USER MANUAL

NI roboRIO

RIO Device for Robotics

The NI roboRIO is a portable reconfigurable I/O (RIO) device that is used to design control, robotics, and mechatronics systems.

This document contains pinouts, connectivity information, dimensions, and mounting instructions for the NI roboRIO. The NI roboRIO provides the I/O shown in the following figure and connects to a host computer over USB and 10/100 Ethernet.

Figure 1. NI roboRIO Features
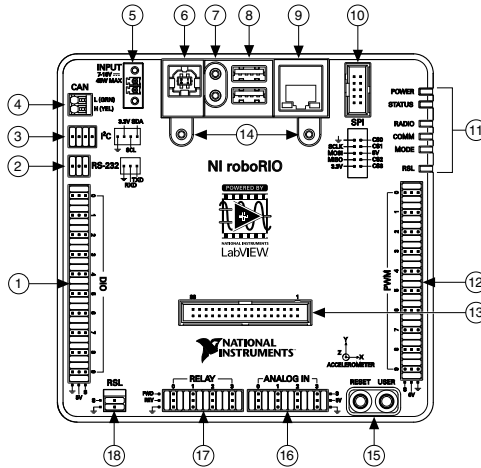
1. Digital input and output (DIO) port
2. RS-232 port
3. I2C port
4. CAN port
5. Power connector
6. USB Device port
7. USB Host retention mount
8. USB Host ports
9. Ethernet port
10. Serial peripheral interface bus (SPI) port
11. LEDs
12. Pulse-width modulation (PWM) port
13. myRIO Expansion Port (MXP)
14. MXP retention mount
15. User and Reset buttons
16. Analog input (AI) port
17. Relay port
18. Robot signal light (RSL) port

Contents

Safety Information

⚠ **Caution** Do not operate the roboRIO in a manner not specified in this document. Product misuse can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way. If the product is damaged, return it to NI for repair.

Clean the product with a soft, nonmetallic brush. Make sure that the product is completely dry and free from contaminants before returning it to service.

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.

Hardware Block Diagram

The following figure shows the arrangement and functions of NI roboRIO components.

Figure 2. NI roboRIO Hardware Block Diagram
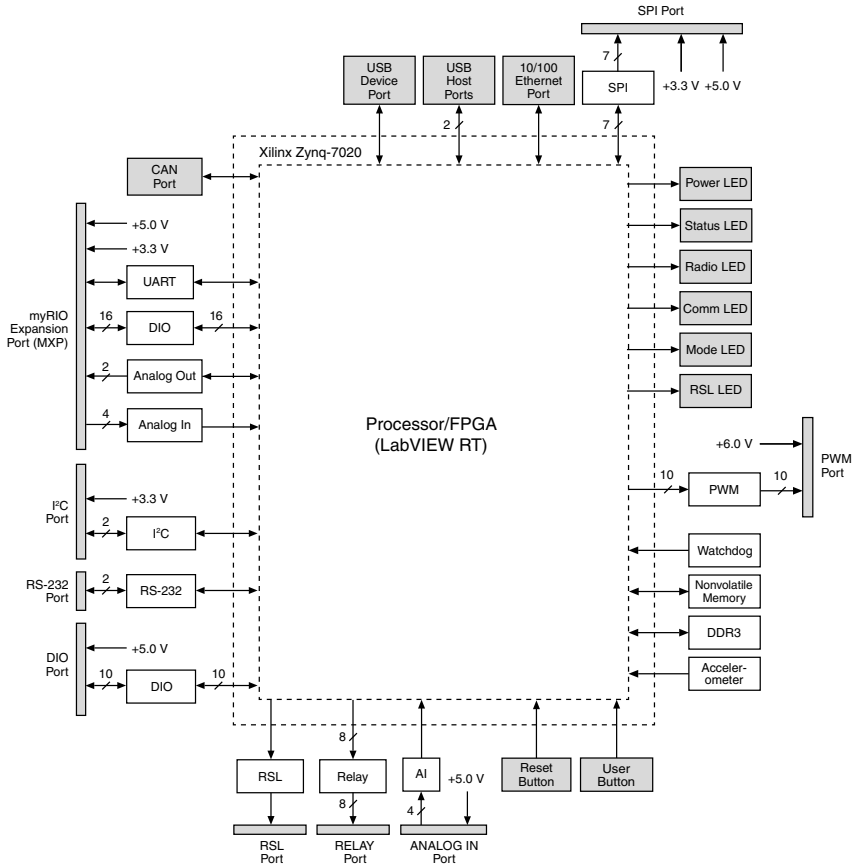
Setting Up the NI roboRIO

Connecting to Power

The NI roboRIO requires an external power supply that meets the specifications in the *Power Requirements* section of the *NI roboRIO Specifications*. The NI roboRIO filters and regulates the supplied power and provides power for all of the I/O and user voltage. The NI roboRIO has one layer of reverse-voltage protection.

Complete the following steps to connect a power supply to the chassis.

1. Ensure that the power supply is turned off.

⚠️ **Caution** Do not install or remove the power connector from the front panel of the NI roboRIO while power is applied.

2. Connect the positive lead of the power supply to the V terminal of the COMBICON power connector shipped with the NI roboRIO, and tighten the terminal screw. The following figure shows the terminal screws, which secure the wires in the screw terminals, and the connector screws, which secure the power connector on the front panel.

Figure 3. NI roboRIO COMBICON Power Connector
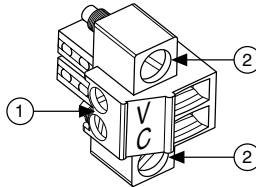
1. Terminal Screws
2. Connector Screws

3. Connect the negative lead of the power supply to the C terminal of the power connector and tighten the terminal screw.

4. Install the power connector on the front panel of the NI roboRIO and tighten the connector screws.

5. Turn on the power supply.

Powering On the Device

The NI roboRIO runs a power-on self test (POST) when you apply power to the device. During the POST, the Power and Status LEDs turn on. When the Status LED turns off, the POST is complete. If the LEDs do not behave in this way when the system powers on, refer to the *LED Indications* section.

Connecting to a Network

Connect the NI roboRIO to an Ethernet network using the Ethernet port. Use a standard Category 5 (CAT-5) or better shielded, twisted-pair Ethernet cable to connect the NI roboRIO to an Ethernet hub, router, or directly to a computer.

⚠️ **Caution** To prevent data loss and to maintain the integrity of your Ethernet installation, do not use a cable longer than 30 m.

The first time you power up the chassis, it attempts to initiate a DHCP network connection. If the chassis is unable to initiate a DHCP connection, it connects to the network with a link-local IP address with the form 169.254.x.x.

User Power

The following table describes the user voltage rails for powering external sensors and peripherals. The rails are independent from the power supplies of internal systems, such as the processor and memory.

Table 1. NI roboRIO Voltage Rails

Voltage Rail	Description
+6 V	Power from PWM ports for use with servos.
+5 V	Power for DIO and AI ports for sensors, and power for the MXP for powering expansion circuits.
+3.3 V	Power for I^2C, SPI, and the MXP.

Input Voltage Brownout Behavior

The NI roboRIO input voltage range is 7 V to 16 V. The input voltage monitoring circuit monitors the voltage on the input voltage pin. When the input voltage drops to between 4.5 V

and 6.8 V, the NI roboRIO enters brownout mode with a staged response, as the following table describes.

Table 2. NI roboRIO Input Voltage Brownout Behavior

Stage	Input Voltage Range	Behavior
1	6.3 V to 6.8 V	The +6 V voltage rail starts to drop.
2	4.5 V to 6.3 V	The NI roboRIO enters a brownout fault condition and the following precautions are taken: • User voltage rails become disabled. • All PWM generation stops at the conclusion of the current cycle. • GPIOs configured as outputs go to High-Z. • Relay control outputs are driven low. • CAN-based motor controllers become disabled. The following systems continue to function normally with valid data and communication: • FPGA, processor, RAM, disk, and user code • USB power and communication • Radio, if powered by USB • Ethernet • CAN • AI and AO • I^2C • SPI • RS-232 serial • LED and RSL status lights Stage 2 continues until the input voltage rises to greater than 7.5 V or drops to less than 4.5 V.
3	Less than 4.5 V	All controller functions cease and the controller state is lost. This condition continues until the input voltage rises to greater than 4.65 V, at which point the controller starts the normal booting sequence. At startup, the controller remains in Stage 2 until the input voltage rises to greater than 7.5 V.

Pinouts

The following describe the pins and signals on the NI roboRIO ports.

MXP

The following figure and table describe the MXP pins and signals. Note that some pins carry both primary and secondary functions.
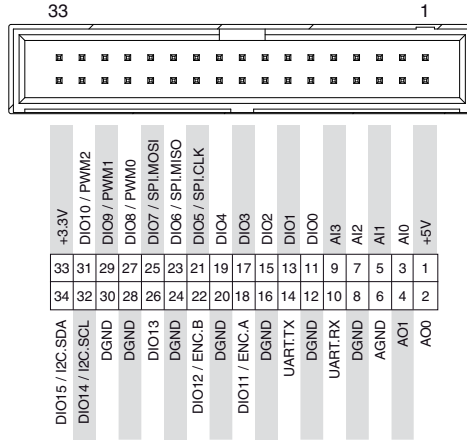
Figure 4. MXP Pinout

Table 3. MXP Signal Descriptions

Signal Name	Reference	Direction	Description
+5V	DGND	Output	+5 V power output.
AI <0..3>	AGND	Input	0 V to 5 V, referenced, single-ended AI channels. Refer to the *AI Channels* section for more information.
AO <0..1>	AGND	Output	0 V to 5 V referenced, single-ended AO. Refer to the *AO Channels* section for more information.
AGND	—	—	Reference for AI and AO.
+3.3V	DGND	Output	+3.3 V power output.
DIO <0..15>	DGND	Input or Output	General-purpose digital lines with 3.3 V output, 3.3 V-/5 V-compatible input. Refer to the *DIO, PWM, and Relay Lines* section for more information.

Table 3. MXP Signal Descriptions (Continued)

Signal Name	Reference	Direction	Description
UART.RX	DGND	Input	UART receive input. UART lines are electrically identical to DIO lines.
UART.TX	DGND	Output	UART transmit output. UART lines are electrically identical to DIO lines.
DGND	—	—	Reference for digital signals, +5 V, and +3.3 V.

CAN Port

The following figure and table describe the CAN port pins and signals.
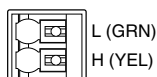
Figure 5. CAN Port Pinout

L (GRN)
H (YEL)

Table 4. CAN Port Signal Descriptions

Signal Name	Direction	Description
L (GRN)	Input/Output	CAN bus differential low signal.
H (YEL)	Input/Output	CAN bus differential high signal.

Note The NI roboRIO contains an internal 120 Ω termination resistor between L (GRN) and H (YEL).

I²C Port

The following figure and table describe the I²C port pins and signals.
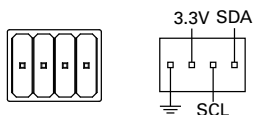
Figure 6. I²C Port Pinout

3.3V SDA

SCL

Table 5. I²C Port Signal Descriptions

Signal Name	Direction	Description
GND	—	Reference for digital lines and +3.3 V power output.
3.3V	Output	+3.3 V power output.
SCL	Input or Output	I²C lines with 3.3 V output, 3.3 V-/5 V-compatible input. Refer to the *I²C Lines* section for more information.
SDA	Input or Output	

RS-232 Port

The following figure and table describe the RS-232 port pins and signals.

Figure 7. RS-232 Serial Port Pinout

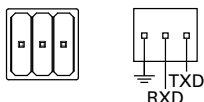**Table 6.** RS-232 Serial Port Signal Descriptions

Signal Name	Direction	Description
TXD	Output	Serial transmit output with ±5 V to ±15 V signal levels. Refer to the *UART and RS-232 Lines* section for more information.
RXD	Input	Serial receive input with ±15 V input voltage range. Refer to the *UART and RS-232 Lines* section for more information.
GND	—	Reference for digital lines.

DIO Port

The following figure and table describe the DIO port pins and signals.
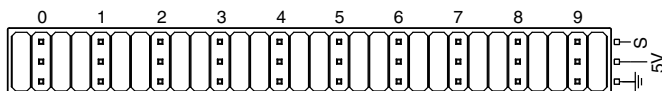
Figure 8. DIO Port Pinout

Table 7. DIO Port Signal Descriptions

Signal Name	Direction	Description
S (DIO) <0..9>	Input/Output	General-purpose digital lines with 3.3 V output, 3.3 V-/5 V-compatible input. Refer to the *DIO, PWM, and Relay Lines* section for more information.
5V	Output	+5 V power output.
GND	—	Reference for digital lines and +5 V power output.

RSL Port

The following figure and table describe the RSL port pins and signals.
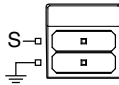
Figure 9. RSL Port Pinout

Table 8. RSL Port Signal Descriptions

Signal Name	Direction	Description
S	Output	Switched power output to drive RSL when RSL is enabled. The voltage level depends on the connected input voltage. RSL current is limited at 120 mA.
GND	—	Reference for S.

Relay Port

The following figure and table describe the Relay port pins and signals.
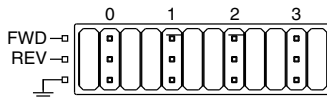
Figure 10. Relay Port Pinout

Table 9. Relay Port Signal Descriptions

Signal Name	Direction	Description
FWD <0..3>	Output	Relay digital lines with 5 V output.
REV <0..3>	Output	Relay digital lines with 5 V output.
GND	—	Reference for digital lines.

AI Port

The following figure and table describe the AI port pins and signals.
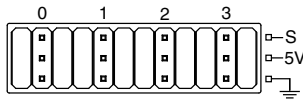
Figure 11. AI Port Pinout

Table 10. AI Port Signal Descriptions

Signal Name	Direction	Description
S (AI) <0..3>	Input	0 V to 5 V referenced, single-ended AI channels. Refer to the *AI Channels* section for more information.
5V	Output	+5 V power output.
GND	—	Reference for AI and +5 V power.

PWM Port

The following figure and table describe the PWM port pins and signals.
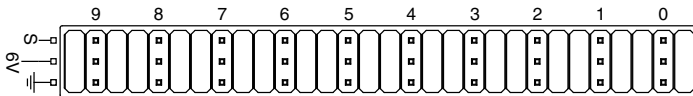
Figure 12. PWM Port Pinout

Table 11. PWM Port Signal Descriptions

Signal Name	Direction	Description
S (PWM) <0..9>	Output	PWM digital lines with 5 V output.
6V	Output	+6 V power output for servos only.
GND	—	Reference for digital lines and +6 V power output.

SPI Port

The following figure and table describe the SPI port pins and signals.
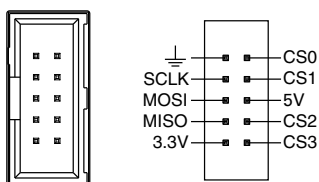
Figure 13. SPI Port Pinout

Table 12. SPI Port Signal Descriptions

Signal Name	Direction	Description
3.3V	Output	+3.3 V power output.
5V	Output	+5 V power output.
CS <0..3>	Output	SPI with 3.3 V output, 3.3 V-/5 V-compatible input. Refer to the *SPI Lines* section for more information.
SCLK	Output	
MOSI	Output	
MISO	Input	
GND	—	Reference for digital lines and +3.3 V and +5.5 V power output.

Signal Ground References

To minimize noise on analog measurement channels, use the ground reference of the corresponding port. For example, when you are using AI, the measurement should reference the GND of the AI port.

Interfaces

AI Channels

The NI roboRIO has AI channels on the MXP and on the AI port. The channels are multiplexed to a single analog-to-digital converter (ADC) that samples all channels.

The MXP and the AI port each has four single-ended AI channels, AI0-AI3, which you can use to measure 0 V to 5 V signals.

✍ **Note** For important information about improving measurement accuracy by reducing noise, visit *ni.com/info* and enter the Info Code analogwiring.

The following figure shows the AI topology of the NI roboRIO.

Figure 14. NI roboRIO AI Circuitry
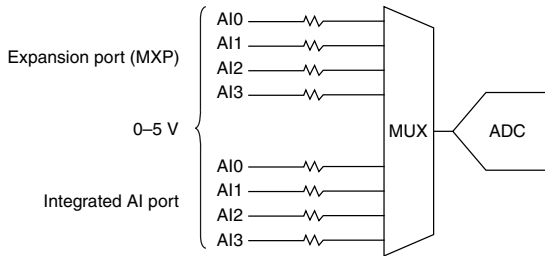
AO Channels

The NI roboRIO MXP has two AO channels, AO0 and AO1, which you can use to generate signals of 0 V to 5 V. Each channel has a dedicated digital-to-analog converter (DAC), which allows all AO channels to update simultaneously. The maximum update rate is specified as an aggregate rate in the *Analog Output* section of the *NI roboRIO Specifications*.

The following figure shows the AO topology of the NI roboRIO.

**Figure 15.** NI roboRIO AO Circuitry
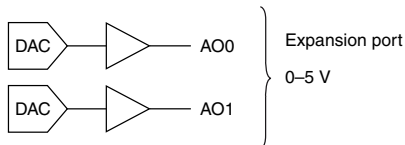
DIO, PWM, and Relay Lines

The NI roboRIO provides the following DIO lines:

- 3.3 V general-purpose DIO lines on the MXP.
- 3.3 V digital lines on the DIO, I²C, and SPI ports.
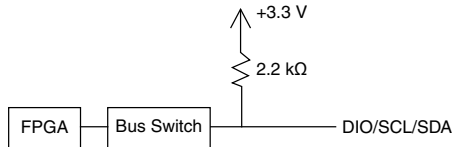- 5 V digital lines on the PWM and Relay ports.

DIO <9..0> on the DIO port, CS <3..0> on the SPI port, and DIO <13..0> on the MXP all have 40 kΩ pullup resistors to 3.3 V, as shown in the following figure.

**Figure 16.** DIO Lines with 40 kΩ Pullup Resistors to 3.3 V
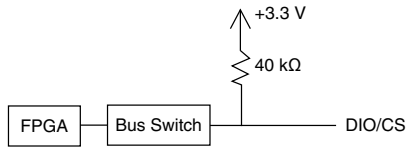
DIO <15..14> on the MXP and the two lines on the I²C port all have 2.2 kΩ pullup resistors to 3.3 V, as shown in the following figure.

Figure 17. DIO Lines with 2.2 kΩ Pullup Resistors to 3.3 V

<SCLK, MOSI, MISO> on the SPI port and the lines on the PWM and Relay ports all have 40 kΩ pulldown resistors to ground, as shown in the following figure.

Figure 18. DIO Lines with 40 kΩ Pulldown Resistors to Ground
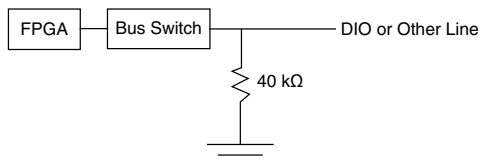
You can program all MXP DIO lines and on-board DIO lines individually as inputs or outputs. Secondary digital functions include SPI, I²C, PWM, and quadrature encoder input. Refer to the NI roboRIO software documentation for information about configuring the behavior of the DIO lines.

When a DIO line is floating, it floats in the direction of the pull resistor. A DIO line may be floating in any of the following conditions:

- When the NI roboRIO device is starting up.
- When the line is configured as an input.
- When the NI roboRIO device is powering down.

You can add a stronger resistor to a DIO line to cause it to float in the opposite direction.

UART and RS-232 Lines

The NI roboRIO has one UART connected to the UART lines on the MXP and one UART connected to the RS-232 port.

The UART lines on the MXP are electrically identical to DIO lines 0 to 13 on the MXP. Like those lines, UART.RX and UART.TX have 40 kΩ pullup resistors to 3.3 V.

The RS-232 lines are compliant with TIA/EIA-232-F voltage levels.

SPI Lines

The SPI port can support up to four devices by using each of the four Chip Select (CS) lines.

I^{2}C Lines

The I^{2}C lines can be used to connect to a network of I^{2}C slave devices.

USB Device Port

You can deploy and debug code by connecting a USB cable from the USB device port on the NI roboRIO to a computer.

USB Host Port

The NI roboRIO USB host port supports the following devices:

- Web cameras that conform to the USB Video Device Class (UVC) protocol.
- Machine vision cameras that conform to the USB3 Vision standard and are backward compatible with the USB 2.0 specification.
- Basler ace USB3 cameras.
- USB Flash drives.
- USB-to-IDE adapters formatted with FAT16 and FAT32 file systems.

LabVIEW usually maps USB devices to the **/ʊ**, **/v**, **/w**, or **/x** drive, starting with the **/ʊ** drive if it is available.

Accelerometer

The NI roboRIO contains a three-axis accelerometer, MMA8452Q. Refer to the *Accelerometer* section of the *NI roboRIO Specifications* for the accelerometer sample rates.

Converting Raw Data Values to Voltage

You can use the following equations to convert raw data values to volts:

$$V = \text{Raw Data Value} \times \text{LSB Weight}$$
$$\text{LSB Weight} = \text{Nominal Range} \div 2^{\text{ADC Resolution}}$$

where

  Raw Data Value is the value returned by reading in the input channel,

  LSB Weight is the value in volts of the increment between data values,

  Nominal Range is the absolute value in volts of the full, peak-to-peak nominal range of the channel,

  and ADC Resolution is the resolution of the ADC in bits (ADC Resolution = 12)

• For AI and AO channels on the MXP,

$$\text{LSB Weight} = 5\,V \div 2^{12} = 1.221\,mV$$
$$\text{Maximum Reading} = 4095 \times 1.221\,mV = 4.999\,V$$

• For the accelerometer,

$$\text{LSB Weight} = 16\,g \div 2^{12} = 3.906\,mg$$
$$\text{Maximum Positive Reading} = +2047 \times 3.906\,mg = +7.996\,g$$

$$\text{Maximum Negative Reading} = -2048 \times 3.906\,mg = -8.000\,g$$

Front Panel Buttons

Reset Button

Pressing and releasing the Reset button restarts the processor and the FPGA.

Pressing and holding the Reset button until the status LED lights (about five seconds) and then releasing the Reset button restarts the processor and the FPGA and forces the NI roboRIO into safe mode. In safe mode, the NI roboRIO launches only the services necessary for updating configuration and installing software.

When the NI roboRIO is in safe mode, you can communicate with it by using the serial lines on the RS-232 serial port. You must configure your serial-port terminal program with the following settings:

• 115,200 bits per second
• Eight data bits
• No parity

- One stop bit
- No flow control

User Button

The User Button produces a logic TRUE when depressed and a logic FALSE when not depressed. The User Button is not debounced in hardware.

LED Indications

📝 **Note** The Radio, Comm, and Mode LEDs do not indicate any specific condition of the device but can be configured to display a set of colors or turned off completely.

Power LED

The Power LED is a dual-color red/green LED that indicates specific conditions, as shown in the following table.

Table 13. Power LED Indications

Color	State	Indication
Off	Off	Power is outside valid input range.
Green	Solid	Power is valid with no fault condition.
Red	Solid	Brownout condition detected. The user rail and outputs are disabled.

Status LED

The Status LED is a single-color yellow LED. The Status LED is off during normal operation. The NI roboRIO runs a power-on self test (POST) when you apply power to the device. During the POST, the Power and Status LEDs turn on. When the Status LED turns off, the POST is complete. The NI roboRIO indicates specific error conditions by flashing the Status LED a certain number of times every few seconds, as shown in the following table.

Table 14. Status LED Indications

Number of Flashes Every Few Seconds	Indication
2	The device has detected an error in its software. This usually occurs when an attempt to upgrade the software is interrupted. Reinstall software on the device.
3	The device is in safe mode.

Table 14. Status LED Indications (Continued)

Number of Flashes Every Few Seconds	Indication
4	The software has crashed twice without rebooting or cycling power between crashes. This usually occurs when the device runs out of memory. Review your LabVIEW Real-Time VI and check the memory usage. Modify the VI as necessary to solve the memory usage issue.
Continuously flashing or solid	The device has detected an unrecoverable error. Contact NI

Radio LED

The Radio LED is a tri-color red/green/yellow LED that indicates specific conditions for a USB-connected radio, as shown in the following table.

Table 15. Radio LED Indications

Color	State	Indication
Off	Off	Green and Red disabled.
Green	Solid	Green enabled.
Red	Solid	Red enabled.
Yellow	Solid	Green and Red enabled.

Note   Other LED states may indicate other, undetermined radio issues or failures. This LED is undefined if a USB radio is not used.

Comm LED

The Comm LED is a tri-color red/green/yellow LED that indicates robot communication conditions, as shown in the following table.

Table 16. Comm LED Indications

Color	State	Indication
Off	Off	Green and Red disabled.
Green	Solid	Green enabled.
Red	Solid	Red enabled.
Yellow	Solid	Green and Red enabled.

Mode LED

The Mode LED is a tri-color red/green/yellow LED that indicates the mode of the NI roboRIO outputs, as shown in the following table.

Table 17. Mode LED Indications

Color	State	Indication
Off	Off	Green and Red disabled.
Green	Solid	Green enabled.
Red	Solid	Red enabled.
Yellow	Solid	Green and Red enabled.

RSL (Safety) LED

The RSL LED is a single-color yellow LED that functions identically to the RSL, which is an external indicator connected to the NI roboRIO using a dedicated connector, and indicates specific conditions, as shown in the following table.

Table 18. RSL LED Indications

Color	State	Indication
Off	Off	RSL disabled.
Yellow	Solid	RSL enabled.

Physical Dimensions

The following figures describe the physical dimensions of the NI roboRIO enclosure and its features.

Figure 19. NI roboRIO Dimensions, Primary Side
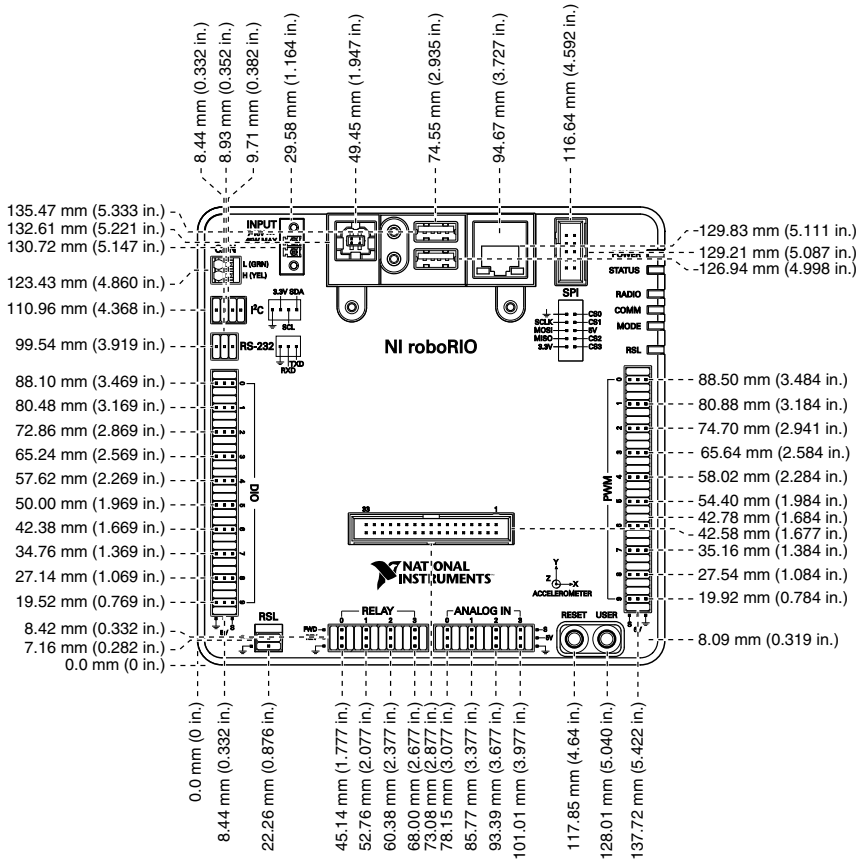
Figure 20. NI roboRIO Dimensions, Primary Side LEDs

143.68 (5.657 in.)

143.18 mm (5.637 in.)

128.51 mm (5.059 in.)
123.51 mm (4.862 in.)
116.01 mm (4.567 in.)
111.01 mm (4.370 in.)
106.01 mm (4.173 in.)
98.51 mm (3.878 in.)

0.0 mm (0 in.)

0.0 mm (0 in.)

146.15 mm (5.754 in.)
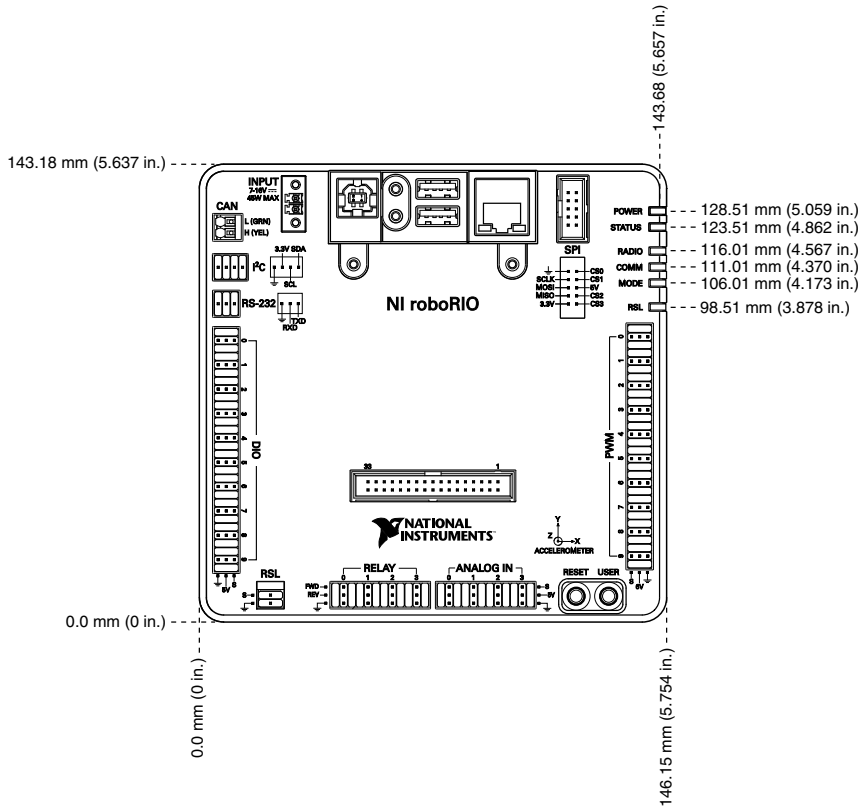
Figure 21. NI roboRIO Dimensions, Secondary Side

142.31 mm (5.603 in.)

3.84 mm (0.151 in.)

4-40 Screw Insert

135.09 mm (5.319 in.)

122.39 mm (4.819 in.)

20.79 mm (0.819 in.)

8.09 mm (0.319 in.)

0.0 mm (0 in.)

123.88 mm (4.877 in.)

22.28 mm (0.877 in.)

0.0 mm (0 in.)
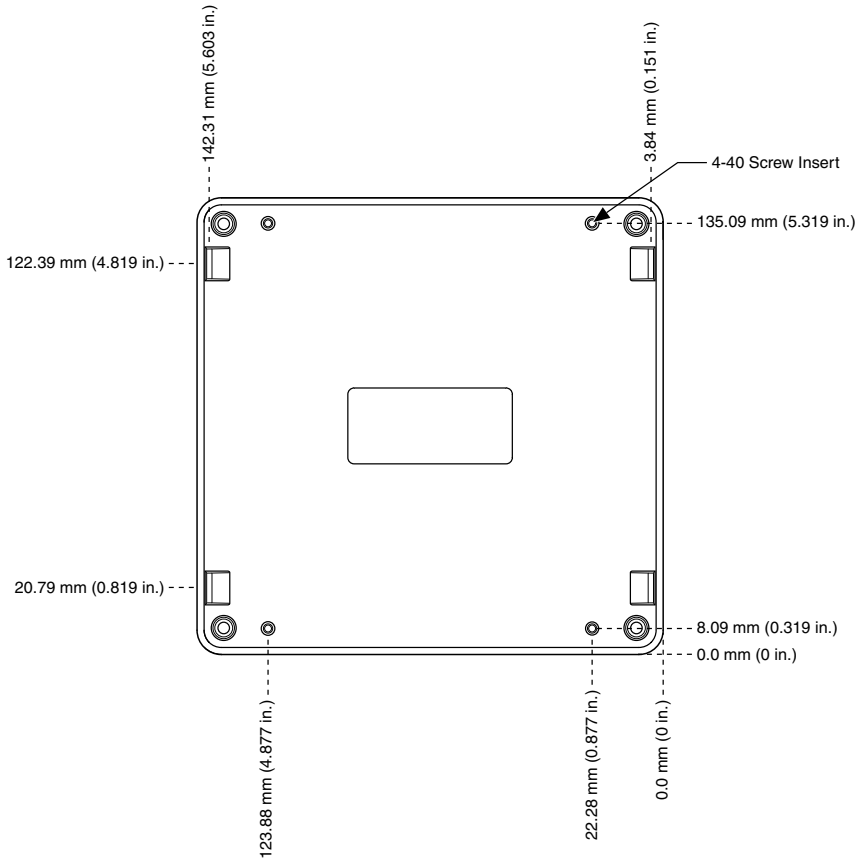
Figure 22. NI roboRIO Dimensions, Side

34.43 mm (1.355 in.)

32.19 mm (1.267a in.)

22.76 mm (0.896 in.)

20.91 mm (0.823 in.)

6.03 mm (0.238 in.)

5.71 mm (0.225 in.)

0.0 mm (0 in.)

0.0 mm (0 in.)

13.59 mm (0.535 in.)

20.79 mm (0.819 in.)

122.39 mm (4.819 in.)

129.59 mm (5.102 in.)
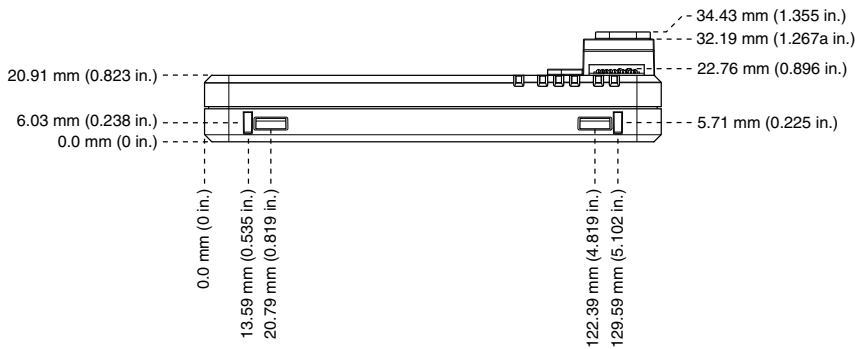
Mounting the NI roboRIO

You can mount the NI roboRIO in the following ways:

- Using cable ties to secure one edge of the NI roboRIO to perfboard with 6.35 mm (0.25 in.) diameter holes on 12.7 mm (0.5 in.) straight centers, such as AndyMark part number am-0836.
- Using cable ties to secure one corner of the NI roboRIO to perfboard.
- Using screws to secure the bottom of the NI roboRIO to a metal plate.

Method One: Using Cable Ties to Secure One Edge of the NI roboRIO to Perfboard

The following figures show how to secure one edge of the NI roboRIO to perfboard.

Figure 23. Step 1 to Secure One Edge of the Device
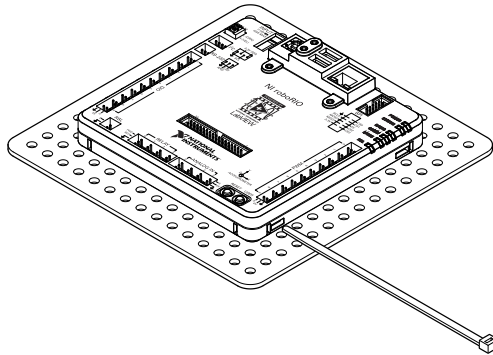
**Figure 24.** Step 2 to Secure One Edge of the Device
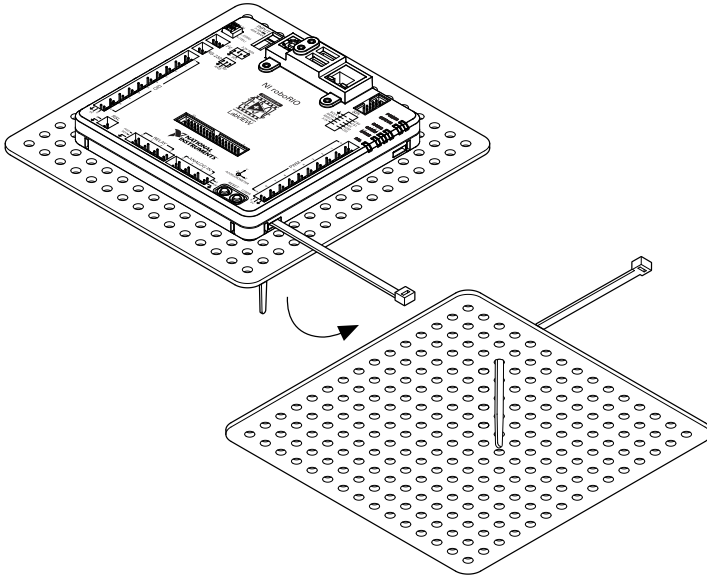
**Figure 25.** Step 3 to Secure One Edge of the Device
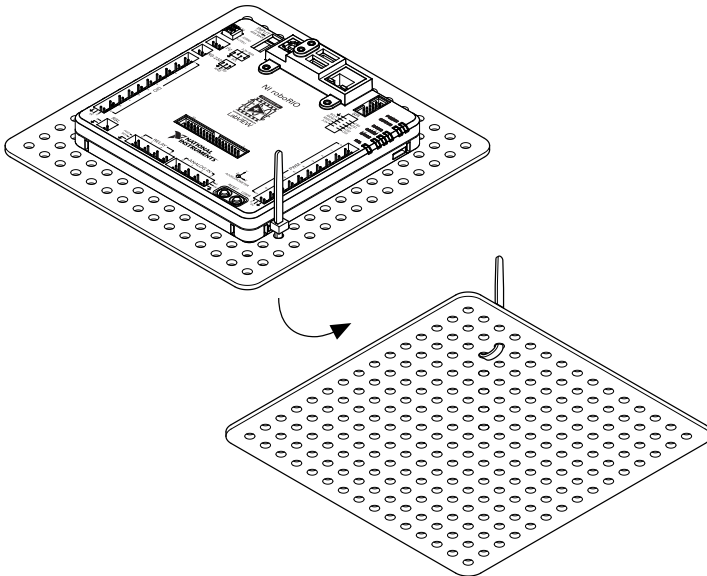
Figure 26. Step 4 to Secure One Edge of the Device
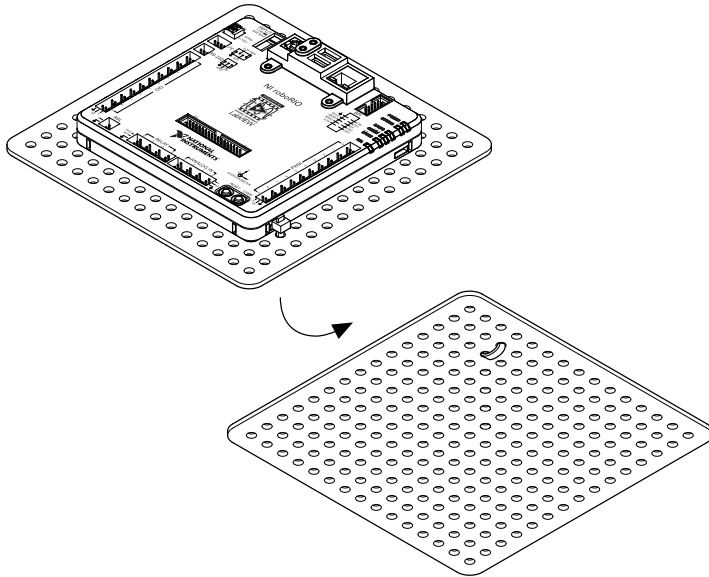
Method Two: Using Cable Ties to Secure One Corner of the NI roboRIO to Perfboard

The following figures show how to secure one corner of the NI roboRIO to perfboard.

Figure 27. Step 1 to Secure One Corner of the Device
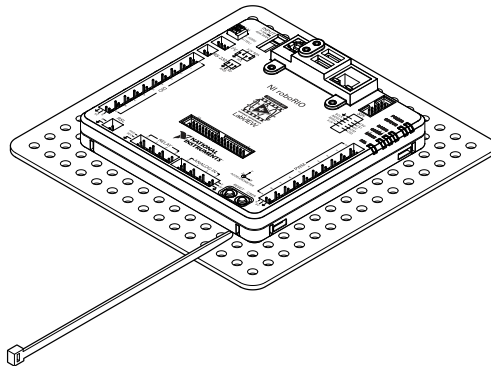
Figure 28. Step 2 to Secure One Corner of the Device
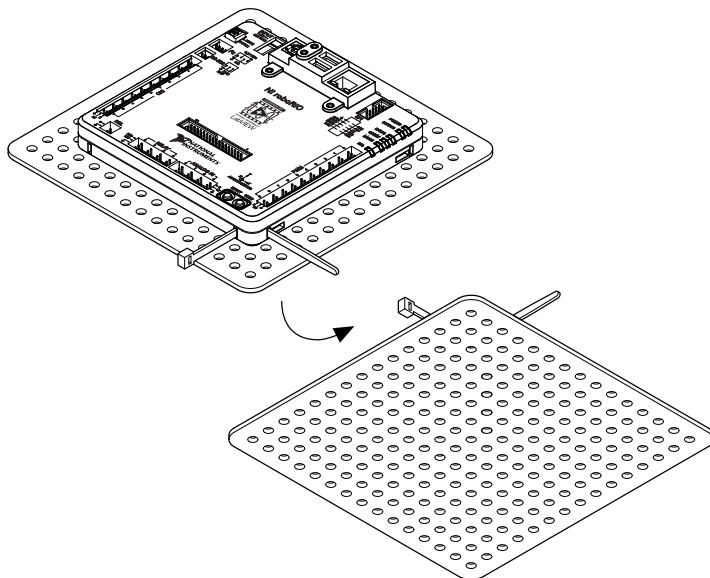
Figure 29. Step 3 to Secure One Corner of the Device
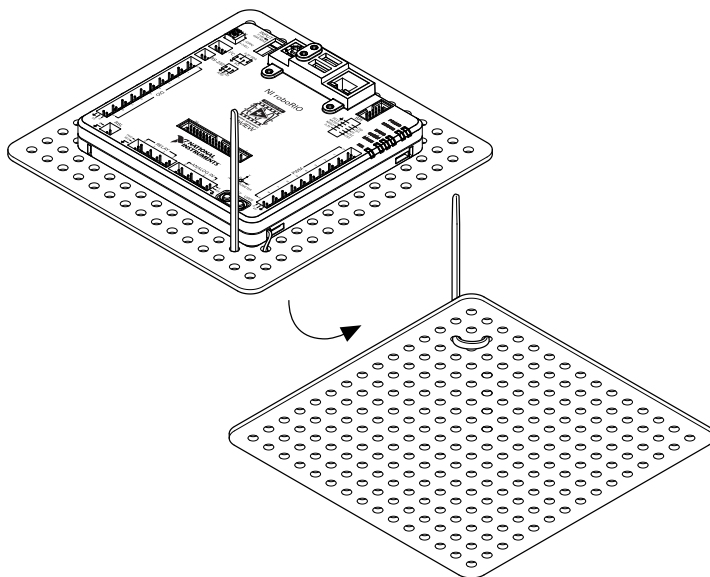
**Figure 30.** Step 4 to Secure One Corner of the Device
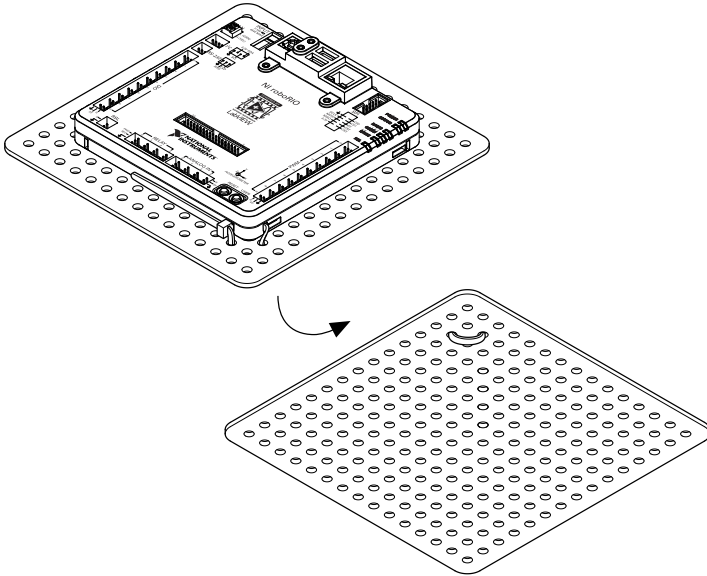
Figure 31. Step 5 to Secure One Corner of the Device
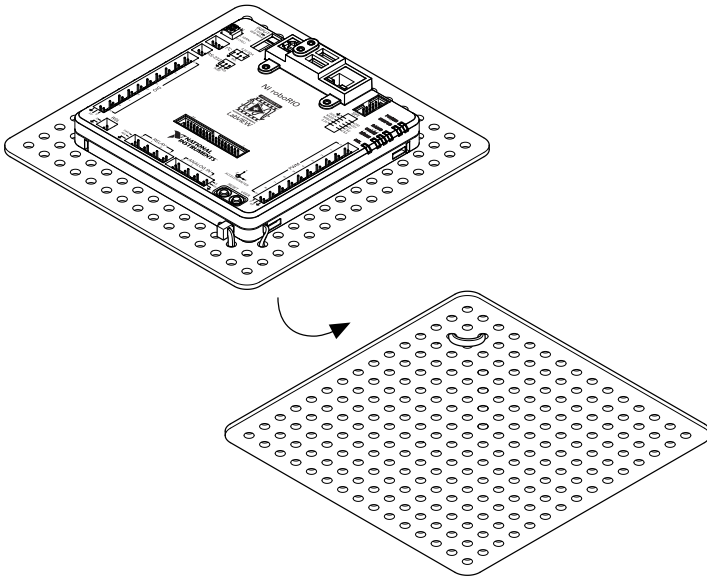
Method Three: Using Screws to Secure the Bottom of the NI roboRIO to a Metal Plate

The following figure shows how to secure the bottom of the NI roboRIO to a metal plate using the built-in 4-40 screw holes. The length of the screws required depends on the thickness of the plate you use. For example, if the plate is 4.76 mm (0.188 in.) thick, the recommended screw length is 7.94 mm (0.313 in.).

Figure 32. Mounting NI roboRIO Using Screws
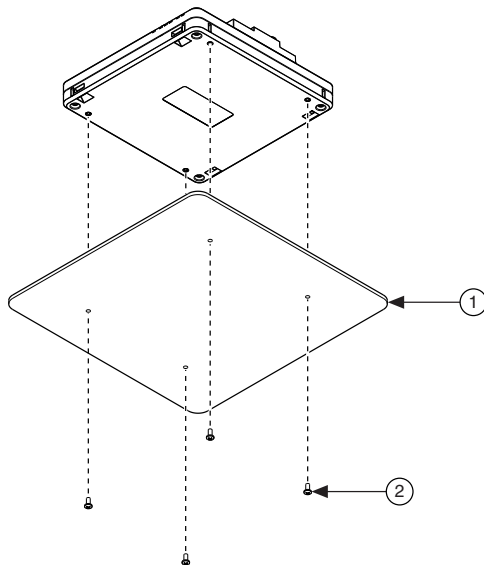
1. Metal Mounting Plate
2. 4-40 Screws x 4

Compatible USB and Ethernet Cables

The following table lists the USB and Ethernet cables available from NI that you can use with the NI roboRIO.

Table 19. Compatible USB and Ethernet Cables Available from NI

Cable	Description	NI Part Number
USB cable	USB 2.0 A/B, black, 1 m	192256A-01
Peripheral USB cable	USB 2.0 A/A, locking, black, 2 m	152166A-02
Ethernet cable	CAT-5E, thin profile, 2 m	151733A-02

⚠ **Caution** To ensure the specified EMC performance, the maximum length for DIO, RS-232, I^{2}C, CAN, SPI, PWM, AI, Relay, and RSL signal wires is 2.0 m (6.56 ft). The maximum length for USB cables is 5.0 m (16.40 ft). The maximum length for Ethernet cables is 30.0 m (98.43 ft).

Warranty

For customers other than private individual users in the EU: The NI roboRIO is warranted against defects in materials and workmanship for a period of three years from the date of shipment, as evidenced by receipts or other documentation. NI will, at its option, repair or replace equipment that proves to be defective during the warranty period. This warranty includes parts and labor.

For private individual users in the EU: Based on your statutory rights, NI will—through its distributor—cure defects in materials and workmanship within two years from delivery.

Worldwide Support and Services

The National Instruments 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 National Instruments product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

A Declaration of Conformity (DoC) is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electromagnetic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting *ni.com/certification*. If your product supports calibration, you can obtain the calibration certificate for your product at *ni.com/calibration*.

National Instruments corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. National Instruments also has offices located around the world. For telephone support in the United States, create your service request at *ni.com/support* or dial 1 866 ASK MYNI (275 6964). For telephone support outside the United States, visit the *Worldwide Offices* section of *ni.com/niglobal* to access the branch office websites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.