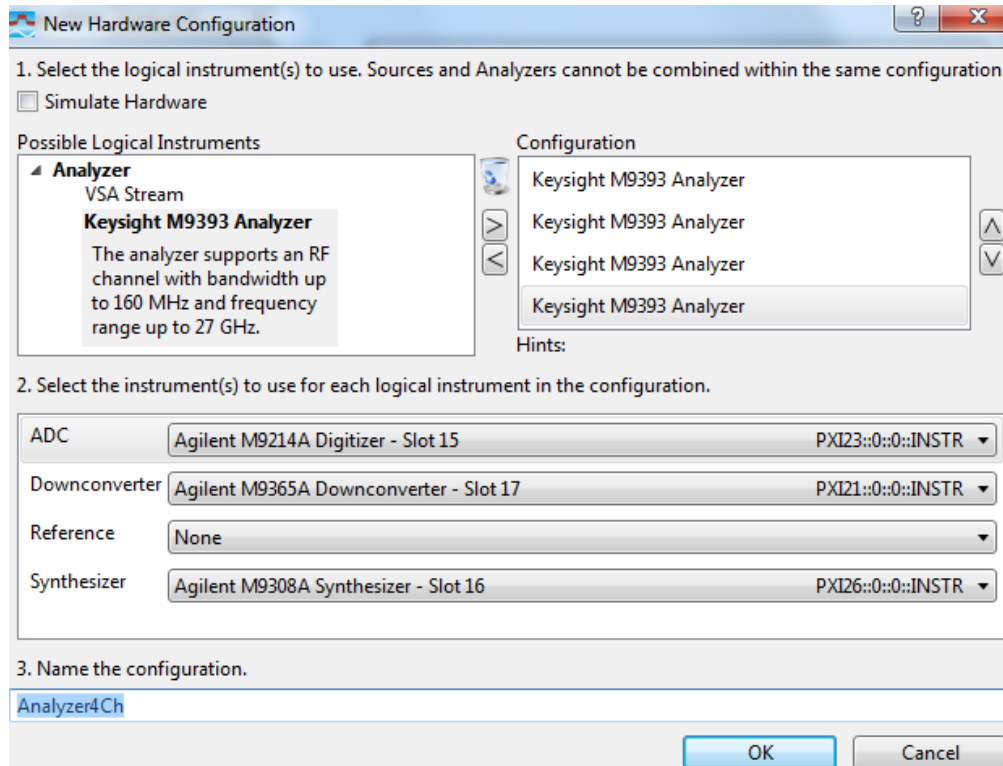
c. Name the new configuration in the "3. Name the configuration" section. The default name "Analyzer1" may be changed. Use a meaningful name for later identification.

d. Save the new configuration by clicking the OK button.

e. The new configuration can be given a name saved for future reloading

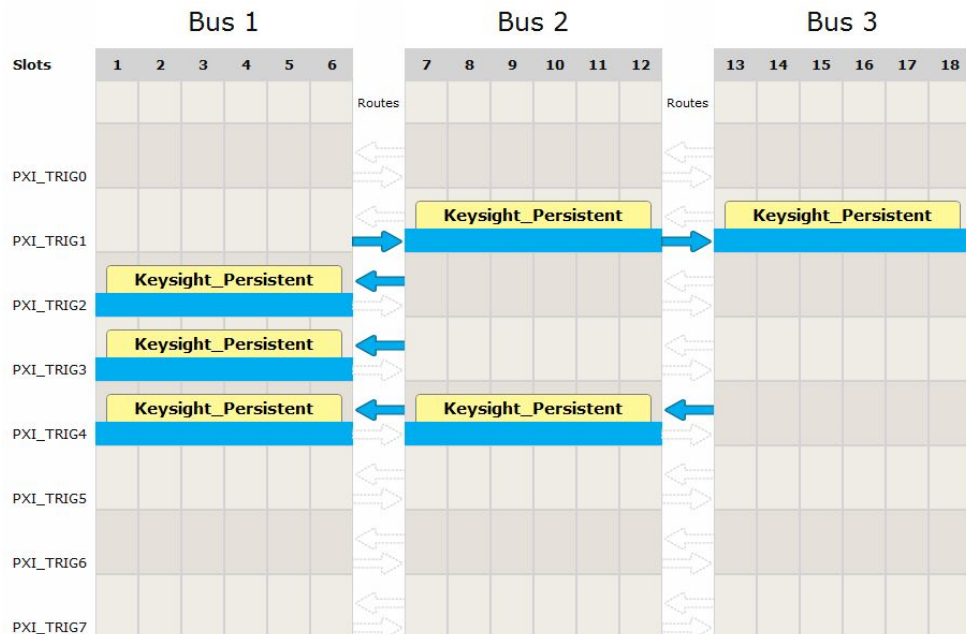This ends the configuration setup for a four channel system.

> **NOTE** As a best practice, after setting up an M9393A measurement, perform a Disconnect/Restart (**Control > Disconnect** and then **Restart**). If there is an unlocked Frequency Reference or Digitizer 100 MHz clock missing condition, the M9214A Digitizer status LED will turn to Red and the INT REF indicator at the bottom of the display will indicate "UNLOCKED" or "Waiting for Frequency Reference Lock". At this point, troubleshoot the instrument cabling. Perform a Disconnect/Restart again to verify that the frequency reference is present. Whether the problem is a broken 100 MHz clock path or an invalid External Reference (either not present or mismatched frequency), the reference status and measurement status messages are the same – "UNLOCKED" reference and "Waiting for frequency reference" measurement status. However, if the external reference signal (not the 100 MHz clock) is invalid, as soon as the signal becomes valid, measurement will resume; whereas in the 100 MHz clock signal case, you must **Disconnect** from the hardware and then reconnect (**Restart**) to start the measurement again.

Keysight M9393A PXIe Performance Vector Signal Analyzer

Procedure for Configuring PXIe Backplane Bus Triggers

For the four channel configuration of modules, the master digitizer has been installed in Slot 2 (which is in Bus 1), Channel 2 digitizer is in Slot 6 (which is Bus 2), Channel 3 digitizer is in Slot 11 (which is Bus 2) and Channel 4 digitizer is in Slot 15 (which is Bus 3). Since sync signals must cross bus boundaries, it is necessary to configure the chassis triggers in Keysight Connection Expert as follows:

1. Click the PXI_TRIG1 row in Bus 2 to route the master in Bus 1 to Bus 2. Use the left to right arrow "→" to set the direction of flow and create the route from Bus 1 to Bus 2.

2. Now, click the same PXI_TRIG1 row in Bus 3 to route the master in Bus 2 to Bus 3. Use the left to right arrow "→" to set the direction of flow and create the route from Bus 2 to Bus 3.

3. Click the PXI_TRIG2 row in Bus 1 to route the slave group sync. Use the right to left arrow "←" to set the direction of flow and create the route from Bus 2 to Bus 1.

4. Click the PXI_TRIG3 row in Bus 1 to route the slave group sync. Use the right to left arrow "←" to set the direction of flow and create the route from Bus 2 to Bus 1.

5. Click the PXI_TRIG4 row in Bus 2 to route the slave group sync. Use the right to left arrow "←" to set the direction of flow and create the route from Bus 3 to Bus 2.

6. Now, click the same PXI_TRIG4 row in Bus 1 to route the slave group sync. Use the right to left arrow " ←" to set the direction of flow and create the route from Bus 2 to Bus 1.

7. Click OK.

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