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USER GUIDE AND SPECIFICATIONS

NI 6528/6529

Français Deutsch 日本語 한국어 简体中文

ni.com/manuals

The NI PCI/PXI-6528 device provides 24 isolated input channels and 24 isolated output channels, and the NI PXI-6529 provides 48 isolated input channels. The NI 6528/6529 features digital filtering, change detection, and Real-Time System Integration (RTSI) capabilities. The NI 6528 also features programmable power-up output states and a watchdog timer. The NI 6528/6529 is ideal for high-voltage isolation and switching in both industrial and laboratory environments.

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Configuration

The NI 6528/6529 device is completely software configurable, so it is not necessary to set jumpers for I/O configuration.

The PCI-6528 device is fully compliant with the *PCI Local Bus Specification, Revision 2.2*, and the PXI-6528/6529 device is fully compliant with the *PXI Hardware Specification, Revision 2.1*. The PCI/PXI system automatically allocates all device resources, including the base address and interrupt level. The device base address is mapped into PCI memory space. It is not necessary to perform configuration steps after the system powers up.

Refer to the application software documentation for configuration instructions.

After the NI 6528/6529 device and the software are installed, the DAQ device appears under the **Devices and Interfaces** branch of the Measurement & Automation Explorer (MAX) configuration tree.

If the DAQ device does not appear in MAX, use the following troubleshooting guidelines.

- Verify that you are using the correct version of NI-DAQ (NI-DAQ 7.1 or later for the NI 6528, and NI-DAQ 8.6 or later for the NI 6529). To download the most recent National Instruments drivers, go to `ni.com/drivers`.
- Press <F5> to refresh the MAX window, or close and re-open MAX.
- Restart the computer.
- Power off and unplug the computer or chassis, and install the device in a different slot. Refer to the *DAQ Getting Started* guides for installation instructions and safety guidelines.

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- NI PCI-6528 devices must be installed into a slot that provides 3.3 V. Check that the 3.3 V LED (reference designator *DS1*—located on the visible edge of the underside of the installed device) is lit. If not, check that the PC motherboard provides 3.3 V to the PCI bus.

Programming Devices in Software

National Instruments measurement devices are packaged with NI-DAQ driver software, an extensive library of functions and VIs you can call from your application software, such as LabVIEW or LabWindows™/CVI™, to program all the features of your NI measurement devices. Driver software has an application programming interface (API), which is a library of VIs, functions, classes, attributes, and properties for creating applications for your device.

NI-DAQ 8.*x* or later includes two NI-DAQ drivers, Traditional NI-DAQ (Legacy) and NI-DAQmx. Each driver has its own API, hardware configuration, and software configuration. Refer to the *DAQ Getting Started* guides for more information about the two drivers.

Traditional NI-DAQ (Legacy) and NI-DAQmx each include a collection of programming examples to help you get started developing an application. You can modify example code and save it in an application. You can use examples to develop a new application or add example code to an existing application.

To locate LabVIEW and LabWindows/CVI examples, open the National Instruments Example Finder:

- In LabVIEW, select **Help»Find Examples**.
- In LabWindows/CVI, select **Help»NI Example Finder**.

Measurement Studio, Visual Basic, and ANSI C examples are in the following directories:

- NI-DAQmx examples for Measurement Studio-supported languages are in the following directories:
  - `MeasurementStudio\VCNET\Examples\NIDaq`
  - `MeasurementStudio\DotNET\Examples\NIDaq`
- Traditional NI-DAQ (Legacy) examples for Visual Basic are in the following two directories:
  - `NI-DAQ\Examples\Visual Basic with Measurement Studio` directory contains a link to the ActiveX control examples for use with Measurement Studio
  - `NI-DAQ\Examples\VBasic` directory contains the examples not associated with Measurement Studio

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- NI-DAQmx examples for ANSI C are in the `NI-DAQ\Examples\DAQmx ANSI C Dev` directory
- Traditional NI-DAQ (Legacy) examples for ANSI C are in the `NI-DAQ\Examples\VisualC` directory

For additional examples, refer to `zone.ni.com`.

Functional Overview

Figures 1 and 2 illustrate the key functional components of the NI 6528/6529 device.

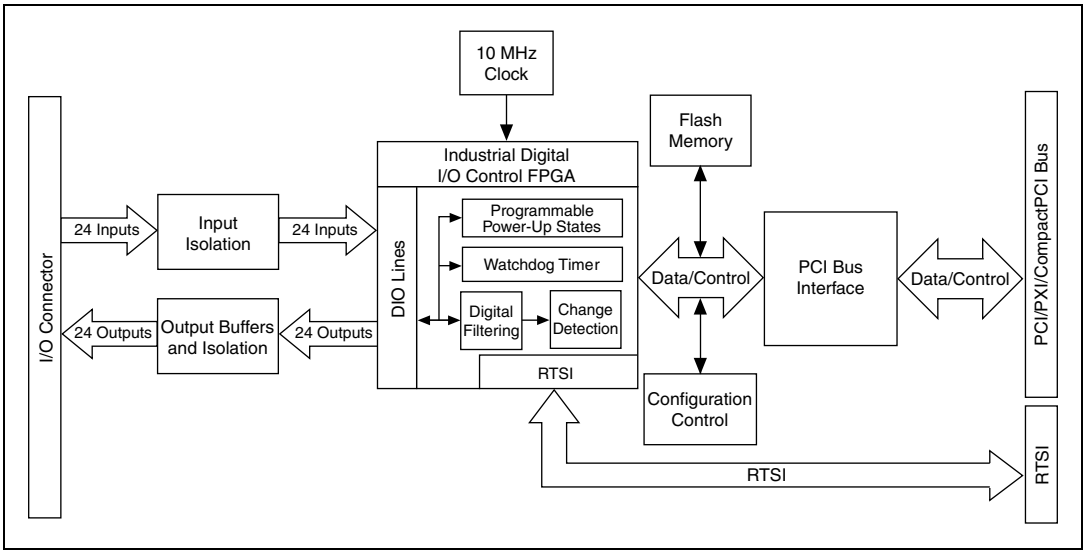


Figure 1. NI 6528 Block Diagram

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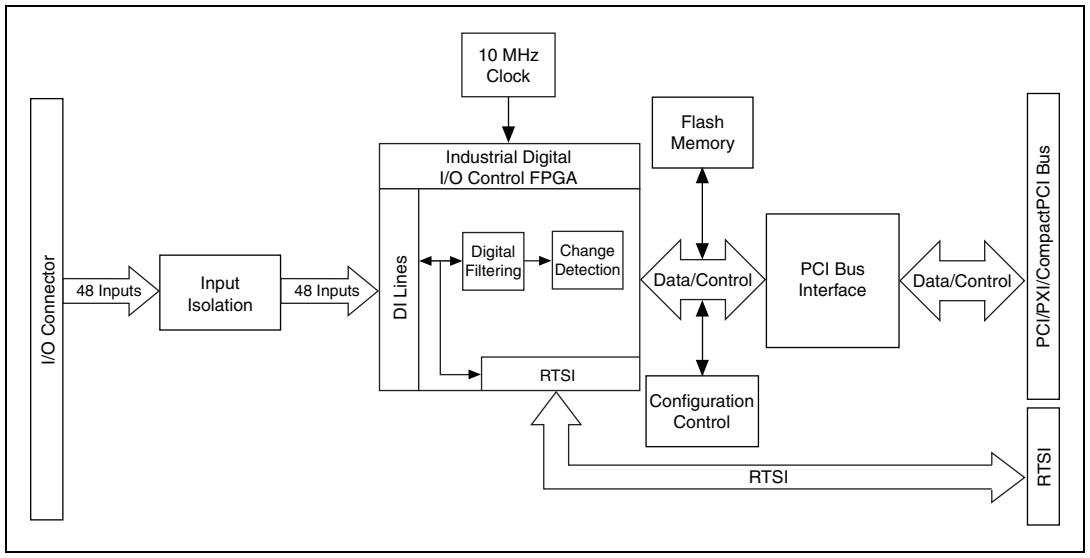


Figure 2. NI 6529 Block Diagram

Safety Information

The following section contains important safety information that you must follow when installing and using National Instruments DIO devices.

Do not operate the device in a manner not specified in this document. Misuse of the DIO device can result in a hazard. You can compromise the safety protection built into the DIO device if it is damaged in any way. If the DIO device is damaged, return it to National Instruments for repair.

Do not substitute parts or modify the DIO device except as described in this document. Use the DIO device only with the chassis, modules, accessories, and cables specified in the installation instructions. You must have all covers and filler panels installed during operation of the DIO device.

Do not operate the DIO device in an explosive atmosphere or where there may be flammable gases or fumes. If you must operate the DIO device in such an environment, it must be in a suitably rated enclosure.

If you need to clean the DIO device, use a soft, nonmetallic brush. Make sure that the DIO device is completely dry and free from contaminants before returning it to service.

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Operate the DIO device only at or below Pollution Degree 2. Pollution is foreign matter in a solid, liquid, or gaseous state that can reduce dielectric strength or surface resistivity. The following is a description of pollution degrees:

- Pollution Degree 1 means no pollution or only dry, nonconductive pollution occurs. The pollution has no influence.
- Pollution Degree 2 means that only nonconductive pollution occurs in most cases. Occasionally, however, a temporary conductivity caused by condensation must be expected.
- Pollution Degree 3 means that conductive pollution occurs, or dry, nonconductive pollution occurs that becomes conductive due to condensation.

You must insulate signal connections for the maximum voltage for which the DIO device is rated. Do not exceed the maximum ratings for the DIO device. Do not install wiring while the DIO device is live with electrical signals. Do not remove or add connector blocks when power is connected to the system. Avoid contact between your body and the connector block signal when hot swapping modules. Remove power from signal lines before connecting them to or disconnecting them from the DIO device.

Operate the DIO device at or below the measurement category[1] marked on the hardware label. Measurement circuits are subjected to working voltages[2] and transient stresses (overvoltage) from the circuit to which they are connected during measurement or test. Installation categories establish standard impulse withstand voltage levels that commonly occur in electrical distribution systems. The following is a description of measurement categories:

- Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as MAINS[3] voltage. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

[1] Measurement categories, also referred to as *installation categories*, are defined in electrical safety standard IEC 61010-1.

[2] Working voltage is the highest rms value of an AC or DC voltage that can occur across any particular insulation.

[3] MAINS is defined as a hazardous live electrical supply system that powers equipment. Suitably rated measuring circuits may be connected to the MAINS for measuring purposes.

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- Measurement Category II is for measurements performed on circuits directly connected to the electrical distribution system. This category refers to local-level electrical distribution, such as that provided by a standard wall outlet (for example, 115 V for U.S. or 230 V for Europe). Examples of Measurement Category II are measurements performed on household appliances, portable tools, and similar DIO devices.
- Measurement Category III is for measurements performed in the building installation at the distribution level. This category refers to measurements on hard-wired equipment such as equipment in fixed installations, distribution boards, and circuit breakers. Other examples are wiring, including cables, bus-bars, junction boxes, switches, socket-outlets in the fixed installation, and stationary motors with permanent connections to fixed installations.
- Measurement Category IV is for measurements performed at the primary electrical supply installation (<1,000 V). Examples include electricity meters and measurements on primary overcurrent protection devices and on ripple control units.

Related Documentation

The following documents contain information that you may find helpful as you use this user guide:

- *DAQ Getting Started* guides—These guides describes how to install the NI-DAQ software, the DAQ device, and how to confirm that the device is operating properly.
- *NI-DAQmx Help*—This help file contains information about using NI-DAQmx to program National Instruments devices. NI-DAQmx is the software you use to communicate with and control NI DAQ devices.
- *Measurement & Automation Explorer Help for NI-DAQmx*—This help file contains information about configuring and testing DAQ devices using Measurement & Automation Explorer (MAX) for NI-DAQmx, and information about special considerations for operating systems.
- *DAQ Assistant Help*—This help file contains information about creating and configuring channels, tasks, and scales using the DAQ Assistant.

Note You can download these documents from `ni.com/manuals`.

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Features

The NI 6528/6529 features digital filtering, Real-Time System Integration (RTSI), and change detection. The NI 6528 also features programmable power-up output states and a watchdog timer.

Digital Filtering

Use the digital filter option available on the NI 6528/6529 input lines to eliminate glitches on input data. When used with change detection, filtering can also reduce the number of changes to examine and process.

You can configure the digital input channels to pass through a digital filter, and you can program the filter interval the filter uses. The filter blocks pulses that are shorter than half of the specified filter interval and passes pulses that are longer than the specified interval. Intermediate-length pulses—pulses longer than half of the interval but less than the interval—may or may not pass the filter.

The filter operates on the inputs from the optocouplers. The optocouplers turn on faster than they turn off, passing rising edges faster than falling edges. The optocouplers can therefore subtract up to 150 µs from a low pulse.

Table 1 lists the pulse widths guaranteed to be passed and blocked.

Table 1. NI 6528/6529 Digital Filtering

Filter Interval	Pulse Width Passed		Pulse Width Blocked	
	Low Pulse	High Pulse	Low Pulse	High Pulse
$t_{interval}$	$t_{interval}$ + 150 µs	$t_{interval}$	$t_{interval}/2$	$(t_{interval}/2)$ – 150 µs

You can enable filtering on as many input lines as is necessary for your application. All filtered lines share the same timing interval, which ranges from 400 ns to 200 ms.

Internally, the filter uses two clocks: the sample clock and the filter clock. The sample clock has a 100 ns period. The filter clock is generated by a counter and has a period equal to one half of the specified timing interval. The input signal is sampled on each rising edge of the sample clock, which is every 100 ns. A change in the input signal is recognized only if it maintains its new state for at least two consecutive rising edges of the filter clock.

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The filter clock is programmable and allows you to control how long a pulse must last to be recognized. The sample clock provides a fast sample rate to ensure that input pulses remain constant between filter clocks.

Digital Filtering Example

Figure 3 shows a filter configuration with a $t_{interval}$ filter interval ($t_{interval}$/2 filter clock).

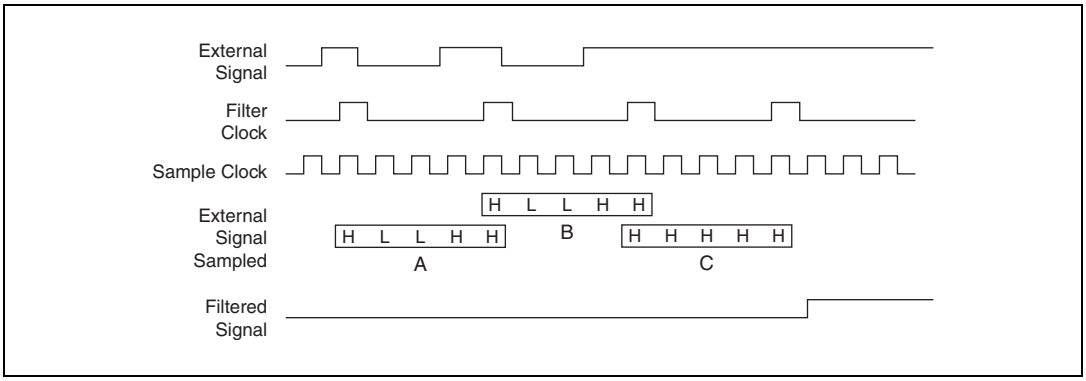


Figure 3. Digital Filtering Example

In periods A and B, the filter blocks the glitches because the external signal does not remain steadily high from one rising edge of the filter clock to the next. In period C, the filter passes the transition because the external signal remains steadily high. Depending on when the transition occurs, the filter may require up to two filter clocks—one full filter interval—to pass a transition. The figure shows a rising (0 to 1) transition. The same filtering applies to falling (1 to 0) transitions.

RTSI

The NI 6528/6529 uses the National Instruments Real-Time System Integration (RTSI) bus interface to route additional timing and trigger signals between the NI 6528/6529 and National Instruments RTSI-compatible devices. Use the National Instruments RTSI cable to connect the NI PCI-6528 to other RTSI-compatible devices.

The NI PXI-6528/6529 uses pins on the RTSI connector to connect the RTSI bus to the PXI trigger bus, as defined in the *PXI Hardware Specification, Revision 2.1*. The NI PCI-6528 uses pins on the RTSI connector to connect the RTSI bus to the PCI trigger bus, as defined in the *PCI Local Bus Specification, Revision 2.2*. All National Instruments PCI/PXI devices that have a connection to these pins can be connected through software. This feature is not supported by CompactPCI.

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The NI 6528 has eight lines that are configurable for either input or output, and the NI PXI-6528 has a PXI star trigger line in addition to these eight I/O lines. The NI PXI-6529 has eight lines for output and a PXI star trigger line.

Note The PXI star trigger is for input only.

Input Port 0 can be configured to route signals to the RTSI port.

Output Port 3 can be configured to route signals from the RTSI port. Additionally, on the NI PXI-6528/6529, the PXI star trigger line can be configured to be routed to line 0 of output Port 4.

Refer to the *Change Detection and RTSI* and *Watchdog Timer and RTSI* sections for more information about using the NI 6528/6529 with RTSI.

Change Detection

You can program the NI 6528/6529 to send an interrupt when a change occurs on any input line.

The NI 6528/6529 can monitor changes on selected input lines or on all input lines. It can monitor for rising edges (0 to 1), falling edges (1 to 0), or both. When an input change occurs, the NI 6528/6529 generates an interrupt, and the NI-DAQ driver then notifies the software.

Note Excessive change detections can affect system performance. Use digital filtering to minimize the effects of noisy input lines.

The NI 6528/6529 sends a change detection when any one of the changes occurs, but it does not report which line changed or if the line was rising or falling. After a change, you can read the input lines to determine the current line states. The maximum rate of change detection is determined by the software response time, which varies from system to system.

An overflow bit indicates that an additional rising or falling edge has been detected before the software could process the previous change.

Refer to the software documentation for information about how to set up and implement the change detection.

Change Detection and RTSI

You can program the NI 6528/6529 to send a 200 ns pulse to any or all RTSI lines when a change is detected. The pulse generates when a change detection event occurs.

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Change Detection Example

Table 2 shows a change detection example for six bits of one port.

Table 2. Change Detection Example

	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Changes to detect	↕	↕	↕	↕	—	—	↑	↓
Enable rising-edge detection	yes	yes	yes	yes	no	no	yes	no
Enable falling-edge detection	yes	yes	yes	yes	no	no	no	yes

This example assumes the following line connections:

- Bits 7, 6, 5, and 4 are connected to data lines from a four-bit TTL output device. The NI 6528/6529 detects any change in the input data so you can read the new data value.
- Bit 1 is connected to a limit sensor. The NI 6528/6529 detects rising edges on the sensor, which correspond to over-limit conditions.
- Bit 0 is connected to a switch. The software can react to any switch closure, which is represented by a falling edge. If the switch closure is noisy, enable digital filtering for this line.

In this example, the NI 6528/6529 reports rising edges only on bit 1, falling edges only on bit 0, and rising and falling edges on bits 7, 6, 5, and 4. The NI 6528/6529 reports no changes for bits 3 and 2. After receiving notification of a change, you can read the port to determine the current values of all eight lines. You cannot read the state of any lines that are configured for change detection until the change detection interrupt occurs.

Programmable Power-Up Output States (NI 6528 Only)

The default power-up state of the digital output lines is logic high, which opens the solid-state relays. The lines on output ports are user-configurable for logic high (open relay) or logic low (closed relay). User-configurable power-up states are useful for ensuring that the NI 6528 powers up in a known state.

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To use MAX (recommended) to program the power-up states, select the device and click the **Properties** button. Refer to the software documentation for information about how to program the power-up states using NI-DAQ with LabVIEW or other National Instruments application development environments (ADEs).

Note The response time of programmable power-up states is 400 ms.

Watchdog Timer (NI 6528 Only)

The watchdog timer is a software configurable feature used to set critical outputs to safe states in the event of a software failure, a system crash, or any other loss of communication between the application and the NI 6528.

When the watchdog timer is enabled, if the NI 6528 does not receive a **watchdog reset** software command within the time specified for the watchdog timer, the outputs go to a user-defined safe state and remain in that state until the watchdog timer is disarmed by the application and new values are written, the NI 6528 is reset, or the computer is restarted. The expiration signal that indicates an expired watchdog will continue to assert until the watchdog is disarmed. After the watchdog timer expires, the NI 6528 ignores any writes until the watchdog timer is disarmed.

You can set the watchdog timer timeout period to specify the amount of time that must elapse before the watchdog timer expires. The counter on the watchdog timer is configurable up to $(2^{32} - 1) \times 100$ ns (approximately seven minutes) before it expires.

Watchdog Timer and RTSI

Using the watchdog timer and RTSI, you can chain multiple NI 6528 devices and configure them to expire simultaneously while updating only one timer.

You can program the NI 6528 to send a 200 ns logic high pulse to any or all RTSI lines when the watchdog timer expires. Additionally, you can program the watchdog timer to expire when it detects either a rising or a falling edge on a single RTSI line.

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Digital I/O

The I/O connector, device pinout, signal descriptions, optically isolated inputs, and solid-state relay (SSR) outputs are discussed in this section.

I/O Connector

The 100-pin high-density SCSI connector provides access to 24 digital inputs and 24 digital outputs on the NI 6528 and to 48 digital inputs on the NI 6529. For easy connection to the I/O connector, use the National Instruments SH100-100-F shielded cable with the SCB-100 connector block, or use the R1005050 cable with the CB-50 or CB-50LP connector block.

Caution Do not make connections to the digital I/O that exceed the maximum I/O specifications. Doing so may permanently damage the NI 6528/6529 device and the chassis. Refer to the *Signal Descriptions* section and the *Specifications* section for information about maximum input ratings.

Refer to the *Pin Assignments* section for the NI 6528/6529 I/O connector pinout.

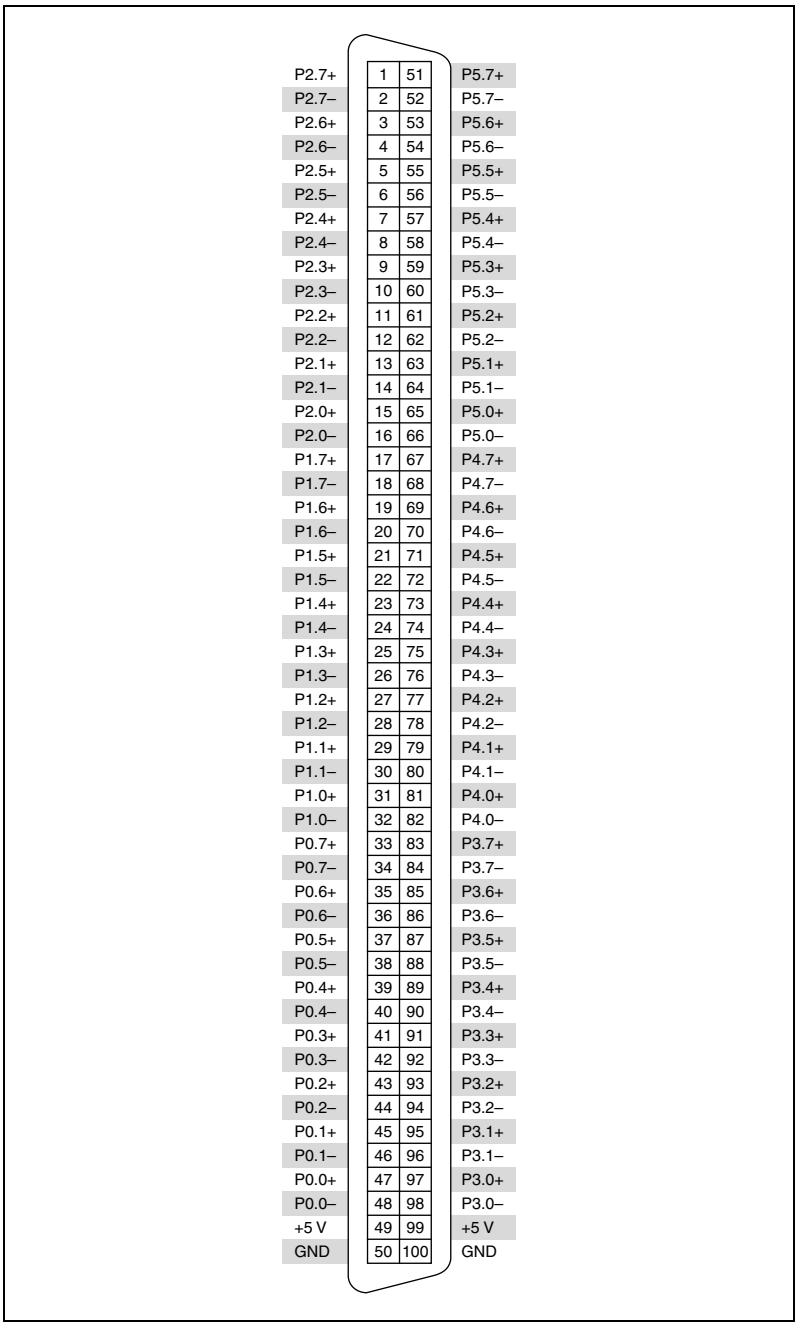
Pin Assignments

Figure 4 shows the pin assignments for the 100-pin connector on the NI 6528/6529 device.

The naming convention for each pin is P*X*.*Y*, where *X* is the port (P) number, *Y* is the line number, and a + or – indicates whether the terminal is positive or negative.

Note For input ports on the NI 6528/6529, connect the higher voltage to the P*X*.*Y*+ pin and the lower voltage to the P*X*.*Y*– pin. For output ports on the NI 6528, you can connect signals to the two pins of each line, regardless of which has the higher voltage. The output lines on the NI 6528 are solid-state relays and act as bi-directional switches.

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NI 6528 (Pins 1–48) Direction Input—Ports 0, 1, and 2
(Pins 51–98) Direction Output with Readback—Ports 3, 4, and 5

NI 6529 (Pins 1–48, 51–98) Direction Input—Ports 0 through 5

Figure 4. NI 6528/6529 Pinout

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Refer to the *Signal Descriptions* section for information about the signals available on this connector.

Signal Descriptions

Table 3 and Table 4 list the signals and descriptions for all signals available on the NI 6528/6529 devices.

Table 3. NI 6528 Signal Descriptions

Signal Name	Direction	Description
P<0..2>.<7..0>+	Input	**Isolated input ports <0..2>, positive terminals**—Take measurements at these terminals. A logic high (data bit of 1) indicates sufficient input voltage and current are present.
P<0..2>.<7..0>–	Input	**Isolated input ports <0..2>, negative terminals**—Each of these terminals serves as the reference terminal from which the corresponding P line is measured.
+5 V	Output	**+5 Volts**—Provides +5 VDC power. These pins are not isolated.
GND	—	**Ground**—These pins are connected to the computer ground reference. These pins are not isolated.
P<3..5>.<7..0>+	Output	**Isolated output ports <3..5>, first terminals**—Each of these is the first of two terminals of a bi-directional solid-state relay. The connection is complete when the relay is closed. The connection is broken when the relay is open. A logic low (data bit of 0) closes the relay.
P<3..5>.<7..0>–	Output	**Isolated output ports <3..5>, second terminals**—Each of these is the second of two terminals of a bi-directional solid-state relay. A logic low (data bit of 0) closes the relay.

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Table 4. NI 6529 Signal Descriptions

Signal Name	Direction	Description
P<0..5>.<7..0>+	Input	**Isolated input port <0..5>, positive terminals**—Take measurements at these terminals. A logic high (data bit of 1) indicates sufficient input voltage and current are present.
P<0..5>.<7..0>–	Input	**Isolated input port <0..5>, negative terminals**—Each of these terminals serves as the reference terminal from which the corresponding P line is measured.
+5 V	Output	**+5 Volts**—Provides +5 VDC power. These pins are not isolated.
GND	—	**Ground**—These pins are connected to the computer ground reference. These pins are not isolated.

Optically Isolated Inputs

Pins 1 through 48 on the NI 6528 and pins 1 through 48 and 51 through 98 on the NI 6529 are optically isolated input signal pins. These inputs consist of a light-emitting diode (LED), a depletion-mode MOSFET-based current limiting circuit, and digital filtering and change-detection circuitry.

The NI 6528 device provides 24 channels of isolated digital input, and the NI 6529 device provides 48 channels of isolated digital input. Each channel has its own positive and negative terminals. The input (V_{IN}) range on the channels is –60 VDC to +60 VDC.

Sensing DC Voltages

The NI 6528/6529 detects a wide range of DC signals, from TTL-like logic levels to DC power supply levels up to 60 V.

Applying a DC voltage of at least 3.2 V across two input terminals registers a logic high. Applying no voltage or a voltage difference of 1 V or less registers as a logic low. DC voltages between 1 V and 3.2 V may not register a consistent or usable value.

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Signal Connection Example

Figure 5 shows signal connections for a supply and load connected to an isolated input.

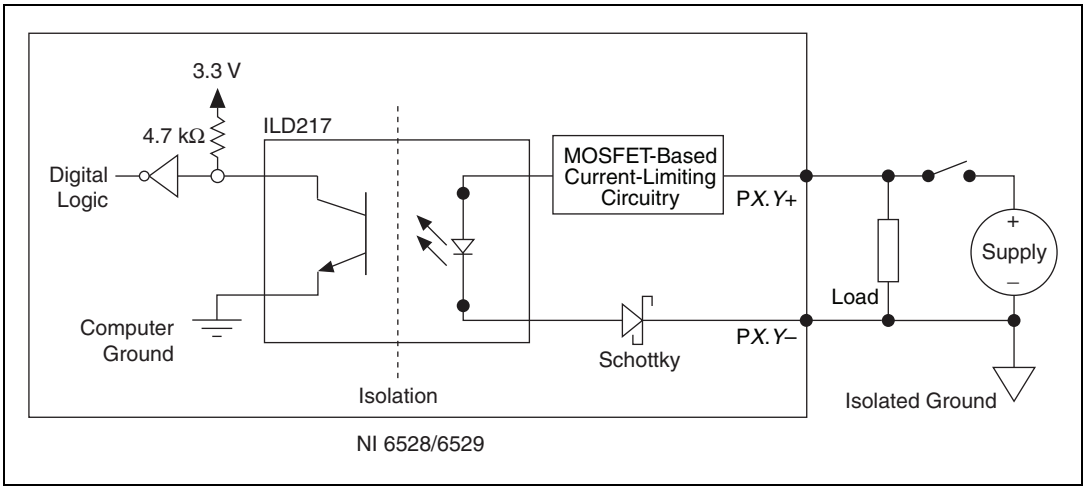


Figure 5. Signal Connection Example

In the figure, the NI 6528/6529 device is sensing a powered load that is connected to the power supply through a switch.

Note Power supplies must be within the NI 6528/6529 device range. Refer to the *Specifications* section for information about these ranges.

When the switch is open, no current flows through the load and no voltage is applied to the load or to the NI 6528/6529 device input. The digital logic of the NI 6528/6529 device then registers a logic low for the channel. When the switch is closed, current flows through both the load and the NI 6528/6529 device input LED, and the NI 6528/6529 device registers a logic high for the channel.

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Solid-State Relay Outputs (NI 6528 Only)

The solid-state relay (SSR) output channels on the NI 6528 device consist of an LED and two MOSFETs that are connected to form a bi-directional switch. Depending on how the load is connected to the terminals, an output can either source or sink current.

Figures 6 and 7 show examples of sinking and sourcing current.

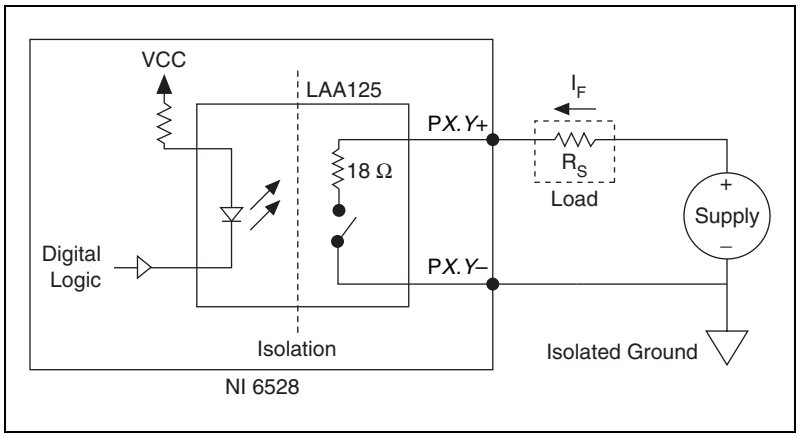


Figure 6. Sinking Current Connection Example

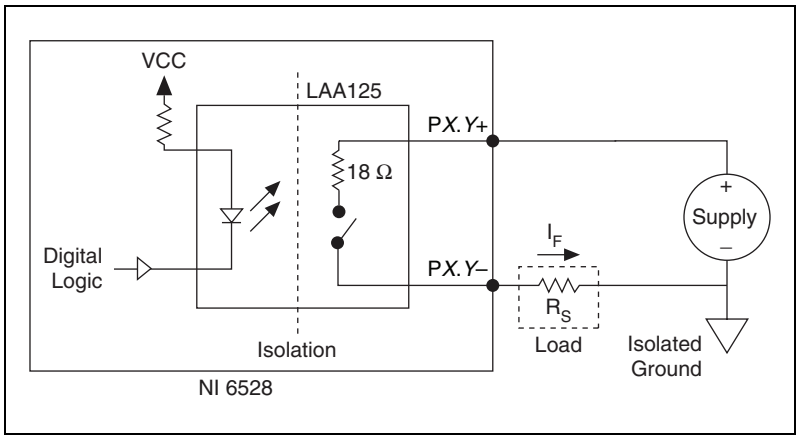


Figure 7. Sourcing Current Connection Example

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Using the NI 6528 as a TTL-Level Device

Using the +5 V line from the NI 6528 device allows you to use it as a TTL-level output device with non-isolated power.

Figure 8 shows a signal connection example for both sinking and sourcing current. This example shows a TTL-level application with a supply voltage of +5 V.

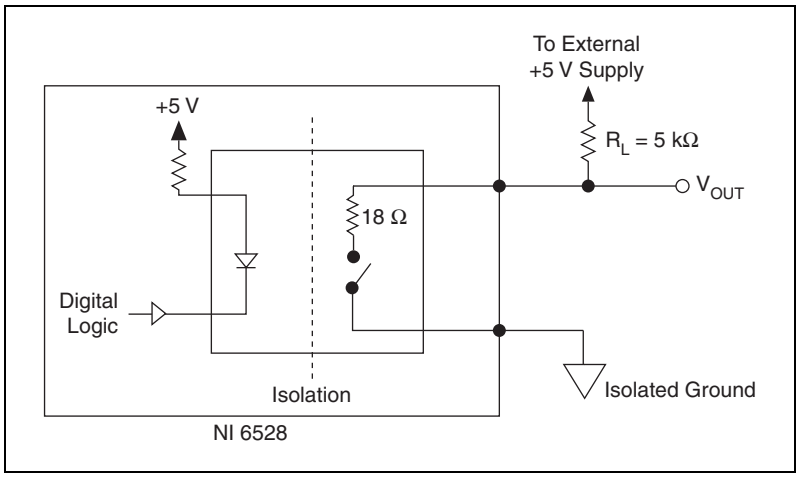


Figure 8. TTL-Level Device Connection Example

When the SSR is open, a small amount of current flows through R_L and the output voltage is close to 5 V, a logic high. When the SSR is closed, current flows through R_L and the output voltage is close to 0 V, a logic low.
If isolation is not a concern, you can use the +5 V line from the NI 6528 device in place of the external +5 V supply.

Choose an R_L value small enough to provide the necessary source current but large enough to reduce sink current and to avoid consuming unnecessary power. Many TTL-level applications use an R_L value of 5 kΩ.

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Maximum Power Ratings

Table 5 lists the maximum power ratings for the output channels.

Table 5. NI 6528 Maximum Power Ratings

Power	Rating
Maximum DC voltage across the terminals (V_{OUT})	60 VDC
Maximum AC voltage across the terminals (V_{OUT})	30 V_{rms} (42 V_{pk})
Maximum current (I_F)	150 mA*

* With all relays carrying 150 mA and all inputs driven to 60 V, the total power dissipation can approach 20 W. The maximum switching capacity CompactPCI systems must be derated according to the ambient temperature and cooling capacity of your system to prevent the device from overheating. The PXI chassis has built-in fans to handle 25 W per slot.

Power-On and Power-Off Conditions

The default power-on state of the digital output lines is logic high with the solid-state relays open. By default, the solid-state relays remain open when the computer and the NI 6528 device are powered off.

Refer to the *Programmable Power-Up Output States (NI 6528 Only)* section for more information about power-on conditions.

Power Connections

Pins 50, 100, 49, and 99 on the I/O connector are not isolated. Pins 50 and 100 connect to GND, the computer ground reference. Pins 49 and 99 of the I/O connector supply +5 V from the computer power supply. The I/O connector power has a fuse for overcurrent protection. This fuse is not customer replaceable. If the fuse is blown, return the device to NI for repair.

Caution The power pins, +5 V and GND, connect to the computer power supply and are not isolated. Do not connect a +5 V power pin directly to GND or connect a +5 V or GND pin to any other voltage source. Doing so may cause injury or permanently damage the NI 6528/6529 components. National Instruments is not liable for any damage or injury resulting from such a connection.

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Isolation Circuitry

The Vishay ILD217T optocouplers optically isolate the NI 6528/6529 digital input ports. Each IC has two independent optocouplers that provide optical isolation for one channel of input.

The Clare LAA125 solid-state relays provide isolation on the output for the NI 6528. Each IC has two independent solid-state relays, each of which provides isolation at each channel of output.

Isolation Voltages

The positive and negative (P*X*.*Y*+ and P*X*.*Y*–) terminals of each channel are isolated from the other input and output channels, from the +5 V and GND pins, and from the computer power supply. Isolation barriers provide isolation up to 60 VDC or 42 VAC between any two terminals, except between the two terminals making up a single digital I/O channel.

Do not exceed 60 VDC or 42 VAC between any two terminals of the NI 6528/6529 device, including the following:

- Any two digital I/O (P*X*.*Y*+ or P*X*.*Y*–) lines of separate channels
- Any P*X*.*Y*+ or P*X*.*Y*– line and the GND or +5 V lines
- **(NI 6528 Only)** The P*X*.*Y*+ line and the P*X*.*Y*– line of any output channel

Do not exceed 60 VDC or 42 VAC or apply voltage below –60 VDC between the P*X*.*Y*+ and P*X*.*Y*– terminals of any input channel.

Caution Do not exceed the isolation voltage limits. Exceeding the voltage limits may cause injury or permanently damage the NI 6528/6529 components. National Instruments is not liable for any damage resulting from signal connections that exceed these limits.

Protecting Inductive Loads (NI 6528 Only)

When inductive loads are connected to outputs, a large counter-electromotive force may occur at switching time because of the energy stored in the inductive load. These flyback voltages can damage the outputs and/or the power supply.

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To limit these flyback voltages at the inductive load, install a flyback diode across the inductive load. For best results, mount the flyback diode within 18 inches of the load. Figure 9 shows an example of using an external flyback diode to protect inductive loads.

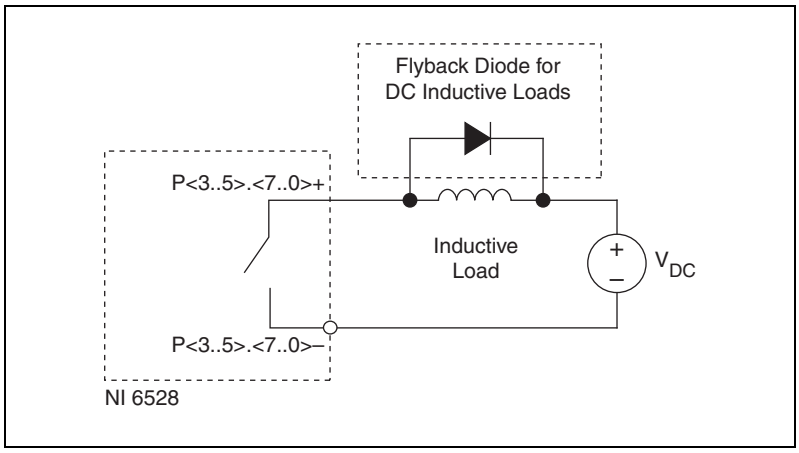


Figure 9. Limiting Flyback Voltages at the Inductive Load

Accessories

National Instruments offers the following products for use with the NI 6528/6529.

Cable (Part Number)	Accessory (Part Number)
SH100-100-F shielded cable (185095)	SCB-100 connector block (776990)
R1005050 ribbon cable (182762)	CB-50 connector block, DIN-rail mount (776164)
	CB-50LP connector block, panel mount (777101)
RTSI cable (776249)	—

For more information about optional equipment available from National Instruments, refer to the National Instruments catalog or visit the National Instruments Web site at `ni.com`.

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Specifications

This section lists the specifications for the NI 6528/6529 device. These specifications are typical at 25 °C, unless otherwise noted.

Power Requirement

+5 VDC (±5%)..... 250 mA, typical (excluding the power consumed through the I/O connector)

+3.3 VDC (±5%)

- NI 6528 ..... 400 mA, typical
- NI 6529 ..... 150 mA, typical

Power available at I/O connector[1]..... +4.0 to +5.25 VDC, 1 A max

Digital I/O

Number of channels

- NI 6528 ..... 24 optically isolated digital input channels and 24 solid-state relay output channels
- NI 6529 ..... 48 optically isolated digital input channels

I/O connector..... 100-pin keyed female SCSI connector

Isolated Inputs

Number of input channels

- NI 6528 ..... 24, each with its own ground reference isolated from other channels
- NI 6529 ..... 48, each with its own ground reference isolated from other channels

Input voltage range..... –60 VDC to 60 VDC

[1] The I/O connector power has a fuse for overcurrent protection. This fuse is not customer replaceable. If the fuse is blown, return the device to NI for repair.

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Digital logic levels

Level	Min	Max
Input low voltage	–60 VDC	1 VDC
Input high voltage	3.2 VDC	60 VDC

Input current .....3.0 mA/channel, max

Minimum pulse-width
for change detection .....150 µs

Propagation delay .....65 µs, typical

Solid-State Relay Outputs (NI 6528 Only)

Number of channels.....24, each with two terminals that are isolated from other channels

Relay type .....Normally open form A solid-state relays

Max switching voltage

AC.....30 V_{rms} (42 V_{pk})

DC.....60 VDC

Max switching capacity .....150 mA[1]

Common-mode isolation .....60 VDC 30 V_{rms} (42 V_{pk}) (channel-to-channel and channel-to-computer)

On resistance.....18 Ω, max

Output capacitance .....50 pF at 50 V

Off leakage current (max).....1 µA

Relay set time (max).....5.0 ms

Relay reset time (max).....5.0 ms

[1] With all relays carrying 150 mA and all inputs driven to 60 V, the total power dissipation can approach 20 W. The maximum switching capacity in PCI and CompactPCI systems must be derated according to the ambient temperature and cooling capacity of your system to prevent the device from overheating. (The PXI chassis has built-in fans to handle 25 W per slot.)

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Default power-on state ..... Relays open

Programmable power-up states response time..... 400 ms

Physical Characteristics

Dimensions

PCI-6528 ..... 17.5 cm × 10.7 cm (6.9 in. × 4.2 in.)

PXI-6528/6529..... 16 cm × 10 cm (6.3 in. × 3.9 in.)

Weight

PCI-6528 ..... 107.7 g (3.8 oz)

PXI-6528/6529..... 130.4 g (4.6 oz)

Environmental

The NI 6528/6529 device is intended for indoor use only.

Operating Environment

Ambient temperature range..... 0 to 55 °C (tested in accordance with IEC-60068-2-1 and IEC-60068-2-2)

Relative humidity range ..... 10 to 90%, noncondensing (tested in accordance with IEC-60068-2-56)

Altitude..... 2,000 m (at 25 °C ambient temperature)

Storage Environment

Ambient temperature range..... –20 to 70 °C (tested in accordance with IEC-60068-2-1 and IEC-60068-2-2)

Relative humidity range ..... 5 to 95%, noncondensing (tested in accordance with IEC-60068-2-56)

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Shock and Vibration (PXI-6528/6529 Only)

Operational shock .....30 g peak, half-sine, 11 ms pulse (tested in accordance with IEC-60068-2-27; test profile developed in accordance with MIL-PRF-28800F)

Random vibration

Operating .....5 to 500 Hz, 0.3 grms

Nonoperating .....5 to 500 Hz, 2.4 grms

Random vibration is tested in accordance with IEC-60068-2-64. The nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.

Safety

This product meets the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

Note For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326 (IEC 61326): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

Note For the standards applied to assess the EMC of this product, refer to the *Online Product Certification* section.

Note For EMC compliance, operate this device with shielded cables.

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CE Compliance CE

This product meets the essential requirements of applicable European Directives as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *NI and the Environment* Web page at `ni.com/environment`. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)



EU Customers At the end of the product life cycle, all products must be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste Electrical and Electronic Equipment, visit `ni.com/environment/weee`.

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