Startup Guide

M9128A, M9146A, M9147A, M9148A.
M9149A, M9150A, M9151A, M9152A,
M9153A

Keysight PXI RF Switch Modules

KEYSIGHT
TECHNOLOGIES

Notices

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www.keysight.com/find/M9128A (product-specific information and support, software and documentation updates)

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

Declaration of Conformity

Declarations of Conformity for this product and for other Keysight products may be downloaded from the Web. Go to http://www.keysight.com/go/conformity and click on "Declarations of Conformity." You can then search by product number to find the latest Declaration of Conformity.

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Safety Information

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

General

Do not use this product in any manner not specified by the manufacturer. The protective features of this product must not be impaired if it is used in a manner specified in the operation instructions.

Before Applying Power

Verify that all safety precautions are taken. Make all connections to the unit before applying power. Note the external markings described under "Safety Symbols".

Ground the Instrument

Keysight chassis' are provided with a grounding-type power plug. The instrument chassis and cover must be connected to an electrical ground to minimize shock hazard. The ground pin must be firmly connected to an electrical ground (safety ground) terminal at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Do Not Operate in an Explosive Atmosphere

Do not operate the module/chassis in the presence of flammable gases or fumes.

Do Not Operate Near Flammable Liquids

Do not operate the module/chassis in the presence of flammable liquids or near containers of such liquids.

Cleaning

Clean the outside of the Keysight module/chassis with a soft, lint-free, slightly dampened cloth. Do not use detergent or chemical solvents.

Do Not Remove Instrument Cover

Only qualified, service-trained personnel who are aware of the hazards involved should remove instrument covers. Always disconnect the power cable and any external circuits before removing the instrument cover.

Keep away from live circuits

Operating personnel must not remove equipment covers or shields. Procedures involving the removal of covers and shields are for use by service-trained personnel only. Under certain conditions, dangerous voltages may exist even with the equipment switched off. To avoid dangerous electrical shock, DO NOT perform procedures involving cover or shield removal unless you are qualified to do so.

DO NOT operate damaged equipment

Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to an Keysight Technologies Sales and Service Office for service and repair to ensure the safety features are maintained.

DO NOT block the primary disconnect

The primary disconnect device is the appliance connector/power cord when a chassis used by itself, but when installed into a rack or system the disconnect may be impaired and must be considered part of the installation.

Do Not Modify the Instrument

Do not install substitute parts or perform any unauthorized modification to the product. Return the product to an Keysight Sales and Service Office to ensure that safety features are maintained.

In Case of Damage

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel

CAUTION

Do NOT block vents and fan exhaust: To ensure adequate cooling and ventilation, leave a gap of at least 50mm (2") around vent holes on both sides of the chassis.

Do NOT operate with empty slots: To ensure proper cooling and avoid damaging equipment, fill each empty slot with an AXIe filler panel module.

Do NOT stack free-standing chassis: Stacked chassis should be rack-mounted.

All modules are grounded through the chassis: During installation, tighten each module's retaining screws to secure the module to the chassis and to make the ground connection.

WARNING

Operator is responsible to maintain safe operating conditions. To ensure safe operating conditions, modules should not be operated beyond the full temperature range specified in the Environmental and physical specification. Exceeding safe operating conditions can result in shorter lifespan, improper module performance and user safety issues. When the modules are in use and operation within the specified full temperature range is not maintained, module surface temperatures may exceed safe handling conditions which can cause discomfort or burns if touched. In the event of a module exceeding the full temperature range, always allow the module to cool before touching or removing modules from the chassis.

Safety Symbols

Products display the following symbols:

Warning, risk of electric shock

Refer to manual for additional safety information.

Earth Ground.

Chassis Ground.

Alternating Current (AC).

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

Antistatic precautions should be taken.

For localized Safety Warnings, Refer to Keysight Safety document (p/n 9320-6792).

Intertek

The instrument has been tested, investigated and found to comply with the requirements of the Standard(s) for Electrical Measuring & Test Equipment.

CE ICES/NMB-001 ISM GRP 1-A

Notice for European Community: This product complies with the relevant European legal Directives: EMC Directive (2004/108/EC) and Low Voltage Directive (2006/95/EC).

ISM

This is the symbol for an Industrial, Scientific, and Medical Group 1 Class A product.

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

ICES/NMB-001

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

This symbol represents the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of this product.

KCC-REM-ATi-BLMODSF01

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
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Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC

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

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

Do not dispose in domestic household waste.

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

Contents

Keysight PXI RF Switch Modules Introduction

The Keysight RF switch modules deliver high-performance switching with fast, easy installation and configuration. They provide for switching frequencies beyond 300 MHz (for the M9128A Matrix module) and 3 GHz (for the Multiplexer modules). All modules exhibit low insertion loss and Voltage Standing Wave Ratio (VSWR).

Keysight PXI RF 50Ω Matrix and Multiplexer Modules

- M9128A PXI RF Matrix Switch: 300 MHz, 8x12, 50Ω
- M9146A PXI RF Multiplexer Module: 3 GHz, Dual 1x4, 50ΩTerminated
- M9147A PXI RF Multiplexer: 3 GHz, Quad 1x4, 50Ω Terminated Common
- M9148A PXI RF Multiplexer: 3 GHz, 1x8, 50Ω
- M9149A PXI High Density RF Multiplexer: 3 GHz, 1x16, 50Ω

Keysight PXI RF 75Ω Multiplexer Modules

- M9150A PXI RF Multiplexer: 3 GHz, Dual 1X4, 75Ω
- M9151A PXI RF Multiplexer: 3 GHz, Quad 1X4, 75Ω
- M9152A PXI RF Multiplexer: 3 GHz, 1X8, 75Ω
- M9153A PXI RF Multiplexer: 3GHz, 1X16, 75Ω

Keysight also supplies software drivers that allow you to support the modules in all popular PXI chassis' and programming environments. Soft Front Panel software allows you to exercise the channels for test purposes.

NOTE	Keysight AgMSwitch driver version 1.1.x or later or the Keysight LabVIEW G driver version 1.1.x or later is required for programmatic control of these switch modules.

Related documentation

This Startup Guide, and the documentation listed below, are on the Switch Module Software and Product Information CD.

- Help file for the PXI Switch Modules Soft Front Panel
- Help file for the PXI Switch Modules IVI-C/IVI-COM device drivers
- Help file for the PXI Switch Modules LabVIEW G device drivers
- Keysight PXI RF Switch Modules Data Sheet. For detailed specifications, check the Keysight web site at: www.Keysight.com/find/pxiswitch.

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Step 1: Unpack and inspect the module

> **CAUTION** Keysight's PXI RF Switch Modules are shipped in materials that prevent static electricity damage. The 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. All work on electronic assemblies should be performed at a static-safe work station. The following figure shows an example of a static-safe work station using two types of ESD protection.

- Conductive table-mat and wrist-strap combination.
- Conductive floor-mat and heel-strap combination.

Both types, when used together, provide a significant level of ESD protection. Of the two, only the table-mat and wrist-strap combination provides adequate ESD protection when used alone. To ensure user safety, the static-safe accessories must provide at least 1 MΩ of isolation from ground. Purchase acceptable ESD accessories from your local supplier.
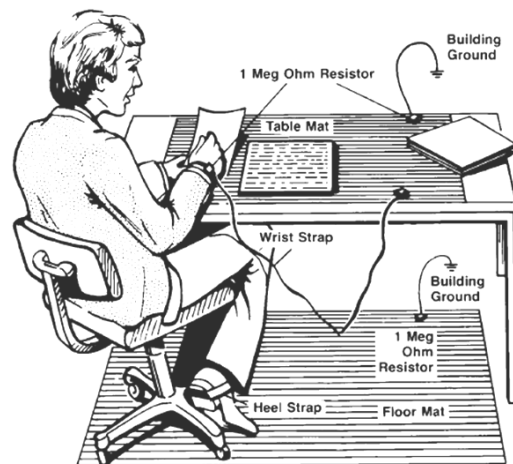
Inspect for damage

After unpacking the RF Switch Module, carefully inspect it for any shipping damage. Report any damage to the shipping agent immediately, as such damage is not covered by the warranty.

> **CAUTION** To avoid damage when handling a module; do not touch exposed connector pins.

Return the module for service

Should it become necessary to return a Keysight RF Switch module for repair or service, follow the steps below:

1 Review the warranty information shipped with your product.

2 Contact Keysight to obtain a return authorization and return address. If you need assistance finding Keysight contact information go to www.keysight.com/find/assist (worldwide contact information for repair and service) or refer to the **Support** information on the product web page at: *www.Keysight.com/find/pxiswitch*.

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

   − Name and address of owner. A Post Office box is not acceptable as a return address.

   − Product model number (for example, M9028A)

   − Product serial number (for example, MYXXXXXXXX). The serial number label is located on the side of the module.

   − A description of failure or service required.

4 Carefully pack the module in its original ESD bag and carton. If the original carton is not available, use bubble wrap or packing peanuts, place the instrument in a sealed container and mark the container "FRAGILE".

5 On the shipping label, write ATTENTION REPAIR DEPARTMENT and the service order number (if known).

NOTE	If any correspondence is required, refer to the product by serial number and model number.

Step 2: Verify shipment contents

Your shipment should have included the following:

- The Keysight PXI RF module that you ordered.

- This document (Keysight PXI RF Switch Modules Startup Guide).

- A *Switch Module Software and Product Information* CD (M9128-10001). This CD contains software, drivers and all product printed documentation in PDF format for the PXI RF Switch modules.

- An *Automation-Ready CD with Keysight IO Libraries Suite* (version 16.0 or later).

- Any other accessories that you ordered (cables, connectors, etc.).

Step 3: Install the software on the system controller

The following illustration shows typical system installations.
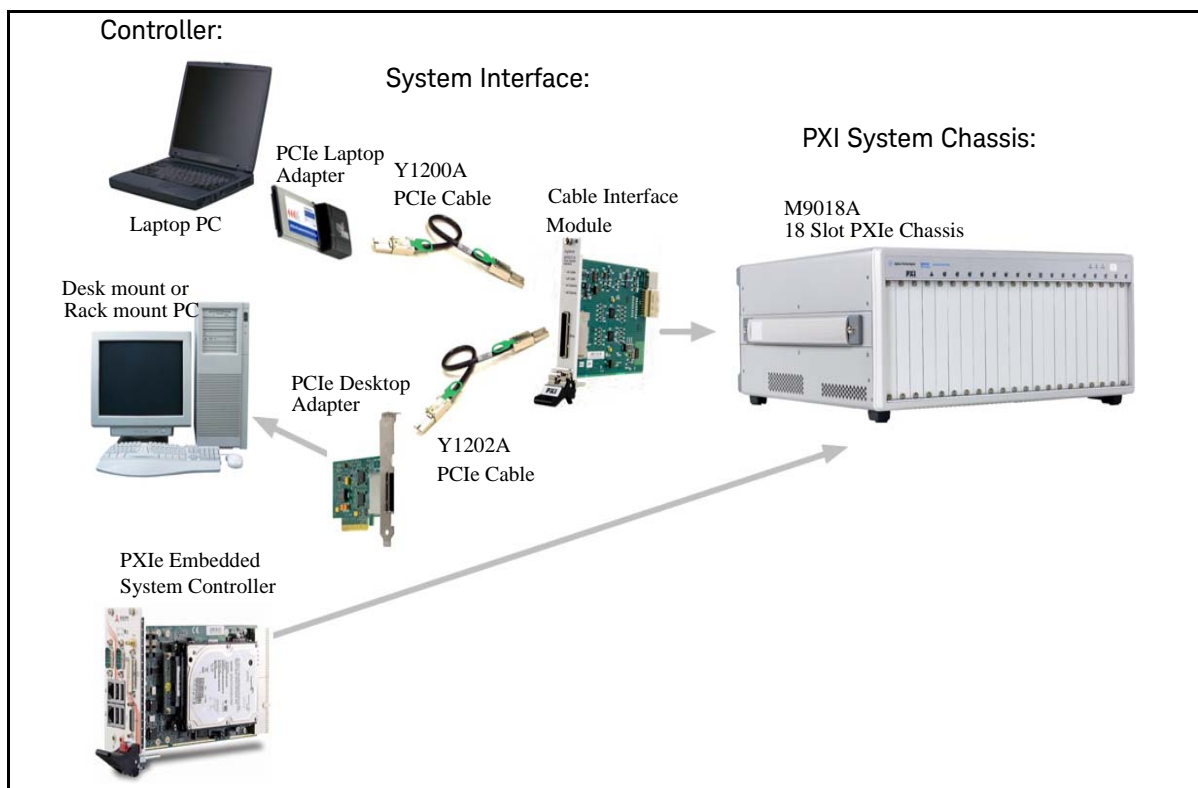
| NOTE | Do not install the PXI modules in the PXI chassis yet! You must install the software prior to installing the modules in the chassis so that Keysight IO Libraries Connection Expert finds them. |

Keysight PXI RF Modules Startup Guide

System requirements

The following table lists the minimum system requirements for Keysight IO Libraries Suite 16. In general, any x86 or x64 (except Itanium) should work but there may be a significant decrease in performance.

Operating System	Windows XP Service Pack 3 or later	Windows Vista SP1 and SP2 (32-bit and 64-bit), Business, Ultimate, Enterprise, Home Basic, and Home Premium	Windows 7 (32- and 64-bit) Starter, Home Basic, Home Premium, Professional, Ultimate, Enterprise
Processor Speed	600 MHz or higher required, 800 MHz recommended	1Ghz 32-bit (x86), 1GHz 64-bit (x64), no support for Itanium64	1Ghz 32-bit (x86), 1GHz 64-bit (x64), no support for Itanium64
Available memory	256 MB minimum (1 GB or greater recommended)	1 GB minimum	1 GB minimum
Available hard disk space[*]	1.5 GB available hard disk space, includes: • 1GB available for Microsoft .NET Framework 3.5 SP1[†] • 100MB for Keysight IO Libraries Suite	1.5 GB available hard disk space, includes: • 1GB available for Microsoft .NET Framework 3.5 SP1[2] • 100MB for Keysight IO Libraries Suite	1.5 GB available hard disk space, includes: • 1GB available for Microsoft .NET Framework 3.5 SP1[2] • 100MB for Keysight IO Libraries Suite
Video	Super VGA (800x600) 256 colors or more	Support for DirectX 9 graphics with 128MB graphics memory recommended (Super VGA graphics is supported)	Support for DirectX 9 graphics with 128MB graphics memory recommended (Super VGA graphics is supported)
Browser	Microsoft Internet Explorer 6.0 or greater	Microsoft Internet Explorer 7 or greater	Microsoft Internet Explorer 7 or greater

[*] Because of the installation procedure, less memory may be required for operation than is required for installation.

[†] .NET Framework Runtime Components are installed by default with Windows Vista. Therefore you may not need this amount of available disk space.

PXIe System

PXI system/ host controller	A PXI or PXI Express embedded controller or PC host controller is required.

Power the controller

- If you are using a desktop, laptop, or rack mount PC as remote controller:

    1 Install any peripheral devices in the PC (e.g., PCIe Interface adapters, etc.). Follow the manufacturers instructions.

    2 Power up the controller. Do not apply power to the PXI chassis yet.

3 Choose the default option for any "Found Hardware" dialogs.

- If you are using a PXI embedded computer as the host computer:

    1 Install the embedded computer module into the PXI chassis following the manufacturers instructions.

    2 Connect peripherals such as a mouse, keyboard, monitor, CD drive, etc.

    3 Power up the chassis.

    4 Choose the default option for any "Found Hardware" dialogs

Install Keysight IO Libraries Suite

Keysight IO Libraries Suite 16.0 (or later) is required for the PXI modules. It includes the Keysight Connection Expert, the IVI Shared Components, and the VISA Shared Components.

> **NOTE** Keysight IO Libraries version 16.0 (or later) <u>must</u> be installed prior to installing and running any other software and prior to powering the chassis. The latest version can be downloaded from: www.keysight.com/find/iosuite.

1 Insert the *Automation-Ready CD with Keysight IO Libraries Suite* into the CD-ROM drive of your system controller. Wait a few seconds for the auto-run window to appear. If the auto-run window does not appear automatically:

- Click **Start > Run...**

- Type: `<drive>:Autorun\IOLibraries.hta`
  where `<drive>` is your CD drive letter.

2 Follow the installation instructions that came with the IO Libraries Suite.

> **NOTE** If the **IVI Shared Components** and **VISA Shared Components** are not already installed on your PC, Keysight IO Libraries Suite installs them in the default locations. If they are already installed, the installer upgrades them to the latest version, using the same location used by the older version. If this is a first-time installation, you can select installation locations for these components by choosing a Custom Installation.

Install instrument drivers

1 Insert the *Switch Module Software and Product Information* CD into the CD-ROM drive of your PC.

Wait a few seconds for the auto-run window to appear. If the auto-run window does not appear automatically:

- Click Start > Run...

- Type: `<drive>:Autorun.exe` where `<drive>` is your CD drive letter.

2 Select the **Install** Software link. Follow the installer prompts. Accept all of the default directories specified during installation if prompted.

3 After the Welcome screen, you will be prompted three times for license agreements. The software installer installs the following drivers:

- Keysight Modular Software License Agreement. The installer program installs the Soft Front Panel (SFP) application and other object code to connect to the switches. Accept the license terms and click Next.

- Keysight IVI Driver Source Code License Agreement. The Interchangeable Virtual Instrument (IVI) driver is available for programming the Keysight switch modules using Microsoft development environments (e.g., Visual Studio, C, C++, C#, Visual Basic), Keysight VEE, MATLAB, or National Instruments LabVIEW. Accept the license terms and click Next.

- Keysight Software License Agreement for drivers for use with LabVIEW Software. The LabVIEW driver provides access to the functionality of the switches through LabVIEW VIs. This driver works in National Instruments LabVIEW development environments. Before this driver can be installed, your computer must already have the IVI Shared Components installed. Accept the license terms and click Next.

| **NOTE** | Installing Keysight IO Libraries also installs the IVI Shared Components. The IVI Shared Components are required before IVI drivers (e.g., IVI-COM, IVI-C) can be installed from the product reference CD. |

4 Next, the installer indicates the LabVIEW installations found on your host computer. Click Next

5 After accepting the licenses, the driver software is ready to be installed on your host computer. Click Install.

6 When the installation wizard is finished, you will be prompted to reboot your host computer. Do not reboot the host computer at this time! Select "`No, I will restart my computer later`." Power down the host computer. Proceed to "Step 4. Connect the PC to the PXI chassis" on the next page.

Step 4. Connect the PC to the PXI chassis

NOTE	To ensure proper system operation and the PC's ability to enumerate all of the PXI modules, you must use an approved embedded PC, desktop PC, or laptop PC along with approved PCIe adaptor and cable.

Using a remote PC

Refer to the following figure. Make certain that both the Remote Controller and the PXI chassis are turned off. Unplug the chassis from the ac power mains. If you are using the M9018A 18 Slot PXIe chassis, install the Keysight M9021A PCIe Cable Interface module in the chassis.

- If you are using a desktop or rack mount PC, install the M9047A PCIe Desktop Adapter in the PC. With a Keysight Y1202A cable, connect the adapter to the System Interface module.

- If you are using a laptop PC, install the M9045A PCIe ExpressCard Adapter in the laptop. With a Keysight Y1200A cable, connect the adapter to the System Interface module on the PXI chassis
.
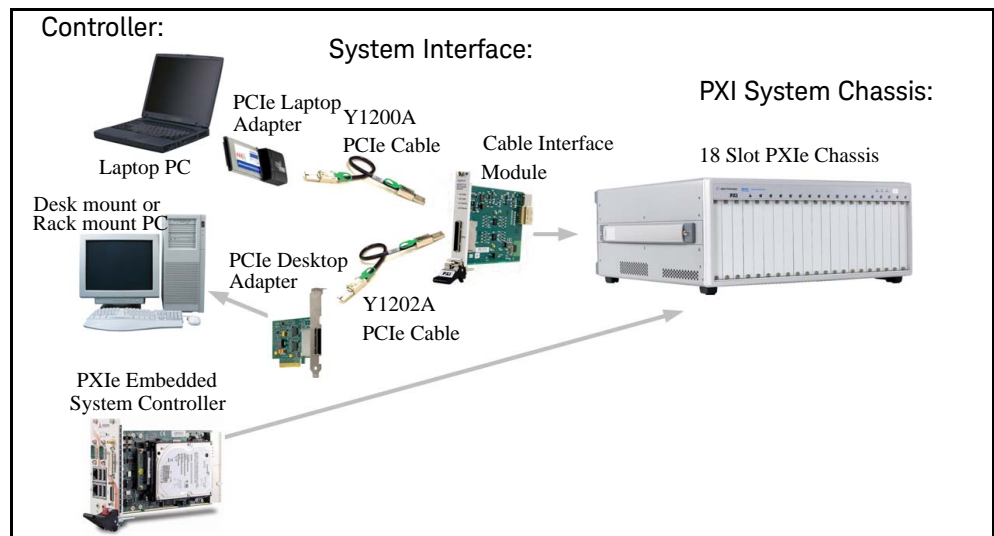
Using an embedded computer

Refer to the figure above. If you are using an embedded controller in the PXI chassis, you should have installed it prior to installing the Keysight IO Libraries and instrument drivers. No cables or other adapters are required. After installation, proceed to "Step 5: Install the switch modules in the PXI chassis"

Step 5: Install the switch modules in the PXI chassis

WARNING
- **PXI hardware does not support "hot-swap" capabilities (changing modules while power is applied to the chassis).**
- **Before installing Keysight PXI Modules into the chassis, the chassis must be powered off to prevent damage to the PXI module. Remove all cables/terminal blocks from the module prior to installing or removing the module.**

NOTE
These modules can be used in a chassis with a cPCI, PXI-1, or PXIh chassis peripheral slot.

3 The modules can be installed in any standard PXI slot marked with a peripheral slot compatibility image (a circle containing the slot number).

7 ᴴ The modules can also be installed in any hybrid PXI slot marked with a peripheral slot compatibility image (the letter "H" and a solid circle containing the slot number).

1 Make sure the PXI chassis power is turned off.

2 If the chassis has multiple fan speed settings, ensure that the fans are set to automatic. Do not set the fan speed to low or turn them off.

3 Position the chassis so that there is 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 cooling information).

4 The modules are shipped with thread protectors over the mounting screws. These must be removed before installing the modules in a chassis.

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

- Install the module in the PXI slot by placing the module card edges into the front module guides (top and bottom).

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

- Slide the module completely into the chassis. When you begin to feel resistance, push up on the injector/ejector handle to fully seat the module into the chassis.
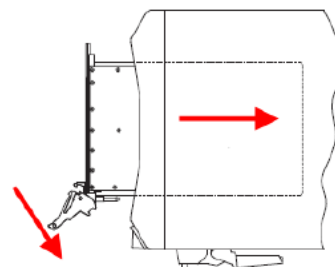
6 Latch the module by pulling up on the injector/ejector handle and secure the front panel to the chassis using the module mounting screws.

7 Tighten the screws on the module (or remote controller) front panel. Performance may suffer if the screws are not securely tightened.

8 Install all chassis covers, filler panels, and air inlet modules after installing the module. Missing filler panels may disrupt necessary air circulation in the chassis.

9 If you are using a remote controller, connect the cable interface module in the chassis to the host computer.

10 Plug in and power up the PXI chassis. Verify that the chassis fans are operating and free of obstructions that may restrict airflow.

CAUTION	If you are using a remote controller linked to the M9021A Cable Interface, you must power up the chassis BEFORE you power up the PC. When you power down your system, you must Shut Down the PC BEFORE you power down the chassis.

NOTE	If you are using MXI-3 to connect a desktop PC to a PXI chassis or link to multiple chassis, power up the system as follows:

- For a system with a PC and one chassis, power up the chassis before powering the PC.
- For a system with more than one chassis, power on the last chassis in the system followed by the penultimate, etc. Finally, turn on the PC or chassis containing the system controller.

11 If you are using a remote host computer (rack mount, desktop, or laptop PC), power-on the computer. Choose the default option for any "Found New Hardware" dialogs.

NOTE	After all of the "Found New Hardware" dialogs are complete, you must reboot the host computer.

Chassis Power Down Process

| **CAUTION**	If you are using a remote controller linked to the M9021A Cable Interface, you must Shut Down the PC BEFORE you power down the chassis. When you restore power, you must power up the chassis BEFORE you power up the PC.

Step 6. Verify operation of the module

Run Keysight IO Libraries Connection Expert

If Keysight Connection Expert is already running on the system controller, click the **Refresh All** button to identify any hardware you have just installed or re-connected.

If Connection Expert is not already running, run it now to verify your I/O configuration. In the Windows Notification Area, click the IO icon ($\boxed{\text{IO}}$), then click Keysight Connection Expert.

Locate your interfaces and instruments in the Keysight Connection Expert Explorer Pane. The following graphic shows the Connection Expert screen.
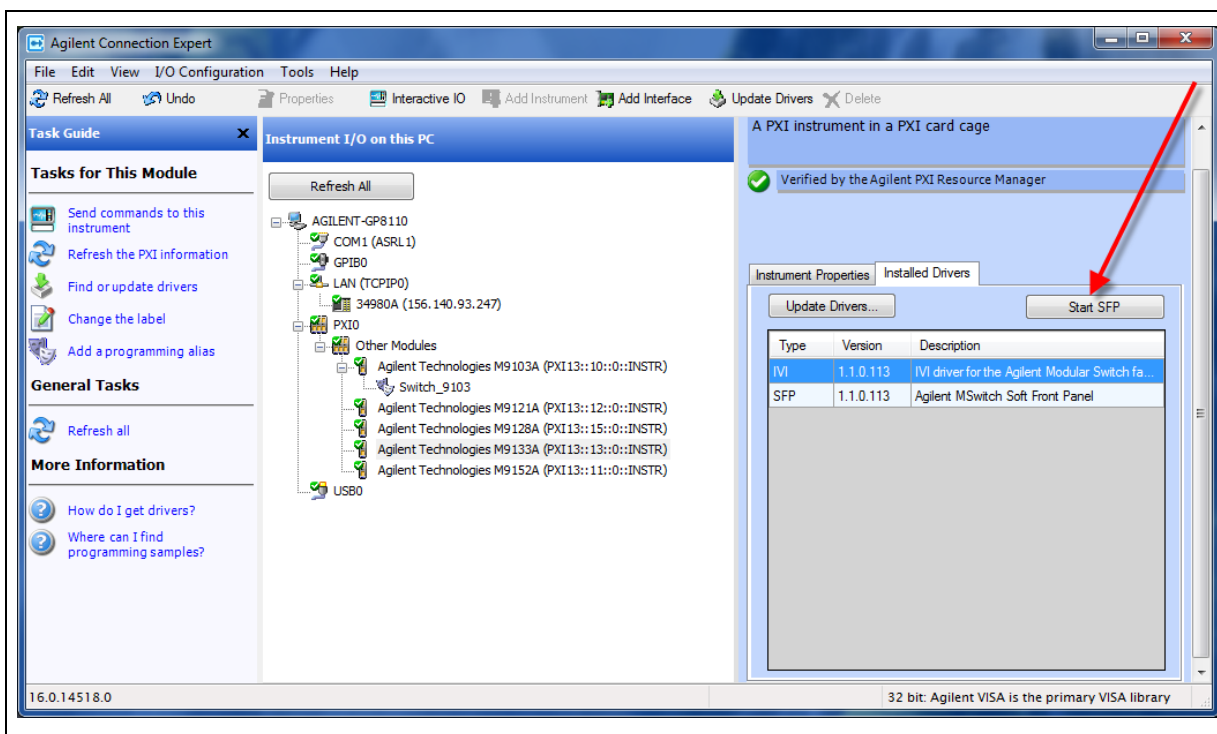
Select a module in the center pane (Instrument I/O on this PC). The right-hand Pane shows the instrument properties. Select the **Installed Drivers** tab then click the **Start SFP** button.

You can use the Soft Front Panel (SFP) software to open and close the relays and verify operation of the switch modules. The Soft Front Panel Software was installed as part of the Software installation process.

Refer to the SFP help file on the *Switch Module Software and Product Information CD* for specific detailed information on the SFP. The following graphic shows an example of the SFP for the M9147A PXI RF Switch module.
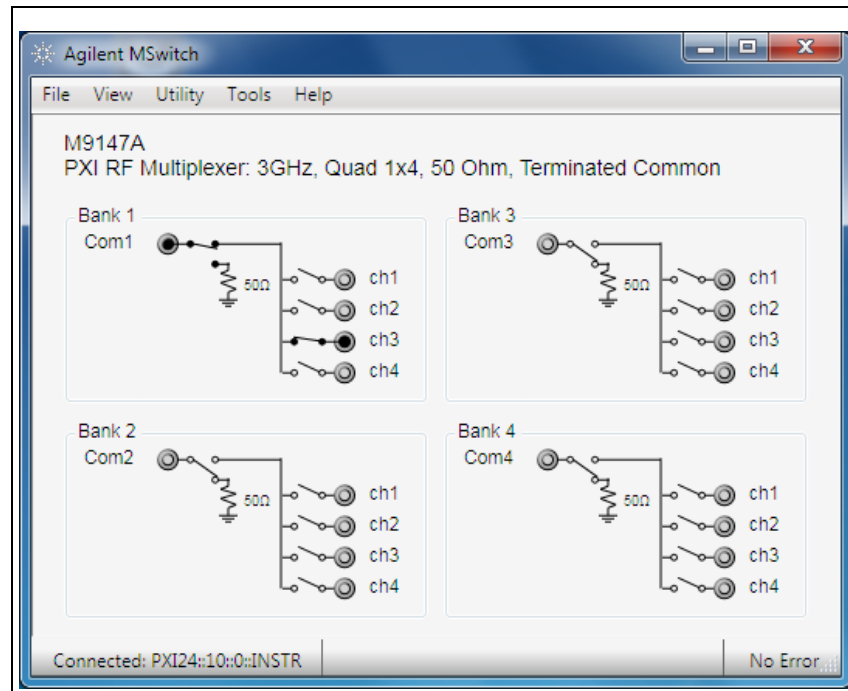
Beginning with SFP Version 1.1.x, if you have another application, either your own program or another instance of the SFP interface, that has initialized the switch module, then the SFP enters it's "monitor" mode. In this mode, you cannot change relay state and the menu buttons are grayed-out. However, as the other application controls the channels, the SFP interface monitors and displays the state of the individual relays. Refer to the SFP help file for additional information.

Verify operation

There are no specific operational verification or self test procedures. However, you can use the Soft Front Panel software to open and close individual channels. Module specifications are guaranteed by design.

Characteristics

For detailed specifications, refer to the module Data Sheet on the *Switch Module Software and Product Information CD.*

Default path settings

The RF switch multiplexer modules always have a signal path closed -- common to one of the channels. Even when the module is in the powered down state, one signal path is always closed. The table below lists the default signal path for the RF Switch modules. This default switch path is also shown in the following diagrams.

Switch Model	Bank	Default Path
M9128A 50Ω RF Matrix Switch	N/A	All relays are open when power is removed.
M9146A, Dual 1x4, 50Ω Terminated	1	All input terminals are terminated to the 50Ω resistor. Com1 is open circuit.
	2	All input terminals are terminated to the 50Ω resistor. Com2 is open circuit.
M9147A, Quad 1x4, 50Ω Terminated Common	1	Com1 terminated to 50Ω, channels open circuit
	2	Com2 terminated to 50Ω, channels open circuit
	3	Com3 terminated to 50Ω, channels open circuit
	4	Com4 terminated to 50Ω, channels open circuit
M9148A, 1x8, 50Ω	1	Com to channel 4
M9149A, 1x16, 50Ω	1	Com to channel 13
M9150A, Dual 1X4, 75Ω	1	Com1 to Bank 1, Channel 4
	2	Com 2 to Bank 2, Channel 4
M9151A, Quad 1X4, 75Ω	1	Com1 to Bank 1, Channel 4
	2	Com2 to Bank 2, Channel 4
	3	Com3 to Bank 3, Channel 4
	4	Com4 to Bank 4, Channel 4
M9152A, 1X8, 75Ω	1	Com to Channel 4
M9153A, 1X16, 75Ω	1	Com to Channel 13

Module functional description

The Keysight PXI RF 50Ω and 75Ω switch modules conform to the single slot, 3U form factor (100mm by 160mm / 3.94 in. by 6.3 in.) Eurocard standard. These modules meet PXI Specification 2.2. Local bus, trigger bus, and star trigger are not included. The modules also include:

-   CPCI Ejector Handle

-   Front panel SMB connectors

-   The front panel secures to the chassis by two M2.5 x 6mm pan-head Posi-drive screws.

Figure 1 shows a functional block diagram for the modules. The PCI connector (J1) provides +3.3Vdc (not all modules use this supply), +5Vdc, +12Vdc, ground, as well as the control signals from the chassis backplane. The relay drivers are activated by the PCI Bridge (U1) via output registers.
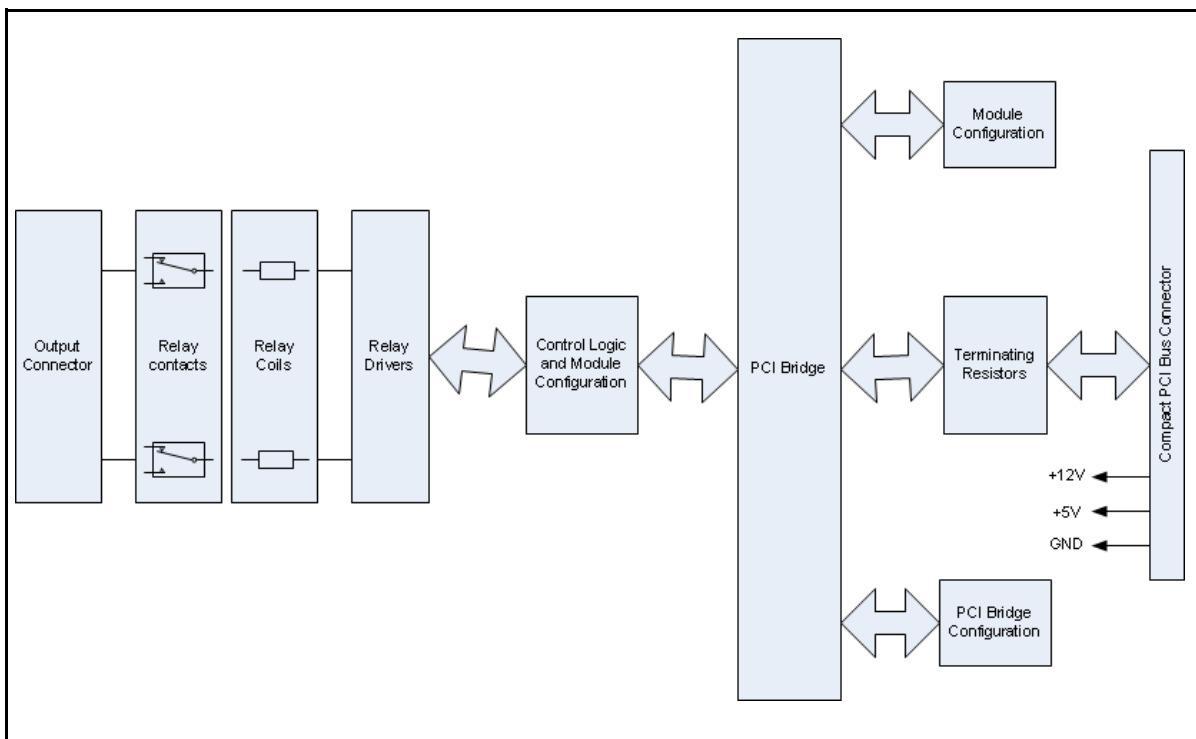
Figure 1   RF Switch Functional Block Diagram

There are no user serviceable or field replaceable components on these modules.

Module programming

Refer to the Soft Front Panel help file for detailed operation of the module. For programming information, refer to the IVI C and LabVIEW driver help files. These help files are located on the Switch Module Software and Product Information CD.

Many methods in the IviSwtch interfaces accept a channel string parameter. The channel names supported by the AgMSwitch driver depend upon the specific switch module to which the driver is connected.

Identifying channel numbers

In the Soft Front Panel interface, when you mouse over a specific channel or crosspoint (M9128A Matrix) the cursor changes to a hand cursor, and a popup tool tip shows the Instrument Specific Syntax for the channel number as shown in the following graphics. The Instrument Specific Syntax for channel numbers is used by the IVI and LabVIEW driver open/close commands.

For multiplexer modules, the Instrument Specific Syntax for channel numbers is in the form: b*n*ch*n* where b*n* is the bank number and ch*n* is the actual channel number. For example, **RouteCloseChannel("b2ch2")** will close the relay that connects channel 2 of bank 2 to the common. For 1-of-n modules, the previously closed channel is opened as a result of this closure. The following graphics show the Soft Front Panel interface and illustrate the channel numbering scheme:
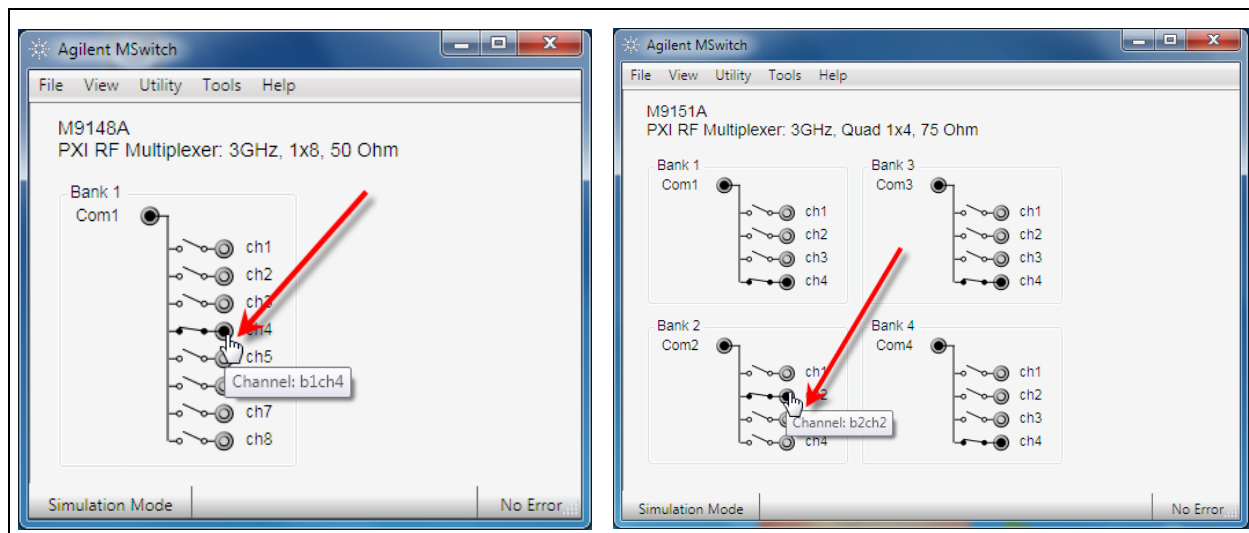
Note that modules without separate, distinct banks still use the same format where the bank number is always 1:
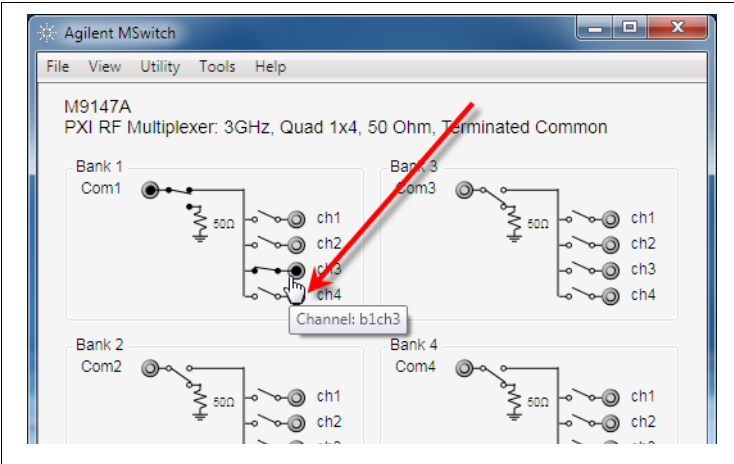
For the M9128A Matrix module, the Instrument Specific Syntax for channel numbers uses the form: m*n*r*n*c*n* where m indicates a matrix module, r*n* is the row and c*n* is the column. For example, **RouteCloseChannel("m1r2c3")** will close the relays to connect row 2 to column 3 of matrix 1. See the example below:
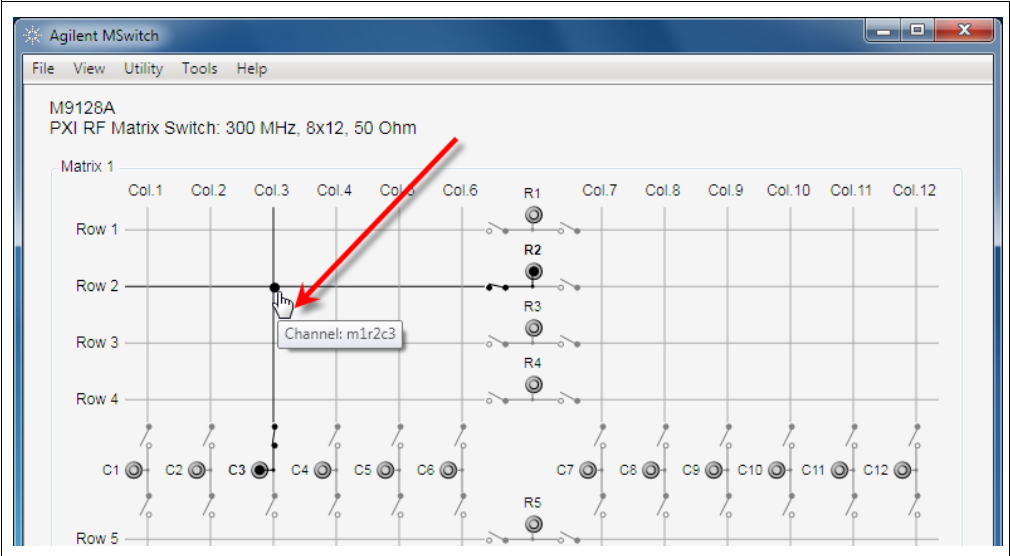
Module front panel connectors and system connections

The following pages show the topology diagrams and front panels for the individual PXI RF 50Ω and 75Ω Switching Modules.

M9128A PXI RF Matrix Switch: 300 MHz, 8x12, 50Ω

The M9128A Matrix module provides isolation switches, located on all coaxial connectors, to disconnect the matrix crosspoint switches. Only the signal is switched, all grounds are common. While the module is an 8X12 matrix, it is formed by joining four separate 4X6 matrices using isolation relays (see the figure below). The module is a true 8X12 matrix where any combination of crosspoints may be selected. Multiple crosspoints may be closed on any row or column but this will significantly degrade RF performance. All relays are open when power is removed.

To connect Row-to-Row or Column-to-Column, you must use two crosspoint channels. For example, to connect Row 2 to Row 4, you might use column 12, closing Row2 Column 12 and Row 4 Column12.

The IVI-C and LabVIEW drivers automatically close the appropriate isolation relays. You specify a row and column and the drivers automatically select the appropriate relays to close.
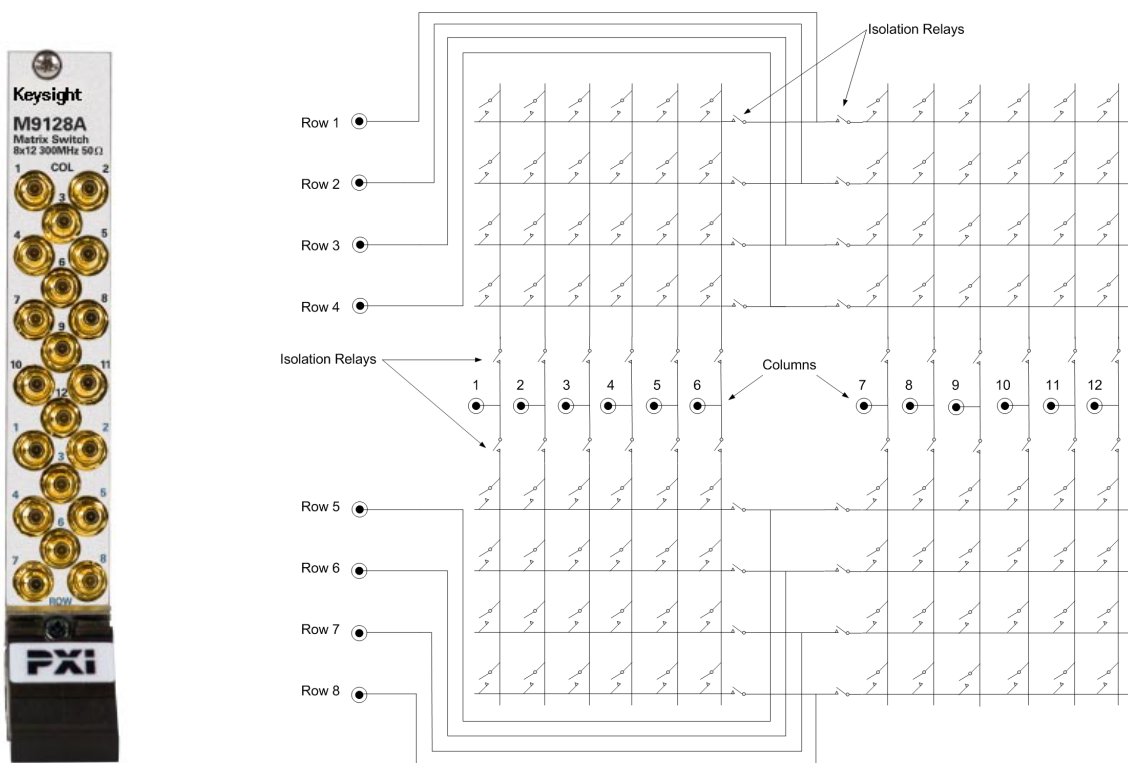
Figure 2   M9128A Front Panel and Simplified Schematic

RF Performance of the M9128A Matrix Module.   RF performance depends on the specific combination of crosspoints closed. For optimum RF performance, close only one crosspoint relay in any one row or column. Performance also depends on the area of the matrix where the crosspoint relay is closed. The following graphic shows the relative performance of different crosspoints. To achieve the best performance of the module -- minimum Voltage Standing Wave Ratio (VSWR), crosstalk, insertion loss, etc. -- route signals through the perimeter of the matrix (for example, Row1/Column1 or Row 8, column 11). Performance diminishes near the center of the matrix (e.g. R4/C6).
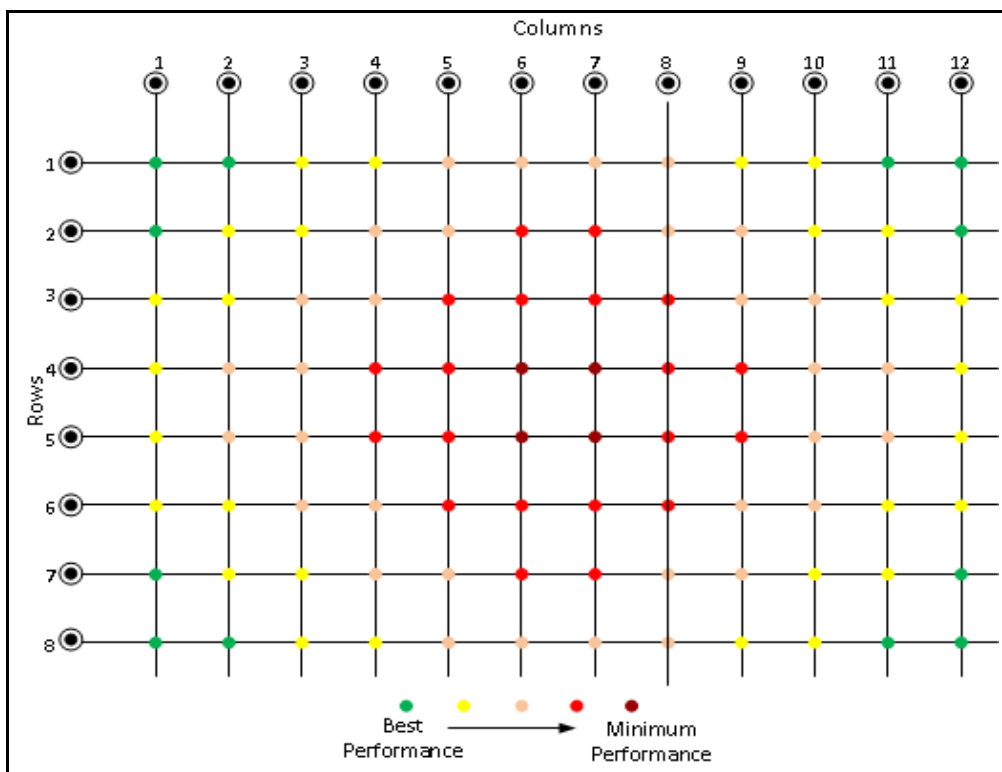
For optimum performance, only one crosspoint should be closed per row/column. Note that while multiple crosspoints may be closed in any row or column, significant RF performance degradation will occur.

For detailed specifications, refer to the M9128A datasheet on the *Switch Module Software and Product Information CD* or the RF Switch data sheet online at www.keysight.com/find/pxiswitch.

M9146A PXI RF Multiplexer Module: 3 GHz, Dual 1x4, 50Ω Terminated

Keysight's M9146A Dual 1x4 50Ω Multiplexer Module exhibits low insertion loss and VSWR. The module is constructed as two separate 1X4 RF switch multiplexers. It offers 50Ω inputs with bi-directional switching up to 3 GHz. This module features excellent insertion loss and VSWR for better RF signal integrity as well as outstanding dynamic range for routing RF signals into your measurement equipment. In addition, each path is carefully designed to ensure repeatable RF performance. Connections are made through easy, snap-on SMB front panel connectors. The default channel relay is terminated in a 50Ω resistor as shown in the diagram below.

With the IVI drivers or Soft Front Panels, you specify a bank and a channel to connect to the common and the drivers automatically set the appropriate relays. Refer to for more information.
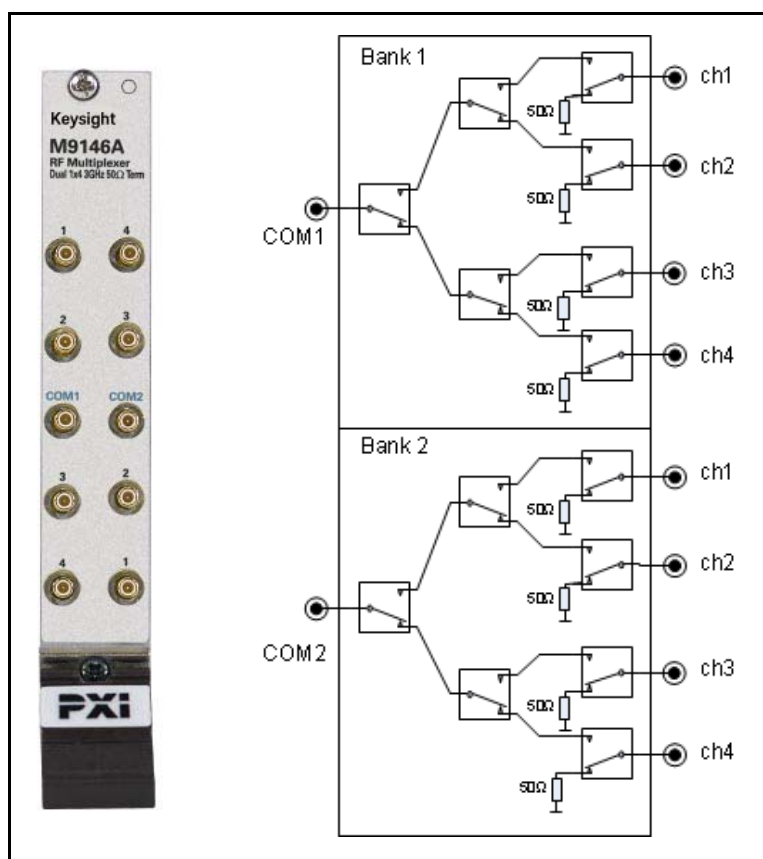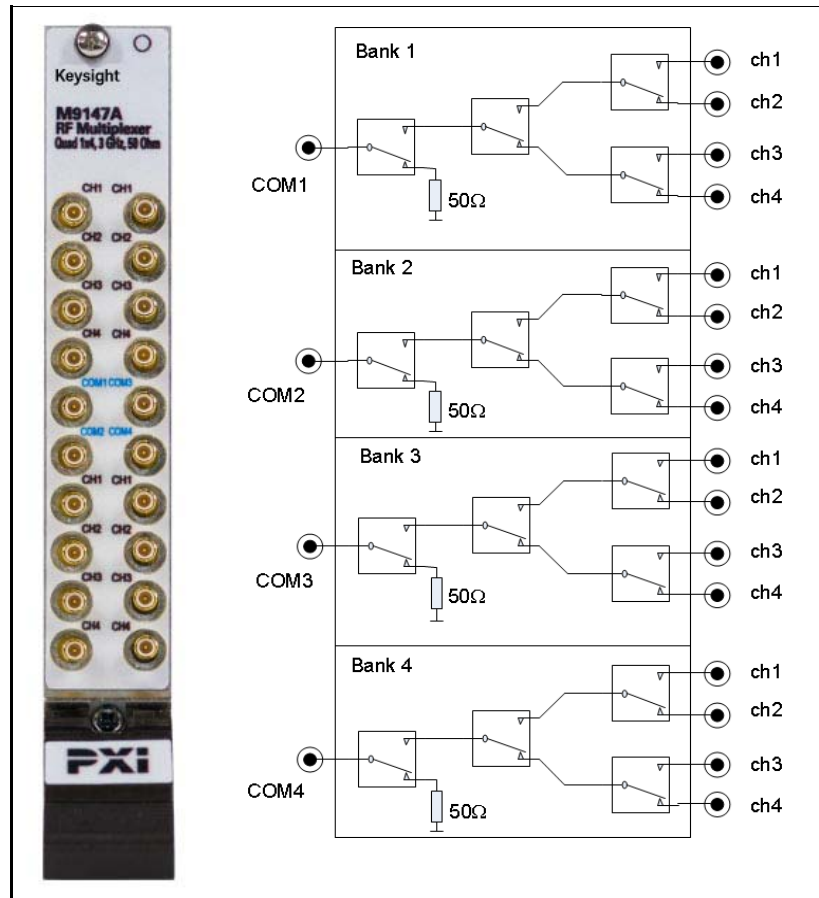

Figure 3   M9146A Front Panel and Simplified Schematic

M9147A PXI RF Multiplexer: 3 GHz, Quad 1x4, 50Ω Terminated Common

Keysight's M9147A Dual 1x4 50Ω Multiplexer Module exhibit low insertion loss and VSWR. The module is constructed as four separate 1X4 multiplexers. The default state of the common relay is terminated in a 50Ω resistor as shown in the diagram below. It offers 50Ω inputs with bi-directional switching up to 3 GHz. This module features excellent insertion loss and VSWR for better RF signal integrity as well as outstanding dynamic range for routing RF signals into your measurement equipment. In addition, each path is carefully designed to ensure repeatable RF performance. Connections are made through easy, snap-on SMB front panel connectors.

With the IVI drivers or Soft Front Panels, you specify a bank and a channel to connect to the common and the drivers automatically set the appropriate relays. Refer to "Module programming" on page 22 for more information.
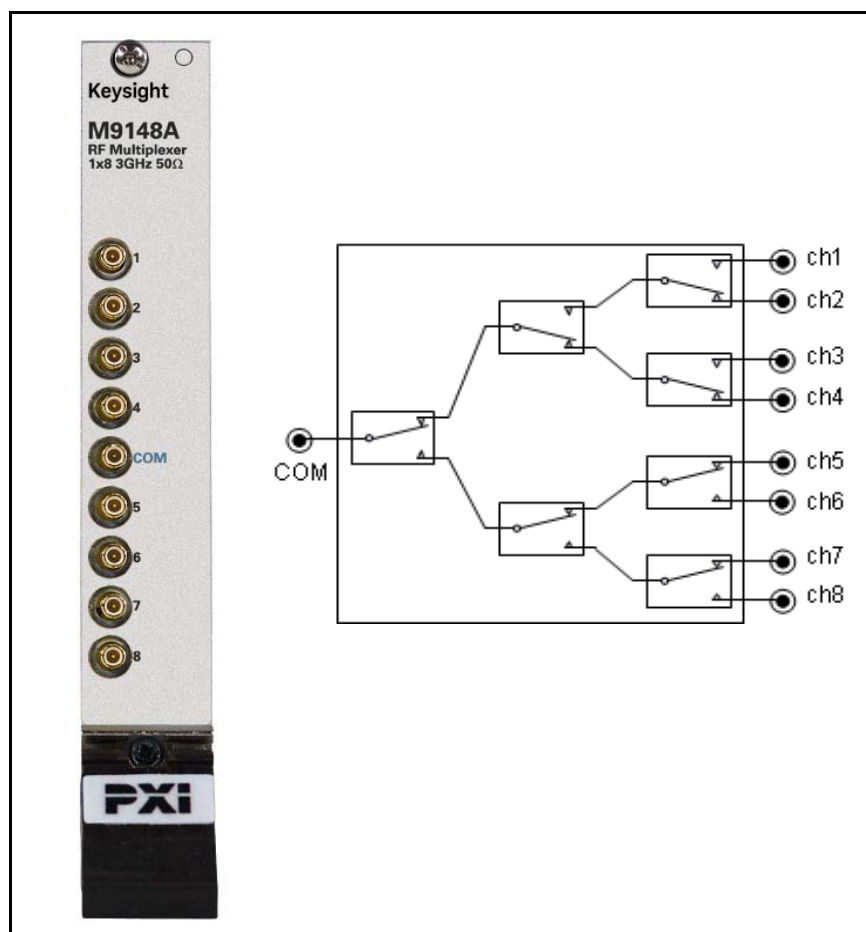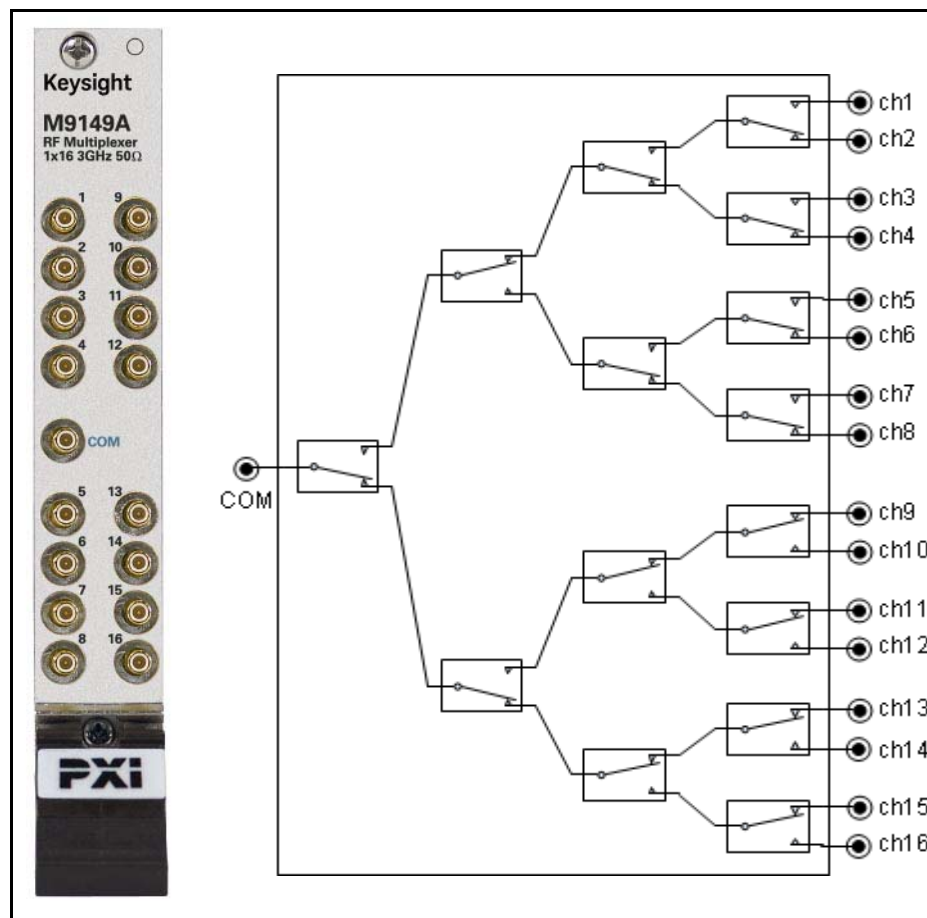

Figure 4   M9147A Front Panel and Simplified Schematic

M9148A PXI RF Multiplexer: 3 GHz, 1x8, 50Ω

Keysight's M9148A 1x8 50Ω Multiplexer Module exhibits low insertion loss and VSWR. This module features excellent insertion loss and VSWR for better RF signal integrity as well as outstanding dynamic range for routing RF signals into your measurement equipment. In addition, each path is carefully designed to ensure repeatable RF performance. Connections are made through easy, snap-on SMB front panel connectors. The diagram below shows the simplified schematic of the module.

With the IVI drivers or Soft Front Panels, you specify a channel to connect to the common and the drivers automatically set the appropriate relays. Refer to "Module programming" on page 22 for more information.
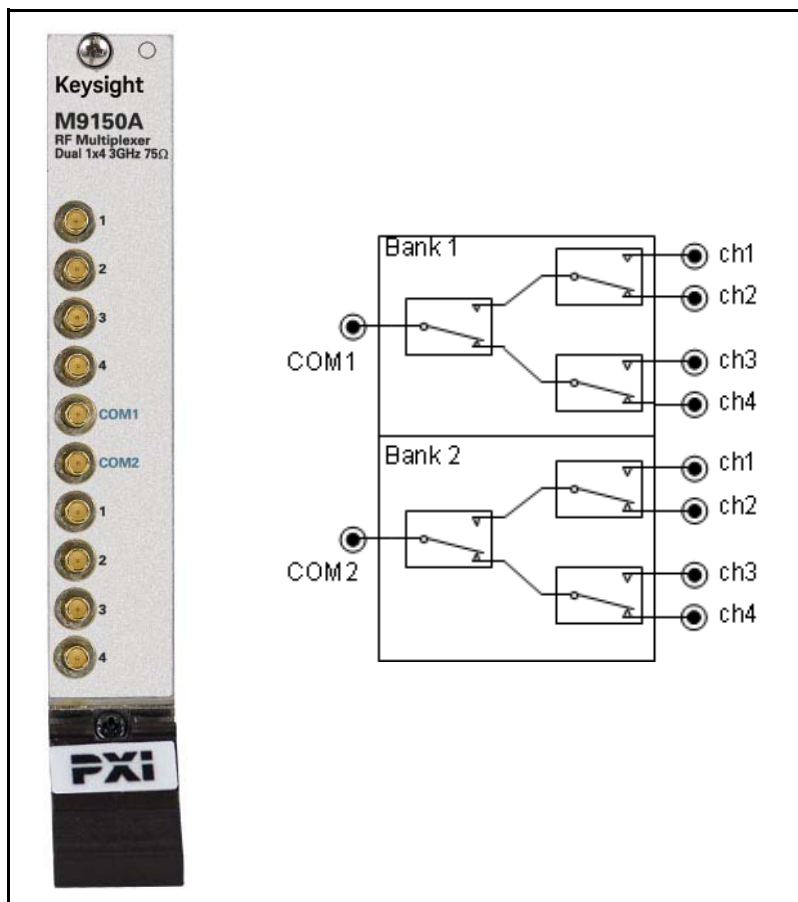

Figure 5   M9148A Front Panel and Simplified Schematic

M9149A PXI High Density RF Multiplexer: 3 GHz, 1x16, 50Ω

Keysight's M9149A 1x16 50Ω Multiplexer Module exhibits low insertion loss and VSWR. This module features excellent insertion loss and VSWR for better RF signal integrity as well as outstanding dynamic range for routing RF signals into your measurement equipment. In addition, each path is carefully designed to ensure repeatable RF performance. Connections are made through easy, snap-on SMB front panel connectors. The diagram below shows the simplified schematic of the module.

With the IVI drivers or Soft Front Panels, you specify a channel to connect to the common and the drivers automatically set the appropriate relays. Refer to "Module programming" on page 22 for more information.
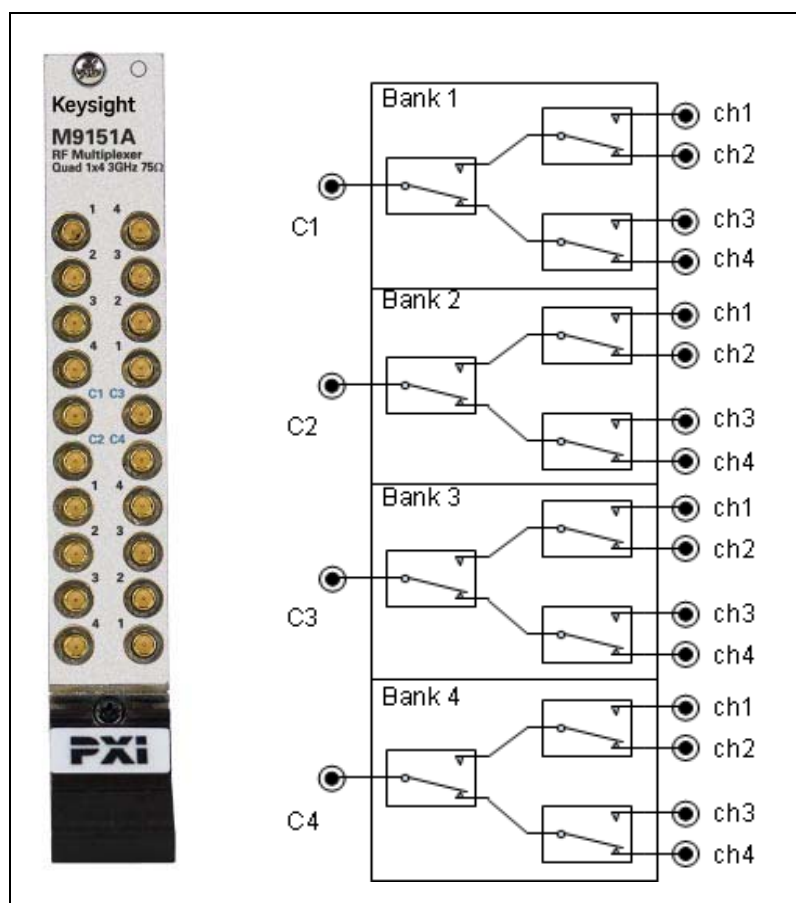

Figure 6   M9149A Front Panel and Simplified Schematic

M9150A PXI RF Multiplexer: 3 GHz, Dual 1X4, 75Ω

Keysight's M9150A Dual 1x4 75Ω Multiplexer Module exhibit low insertion loss and VSWR. The module is constructed as four separate 1X4 multiplexers. The 75Ω inputs make it ideal for routing video RF signals. Each path is carefully designed to ensure repeatable RF performance. It also features easy, snap-on SMB front panel connectors. The diagram below shows the simplified schematic for the module.

With the IVI drivers or Soft Front Panels, you specify a bank and channel to connect to the common and the drivers automatically set the appropriate relays. Refer to "Module programming" on page 22 for more information.

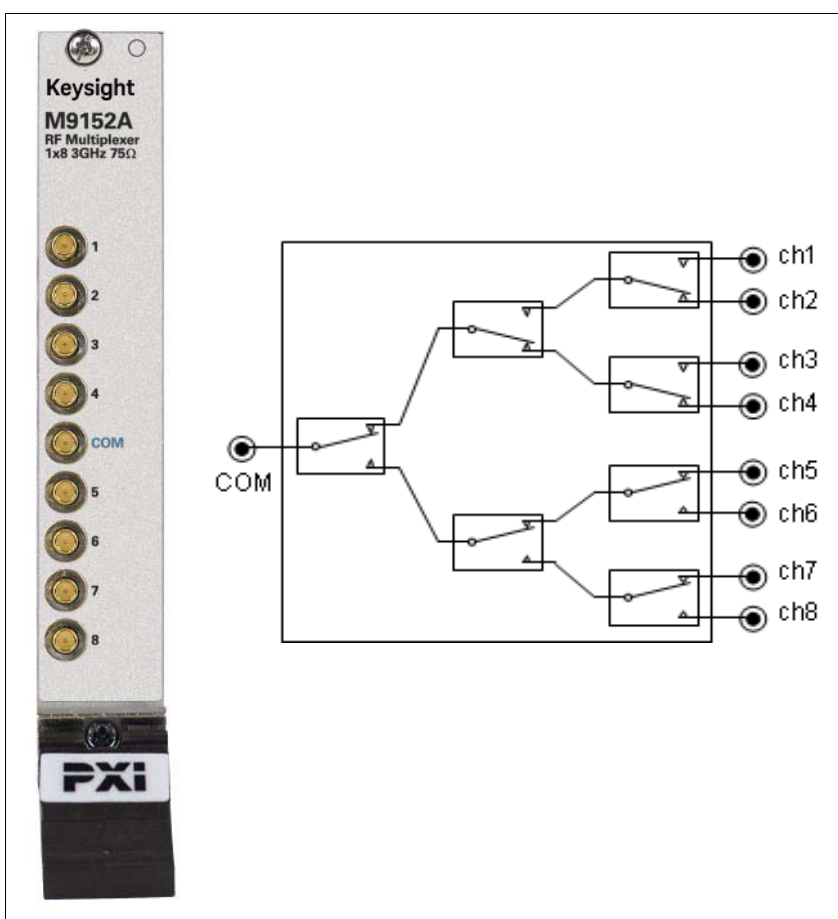**Figure 7**   M9150A Front Panel and Simplified Schematic

M9151A PXI RF Multiplexer: 3 GHz, Quad 1X4, 75Ω

Keysight's M9151A quad 1x4 75Ω Multiplexer Module exhibit low insertion loss and VSWR. The module is constructed as four separate 1X4 multiplexers as shown in the diagram below. The 75Ω inputs make it ideal for routing video RF signals. Each path is carefully designed to ensure repeatable RF performance. It also features easy, snap-on SMB front panel connectors.

With the IVI drivers or Soft Front Panels, you specify a bank and channel to connect to the common and the drivers automatically set the appropriate relays. Refer to "Module programming" on page 22 for more information.
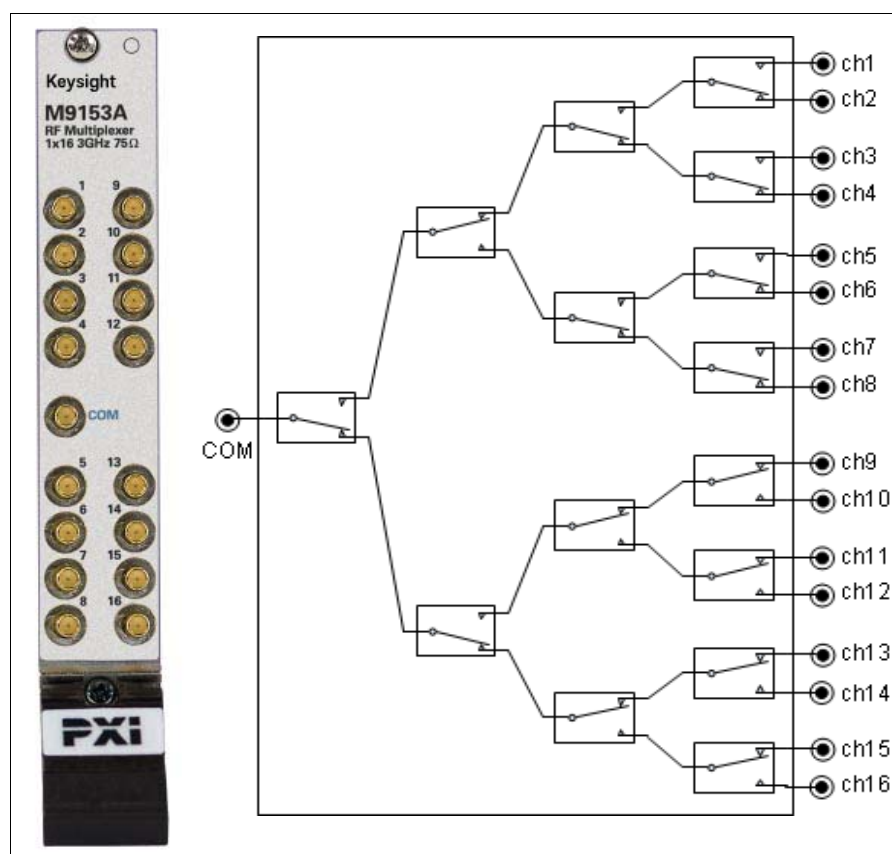

Figure 8   M9151A Front Panel and Simplified Schematic

M9152A PXI RF Multiplexer: 3 GHz, 1X8, 75Ω

Keysight's M9152A 1x8 75Ω Multiplexer Module exhibits low insertion loss and VSWR. The 75Ω inputs make it ideal for routing video RF signals. Each path is carefully designed to ensure repeatable RF performance. It also features easy, snap-on SMB front panel connectors. The diagram below shows the simplified schematic of the module.

With the IVI drivers or Soft Front Panels, you specify a bank and channel to connect to the common and the drivers automatically set the appropriate relays. Refer to "Module programming" on page 22 for more information.

Figure 9   M9152A Front Panel and Simplified Schematic

M9153A PXI RF Multiplexer: 3 GHz, 1X16, 75Ω

Keysight's M9153A 1x16 75Ω Multiplexer Module exhibits low insertion loss and VSWR. The 75Ω inputs make it ideal for routing video RF signals. Each path is carefully designed to ensure repeatable RF performance. It also features easy, snap-on SMB front panel connectors. The diagram below shows the simplified schematic of the module.

With the IVI drivers or Soft Front Panels, you specify a channel to connect to the common and the drivers automatically set the appropriate relays. Refer to "Module programming" on page 22 for more information.

Figure 10 M9153A Front Panel and Simplified Schematic

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