



# NATIONAL INSTRUMENTS PXIe-5840 PXI Vector Signal Transceivers Owner's Manual

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## PRODUCT FLYER PXI Vector Signal Transceivers



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

This document explains how to install, configure, and test the PXIe-5840. The PXIe-5840 is an RF vector signal transceiver (VST) and ships with the following software options, which you use to program the device.

- NI-RFmx driver software
- NI-RFSA and NI-RFSG driver software



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

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## 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 shielded cables and accessories.



**Caution** To ensure the specified EMC performance, operate this product only with cables less than 3 meters in length.

## Verifying the System Requirements

To use the PXIe-5840, 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](http://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-5840 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.



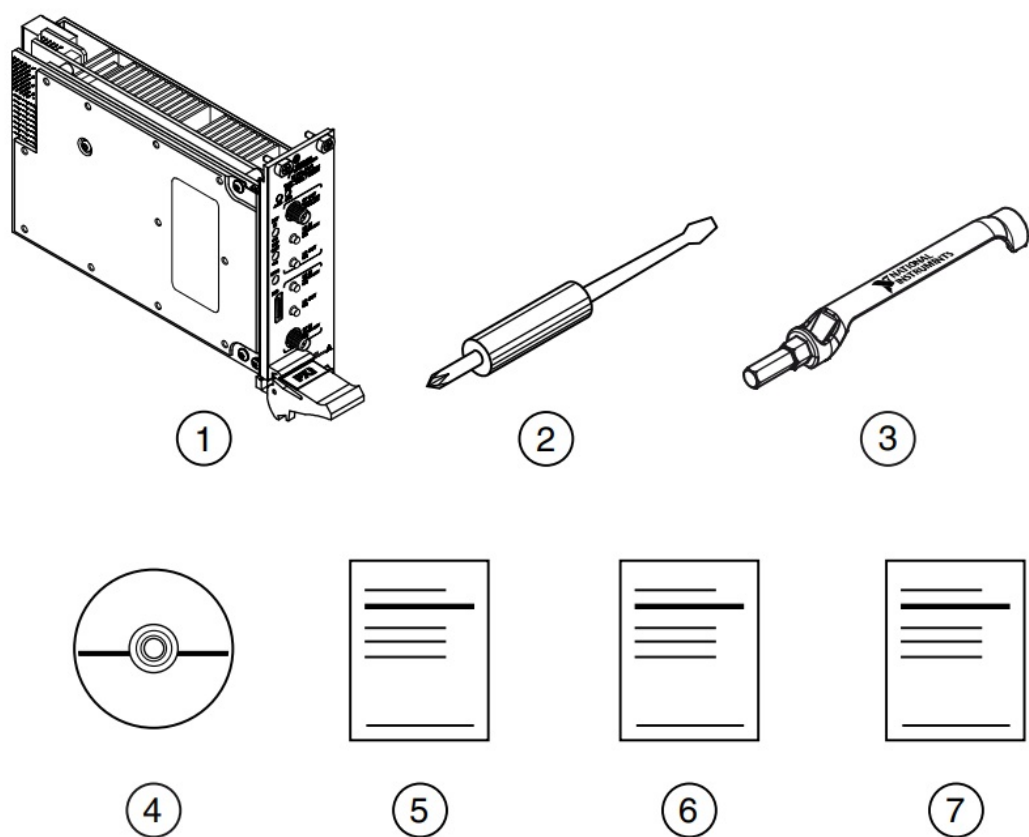
**Caution** Clean the hardware with a soft, nonmetallic brush or lint free cloth. Make sure that the hardware is completely dry and free from contaminants before returning it to service.



**Note** Refer to the PXIe-5840 Specifications at [ni.com/manuals](http://ni.com/manuals) for complete specifications.

# Verifying the Kit Contents

Figure 1. PXIe-5840 Kit Contents



1. PXIe-5840 Module	5. Read Me First: Safety and Electromagnetic Compatibility
2. Screwdriver, Part Number 772006-01	6. Maintain Forced-Air Cooling Note to Users
3. SMA Driver Bit, Part Number 780895-01	7. PXIe-5840 Getting Started Guide
4. Driver Software DVD	

## Other Equipment

There are several required items not included in your device kit that you need to operate the PXIe-5840. 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. For more information about compatible chassis options, visit [ni.com/info](http://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.

### Optional Items

- PXI Chassis Slot Blocker kit (NI part number 199198-01)
- SMA (m)-to-SMA (m) cables

- SMA (m)-to-MMPX (m) cables
- MMPX (m)-to-MMPX (m) cables
- OcuLink x4, 1 m cable<sup>1</sup>

## Choosing and Installing the Software

### Software Options

NI provides three software options for programming the PXIe-5840—NI-RFmx, NI-RFSA and NI-RFSG instrument driver software.

**Table 1.** PXIe-5840 Software Options

Software Option	Description	Use Case
NI-RFmx	Provides a single-handle instrument driver with built-in measurements. You can use instrument driver FPGA extensions to customize the device FPGA using precompiled bitfiles.	Use NI-RFmx SpecAn to perform spectral measurements. Use NI-RFmx Demod to perform modulation quality measurements, such as EVM. Use NI-RFmx personalities to perform physical layer analysis on supported cellular signals.
NI-RFSA and NI-RFSG instrument driver	The NI-RFSA and NI-RFSG APIs each provide a fixed API for interacting with your PXIe-5840 device. NI-RFSA and NI-RFSG provide standard I/VI-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 UQ 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-RFmx SpecAn Help, the NI-RFmx Demod Help, the NI RF Vector Signal Analyzers Help, or the NI RF Signal Generators Help for more information about using the NI-RFmx, 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-RFmx, 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-5840

**Caution** To prevent damage to the device caused by ESD or contamination, handle the device using the edges or the metal bracket.

You must install the software before installing the hardware.

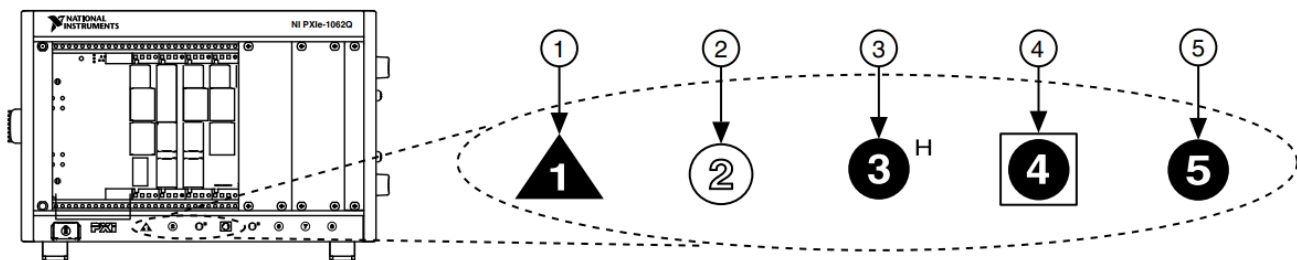
Before you install the hardware, refer to the guidelines in the Maintain Forced-Air Cooling Note to Users included with the module to ensure that the device can cool itself effectively.

This document is also available at [ni.com/manuals](https://ni.com/manuals).

The PXIe-5840 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 modules.  
The AC power cord grounds the chassis and protects it from electrical damage while you install the modules.
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.

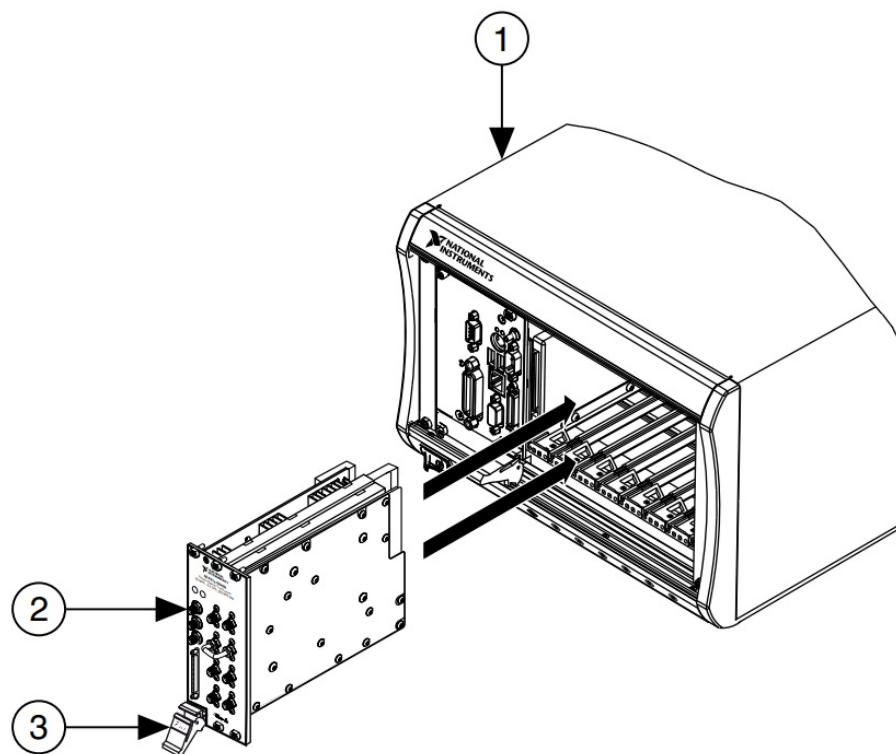
Figure 2. Chassis Compatibility Symbols



1. PXI Express System Controller Slot	4. PXI Express System Timing Slot
2. PXI Peripheral Slot	5. PXI Express Peripheral Slot
3. PXI Express Hybrid Peripheral Slot	

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-5840 Module Installation



1. PXI Express Chassis
2. PXIe-5840 Module
3. Ejector Handle in Unlatched (Downward) Position

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

12. Secure the device 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. Cover all empty slots with filler panels or use slot blockers to maximize cooling air flow.

Note Proper airflow is critical to device operation.

14. Power on the chassis.

### Direct Connections to the PXIe-5840

The PXIe-5840 is a precision RF instrument that is sensitive to ESD and transients. Ensure you take the following precautions when making direct connections to the PXIe-5840 to avoid damaging the device.

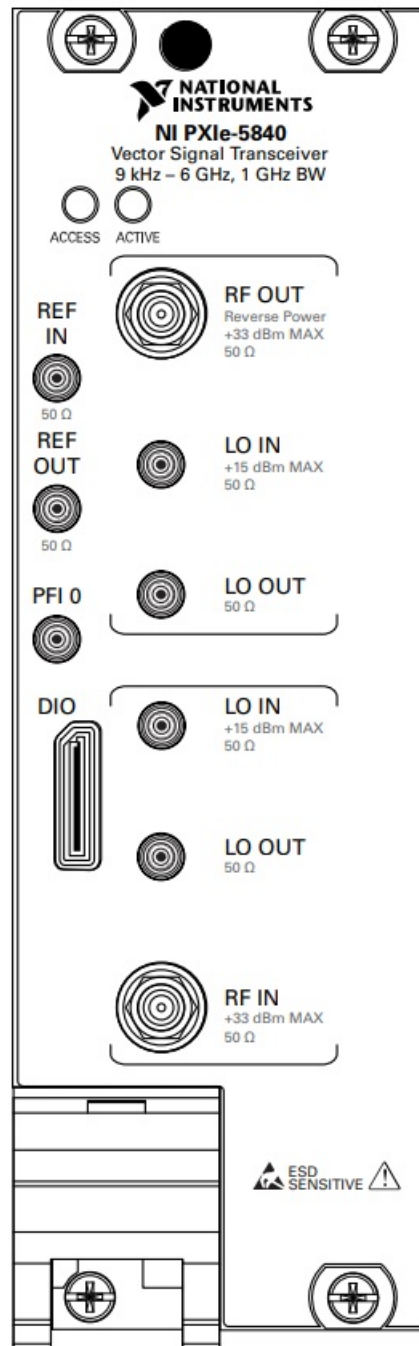


**Caution** Apply external signals only while the PXIe-5840 is powered on. Applying external signals while the device is powered off may cause damage.

- Ensure you are properly grounded when manipulating cables or antennas connected to the PXIe-5840 RF IN connector.
- 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-5840 RF IN connector, ensure that the device cannot generate signal transients greater than the RF and DC specifications of the PXIe-5840 RF IN connector.

### Hardware Front Panel Connectors and Indicators

**Figure 4.** PXIe-5840 Front Panel



**Caution** Apply external signals only while the PXIe-5840 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-5840 General Front Panel Connectors



Connector	Use	Connector Type
REF IN	Input terminal that allows for the use of an external 10 MHz Reference Clock.	MMPX (0
REF OUT	Output terminal that can export a 10 MHz Reference Clock or the 156.25 MHz Data Clock.	MMPX (f)
PFI 0	Programmable-function digital I/O (DIO) connector for use with triggers or events.	MMPX (0
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-5840 to the OcuLink interface of another device. NI is not liable for any damage resulting from such signal connections.

### Related Information

Refer to the PXIe-5840 Specifications for more information about front panel connectors and LEDs.

## 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-5840 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-5840.



**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-5840 for variations in the module environment using an onboard high-precision calibration tone.

The PXIe-5840 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-5840 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  $\pm 5$  °C from the temperature at the last selfcalibration
- 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.

### Performing a Device Self-Calibration Using the NIRFSA or NI-RFSG SFP

NI recommends you perform the self-calibration using the NI-RFSA or NI-RFSG Soft Front Panel (SFP). The NI-RFSA and NI-RFSG SFPs perform the same self-calibration, so it is not necessary to use both SFPs when you self-calibrate the module.

1. Launch the NI-RFSA or NI-RFSG Soft Front Panel by navigating to Start»All Programs»National Instruments»<Driver>» <Driver> Soft Front Panel.
2. Click Device/System»Calibration»Self Calibration.
3. Click OK to run the self-calibration.

### Related Information

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

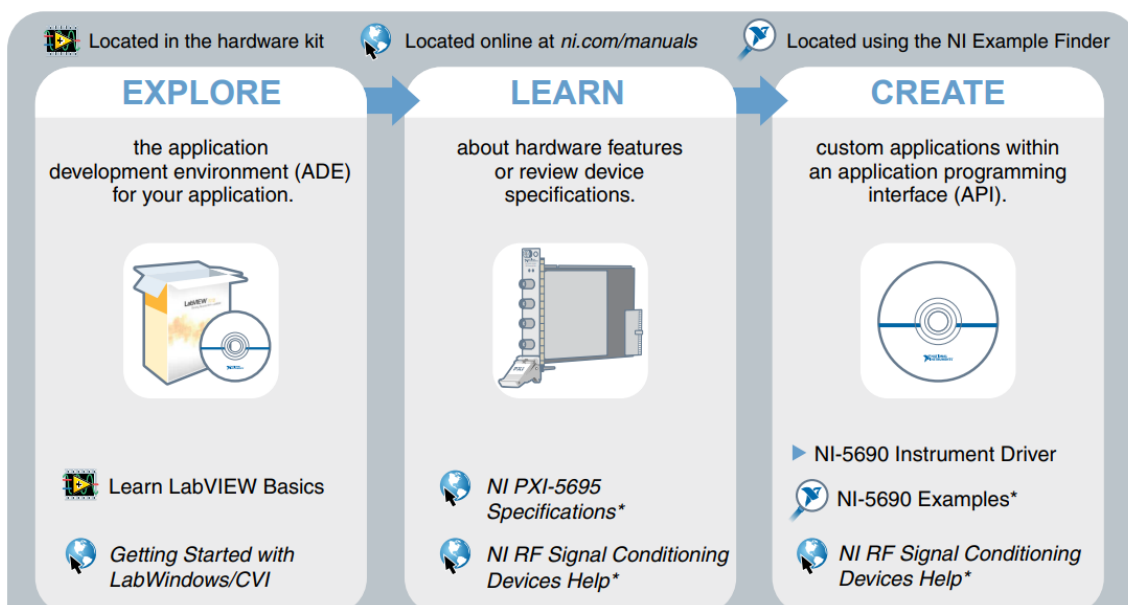
## Locating the Software and Examples

### Software Locations

Table 6. Location of PXIe-5840 Software Options

Software Option	ADE	Location
NI-RFmx	LabVIEW	Available on the LabVIEW Functions palette at Measurement 1/0 »NI-RFmx.
	LabWindows/CVI	NI-RFmx functions are available from the LabWindows/CVI Library menu at Library»RFmx SpecAn Library and Library»RFmx Demod Library.
	Microsoft Visual C/C-H-	Use the header files located in the <NIDir>\ Shared \ExternalCompilerSupport\C\include directory and import library files located in one of the following directories: •Windows 10 (32-bit)/8.1 (32-bit)/7 (32-bit)- CNIDirAShared \ExternalCompilerSupport \C \ include •Windows 10 (64-bit)/8.1 (64-bit)/7 (64-bit) : — 32-bit installation-onDir> \ Shared \ExternalCompilerSupport \ C \ lib32 \msvc — 64-bit installation-ou-Dir> \ Shared \ExternalCompilerSupport \ C \ lib64 \msvc where <NI Dir> is one of the following locations: •Windows 10 (32-bit)/81 (32-bit)/7 (32-bit)Program Files\National Instruments •Windows 10 (64-bit)/8.1 (64-bit)/7 (64-bit)Program Files (x86)\National Instruments
	Microsoft .NET	For the location of .NET class libraries, refer to the installed NI-RFmx readme.





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\*This item is also installed with the driver software.



**Tip** The NI RF Signal Conditioning Devices Help is an HTML version of a traditional user manual that includes detailed information about RF fundamentals, device features, and programming with the NI-5690 instrument driver.

## Worldwide Support and Services

The National Instruments website is your complete resource for technical support. At [ni.com/support](https://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.

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## Documents / Resources

	<b><a href="#">NATIONAL INSTRUMENTS PXIe-5840 PXI Vector Signal Transceivers</a></b> [pdf] Owner's Manual PXI Vector Signal Transceivers, PXIe-5840, PXIe-5820, PXIe-5646, PXIe-5645, PXIe-5644, PXI e-5840 PXI Vector Signal Transceivers, PXI Vector Signal Transceivers, Vector Signal Transceiv ers, Signal Transceivers, Transceivers
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## References

- [NI Engineer Ambitiously - NI](#)
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