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GETTING STARTED GUIDE

PXIe-5820

1.25 GS/s Baseband I/Q Vector Signal Transceiver

📝 **Note** Before you begin, install and configure your chassis and controller.

This document explains how to install, configure, and test the PXIe-5820. The PXIe-5820 is a baseband I/Q vector signal transceiver (VST) and ships with the NI-RFSA and NI-RFSG driver software, which you use to program the device.

⚠️ **Caution** The protection provided by this equipment may be impaired if it is used in a manner not described in the documentation.

Contents

Electromagnetic Compatibility Guidelines

This product was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) stated in the product specifications. These requirements and limits provide reasonable protection against harmful interference when the product is operated in the intended operational electromagnetic environment.

This product is intended for use in industrial locations. However, harmful interference may occur in some installations, when the product is connected to a peripheral device or test object, or if the product is used in residential or commercial areas. To minimize interference with radio and television reception and prevent unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

Furthermore, any changes or modifications to the product not expressly approved by National Instruments could void your authority to operate it under your local regulatory rules.

⚠ **Caution** To ensure the specified EMC performance, operate this product only with high-quality shielded cables and accessories.

⚠ **Caution** To ensure the specified EMC performance, operate this product only with cables less than 1 meter in length.

Verifying the System Requirements

To use the PXIe-5820, your system must meet certain requirements. For more information about minimum system requirements, recommended system, and supported application development environments (ADEs), refer to the readme, which is available on the software media or online at *ni.com/updates*.

Unpacking the Kit

⚠ **Caution** To prevent electrostatic discharge (ESD) from damaging the device, ground yourself using a grounding strap or by holding a grounded object, such as your computer chassis.

1. Touch the antistatic package to a metal part of the computer chassis.
2. Remove the device from the package and inspect the device for loose components or any other sign of damage.

⚠ **Caution** Never touch the exposed pins of connectors.

📝 **Note** Do not install a device if it appears damaged in any way.

3. Unpack any other items and documentation from the kit.

Store the device in the antistatic package when the device is not in use.

Preparing the Environment

Ensure that the environment you are using the PXIe-5820 in meets the following specifications.

Operating ambient temperature	0 °C to 45 °C
Operating relative humidity	10% to 90%, noncondensing (IEC 60068-2-56)
Maximum altitude	2,000 m (800 mbar) (at 25 °C ambient temperature)
Pollution Degree	2

Indoor use only.

⚠️ **Caution** Clean the hardware with a soft, nonmetallic brush or lint free cloth. Make sure that the hardware is completely dry and free from contaminants before returning it to service.

📝 **Note** Refer to the *PXIe-5820 Specifications* at *ni.com/manuals* for complete specifications.

Verifying the Kit Contents

Figure 1. PXIe-5820 Kit Contents
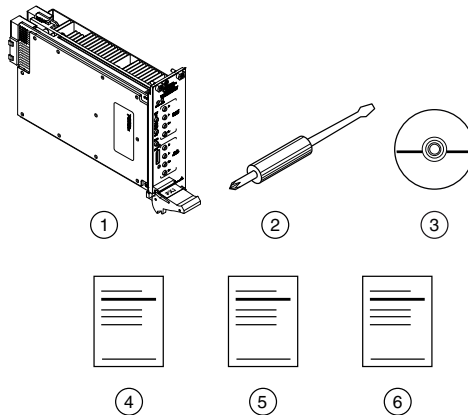
1. PXIe-5820 Module
2. Screwdriver, Part Number 772006-01
3. Driver Software DVD
4. Read Me First: Safety and Electromagnetic Compatibility
5. Maintain Forced-Air Cooling Note to Users
6. PXIe-5820 Getting Started Guide

Other Equipment

There are several required items not included in your device kit that you need to operate the PXIe-5820. Your application may require additional items not included in your kit to install or operate your device.

Required Items

- A PXI Express chassis and chassis documentation. The NI PXIe-1075 chassis is one available option for your PXI Express device. For more information about compatible chassis options, visit *ni.com/info* and enter the Info Code `pxiechassis.`
- A PXI Express embedded controller or PC with MXI controller system that meets the system requirements specified in this guide and chassis documentation.
- PXI Chassis Slot Blocker kit (NI part number 199198-01)

Optional Items

- SMA (m)-to-MMPX (m) cables
- MMPX (m)-to-MMPX (m) cables
- OCuLink x4, 1 m cable (NI part number 785486-01)[1]

---

[1] Using an OCuLink x4 cable supplied by another manufacturer is not recommended.

Choosing and Installing the Software

Software Options

NI provides two software options for programming the PXIe-5820—NI-RFSA and NI-RFSG instrument driver software.

Table 1. PXIe-5820 Software Options

Software Option	Description	Use Case
NI-RFSA and NI-RFSG instrument driver	The NI-RFSA and NI-RFSG APIs each provide a fixed API for interacting with your PXIe-5820 device. NI-RFSA and NI-RFSG provide standard IVI-based functionality needed for most vector signal analyzer and vector signal generator applications. You can use NI-RFSA and NI-RFSG instrument driver FPGA extensions to customize the device FPGA using precompiled bitfiles.	Use NI-RFSA to create custom measurements or applications that require I/Q data. Use NI-RFSG to generate CW or modulated waveforms. Use NI-RFSA and NI-RFSG with the NI Modulation Toolkit to develop software-defined radio transmitters and receivers. Use NI-RFSG with the NI Modulation Toolkit to create and generate modulated signals to test receivers.

Related Information

Refer to the NI RF Vector Signal Analyzers Help or the NI RF Signal Generators Help for more information about using the NI-RFSA and NI-RFSG instrument driver FPGA extensions.

Installing the Software

You must be an Administrator to install NI software on your computer.

1. Install NI LabVIEW.
2. (Recommended) Install the latest service pack for LabVIEW and any LabVIEW modules you are using.
3. Insert the driver software media into your computer. The installer should open automatically.

   If the installation window does not appear, navigate to the drive, double-click it, and double-click `autorun.exe`.
4. Follow the instructions in the installation prompts.

> **Note** Windows users may see access and security messages during installation. Accept the prompts to complete the installation.

> **Note** The default installation installs NI-RFSA and NI-RFSG.

5. When the installer completes, select **Restart** in the dialog box that prompts you to restart, shut down, or restart later.

Installing the PXIe-5820

> ⚠ **Caution** To prevent damage to the PXIe-5820 caused by ESD or contamination, handle the module using the edges or the metal bracket.

You must install the software before installing the hardware.

Before you install the hardware, refer to the guidelines in the *Maintain Forced-Air Cooling Note to Users* included with the module to ensure that the device can cool itself effectively. This document is also available at *ni.com/manuals*.

The PXIe-5820 is a two-slot module with two backplane connectors. The module must be installed into two adjacent chassis slots.

1. Ensure the AC power source is connected to the chassis before installing the module.

   The AC power cord grounds the chassis and protects it from electrical damage while you install the module.

2. Power off the chassis.

3. Inspect the slot pins on the chassis backplane for any bends or damage prior to installation. Do not install a module if the backplane is damaged.

4. If the chassis has multiple fan speed settings, ensure the fans are set to the highest setting.

> **Note** Inadequate air circulation could cause the temperature inside the chassis to rise above the optimal operating temperature for the device, potentially causing thermal shutdown, shorter lifespans, or improper performance.

5. Position the chassis so that inlet and outlet vents are not obstructed.

6. Remove the black plastic covers from all the captive screws on the module front panel.

7. Identify two adjacent PXI Express-compatible slots in the chassis. The following figure shows the symbols that indicate the slot types.

Figure 2. Chassis Compatibility Symbols
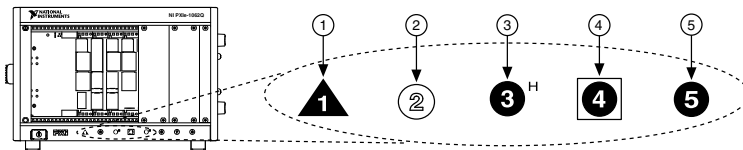
1. PXI Express System Controller Slot
2. PXI Peripheral Slot
3. PXI Express Hybrid Peripheral Slot
4. PXI Express System Timing Slot
5. PXI Express Peripheral Slot

The PXIe-5820 can be placed in PXI Express peripheral slots, PXI Express Hybrid peripheral slots, or PXI Express system timing slots.

8. Touch any metal part of the chassis to discharge static electricity.

9. Ensure that the ejector handle is in the unlatched (downward) position.

10. Hold the module by the edges and slide it into the empty compatible slots. Ensure the base engages with the guides in the chassis.

Figure 3. PXIe-5820 Module Installation
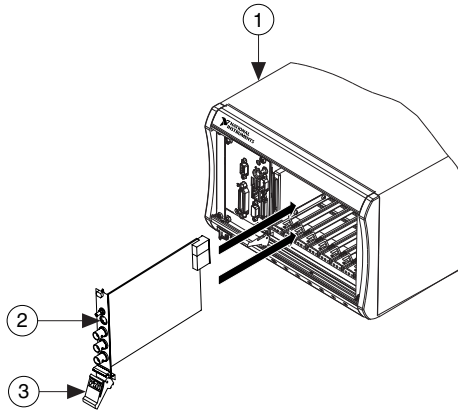
1. PXI Express Chassis
2. PXI Express Module
3. Ejector Handle in Unlatched (Downward) Position

11. Latch the module in place by pulling up on the ejector handle.

12. Secure the module front panel to the chassis using the front-panel mounting screws.

> **Note** Tightening the top and bottom mounting screws increases mechanical stability and also electrically connects the front panel to the chassis, which can improve the signal quality and electromagnetic performance.

13. Use slot blockers and cover all empty slots with filler panels to maximize cooling air flow.

> **Note** Proper airflow is critical to device operation.

14. Power on the chassis.

Direct Connections to the PXIe-5820

The PXIe-5820 is a precision instrument that is sensitive to ESD and transients. Ensure you take the following precautions when making direct connections to the PXIe-5820 to avoid damaging the device.
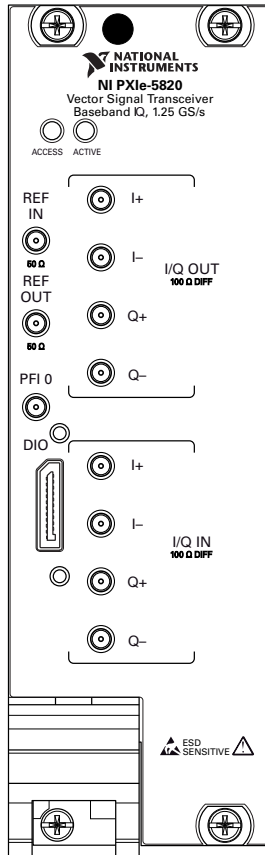
> ⚠ **Caution** Apply external signals only while the PXIe-5820 is powered on. Applying external signals while the device is powered off may cause damage.

- Ensure you are properly grounded when manipulating cables connected to the PXIe-5820 I/Q IN connectors.
- If you are using nonisolated devices, such as a nonisolated RF antenna, ensure the devices are maintained in a static-free environment.
- If you are using an active device, such as a preamplifier or switch routed to the PXIe-5820 I/Q IN connectors, ensure that the device cannot generate signal transients greater than the AC and DC specifications of the PXIe-5820 I/Q IN connectors.

Hardware Front Panel Connectors and Indicators

Figure 4. PXIe-5820 Front Panel

⚠️ **Caution** Apply external signals only while the PXIe-5820 is powered on. Applying external signals while the device is powered off may cause damage.

Table 2. Device Front Panel Icon Definitions

⚠️	Refer to the user documentation for required maintenance measures to ensure user safety and/or preserve the specified EMC performance.
⚠️	The signal pins of this product's input/output ports can be damaged if subjected to ESD. To prevent damage, employ industry-standard ESD prevention measures during installation, maintenance, and operation.

Table 3. PXIe-5820 General Front Panel Connectors

Connector	Use	Connector Type
REF IN	Input connector that allows for the use of an external 10 MHz Reference Clock.	MMPX (f)
REF OUT	Output connector that can export a 10 MHz Reference Clock.	MMPX (f)
PFI 0	Programmable-function digital I/O (DIO) connector for use with triggers or events.	MMPX (f)
DIO	Multi-signal DIO connector that provides access to FPGA multi-gigabit transceivers (MGTs) and general purpose LVCMOS signals.	Nano-Pitch

⚠️ **Caution** The DIO connector is not an OCuLink interface. Do not connect the DIO connector on the PXIe-5820 to the OCuLink interface of another device. NI is not liable for any damage resulting from such signal connections.

Table 4. PXIe-5820 I/Q Front Panel Connectors

Connector	Use		Connector Type
I/Q OUT	I+	Output connector for I+ signals.	MMPX (f)
	I-	Output connector for I- signals.	MMPX (f)
	Q+	Output connector for Q+ signals.	MMPX (f)
	Q-	Output connector for Q- signals.	MMPX (f)

Table 4. PXIe-5820 I/Q Front Panel Connectors (Continued)

Connector	Use	Connector Type	
I/Q IN	I+	Input connector for I+ signals.	MMPX (f)
	I-	Input connector for I- signals.	MMPX (f)
	Q+	Input connector for Q+ signals.	MMPX (f)
	Q-	Input connector for Q- signals.	MMPX (f)

Table 5. PXIe-5820 Front Panel LEDs

LED	Indications
ACCESS	Indicates the basic hardware status of the device.
	Off—The device is not yet functional or has detected a problem with a PXI Express power rail.
	Amber—The device is being accessed. *Accessed* means that you are writing to the device setup registers to control the device, reading from the device to monitor the device status, or transferring data to/from the device.
	Green—The device is controllable through the software.
ACTIVE	Off—The device is idle.
	Solid green—The device is generating a waveform.
	Dim amber—The device is waiting for an acquisition Reference Trigger.
	Solid amber—The device is acquiring a waveform.
	Solid red—The device has detected an error. The LED remains red until the error condition is removed.
	Note The indicators are listed in increasing order of priority. For example, if you are generating a waveform using NI-RFSG and waiting on an acquisition Reference Trigger in NI-RFSA, the LED is dim amber.

Configuring the Hardware in MAX

Use Measurement & Automation Explorer (MAX) to configure your NI hardware. MAX informs other programs about which devices reside in the system and how they are configured. MAX is automatically installed with NI-RFSA and NI-RFSG.

1. Launch MAX by navigating to **Start**»**All Programs**»**National Instruments**»**NI MAX** or by clicking the NI MAX desktop icon.

2. In the Configuration pane, expand **Devices and Interfaces** to see the list of installed devices. Installed devices appear under the name of their associated chassis.

3. Expand your **Chassis** tree item.

   MAX lists all devices installed in the chassis. PXIe-5820 devices appear as NI-RIO devices in the list. Your default device names may vary.

   Note If you do not see your hardware listed, refer to the *Troubleshooting* section of this document.

4. Record the device identifier MAX assigns to the hardware. Use this identifier when programming the PXIe-5820.

   Caution When you install, uninstall, or move an NI-RIO device in your system, resource identification of your NI-RIO devices may change. Whenever any of these changes occur, verify resource identification of all your NI-RIO devices in MAX, and, if necessary, make changes to your software and documentation.

Self-Calibration

Self-calibration adjusts the PXIe-5820 for variations in the module environment using an onboard high-precision calibration tone.

The PXIe-5820 modules are externally calibrated at the factory; however, you should perform a self-calibration in any of the following situations:

- After first installing the PXIe-5820 into your chassis
- After any module in the chassis is installed, uninstalled, or moved
- When the system is in an environment where the ambient temperature varies or the module temperature has drifted more than ±5 °C from the temperature at the last self-calibration
- To periodically adjust for small performance drifts that occur with product aging

   Note Allow the module to warm up for 30 minutes after the PXI Express chassis has powered on and the operating system has completely loaded before you use the module or perform self-calibration.

   Note Disconnect external I/Q port cables prior to self calibration for best performance. If this is not possible then make sure external devices are turned off or in idle state and not transmitting. It is not recommended to perform self calibration while connected in direct loopback configuration.

Performing a Device Self-Calibration Using NI-RFSA

NI recommends you perform the self-calibration using the NI-RFSA example when you self-calibrate the module.

1. Select **Start**»**All Programs**»**National Instruments**»**LabVIEW** to launch LabVIEW.

2. Launch the Example Finder and navigate to the example.
   a) Select **Hardware Input and Output**»**Modular Instruments**»**NI-RFSA**»**Utilities**»**RFSA Self Calibration**.
   b) Open the example.
3. Complete the following steps to configure the example:
   a) Select the device identifier assigned to the PXIe-5820 in MAX in the **[Resource Name]** drop-down menu .
   b) Set Clock Source to **OnboardClock**.
   c) Set Self Calibration Step Operations to **Perform All Self Calibration Steps**.
4. Run the VI.

Related Information

Refer to the NI RF Vector Signal Analyzers Help for more information about self-calibration and self-calibrating in text-based languages.

Locating the Software and Examples

Software Locations

Table 6. Location of PXIe-5820 Software Options

Software Option	ADE	Location
NI-RFSA	LabVIEW	Available on the LabVIEW Functions palette at **Measurement I/O»NI-RFSA**.
	LabWindows/CVI	Available in the `<IVIROOTDIR32>\Drivers \niRFSA` directory, where `<IVIROOTDIR32>` is one of the following locations: • Windows 10 (32-bit)/8.1 (32-bit)/7 (32-bit)- `Program Files\IVI Foundation\IVI` • Windows 10 (64-bit)/8.1 (64-bit)/7 (64-bit)- `Program Files (x86)\IVI Foundation \IVI`
	Microsoft Visual C/C++	Use the header files located in the `<IVIROOTDIR32> \Include` directory and import library files located in the `<IVIROOTDIR32>\Lib` directory, where `<IVIROOTDIR32>` is one of the following directories: • Windows 10 (32-bit)/8.1 (32-bit)/7 (32-bit)- `Program Files\IVI Foundation\IVI` • Windows 10 (64-bit)/8.1 (64-bit)/7 (64-bit)- `Program Files (x86)\IVI Foundation \IVI`
	Microsoft .NET	To use the .NET API, you must install the .NET class libraries. For download and installed file locations, visit *ni.com/info* and enter Info Code `NETAPIdriversupport`.

Table 6. Location of PXIe-5820 Software Options (Continued)

Software Option	ADE	Location
NI-RFSG	LabVIEW	Available on the LabVIEW Functions palette at **Measurement I/O»NI-RFSG**.
	LabWindows/CVI	Available in the `<IVIROOTDIR32>`\Drivers\niRFSG directory, where `<IVIROOTDIR32>` is one of the following locations: • Windows 10 (32-bit)/8.1 (32-bit)/7 (32-bit)- Program Files\IVI Foundation\IVI • Windows 10 (64-bit)/8.1 (64-bit)/7 (64-bit)- Program Files (x86)\IVI Foundation \IVI
	Microsoft Visual C/C++	Use the header files located in the `<IVIROOTDIR32>`\Include directory and import library files located in the `<IVIROOTDIR32>`\Lib directory, where `<IVIROOTDIR32>` is one of the following directories: • Windows 10 (32-bit)/8.1 (32-bit)/7 (32-bit)- Program Files\IVI Foundation\IVI • Windows 10 (64-bit)/8.1 (64-bit)/7 (64-bit)- Program Files (x86)\IVI Foundation \IVI
	Microsoft .NET	To use the .NET API, you must install the .NET class libraries. For download and installed file locations, visit *ni.com/info* and enter Info Code NETAPIdriversupport.

Programming Examples Locations

Using the NI Example Finder

If you're using NI-RFSA or NI-RFSG with LabVIEW or LabWindows/CVI, use the NI Example Finder to locate programming examples.

1. Launch LabVIEW or LabWindows/CVI.
2. Select **Help»Find Examples** to open the NI Example Finder.
3. Navigate to **Hardware Input and Output»Modular Instruments**.
4. Open the example that best matches your application requirements.

Using Microsoft Visual C/C++

If you're using NI-RFSA with Microsoft Visual C/C++, locate examples in the following directory.

Table 7. Location of Microsoft Visual C/C++ Programming Examples

Software Option	Examples Location
NI-RFSA	`<NIDocDir>\NI-RFSA\examples` where `<NIDocDir>` is the `Users\Public\Public Documents \National Instruments` directory.

Making a First Measurement

You can verify proper installation and configuration of your device by making a measurement using the NI-RFSG and NI-RFSA Examples in LabVIEW.

1. Connect the PXIe-5820 as follows:
   a) Connect the I/Q IN I+ port to the I/Q OUT I+ port using an MMPX (m)-to-MMPX (m) cable.
   b) Connect the I/Q IN I- port to the I/Q OUT I- port using an MMPX (m)-to-MMPX (m) cable.
   c) Connect the I/Q IN Q- port to the I/Q OUT Q- port using an MMPX (m)-to-MMPX (m) cable.
   d) Connect the I/Q IN Q+ port to the I/Q OUT Q+ port using an MMPX (m)-to-MMPX (m) cable.

2. Select **Start**»**All Programs**»**National Instruments**»**LabVIEW** to launch LabVIEW.

3. Complete the following steps to open the Getting Started Examples:
   a) Select **LabVIEW**»**Help**» **Find Examples**
   b) Select **Hardware Input and Output**» **Modular Instruments**»**NI-RFSA**»**Getting Started**»**RFSA Getting Started IQ (IQ Device).vi**
   c) Select **Hardware Input and Output**»**> Modular Instruments**»**NI-RFSG**»**Getting Started**»**RFSG Getting Started Single Tone Generation (IQ Device).vi**

4. Select the device identifier assigned to the PXIe-5820 in MAX in the **Device** drop-down menu in both examples.

5. Start the NI-RFSG example to generate the CW tone at the I/Q OUT connectors of the device.

6. Start the NI-RFSA example to acquire the CW tone at the I/Q IN connectors of the device.

Troubleshooting

If an issue persists after you complete a troubleshooting procedure, contact NI technical support or visit *ni.com/support*.

What Should I Do if the PXIe-5820 Doesn't Appear in MAX?

1. In the MAX configuration tree, expand **Devices and Interfaces**.
2. Expand the **Chassis** tree to see the list of installed hardware, and press <F5> to refresh the list.
3. If the module is still not listed, power off the system, ensure that all hardware is correctly installed, and restart the system.
4. Navigate to the Device Manager.

Operating System	Description
Windows 10	Select **Start»Control Panel»Device Manager**.
Windows 8.1	Right-click the Start button, and select **Device Manager**.
Windows 7	Select **Start»Control Panel»Device Manager**.

5. If you are using a PXI controller, verify that a **National Instruments** entry appears in the system device list. If error conditions appear in the list, right-click the **PXIe-5820** and **NI-RIO FPGA Device** nodes and select **Update Driver**. If you are using an MXI controller, right-click **PCI-to-PCI Bridge**, and select **Properties** from the shortcut menu to verify that the bridge is enabled.
6. Restart your computer.

Why Is the ACCESS LED Off When the Chassis Is On?

The LEDs may not light until the device has been configured in MAX. Before proceeding, verify that the PXIe-5820 appears in MAX.

If the module appears in MAX but the ACCESS LED fails to light after you power on the chassis, a problem may exist with the chassis power rails, the hardware module, or the LED.
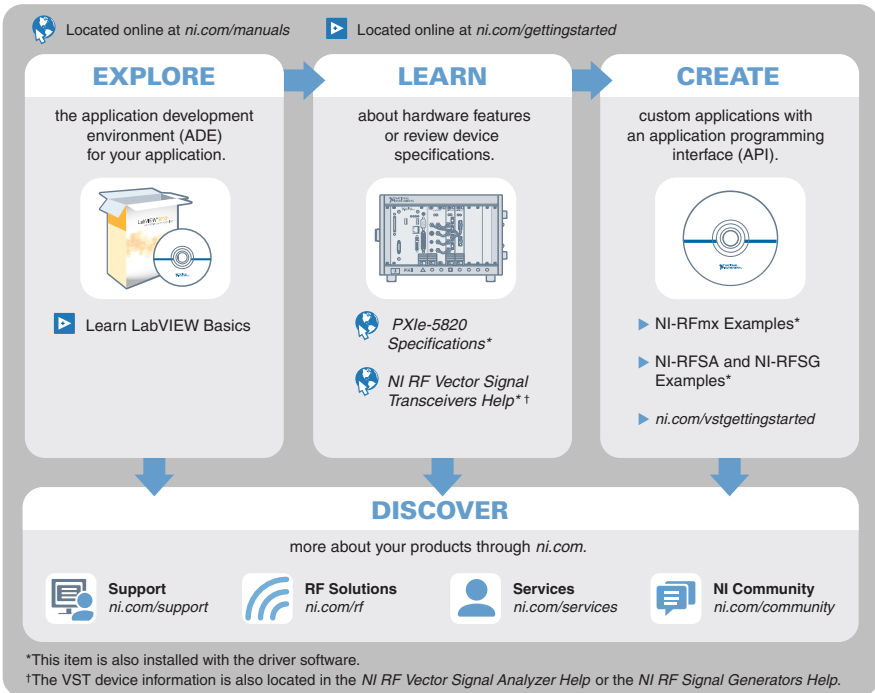
⚠ **Caution** Apply external signals only while the PXIe-5820 is powered on. Applying external signals while the device is powered off may cause damage.

1. Disconnect any signals from the PXI Express module front panel.
2. Power off the PXI Express chassis.
3. Remove the module from the PXI Express chassis and inspect it for damage. Do not reinstall a damaged device.
4. Install the module in a different PXI Express chassis slot from which you removed it.
5. Power on the PXI Express chassis.

6. Restart your computer.
7. Verify that the device appears in MAX.

Where to Go Next

Refer to the following figure for information about other product tasks and associated resources for those tasks.

Located online at *ni.com/manuals*   Located online at *ni.com/gettingstarted*

EXPLORE the application development environment (ADE) for your application.

Learn LabVIEW Basics

LEARN about hardware features or review device specifications.

PXIe-5820 Specifications*

NI RF Vector Signal Transceivers Help* †

CREATE custom applications with an application programming interface (API).

▸ NI-RFmx Examples*

▸ NI-RFSA and NI-RFSG Examples*

▸ *ni.com/vstgettingstarted*

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*This item is also installed with the driver software.
†The VST device information is also located in the *NI RF Vector Signal Analyzer Help* or the *NI RF Signal Generators Help*.

Tip The *NI RF Vector Signal Transceivers Help*, available at *ni.com/manuals*, is an HTML version of a traditional user manual that includes detailed information about RF fundamentals, device features, and programming for vector signal transceivers.

Worldwide Support and Services

The NI website is your complete resource for technical support. At *ni.com/support*, you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

Visit *ni.com/services* for NI Factory Installation Services, repairs, extended warranty, and other services.

Visit *ni.com/register* to register your NI product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

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