

Startup Guide

# Keysight M9391A PXIe Signal Analyzer and M9381A PXIe Vector Signal Generator 1 MHz to 3 GHz or 6 GHz

# Notices

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## Manual Part Number

M9300-90090

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## Edition

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## Regulatory Compliance

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## 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.

### WARNING

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.

### WARNING

Operator is responsible to maintain safe operating conditions. To ensure safe operating conditions, modules should not be operated beyond the full temperature range specified in the Environmental and physical specification. Exceeding safe operating conditions can result in shorter 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.

### WARNING

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).



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 buildup 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.

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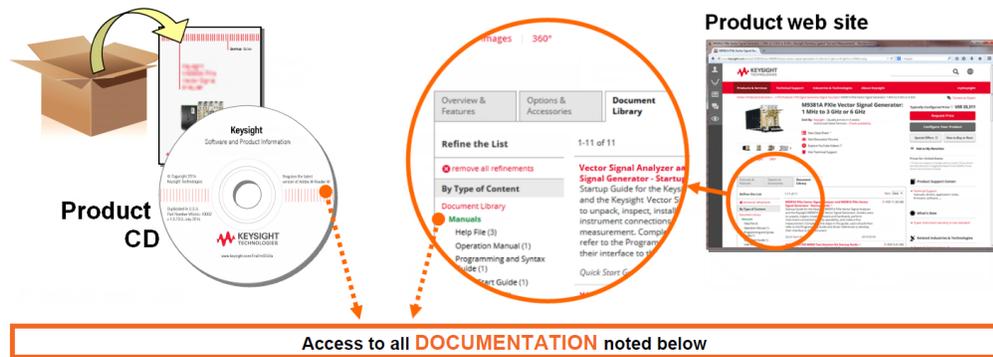
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# Documentation Access



## Startup Guide



- Unpack product
- Verify shipment
- Install software
- Install hardware
- Verify operation
- Troubleshooting

## Data Sheet



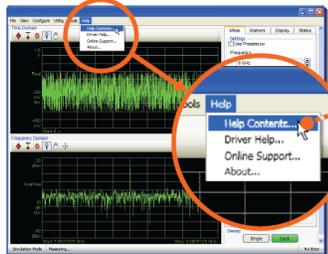
- Product description
- Technical specifications

## Programming Guide

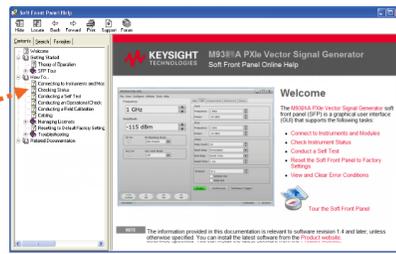


- Product intro
- Programming Procedures
- Sample Programs

## Soft Front Panel (SFP) user interface

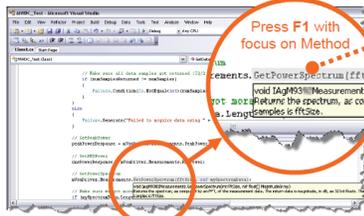


## SFP help system



- Theory of operation
- Block diagram
- Configuration
- Self test
- Operational check
- Field calibration
- Troubleshooting

## Visual Studio

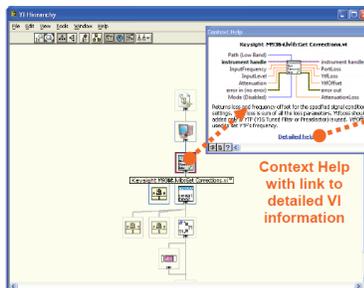


## IVI Driver help system

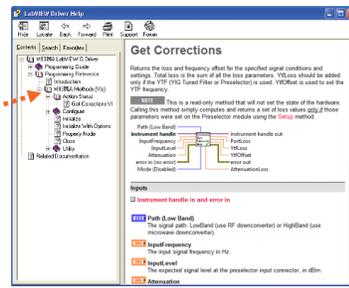


- IVI-COM and IVI-C driver reference
- Sample programs

## LabVIEW



## LabVIEW Driver help system



- LabVIEW driver reference
- Sample programs

# VSA and VSG Introduction

## Introduction

The scope of this Startup Guide is to detail the processes of receiving and installing the modules and cables that compose the Keysight M9381A PXIe Vector Signal Generator and the Keysight M9391A PXIe Vector Signal Analyzer in both single channel and multi-channel configurations.

Steps 1 - 7 cover the basics of setting up and configuring both a single and a multi-channel VSA and VSG system. Both the number and mix of VSGs and VSAs used in a system is variable. In addition, the configuration of the synthesizer module being used as the local oscillator (LO) can be either shared or independent. Setting up, aligning, and operating a multi-channel system manually is time consuming. To make this process easier, a Multi-Channel PXIe Config Utility program has been developed and is provided on the installation CD and is available for download.

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/pxi-mimo](http://www.keysight.com/find/pxi-mimo).

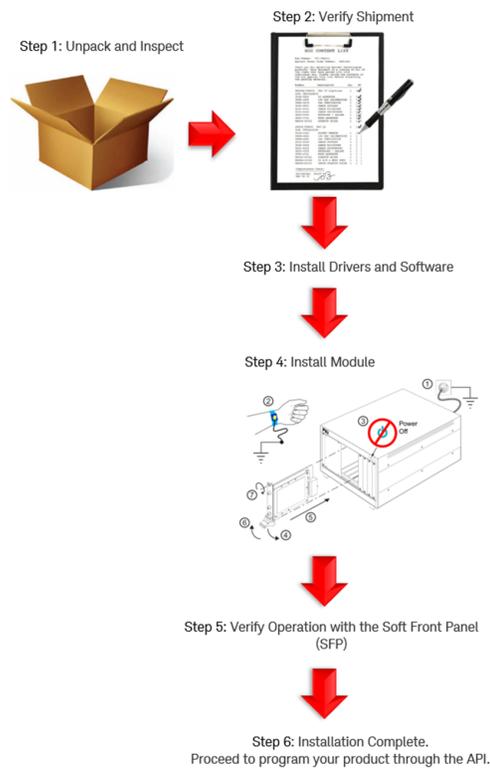
### NOTE

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.



## Related Documentation

To access documentation related to the Keysight M9381A PXIe Vector Signal Generator and the Keysight M9391A PXIe 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.

Document	Description	Default Location on 64-bit Windows system
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Document	Description	Default Location on 64-bit Windows system
<b>Startup Guide</b>	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.	<i>For M9381:</i> C:/Program Files (x86)/Agilent/M938x/Help\M9391_and_M9381_StartupGuide.pdf  <i>For M9391A:</i> C:\Program Files (x86)\Agilent\M9391\Help\M9391_and_M9381_StartupGuide.pr
<b>Programming Guide</b>	Shows you how to use Visual Studio 2010 with the .NET Framework to write IVI-COM Console Applications in Visual C#.	<i>For M9381:</i> C:/Program Files (x86)/Agilent/M938x/Help\M9391_and_M9381_ProgrammingGuide.pdf  <i>For M9391A:</i> C:\Program Files (x86)\Agilent\M9391\Help\M9391_and_M9381_ProgrammingGuide.pdf
<b>Soft Front Panel (SFP) help system</b>	Provides product introduction, tour of the SFP user interface, how-to procedures (for example, configuration, self test, operational check), and troubleshooting.	<i>For M9381:</i> C:/Program Files (x86)/Agilent/M938x/Help\M9381_SFP_Help.chm  <i>For M9391A:</i> C:\Program Files (x86)\Agilent\M9391\Help\M9391_SFP_Help.chm

Document	Description	Default Location on 64-bit Windows system
<b>IVI Driver reference (help system)</b>	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.	<i>For M9381:</i> C:/Program Files (x86)/Agilent/M938x/Help/AgM938x.chm <i>For M9391A:</i> C:\Program Files (x86)\Agilent\M9391\Help\AgM9391.chm
<b>LabVIEW Driver Reference</b>	Provides detailed documentation of the LabVIEW G Driver API functions.	<i>For M9381:</i> C:/Program Files (x86)/Agilent/M938x/Help/AgM938x_LabVIEW_Help.chm <i>For M9391A:</i> C:\Program Files (x86)\Agilent\M9391\Help\AgM9391_LabVIEW_Help.chm
<b>Data Sheet</b>	In addition to a detailed product introduction, the data sheet supplies full product specifications.	<i>For M9381:</i> C:/Program Files (x86)/Agilent/M938x/Help/M9381_DataSheet_5991-0279EN.pdf <i>For M9391A:</i> C:\Program Files (x86)\Agilent\M9391\Help\M9391_DataSheet_5991-2603EN.pc

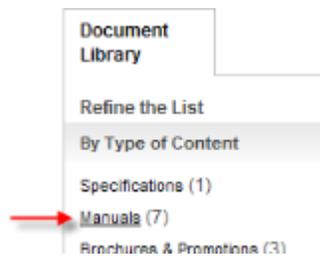
Document	Description	Default Location on 64-bit Windows system
Specification Guide	Provides technical specifications for all manufacturing versions of the M9381A PXI Vector Signal Generator and the M9391A PXI Vector Signal Analyzer hardware and firmware.	<p><b>For M9381:</b> C:/Program Files (x86)/Agilent/M938x/Help\M9381_SpecificationsGuide.pdf</p> <p><b>For M9391A:</b> C:\Program Files (x86)\Agilent\M9391\Help\M9391_SpecificationsGuide.pdf</p>

**NOTE**

Alternatively, you can find these documents under:

- Start > All Programs > Keysight > M938x.
- Start > All Programs > Keysight > M9391.

- The documentation listed above is also available on the product CD.
- 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/M9381A](http://www.keysight.com/find/M9381A) or [www.keysight.com/find/M9391A](http://www.keysight.com/find/M9391A)) and download the files from the Manuals support page (go to Document Library > Manuals):



The Keysight M9381A, M9380A and M9391A Security Guide is available at <http://edownload.software.keysight.com/Modular/M9300A/2.0/M9300-90021.pdf>.

If you are using Keysight M9381A PXIe VSG and Keysight M9391A PXIe VSA for MIMO measurements, refer to Keysight LTE/LTE-Advanced Multi-Channel Reference Solution Startup Guide at <http://literature.cdn.keysight.com/litweb/pdf/Y1299-90001.pdf>.

**NOTE**

If you ordered the M9391A PXIe VSA with the M9300A PXIe Frequency Reference (order option M9391A-300) and did not order the M9381A PXIe VSG or M9380A PXIe CW Source, be aware that the M9300A software and documentation are not installed with the M9391A installer. To install the M9300A software and documentation, run the M938x installer, available at [www.keysight.com/find/M9381A-driver](http://www.keysight.com/find/M9381A-driver). (When you run the M938x installer, you have the option to install only the M9300A-related files.)

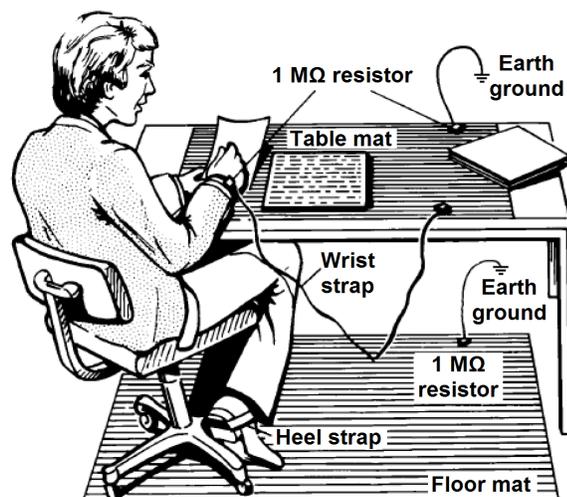
## Step 1 - Unpack and Inspect the Module

### Step 1 - Unpack and Inspect the Modules

#### CAUTION

The modules are shipped in materials which prevent damage from static. Modules 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 M $\Omega$  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.

## Return an Instrument for Service

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

### NOTE

It is recommended that you return all modules and cables of the M9381A or M9391A instrument for repair and calibration. If your Keysight M9300A PXIe Frequency Reference is operating properly, you need not send it in with the other modules because your instrument may be repaired and calibrated without your M9300A. Doing so, however, will effect your calibration schedule, since repairs are followed by calibration. The Calibration Due Date for your M9300A will not match the date of your other modules.

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 Keysight contact information, go to [www.keysight.com/find/assist](http://www.keysight.com/find/assist).
3. Write the following information on a tag and attach it to the malfunctioning equipment:
  - Name and address of owner. A P.O. box is not acceptable as a return address.
  - Module serial number(s). The serial number label is located on the side panel of the module. The serial number can also be read from the Soft Front Panel interface - *after* the hardware is installed.
  - 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.

## Step 2 – Verify Shipment Contents and Model Options

### M9381A Shipment Contents

The Keysight M9381A PXIe Vector Signal Generator is a multi-module instrument (MMI), housed in a PXIe chassis. The minimum Vector Signal Generator consists of the software, chassis, a Keysight M9301A PXIe Synthesizer, a Keysight M9310A PXIe Source Output, a Keysight M9311A PXIe Digital Vector Modulator and a Keysight M9300A PXIe Frequency Reference. The M9300A may be used in this and other configurations. You may configure the Keysight M9380A PXIe CW Source in the same chassis and also use the same M9300A.

### Items included in your M9381A Shipment

Qty	Keysight Part Number	Description
1	M9300-10002	Software and Product Information CD, contains: Soft Front Panels, drivers, and all printed documentation in PDF format (also available at <a href="http://www.keysight.com/find/m9381a">http://www.keysight.com/find/m9381a</a> )
1	M9300-90090	Keysight M9391A PXIe Vector Signal Analyzer and M9381A PXIe Vector Signal Generator Startup Guide in hard copy
1	5023-1450	Wrench, socket, extension, 5/16 inch, SMA
1	5002-3361	SMB/MMCX Cable Removal Tool
3	1250-4261	Microwave Plug 18 GHz-MAX SMA Male Straight 50-Ohm. These are attached to the M9301A RF/LO ports.
1 *	M9300A	(Optional) Keysight M9300A PXIe Frequency Reference
1 *	M9300-90001	(Optional) M9300A Startup Guide (ships with M9300A)
1	M9301A	Keysight M9301A PXIe Synthesizer
1	M9310A	Keysight M9310A PXIe Source Output
1	M9311A	Keysight M9311A PXIe Digital Vector Modulator
1	5972-3335	PXIe Modular Product Startup Guide Reference
1	9320-6691	China ROHS Addendum for Signal Generator

Qty	Keysight Part Number	Description
1	5962-0476	Certificate of Calibration
1	5959-4660	Recommended Due Date for Adjustment/Calibration
1 *	8121-2063	(Optional) Cable, coaxial, BNC/male-SMB/female, 1200 mm (ships with M9300A)
1	8121-2175	Cable, coaxial, SMB/female SMB/female (300 mm)
4	8120-5091	Cable, coaxial, SMB-SMB (120 mm)
1	1250-2316	Adaptor, coaxial, straight, SMA (f) to SMA (m)
1	W1312-20266	Cable, semi-rigid, (SMA-SMA)
1	W1312-20267	Cable, semi-rigid, (SMA-SMA)
4	W1312-20265	Cable, coaxial, SMB-SMB (85 mm)

\* The Keysight M9300A PXIe Frequency Reference is required to configure a Keysight M9381A PXIe Vector Signal Generator. It is an option to the M9381A because it may be ordered in, and shared by other instruments including the M9380A or the M9391A.

#### Model - Option List for the Keysight M9381A PXIe Vector Signal Generator

M9381A	Description
M9381A	PXIe C W Source: 1 MHz to 3 GHz or 6 GHz
M9381A-F03	Frequency Range, 1 MHz to 3 GHz
M9381A-F06	Frequency Range: 1 MHz to 6 GHz
M9381A-1EA	High Output Power
M9381A-UNZ	Fast Switching
M9381A-B04	RF Modulation Bandwidth, 40 MHz
M9381A-B10	RF Modulation Bandwidth, 100 MHz

<b>M9381A</b>	<b>Description</b>
M9381A-B16	RF Modulation Bandwidth, 160 MHz
M9381A-M01	Memory, 32 MSa
M9381A-M05	Memory, 512 MSa
M9381A-M10	Memory, 1024 MSa
M9381A-UNT	Analog Modulation
M9381A-300	Keysight M9300A PXIe Frequency Reference: 10 MHz and 100 MHz
M9381A-UK6	Commercial calibration certificate with test data
M9381A-012	LO Sharing for Phase Coherency

## M9391A Shipment Contents

Items included in your Keysight M9391A PXIe Vector Signal Analyzer Shipment

<b>Qty</b>	<b>Keysight Part Number</b>	<b>Description</b>
1	M9300-10002	Software and Product Information CD, contains: Soft Front Panels, drivers, and all printed documentation in PDF format (also available at <a href="http://www.keysight.com/find/m9391a">www.keysight.com/find/m9391a</a> )
1	M9300-90090	Keysight M9391A PXIe Vector Signal Analyzer and M9381A PXIe Vector Signal Generator Startup Guide in hard copy
1	5962-0476	Certificate of Calibration
1	5959-4660	Recommended Due Date for Adjustment/Calibration
1	5023-1450	Wrench, socket, extension, 5/16 inch, SMA
1	5002-3361	Cable removal tool, SMB/MMCX
1	5972-3335	PXIe Modular Product Startup Quick Reference
1	9320-6698	China RoHS Addendum for Vector Signal Analyzer

Qty	Keysight Part Number	Description
1	M9300A	(Optional) Keysight M9300A PXIe Frequency Reference
1	M9300-90001	(Optional) M9300A Startup Guide (ships with M9300A)
3	1250-4261	Microwave Plug 18 GHz-MAX SMA Male Straight 50-Ohm. These are attached to the M9301A RF/LO ports.
1	M9301A	Keysight M9301A PXIe Synthesizer
1	M9350A	Keysight M9350A PXIe Downconverter
1	M9214A	Keysight M9214A PXIe IF Digitizer
1	8121-2063	(Optional) Cable, coaxial, BNC/male-SMB/female, 1200 mm (ships with M9300A)
4	8120-5091	Cable, coaxial, SMB/female-SMB/female (120 mm)
1	8121-2100	Cable, coaxial SMB/female SMB/female (85 mm)
1	8121-2175	Cable, coaxial, SMB/female SMB/female (300 mm)
1	W1312-20237 or W1312-20271	Cable, semi-rigid, SMA/male-SMA/male, 32mm
3	1250-2316	Adaptor, coaxial straight, male-SMA to female SMA

#### Model - Option List for the Keysight M9391A PXIe Vector Signal Analyzer

M9391A	Description
M9391A	PXIe Vector Signal Analyzer: 1 MHz to 3 GHz or 6 GHz
M9391A-F03	Frequency Range, 1 MHz to 3 GHz
M9391A-F06	Frequency Range: 1 MHz to 6 GHz
M9391A-UNZ	Fast Switching
M9391A-B04	Analysis Bandwidth, 40 MHz

<b>M9391A</b>	<b>Description</b>
M9391A-B10	Analysis Bandwidth, 100 MHz
M9391A-B16	Analysis Bandwidth, 160 MHz
M9391A-M01	Memory, 32 MSa
M9391A-M05	Memory, 512 MSa
M9391A-M10	Memory, 1024 MSa
M9391A-300	Add Keysight M9300A PXIe Frequency Reference: 10 MHz and 100 MHz
M9391A-UK6	Commercial calibration certificate with test data
M9391A-012	LO Sharing for Phase Coherency

## Step 3 - Install the Software

### Step 3 - Install the Software

#### System Requirements

Topic	Windows 7 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	1.5 GB available hard disk space, includes: <ul style="list-style-type: none"><li>- 1 GB available for Microsoft .NET Framework 4.5.2</li><li>- 100 MB for Keysight IO Libraries Suite</li></ul>
Video	Support for DirectX 9 graphics with 128 MB graphics memory recommended (Super VGA graphics is supported)
Browser	Microsoft Internet Explorer 7.0 or greater

#### Hardware Requirements

Topic	Requirements
Chassis	PXIe or PXI-H chassis slot
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 <b>M9036A</b> or <b>M9307A</b> or an embedded controller that meets the following requirements: <ul style="list-style-type: none"><li>- PXIe system controller (PXI-1 embedded controllers are not compatible)</li><li>- Utilize a 2x8, or 4x4 PXIe system slot link configuration.</li><li>- Run one of the operating systems listed in System Requirements (above).</li></ul>

Topic	Requirements
Remote controller	<p>(for Keysight M9018/M9019A chassis use 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:</p> <ul style="list-style-type: none"> <li>- Keysight <a href="#">M9045B</a> PCIe ExpressCard Adaptor x1, with cable (for a laptop PC)</li> <li>- Keysight <a href="#">M9048A</a> PCIe Desktop Adaptor x8, with cable (for desktop PCs)</li> </ul>

## Chassis Requirements

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 M9018A chassis/Keysight M9018B chassis/Keysight M9019A 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.

## M9018/M9019A Chassis Air Flow



The M9018/M9019A has multiple air intakes. They are located at the lower sides, lower front, and bottom of the chassis.

## Power up the Controller

**CAUTION** If you are using a remote controller and you have installed the interface cable, you must power up the chassis **BEFORE** you power up the PC. When you power down your chassis, Shut Down the PC **BEFORE** you power down the chassis.

If you are using an embedded controller, complete the following steps:

1. Install the embedded controller module into the compatible chassis. The Keysight M9036A/M9037A PXIe Embedded Controller and Keysight M9018 /M9019A PXIe Chassis are recommended. Please refer to the embedded controller and chassis documentation for further details.
2. Connect peripherals (mouse, keyboard, monitor).
3. Power up the chassis.

## Software Installation Overview

This installation includes the following:

- Keysight IO Libraries Suite (version 2019 U1 or newer), which includes the Keysight Connection Expert. The latest IO Libraries Suite software is available at [www.keysight.com/find/iosuite](http://www.keysight.com/find/iosuite). This software must be installed first.

**NOTE**

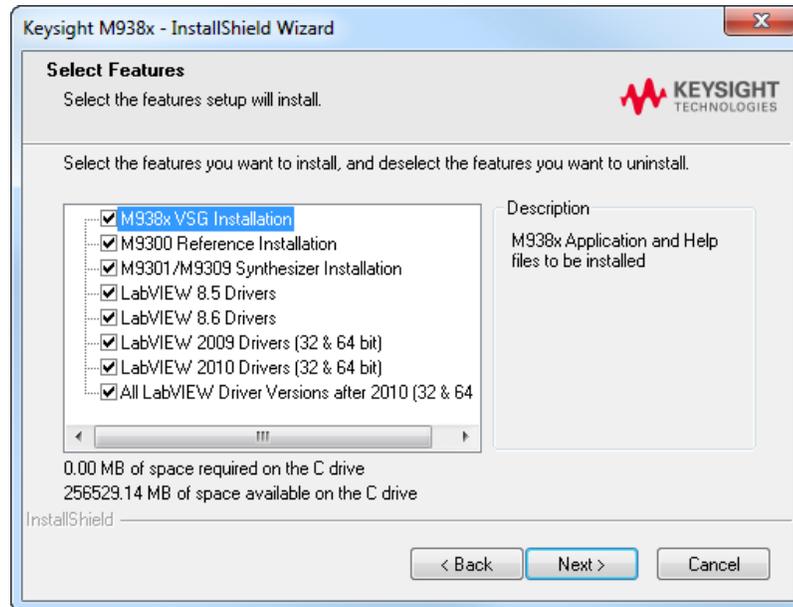
The Keysight Instrument Control DVD, which includes the IO Libraries Suite software, is no longer shipped with Keysight instruments. If you require a Keysight Instrument Control DVD, it can be ordered by contacting your local Keysight Customer Contact Center.

- Instrument software, which includes the soft front panel (SFP), device drivers (IVI-C, IVI-COM, and LabVIEW G) and documentation for the M9381A PXIe Vector Signal Generator and M9391A PXIe Vector Signal Analyzer. This software is included with your shipment and is also available at [www.keysight.com/find/M9391A](http://www.keysight.com/find/M9391A).

## Software Installation Procedure

1. Install the Keysight IO Libraries Suite. Follow the installer prompts to install the IO libraries.

2. Install the product software.  
If you have both Keysight PXle VSA and VSG, repeat the procedure with the respective installer.
  - a. Launch the software installer.

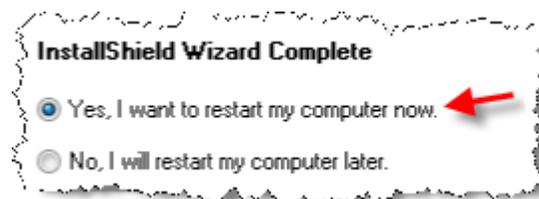


- b. Follow the installer prompts. Choose a "Complete" installation to install all software and documentation, or a "Custom" installation to select from a listing of modules and other features.

### 3. Complete the installation.

Embedded controller (M9036A, M9037A):

1. Select "Yes, I want to restart my computer now." This is the default selection.



2. Click on Finish.
3. Wait for the system to restart.

Remote controller:

(Follow these steps in order, or else instrument damage may result.)

1. Select "No, I will restart my computer later."



2. Click on Finish.
3. Shut down the remote controller PC. Use Start > Shut down.
4. Power down the chassis.
5. Power up the chassis.
6. Power up the remote controller PC.

## Step 4 - Install the Module

### Step 4 - Install the Modules

#### 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 or M9391A 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.

#### NOTE

These modules can be used in a chassis with PXIe or PXIe-H chassis slots.

### Module Installation Process Overview

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The module can be installed in any PXIe or hybrid PXIe slot marked with a peripheral slot compatibility image (solid black circle for PXIe, or solid black circle with the letter -H- for hybrid).

7

1. Make sure that the line cord is plugged in to establish earth ground and that the chassis power switch is Off.
2. 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.



3. 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. (Refer to the chassis documentation for more information about cooling).
4. Before inserting a module into the chassis, back the mounting screws out to ensure that there is no interference between the screws and the mounting rails.

5. See [M9391A Instrument Connections](#) for positioning the M9391A modules.  
See [M9381A Instrument Connections](#) for positioning the M9381A modules.

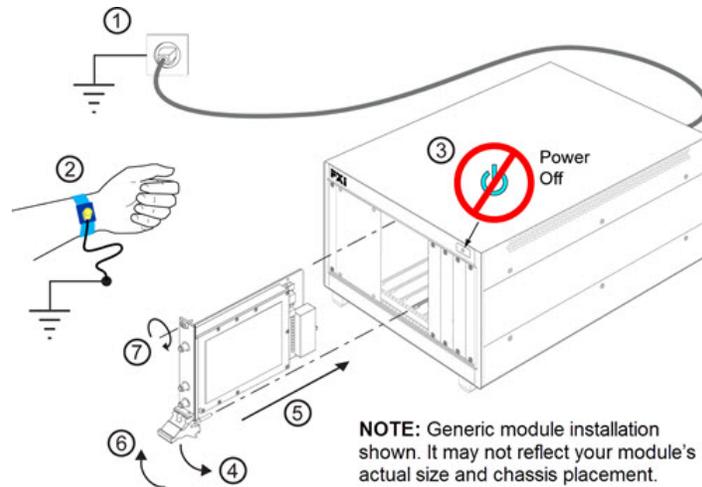
**CAUTION**

The M9381A uses peer-to-peer (module-to-module) triggering across the PXIe Express chassis backplane. Therefore, be sure to install the M9381A modules into a chassis that supports peer-to-peer PXIe Express I/O switch topology. When using the Keysight M9018/M9019B PXIe 18-Slot Chassis, install the M9381A modules into one of its three slot groups: 1 through 6, 7 through 12, or 13 through 18. Unless you install the M9381A modules entirely within one of the slot groups, you will experience trigger errors. If you install the modules across (straddling) any of these groups of slots, you will have to reconfigure the chassis's PXIe trigger bus routing for trigger 6 and trigger 7. (EXCEPTION: You can install the M9300A Reference module in a different slot group, thus allowing one M9300A module to provide an RF reference across slot groups to one or more modular instruments.) For details on reconfiguring the M9018/M9019A chassis triggers, see [Configuring M9018A PXIe Backplane Triggers/Configuring M9018B/M9019A PXIe Backplane Triggers](#) or see the [Keysight M9018A Chassis documentation/Keysight M9018B Chassis documentation/Keysight M9019A Chassis documentation](#). If you are using a non-Keysight chassis, consult your manufacturer's documentation.

**NOTE**

When using the Keysight M9018/M9019A Chassis you will achieve the highest data throughput for the Keysight M9391A PXIe Vector Signal Analyzer by using Slots 2, 6, 11 or 15 for the Keysight M9214A PXIe IF Digitizer. They are "x8" slots and the others are "x4". For further details see the [Keysight M9018A Chassis documentation/Keysight M9018B Chassis documentation/Keysight M9019A Chassis documentation](#). If you are using a non-Keysight chassis, consult your manufacturer's documentation.

6. Holding the module by the injector/ejector handle, slide it into an available PXIe (or hybrid) slot, as shown in the following figure.
  - a. Install the module into the slot of the chassis by placing the module card edges into the front module guides (top and bottom).
  - b. Slide the module to the rear of the chassis and ensure that the injector/ejector handle is pushed down in the unlatched (downward) position.
  - c. Slide the module completely into the chassis. When you begin to feel resistance, pull up on the injector/ejector handle to fully inject the module into the chassis.



7. Secure all modules to the chassis using the module mounting screws. Use a #1 Pozidriv® or a slotted screwdriver and torque to 5 Lb-In (0.57 N-m). Performance may suffer if the screws are not tightened properly.
8. Verify that the PXIe chassis fans are operable and free of dust and other contaminants that may restrict airflow.
9. Install filler panels and slot blockers after installing the modules. Missing filler panels or slot blockers may disrupt air circulation in the chassis. The left-most slot does not accept a slot blocker.
10. Your shipment included an Keysight M9310A PXIe Source Output and an Keysight M9350A PXIe Downconverter. With these modules you received a straight, coaxial adapter (1250-2316) (SMA female to SMA male). Connect this adapter to the RF Out connector of each M9310A and the RF In connector of each M9350A, and torque to 8 Lb-In (0.904 Nm). This will extend the life of these often-used connectors.
11. Use the [M9391A Instrument Connections with M9381A VSG](#) to attach the cables to the instrument. The torque specification for SMA connectors is 8 Lb-In (0.904 Nm).
12. If you are using a PCIe Cable Interface, such as the Keysight M9021, connect the Cable Interface in the chassis to the PC host per the instructions that came with the Cable Interface.
13. Power up the PXIe chassis.

14. Remap the backplane triggers, if necessary. See [Configuring M9018A PXIe Backplane Triggers/Configuring M9018B/M9019A PXIe Backplane Triggers](#).
15. If you are using a remote PC, reboot the PC host.
16. Proceed to [Step 5 - Verify Operation of the M9391A VSA and M9381A VSG](#).

## M9381A Instrument Connections

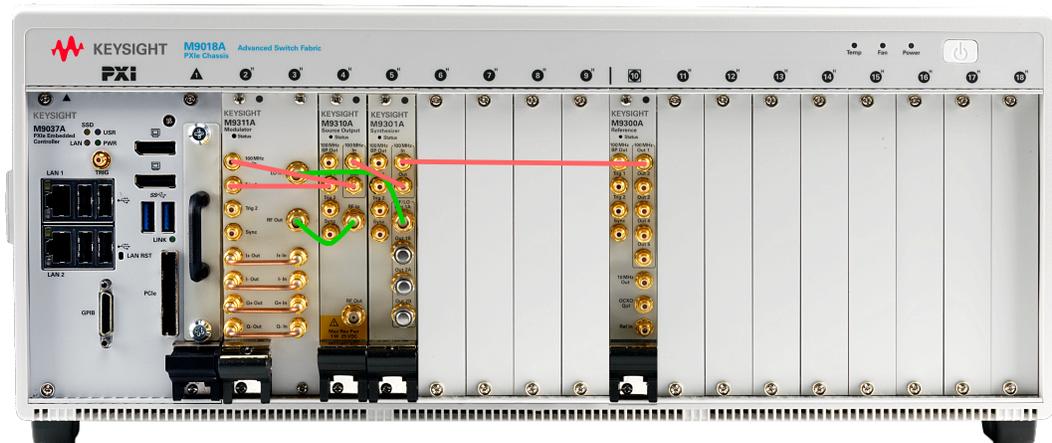
### Single M9381A VSG

This section contains a cabling diagram for the Keysight M9381A PXIe Vector Signal Generator, and a cable and module association table. For front panel feature descriptions, see the following:

- [M9300A Front Panel Connectors](#)
- [M9301A Front Panel Connectors](#)
- [M9310A Front Panel Connectors](#)
- [M9311A Front Panel Connectors](#)

#### NOTE

If you are building an M9381A PXIe VSA plus an M9391A PXIe VSG, see [M9391A and M9381A Instrument Connections](#).



The recommended single PXIe VSG system is configured as follows:

**VSG: M9381A**

**REF: M9300A**

M9311A in slot 2/3

M9300A in slot 10

M9310A in slot 4

M9301A in slot 5

Recommendation: Install the semi-rigid cables first.

Torque specification for all SMA connectors is 8 Lb-In (0.904 Nm).

## M9381A Cable and Module Table

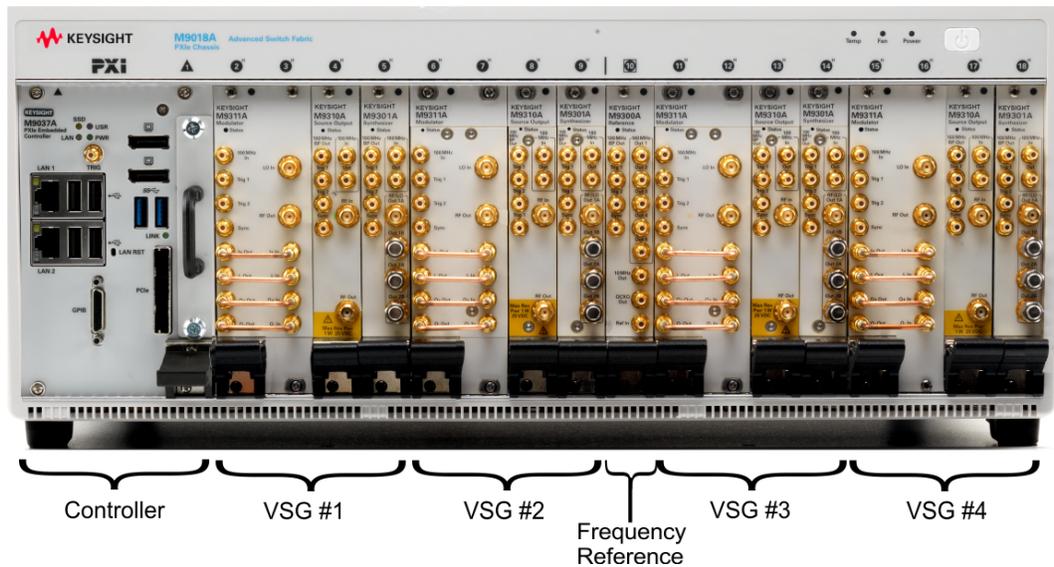
Part Number	Connection	Cable Description
8120-5091	M9300A 100 MHz Out 1 to M9301A 100 MHz In	Cable, coaxial, SMB (female)-SMB (female)
8120-5091	M9301A 100 MHz Out to M9310A 100 MHz In	Cable, coaxial, SMB (female)-SMB (female)
8120-5091	M9310A 100 MHz Out to M9311A 100 MHz In	Cable, coaxial, SMB (female)-SMB (female)
8120-5091	M9310A Trig 1 to M9311A Trig 1 for Pulse Modulation	Cable, coaxial, SMB (female)-SMB (female)
W1312-20266	M9301A RF/LO Out 1A to M9311A LO In	Cable, semi-rigid, SMA (male) - SMA (male)
W1312-20267	M9311A RF Out to M9310A RF In	Cable, semi-rigid, SMA (male) - SMA (male)
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
1250-2316	M9310A RF Out connector saver	Adaptor, coaxial, straight SMA (male) - SMA (female)
8121-2175	M9311A Trig 2 to M9214A Trig 1 *	Cable, coaxial, SMB (female)-SMB (female) 300 mm

### NOTE

\*The 8121-2175 cable is not required for standard M9381A operation. It is useful for power amplifier (PA) testing with the M9391A. This cable improves repeatability by enabling you to consistently measure the same portion of the input signal.

## Multiple M9381A PXIe VSGs in a Chassis

Up to four M9381A PXIe VSGs can be installed in a single M9018/M9019A 18-slot PXIe Chassis, sharing a single embedded controller, as shown here. These PXIe VSGs share one M9300A PXIe Frequency Reference and can be time-synchronized with backplane triggering to generate test stimulus for multi-channel receivers and MIMO devices. The PXIe VSGs can also be configured to be phase coherent with Option 012 and cabling all channels to use a single M9301A PXIe Synthesizer module with Y1243A cable kit.



The recommended multiple PXIe VSG system is configured as follows:

VSG #1: M9381A	VSG #2: M9381A	REF: M9300A	VSG #3: M9381A	VSG #4: M9381A
M9311A in slot 2/3	M9311A in slot 6/7	M9300A in slot 10	M9311A in slot 11	M9311A in slot 15
M9310A in slot 4	M9310A in slot 8		/12	/16
M9301A in slot 5	M9301A in slot 9		M9310A in slot 13	M9310A in slot 17
			M9301A in slot 14	M9301A in slot 18

Other module and instrument placements can be used, but this configuration optimizes speed and makes cabling simpler for phase coherent configuration.

**NOTE**

The M9300A Frequency Reference module must be installed in slot 10 for proper time synchronization between instruments. For more information, see [Sharing the M9300A Frequency Reference](#).

Cabling is different for time-synchronization-only (independent LO) configuration and phase-coherent (shared LO) configuration.

Time-Synchronized Only, Multi-Channel PXIe VSG (Independent LO)

When phase coherence is not required, cable the instrument as follows for time synchronized multi-channel operation for independently tunable channels.

4x4 Independent LO Cable Connections:

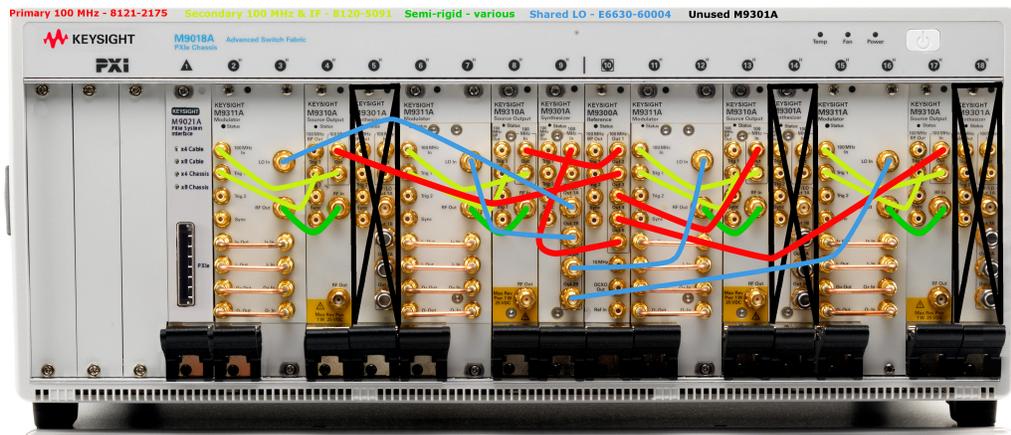
- ■ - Primary 100 MHz connection (8121-2175, long SMB-SMB)
- ■ - Secondary 100 MHz connections (8120-5091, short SMB-SMB)
- ■ - Semi-rigid



### Phase-Coherent, Multi-Channel PXIe VSG (Shared LO)

When the carrier phase must be aligned between channels (beamforming, relative phase measurements), cable the instrument as follows:

- ■ – Primary 100 MHz connections (8121-2175, long SMB-SMB)
- ■ – Secondary 100 MHz & IF connections (8120-5091, short SMB-SMB)
- ■ – LO distribution connections (E6630-60004, SMA-SMA)
- ■ – Semi-rigid
- – Unused M9301A modules



For additional information, see [Sharing the M9301A Synthesizer's LO](#).

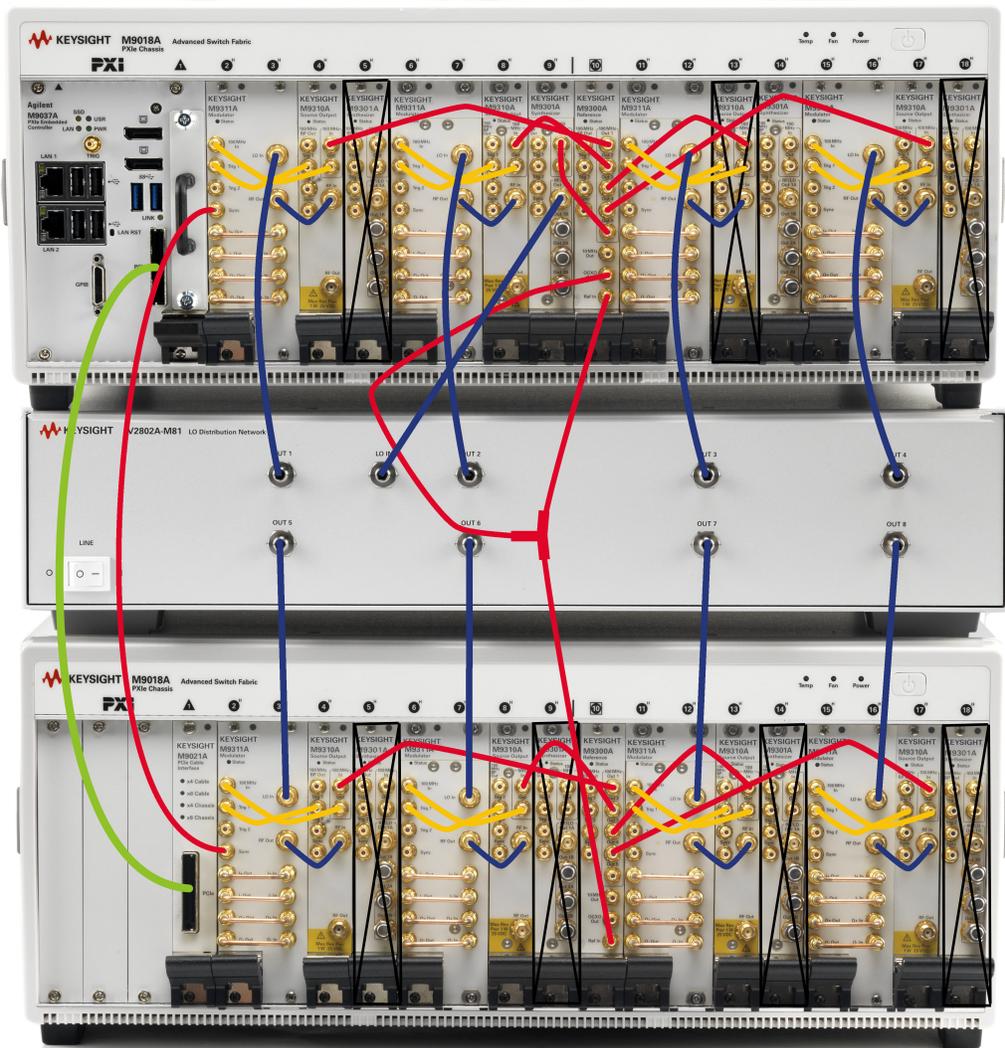
### Multiple M9381A PXIe VSGs in Two Chassis

Up to eight M9381A PXIe VSGs can be installed in two M9018/M9019A 18-slot PXIe Chassis, sharing a single embedded controller, as shown in the image below. In the recommended configuration described below, the master chassis is the chassis containing the M9037A embedded container. The first M9381A instrument

in the master chassis is designated as the System Master while the first M9381A instrument in the other (slave) chassis is designated as the Group Master of that chassis. All the other M9381A instruments in the configuration are designated as slaves.

Each chassis has its own M9300A PXIe Frequency Reference that is shared by all the instruments in that chassis. The M9300A PXIe Frequency Reference must be installed in slot 10 of each chassis. For recommended configuration, the 10MHz reference signal for both chassis is provided by the M9300A in the master chassis from the OCXO Out connector. Alternatively, you can use an external 10 MHz reference signal. For recommended configuration, the OCXO output is split and distributed to the two Reference modules using equal length cables as shown in the figure below. It is critical to synchronize multiple chassis if timing and/or phase synchronization is important to your measurements. For more information on how to setup the 10MHz reference, refer to [Synchronizing Multiple Chassis](#).

The M9037A embedded controller is recommended for multi-chassis configurations. The M9036A embedded controller or standalone PC are both supported. For a list of personal computers that have been tested to be compatible with the M9018/M9019A chassis, refer to [PC Tested Configurations with PXI/AXIe Chassis – Technical Overview](#). Similarly, using M9037A or M9036A has several prerequisites. For more information, please contact your local Keysight Technologies Inc. representative.



The Keysight M9021A PCIe cable interface is extended from one chassis to the other. The Sync connector of the first M9311A PXIe Digital Vector Modulator of the master chassis must be cabled to the Sync connector of the first M9311A PXIe Digital Vector Modulator of the slave chassis. The PXIe VSGs in each chassis can be time-synchronized to generate test stimulus for multi-channel receivers and MIMO devices. Multi-channel operation requires proper configuration of the chassis backplane trigger lines. For more information, see [Configuring M9018A PXIe Backplane Triggers/Configuring M9018B/M9019A PXIe Backplane Triggers](#). The PXIe VSGs can also be configured to be phase coherent with Option 012 and by cabling all channels to use a single M9301A PXIe Synthesizer module via the [V2802A LO Distribution Network](#). See the image above.

The recommended multiple PXIe VSG system is configured as follows:

Chassis 1:

<b>VSG #1: M9381A</b>	<b>VSG #2: M9381A</b>	<b>REF: M9300A</b>	<b>VSG #3: M9381A</b>	<b>VSG #4: M9381A</b>
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VSG #1: M9381A	VSG #2: M9381A	REF: M9300A	VSG #3: M9381A	VSG #4: M9381A
M9311A in slot 2 /3	M9311A in slot 6 /7	M9300A in slot 10	M9311A in slot 11 /12	M9311A in slot 15 /16
M9310A in slot 4	M9310A in slot 8		M9310A in slot 13	M9310A in slot 17
M9301A in slot 5	M9301A in slot 9		M9301A in slot 14	M9301A in slot 18

Chassis 2:

VSG #5: M9381A	VSG #6: M9381A	REF: M9300A	VSG #7: M9381A	VSG #8: M9381A
M9311A in slot 2 /3	M9311A in slot 6 /7	M9300A in slot 10	M9311A in slot 11 /12	M9311A in slot 15 /16
M9310A in slot 4	M9310A in slot 8		M9310A in slot 13	M9310A in slot 17
M9301A in slot 5	M9301A in slot 9		M9301A in slot 14	M9301A in slot 18

Other module and instrument placements can be used, but this configuration optimizes speed and makes cabling simpler for phase coherent configuration.

**NOTE**

The M9300A frequency Reference module must be installed in slot 10 for proper time synchronization between instruments. For more information, see [Sharing the M9300A Frequency Reference](#).

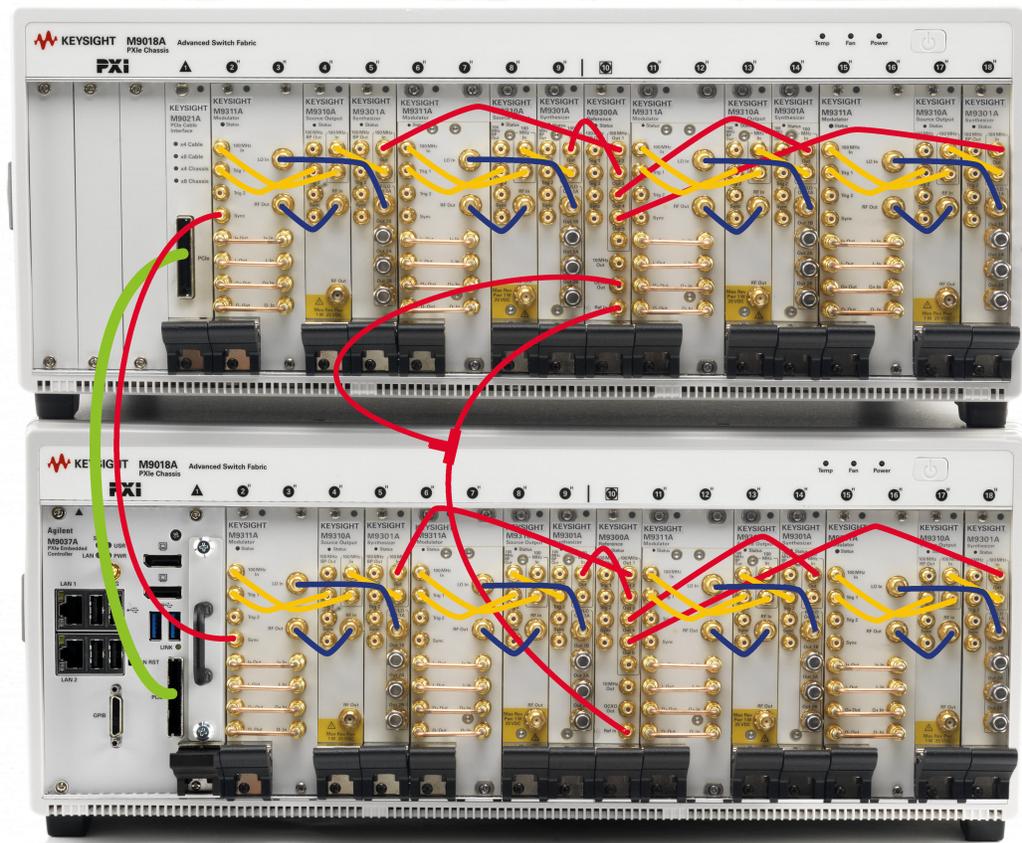
Cabling is different for time-synchronization-only (independent LO) configuration and phase-coherent (shared LO) configuration.

Time-Synchronized Only, Multi-Channel PXIe VSG (Independent LO)

When phase coherence is not required, cable the instrument as follows for time synchronized multi-channel operation for independently tunable channels.

8x8 Independent LO Cable Connections:

-  – Primary 100 MHz connection (8121-2175, long SMB-SMB); chassis sync; 10 MHz distribution
-  – Secondary 100 MHz connections (8120-5091, short SMB-SMB); trigger cables
-  – LO distribution connections; Semi-rigids (W1312-20266 and W1312-20267)
-  – PCIe cable (Y1202A)



### Phase-Coherent, Multi-Channel PXIe VSG (Shared LO)

#### V2802A LO Distribution Network

Unlike the independent LO use case, phase coherency requires the V2802A LO Distribution Network to be placed between the two chassis. In the 4-channel configuration, a single LO (M9301A) has four ports that can drive up to four M9381A or M9391A instruments. For more than five and up to 8-channel configurations, it is required to have all LO outputs drive from a single device. The LO Distribution Network enables phase coherency for five to eight VSGs or VSAs by distributing a single LO to all channels. This gives the multi-channel system a highly precise and stable alignment between up to eight signal analyzers and eight signal generators.



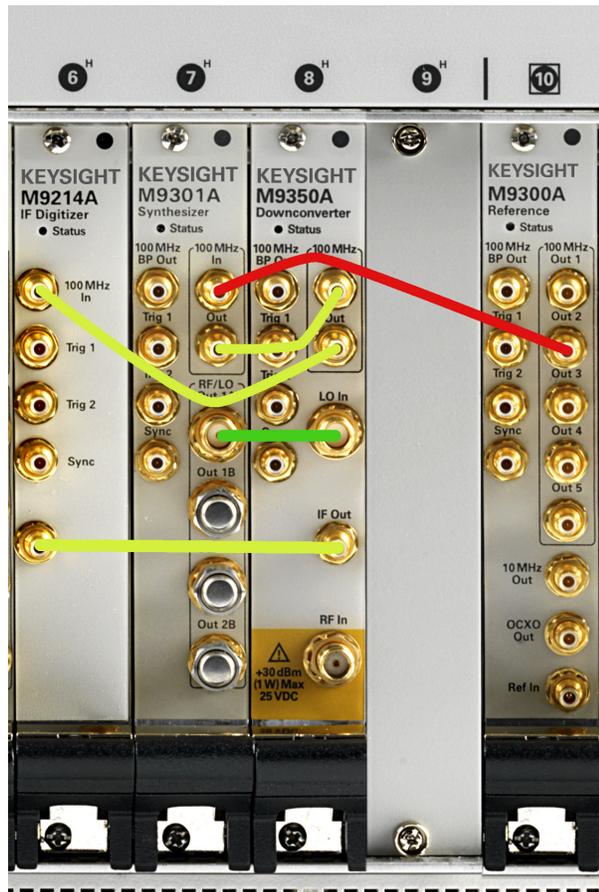
The LO Distribution Network is an 8-way splitter that operates in a frequency range of 400MHz to 6GHz and splits the LO output from a single M9301A synthesizer to eight VSGs or eight VSAs. The LO Distribution Network also contains a power amplifier to compensate for the splitter losses. As shown above, the LO Distribution Network has one LO input (LO IN) and 8 outputs (OUT 1-8).

Because the M9018/M9019A chassis use a non-standard foot, the LO Distribution Network comes with special brackets that must be used so that the chassis and the LO Distribution Network can be stacked. When stacked, each unit is slightly behind the one below it to safely support the weight. This bracket enables semi-rigid cables to be used for interconnections. When powering up the instruments, ensure that the master chassis is powered up after the other chassis and the LO Distribution Network are powered up.

When the carrier phase must be aligned between channels (beamforming, relative phase measurements), cable the instrument as follows:

-  – Primary 100 MHz connections (8121-2175, long SMB-SMB); chassis sync; 10 MHz distribution
-  – Secondary 100 MHz & IF connections (8120-5091, short SMB-SMB); trigger cables
-  – LO distribution connections; Semi-rigids (V2800-20006, V2800-20008, V2800-20009)
-  – PCIe cable (Y1202A)
-  – Unused M9301A modules





The recommended single PXle VSA system is configured as follows:

<b>VSA: M9391A</b>	<b>REF: M9300A</b>
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M9214A in slot 6                      M9300A in slot 10  
M9301A in slot 7  
M9350A in slot 8

Recommendation: Install the semi-rigid cable first.

Torque specification for all SMA connectors is 8 Lb-In (0.904 Nm).

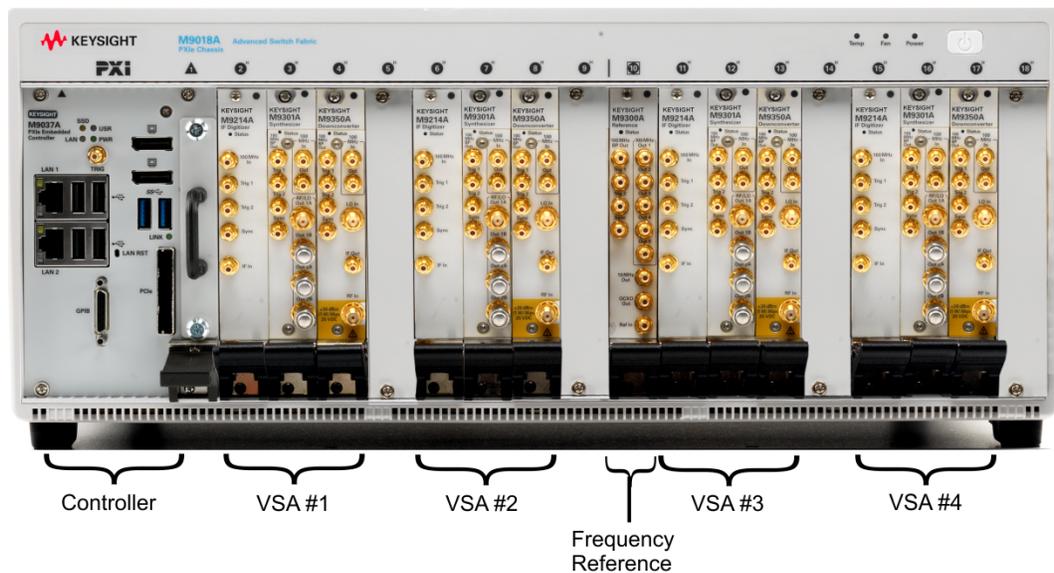
#### M9391A Cable and Module Table

Part Number	Connection	Cable Description
8120-5091	M9300A 100 MHz Out 1 to M9301A 100 MHz In	Cable, coaxial, SMB (female) - SMB (female) 120 mm
8120-5091	M9301A 100 MHz Out to M9350A 100 MHz In	Cable, coaxial, SMB (female) - SMB (female) 120 mm
8120-5091		

Part Number	Connection	Cable Description
	M9350A 100 MHz Out to M9214A 100 MHz In	Cable, coaxial, SMB (female) - SMB (female) 120 mm
8120-5091	M9350A IF Out to M9214A IF In	Cable, coaxial, SMB (female) - SMB (female) 120 mm
W1312-20237 or W1312-20271	M9301A RF/LO Out 1A to M9350A LO In	Cable, semi-rigid, SMA (male) - SMA (male)
1250-23161	M9350A RF In connector saver	Adaptor, coaxial straight SMA (male) - SMA (female)
8121-20631	This cable can be used to direct an External Reference into the M9300A Ref In connector.	Cable, coaxial, BNC (male) - SMB (female) 1200 mm

### Multiple M9391A PXle VSAs in a Chassis

Up to four M9391A PXle VSAs can be installed in a single M9018/M9019A 18-slot PXle Chassis, sharing a single embedded controller as shown here. These PXle VSAs share one M9300A PXle Frequency Reference and can be time-synchronized with backplane triggering to measure multi-channel transmitters and analyze MIMO devices. The PXle VSAs can also be configured to be phase coherent with Option 012 and cabling all channels to use a single M9301A PXle Synthesizer module with Y1243A cable kit. Slot blockers and EMC filler panels are installed in the empty slots.



The recommended multiple PXle VSA system is configured as follows:

VSA #1: M9391A	VSA #2: M9391A	REF: M9300A	VSA #3: M9391A	VSA #4: M9391A
M9214A in slot 2	M9214A in slot 6	M9300A in slot 10	M9214A in slot 11	M9214A in slot 15
M9301A in slot 3	M9301A in slot 7		M9301A in slot 12	M9301A in slot 16
M9350A in slot 4	M9350A in slot 8		M9350A in slot 13	M9350A in slot 17

Other module and instrument placements can be used, but this configuration optimizes speed and makes cabling simpler for phase coherent configuration.

**NOTE** The M9300A PXIe Frequency Reference must be installed in slot 10 for proper time synchronization between instruments. For more information, see [Sharing the M9300A Frequency Reference](#).

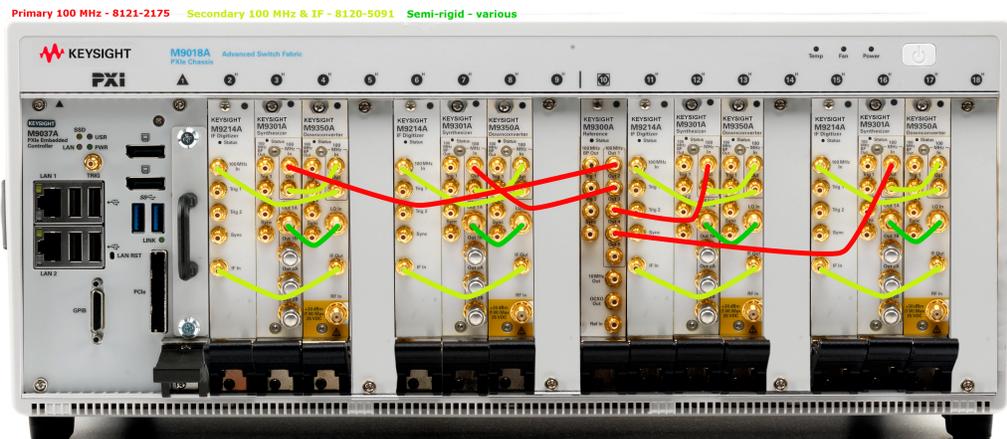
Cabling is different for time-synchronization-only (independent LO) configuration and phase-coherent (shared LO) configuration. See the following sections for cabling information.

#### Time-Synchronized Only, Multi-Channel PXIe VSA (Independent LO)

When phase coherence is not required, cable the instrument as follows for time synchronized multi-channel operation for independently tunable channels.

#### 4x4 Independent LO Cable Connections:

- ■ – Primary 100 MHz connection (8121-2175, long SMB-SMB)
- ■ – Secondary 100 MHz connections (8120-5091, short SMB-SMB)
- ■ – Semi-rigids

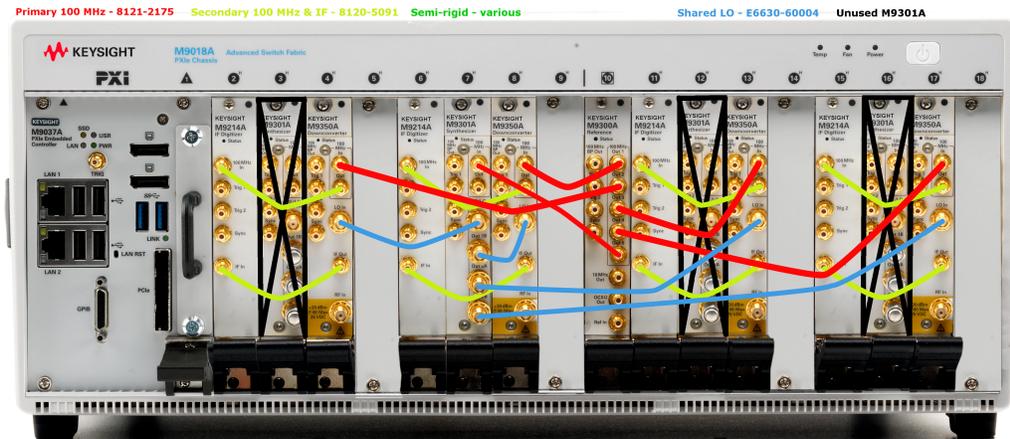


#### Phase-Coherent, Multi-Channel PXIe VSA (Shared LO)

When the carrier phase must be aligned between channels (beamforming, relative phase measurements), cable the instrument as follows:

- ■ – Primary 100 MHz connections (8121-2175, long SMB-SMB)

- ■ – Secondary 100 MHz & IF connections (8120-5091, short SMB-SMB)
- ■ – LO distribution connections (E6630-60004, SMA-SMA)
- – Unused M9301A modules



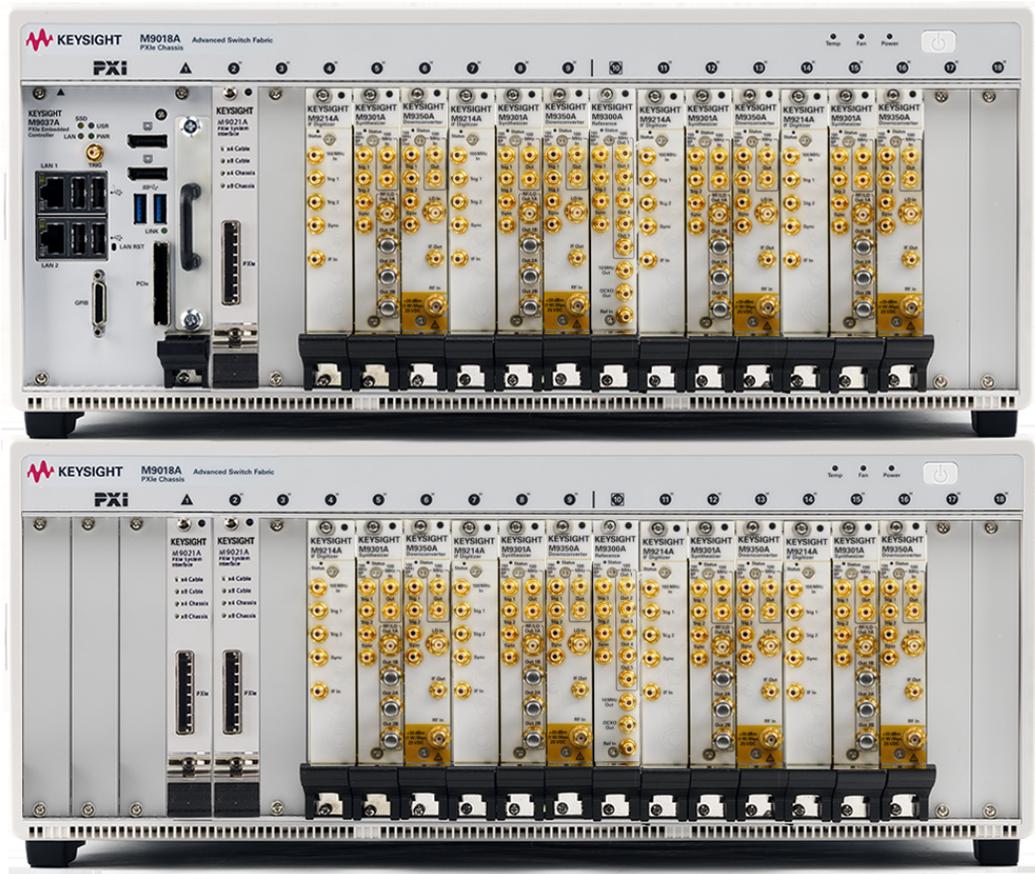
For additional information, see [Sharing the M9301A Synthesizer's LO](#).

### Multiple M9391A PXIe VSAs in Two Chassis

Up to eight M9391A PXIe VSAs can be installed in two M9018/M9019A 18-slot PXIe Chassis, sharing a single embedded controller, as shown in the image below. In the recommended configuration described below, the master chassis is the chassis containing the M9037A embedded controller. The first M9391A instrument in the master chassis is designated as the System Master while the first M9391A instrument in the other (slave) chassis is designated as the Group Master of that chassis. All the other M9391A instruments in the configuration are designated as slaves.

Each chassis has its own M9300A PXIe Frequency Reference that is shared by all the instruments in that chassis. The M9300A PXIe Frequency Reference must be installed in slot 10 of each chassis. For recommended configuration, the 10 MHz reference signal for both the chassis is provided by the M9300A in the master chassis from the OCXO Out connector. Alternatively, you can use an external 10 MHz reference signal. For recommended configuration, the OCXO output is split and distributed to the two Reference modules using equal length cables as shown in the image below. It is critical to synchronize multiple chassis if timing and/or phase synchronization is important to your measurements. For more information on how to set up the 10 MHz reference, refer to [Synchronizing Multiple Chassis](#).

The M9037A embedded controller is recommended for multi-chassis configurations. The M9036A embedded controller or standalone PC are both supported. For a list of personal computers that have been tested to be compatible with the M9018/M9019A chassis, refer to [PC Tested Configurations with PXI/AXIe Chassis – Technical Overview](#). Similarly, using M9037A or M9036A has several prerequisites. For more information, please contact your local Keysight Technologies Inc. representative.



The Keysight M9021A PCIe cable interface is extended from one chassis to the other. The Sync connector of the first M9214A PXIe Digitizer of the master chassis must be cabled to the Sync connector of the first M9214A PXIe Digitizer of the other chassis. The PXIe VSAs in each chassis can be time-synchronized to measure multi-channel transmitters and analyze MIMO devices. Multi-channel operation requires proper configuration of the chassis backplane trigger lines. For more information, refer to [Configuring M9018A PXIe Backplane Triggers/Configuring M9018B/M9019A PXIe Backplane Triggers](#). The PXIe VSAs can also be configured to be phase coherent with Option 012 and by cabling all channels to use a single M9301A PXIe Synthesizer module via the [V2802A LO Distribution Network](#). Slot blockers and EMC filler panels are installed in the empty slots.

The recommended multiple PXIe VSA system is configured as follows:

Chassis 1:

VSA #1: M9391A	VSA #2: M9391A	REF: M9300A	VSA #3: M9391A	VSA #4: M9391A
M9214A in slot 2	M9214A in slot 6	M9300A in slot 10	M9214A in slot 11	M9214A in slot 15
M9301A in slot 3	M9301A in slot 7		M9301A in slot 12	M9301A in slot 16
M9350A in slot 4	M9350A in slot 8		M9350A in slot 13	M9350A in slot 17

Chassis 2:

VSA #5: M9391A	VSA #6: M9391A	REF: M9300A	VSA #7: M9391A	VSA #8: M9391A
M9214A in slot 2	M9214A in slot 6	M9300A in slot 10	M9214A in slot 11	M9214A in slot 15
M9301A in slot 3	M9301A in slot 7		M9301A in slot 12	M9301A in slot 16
M9350A in slot 4	M9350A in slot 8		M9350A in slot 13	M9350A in slot 17

Other module and instrument placements can be used, but this configuration optimizes speed and makes cabling simpler for phase coherent configuration.

**NOTE**

The M9300A PXIe Frequency Reference must be installed in slot 10 for proper time synchronization between instruments. For more information, see [Sharing the M9300A Frequency Reference](#).

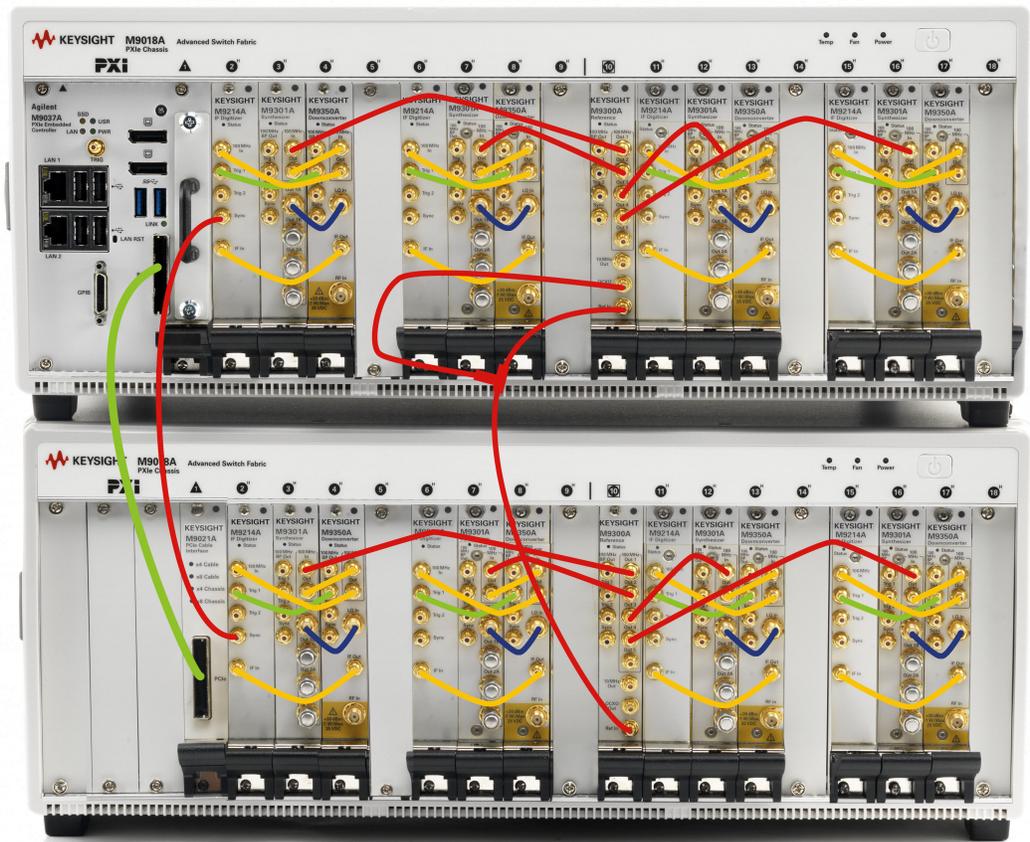
Cabling is different for time-synchronization-only (independent LO) configuration and phase-coherent (shared LO) configuration. See the following sections for cabling information.

Time-Synchronized Only, Multi-Channel PXIe VSA (Independent LO)

When phase coherence is not required, cable the instrument as follows for time synchronized multi-channel operation for independently tunable channels.

8-Channel Independent LO Cable Connections:

-  – Primary 100 MHz connection (8121-2175, long SMB-SMB); chassis sync; 10 MHz distribution
-  – Secondary 100 MHz and IF connections (8120-5091, short SMB-SMB)
-  – LO distribution connections (W1312-20237)
-  – PCIe cable (Y1202A); trigger cables

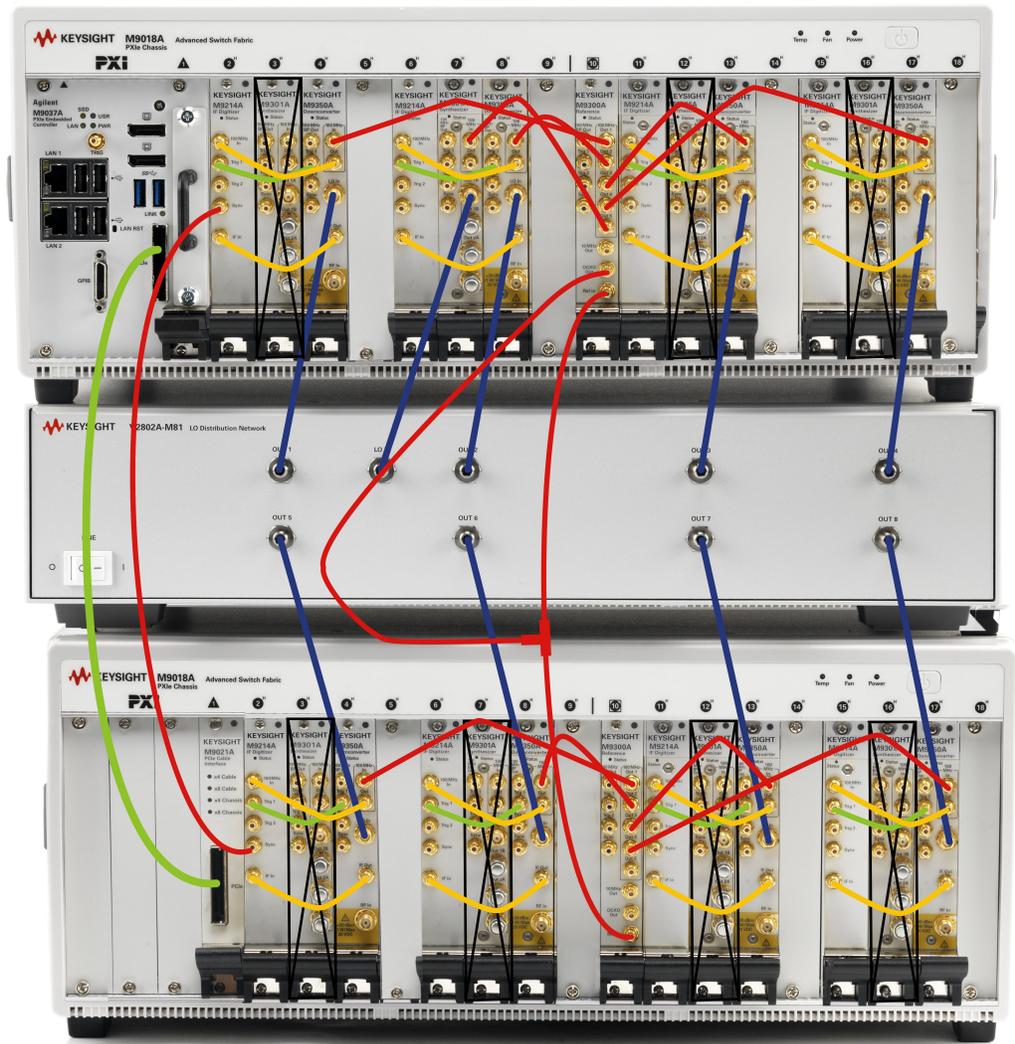


### Phase-Coherent, Multi-Channel PXIe VSA (Shared LO)

Unlike the independent LO use case, phase coherency requires the V2802A LO Distribution Network to be placed between the two chassis. For more information, refer to [V2802A LO Distribution Network](#).

When the carrier phase must be aligned between channels (beamforming, relative phase measurements), cable the instrument as follows:

- ■ – Primary 100 MHz connections (8121-2175, long SMB-SMB); chassis sync; 10 MHz distribution
- ■ – Secondary 100 MHz & IF connections (8120-5091, short SMB-SMB)
- ■ – LO distribution connections (V2800-20010, V2800-200011, V2800-20007)
- ■ – PCIe cable (Y1202A); trigger cables
- – Unused M9301A modules



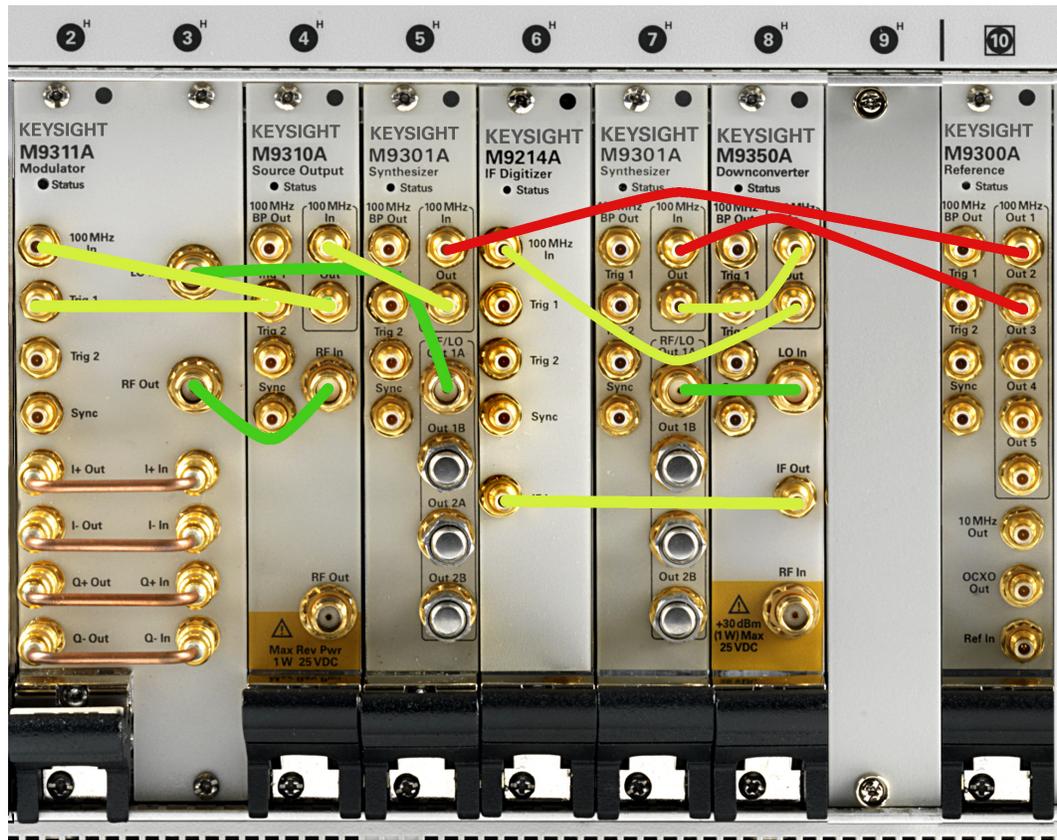
For additional information, see [Sharing the M9301A Synthesizer's LO](#).

## M9391A and M9381A Instrument Connections

This section contains a cabling diagram for the Keysight M9391A PXIe Vector Signal Analyzer with a Keysight M9381A PXIe Vector Signal Generator. For cable part numbers, see [M9391A Instrument Connections](#) and [M9381A Instrument Connections](#).

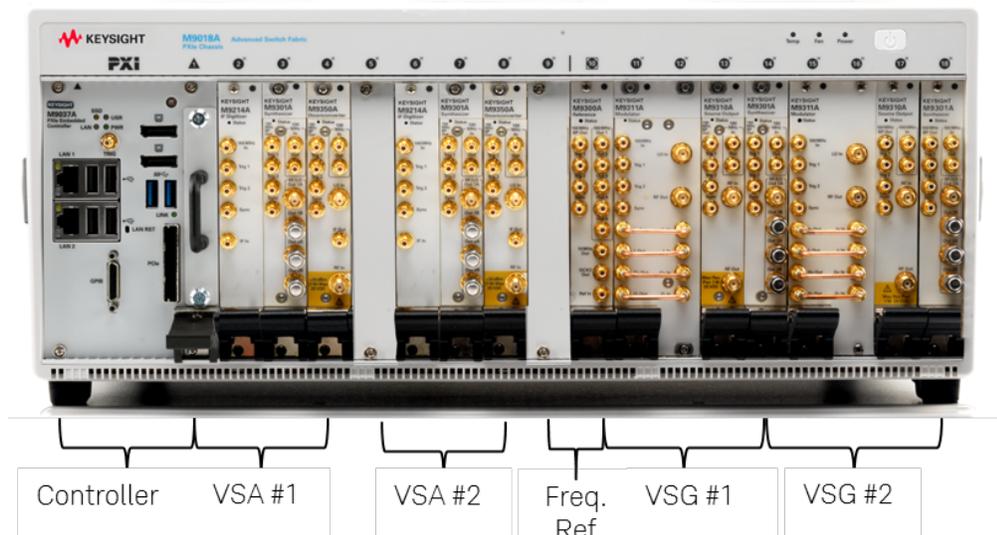
### NOTE

The M9300A PXIe Frequency Reference module must be installed in slot 10 for proper time synchronization between instruments. For more information, see [Sharing the M9300A Frequency Reference](#).



## 2x2 M9391A and M9381A Instrument Connections

Two M9381A PXIe VSGs and two M9391A PXIe VSAs can be installed together in a single M9018/M9019B 18-slot PXIe Chassis, sharing a single embedded controller, as shown here. The PXIe VSGs and PXIe VSAs share one M9300A PXIe Frequency Reference and backplane triggering is used to create a 2-channel source and a 2-channel analyzer for testing 2x2 MIMO devices. Slot blockers and EMC filler panels are installed in the empty slots.



The recommended 2x2 system is configured as follows:

VSA #1: M9391A	VSA #2: M9391A	REF: M9300A	VSG #1: M9381A	VSG #2: M9381A
M9214A in slot 2	M9214A in slot 6	M9300A in slot 10	M9311A in slot 11	M9311A in slot 15
M9301A in slot 3	M9301A in slot 7		M9310A in slot 13	M9310A in slot 17
M9350A in slot 4	M9350A in slot 8		M9301A in slot 14	M9301A in slot 18

Other module and instrument placements can be used, but this configuration optimizes speed and makes cabling simpler for phase coherent configuration.

**NOTE** The M9300A PXIe Frequency Reference module must be installed in slot 10 for proper time synchronization between instruments. For more information, see [Sharing the M9300A Frequency Reference](#).

Cabling is different for time-synchronization-only (independent LO) configuration and phase-coherent (shared LO) configuration. See the following sections for cabling information.

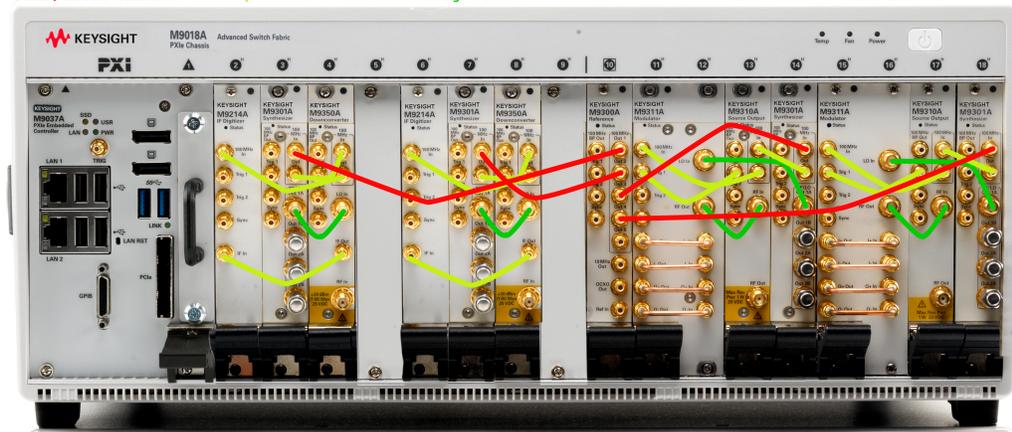
### Time-Synchronized, Multi-Channel PXIe VSA & VSG (Independent LO)

When phase coherence is not required, cable the instrument as follows for time synchronized multi-channel operation for independently tunable channels.

2x2 Independent LO Cable Connections:

- ■ – Primary 100 MHz connection (8121–2175, long SMB-SMB)
- ■ – Secondary 100 MHz and IF connections (8120–5091, short SMB-SMB)
- ■ – Semi-rigids

■ Primary 100 MHz - 8121-2175    ■ Secondary 100 MHz & IF - 8120-5091    ■ Semi-rigid - various

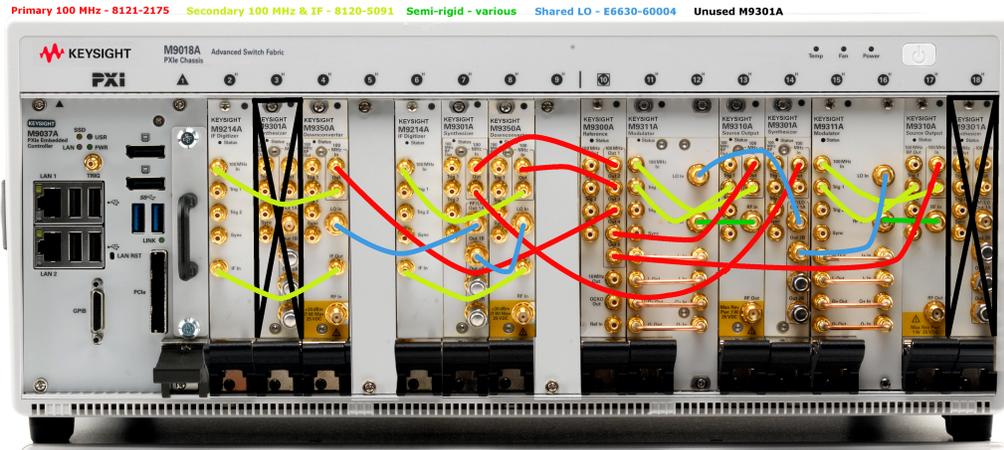


### Phase-Coherent, Multi-Channel PXIe VSA & VSG (Shared LO)

When the carrier phase must be aligned between channels (beamforming, relative phase measurements), cable the instrument as follows:

2x2 Shared LO Cable Connections:

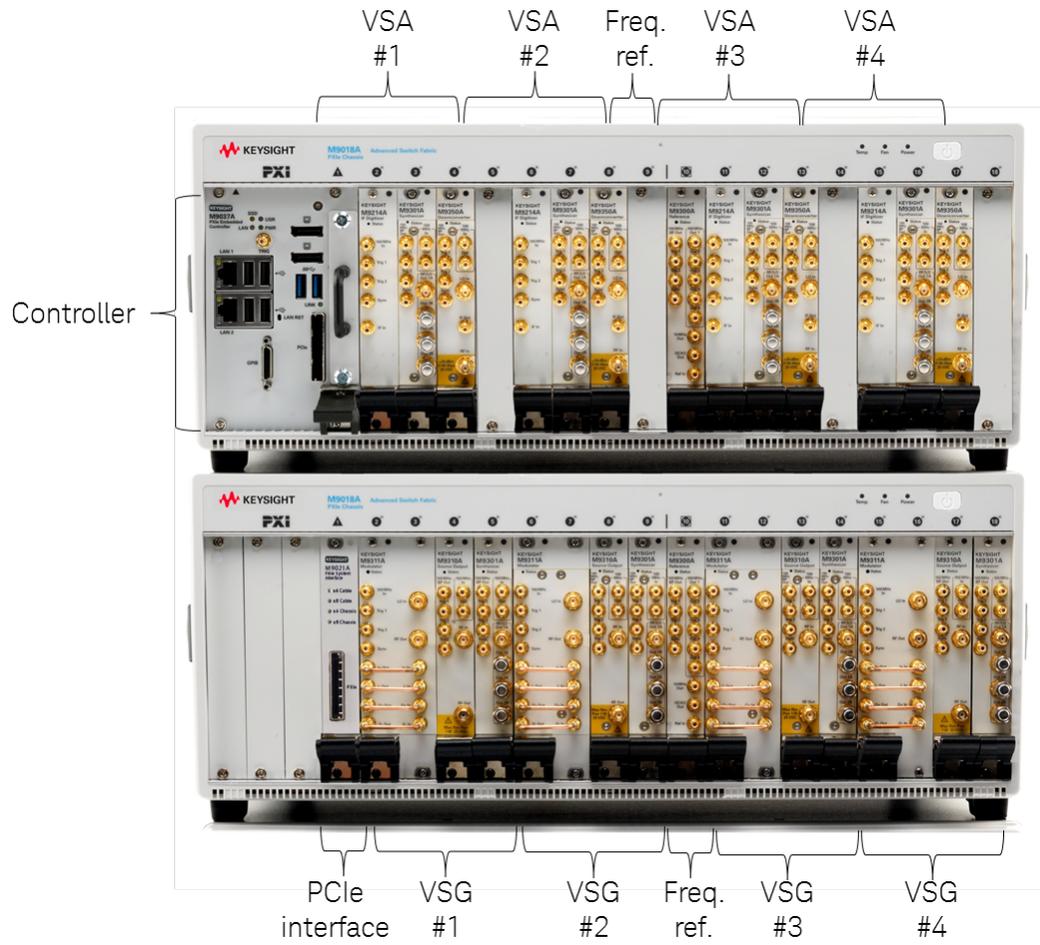
- ■ – Primary 100 MHz connections (8121-2175, long SMB-SMB)
- ■ – Secondary 100 MHz & IF connections (8120-5091, short SMB-SMB)
- ■ – Semi-rigids
- ■ – LO distribution connections (E6630-60004, SMA-SMA)
- – Unused M9301A modules



For additional information, see [Sharing the M9301A Synthesizer's LO](#).

#### 4x4 M9391A and M9381A Instrument Connections

A 4-channel M9381A PXIe VSG and 4-channel M9391A PXIe VSA can be configured using a single (M9036A or M9037A) embedded controller, M9021A PCIe cable interface modules (2 with M9036A and 1 with M9037A) and PCIe cable to connect the two M9018/M9019A 18-slot PXIe Chassis. One M9300A PXIe Frequency Reference is installed per chassis and shared between all instruments in that chassis. All channels within a chassis are synchronized with backplane triggering and phase coherency is enabled with Option 012 and Y1243A cable kit to use one M9301A PXIe Synthesizer for the PXIe VSAs and one for the PXIe VSGs. Slot blockers and EMC filler panels are installed in the empty slots.



The recommended 4x4 system is configured as follows:

Chassis #1

Controller	VSA #1: M9391A	VSA #2: M9391A	REF: M9300A	VSA #3: M9391A	VSA #4: M9391A
M9037A in slot 1	M9214A in slot 2	M9214A in slot 6	M9300A in slot 10	M9214A in slot 11	M9214A in slot 15
	M9301A in slot 3	M9301A in slot 7		M9301A in slot 12	M9301A in slot 16
	M9350A in slot 4	M9350A in slot 8		M9350A in slot 13	M9350A in slot 17

## Chassis #2

PCIe Interface	VSG #1: M9381A	VSG #2: M9381A	REF: M9300A	VSG #3: M9381A	VSG #4: M9381A
M9021A in slot 1	M9311A in slot 2	M9311A in slot 6	M9300A in slot 10	M9311A in slot 11	M9311A in slot 15
	M9310A in slot 4	M9310A in slot 8		M9310A in slot 13	M9310A in slot 17
	M9301A in slot 5	M9301A in slot 9		M9301A in slot 14	M9301A in slot 18

If you use an M9036A Controller, you will need to install an additional M9021A PCIe interface in chassis 1, slot 2 to connect chassis 1 to chassis 2. In that case, VSA #1 will need to occupy slots 3, 4, and 5.

Other module and instrument placements can be used, but this configuration optimizes speed and makes cabling simpler for phase coherent configuration.

### NOTE

The M9300A PXIe Frequency Reference must be installed in slot 10 for proper time synchronization between instruments. For more information, see [Sharing the M9300A Frequency Reference](#). To use one M9300A PXIe Frequency Reference for multiple chassis, see [Synchronizing Multiple Chassis](#).

Cabling is different for time-synchronization-only (independent LO) configuration and phase-coherent (shared LO) configuration. See the following sections for cabling information:

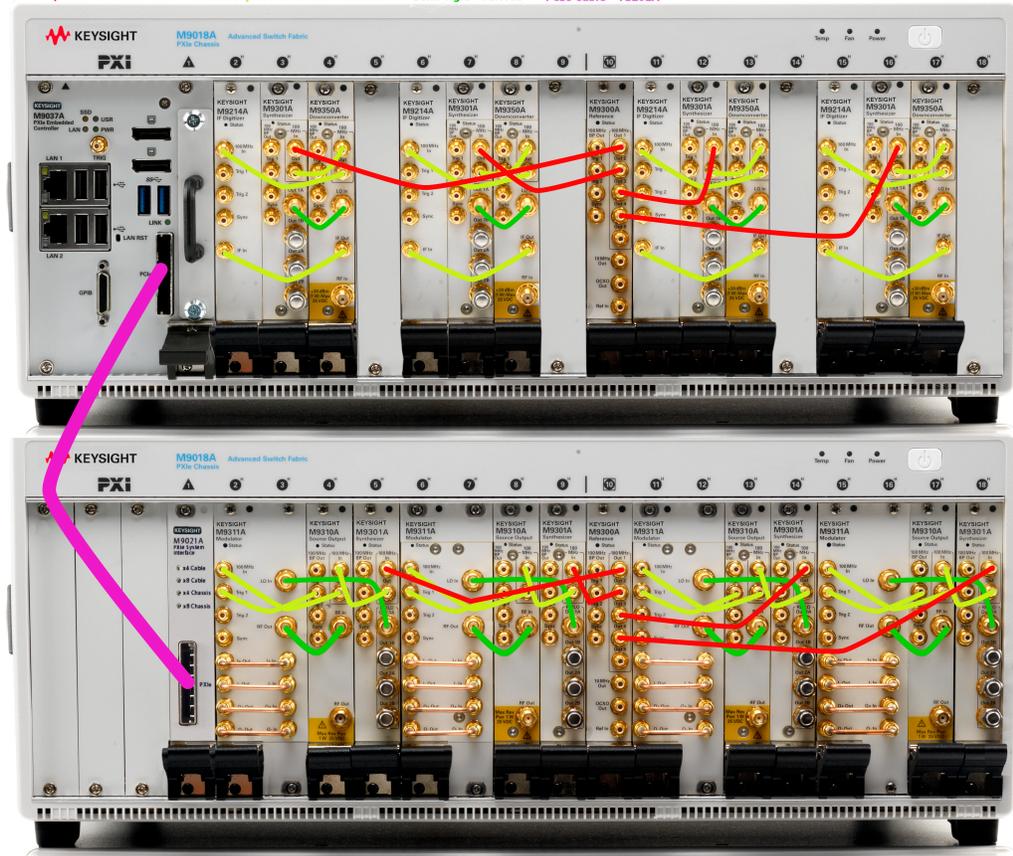
### Time-Synchronized, Multi-Channel PXIe VSA & VSG (Independent LO)

When phase coherence is not required, cable the instrument as follows for time synchronized multi-channel operation for independently tunable channels.

4x4 Independent LO Cable Connections:

-  – Primary 100 MHz connection (8121–2175, long SMB-SMB)
-  – Secondary 100 MHz and IF connections (8120–5091, short SMB-SMB)
-  – Semi-rigids
-  – PCIe cable (Y1202A)

Primary 100 MHz - 8121-2175    Secondary 100 MHz & IF - 8120-5091    Semi-rigid - various    PCIe Cable - Y1202A



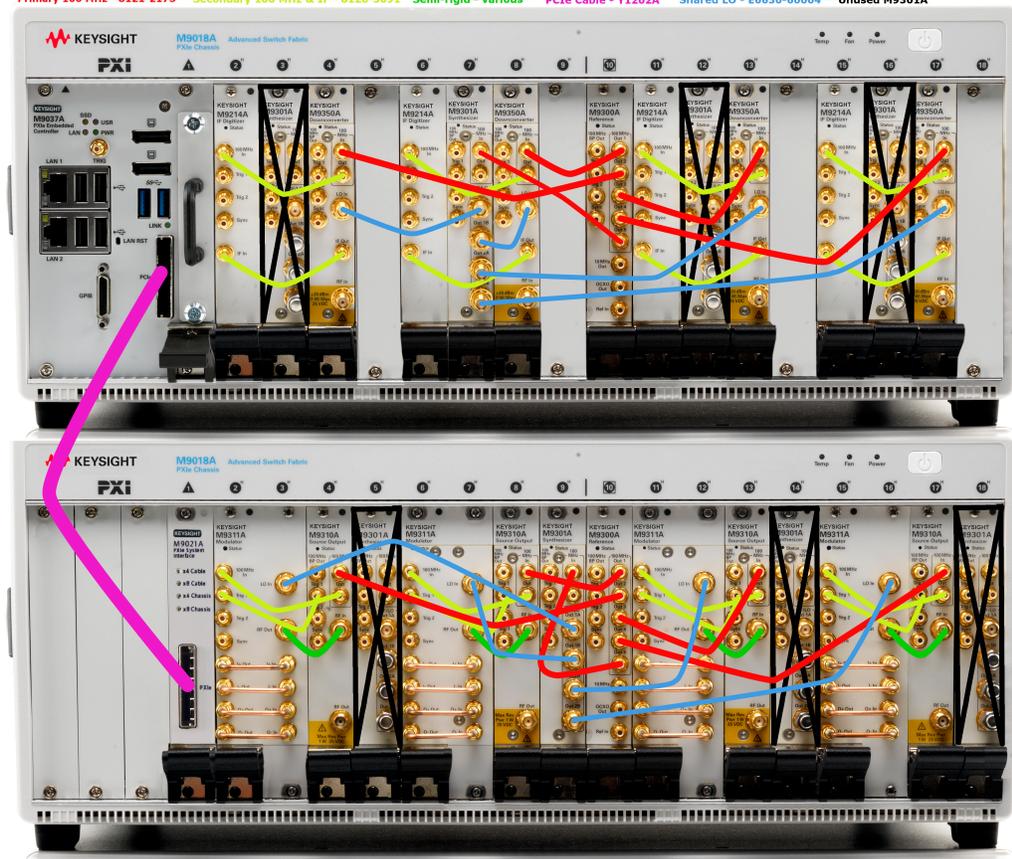
### Phase-Coherent, Multi-Channel PXIe VSA & VSG (Shared LO)

When the carrier phase must be aligned between channels (beamforming, relative phase measurements), cable the instrument as follows:

4x4 Shared LO Cable Connections:

- ■ - Primary 100 MHz connections (8121-2175, long SMB-SMB)
- ■ - Secondary 100 MHz & IF connections (8120-5091, short SMB-SMB)
- ■ - Semi-rigids
- ■ - LO distribution connections (E6630-60004, SMA-SMA)
- ■ - PCIe cable (Y1202A)
- - Unused M9301A modules

Primary 100 MHz - 8121-2175    Secondary 100 MHz & IF - 8120-5091    Semi-rigid - various    PCIe Cable - Y1202A    Shared LO - E6630-60004    Unused M9301A



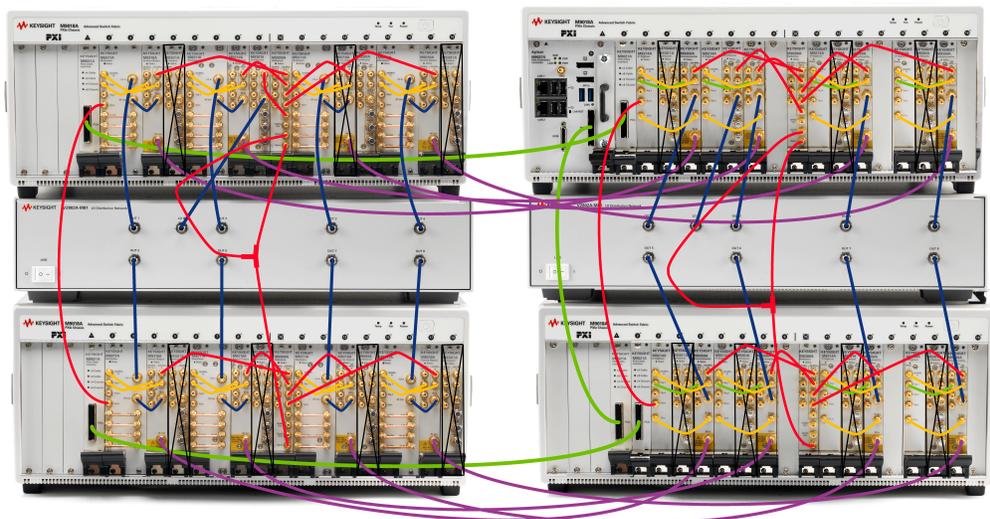
For additional information, see [Sharing the M9301A Synthesizer's LO](#).

## 8x8 M9391A and M9381A Instrument Connections

A set of 8-channel M9381A PXIe VSGs installed in two M9018/M9019A 18-slot chassis and a set of 8-channel M9391A PXIe VSAs installed in another pair of M9018/M9019A 18-slot chassis can be configured for multi-channel testing by using a single (M9036A or M9037A) embedded controller, M9021A PCIe cable interface modules (6 with M9036A and 5 with M9037A) and 3 PCIe cables to connect the four chassis. Each chassis has its own M9300A PXIe Frequency Reference that is shared by all the instruments in that chassis. The M9300A PXIe Frequency Reference must be installed in slot 10 of each chassis. For recommended configuration, the 10 MHz reference signal for each pair of chassis (containing 8-channel M9381A or 8-channel M9391A) is provided by the M9300A in the master chassis from the OCXO Out connector. Alternatively, you can use an external 10 MHz reference signal. For recommended configuration, the OCXO output is split and distributed to the two Reference modules using equal length cables, as shown below. It is critical to synchronize chassis within each chassis group if timing and/or phase synchronization is important to your measurements. For more information on how to set up the 10 MHz reference, refer to [Synchronizing Multiple Chassis](#).

The M9037A embedded controller is recommended for multi-chassis configurations. The M9036A embedded controller or standalone PC are both supported. Not all standalone personal computers work with four chassis configuration. For a list of personal computers that have been tested to be compatible with the M9018/M9019A chassis, refer to [PC Tested Configurations with PXI/AXIe Chassis – Technical Overview](#). Similarly, using M9037A or M9036A has several prerequisites. For more information, please contact your local Keysight Technologies Inc. representative.

The Keysight M9021A PCIe cable interface modules are connected from one chassis to the other, as shown in the image below. In the M9381A chassis group, the Sync connector of the first M9311A PXIe Digital Vector Modulator of each chassis must be connected to each other. Similarly, in the M9391A chassis group, the Sync connector of the first M9214A PXIe Digitizer of each chassis must be connected to each other. Multi-channel operation requires proper configuration of the chassis backplane trigger lines. For more information, refer to [Configuring M9018A PXIe Backplane Triggers/Configuring M9018B/M9019A PXIe Backplane Triggers](#). The PXIe VSGs or PXIe VSAs can also be configured to be phase coherent with Option 012 and by cabling all channels in the chassis group to use a single M9301A PXIe Synthesizer module via the [V2802A LO Distribution Network](#). See the image below. Slot blockers and EMC filler panels are installed in the empty slots.



The recommended 8x8 system is configured as follows:

Chassis #1

VSG #1:	VSG #2:	REF:	VSG #3:	VSG #4:
M9381A	M9381A	M9300A	M9381A	M9381A

M9021A PCIe Cable  
Interface in slot 1

M9300A in  
slot 10

	<b>VSG #1: M9381A</b>	<b>VSG #2: M9381A</b>	<b>REF: M9300A</b>	<b>VSG #3: M9381A</b>	<b>VSG #4: M9381A</b>
	M9311A in slots 2,3 M9310A in slot 4 M9301A in slot 5	M9311A in slots 6,7 M9310A in slot 8 M9301A in slot 9		M9311A in slots 11,12 M9310A in slot 13 M9301A in slot 14	M9311A in slots 15,16 M9310A in slot 17 M9301A in slot 18

### Chassis #2

	<b>VSG #5: M9381A</b>	<b>VSG #6: M9381A</b>	<b>REF: M9300A</b>	<b>VSG #7: M9381A</b>	<b>VSG #8: M9381A</b>
M9021A PCIe Cable Interface in slot 1	M9311A in slots 2,3 M9310A in slot 4 M9301A in slot 5	M9311A in slots 6,7 M9310A in slot 8 M9301A in slot 9	M9300A in slot 10	M9311A in slots 11,12 M9310A in slot 13 M9301A in slot 14	M9311A in slots 15,16 M9310A in slot 17 M9301A in slot 18

### Chassis #3

	<b>VSA #1: M9391A</b>	<b>VSA #2: M9391A</b>	<b>REF: M9300A</b>	<b>VSA #3: M9391A</b>	<b>VSA #4: M9391A</b>
M9037A Controller in slot 1 M9021A PCIe Cable Interface in slot 2	M9214A in slot 3 M9301A in slot 4 M9350A in slot 5	M9214A in slot 6 M9301A in slot 7 M9350A in slot 8	M9300A in slot 10	M9214A in slot 11 M9301A in slot 12 M9350A in slot 13	M9214A in slot 15 M9301A in slot 16 M9350A in slot 17

### Chassis #4

	<b>VSA #5: M9391A</b>	<b>VSA #6: M9391A</b>	<b>REF: M9300A</b>	<b>VSA #7: M9391A</b>	<b>VSA #8: M9391A</b>
M9021A PCIe Cable Interface modules in slots 1 and 2	M9214A in slot 3 M9301A in slot 4 M9350A in slot 5	M9214A in slot 6 M9301A in slot 7 M9350A in slot 8	M9300A in slot 10	M9214A in slot 11 M9301A in slot 12 M9350A in slot 13	M9214A in slot 15 M9301A in slot 16 M9350A in slot 17

Other module and instrument placements can be used, but this configuration optimizes speed and makes cabling simpler for phase coherent configuration.

**NOTE**

The M9300A PXle Frequency Reference must be installed in slot 10 for proper time synchronization between instruments. For more information, see [Sharing the M9300A Frequency Reference](#).

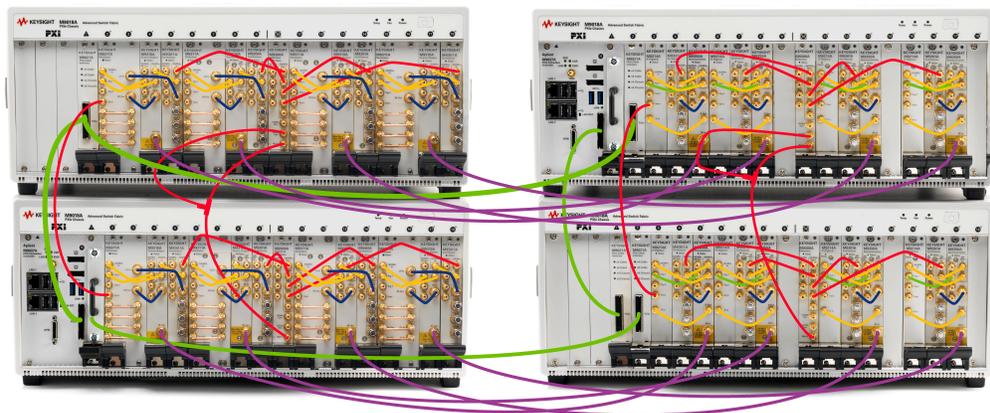
Cabling is different for time-synchronization-only (independent LO) configuration and phase-coherent (shared LO) configuration. See the following sections for cabling information:

### Time-Synchronized Only, Multi-Channel PXle VSA & VSG (Independent LO)

When phase coherence is not required, cable the instrument as follows for time synchronized multi-channel operation for independently tunable channels.

8x8 Independent LO Cable Connections:

- ■ – Primary 100 MHz connection (8121-2175, long SMB-SMB); chassis sync; 10 MHz distribution
- ■ – Secondary 100 MHz and IF connections (8120-5091, short SMB-SMB); trigger cables
- ■ – LO distribution connections; semi-rigids (W1312-20266 and W1312-20267 for M9381A VSGs and W1312-20237 for M9391A VSAs)
- ■ – PCIe cables (Y1202A)
- ■ – RF loopback

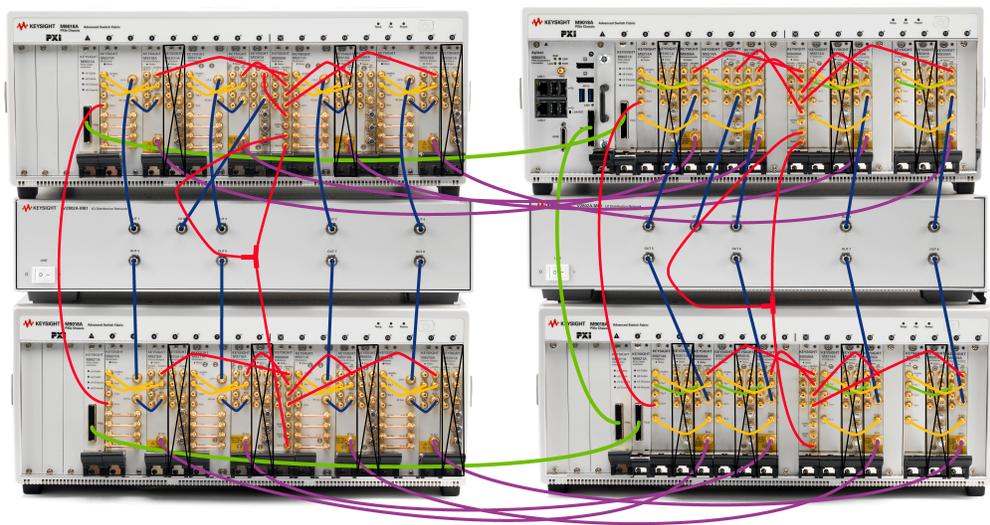


### Phase-Coherent, Multi-Channel PXle VSA & VSG (Shared LO)

Unlike the independent LO use case, phase-coherency requires the V2802A LO Distribution Network to be placed between each pair of chassis. For more information, refer to [V2802A LO Distribution Network](#). When the carrier phase must be aligned between channels (beamforming, relative phase measurements), cable the instrument as follows:

## 8x8 Shared LO Cable Connections:

- ■ – Primary 100 MHz connection (8121–2175, long SMB-SMB); chassis sync; 10 MHz distribution
- ■ – Secondary 100 MHz and IF connections (8120–5091, short SMB-SMB); trigger cables
- ■ – LO distribution connections; Semi-rigids (V2800–20006, V2800–20008, V2800–20009 for VSGs and V2800–20010, V2800–20011, V2800–20007 for VSAs)
- ■ – PCIe cables (Y1202A)
- ■ – RF loopback
- – Unused M9301A modules



For additional information, see [Sharing the M9301A Synthesizer's LO](#).

## Sharing the M9301A Synthesizer's LO

For Phase-Coherent multiple channel operation, M9381A-012 option is required for each PXIe VSG and M9391A-012 option is required for each PXIe VSA. For a single chassis, multiple channel system, you can share a single M9301A PXIe Synthesizer with up to four PXIe VSG or PXIe VSA instruments. For a multiple chassis, multiple channel system, you can use Port 1a of the M9301A PXIe Synthesizer routed through a V2802A LO Distribution Network to connect up to eight PXIe VSG or PXIe VSA instruments.

Before enabling shared synthesizer functionality, install the modules and cable as recommended in the previous sections.

## Enabling Shared Synthesizer Functionality

Shared synthesizer functionality is enabled using options during initialization. To initialize a shared synthesizer session, the following three options must be set in the `DriverSetup=` section of the option string for each PXIe VSG or VSA instrument:

- `ShareSynthesizerVisaSession`
- `SynthesizerRole`
- `SynthesizerOutputPort`

### ShareSynthesizerVisaSession

For each instrument that you want to share the synthesizer module, set this option to true by setting the command line option `ShareSynthesizerVisaSession=true`. The default for this option is set to false. If this option is not set to true when the instrument tries to connect to a synthesizer module that is already a part of a session, an initialization error reports that the module is locked.

### SynthesizerRole

First you must decide which instrument will act as master, then you need to set all other instruments to slave by setting the command line option `SynthesizerRole=slave`. The default for this option is master so failing to set the other instruments to slave will result in multiple instruments trying to adjust the synthesizer. After initialization, this option cannot be changed within the session.

### SynthesizerOutputPort

The M9301A PXIe Synthesizer has four output ports and each output port has been individually calibrated. For highest accuracy, set which output port is connected to each instrument by setting the command line option `SynthesizerOutputPort=XX`, where XX is the name of the port (1a, 1b, 2a, or 2b). The default setting is port 1a.

The M9301A PXIe Synthesizer's output ports are paired, such that port 1a and 1b always output the same signal level, and likewise for port 2a and 2b. During startup the driver checks the signal level and reports an error if the expected signal level was not detected. This can occur, for example, if you connect port 1a to the instrument but set `SynthesizerOutputPort=2a`.

When using an LO Distribution Network, you must configure the following option in the "`DriverSetup=`" section of the `OptionString` during the initialization process:

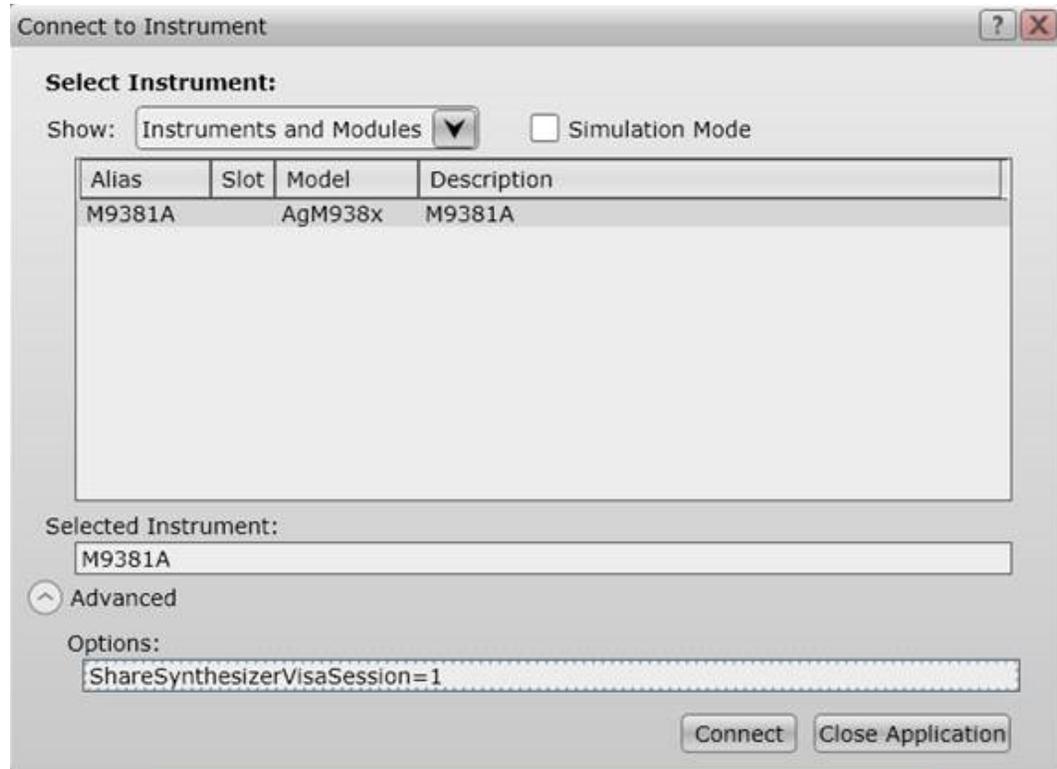
### ExtLoDistributionUnit

Set this option to true, or use a supported model number such as V2802A. Setting this option prepares the driver for use with the LO Distribution Network by loading the LO Level field alignment data.

**CAUTION** The V2802A LO Distribution Network has approximately +4 dBm of nominal gain across its range of operation. The M9311A Modulator module is highly sensitive to excessive power levels at the LO input port. Therefore, be sure to set the `ExtLoDistributionUnit` option to true at initialization whenever the system is configured with an LO Distribution Network to prevent possible damage to the module(s).

To enable the Shared Synthesizer functionality using the M9381A or M9391A Soft Front Panel, set the following option in the Advanced Options field in the Connect to Instrument dialog box:

`ShareSynthesizerVisaSession=1`



Additionally, as required, set the `SynthesizerRole`, `SynthesizerOutputPort`, and `ExtLoDistributionUnit` (when using LO Distribution Network) options in the Advanced Options field of the Connect to Instrument dialog box.

### Initialization Process

When initializing the instruments you must first initialize the master, followed by all the slaves. Similarly, when closing down the instruments you should reverse the order – close all the slaves and close the master last. This helps ensure that the “owner” of the synthesizer can cleanly initialize and shutdown the module.

The following is an example of a typical driver construction:



```

string masterOptions =
"DriverSetup=ShareSynthesizerVisaSession=true";
string slaveOptions =
"DriverSetup=ShareSynthesizerVisaSession=true,
SynthesizerRole=slave,SynthesizerOutputPort=1b";

IAgM938xEx2 driver1 = new AgM938xClass();
IAgM938xEx2 driver2 = new AgM938xClass();

driver1.Initialize( resources, idquery, reset,
masterOptions);
driver2.Initialize( resources, idquery, reset,
slaveOptions);

```

## Alignments

After the system has been cabled and shared synthesizer functionality has been enabled, you can run the LO Level Alignments to adjust the signal level from a shared M9301A Synthesizer module to offset the effects of additional loss from non-standard cabling, additional gain from LO Distribution Network, and temperature variation. You must first run the alignment on the master PXIe VSG or VSA, then on each slave instrument. Running the LO Level Alignments is only required on systems using the LO Distribution Network.

From the PXIe VSG's soft front panel, select Utilities > LO Level Alignment > Align...

From the PXIe VSA's soft front panel, select Utilities > Alignments > LO Level > All States.

For more information, refer to the *Appendix - Using LO Distribution Network in Multi-Channel Systems* in the *Keysight M9391A and M9381A Programming Guide*.

## Sharing the M9300A Frequency Reference

### Sharing the M9300A Frequency Reference

The M9300A PXIe Frequency Reference can be shared by multiple instruments, such as all the M9381A PXIe Vector Signal Generators and M9391A PXIe Vector Signal Analyzers in your chassis. You can also synchronize multiple chassis to ensure that the instruments initialize with aligned clocks—see [Synchronizing Multiple Chassis](#).

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.

**NOTE**

If you set the frequency for the external reference in one configuration, that value is not reflected in the other configurations sharing the reference. For example, if you set the external reference frequency to 8 MHz in the M9381A SFP, the M9391A SFP will still show the default value of 10 MHz.

**CAUTION**

The M9300A PXIe Frequency Reference can also be shared among multiple measurement applications, such as the Keysight 89600 VSA software. The M9300A module must be initialized before use, so including it in all configurations enables 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 89600 VSA software can control the M9300A module internal/external setting, but the changes made by other applications will not be reflected in the 89600 VSA software.

**NOTE**

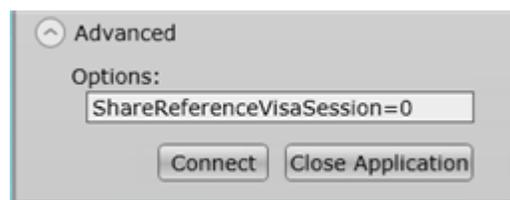
FPGA updates are not allowed on a Keysight M9300A PXIe Frequency Reference while it is being shared. To perform M9300A FPGA updates, reserve the frequency reference.

### Reserving the Reference for a Configuration

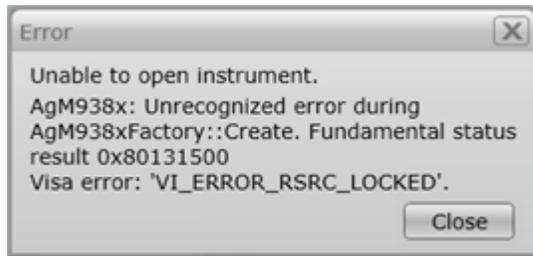
If you are running a test in the background with a certain M9300A setting and then connect a hardware configuration that also contains the same M9300A, you may alter the test setup that is already running.

If you would prefer to be 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:



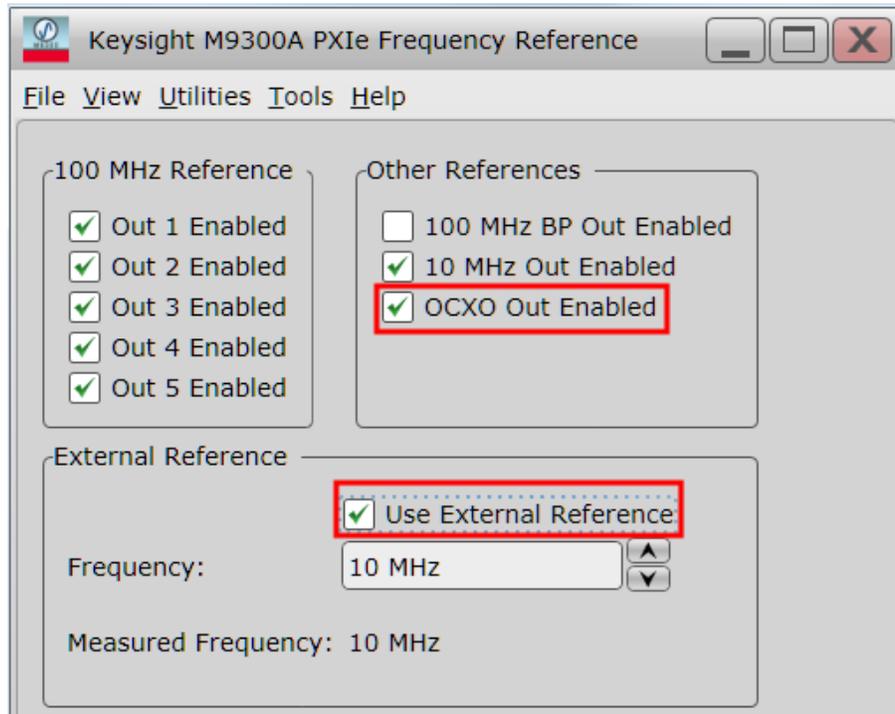
**CAUTION** If an existing instance of the SFP is connected to the reference module in a shared (default) mode, and you try to connect a second instance of the SFP to the same reference with `ShareReferenceVisaSession=0` Advanced Option, you will get the resource locked error shown above.

### Synchronizing Multiple Chassis

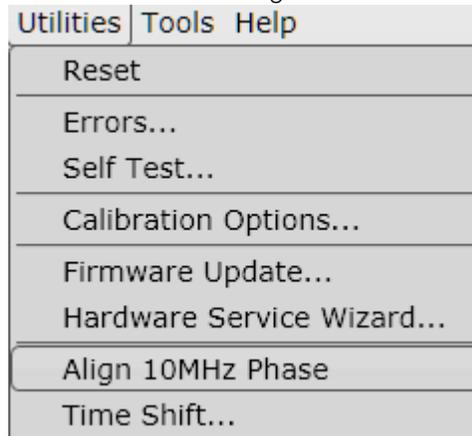
When synchronizing multiple chassis, you must provide the same 10 MHz frequency reference to the M9300A located in slot 10 of each chassis. You can either use the 10 MHz *OCXO Out* from the Keysight M9300A PXIe Frequency Reference master or an external 10 MHz frequency reference. The timing of the 10 MHz frequency reference is critical, so a symmetric splitter and equal length cables should be used to split the 10 MHz and connect to the M9300A *Ref In* connector in each chassis. Thus, if an external splitter is to be used, it must have sufficient level to be split and drive both the Reference modules. Each M9300A must be in external reference mode (Use External Reference) and the OCXO Out (if used) must be enabled. The M9300A frequency locks an internal 100 MHz oscillator to the 10 MHz frequency reference and divides the 100 MHz signal to create a local 10 MHz, which is then routed to modules in the chassis using the PXIe backplane. This local 10 MHz signal does not have a guaranteed phase relationship to the 10 MHz frequency reference provided through the Ref In connector. Therefore, before the instruments in the chassis are initialized, select Utilities > Align 10MHz Phase to align the 10 MHz Out with the 10 MHz frequency reference. This ensures that the instruments initialize with aligned clocks. The alignment needs to be repeated whenever the 10 MHz cabling is changed, whenever power is cycled, and once every 24 hours to ensure the clocks don't drift.

Thus, the following steps need to be performed to align the 10 MHz Reference:

1. Before you power up the system, ensure that:
  - a. All channels are properly cabled.
  - b. OCXO out from reference in master chassis is split and provided to 10 MHz In on both reference modules using equal length cables.
2. Power up the system.
3. Run the SFP for the M9300A PXIe Frequency Reference in the master chassis.
  - a. Turn OCXO out on.
  - b. Turn the External Reference on.



- c. Choose Utilities > Align 10 MHz Phase

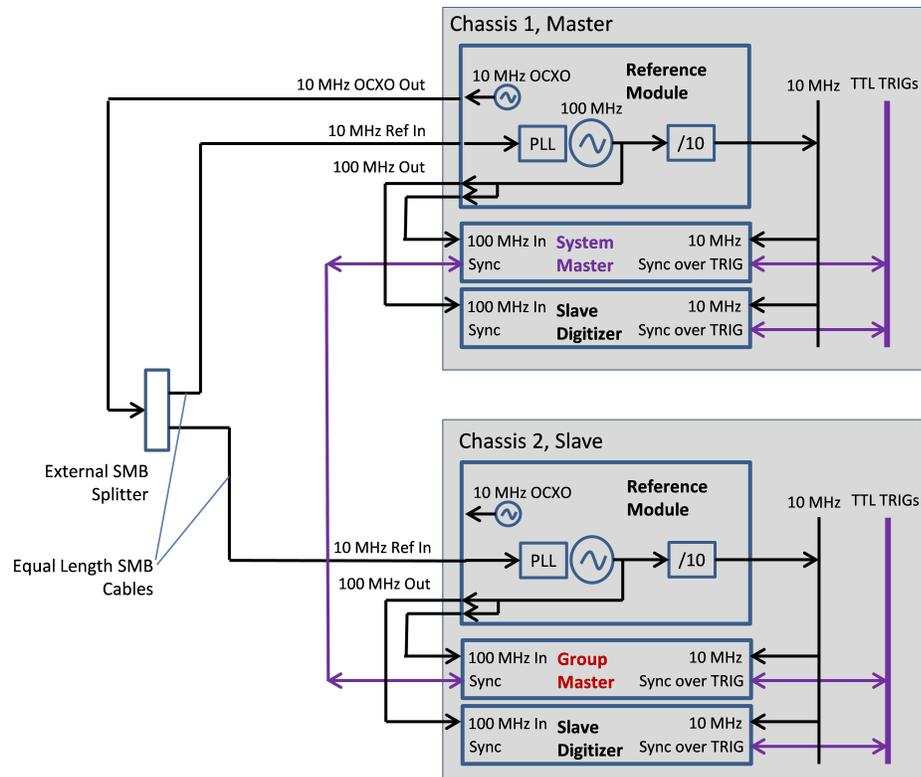


4. Run the SFP for the M9300A PXIe Frequency Reference in the second chassis.
  - a. Turn the External Reference on.
  - b. Choose Utilities > Align 10 MHz Phase.

**NOTE**

The M9300A SFP and IVI provide a method to shift the timing of the 100 MHz oscillator (**Utilities > Time Shift**). Changing the time shift will invalidate the multiple chassis synchronization from **Align 10 MHz Phase**.

## Example Two Chassis Receiver Configuration, two receivers per Chassis



## Configuring M9018A PXIe Backplane Triggers

When using the Keysight M9018A PXIe 18-slot Chassis, you should install the M9381A modules entirely within one of the slot groups: 1 through 6, 7 through 12, or 13 through 18. If you install the M9381A modules straddling any of these groups of slots, you will have to reconfigure the chassis's PXIe trigger bus routing for trigger 6 and trigger 7.

In both 2x2 configurations described in the [2x2 M9391A and M9381A Instrument Connections](#) section, backplane triggers will have to be applied to the VSA #2 and the VSG #1. This is because VSA #2 straddles slot groups 1 and 2. VSG #1 straddles slot groups 2 and 3.

### Backplane Triggers Used

- PXIe backplane trigger 6 is used to route the External Trigger signal from the Keysight M9301A PXIe Synthesizer front panel to the Keysight M9311A PXIe Digital Vector Modulator. Trigger 6 can be reassigned using API hints. You can use backplane triggering directly to the M9311A (no M9301A involved) by selecting the External Trigger source to be PXIe trigger 0 to 7.
- PXIe backplane trigger 7 is used for routing the ALC Trigger signal from the Keysight M9311A PXIe Digital Vector Modulator to the Keysight M9310A PXIe Source Output. Although the default is PXIe trigger 7, it can be reassigned using API hints.

**CAUTION**

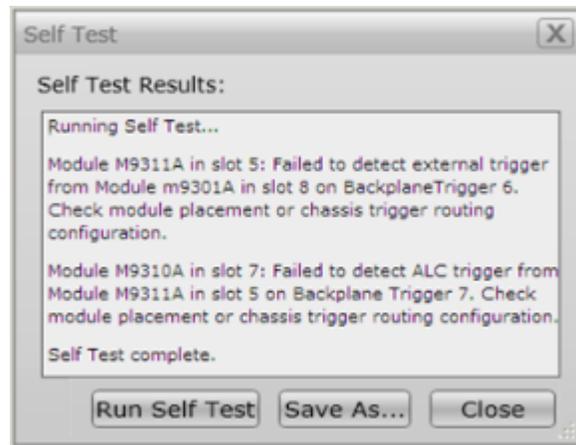
The Keysight M9018A PXIe Chassis does not remember the trigger bus configuration upon cycling power. After a power cycle, you must reconfigure the bus triggers by using the M9018A SFP or by creating a persistent configuration by using the AgM9018 API. Refer to the Keysight M9391A PXIe VSA and M9381A PXIe VSG Programming Guide (M9300-90080) for details and programming examples. This document is available on your installation CD and online at [http://edadownload.software.keysight.com/Modular/M938XA/2.0/M9391\\_and\\_M9381\\_ProgrammingGuide.pdf](http://edadownload.software.keysight.com/Modular/M938XA/2.0/M9391_and_M9381_ProgrammingGuide.pdf).

### Procedure for Configuring PXIe Backplane Bus Triggers

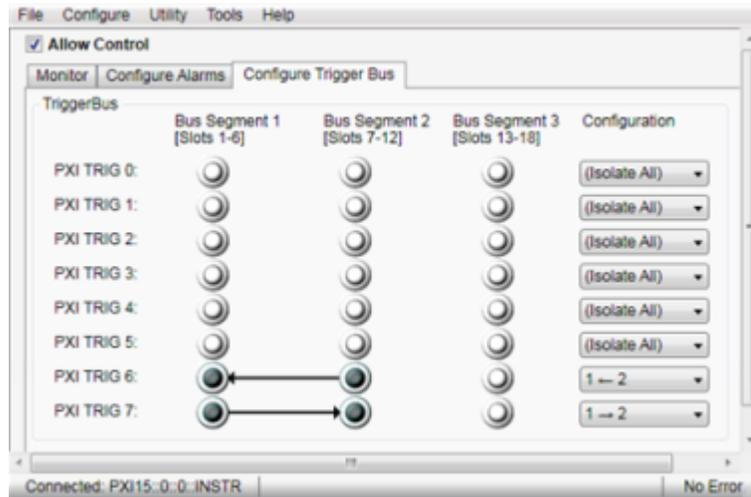
1. Make sure you have followed Steps 1 through 4 in this Startup Guide to setup and configure the Keysight M9381A PXIe Vector Signal Generator.
2. Conduct a Self Test (Utilities > Self Test... > Run Self Test). If your configuration straddles two slot groups, you will receive error messages.

**NOTE**

In the following graphic a Self Test has been run on an M9381A that is installed in slots 5 through 9; therefore, it straddles two slot groups. The Self Test detects errors with backplane triggers 6 and 7.



3. Open the M9018A SFP (Start > All Programs > Keysight > M9018 > M9018 SFP).
4. Select (enable) Allow Control.



5. Trigger 6 routes the External Trigger signal from the M9301A to the M9311A. In this example, the M9301A has been installed in Slot 8 (Bus Segment 2), while the M9311A is in Slots 5 (Bus Segment 1). Therefore, backplane trigger 6 must be redirected from Bus Segment 2 to Bus Segment 1. Use the drop-down menu to select "1 ← 2".
6. Trigger 7 routes the ALC Trigger signal from the M9311A to the M9310A. Since the M9311A is now in Bus Segment 1 and the M9310A is in Bus Segment 2, backplane trigger 7 must be redirected from Bus Segment 1 to Bus Segment 2. Use the drop-down menu to select "1 → 2".

**NOTE**

If two to four sources are installed in the M9018A chassis, each source should have its own backplane trigger line. If you have a source that spans segment 1 and segment 2 and another source that spans segment 2 and segment 3, using a single set of trigger lines with 1 → 2 → 3 and 1 ← 2 ← 3 does not work for both sources. In this case, you must configure one set of trigger lines with 1 → 2 and 1 ← 2 connections and another set of trigger lines with 2 → 3 and 2 ← 3 connections.

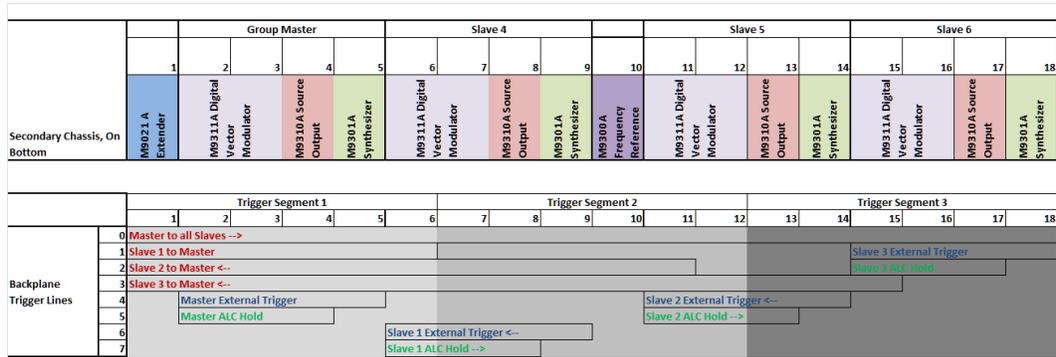
### Configuring PXIe Backplane Triggers for Multi-Channel Operations

For a multi-channel system spanning one or more chassis, you must configure additional backplane triggers for the required synchronization between the channels in a chassis.

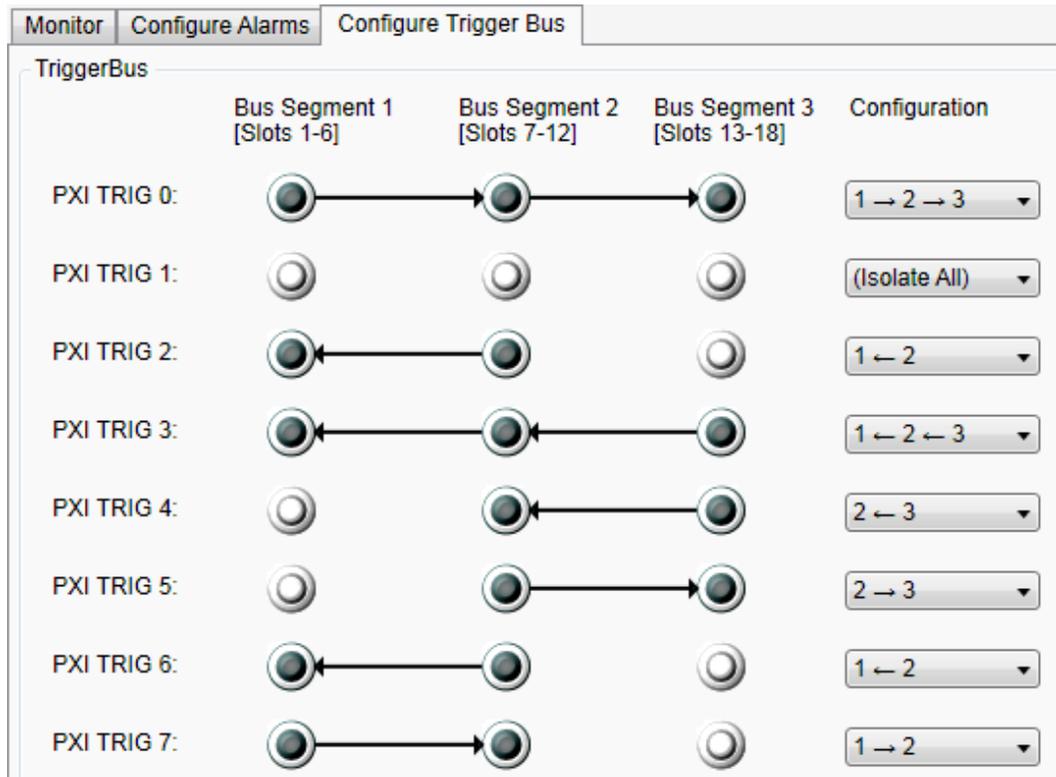
- On each master channel, configure the PXI backplane trigger line from the master channel to all the slave channels.
- On each slave channel, configure a unique PXI backplane trigger line as the handshaking line from the slave channel to the master channel.

### Recommended Module and Backplane Layout for M9381A VSG

The following is the recommended module and backplane layout for multiple M9381A PXIe VSGs in two chassis. The diagram below shows the layout of the second chassis. Each chassis is configured in the same manner.

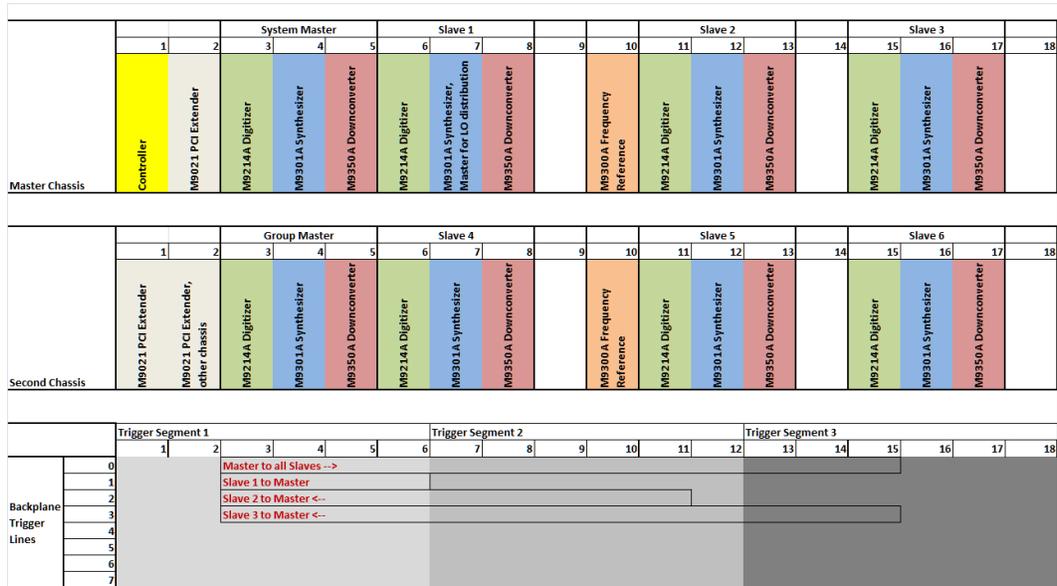


Perform the steps in [Procedure for Configuring PXIe Backplane Bus Triggers](#) to arrive at the following backplane configuration:

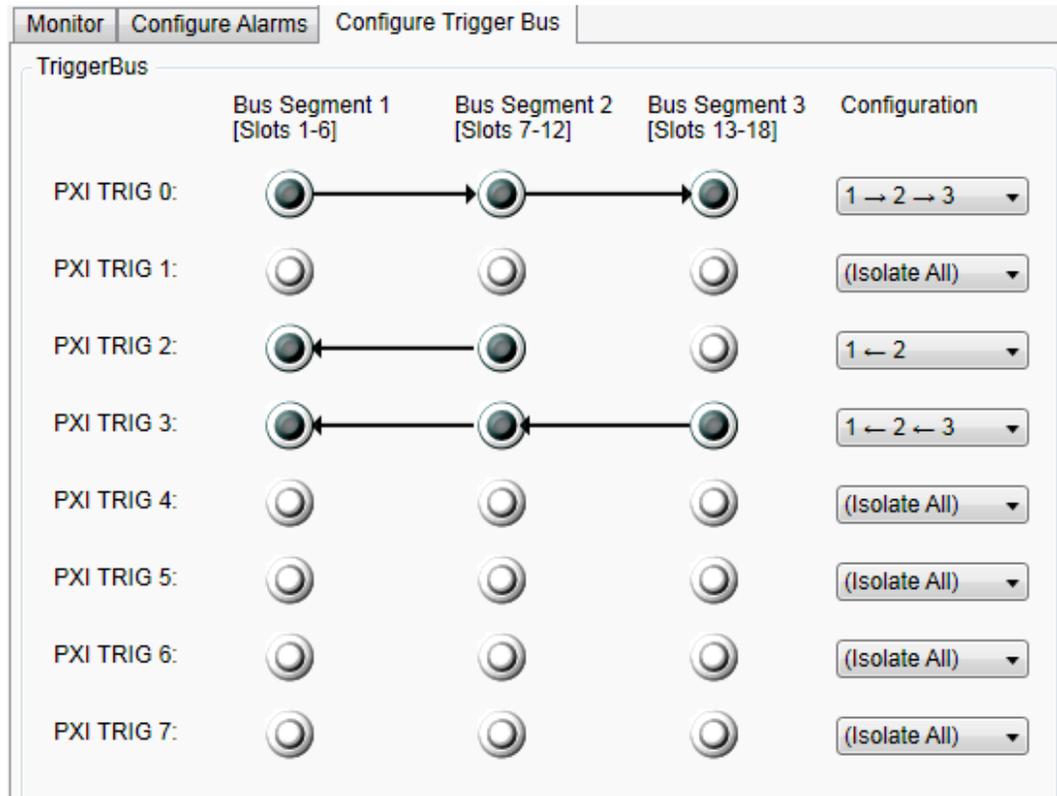


### Recommended Module and Backplane Layout for M9391A VSA

The following is the recommended module and backplane layout for multiple M9391A PXIe VSAs in two chassis. The diagram below shows the layout of both the first and the second chassis.



Perform the steps in [Procedure for Configuring PXIe Backplane Bus Triggers](#) to arrive at the following backplane configuration:



**NOTE**

In the Shared LO configurations, there is an additional External Trigger line radiating out from the shared Synthesizer (Slave 1's Synthesizer) as shown below:

1 ← 2 → 3.

## Configuring M9018B/M9019A PXIe Backplane Triggers

When using the Keysight M9018B/M9019A PXIe 18-slot Chassis, you should install the M9381A modules entirely within one of the slot groups: 1 through 6, 7 through 12, or 13 through 18. If you install the M9381A modules straddling any of these groups of slots, you will have to reconfigure the chassis's PXIe trigger bus routing for trigger 6 and trigger 7.

In both 2x2 configurations described in the [2x2 M9391A and M9381A Instrument Connections](#) section, backplane triggers will have to be applied to the VSA #2 and the VSG #1. This is because VSA #2 straddles slot groups 1 and 2. VSG #1 straddles slot groups 2 and 3.

### Backplane Triggers Used

- PXIe backplane trigger 6 is used to route the External Trigger signal from the Keysight M9301A PXIe Synthesizer front panel to the Keysight M9311A PXIe Digital Vector Modulator. Trigger 6 can be reassigned using API hints. You can use backplane triggering directly to the M9311A (no M9301A involved) by selecting the External Trigger source to be PXIe trigger 0 to 7.
- PXIe backplane trigger 7 is used for routing the ALC Trigger signal from the Keysight M9311A PXIe Digital Vector Modulator to the Keysight M9310A PXIe Source Output. Although the default is PXIe trigger 7, it can be reassigned using API hints.

#### CAUTION

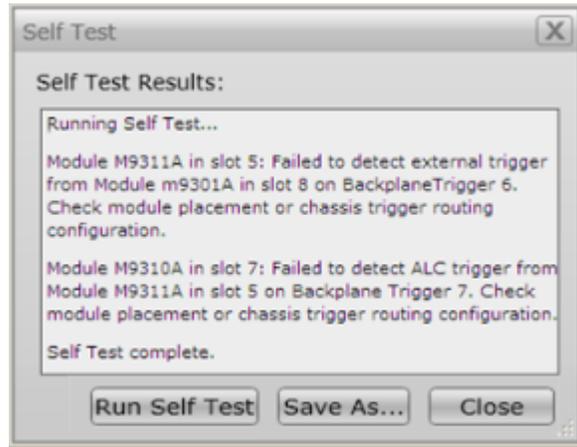
The Keysight M9018B/M9019A PXIe Chassis does not remember the trigger bus configuration upon cycling power. After a power cycle, you must reconfigure the bus triggers by using the M9018B/M9019A SFP or by creating a persistent configuration by using the KtMPxiChassis API. Refer to the Keysight M9391A PXIe VSA and M9381A PXIe VSG Programming Guide (M9300-90080) for details and programming examples. This document is available on your installation CD and online at [http://edownload.software.keysight.com/Modular/M938XA/2.0/M9391\\_and\\_M9381\\_ProgrammingGuide.pdf](http://edownload.software.keysight.com/Modular/M938XA/2.0/M9391_and_M9381_ProgrammingGuide.pdf).

### Procedure for Configuring PXIe Backplane Bus Triggers

1. Make sure you have followed Steps 1 through 4 in this Startup Guide to setup and configure the Keysight M9381A PXIe Vector Signal Generator.
2. Conduct a Self Test (Utilities > Self Test... > Run Self Test). If your configuration straddles two slot groups, you will receive error messages.

#### NOTE

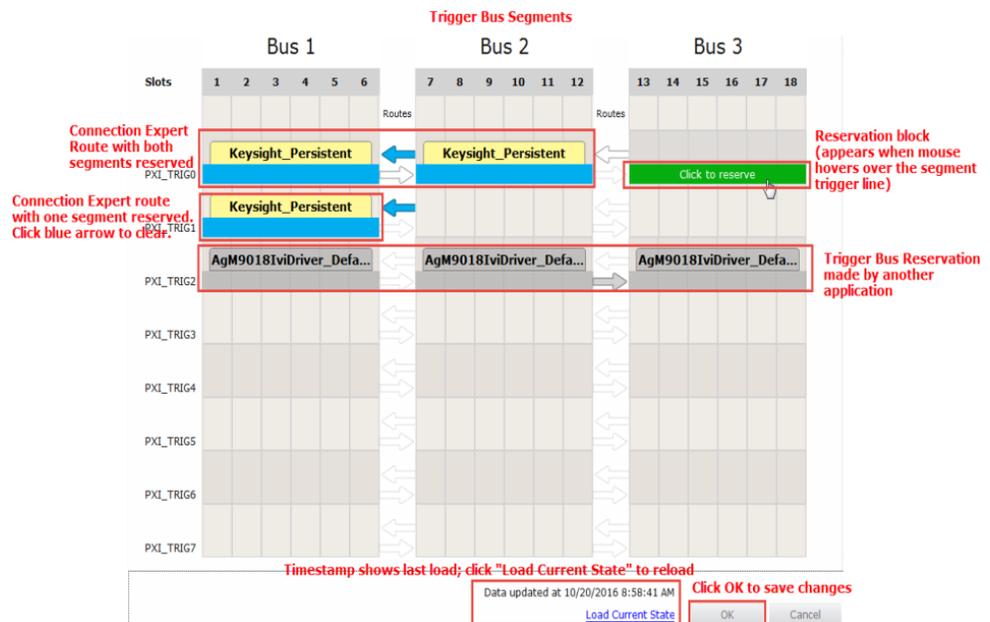
In the following graphic a Self Test has been run on an M9381A that is installed in slots 5 through 9; therefore, it straddles two slot groups. The Self Test detects errors with backplane triggers 6 and 7.



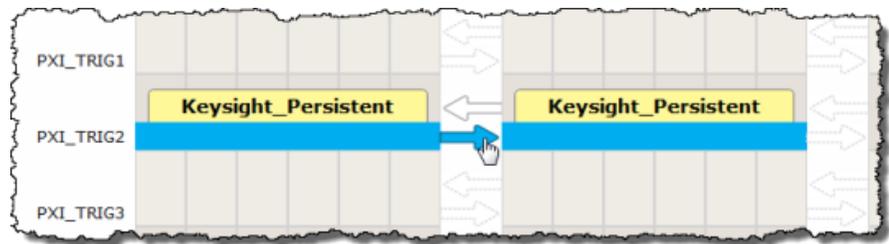
3. Open Connection Expert from the IO Control icon in the Windows notification area.
4. Navigate to the Chassis Triggers view in the PXI/AXIe tab.
5. Click the green reservation block (that appears when you point to an unreserved trigger line) in the Bus 1 and Bus 2 segments. When you click the green reservation block, it changes to a blue Keysight\_Persistent reserved block.
6. Set the flow of direction and create the route using the arrows "→" or "←".
7. Click OK.

**NOTE**

Keysight strongly recommend that you make Trigger Bus Reservations before you actually use the Trigger Lines in your application. In this example, it is assumed that the trigger signals need to be routed from /to Bus 1 segment to/from Bus 2 segment.



8. PXIe backplane trigger 6 routes the External Trigger signal from the M9301A to the M9311A. In this example, the M9301A has been installed in Slot 8 (Bus Segment 2), while the M9311A is in Slots 5 (Bus Segment 1). Therefore, PXIe backplane trigger 6 must be redirected from Bus Segment 2 to Bus Segment 1.
  - a. Click the PXI\_TRIG6 row in Bus 1.
  - b. Use the right to left arrow "←" to set the flow of direction and create the route from Bus 2 to Bus 1.
9. PXIe backplane trigger 7 routes the ALC Trigger signal from the M9311A to the M9310A. Since the M9311A is now in Bus Segment 1 and the M9310A is in Bus Segment 2, PXIe backplane trigger 7 must be redirected from Bus Segment 1 to Bus Segment 2.
  - a. Click the PXI\_TRIG7 row in Bus 2.
  - b. Use the left to right arrow "→" to set the flow of direction and create the route from Bus 1 to Bus 2. For example, in the figure below, the PXIe backplane trigger 2 (PXI\_TRIG2) has been directed from Bus 1 to Bus 2.



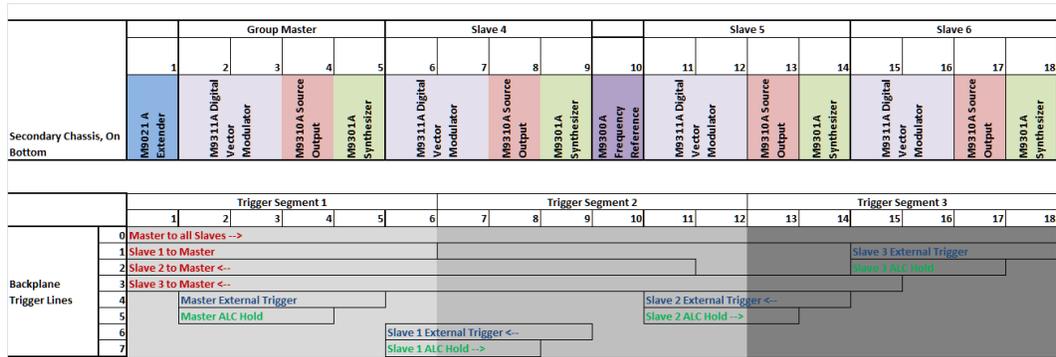
### Configuring PXIe Backplane Triggers for Multi-Channel Operations

For a multi-channel system spanning one or more chassis, you must configure additional backplane triggers for the required synchronization between the channels in a chassis.

- On each master channel, configure the PXI backplane trigger line from the master channel to all the slave channels.
- On each slave channel, configure a unique PXI backplane trigger line as the handshaking line from the slave channel to the master channel.

### Recommended Module Layout for M9381A VSG

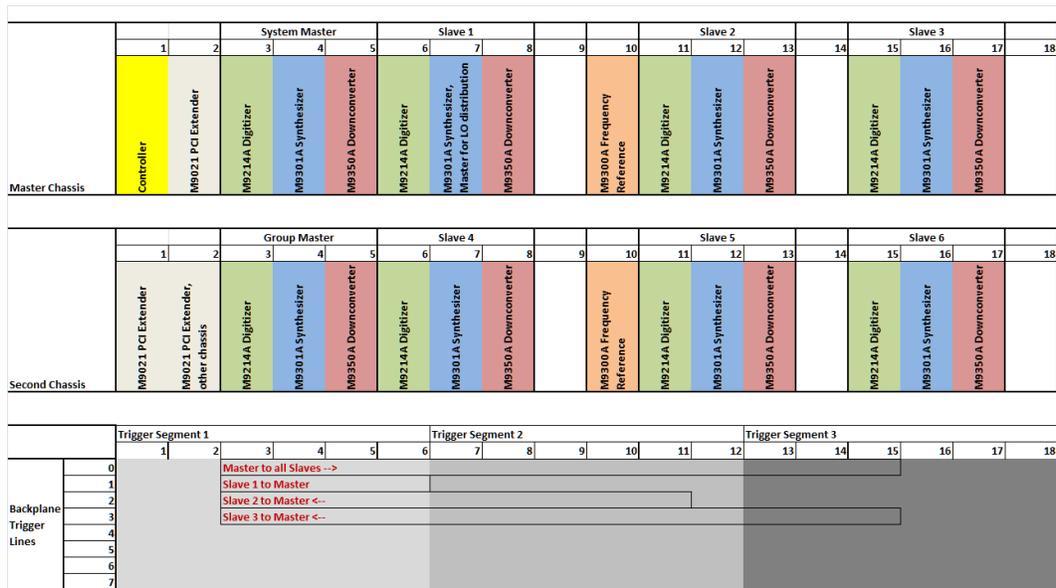
The following is the recommended module layout for multiple M9381A PXIe VSGs in two chassis. The diagram below shows the layout of the second chassis. Each chassis is configured in the same manner.



Perform the steps in [Procedure for Configuring PXle Backplane Bus Triggers](#) to arrive at the above module configuration.

### Recommended Module Layout for M9391A VSA

The following is the recommended module layout for multiple M9391A PXle VSAs in two chassis. The diagram below shows the layout of both the first and the second chassis.



Perform the steps in [Procedure for Configuring PXle Backplane Bus Triggers](#) to arrive at the above module configuration.

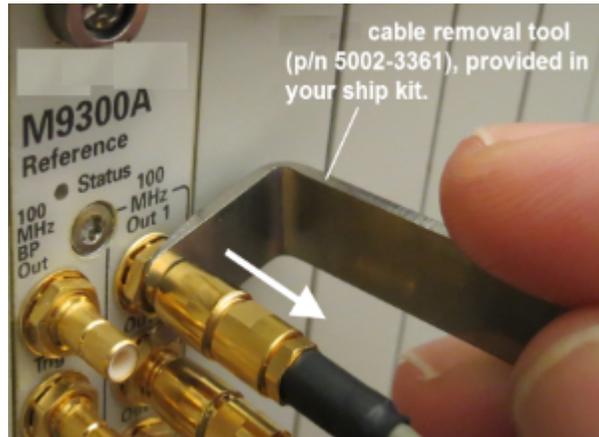
**NOTE** In the Shared LO configurations, there is an additional External Trigger line radiating out from the shared Synthesizer (Slave 1's Synthesizer) as shown below:  
 1 ← 2 → 3.

### Cable and Connector Care

Use the Keysight Cable Removal Tool to disconnect push-on cables from the module front panel connectors.

**CAUTION**

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.



## Module Front Panel Features

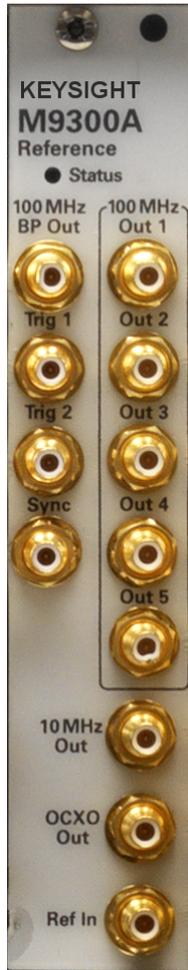
### Module Front Panel Features

- [M9300A PXIe Frequency Reference Front Panel Features](#)
- [M9301A PXIe Synthesizer Front Panel Features](#)
- [M9310A PXIe Source Output Front Panel Features](#)
- [M9311A PXIe Digital Vector Modulator Front Panel Features](#)
- [M9350A PXIe Downconverter Front Panel Features](#)
- [M9214A PXIe IF Digitizer Front Panel Features](#)

## M9300A Front Panel Connectors

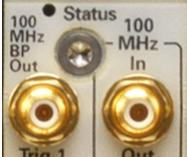
For parameter limits and specifications on the M9300A, see [M9391A Block Diagram Reference Table for M9300A](#).

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 to the 100 MHz input of the Keysight M9301A PXle Synthesizer, Keysight M9310A Source Output, or Keysight M9350A Downconverter depending on the configuration.
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 $\Omega$ .



## M9301A Front Panel Connectors

For parameter limits and specifications on the M9301A connectors, see [M9391A Block Diagram Reference Table for M9301A](#).

Connector	Description
	This SMB male connector outputs a 100 MHz signal from the chassis backplane.
	This SMB male connector inputs a 100 MHz reference and clock signal from the 100 MHz Out connectors of the Keysight M9300A PXIe Frequency Reference.
	This SMB male connector outputs the 100 MHz Reference signal.
	This connector is intended for future use.
	This SMB male connector is the End of Acquisition Output.
	This connector is intended for future use.
	These SMA female connectors (1A,1B, 2A, and 2B) provide the LO input to the Keysight M9350A PXIe Downconverters in an VSA configuration and to the Keysight M9311A PXIe Digital Vector Modulators in a VSG configuration. Unused connectors should be terminated with the provided 50 Ω loads.

## M9310A Front Panel Connectors

For parameter limits and specifications on the M9310A connectors, see [M9381A Block Diagram Reference Table for M9310A](#).

Connector	Description
100 MHz BP Out	This SMB male connector outputs a 100 MHz signal from the chassis backplane.
100 MHz In	This SMB male connector inputs a 100 MHz reference signal.
100 MHz Out	This SMB male connector outputs the 100 MHz Reference signal.
Trig 1	This SMB male connector accepts the Pulse RF Blanking Input Trigger from the M9311A Trig 1 connector.
Trig 2	This SMB male connector is the Source Settled Output Trigger.
Sync	This connector is intended for future use.
RF In	This SMA female connector inputs the RF signal from the Keysight M9311A PXIe Digital Vector Modulator RF Out connector.
RF Out	This SMA female connector outputs a RF signal of 1 MHz to 3 GHz or 6 GHz.

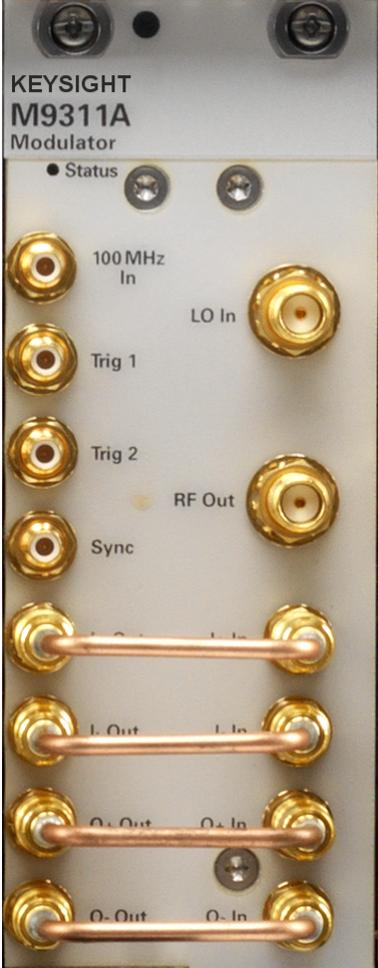


### CAUTION

To avoid damage, do not exceed 1 Watt (25 VDC) reverse power into the M9310A RF Out connector.

## M9311A Front Panel Connectors

For parameter limits and specifications on the M9311A connectors, see [M9381A Block Diagram Reference Table for M9311A](#).

	Connector	Description
	100 MHz In	This SMB male connector inputs a 100 MHz reference signal.
	LO In	This SMA female connector inputs the LO signal from the Keysight M9301A PXle Synthesizer RF /LO Out connector.
	Trig 1	This SMB male connector is the Pulse RF Blanking Output Trigger. The Pulse Modulation trigger is received by the M9310A Trig 1 connector.
	Trig 2	This SMB male connector is the Synchronization Output Trigger.
	Sync	This SMB male connector is used in multi-channel M9381A VSG setups spanning multiple chassis.
	RF Out	This SMA female connector outputs a modulated RF signal of 1 MHz to 3 GHz or 6 GHz. This signal is routed to the M9310A RF In connector.

**CAUTION**

Do not remove or replace any of the four IQ cables at the bottom of the module.

## M9350A Front Panel Connectors

For parameter limits and specifications on the M9350A connectors, see [M9391A Block Diagram Reference Table for M9350A](#).

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.
Trig 1	This connector is intended for future use.
Trig 2	Receiver Armed Output.
Sync	This connector is intended for future use.
100 MHz In	This SMB male connector inputs a 100 MHz reference signal from the 100 MHz Out connector of the Keysight M9301A PXIe Synthesizer. In a multi-channel LO sharing configuration, slave channels do not require this input.
100 MHz Out	This SMB male connector outputs the 100 MHz In signal to the Keysight M9214A PXIe IF Digitizer 100 MHz In connector.
LO In	This SMA female connector inputs the LO signal from the Keysight M9301A PXIe Synthesizer RF/LO Out connector.
IF Out	This SMB male connector sends the IF signal to the M9214A IF Input.
RF In	This SMA female connector inputs a modulated RF signal of 1 MHz to 6 GHz.



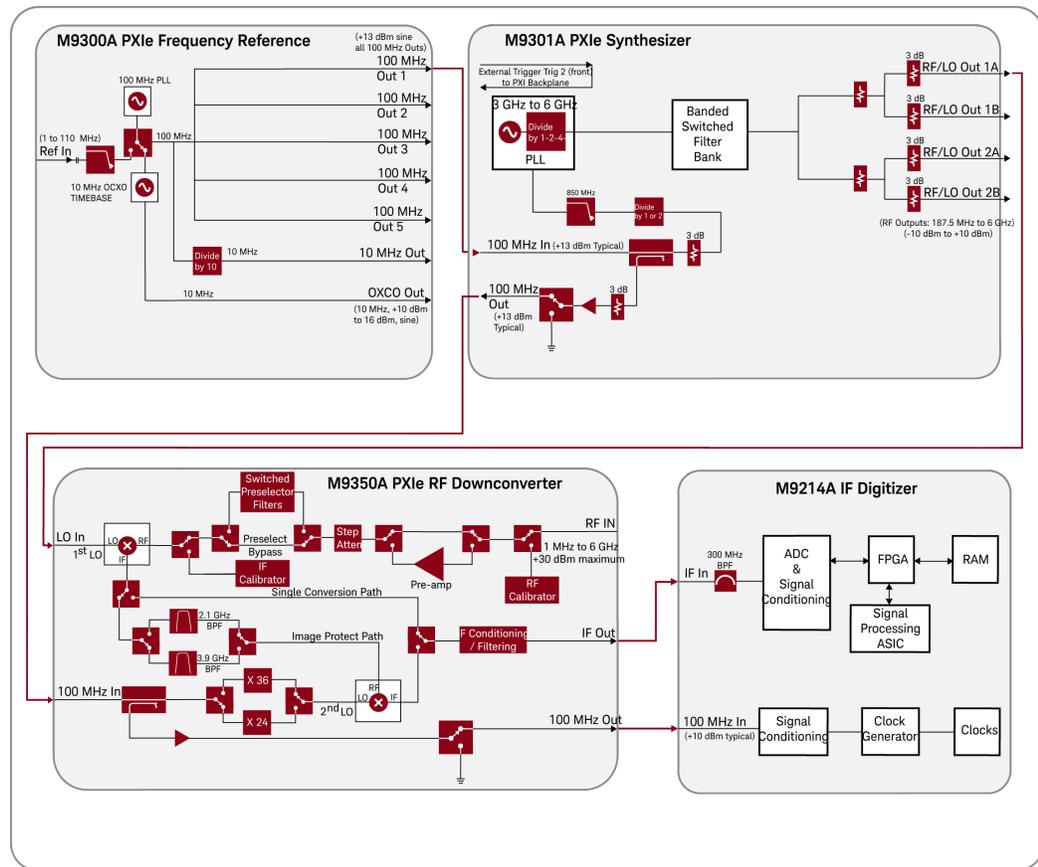
## M9214A Front Panel Connectors

For parameter limits and specifications on the M9214A connectors, see [M9391A 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 M9350A Downconverter.
Trig 1	External Trigger Input.
Trig 2	Trigger Received Output.
Sync	This SMB male connector is used in multi-channel M9391A VSA setups spanning multiple chassis.
IF In	This SMB male connector accepts the IF Input from the M9350A IF Out connector.

# M9391A Block Diagram

## M9391A Block Diagram



### M9391A Block Diagram Reference Table for M9300A

M9300A PXle 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 Output level: >+12 dBm sine (+13 dBm typical)
	10 MHz Out	Output level: 3.3 Vpp square (1.65 v into 50 Ω)

### M9300A PXIe Reference Operation

	OCXO Out	Frequency: 10 MHz, AC coupled, 50 $\Omega$ 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 $\Omega$ , +16 dBm max @ 0 VDC into 50 $\Omega$	Trigger 1 & 2	3.3 V into 50 $\Omega$
From: Chassis back plane board Frequency: 100 MHz	100 MHz BP Out	Frequency: 100 MHz Output level: +10 dBm

### M9391A Block Diagram Reference Table for M9301A

#### M9301A PXIe Synthesizer Operation

Input	Connector	Output
	RF/LO Out 1A, 1B, 2A, 2B	Frequency: 187.5 MHz to 6.0 GHz  Output level: -10 dBm to +10 dBm
From: M9300A 100 MHz Out - frequency: 100 MHz, Amplitude: >+12 dBm	100 MHz In	
	100 MHz Out	Frequency: 100 MHz Output level: >+10 dBm (typical)
	Sync	This connector is intended for future use.
Sine or square wave -2 V to +5 V max into 50 $\Omega$ , +16 dBm max @ 0 VDC into 50 $\Omega$	Trigger 1 & 2 (In /Out)	3.3 V into 50 $\Omega$
Chassis back plane board	100 MHz BP Out	Frequency: 100 MHz Output level: >+10 dBm

## M9391A Block Diagram Reference Table for M9350A

<b>M9350A PXIe Downconverter Operation</b>		
<b>Input</b>	<b>Connector</b>	<b>Output</b>
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 $\Omega$ , +16 dBm max @ 0 VDC into 50 $\Omega$	Trigger 1 & 2 (In /Out)	3.3 V into 50 $\Omega$
	Sync	This connector is intended for future use.
From: M9301A 100 MHz Out - frequency: 100 MHz, Amplitude: >+12 dBm	100 MHz In	
	100 MHz Out	To: M9214A 100 MHz In Frequency: 100 MHz Output level: >+10 dBm (typical)
From: M9301A Synthesizer RF/LO Out. Frequency: 187.5 MHz to 6 GHz Input level: -10 dBm to +10 dBm	LO In	
	IF Out	326 MHz (for 15 MHz BW), 240 MHz (for 40 MHz BW) or 300 MHz (for 160 MHz BW) +5 dBm
1 MHz to 6 GHz, +30 dBm maximum	RF In	

## M9391A Block Diagram Reference Table for M9214A

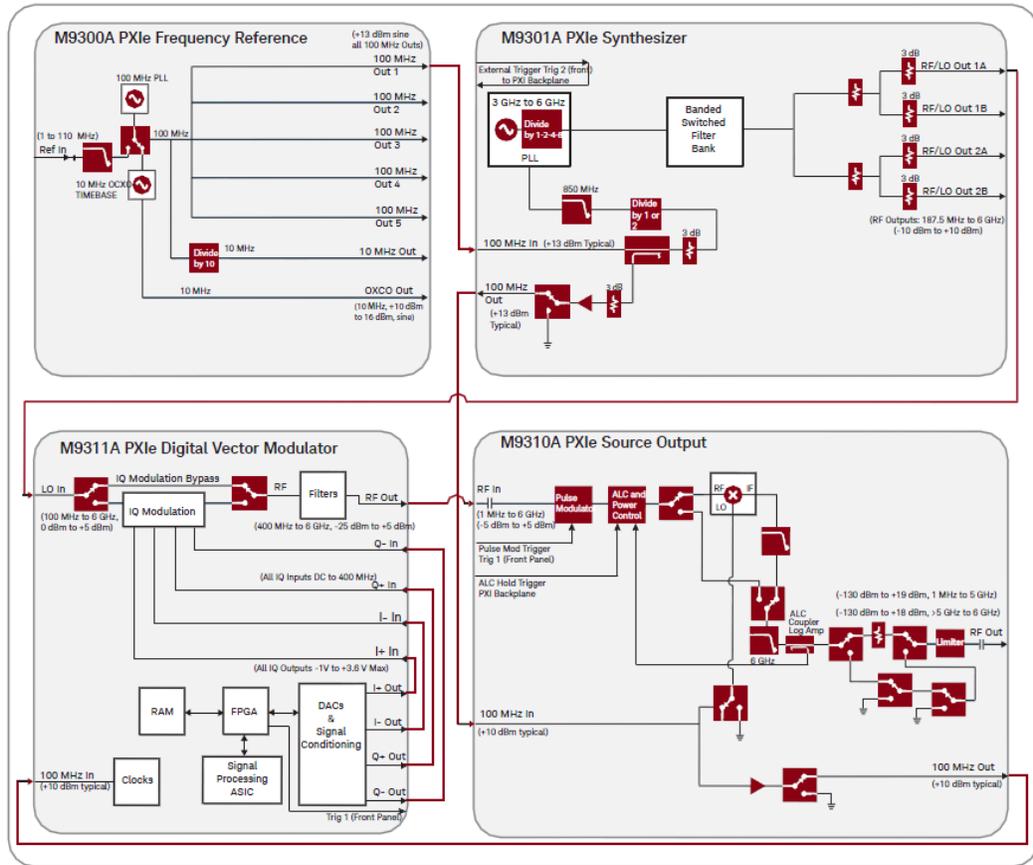
<b>M9214A PXIe IF Digitizer Operation</b>		
<b>Input</b>	<b>Connector</b>	<b>Output</b>
Sine or square wave -2 V to +5 V max into 50 $\Omega$ , +16 dBm max @ 0 VDC into 50 $\Omega$	Trigger 1 & 2	3.3 V into 50 $\Omega$
	Sync	This connector is intended for future use.

## M9214A PXIe IF Digitizer Operation

Input	Connector	Output
Frequency: 100 MHz, Amplitude: >+12 dBm	100 MHz In	
326 MHz (for 15 MHz BW), 240 MHz (for 40 MHz BW) or 300 MHz (for 160 MHz BW) +5 dBm	IF In	

## M9381A Block Diagram

## M9381A Block Diagram



## M9381A Block Diagram Reference Table for M9300A

M9300A PXIe Reference Operation		
Input	Connector	Output
	Ref In	

### M9300A PXIe Reference Operation

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

### M9381A Block Diagram Reference Table for M9301A

#### M9301A PXIe Synthesizer Operation

Input	Connector	Output
	RF/LO Out 1A, 1B, 2A, 2B	Frequency: 187.5 MHz to 6.0 GHz Output level: -10 dBm to +10 dBm
From: M9300A 100 MHz Out - frequency: 100 MHz, Amplitude: >+12 dBm @100 Hz: -130 dBc/Hz @1 kHz: -160 dBc/Hz	100 MHz In	

### M9301A PXIe Synthesizer Operation

Input	Connector	Output
	100 MHz Out	To M9310A 100 MHz In Frequency: 100 MHz Output level: >+10 dBm (typical)
	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 (In /Out)	3.3 V into 50 Ω
Chassis back plane board	100 MHz BP Out	Frequency: 100 MHz Output level: >+10 dBm

### M9381A Block Diagram Reference Table for M9310A

#### M9310A PXIe RF Output Operation

Input	Connector	Output
	RF In	
	RF Out	Frequency: 1 MHz to 6 GHz Output level: -120 dBm to +10 dBm (standard power) Output level: +19 dBm (Option 1EA high power) for frequencies from 1 MHz to 5 GHz and +18 dBm for frequencies > 5 GHz to 6 GHz.
from: M9301A 100 MHz Out Frequency: 100 MHz Amplitude: >+12 dBm	100 MHz In	
	100 MHz Out	To M9311A 100 MHz In Frequency: 100 MHz Output level: >+10 dBm (typical)
	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 (In /Out)	3.3 V into 50 Ω. Trig 1 Output .

### M9310A PXIe RF Output Operation

Input	Connector	Output
Chassis back plane board	100 MHz BP Out	Frequency: 100 MHz Output level: >+10 dBm

### M9381A Block Diagram Reference Table for M9311A

#### M9311A PXIe Digital Vector Modulator Operation

Input	Connector	Output
From: M9301A Synthesizer RF/LO Out Frequency: 187.5 MHz to 6 GHz Input level: 0 dBm to +5 dBm	LO In	
	RF Out	To M9310A RF In - Frequency: 400 MHz to 6 GHz Output power: -25 dBm to +5 dBm
100 MHz Reference from M9310A	100 MHz In	
	Sync	This connector is intended for future use.
Sine or square wave -2 V to +5 V max into 50 $\Omega$ , +16 dBm max @ 0 VDC into 50 $\Omega$	Trigger 1 & 2 (In/Out)	3.3 V into 50 $\Omega$ Trig 1. Input from M9310A trig 1

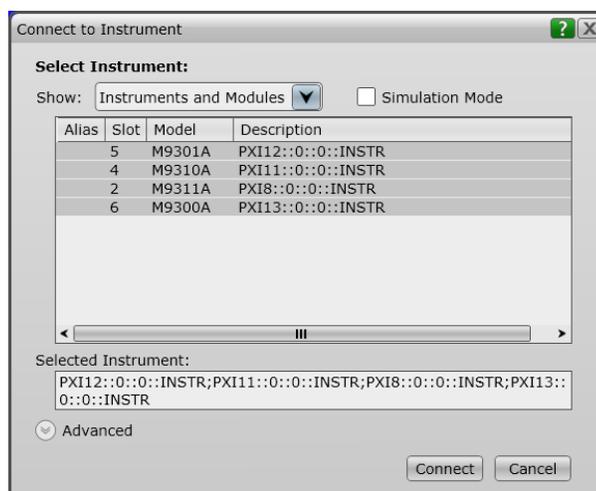
## Step 5 - Verify Operation of the M9391A VSA and M9381A VSG

### Step 5 - Verify Operation of the M9381A VSG and M9391A VSA

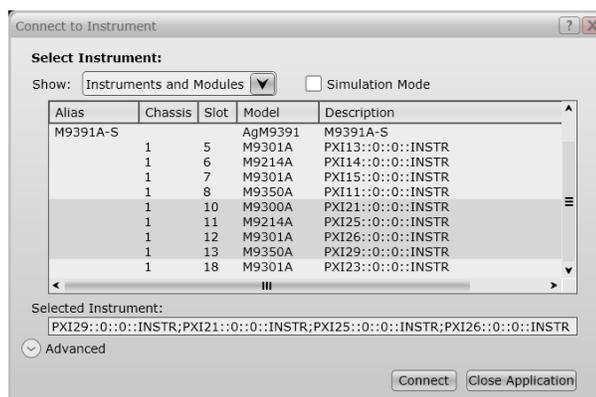
Use the following procedure to verify operation of each M9381A VSG and M9391A VSA configuration.

1. Power on the Chassis, if you haven't already.
2. The first step in is to conduct a Self Test on each M9381A and M9391A.
  - a. For each M9381A, open the M9381A SFP by selecting Start > All Programs > Keysight > M938x > M9381 SFP.
  - b. For each M9391A, open the M9391A SFP by selecting Start > All Programs > Keysight > M9391 > M9391 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 or M9391A, then press Connect. Leave the SFPs open. For example:

M9381A



M9391A



**NOTE**

If not all modules and slot locations are visible in the SFP "Connect to Instrument" dialog, Close the SFP. See [Communications](#).

**NOTE**

Selecting **Connect** initializes the instrument and all associated modules. Prior to initialization, all LEDs are off.

3. Check the front panel Status LEDs of all modules, according to the following table.

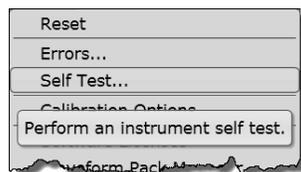
Module	Green	Orange	Red	Off
M9300A	The Soft Front Panel has initialized the connection to the module	n/a	Indicates that the VCXO is unlocked.	<ul style="list-style-type: none"> <li>- Not connected by the SFP</li> <li>- Failure in the power supplies. Module hardware health can't be determined until the power supply failure is resolved.</li> </ul>
M9301A	The Soft Front Panel has initialized the connection to the module	Tuning is in progress, or the M9301A is unlocked from the reference.	n/a	<ul style="list-style-type: none"> <li>- Not connected by the SFP</li> <li>- Failure in the power supplies. Module hardware health can't be determined until the power supply failure is resolved.</li> </ul>
M9310A		n/a	n/a	

Module	Green	Orange	Red	Off
	The Soft Front Panel has initialized the connection to the module			<ul style="list-style-type: none"> <li>- Not connected by the SFP</li> <li>- Failure in the power supplies. Module hardware health can't be determined until the power supply failure is resolved.</li> </ul>
M9311A	<ul style="list-style-type: none"> <li>- The Soft Front Panel has initialized the connection to the module.</li> <li>- The module has returned to idle from modulation.</li> </ul>	<ul style="list-style-type: none"> <li>- Modulation is turned on.</li> </ul>	<ul style="list-style-type: none"> <li>- DAC overload detected.</li> <li>- IQ overload detected</li> </ul>	<ul style="list-style-type: none"> <li>- Not connected by the SFP</li> <li>- Failure in the power supplies. Module hardware health can't be determined until the power supply failure is resolved.</li> </ul>
M9214A	The Soft Front Panel has initialized the connection to the module	Missing 100 MHz Reference.	n/a	<ul style="list-style-type: none"> <li>- Not connected by the SFP</li> <li>- Failure in the power supplies. Module hardware health can't be</li> </ul>

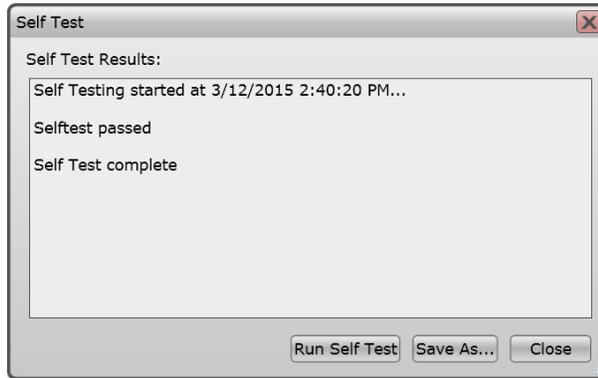
Module	Green	Orange	Red	Off
				determiner until the power supply failure is resolved.
M9350A	The Soft Front Panel has initialized the connection to the module	Missing 100 MHz Reference.	n/a	<ul style="list-style-type: none"> <li>- Not connected by the SFP</li> <li>- Failure in the power supplies. Module hardware health can't be determiner until the power supply failure is resolved.</li> </ul>

**CAUTION** It is important that no signal is present at the RF Input of the Keysight M9350A PXIe Downconverter when doing a Self Test. If a signal is present, it may result in a false failure.

4. If the M9381A is configured for Shared LO, run the LO Level Alignment on the M9381A designated as master, then run the alignment on the M9381A's designated as slaves (Utilities > LO Level Alignment > All States).
5. Run the alignments on each M9391A (Utilities > Alignments > Comprehensive > All States). If the instrument is configured for Shared LO, you must run the alignments on the M9391A designated as master before you run the alignments on the M9391A's designated as slaves.
6. Conduct a Self Test on all modules of the M9391A and also the M9381A (Utilities > Self Test... > Run Self Test).



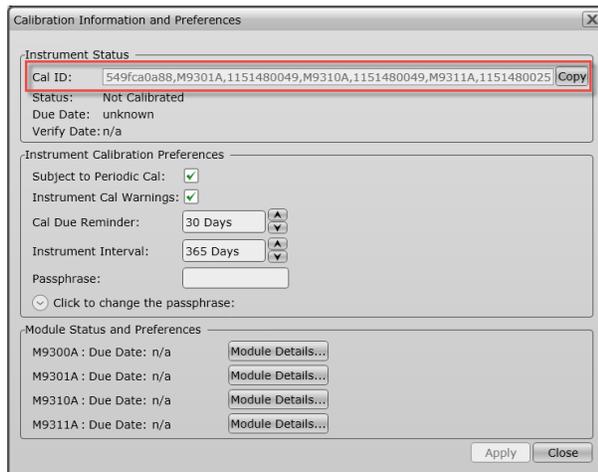
If the Self Test passes (see results below), go to **Step 6 - Make a Measurement**.



## Self Test Failure

If the Self Test does not pass for any of the multi-module instruments, the test indicates which module is likely to need service. However, you should return all modules (except the M9300A) and all cables for that particular instrument. All component modules for an M9381A or M9391A MMI are factory tested and calibrated as a "bundle". It is important that you maintain the bundle when returning an MMI for repair.

To ensure that you send in the group of modules that was reported in a Self Test failure, go to Utilities > Calibration Options... to view this screen:



The string pointed out in this image is the Cal ID. The first 10 characters represent the Unique ID and the remaining characters show the modules (and their serial numbers) that constitute the M9381A or M9391A instrument. A Certificate of Calibration for that instrument contains the same information. Additionally, you may see this same information from the SFP by using Help > About.

See [Return an Instrument for Service](#).

### CAUTION

It is important that no signal is present at the RF Input of the Keysight M9350A PXIe Downconverter when doing a Self Test. If a signal is present, it may result in a false failure.

### NOTE

If the Self Test reports backplane trigger errors, follow the PXI trigger bus reconfiguration instructions in [Configuring M9018A PXIe Backplane Triggers/Configuring M9018B/M9019A PXIe Backplane Triggers](#) .

## Communications

If you are unable to communicate with the M9391A or M9381A verify that the following installations are correct:

- Keysight IO Libraries Suite
- M9381A and M9391A SFP programs
- 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.

## Step 6 - Make a Measurement

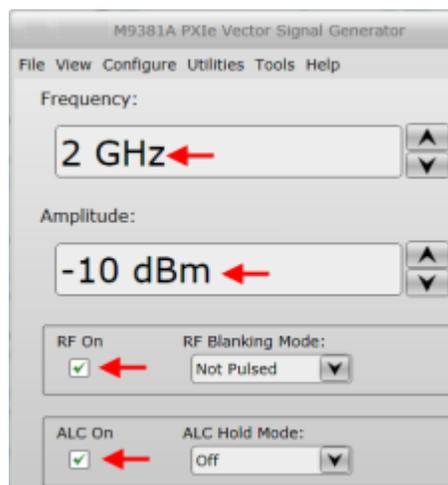
### NOTE

As a best practice, always run a Self Test of each instrument before making a measurement.

### NOTE

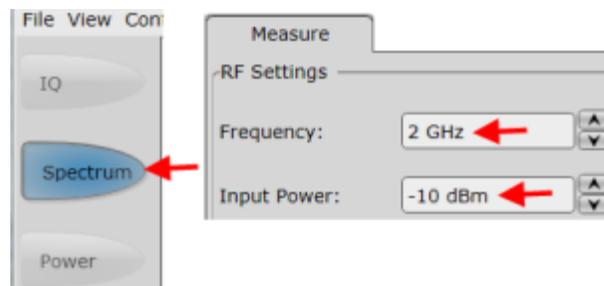
If your solution has more than one channel, repeat this process for each channel. Alternatively, you can use Signal Studio to make measurements with multiple M9381A instruments and the 89600 VSA software to make measurements with multiple M9391A instruments (see [Keysight 89600 VSA Software for M9391A](#)).

1. The first step in this process is to open the SFP of the M9381A and the M9391A.
  - a. Open the M9381A SFP by selecting Start > All Programs > Keysight > M938x > M9381 SFP.
  - b. Open the M9391A SFP by selecting Start > All Programs > Keysight > M9391 > M9391 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 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 Keysight M9350A PXIe Downconverter.
3. Torque the connectors to 8 Lb-In (0.904 Nm).

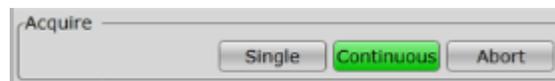


4. On the M9381A SFP make the following settings:
  - a. Frequency: 2 GHz
  - b. Amplitude: -10 dBm
  - c. RF On: checked
  - d. ALC On: checked.

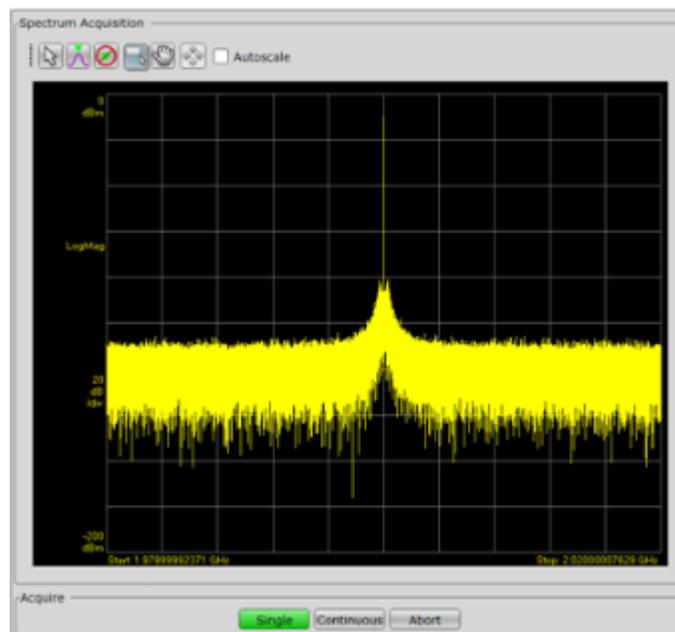
5. On the M9391A SFP Measure Tab, make the following settings:
  - a. Frequency: 2 GHz
  - b. Input Power: -10 dBm
  - c. Acquisition: Spectrum



6. Below the display, select Continuous for a sustained sweep of the analyzer.



You should see the following display on your M9391A 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

#### IVI Drivers

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\AgM9391\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 (AgM9391.chm) from this Start menu location: Start > All Programs > Keysight Instrument Drivers > IVI-COM-C Drivers > AgM9391 VSA > AgM9391 IVI Driver Help.

#### LabVIEW Driver

In addition to the IVI drivers, Keysight provides a LabVIEW driver that includes all the functionality of the IVI-C driver. When you install the product software, the LabVIEW driver is installed to each LabVIEW instr.lib directory for each version of LabVIEW you have on your computer (for example, C:\Program Files (x86)\National Instruments\<LabVIEW version>\instr.lib\<Keysight product model>). If you install LabVIEW drivers before you install LabVIEW itself, drivers will be installed in the Keysight directory instead of the National Instruments directory (for example, C:\Program Files (x86)\Keysight\<Keysight product model>\LabVIEW Driver\<LabVIEW version>\...). Example programs are provided to demonstrate most driver functionality. The reference information for the driver (a Microsoft HTML Help .chm file) is also installed with the driver and the content is available

from LabVIEW's Context Help window. In addition, you can directly access the chm file (AgM9391 LabVIEW\_Help) from this Start menu location: Start > All Programs > Keysight > M9391 > M9391 LabVIEW Help.

#### SCPI Interface (M9380A and M9381A only)

Keysight provides a SCPI server for the M9380A and M9381A source instruments. To access the server from the Start menu, go to Start > All Programs > Keysight > M938x > M938x SCPI Server. The SCPI Reference is located at Start > All Programs > Keysight > M938x > M938x SCPI Reference.

# Keysight 89600 VSA Software for M9391A

One of the components of Keysight M9391A PXIe VSA software installation is the M9391 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 M9391A program files during the M9391A driver installation process. If a compatible version of 89600 VSA software is detected during the installation process, the integration utility will put a copy of the M9391 hardware extension files into the associated 89600 installation location. Each compatible version of 89600 VSA software should have a copy of the M9391 hardware extension files in its installation location.

## NOTE

If the Keysight 89600 VSA software is installed after the M9391A drivers, you need to run the 89600 VSA Integration utility to install the M9391 hardware extension. Go to **Start > All Programs > Keysight > M9391 > 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, etc. In general, the M9391 hardware extension maps M9391 interface methods to COM interface methods for supported 89600 VSA functionalities.

The M9391 hardware extension enables 89600 VSA software to detect the presence of M9391A modules and to configure an M9391A Vector Signal Analyzer instrument from these modules based on a set of rules. As with other 89600 VSA supported instruments, an M9391 VSA can be configured via the 89600 VSA's New Hardware Configuration dialog.

To configure an M9391A instrument with multiple channels in 89600 VSA software, there are a set of rules that will be enforced by the M9391 hardware extension:

1. The M9300A Reference module must be installed in Slot 10 of each chassis.
2. Only the Master channel (the leftmost physical channel in each chassis) can (and must) include the M9300A Reference module (Slot 10) in its channel configuration.
3. Each channel must have its own Downconverter and Digitizer (ADC) modules. Specifically, each Downconverter and Digitizer in the system can only be utilized once in a configuration.

The current M9391A drivers support two types of multi-channel VSA configurations, each of which has its own rule regarding the Synthesizer module:

1. Independent LO VSA - For this type of M9391 multi-channel VSA, each channel must have its own Synthesizer module - each Synthesizer in the system can only be utilized once in a configuration.

2. Shared LO VSA – For this type of M9391 multi-channel VSA, all channels must share the same Synthesizer module.

**NOTE**

When sharing a synthesizer module in a single chassis configuration without the V2802A LO Distribution Network, the shared synthesizer outputs are assigned as the following: 1A to Channel 1, 1B to Channel 2, 2A to Channel 3 and 2B to Channel 4. This configuration supports VSA with 2, 3, or 4 channels. With this configuration, the associated LO cable connection must match that of the channel assignment.

When sharing a synthesizer module via the V2802A LO Distribution Network, synthesizer output 1A is assigned to all channels in the configuration. This configuration supports VSA with 2, 3, 4, 5, 6, 7, or 8 channels spanning two chassis. With this configuration, all LO connections from the shared synthesizer to the downconverters must go through the V2802A following the associated channel assignment using the cable kit.

To utilize the Keysight 89600 VSA software measurement capabilities using the M9391A Vector Signal Analyzer hardware configuration you've just created, you must first connect to the hardware configuration from the 89600 VSA software by selecting it from the pulldown list of configured hardware.

**NOTE**

The minimum required version of Keysight 89600 VSA software is 16.01.254.0. However, if you are using more than one chassis to configure multiple channels, then the minimum required version is 19.0. You can find this online at [www.keysight.com/find/89600](http://www.keysight.com/find/89600).

**NOTE**

As a best practice, after setting up an M9391A 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 89600 VSA Software For Multi-Channel M9391A VSA in Two Chassis

Keysight 89600 VSA versions 19.0 and higher support configuration of multiple M9391A channels distributed across two chassis. The following are the prerequisites:

- Each chassis must have a M9300A Reference module in slot 10.
- The first (leftmost) M9391A channel in each chassis is designated as the Master of that chassis and must contain the M9300A Reference module in the same chassis Slot 10. The M9391A instrument in Channel 1 is designated as the System Master while the Master M9391A instrument in the second chassis is designated as the Group Masters of that chassis. All other M9391A instruments in the configuration are designated as slaves and must not contain any M9300A reference module in their configuration.
- Each M9391A instrument is cabled between its modules as usual. For more information, refer to [M9391A Instrument Connections](#).
- The OCXO out of the System Master Reference module is connected to a Tee, which splits the 10MHz timebase signal to be connected to each Master's Reference module's Ref In connector.
- Each Master's M9214A Digitizer module Sync connector must be connected to each other.

For more information about the hardware arrangement of upto eight M9391A channels in two chassis, refer to [Multiple M9391A PXIe VSAs in Two Chassis](#).

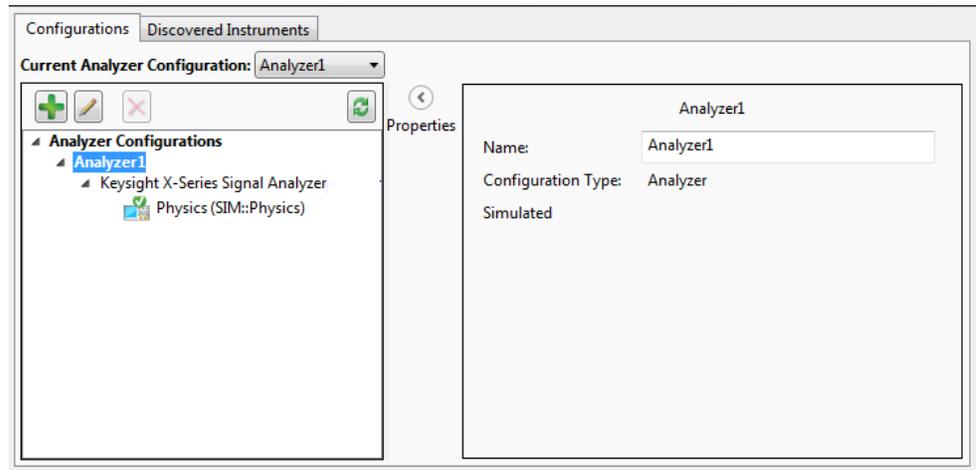
In the New Hardware Configuration dialog, each channel in a Multi-channel M9391 VSA must be configured separately. Channels in the same chassis must logically be added contiguously in the dialog but physically from left to right (based on the physical location in the chassis) and in a sequential order. The System Master must be added as Channel 1. The Group Master must be the first channel in its chassis; for an eight channel VSA, this is Channel 5. A M9300A Reference module is specified for each master and None is specified as the Reference for each slave channel.

## Configuration Procedure

This procedure is for setting up and configuring a system.

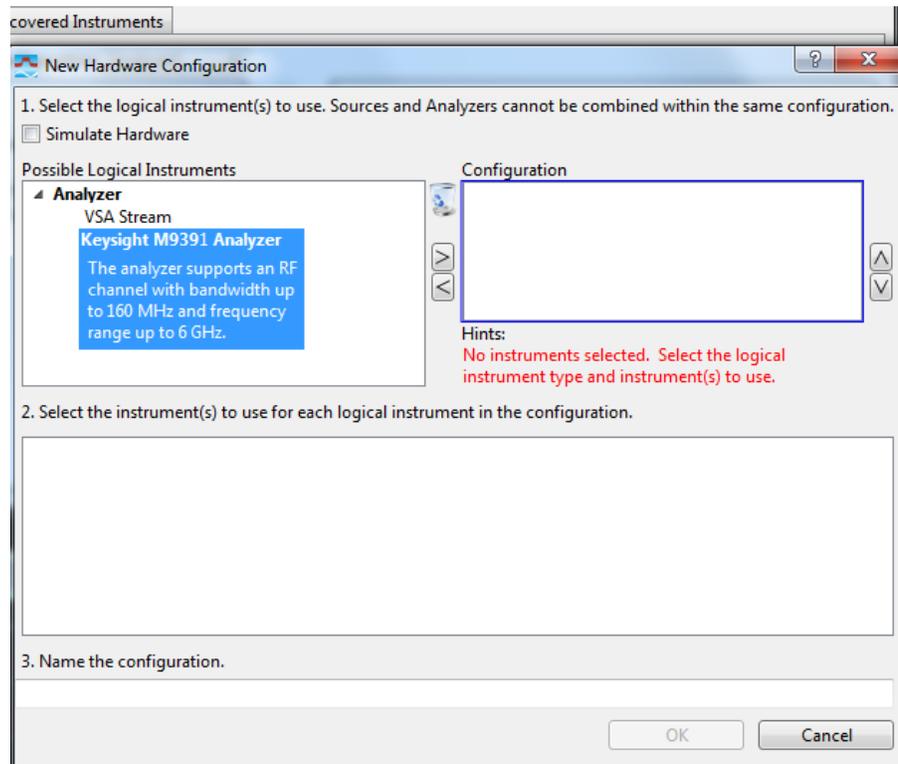
To create a new M9391A instrument, use the Keysight 89600 VSA software and follow these steps:

1. Open the "Hardware" 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 M9391A Analyzer entry and click on the  icon to copy the entry to the "Configuration" window.



Configure the new M9391A instrument by selecting the modules identified by their chassis and slot identification or their VISA address in the "2. *Select the instrument(s) to use for each logical instrument in the configuration*" section.

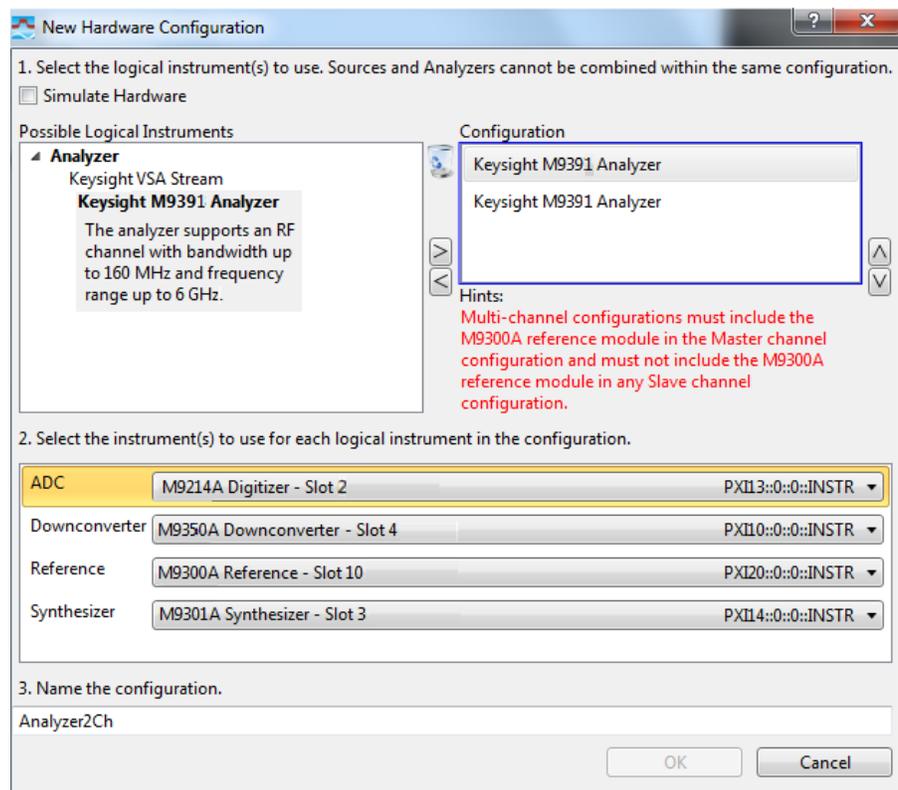
**NOTE** For eight-channel, two-chassis configuration, the modules associated with the first channel in both master and slave chassis are Slots 2, 4, 10, and 3. For eight-channel, MIMO test

system - 8-channel VSG with 8-channel VSA configuration, the modules associated with the first channel in both chassis are Slots 3, 5, 10, and 4.

The first channel in the master chassis is considered the System Master and it must be configured in the "Configuration" window as Channel 1 of the eight-channel VSA. The Reference module in Slot 10 of the master chassis must be included in its configuration.

The first channel in the slave chassis is considered the Group Master and it must be configured in the "Configuration" window as Channel 5 of the eight-channel VSA. The Reference module in Slot 10 of the slave chassis must be included in its configuration.

The Reference module for all other channels in the eight-channel VSA configuration must be set to "None".



- b. Name the new configuration in the "3. Name the configuration" section. Use a meaningful name for later identification.
  - c. Save the new configuration by selecting the "OK" button.
3. Repeat step 2 for each additional channel, selecting the next higher slot number offered and setting the Reference to "None".

**NOTE**

**Auto Calibrate** takes approximately 4 minutes per channel. Therefore, you should turn **Auto Calibrate** off (**Utilities > Calibrations**, clear the **Auto Calibrate** check box) immediately after selecting a hardware configuration with multiple M9391A channels.

Refer to the [Keysight 89600 VSA Software](#) for further details about making measurements with your Keysight M9391A PXIe Vector Signal Analyzer.

## Parameter Control and Input Extensions

The M9391 hardware extension for Keysight 89600 VSA software enables 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 hardware configuration and setup parameters that apply to the Keysight 89600 VSA software with M9391A. 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.

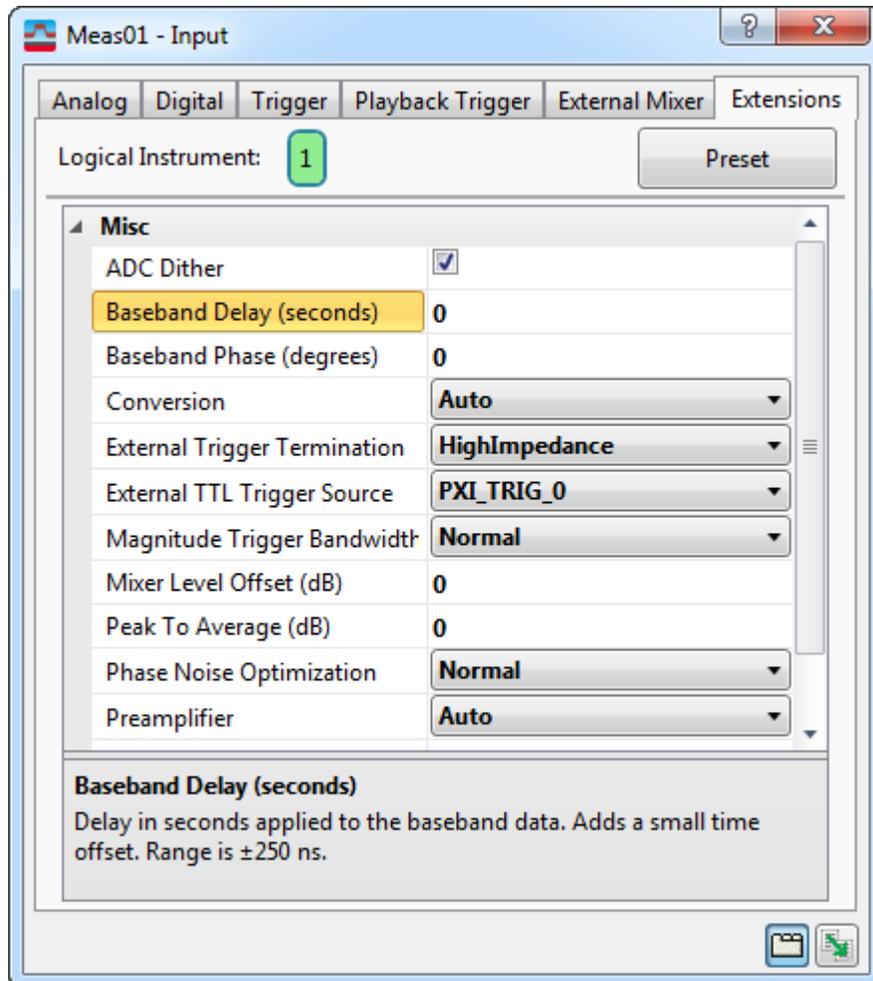
The following input extensions are instrument level (coupled across channels):

- Conversion (to set mixer conversion type) {Auto, Image Protect, SingleHighSide, SingleLowSide}
- External Trigger Termination {HighImpedance, 50 Ohm}
- External TTL Trigger Source (PXI\_TRIG0...PXI\_TRIG7)
- Magnitude Trigger Bandwidth {Normal, Wideband}
- Phase Noise Optimization {Normal, BestWideOffset}
- Time Average Count
- Time Average Period (Seconds)

The following input extensions are channel dependent (not coupled across channels):

- ADC Dither (to improve small signal performance) {On, Off}
- Baseband Delay (seconds)

- Baseband Phase (degrees)
- Mixer Level Offset (dB) (dB, relative to default)
- Peak To Average (dB) (ratio of expected input signal, used to adjust IF gain and mixer level)
- Preamplifier {Auto, Off, On}



**NOTE**

For additional information on each extension item, highlight the item and a summary is displayed near the bottom of the extension dialog box.

## M9391A and M9381A Specifications

Some specifications for component modules were adjusted following a manufacturing serial number break. Data sheets contain specifications for current production modules. Specification Guides contains serial number breaks where specifications were adjusted.

The Data Sheet and Specifications Guide for both the M9391A and the M9381A are included on the Keysight PXIe VSA & VSG M9391A VSA, M9381A VSG and M9380A CW Source Software and Product Information CD that came with your multi-module instruments (MMI). Please check the Keysight website at [www.keysight.com/find/m9391a](http://www.keysight.com/find/m9391a) for the latest updates to the M9391A information. The Data Sheet for the M9391A can also be found at <http://edownload.software.keysight.com/Modular/M9391A/2.0/5991-2603EN.pdf>. The Specifications Guide for the M9391A can also be found at <http://edownload.software.keysight.com/Modular/M9391A/2.0/M9391-90015.pdf>.

The Data Sheet and Specifications Guide for the M9381A are also available at [www.keysight.com/find/m9381a](http://www.keysight.com/find/m9381a). The Data Sheet for the M9381A can also be found at <http://edownload.software.keysight.com/Modular/M938XA/2.0/5991-0279EN.pdf>. The Specifications Guide for the M9381A can also be found at <http://edownload.software.keysight.com/Modular/M938XA/2.0/M9381-90015.pdf>.



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