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USER MANUAL

IC-317x

Industrial Controller with Reconfigurable I/O

This document describes the features of the National Instruments IC-317x and contains information about mounting and operating the device.

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IC-3171, IC-3172, and IC-3173

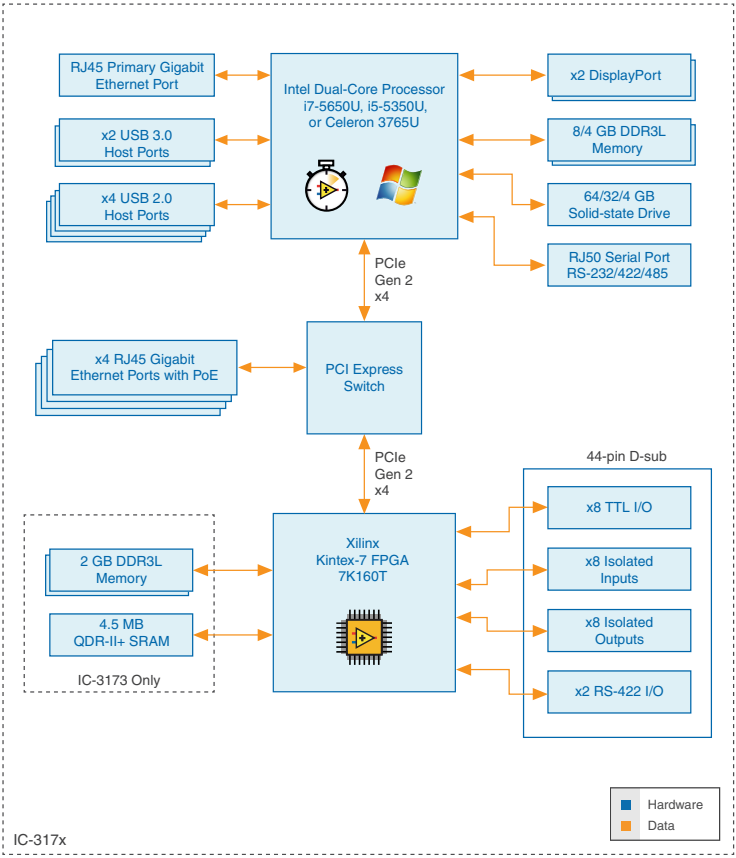
The following information applies to the IC-3171, IC-3172, and IC-3173.

About the IC-317x

The IC-317x is a high-performance, small, fanless embedded computer designed for rugged industrial applications. The IC-317x also provides multiple digital input/output (I/O) options for communicating with external devices.

NATIONAL INSTRUMENTS

Figure 1. IC-317x Block Diagram

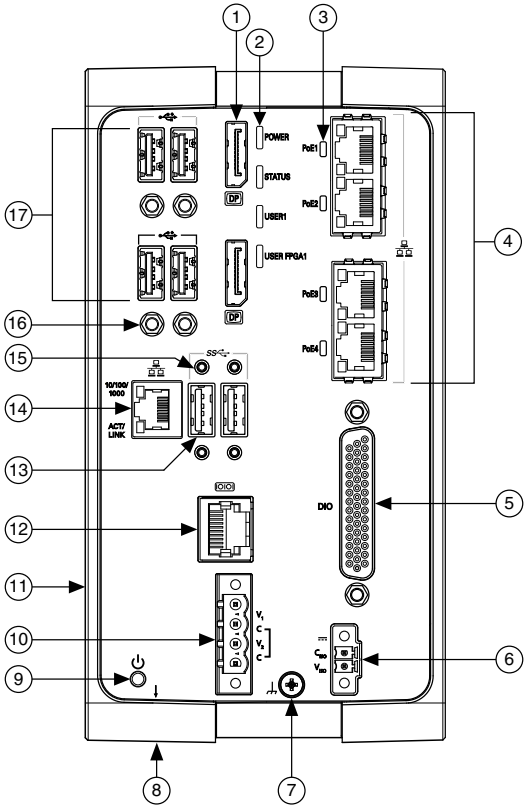


Hardware Overview

The IC-317x front panel consists of four Gigabit Ethernet ports with Power over Ethernet (PoE), one RS-232/RS-485 serial port, one standard Gigabit Ethernet Port, two USB 3.0 ports, four USB 2.0 ports, and two DisplayPort connectors.

The IC-317x front panel also includes LEDs for communicating system status and a 44-pin Digital I/O port. The Digital I/O port offers 8 isolated inputs, 8 isolated outputs, 2 bidirectional differential I/O (RS-422) or single-ended input lines that can be used with a quadrature encoder, and 8 bidirectional TTL lines.

Figure 2. IC-317x Front Panel



1. DisplayPort Connectors
2. LED Indicators
3. Power over Ethernet (PoE) LED Indicators
4. Gigabit Ethernet Ports with PoE
5. 44-pin Digital I/O Connector
6. Isolated Power Input Connector
7. Chassis Grounding Screw
8. Reset Button (not pictured)
9. Power Button
10. System Power Connector
11. User-Accessible Battery Compartment (not pictured)
12. RS-232/RS-485 Serial Port
13. USB 3.0 Ports
14. Primary Gigabit Ethernet Port
15. Retention Mounts for USB 3.0 Ports
16. Retention Mounts for USB 2.0 Ports
17. USB 2.0 Ports

Connector Pinouts

The IC-317x provides the following connectors.

DisplayPort

Use the DisplayPort connectors to connect one or more monitors to implement a local HMI for your controller. You can develop a single real-time VI to use for both your user interface and system logic. For more information, refer to the *Using the Embedded UI to Access RT Target*

VIs topic in the *LabVIEW Help*. For up-to-date information about supported NI cables and accessories, refer to the pricing section of the product page at *ni.com*.

Use an appropriate adapter cable to connect a DisplayPort connector to a VGA or DVI connector. The following figure lists the DisplayPort pins and signals.

Figure 3. DisplayPort Connector Pin Locations (IP20)

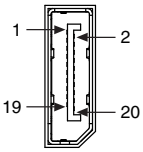


Table 1. DisplayPort Connector Pin Descriptions

Pin	Signal Name
1	ML_Lane0(p)
2	GND
3	ML_Lane0(n)
4	ML_Lane1(p)
5	GND
6	ML_Lane1(n)
7	ML_Lane2(p)
8	GND
9	ML_Lane2(n)
10	ML_Lane3(p)
11	GND
12	ML_Lane3(n)
13	CONFIG1
14	CONFIG2
15	AUX CH (p)
16	GND
17	AUX CH (n)
18	Hot Plug Detect

Table 1. DisplayPort Connector Pin Descriptions (Continued)

Pin	Signal Name
19	Return
20	DP_PWR

Ethernet Ports

The IC-317x provides one standard Gigabit Ethernet network port and four Gigabit Ethernet ports with Power over Ethernet (PoE). The Ethernet ports provide a connection between the IC-317x, a network, and other Ethernet devices. The IC-317x automatically detects the speed of the connection and configures itself accordingly.

If a PoE-capable device is plugged into an Ethernet port with PoE, the IC-317x automatically supplies power to the device. When the IC-317x supplies PoE, the LED that corresponds to the port illuminates. When you unplug a PoE device, PoE is automatically disabled. You can use non-PoE Ethernet devices with PoE-enabled Gigabit Ethernet ports.

A CAT 5e or CAT 6 1000Base-T Ethernet cable is required to achieve 1,000 Mbps (Gigabit) Ethernet performance. CAT 5 Ethernet cables are not guaranteed to meet the necessary requirements. While CAT 5 cables may appear to work at 1,000 Mbps, CAT 5 cables can cause bit errors, resulting in degraded or unreliable network performance.

(Windows only) The network Ethernet port provides Wake-on-LAN functionality from the power off state when associated with the Intel® driver. Wake-on-LAN must be enabled in the Power Management tab of the Intel I210 Gigabit Network Connection Properties dialog for the primary Ethernet port in Device Manager. The NI GigE Vision driver (NI-GEV) does not support Wake-on-LAN. The Ethernet ports with PoE do not support Wake-on-LAN.

Figure 4. Ethernet Port Pin Locations (IP20)

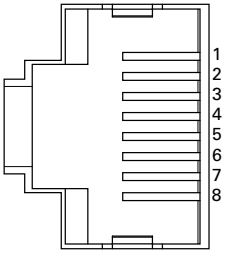


Table 2. Ethernet Port Pin Descriptions

Pin	Fast Ethernet (100 Mbps)	Gigabit Ethernet	
		MDI	MDI-X
1	TX+	BI_DA+	BI_DB+
2	TX-	BI_DA-	BI_DB-
3	RX+	BI_DB+	BI_DA+
4	No Connect	BI_DC+	BI_DD-
5	No Connect	BI_DC-	BI_DD-
6	RX-	BI_DB-	BI_DA-
7	No Connect	BI_DD+	BI_DC+
8	No Connect	BI_DD-	BI_DC-

Digital I/O

The 44-pin Digital I/O port on the IC-317x offers 8 isolated inputs, 8 isolated outputs, 2 bidirectional differential inputs (RS-422) or single-ended input lines that can be used with a quadrature encoder, and 8 bidirectional TTL lines. The Digital I/O port can be connected to any appropriate shielded device or connector block using a shielded cable.

NI recommends the following digital I/O cables for the IC-317x.

Cable	Part Number
44-pin D-sub male to pigtail cable	156083-03 for 3 meter cable
44-pin D-sub male to 44-position D-sub female cable	156084-03 for 3 meter cable
	156084-0R5 for 0.5 meter cable

Refer to the following image and table for pin locations and descriptions.

Figure 5. 44-pin Digital I/O Connector Pin Locations (IP20)

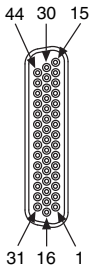


Table 3. Digital I/O Pin Descriptions

Pin Number	Signal	Description
1	Diff 0+	Bidirectional RS-422 I/O (positive side), or quadrature encoder phase A+
2	GND	Digital ground reference for TTL and differential I/O
3	TTL 0	Bidirectional TTL I/O
4	TTL 1	Bidirectional TTL I/O
5	GND	Digital ground reference for TTL and differential I/O
6	TTL 2	Bidirectional TTL I/O
7	TTL 3	Bidirectional TTL I/O
8	GND	Digital ground reference for TTL and differential I/O
9	Diff 1+	Bidirectional RS-422 I/O (positive side), or quadrature encoder phase B+
10	V_{ISO}	Isolated power voltage reference output
11	C_{ISO}	Common ground reference for isolated inputs and outputs
12	Iso Out 0	General purpose isolated input
13	Iso Out 1	General purpose isolated input
14	C_{ISO}	Common ground reference for isolated inputs and outputs
15	Iso Out 4	General purpose isolated output
16	Diff 0-	Bidirectional RS-422 I/O (negative side), or quadrature encoder phase A-
17	GND	Digital ground reference for TTL and differential I/O
18	TTL 4	Bidirectional TTL I/O
19	TTL 5	Bidirectional TTL I/O
20	GND	Digital ground reference for TTL and differential I/O
21	TTL 6	Bidirectional TTL I/O
22	TTL 7	Bidirectional TTL I/O
23	GND	Digital ground reference for TTL and differential I/O
24	Diff 1-	Bidirectional RS-422 I/O (negative side), or quadrature encoder phase B-
25	V_{ISO}	Isolated power voltage reference output

Table 3. Digital I/O Pin Descriptions (Continued)

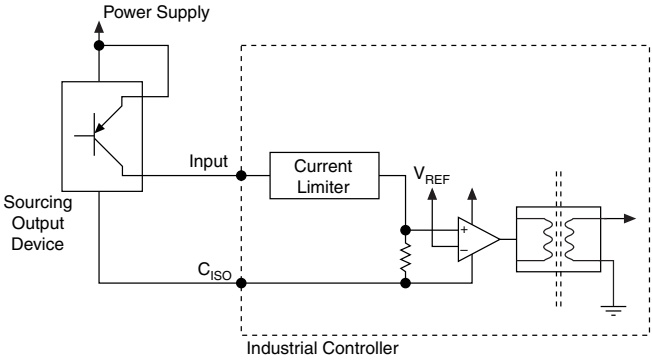
Pin Number	Signal	Description
26	C_{ISO}	Common ground reference for isolated inputs and outputs
27	Iso Out 2	General purpose isolated output
28	Iso Out 3	General purpose isolated output
29	C_{ISO}	Common ground reference for isolated inputs and outputs
30	Iso Out 5	General purpose isolated output
31	Iso In 0	General purpose isolated input
32	iso In 1	General purpose isolated input
33	C_{ISO}	Common ground reference for isolated inputs and outputs
34	Iso In 2	General purpose isolated input
35	Iso In 3	General purpose isolated input
36	C_{ISO}	Common ground reference for isolated inputs and outputs
37	Iso In 4	General purpose isolated input
38	Iso In 5	General purpose isolated input
39	C_{ISO}	Common ground reference for isolated inputs and outputs
40	Iso In 6	General purpose isolated input
41	Iso In 7	General purpose isolated input
42	C_{ISO}	Common ground reference for isolated inputs and outputs
43	Iso Out 6	General purpose isolated output
44	Iso Out 7	General purpose isolated output

Wiring an Isolated Input

You can wire an isolated input to a sourcing output device.

Caution Do not allow the voltage on the isolated inputs to exceed 30 VDC. Doing so will damage the IC-317x.

Figure 6. Connecting an Isolated Input to a Sourcing Output Device



Wiring an Isolated Output

The digital isolated output circuits source current to external loads.

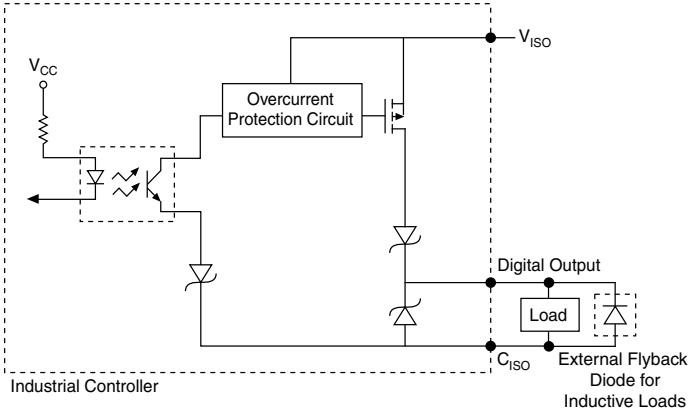
When an inductive load, such as a relay or solenoid, is connected to an output, a large counter-electromotive force may occur at switching time due to energy stored in the inductive load. This flyback voltage can damage the outputs and the power supply.

To limit flyback voltages at the inductive load, install a flyback diode across the load. Mount the flyback diode as close to the load as possible. Use this protection method if you connect any of the isolated outputs on the IC-317x to an inductive load.

The following image shows an example of an isolated output wired to an external load with a flyback diode installed across the load.

Caution Do not draw more than 35 mA from each isolated output when V_{ISO} is 5 V. Do not draw more than 80 mA from each isolated output when V_{ISO} is 24 V.

Figure 7. Connecting an Isolated Output to an External Load



Connecting to Differential I/O

The IC-317x accepts differential (RS-422) line driver inputs. Each of the two differential I/O can be configured as an output. Use shielded cables for all applications. Unshielded cables are more susceptible to noise and can corrupt signals.

Figure 8. Quadrature Encoder/RS-422 Input/Output Circuit

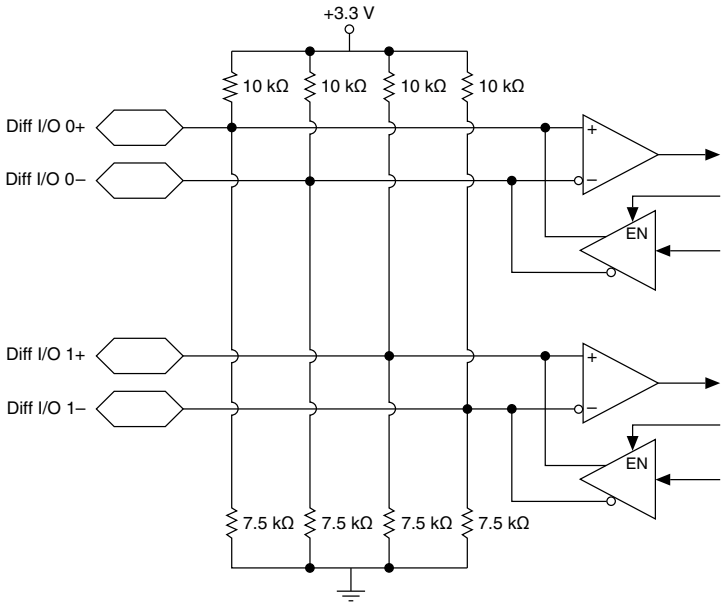


Figure 9. Connecting Differential Line Drivers

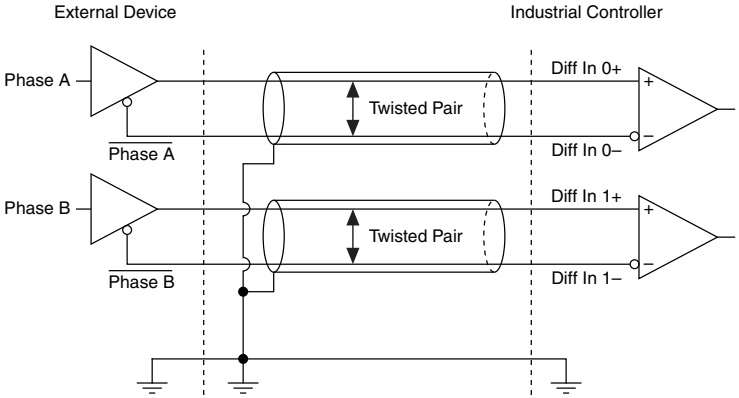
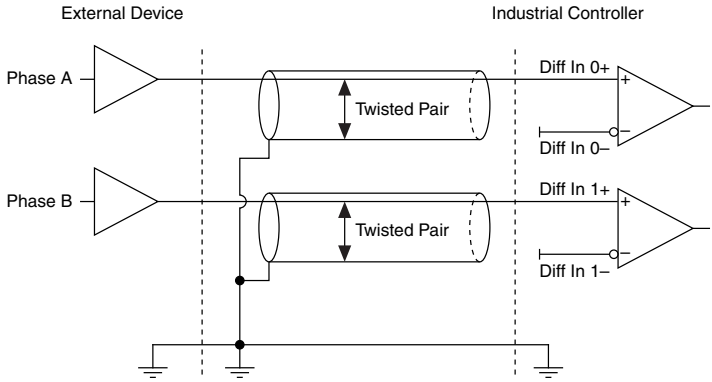


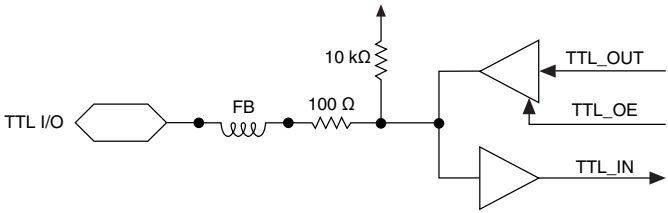
Figure 10. Connecting Single-Ended Line Drivers



TTL I/O

The following image shows the circuit for a bidirectional TTL I/O.

Figure 11. TTL Input/Output Circuit



Power Input Connectors

The IC-317x requires a power supply to power the system and, if you want to use the isolated outputs, a power supply to power the isolated outputs.

Table 4. System Power Connector Terminals

Terminal	Description
V_1	System power (9-30 VDC)
C	Common signal
V_2	System power (9-30 VDC)

Table 5. Isolated Power Connector Terminals

Terminal	Description
C_{ISO}	Isolated common signal
V_{ISO}	Power for isolated outputs (4.5 to 30 VDC)

Chassis Grounding Screw

Use the grounding screw to connect the chassis to earth ground. An earth ground connection is optional.

RS-485/422/232 Serial Port

The IC-317x has a single serial port that can operate in either RS-485/422 mode or RS-232 mode. Set the serial port mode in the BIOS setup utility.

The serial port is a 10-position RJ50 modular jack, which can connect to serial devices, such as PLCs, scanners, and lighting devices.

NI recommends the following serial cables for the IC-317x.

Cable	Part Number
RJ50 10-position modular plug to DB-9 serial cable	182845-01 for 1 meter cable
	182845-02 for 2 meter cable
	182845-03 for 3 meter cable

Figure 12. RS-485/422/232 Serial Port Pin Locations (IP20)

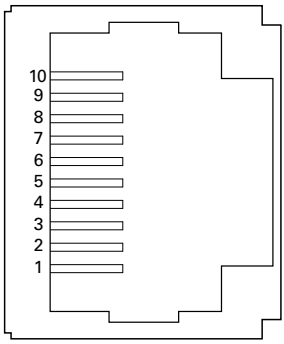


Table 6. RS-485/422/232 Serial Port Pin Descriptions

Pin	RS-485/422 Mode	RS-232 Mode
1	No Connect	No Connect
2	TXD-	Unused
3	TXD+	Unused
4	No Connect	No Connect
5	No Connect	No Connect
6	RXD-	GND
7	RXD+	Unused
8	Unused	TXD
9	Unused	RXD
10	GND	Unused

Related Information

Serial Port Configuration Submenu on page 53
Serial Port Configuration Submenu on page 53

USB 3.0 Ports

The USB ports support common USB peripheral devices such as USB flash drives, USB hard drives, USB-to-IDE adapters, keyboards, mice, and USB cameras.

LabVIEW Real-Time usually maps USB mass-storage devices to the /U, /V, /W, or /X drive, starting with the /U drive if it is available. Refer to the *LabVIEW Help* for more information.

LabVIEW Real-Time usually maps USB mass-storage devices to the /U, /V, /W, or /X drive, starting with the /U drive if it is available. Refer to the *LabVIEW Help* for more information.

Figure 13. USB 3.0 Port Pin Locations (IP20)

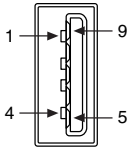


Table 7. USB 3.0 Port Pin Descriptions

Pin	Signal Name	Signal Description
1	VBUS	Cable Power (+5 VDC)
2	D-	USB Data -
3	D+	USB Data +
4	GND	Ground for power return
5	StdA_SSRX-	SuperSpeed receiver differential pair
6	StdA_SSRX+	
7	GND_DRAIN	Ground for signal return
8	StdA_SSTX-	SuperSpeed transmitter differential pair
9	StdA_SSTX+	

USB 2.0 Ports

The USB ports support common USB peripheral devices such as USB flash drives, USB hard drives, USB-to-IDE adapters, keyboards, mice, and USB cameras.

LabVIEW Real-Time usually maps USB mass-storage devices to the /U, /V, /W, or /X drive, starting with the /U drive if it is available. Refer to the *LabVIEW Help* for more information.

LabVIEW Real-Time usually maps USB mass-storage devices to the /U, /V, /W, or /X drive, starting with the /U drive if it is available. Refer to the *LabVIEW Help* for more information.

Figure 14. USB 2.0 Pin Locations (IP20)

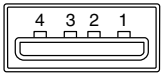


Table 8. USB 2.0 Port Pin Descriptions

Pin	Signal Name	Signal Description
1	VBUS	Cable Power (+5 VDC)
2	D-	USB Data -
3	D+	USB Data +
4	GND	Ground for power return

LED Indicators

The LED indicators are located on the front panel of the device. The IC-317x provides the following LED indicators.

POWER LED

The following table lists the POWER LED indications.

Table 9. POWER LED Indications

LED Color	LED Pattern	Indication
Green	Solid	The IC-317x is powered from the V1 input.
Yellow	Solid	The IC-317x is powered from the V2 input.
—	Off	The IC-317x is powered off.

STATUS LED

The following table describes the STATUS LED indications.

Table 10. STATUS LED Indications

LED Color	LED State	Indication
Yellow	OFF	The IC-317x initialized successfully and is ready for use.
	2 blinks	(RT only) The device has automatically booted into safe mode. This occurs when there is no software installed, which is the out-of-box state, or the device has detected an error in its software. Reinstall software on the IC-317x.
	3 blinks	(RT only) The IC-317x has booted into safe mode.
	4 blinks	(RT only) The IC-317x has experienced two consecutive software exceptions. The IC-317x automatically restarts after an exception. After the second exception, the IC-317x remains in the exception state, alerting you to resolve the problem. Reinstall software on the IC-317x or contact National Instruments.
	Continuous blink	(RT only) The IC-317x has not booted into NI Linux Real-Time. The controller either booted into an unsupported operating system, was interrupted during the boot process, or detected an unrecoverable software error.
	ON	(RT only) The IC-317x is booting up. (Windows only) An internal drive is being accessed.
Red	Continuous blink	This indicates a hardware error. An internal power supply has failed. Check front-panel I/O connections for shorts. Remove any shorts and cycle power to the IC-317x. If the problem persists, contact National Instruments.

Related Information

Safe Mode on page 19
Safe Mode on page 19

User LEDs

You can define the USER1 and USER FPGA1 LEDs to meet the needs of your application. The following table describes the USER1 and USER FPGA1 LED indicators.

Table 11. User LEDs

LED	LED Color	Indication
USER1	Green/Yellow	Use LabVIEW Real-Time to define the USER1 LED with the RT LEDs VI. For more information about the RT LEDs VI, refer to the *LabVIEW Help*.
USER FPGA1	Green/Yellow	Use the LabVIEW FPGA Module and NI Industrial Controller Device Drivers software to define the USER FPGA1 LED. Use the USER FPGA1 LED to help debug your application or display application status. Refer to the *LabVIEW Help* for information about programming this LED.

PoE LEDs

The PoE (Power over Ethernet) LEDs are located to the left of the PoE ports. The following table describes the PoE LED indications:

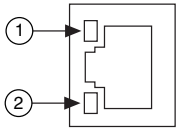
Table 12. PoE LED Indications

PoE LED State	Indication
OFF	The corresponding PoE port is not supplying power.
ON	The corresponding PoE port is powering the connected device.

Ethernet LEDs

The Gigabit Ethernet ports have the following LEDs.

Figure 15. LEDs for the Gigabit Ethernet Ports



1. Speed LED
2. Activity/Link LED

Table 13. Ethernet LED Indications

LED	Status	Indication
Speed	OFF	No link, or 10 Mbps link
	Green	100 Mbps link
	Amber	1,000 Mbps link

Table 13. Ethernet LED Indications (Continued)

LED	Status	Indication
Activity/Link	OFF	No link has been established
	Solid	A link has been negotiated
	Blinking	Activity on the link

Using the RESET Button

Pressing the RESET button resets the processor in the same manner as cycling power. You can also use the RESET button to troubleshoot network connectivity.

The RESET button is located on the bottom of the controller.

1. Hold the RESET button for 5 seconds, and then release it to boot the IC-317x into safe mode and enable Console Out.
2. After booting the controller into safe mode, hold the RESET button again for 5 seconds to enable IP reset, which resets the network adapter to its default configuration.

Safe Mode

When you boot the IC-317x into safe mode, it launches only the services necessary for updating its configuration and installing software. To resume normal operations, press the RESET button for less than 5 seconds.

IP Reset

Use IP reset to reset the TCP/IP settings when moving the system from one subnet to another or when the current TCP/IP settings are invalid.

When the IC-317x is in the IP reset state, the IP address of the network port resets to DHCP or a link-local address. You can then set up a new network configuration for the IC-317x from a development machine on the same subnet, or you can connect the IC-317x directly to the development computer.

Note By default, the target automatically attempts to connect to the network using DHCP. If the target is unable to initiate a DHCP connection, the target connects to the network with a link-local IP address (169.254.x.x).

Replacing the Battery

The IC-317x contains a user-replaceable battery. The battery compartment is located on the left side of the device as you look at the device from the front. Take the following steps to replace the battery:

Caution Before removing the battery cover, disconnect all power connectors and I/O cables from the device. To prevent damage from electrostatic discharge (ESD), ground the unit and yourself by using a grounding strap or touching a grounded object, such as a computer chassis.

1. Use a Phillips head screwdriver to remove the two screws holding the battery cover plate. Remove the plate, then remove battery from the device.
2. Insert a new battery in the device. Ensure the positive terminal of the battery faces outward. Refer to the device specifications for the required battery type.
3. Replace the battery cover plate.

Replacing the battery resets the BIOS settings to their default values.

Increasing the Battery Life

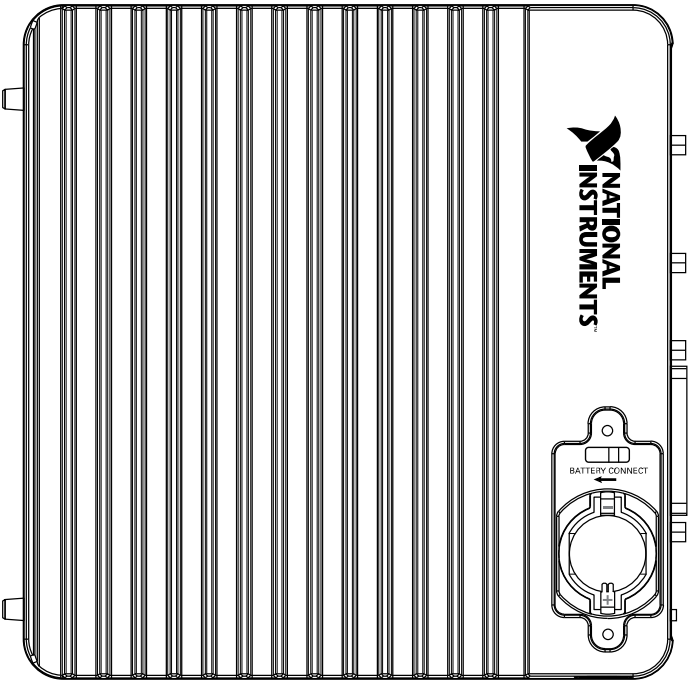
When storing the controller, you can disconnect the battery to deactivate the real-time clock and reset the BIOS settings to their default values. Take the following steps to disconnect the battery:



Caution Before removing the battery cover, disconnect all power connectors and I/O cables from the device. To prevent damage from electrostatic discharge (ESD), ground the unit and yourself by using a grounding strap or touching a grounded object, such as a computer chassis.

1. Use a Phillips head screwdriver to remove the two screws holding the battery cover plate. Remove the plate.
2. Locate the BATTERY CONNECT switch above the battery and move the switch toward the front panel of the device. The battery is now disconnected from the device.
3. Replace the battery cover plate.

Figure 16. Side of Device with Removed Battery Cover Plate and BATTERY CONNECT Switch in Disconnected Position



Mounting the IC-317x

This section provides information for creating a custom mount for the IC-317x. If you do not want to create a custom mount, a panel mount kit for the IC-317x is available from National Instruments (part number 784791-01).

Caution Do not position the IC-317x with the heat sinks resting on any surface. Doing so may cause the IC-317x device to overheat. Refer to the *IC-317x Specifications* for temperature specifications.

To obtain the maximum allowable ambient temperature, you must mount the IC-317x vertically. The following figures provide dimensional drawings and clearance information for the IC-317x.

Figure 17. Front View Dimensions

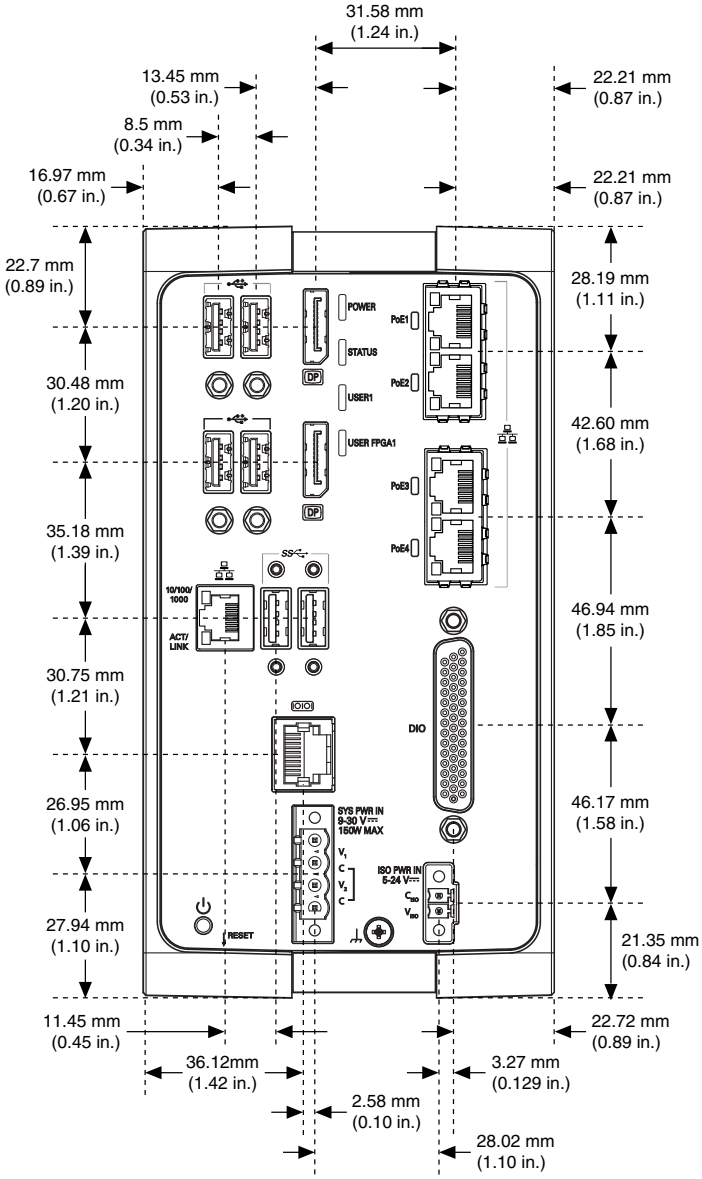


Figure 18. Side View Dimensions

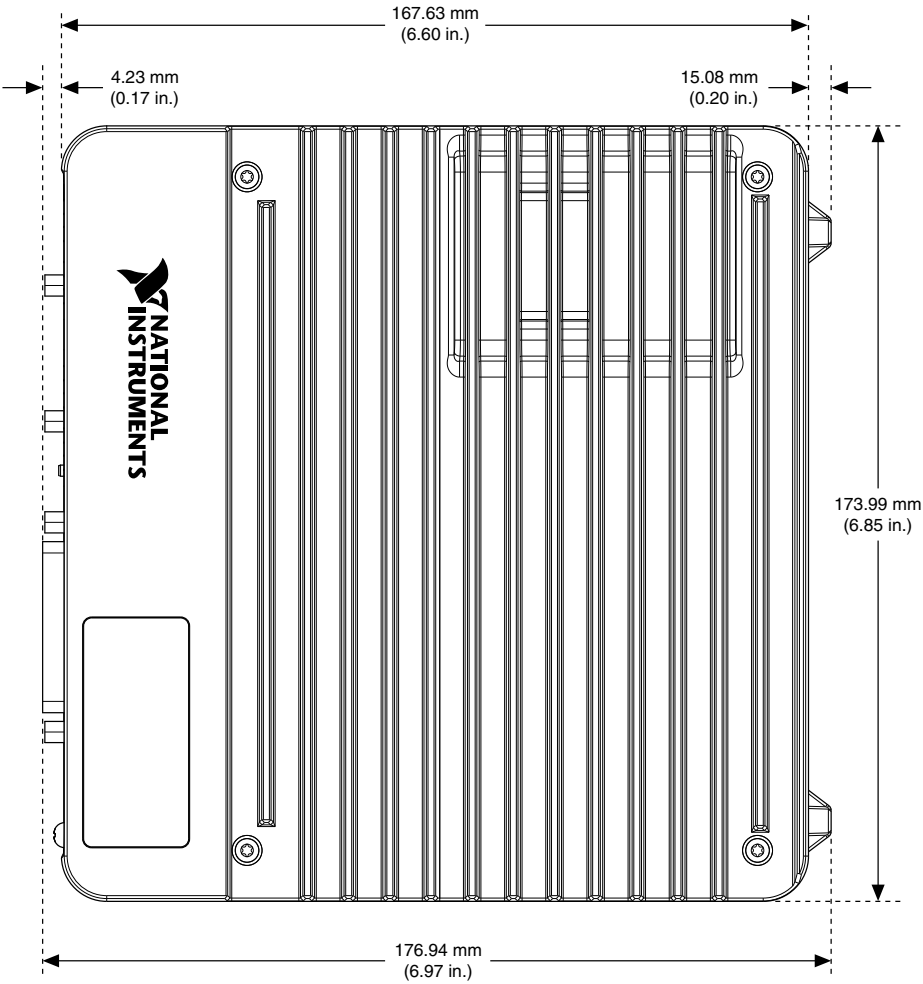
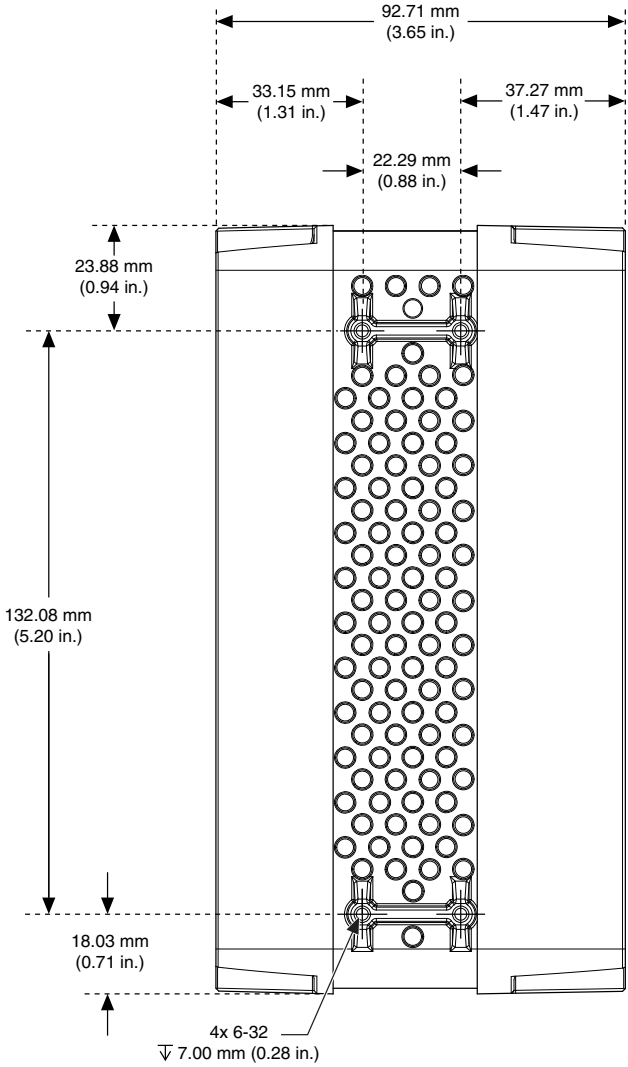


Figure 19. Rear View Dimensions



Securing the IC-317x to a Mount

1. Align the screw holes of the mounting bracket with the four holes on the back of the IC-317x.
2. Insert four 6-32 screws and tighten them 0.28 N · m (3.5 lb · in) until they are secure. Ensure the heads of the screws are flush with the mounting bracket.

Figure 20. Securing a Mounting Bracket to the Device

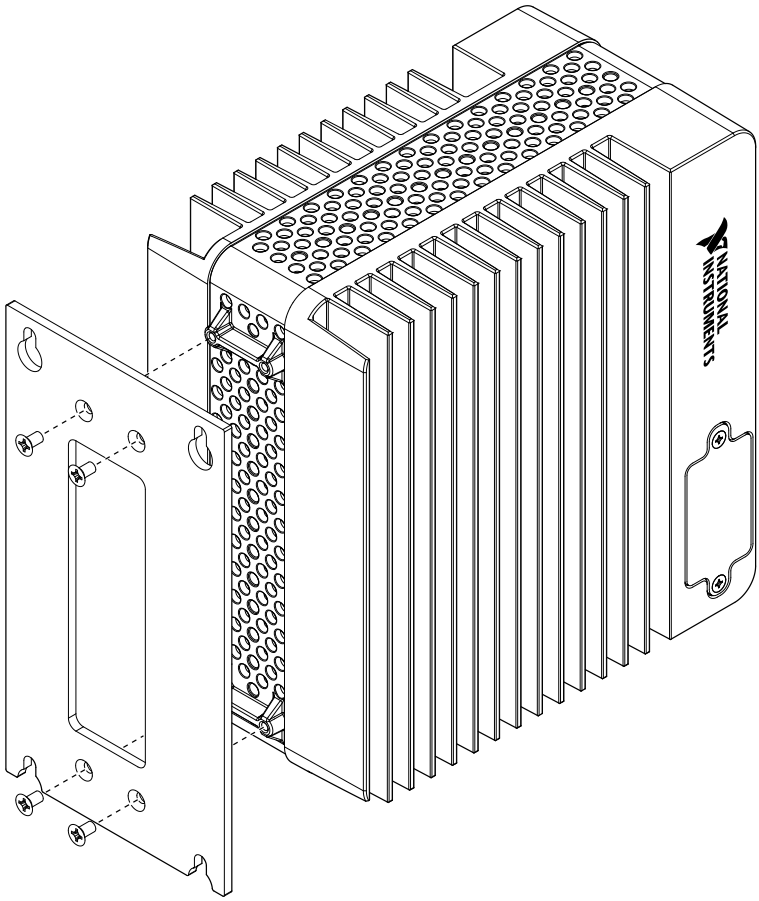
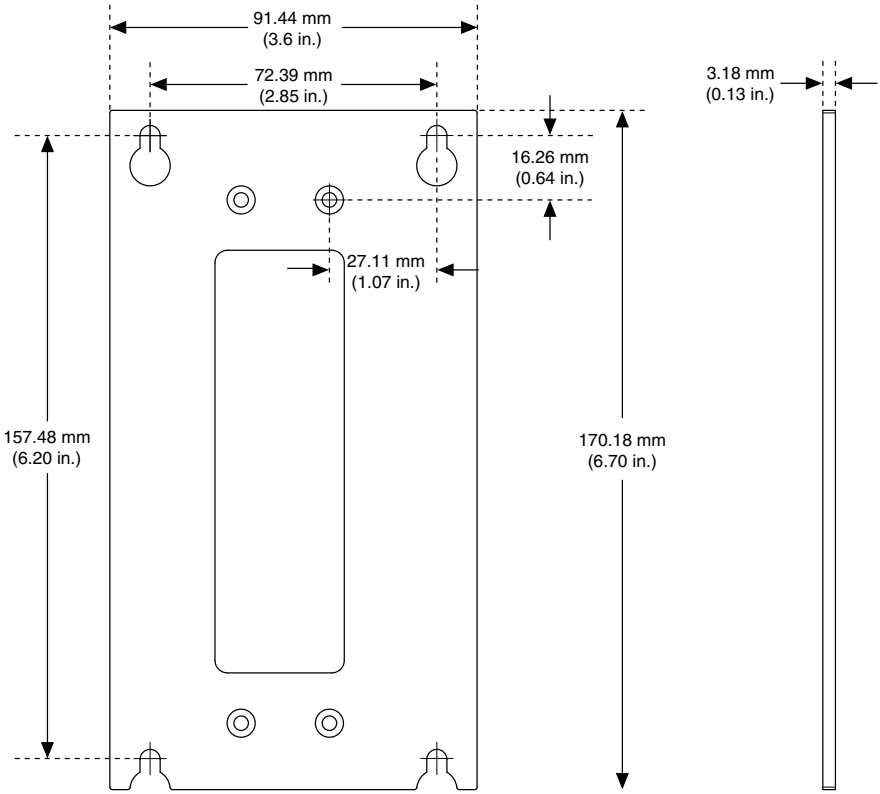


Figure 21. Mounting Bracket Dimensions

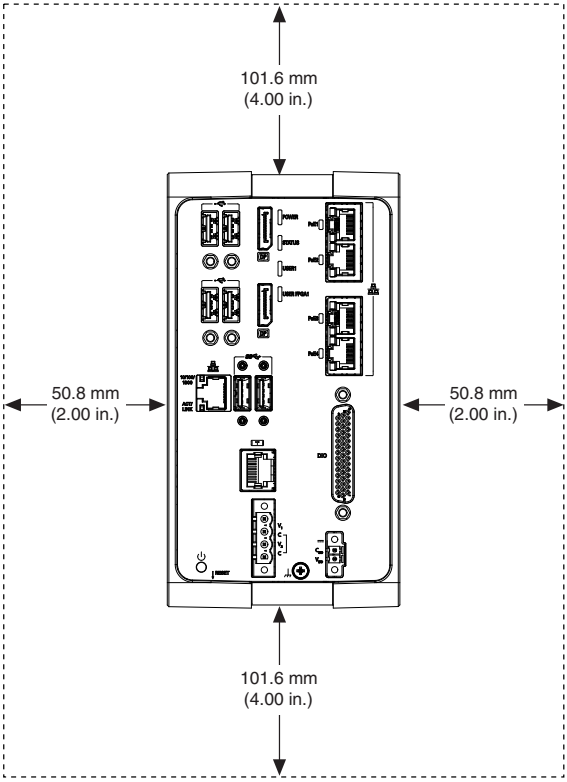


Clearance Requirements

The IC-317x installation must meet the following space and cabling clearance requirements for optimum cooling:

- Allow 101.6 mm (4.0 in.) on the top and bottom of the IC-317x for air circulation.
- Allow 50.8 mm (2.0 in.) on the sides of the IC-317x for air circulation.
- Allow enough space in front of the IC-317x to connect cables.

Figure 22. Clearance Requirements for the IC-317x



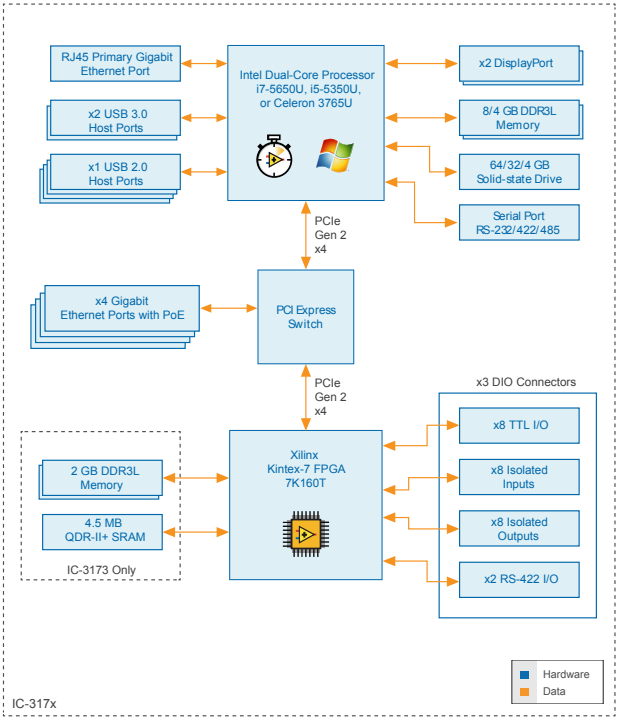
IC-3173 (IP67)

The following information applies to the IC-3173 (IP67).

About the IC-3173 (IP67)

The IC-3173 (IP67) is a high-performance, small, fanless embedded computer designed for rugged industrial applications. The IC-3173 (IP67) also provides multiple digital input/output (I/O) options for communicating with external devices.

Figure 23. IC-3173 (IP67) Block Diagram

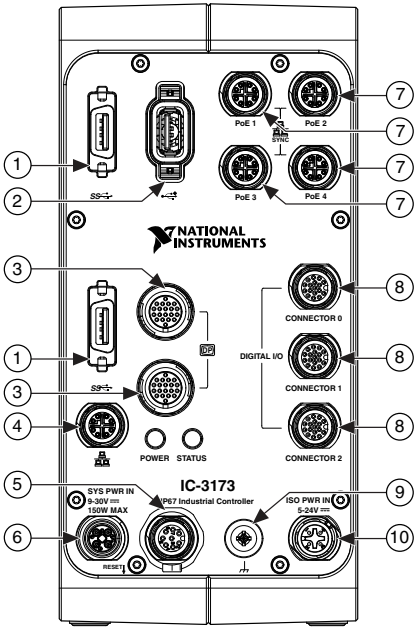


Hardware Overview

The IC-3173 (IP67) front panel consists of four Gigabit Ethernet ports with Power over Ethernet (PoE), one RS-232/RS-485 serial port, one system Gigabit Ethernet Port, two USB 3.0 ports, one USB 2.0 port, and two DisplayPort connectors.

The IC-3173 (IP67) front panel also includes LEDs for communicating system status and three 17-pin Digital I/O ports. The Digital I/O ports offer 8 isolated inputs, 8 isolated outputs, 2 bidirectional differential I/O (RS-422) or single-ended input lines that can be used with a quadrature encoder, and 8 bidirectional TTL lines.

Figure 24. IC-3173 (IP67) Front Panel



1. USB 3.0 Ports
2. USB 2.0 Port
3. DisplayPort Connectors
4. System Gigabit Ethernet Port
5. RS-232/RS-485 Serial Port
6. System Power Connector
7. Gigabit Ethernet Ports with PoE
8. 17-pin Digital I/O Ports
9. Chassis Grounding Screw
10. Isolated Power Input Connector

Connector Pinouts

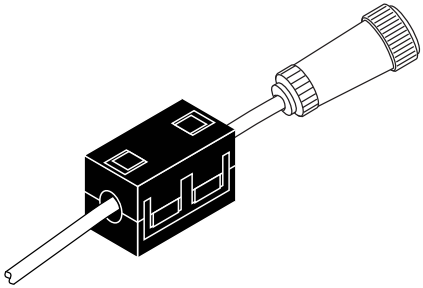
The IC-3173 (IP67) provides the following connectors.

DisplayPort

Use the DisplayPort connectors to connect one or more monitors to implement a local HMI for your controller. You can develop a single real-time VI to use for both your user interface and system logic. For more information, refer to the *Using the Embedded UI to Access RT Target VIs* topic in the *LabVIEW Help*. For up-to-date information about supported NI cables and accessories, refer to the pricing section of the product page at *ni.com*.

For each DisplayPort connector you use, you must install one ferrite clip, NI part number 711856-01, approximately 25 to 50 mm (1 to 2 in.) from the end of the connector.

Figure 25. Installing a Ferrite on the Cable



NI recommends the following DisplayPort cable for the IC-3173 (IP67).

Cable	Part Number
20-position M12 to DisplayPort male cable for IC-3173 (IP67), 3 meters	146858-03

The following figure and table lists the DisplayPort pins and signals.

Figure 26. DisplayPort Connector Pin Locations (IC-3173 (IP67))

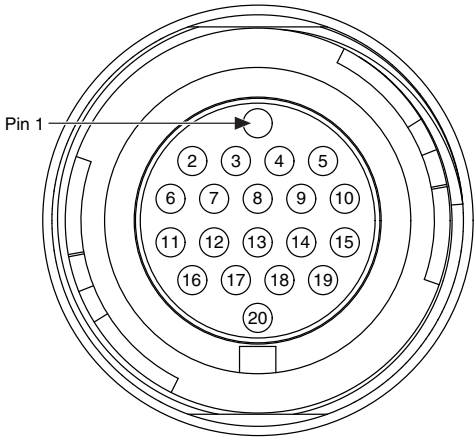


Table 14. DisplayPort Connector Pin Descriptions

Pin	Signal Name
1	DP_PWR
2	ML_Lane 0 (p)
3	ML_Lane 0 (n)

Table 14. DisplayPort Connector Pin Descriptions (Continued)

Pin	Signal Name
4	Hot Plug Detect
5	ML_Lane 1 (p)
6	Return
7	GND
8	CONFIG1
9	GND
10	ML_Lane 1 (n)
11	ML_Lane 2 (p)
12	GND
13	CONFIG2
14	AUX CH (n)
15	GND
16	ML_Lane 2 (n)
17	GND
18	ML_Lane 3 (n)
19	AUX CH (p)
20	ML_Lane 3 (p)

Ethernet Ports

The IC-3173 (IP67) provides one system Gigabit Ethernet network port and four Gigabit Ethernet ports with Power over Ethernet (PoE). The Ethernet ports provide a connection between the IC-3173 (IP67), a network, and other Ethernet devices. The IC-3173 (IP67) automatically detects the speed of the connection and configures itself accordingly.

If a PoE-capable device is plugged into an Ethernet port with PoE, the IC-3173 (IP67) automatically supplies power to the device. When you unplug a PoE device, PoE is automatically disabled. You can use non-PoE Ethernet devices with PoE-enabled Gigabit Ethernet ports.

(Windows only) The network Ethernet port provides Wake-on-LAN functionality from the power off state when associated with the Intel® driver. Wake-on-LAN must be enabled in the Power Management tab of the Intel I210 Gigabit Network Connection Properties dialog for the primary Ethernet port in Device Manager. The NI GigE Vision driver (NI-GEV) does not support Wake-on-LAN. The Ethernet ports with PoE do not support Wake-on-LAN.

NI recommends the following ethernet cables for the IC-3173 (IP67).

Cable	Part Number
X-Code M12 to X-Code M12 CAT 6A network cable, 5 meters	145231-05
X-Code M12 to RJ45 CAT 6A network cable, 5 meters	145230-05

Figure 27. Ethernet Port Pin Locations (IC-3173 (IP67))

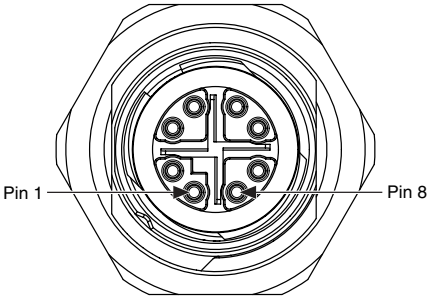


Table 15. Ethernet Port Pin Descriptions

Pin	Fast Ethernet (100 Mbps)	Gigabit Ethernet	
		MDI	MDI-X
1	TX+	BI_DA+	BI_DB+
2	TX-	BI_DA-	BI_DB-
3	RX+	BI_DB+	BI_DA+
4	RX-	BI_DB-	BI_DA-
5	No Connect	BI_DD+	BI_DC+
6	No Connect	BI_DD-	BI_DC-
7	No Connect	BI_DC-	BI_DD-
8	No Connect	BI_DC+	BI_DD+

Digital I/O

The three 17-pin Digital I/O ports on the IC-3173 (IP67) offer 8 isolated inputs, 8 isolated outputs, 2 bidirectional differential inputs (RS-422) or single-ended input lines that can be used with a quadrature encoder, and 8 bidirectional TTL lines. The Digital I/O port can be connected to any appropriate shielded device or connector block using a shielded cable.

NI recommends the following digital I/O cable for the IC-3173 (IP67).

Cable	Part Number
17-position M12 A-coded pigtail FPGA I/O cable for IC-3173 (IP67), 3 meters	785932-01

Refer to the following image and table for pin locations and descriptions.

Figure 28. 17-pin Digital I/O Connector Pin Locations (IC-3173 (IP67))

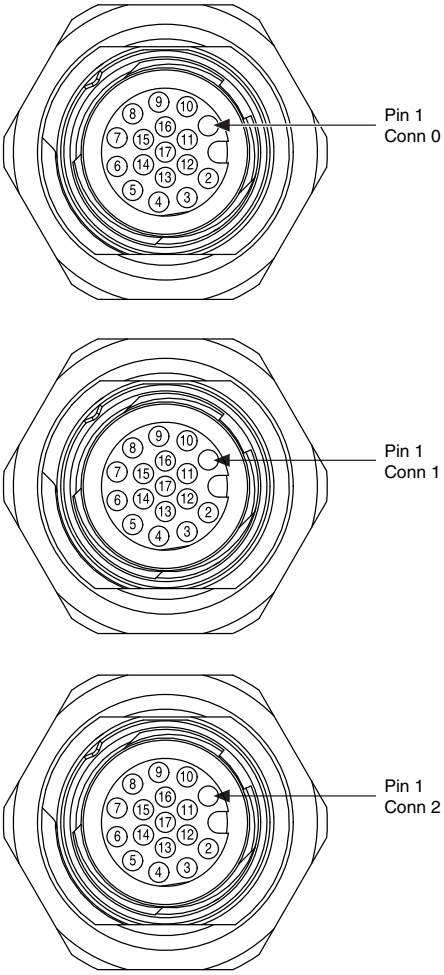


Table 16. Digital I/O Connector 0 Pin Descriptions

Pin Number	Signal	Description
1	Iso In 0	Isolated Input
2	NC	No connection
3	GND	Ground for TTL and differential I/O
4	TTL 0	Bidirectional TTL I/O
5	TTL 2	Bidirectional TTL I/O
6	GND	Ground for TTL and differential I/O
7	Iso Out 0	Isolated output
8	Iso Out 1	Isolated output
9	V_{ISO}	Isolated power voltage reference output
10	Iso In 1	Isolated input
11	Iso In 2	Isolated input
12	NC	No connection
13	TTL 1	Bidirectional TTL I/O
14	TTL 3	Bidirectional TTL I/O
15	Iso Out 2	Isolated output
16	C_{ISO}	Common for isolated inputs and outputs
17	C_{ISO}	Common for isolated inputs and outputs

Table 17. Digital I/O Connector 1 Pin Descriptions

Pin Number	Signal	Description
1	Iso In 3	Isolated Input
2	NC	No connection
3	GND	Ground for TTL and differential I/O
4	TTL 4	Bidirectional TTL I/O
5	TTL 6	Bidirectional TTL I/O
6	GND	Ground for TTL and differential I/O
7	Iso Out 3	Isolated output
8	Iso Out 4	Isolated output

Table 17. Digital I/O Connector 1 Pin Descriptions (Continued)

Pin Number	Signal	Description
9	V_{ISO}	Isolated power voltage reference output
10	Iso In 4	Isolated input
11	Iso In 5	Isolated input
12	NC	No connection
13	TTL 5	Bidirectional TTL I/O
14	TTL 7	Bidirectional TTL I/O
15	Iso Out 5	Isolated output
16	C_{ISO}	Common for isolated inputs and outputs
17	C_{ISO}	Common for isolated inputs and outputs

Table 18. Digital I/O Connector 2 Pin Descriptions

Pin Number	Signal	Description
1	Iso In 6	Isolated Input
2	NC	No connection
3	GND	Ground for TTL and differential I/O
4	Diff 0+	Bidirectional RS-422+/Quadrature Encoder A+
5	Diff 1+	Bidirectional RS-422+/Quadrature Encoder B+
6	GND	Ground for TTL and differential I/O
7	Iso Out 6	Isolated output
8	Iso Out 7	Isolated output
9	V_{ISO}	Isolated power voltage reference output
10	Iso In 7	Isolated input
11	NC	No connection
12	NC	No connection
13	Diff 0-	Bidirectional RS-422+/Quadrature Encoder A-
14	Diff 1-	Bidirectional RS-422+/Quadrature Encoder B-
15	NC	No connection

Table 18. Digital I/O Connector 2 Pin Descriptions (Continued)

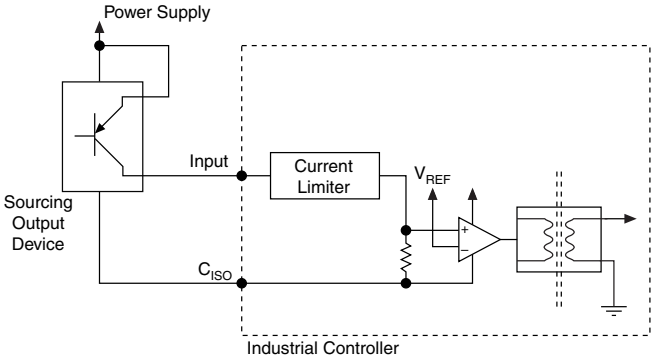
Pin Number	Signal	Description
16	C_{ISO}	Common for isolated inputs and outputs
17	C_{ISO}	Common for isolated inputs and outputs

Wiring an Isolated Input

You can wire an isolated input to a sourcing output device.

Caution Do not apply a voltage greater than 30 VDC to the isolated inputs. Voltage greater than 30 VDC may damage the IC-3173 (IP67).

Figure 29. Connecting an Isolated Input to a Sourcing Output Device



Wiring an Isolated Output

The digital isolated output circuits source current to external loads.

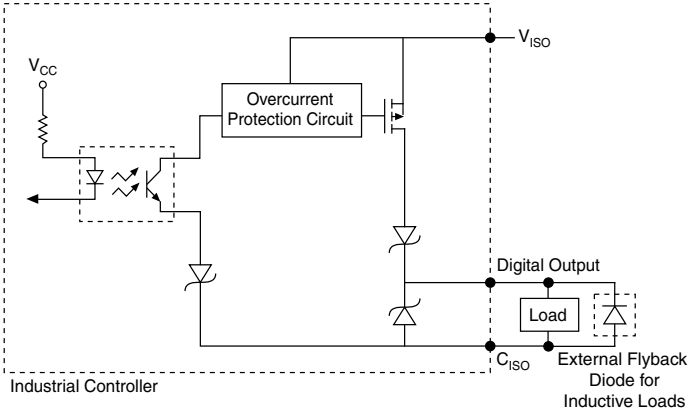
When an inductive load, such as a relay or solenoid, is connected to an output, a large counter-electromotive force may occur at switching time due to energy stored in the inductive load. This flyback voltage can damage the outputs and the power supply.

To limit flyback voltages at the inductive load, install a flyback diode across the load. Mount the flyback diode as close to the load as possible. Use this protection method if you connect any of the isolated outputs on the IC-3173 (IP67) to an inductive load.

The following image shows an example of an isolated output wired to an external load with a flyback diode installed across the load.

Caution Do not draw more than 35 mA from each isolated output when V_{ISO} is 5 V. Do not draw more than 80 mA from each isolated output when V_{ISO} is 24 V.

Figure 30. Connecting an Isolated Output to an External Load



Connecting to Differential I/O

The IC-3173 (IP67) accepts differential (RS-422) line driver inputs. Each of the two differential I/O can be configured as an output. Use shielded cables for all applications. Unshielded cables are more susceptible to noise and can corrupt signals.

Figure 31. Quadrature Encoder/RS-422 Input/Output Circuit

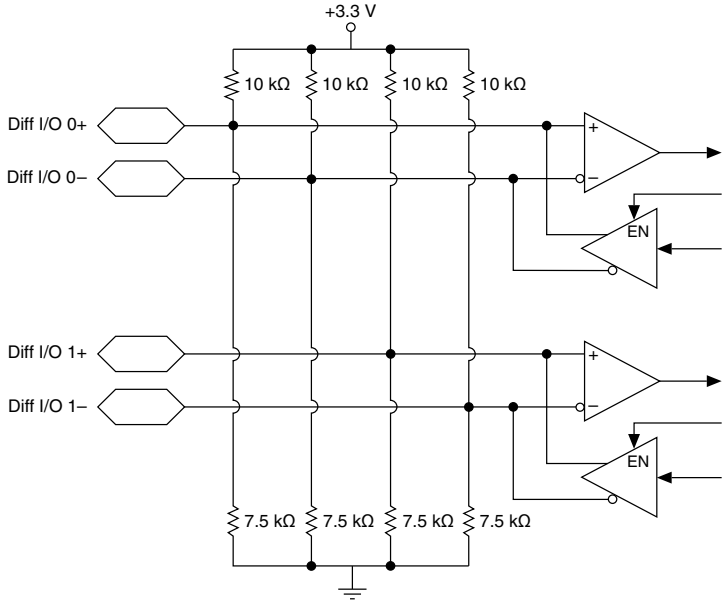


Figure 32. Connecting Differential Line Drivers

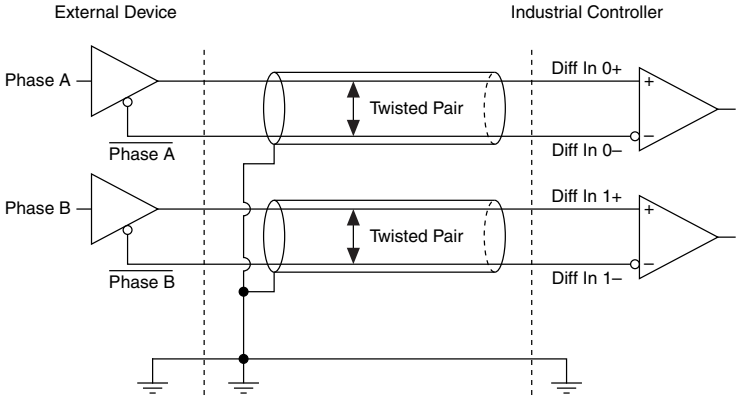
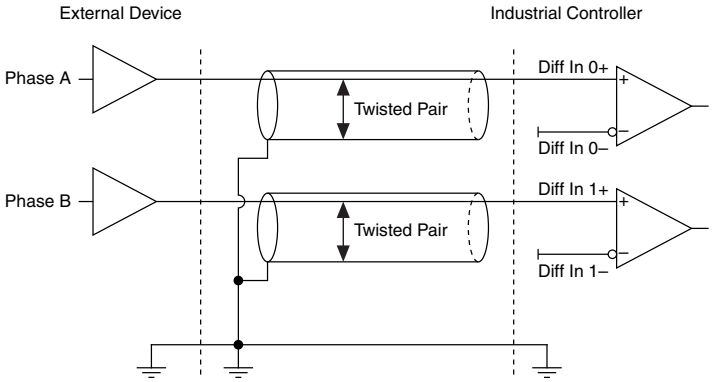


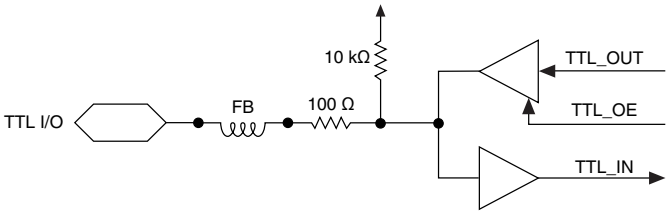
Figure 33. Connecting Single-Ended Line Drivers



TTL I/O

The following image shows the circuit for a bidirectional TTL I/O.

Figure 34. TTL Input/Output Circuit



Power Input Connectors

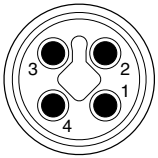
The IC-3173 (IP67) requires a power supply to power the system and, if you want to use the isolated outputs, a power supply to power the isolated outputs.

NI recommends the following accessories for the IC-3173 (IP67).

Cable	Part Number
4-position M12 T-coded pigtail power cable for IC-3173 (IP67), 3 meters	785930-01
4-position M12 T-coded power connector for IC-3173 (IP67)	785928-01

The following figure shows the system power connector.

Figure 35. System Power Connector (IC-3173 (IP67))



1. C
2. V2
3. C
4. V1

Table 19. System Power Connector Terminals

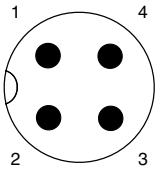
Terminal	Description
V_1	System power (9-30 VDC)
C	Common signal
V_2	System power (9-30 VDC)

NI recommends the following accessories for the isolated power input of the IC-3173 (IP67).

Cable	Part Number
4-position M12 A-coded pigtail ISO power cable for IC-3173 (IP67), 3 meters	785931-01
4-position M12 A-coded ISO power connector for IC-3173 (IP67)	785929-01

The following figure shows the terminal of the isolated power input connector.

Figure 36. Isolated Power Input Connector (IC-3173 (IP67))



1. C (Negative) Terminal
2. V (Positive) Terminal
3. No connect
4. No connect

Table 20. Isolated Power Connector Terminals

Terminal	Description
C_{ISO}	Isolated common signal
V_{ISO}	Power for isolated outputs (4.5 to 30 VDC)

Chassis Grounding Screw

Use the grounding screw to connect the chassis to earth ground. An earth ground connection is optional.

RS-485/422/232 Serial Port

The IC-3173 (IP67) has a single serial port that can operate in either RS-485/422 mode or RS-232 mode. Set the serial port mode in the BIOS setup utility.

The serial port is an 8-position A-code M12 connector, which can connect to serial devices, such as PLCs, scanners, and lighting devices.

NI recommends the following serial cables for the IC-3173 (IP67).

Cable	Part Number
8-position M12 A-coded pigtail serial cable for IC-3173 (IP67), 5 meters	785933-01

Figure 37. RS-485/422/232 Serial Port Pin Locations (IC-3173 (IP67))

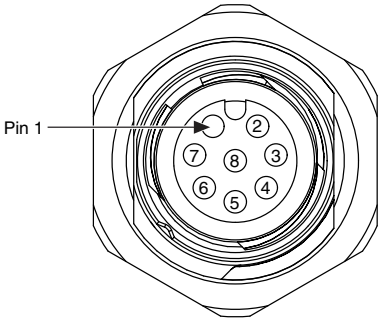


Table 21. RS-485/422/232 Serial Port Pin Descriptions

Pin	RS-485/422 Mode	RS-232 Mode
1	No Connect	No Connect
2	TXN	Unused
3	TXP	Unused
4	RXN	GND
5	RXP	Unused
6	Unused	TX
7	Unused	RX
8	GND	Unused

USB 3.0 Ports

The USB ports support USB peripheral devices such as USB flash drives, USB hard drives, USB-to-IDE adapters, keyboards, mice, and USB cameras.

Figure 38. USB 3.0 Port Pin Locations (IC-3173 (IP67))

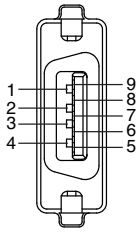


Table 22. USB 3.0 Port Pin Descriptions

Pin	Signal Name	Signal Description
1	VBUS	Cable Power (+5 VDC)
2	D-	USB Data -
3	D+	USB Data +
4	GND	Ground for power return
5	StdA_SSRX-	SuperSpeed receiver differential pair
6	StdA_SSRX+	
7	GND_DRAIN	Ground for signal return
8	StdA_SSTX-	SuperSpeed transmitter differential pair
9	StdA_SSTX+	

USB 2.0 Port

The USB port supports common USB peripheral devices such as USB flash drives, USB hard drives, USB-to-IDE adapters, keyboards, mice, and USB cameras.

Figure 39. USB 2.0 Pin Locations (IC-3173 (IP67))

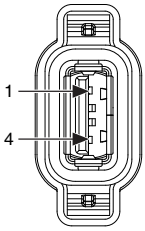


Table 23. USB 2.0 Port Pin Descriptions

Pin	Signal Name	Signal Description
1	VBUS	Cable Power (+5 VDC)
2	D-	USB Data -
3	D+	USB Data +
4	GND	Ground for power return

LED Indicators

The LED indicators are located on the front panel of the device. The IC-3173 (IP67) provides the following LED indicators.

POWER LED

The following table lists the POWER LED indications.

Table 24. POWER LED Indications

LED Color	LED Pattern	Indication
Green	Solid	The IC-3173 (IP67) is powered from the V1 or V2 input.
—	Off	The IC-3173 (IP67) is powered off.

STATUS LED

The following table describes the STATUS LED indications.

Table 25. STATUS LED Indications

LED Color	LED State	Indication
Yellow	OFF	The IC-3173 (IP67) initialized successfully and is ready for use.
	2 blinks	(RT only) The device has automatically booted into safe mode. This occurs when there is no software installed, which is the out-of-box state, or the device has detected an error in its software. Reinstall software on the IC-3173 (IP67).
	3 blinks	(RT only) The IC-3173 (IP67) has booted into safe mode.
	4 blinks	(RT only) The IC-3173 (IP67) has experienced two consecutive software exceptions. The IC-3173 (IP67) automatically restarts after an exception. After the second exception, the IC-3173 (IP67) remains in the exception state, alerting you to resolve the problem. Reinstall software on the IC-3173 (IP67) or contact National Instruments.
	Continuous blink	This indicates one of the following errors. (RT only) The IC-3173 (IP67) has not booted into NI Linux Real-Time. The controller either booted into an unsupported operating system, was interrupted during the boot process, or detected an unrecoverable software error. An internal power supply has failed. Check front-panel I/O connections for shorts. Remove any shorts and cycle power to the IC-3173 (IP67). If the problem persists, contact National Instruments.
	ON	(RT only) The IC-3173 (IP67) is booting up. (Windows only) An internal drive is being accessed.

Using the RESET Button

Pressing the RESET button resets the processor in the same manner as cycling power. If the controller is powered but shut down, pressing the RESET button turns on the controller. You can also use the RESET button to troubleshoot network connectivity.

The RESET button is located on the bottom of the controller.

1. Remove the IC-3173 (IP67) from any wet or dusty environment, as the product is not rated IP67 while the reset screw is removed.
2. Remove the reset screw using a screwdriver. Retain the gasket.
3. Hold the RESET button for 5 seconds, and then release it to boot the IC-3173 (IP67) into safe mode and enable Console Out.

4. After booting the controller into safe mode, hold the RESET button again for 5 seconds to enable IP reset, which resets the network adapter to its default configuration.
5. Reattach the reset screw using a recommended torque range of 2 Nm - 3 Nm with the gasket in place. These values are recommended average values only. Variations in local conditions may require deviations from these recommended values.

Safe Mode

When you boot the IC-3173 (IP67) into safe mode, it launches only the services necessary for updating its configuration and installing software. To resume normal operations, press the RESET button for less than 5 seconds.

IP Reset

Use IP reset to reset the TCP/IP settings when moving the system from one subnet to another or when the current TCP/IP settings are invalid.

When the IC-3173 (IP67) is in the IP reset state, the IP address of the network port resets to DHCP or a link-local address. You can then set up a new network configuration for the IC-3173 (IP67) from a development machine on the same subnet, or you can connect the IC-3173 (IP67) directly to the development computer.

Note By default, the target automatically attempts to connect to the network using DHCP. If the target is unable to initiate a DHCP connection, the target connects to the network with a link-local IP address (169.254.x.x).

Mounting the IC-3173 (IP67)

The IC-3173 (IP67) has 11 screw holes with M4x0.7 thread and 8mm depth on both sides of the device that can be used for mounting.

Caution Mounting the IC-3173 (IP67) to a hot surface may result in undesirable performance. Refer to the *IC-3173 (IP67) Specifications* for temperature specifications.

To obtain the maximum allowable ambient temperature, you must mount the IC-3173 (IP67) vertically. The following figures provide dimensional drawings and clearance information for the IC-3173 (IP67).

Figure 40. Front View Dimensions

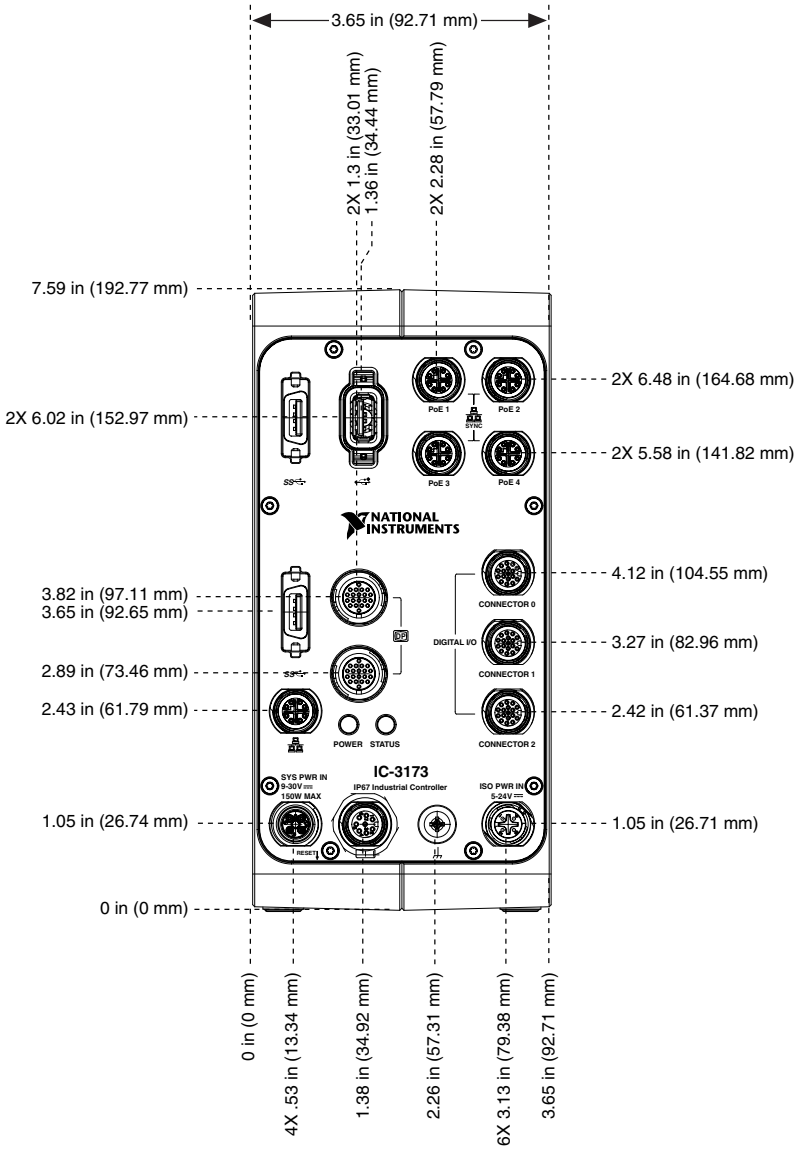
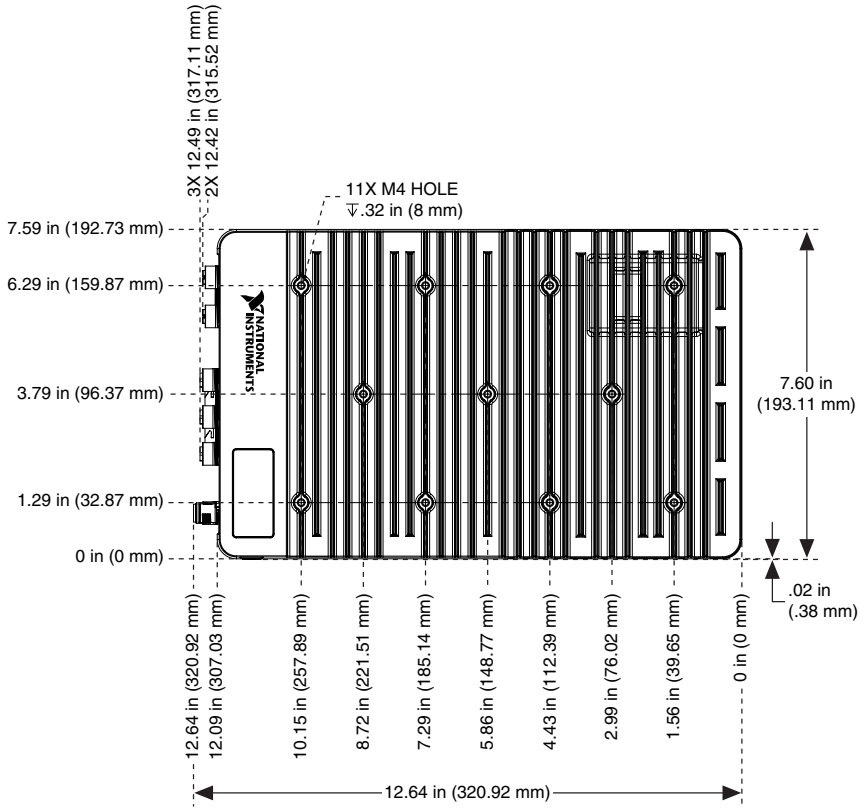


Figure 41. Side View Dimensions

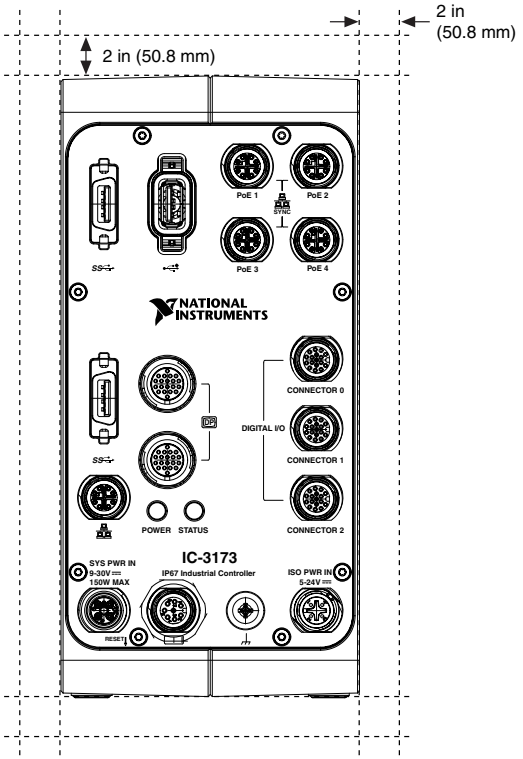


Clearance Requirements

The IC-3173 (IP67) installation must meet the following space and cabling clearance requirements for optimum cooling:

- Allow 50.8 mm (2.0 in.) on the top and bottom of the IC-3173 (IP67) for air circulation.
- Allow 50.8 mm (2.0 in.) on the sides of the IC-3173 (IP67) for air circulation.
- Allow enough space in front of the IC-3173 (IP67) to connect cables.

Figure 42. Clearance Requirements for the IC-3173 (IP67)



Software Options

Use the following software to develop applications with the IC-317x. Refer to the *IC-317x Getting Started Guide* for information about installing software.

- NI Industrial Controller Device Drivers 15.5 or later driver software.
- One of the following options for developing machine vision applications:
  - LabVIEW 2014 SP1 or later, LabVIEW Real-Time 2014 SP1 or later, the NI Vision Development Module 2015 SP1 or later.
  - NI Vision Builder for Automated Inspection (Vision Builder AI) 2015 or later.
- Software for using and reconfiguring the IC-317x FPGA. Different configurations are referred to as hardware personalities, and are defined by bitfiles. NI Industrial Controller Device Drivers include a reconfigurable I/O personality that you can use out of the box. Install the following software if you need to compile a custom personality for your application:
  - LabVIEW 2014 SP1 or later and LabVIEW FPGA Module 2014 SP1 or later—You must install the LabVIEW FPGA Module to reconfigure the default personality of the IC-317x FPGA.

IEEE 1588 Precision Time Protocol References

IC-317x controllers are compatible with the IEEE 1588 Precision Time Protocol (PTP). Visit *ni.com/info* and enter the following info codes for more information on the IEEE 1588 PTP and IC-317x industrial controllers.

- `ICConnect1588` - Provides information on which IC-317x port to connect to an IEEE 1588 PTP Grand Master.
- `ICLinkSpeed1588` - Provides information on which link speed optimizes IEEE 1588 PTP synchronization performance on the IC-317x.
- `ICModSysTime1588` - Provides information on modifying system time on the IC-317x when NI-TimeSync is installed.
- `swsync` - Provides an introduction to distributed clock synchronization and the IEEE Precision Time Protocol.

BIOS Configuration and System Recovery

You can change the configuration settings for the IC-317x in the BIOS setup utility. The BIOS is the low-level interface between the hardware and PC software that configures and tests your hardware when you boot the system. The BIOS setup utility includes menus for configuring settings and enabling features.

Most users do not need to use the BIOS setup utility. The system ships with default settings that work well for most configurations.

Entering BIOS Setup

Complete the following steps to start the BIOS setup utility.

1. Connect a monitor to one of the DisplayPort connectors on the IC-317x.
2. Connect a USB keyboard to one of the USB ports on the IC-317x.
3. Power on or reboot the IC-317x.
4. Immediately hold down the <Delete> key until the BIOS setup utility appears.

The Main setup menu is displayed when you first enter the BIOS setup utility.

BIOS Setup Utility Keyboard Navigation

Use the following keys to navigate through the BIOS setup utility:

Table 26. Navigation Keys

Key(s)	Function(s)
Left Arrow, Right Arrow	Move between the different setup menus. If you are in a submenu, these keys have no effect, and you must press <Esc> to leave the submenu first.
Up Arrow, Down Arrow	Move between the options within a setup menu.
<Enter>	Enter a submenu or display all available settings for a highlighted configuration option.
<Esc>	Return to the parent menu of a submenu. At the top-level menus, this key serves as a shortcut to the Exit menu.
<+>, <->	Cycle between all available settings for a selected configuration option.
<Tab>	Select time and date fields.
<F9>	Load the optimal default values for all BIOS configuration settings. The optimal default values are the same as the shipping configuration default values.
<F10>	Save settings and exits the BIOS setup utility.

Main Setup Menu

The Main setup menu reports the following configuration information:

- BIOS Version and Build Date—These values indicate the version of the controller BIOS and the date on which the BIOS was built.
- Embedded Firmware Version—This value identifies the built-in hardware capabilities.
- Processor Type, Base Processor Frequency, and Active Processor Cores—These values indicate the type of processor used in the controller, the speed of the processor, and the number of active processor cores.
- Total Memory—This value indicates the size of system RAM detected by the BIOS.

The Main setup menu includes System Date and System Time settings, which are the most commonly accessed and modified BIOS settings. These settings are stored in a battery-backed real-time clock. In the BIOS menu, use <+> and <-> in conjunction with <Enter> and <Tab> to change these values. You can also change these settings using NI-MAX or Vision Builder AI.

- System Date—This value controls the date.
- System Time—This value controls the time of day.

Advanced Menu

This menu contains BIOS settings that normally do not require modification. If you have specific problems such as unbootable disks or resource conflicts, you may need to examine these settings.

The Advanced setup menu includes the following submenus:

- SATA Configuration
- CPU Configuration
- Video Configuration
- Power/Wake Configuration
- AMT Configuration
- USB Configuration
- Serial Port Configuration

SATA Configuration Submenu

Use this submenu to apply custom configurations to the internal disk drive of the IC-317x. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration.

- SATA Controller(s)—Enables or disables the SATA controller. The default is **Enabled**.
  - SATA Port 0—Enables or disables SATA port 0.
  - SATA Port 1—Enables or disables SATA port 1.
  - SATA Port 3—Enables or disables SATA port 3.
- Onboard Storage—Lists the SATA disk drive and displays the size of the disk.

CPU Configuration Submenu

Use this submenu to apply custom configurations to the internal processor of the device. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration.

- Hyper-Threading—This setting specifies whether or not to enable Intel Hyper-Threading technology in the processor. When enabled, performance may increase because virtual processing cores are enabled, but software jitter may increase. The default setting is **Disabled**.
- Enabled CPU Cores—This setting specifies the number of processing cores that are enabled. The default setting is **All**.
- Turbo Boost—This setting specifies whether or not to enable Intel Turbo Boost technology. When enabled, if current conditions within the processor allow, the processor operates at frequencies higher than the base frequency. This may increase processing performance, but software jitter may increase. The default setting is **Enabled**.
- C-States—This setting specifies whether or not to enable CPU power management. When enabled, the processor may achieve maximum operating frequency when Turbo Boost is enabled, but software jitter may increase. The default setting is **Enabled**.
- Hardware Prefetcher—This setting specifies whether or not to enable the hardware prefetcher. Enabling this setting may increase performance by prefetching portions of

memory for the processor, but software jitter may increase. The default setting is **Enabled**.

- Adjacent Cache Prefetcher—This setting specifies whether or not to enable the adjacent cache line prefetcher. Enabling the adjacent cache prefetcher may increase performance by prefetching portions of memory for the processor, but software jitter may increase. The default setting is **Enabled**.

Video Configuration Submenu

Use this submenu to enable or disable the display interface.

- Primary Display—This setting can disable the onboard video for the product. Setting the value to **Onboard Video** enables the internal display capabilities and the DisplayPort connectors. Setting the value to **Disabled** disables the internal display capabilities and the DisplayPort connectors. The default setting is **Onboard Video**.

Power/Wake Configuration Submenu

The Power/Wake configuration submenu contains the power and wake settings for the IC-317x. The factory default settings provide the most compatible and optimal configuration.

- Restore After Power Loss—This setting specifies the power state that the IC-317x should return to after power is lost. Valid values are **Stay Off** and **Turn On**. The default value is **Turn On**. When set to **Stay Off**, the IC-317x returns to the soft off power state after power is restored. When set to **Turn On**, the IC-317x powers on when power is restored.
- Power Button Off Behavior—This setting specifies how the system responds to the power button. Valid options are **Normal** and **Disabled**. The default value is **Normal**. If the value is **Normal**, the system responds to the power button as defined by the OS. If the value is **Disabled**, pressing the power button has no effect when the system is on. When the system is in the soft off state, pushing the power button always powers on the system. This setting has no effect on the IC-3173 (IP67)

AMT Configuration Submenu

The AMT configuration submenu contains settings to configure Intel Active Management Technology.

- Management Engine Setup Prompt—This setting specifies whether or not to show the Intel Management Engine prompt during boot. Enabling this option enables the other options on this submenu. The default setting is **Disabled**.
- Unconfigure Management Engine—This setting specifies whether or not to unconfigure the Management Engine during the next boot. The default setting is **Disabled**.
- USB-Based Configuration—This setting specifies whether or not to search connected USB drives for AMT configuration files. The system prompts the user if it finds any configuration files. The default setting is **Disabled**.

USB Configuration Submenu

The USB configuration submenu contains the USB host ports settings. The factory default settings provide the most compatible and optimal configuration.

- USB Devices—This item lists the total number of devices detected in the system, categorized by device type.
- Legacy USB Support—This setting specifies whether legacy USB support is enabled. Legacy USB support refers to the ability to use a USB keyboard and mouse in a legacy operating system such as DOS.
- Overcurrent Reporting—This setting allows the BIOS to notify the operating system about any USB ports that source too much current. The default value is **Disabled**. Hardware overcurrent protection is always active and cannot be disabled.
- Transfer Timeout—This setting specifies the timeout value for Control, Bulk, and Interrupt USB transfers. The default value is **20** seconds.
- Device Reset Timeout—This setting specifies the number of seconds the POST waits for a USB mass-storage device to start. The default value is **20** seconds.
- Device Power-Up Delay—This setting specifies the maximum time a device takes before enumerating. Valid options are **Auto** and **Manual**. The default value is **Auto**. When set to **Auto**, a root port is granted 100 ms, and the delay value of a hub port is assigned from the hub descriptor.
- Device Power-Up Delay in Seconds—This setting specifies the number of seconds the POST waits for a USB device or hub to power on. This setting is only visible when the Device Power-Up Delay is set to **Manual**. The default value is **5** seconds.
- Mass Storage Devices—This list allows you to configure how the BIOS presents the USB mass-storage device to the system for each detected USB mass-storage device. This option presents a USB mass-storage device as a floppy, Zip, hard disk, or CD-ROM drive. The default value is **Auto**, which allows the BIOS to treat small USB flash disk drives as floppy drives and larger USB flash disk drives as hard disk drives.

Serial Port Configuration Submenu

Use this submenu to view the serial port configuration.

- RS485/RS232 Select—This setting selects the transceiver mode between RS-232 and RS-485. The default value is **RS485**.
- RS-485 Configuration—Use this menu to configure the RS-485/422 wire-mode. The default value is **Auto**.

Boot Menu

This screen displays the boot order of devices associated with the IC-317x and allows you to configure the boot settings.

The Boot setup menu includes the following submenus:

- Boot Settings Configuration—Use this setting to access the **Boot Settings Configuration** submenu.
- PXE Network Boot—This setting specifies whether or not the PXE network boot agent is enabled. The default value is **Disabled**. To enable this setting, you must select **Enable** and then select **Save & Exit** to restart the device. When this setting is enabled, the Intel

Boot Agent is visible in the Boot Option Priorities menu. This allows you to boot from a PXE server on the local subnet. Note that the Intel Boot Agent device names are preceded by **IBA GE Slot** in the **Boot Option Priorities** menu.

- Boot Option Priorities—These settings specify the order in which the BIOS attempts to boot from bootable devices, including the local hard disk drive, removable devices such as USB flash disk drives or USB CD-ROM drives, or the PXE network boot agent. The BIOS will first attempt to boot from the device associated with **Boot Option #1**, followed by **Boot Option #2** and **Boot Option #3**. If multiple boot devices are not present, the BIOS setup utility will not display all of these configuration options. To select a boot device, press <Enter> on the desired configuration option and select a boot device from the resulting menu. You can also disable individual boot options by selecting **Disabled**.



Note For each detected drive, the boot option may list a UEFI option and an option without UEFI. This depends on whether the drive supports booting with UEFI, legacy BIOS, or both. If a drive is not displayed as a boot option, use the Drive or Device BBS Priorities setting to change the relative priority of the drive.

Boot Settings Configuration Submenu

- Setup Prompt Timeout—This setting specifies the amount of time the system waits for a BIOS Setup menu keypress (the <Delete> key) in units of a second. The default value is **1** for a delay of one second.
- Bootup NumLock State—This setting specifies the power-on state of the keyboard NumLock setting. The default value is **On**.

Save & Exit Menu

The Save & Exit setup menu includes all available options for exiting, saving, and loading the BIOS default configuration. You can also press <F9> to load BIOS default settings and <F10> to save changes and exit setup.

The Save & Exit setup menu includes the following settings:

- Save Changes and Reset—Any changes made to BIOS settings are stored in NVRAM. The setup utility then exits and reboots the controller.
- Discard Changes and Reset—Any changes made to BIOS settings during this session since the last save are discarded. The setup utility then exits and reboots the controller.
- Save Changes—Any changes made to BIOS settings during this session are committed to NVRAM. The setup utility remains active, allowing further changes.
- Discard Changes—Any changes made to BIOS settings during this session since the last save are discarded. The BIOS setup continues to be active.
- Restore Defaults—This option restores all BIOS settings to the factory default. This option is useful if the controller exhibits unpredictable behavior due to an incorrect or inappropriate BIOS setting. The <F9> key can also be used to select this option.
- Save as User Defaults—This option saves a copy of the current BIOS settings as the User Defaults. This option is useful for preserving custom BIOS setup configurations.
- Restore User Defaults—This option restores all BIOS settings to the values last saved as user defaults.
- Boot Override—This option lists all possible bootable devices and allows the user to override the **Boot Option Priorities** list for the current boot. If no changes have been

made to the BIOS setup options, the system will continue booting to the selected device without first rebooting. If BIOS setup options have been changed and saved, a reboot is required and the boot override selection will not be valid.

Restoring the NI Linux Real-Time Operating System

Complete the following steps to restore the NI Linux Real-Time operating system to its factory default condition. These steps do not restore the BIOS settings to factory default. Use the **Restore Defaults** option in the *Save & Exit Menu* of the BIOS setup utility to restore the BIOS settings.

Caution Restoring the operating system erases the contents of the hard drive. Back up any files you want to keep before restoring the hard drive.

1. Start the IC-317x in safe mode. To start in safe mode, apply power, turn on the device, press the RESET button for more than 5 seconds, then release the button.
2. Launch NI MAX on the development computer.
3. In the MAX configuration tree, expand **Remote Systems**.
4. Right-click the name of the IC-317x you want to restore and select **Format Disk**.
5. Enter the username and password for the device. By default, the username is `admin` and the password field is blank.
6. Click **Format**.
7. After formatting is complete, a confirmation dialog window appears. Click **Close**.
8. Refer to the *IC-317x Getting Started Guide* for information about installing software and configuring the device.

Restoring the Windows Operating System

You can restore the Windows operating system on the hard drive of the IC-317x from the reinstallation DVD shipped with device.

Note Restoring the operating system erases the contents of the hard drive. Back up any files you want to keep before restoring the hard drive.

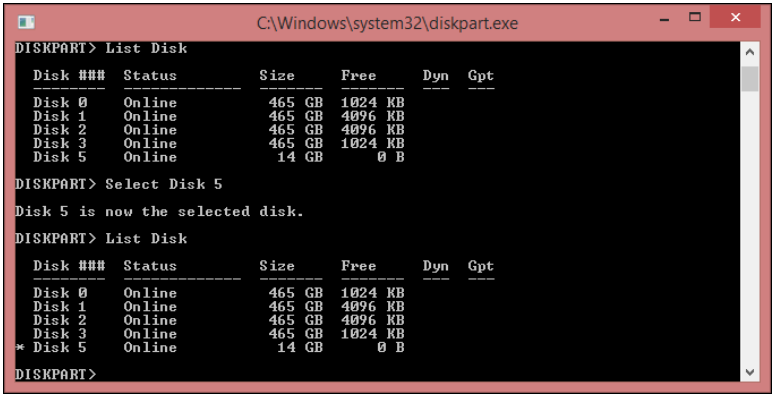
Creating a Bootable USB Flash Drive

You can create a bootable USB flash drive from the reinstallation DVD if you do not have a USB DVD drive to connect to the IC-317x. The USB flash drive must be at least 8 GB. Ensure the USB flash drive appears as a Removable Drive in Windows. Avoid using drives that appear as Fixed Disk drives. Complete the following steps to prepare the USB flash drive for recovery.

Note If you have an external USB DVD drive, you can use the external DVD drive to restore Windows without creating a bootable USB flash drive. Proceed to the next section if you are using an external DVD drive.

1. Insert the USB flash drive into a computer with a DVD drive running Windows, and wait for the flash drive to be recognized.
2. Open a command prompt as an administrator.
3. Type `diskpart.exe` and press <Enter>.

4. Type `list disk` and press <Enter>.
5. Identify the drive number that corresponds to the USB flash drive.
6. Type `select disk x`, where *x* is the drive number of the USB flash drive, and press <Enter>. For example, in the following image, the USB flash drive is disk number 5. The command is `select disk 5`.



Caution Following this process will delete all data on the USB flash drive.

7. Type `clean` and press <Enter>. This command deletes all data from the USB flash drive.
8. Type `create partition primary` and press <Enter>.
9. Type `active` and press <Enter>
10. Type `format fs=ntfs quick` and press <Enter> to format the USB flash drive.
11. Type `assign letter` *`free volume letter`*, where *`free volume letter`* is a letter not currently associated with any disk drives. For example, `assign letter K`.
12. Copy the contents of the reinstallation DVD to the root of the USB flash drive.

    The USB flash drive is now bootable and will install Windows.

Reinstalling Windows

Complete the following steps to use the recovery media to install Windows.

1. Connect the bootable USB flash drive to one of the USB ports on the IC-317x. Or connect an external DVD drive to one of the USB ports on the IC-317x and insert the recovery DVD into the external drive.
2. Connect a USB hub to the other USB port on the IC-317x. Connect a keyboard and mouse to the USB hub. If a USB hub is not available, the keyboard can be used to navigate the recovery software.
3. Power on the IC-317x.
4. Press the <F10> key on the keyboard.
5. Select the bootable USB flash drive or the DVD drive.

6. Press any key to boot from the recovery media.
7. Follow the on-screen instructions to format the hard drive and install the operating system.

After restoring the operating system, reinstall any software and drivers onto the IC-317x.

Where to Go Next

The following documents and resources contain information you may find helpful as you use the IC-317x in an application. Refer to the National Instruments Product Manuals Library at *ni.com/manuals* for the most recent versions of product documentation.

- *IC-317x Specifications*—Contains detailed specifications for the IC-317x.
- *IC-317x Getting Started Guide*—Explains how to install and configure the software necessary to use the IC-317x, and how to get started using the hardware.
- *NI CVS I/O Accessory User Manual*—Contains installation and operation instructions for the NI CVS I/O Accessory.

Resources for LabVIEW Users

Documentation for LabVIEW is available from the **Help** menu on the LabVIEW toolbar. Access documentation for the NI Vision Development Module, NI-IMAQdx, and Vision RIO by selecting **Start»All Programs»National Instruments»Vision»Documentation**.

Documentation for the MAX configuration software is available from the **Help** menu on the MAX toolbar. Specific information about using MAX with NI Vision hardware is available by selecting **Help»Help Topics»NI Vision»NI-IMAQdx**.

National Instruments Example Finder—LabVIEW contains an extensive library of VIs and example programs. To access the NI Example Finder, open LabVIEW and select **Help»Find Examples**.

Resources for Vision Builder AI Users

Refer to the *NI Vision Builder for Automated Inspection Tutorial* to learn how to perform basic machine vision techniques using Vision Builder AI. You can access the *NI Vision Builder for Automated Inspection Tutorial* and other documentation by selecting **Start»All Programs»National Instruments»Vision Builder AI»Documentation**. You can also access context help within Vision Builder AI by clicking the **Show Context Help** button on the Vision Builder AI toolbar.

Examples of common Vision Builder AI inspections are installed to the `<Vision Builder AI>\Examples` directory, where <Vision Builder AI> is the location Vision Builder AI is installed.

Worldwide Support and Services

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