PXIe-4190 Getting Started

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This document explains how to install, configure, and test the PXIe-4190.

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

Verifying the System Requirements

To use the NI-DCPower instrument driver, your system must meet certain requirements.

Refer to the product readme, which is available online on the driver software download page or at ni.com/manuals, for more information about minimum system requirements, recommended system, and supported application development environments (ADEs).

Unpacking the Kit

The following items are included in the PXIe-4190 kit.

- PXIe-4190
- **PXIe-4190 Safety, Environmental, and Regulatory Information**

> ⊘ Notice To prevent electrostatic discharge (ESD) from damaging the module, 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 module from the package and inspect it for loose components or other signs of damage.

> (!) Notice Never touch the exposed pins of connectors.

> ✎ Note Do not install a module if it appears damaged in any way.

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

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

Other Equipment

There are several required items not included in your PXIe-4190 kit that you need to operate the PXIe-4190. Your application may require additional items not included in your kit to install or operate your PXIe-4190.

Required Items

- A PXI Express chassis and chassis documentation. For more information about compatible chassis options, refer to ni.com.
- A PXI Express embedded controller or MXI controller system that meets the system requirements specified in this guide and chassis documentation.

Accessory Items

- SHDB13W6-DB13W6-LL D-SUB to D-SUB Cable
  - 1 m (NI part number 788279-01)
  - 2 m (NI part number 788279-02)
  - 4 m (NI part number 788279-04)
- SHDB13W6-4BNCM-LL D-SUB to male BNC Cable
  - 1 m (NI part number 788280-01)
  - 2 m (NI part number 788280-02)
  - 4 m (NI part number 788280-04)
- SHDB13W6-4TriaxM-LL D-SUB to male Triax Cable

- 1 m (NI part number 788281-01)
- 2 m (NI part number 788281-02)
- 4 m (NI part number 788281-04)

- PXI Slot Blocker Kit (NI part number 199198-01)

Installing the Software

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

1. Install an ADE, such as LabVIEW or LabWindows™/CVI™.
2. Download the latest NI-DCPower driver software installer from ni.com/r/downloaddcpower.
   Driver support for the PXIe-4190 was first available in NI-DCPower 21.8.

   NI Package Manager downloads with the driver software to handle the installation. Refer to the NI Package Manager Manual for more information about installing, removing, and upgrading NI software using NI Package Manager.

3. 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.

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

Installing the PXIe-4190

> Notice To prevent damage to the PXIe-4190 caused by ESD or contamination, handle the module using the edges or the metal bracket.

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

5. Identify a supported slot in the chassis. The following figure shows the symbols that indicate the slot types.
Figure 1. Chassis Compatibility Symbols
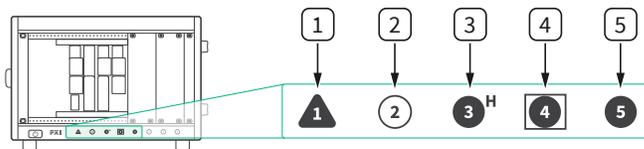
1. PXI Express System Controller Slot

2. PXI Peripheral Slot

3. PXI Express Hybrid Peripheral Slot

4. PXI Express System Timing Slot

5. PXI Express Peripheral Slot

PXIe-4190 modules can be placed in PXI Express peripheral slots, PXI Express hybrid peripheral slots, or PXI Express system timing slots.

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

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

8. Place the module edges into the module guides at the top and bottom of the chassis. Slide the module into the slot until it is fully inserted.
Figure 2. Module Installation
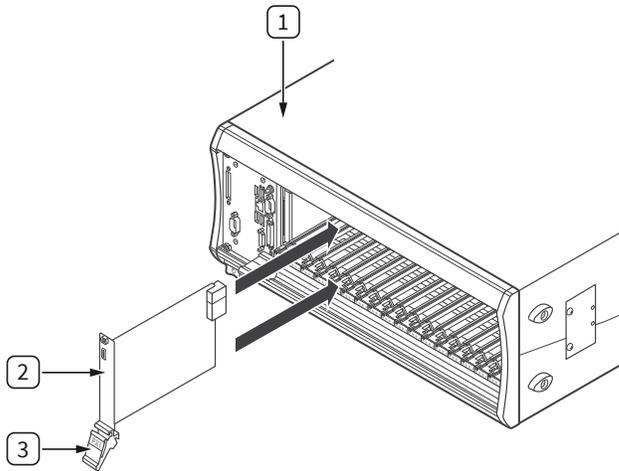
1. Chassis
2. Hardware Module
3. Ejector Handle in Downward (Unlatched) Position

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

10. 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.

11. Cover all empty slots using either filler panels (standard or EMC) or slot blockers with filler panels, depending on your application.

> **Note** For more information about installing slot blockers and filler panels, go to ni.com/r/pxiblocker.

12. Power on the chassis.

PXIe-4190 Pinout and LEDs
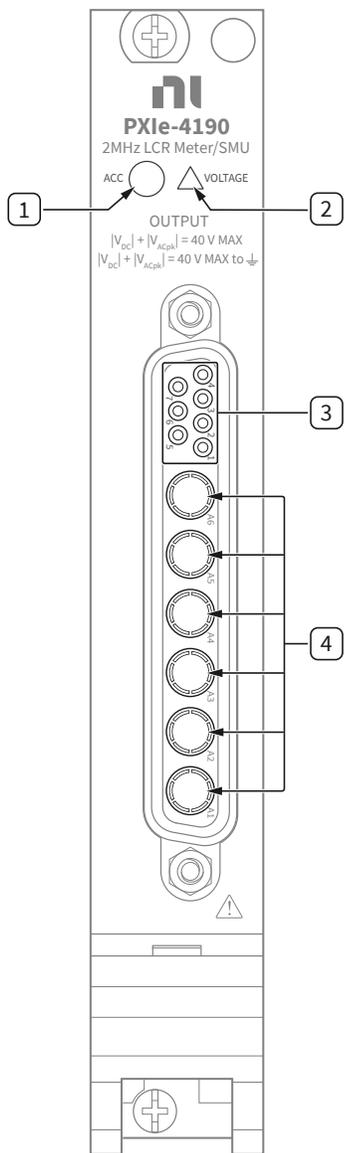
Table 7. Item Descriptions

Item	Description
1	LED Access Status Indicator
2	LED Voltage Status Indicator
3	General purpose input/output contacts
4	Coaxial contacts

Table 2. Coaxial Contacts Descriptions

Contact	LCR Mode Functionality	SMU Mode Functionality
A1 (Center Conductor)	LO CUR	HI
A1 (Outer Conductor)	Isolated Shield	GUARD
A2 (Center Conductor)	LO POT	Sense HI
A2 (Outer Conductor)	Isolated Shield	GUARD
A3 (Center Conductor)	CAL SENSE	
A3 (Outer Conductor)	Isolated Shield	
A4 (Center Conductor)	CAL FORCE	
A4 (Outer Conductor)	Isolated Shield	
A5 (Center Conductor)	HI POT	Sense LO
A5 (Outer Conductor)	Isolated Shield	
A6 (Center Conductor)	HI CUR	LO
A6 (Outer Conductor)	Isolated Shield	

Table 3. LED Access Status Indicator

Status Indicator	Device State
(Off)	Not Powered
Green	Powered
Amber	Device is being accessed

Table 4. LED Voltage Status Indicator

Status Indicator	Output Channel State
(Off)	All device outputs are disconnected from their voltage generation sources through output disconnect relays.
Green	The device output is connected to a voltage generation source.
Red	The device has a fault or is in error due to the voltage generated or measured by the device. Refer to the driver software for possible sources. The device will not operate until the error is cleared and/or the device is reset.

Configuring the PXIe-4190 in MAX

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

1. Launch MAX.

2. In the configuration tree, expand Devices and Interfaces to see the list of installed NI hardware.
   Installed modules appear under the name of their associated chassis.

3. Expand your Chassis tree item.
   MAX lists all modules installed in the chassis. Your default names may vary.

   > Note If you do not see your module listed, press <F5> to refresh the list of installed modules. If the module is still not listed, power off the system, ensure the module is correctly installed, and restart.

4. Record the identifier MAX assigns to the hardware. Use this identifier when programming the PXIe-4190.

5. Self-test the hardware by selecting the item in the configuration tree and clicking Self–Test in the MAX toolbar.
   The MAX self-test performs a basic verification of hardware resources.

PXIe-4190 Block Diagram
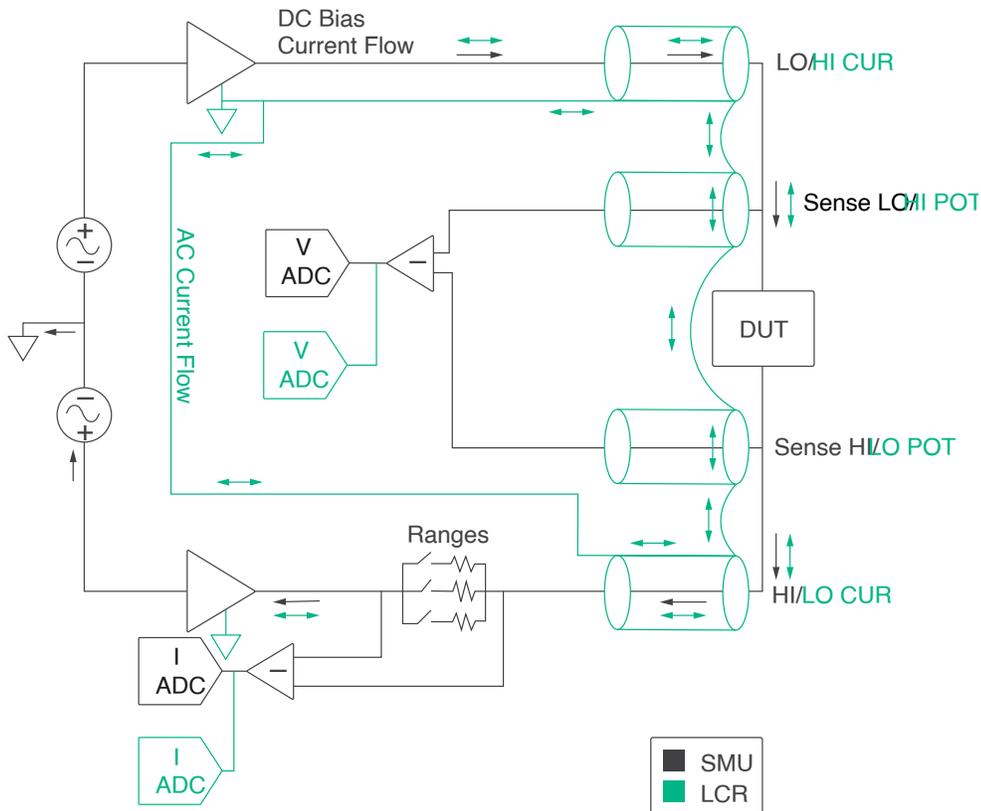
Cabling Guidelines

▪ When using the PXIe-4190 in LCR mode or in the lower two current ranges in SMU mode, you must set the niDCPower Cable Length property or NIDCPOWER_ATTR_CABLE_LENGTH attribute.

▪ For cables that breakout into BNC/Triax terminations, secure the attached strain relief bracket to a solid work surface with the integrated #4-40 captive screws to minimize cable motion that may impact results during testing.

▪ Connections between force and sense leads are required and must be made while the niDCPower Output Enabled or niDCPower Output Connected properties are set to FALSE.

> Note Disconnecting the sense leads while both the niDCPower Output Enabled and niDCPower Output Connected are set to TRUE may result in output protection errors or long settling tails due to the feedback path

> for the control loop being open. If the PXIe-4190 is run open loop due to accidental sense lead disconnection, allow a minimum of 1 minute after establishing proper lead connections before making measurements.

Four-Terminal Pair Connections

To minimize the effects of cable inductance on measurements, you must use a four-terminal pair (4TP) connection scheme to provide a low-inductance path for the return current from the excitation source to flow. To implement a 4TP connection, ensure the four isolated shield conductors of the HI CUR, HI POT, LO CUR, and LO POT coaxial signals are shorted together at the load and no other locations.

The following figures illustrate 4TP connections for LCR open, short, and load compensation measurements using a SHDB13W6-4BNCM-LL cable. The isolated shield connections shown in these figures are also applicable to 4TP connections made with other cable types. The **LCR Load Connection** figure also applies to user DUT measurements.

LCR Open Connection
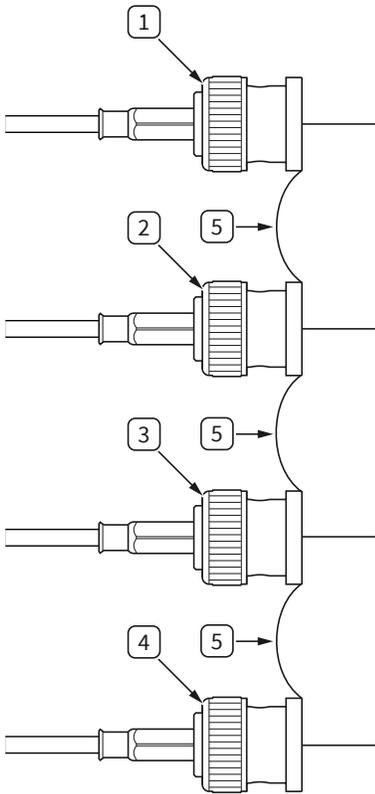
1. HI CUR
2. HI POT
3. LO POT
4. LO CUR
5. Connection between isolated shield conductors

LCR Short Connection
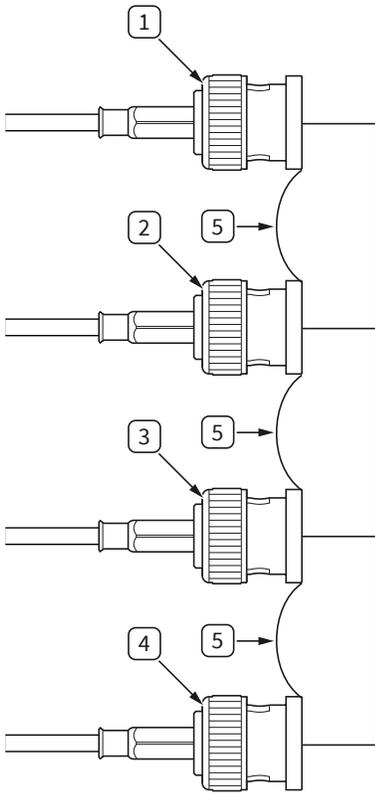
1. HI CUR
2. HI POT
3. LO POT
4. LO CUR
5. Connection between isolated shield conductors

LCR Load Connection
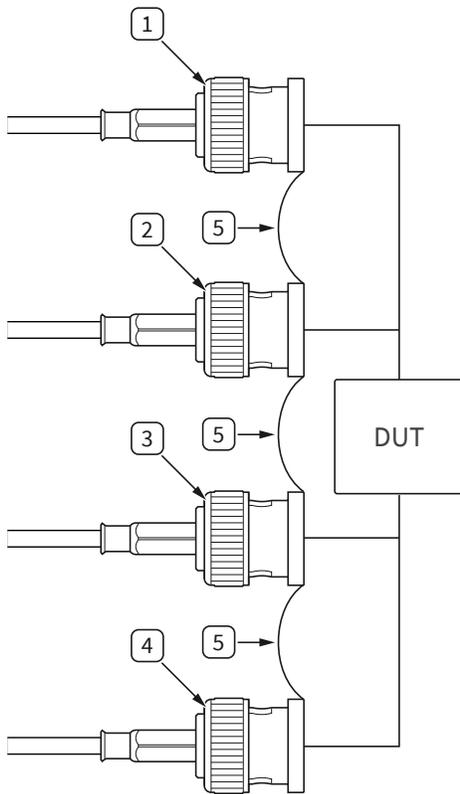
1. HI CUR
2. HI POT
3. LO POT
4. LO CUR
5. Connection between isolated shield conductors

Switching DUTs

1. Set the niDCPower Output Connected or Output Enabled property to FALSE.
2. Disconnect the DUT from the PXIe-4190.
3. Reconnect the DUT to the PXIe-4190.
4. Set the niDCPower Output Connected or Output Enabled property to TRUE.

> ✏️ Note Overload protection errors may occur if you change the connections to the load while the niDCPower Output Connected or Output Enabled properties are set to TRUE.

Self-Calibrating the PXIe-4190

Self-calibration adjusts the PXIe-4190 for variations in the module environment. Perform a complete self-calibration after the first time you install the PXIe-4190.

1. Install the PXIe-4190 and let it warm up for 30 minutes.

   > ✏️ Note Warm up begins when the PXI Express chassis has been powered on and the operating system has completely loaded.

2. Self-calibrate the PXIe-4190 by clicking the Self-Calibrate button in MAX or calling niDCPower Cal Self Calibrate or niDCPower_CalSelfCalibrate.

The PXIe-4190 modules are externally calibrated at the factory but you should perform a self-calibration in all of the following situations:

- After first installing the PXIe-4190 in a chassis
- After any module that is in the same chassis as the PXIe-4190 is installed, uninstalled, or moved
- When the PXIe-4190 is in an environment where the ambient temperature varies or the PXIe-4190 temperature has drifted more than ±5 °C from the temperature at the last self-calibration
- Within 24 hours of the previous self-calibration

Programming the PXIe-4190

You can generate signals interactively using InstrumentStudio or you can use the NI-DCPower instrument driver to program your device in the supported ADE of your choice.

Software	Location	Description
InstrumentStudio	InstrumentStudio is automatically installed when you install the NI-DCPower driver on a 64-bit system. You can access InstrumentStudio in any of the following ways: • From the Windows start menu, select National Instruments » [Driver] Soft Front Panel. This launches InstrumentStudio and runs a soft front panel populated with NI-DCPower devices. • From the Windows start menu, select National Instruments » InstrumentStudio. This launches InstrumentStudio and runs a soft front panel populated with devices detected on your system. • From Measurement & Automation Explorer (MAX), select a device and then click Test Panels.... This launches InstrumentStudio and runs a soft front panel for the device you selected.	When you install NI-DCPower on a 64-bit system, you can monitor, control, and record measurements from supported devices using InstrumentStudio. InstrumentStudio is a software-based soft front panel application that allows you to perform interactive measurements on several different device types in a single program.
NI-DCPower Instrument Driver	LabVIEW—Available on the LabVIEW Functions palette at Measurement I/O » NI–DCPower. Examples are available from the Start menu in the National Instruments folder. LabVIEW NXG—Available from the diagram at Hardware Interfaces » Electronic Test » NI–DCPower. Examples are available from the Learning tab in the Examples » Hardware Input and Output folder. LabWindows/CVI—Available at Program Files » IVI Foundation » IVI » Drivers » NI–DCPower. LabWindows/CVI examples are available from the Start menu in the National Instruments folder. C/C++—Available at Program Files » IVI Foundation » IVI. Refer to the **Creating an**	The NI-DCPower API configures and operates the module hardware and performs basic acquisition and measurement functions.

Software	Location	Description
	Application with NI-DCPower in Microsoft Visual C and C++ topic of the **NI DC Power Supplies and SMUs Help** (installed with the NI-DCPower driver software) to manually add all required include and library files to your project. NI-DCPower does not ship with installed C/C++ examples.	

Troubleshooting

If an issue persists after you complete a troubleshooting procedure, search our KnowledgeBase for additional information our technical support engineers create as they answer common user questions and resolve unexpected issues.

What Should I Do if the PXIe-4190 Does Not 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 by right-clicking the Start button, and selecting Device Manager.

5. Verify the PXIe-4190 appears in the Device Manager.

    1. Under an NI entry, confirm that a PXIe-4190 entry appears.

        Note If you are using a PC with a device for PXI remote control system, under System Devices, also confirm that no error conditions appear for the PCI–to–PCI Bridge.

    2. If error conditions appear, reinstall the NI-DCPower driver.

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

The LEDs may not light until the module has been configured in MAX. Before proceeding, verify that the PXIe-4190 appears in MAX.

If the ACCESS LED fails to light after you power on the chassis, a problem may exist with the chassis power rails, a hardware module, or the LED.

> ❗ Notice Apply external signals only while the PXIe-4190 is powered on. Applying external signals while the module is powered off may cause damage.

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

   > ✏️ Note If you are using a PC with a device for PXI remote control system, power on the chassis before powering on the computer.

6. Verify that the module appears in MAX.
7. Reset the module in MAX and perform a self-test.

What Should I Do if the PXIe-4190 Fails the Self-Test?

1. Restart the system.
2. Launch MAX, and perform the self-test again.
3. Power off the chassis.
4. Reinstall the failed module in a different slot.
5. Power on the chassis.
6. Perform the self-test again.

LCR Cables

SHDB13W6-4BNCM-LL Cable

SHDB13W6-4BNCM-LL Cable

The SHDB13W6-4BNCM-LL is a D-SUB to male BNC cable for connecting the PXIe-4190.
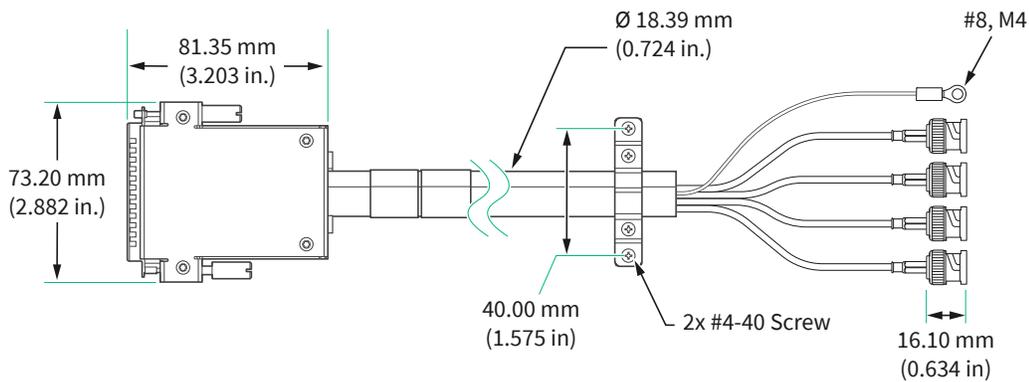
SHDB13W6-4BNCM-LL Cable Pinout
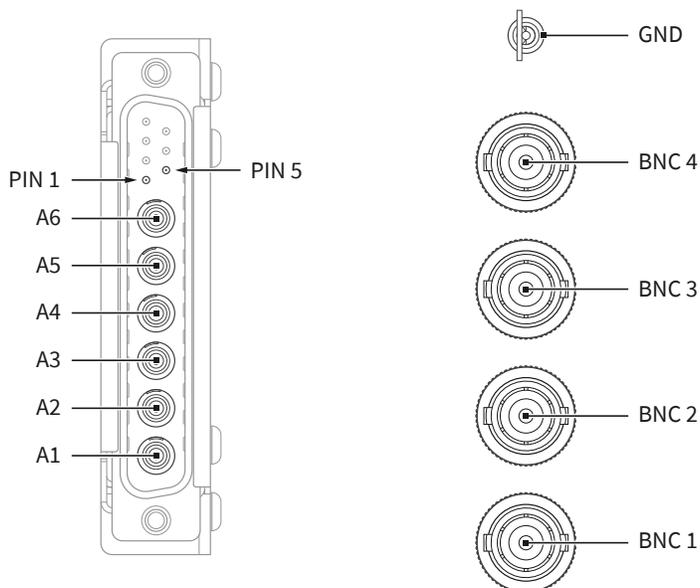
Table 5. Signal Descriptions

Left (D-SUB)	Right (BNC/Ring Terminal)	LCR Mode Functionality	SMU Mode Functionality	BNC Cable Color
PIN 1 to PIN 7	—	General purpose input/output		—
A1 (Inner Conductor)	BNC 1 (Inner Conductor)	LO CUR	HI	Black
A1 (Outer Conductor)	BNC 1 (Outer Conductor)	Isolated Shield	GUARD	
A2 (Inner Conductor)	BNC 2 (Inner Conductor)	LO POT	Sense HI	Gray
A2 (Outer Conductor)	BNC 2 (Outer Conductor)	Isolated Shield	GUARD	
A5 (Inner Conductor)	BNC 3 (Inner Conductor)	HI POT	Sense LO	Orange
A5 (Outer Conductor)	BNC 3 (Outer Conductor)	Isolated Shield		
A6 (Inner Conductor)	BNC 4 (Inner Conductor)	HI CUR	LO	Red
A6 (Outer Conductor)	BNC 4 (Outer Conductor)	Isolated Shield		
Outer Shell	GND	Chassis Ground		Green

Note Isolated Shield and GUARD are electrically equivalent and are allowed to be tied together in SMU mode.

SHDB13W6-4TRIAXM-LL Cable

SHDB13W6-4TriaxM-LL Cable

The SHDB13W6-4TriaxM-LL is a D-SUB to Triaxial cable for connecting the PXIe-4190.
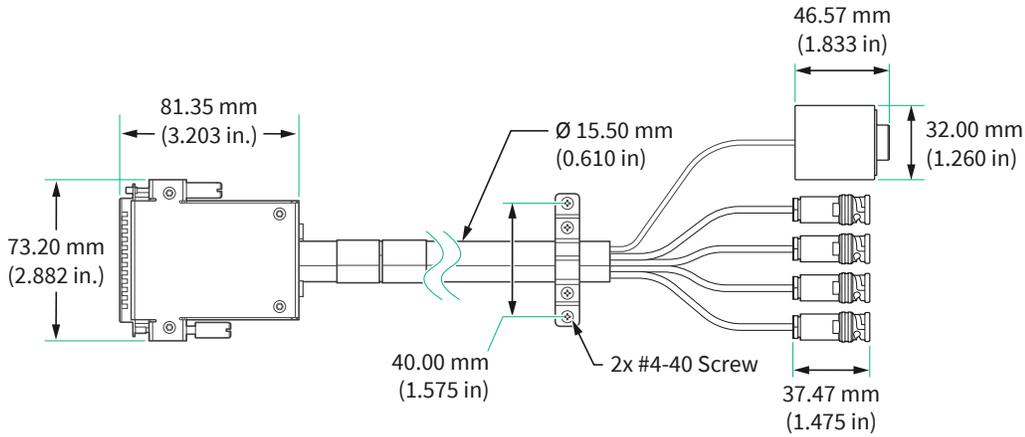
SHDB13W6-4TriaxM-LL Cable Pinout
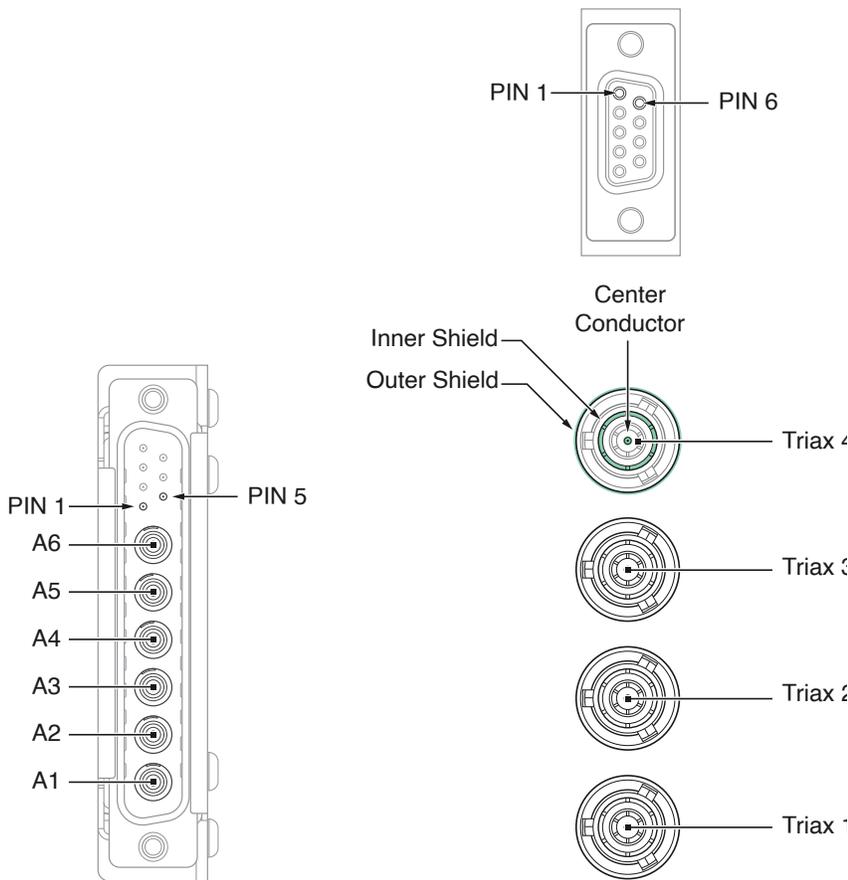
Table 6. Signal Descriptions

Left (D-SUB)	Right (Triax and 9-pin D-SUB)	LCR Mode Functionality	SMU Mode Functionality
PIN 1 to PIN 7	PIN 1 to PIN 7	General Purpose Input/Output	
A1 (Center Conductor)	Triax 1 (Center Conductor)	LO CUR	HI
A1 (Outer Conductor)	Triax 1 (Inner Shield)	Isolated Shield	GUARD
A2 (Center Conductor)	Triax 2 (Center Conductor)	LO POT	Sense HI
A2 (Outer Conductor)	Triax 2 (Inner Shield)	Isolated Shield	GUARD
A5 (Center Conductor)	Triax 3 (Center Conductor)	HI POT	Sense LO
A5 (Outer Conductor)	Triax 3 (Inner Shield)	Isolated Shield	
A6 (Center Conductor)	Triax 4 (Center Conductor)	HI CUR	LO
A6 (Outer Conductor)	Triax 4 (Inner Shield)	Isolated Shield	
Outer Shell	Triax 1 to Triax 4 (Outer Shield)	Chassis Ground	

Note Isolated Shield and GUARD are electrically equivalent and are allowed to be tied together in SMU mode.

SHDB13W6-DB13W6-LL Cable

SHDB13W6-DB13W6-LL Cable

The SHDB13W6-DB13W6-LL is a D-SUB to D-SUB cable for connecting the PXIe-4190.
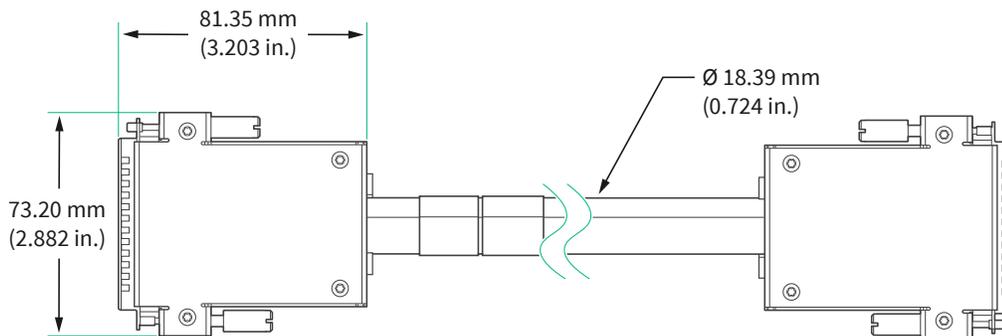
SHDB13W6-DB13W6-LL Cable Pinout
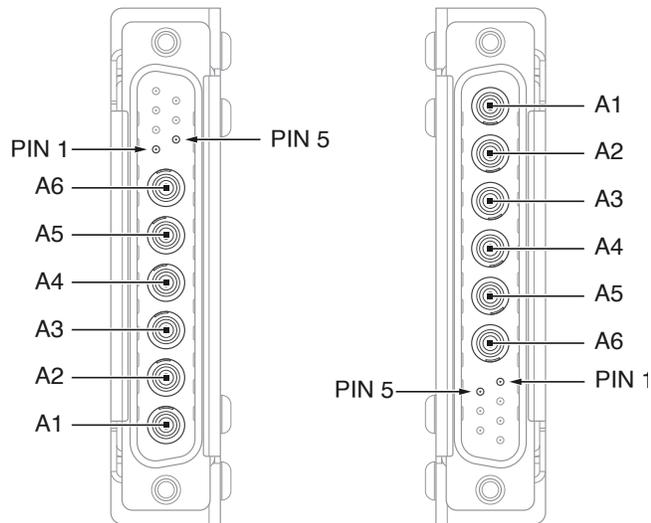
Table 7. Signal Descriptions

Left/Right (D-SUB)	LCR Mode Functionality	SMU Mode Functionality
PIN 1 to PIN 7	General purpose input/output contacts	
A1 (Inner Conductor)	LO CUR	HI
A1 (Outer Conductor)	Isolated Shield	GUARD
A2 (Inner Conductor)	LO POT	Sense HI
A2 (Outer Conductor)	Isolated Shield	GUARD
A3 (Inner Conductor)	CAL SENSE	
A3 (Outer Conductor)	Isolated Shield	
A4 (Inner Conductor)	CAL FORCE	
A4 (Outer Conductor)	Isolated Shield	
A5 (Inner Conductor)	HI POT	Sense LO
A5 (Outer Conductor)	Isolated Shield	
A6 (Inner Conductor)	HI CUR	LO
A6 (Outer Conductor)	Isolated Shield	
Outer Shell	Chassis Ground	

> **Note** Isolated Shield and GUARD are electrically equivalent and are allowed to be tied together in SMU mode.