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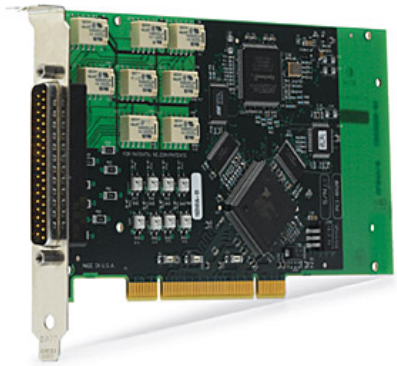
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Requirements and Compatibility | Ordering Information | Detailed Specifications | Pinouts/Front Panel Connections
For user manuals and dimensional drawings, visit the product page resources tab on ni.com.

Last Revised: 2014-11-06 07:14:36.0

Low-Cost Industrial Digital I/O – 150 V





- 8, ±30 VDC digital inputs with 60 V channel-to-channel isolation
- 8 nonlatching mechanical relay outputs
- 150 V AC/DC maximum switching voltage with maximum switching current of 2 A and maximum switching power of 60 W
- UL listed: UL 61010-1 (IEC 61010-1)
- High-reliability industrial feature set includes isolation, programmable power-up states, digital filtering, watchdog timers, and change detection
- NI measurement services software for highest productivity and performance

Overview

NI 6521 industrial digital I/O devices feature eight channel-to-channel isolated digital inputs and eight nonlatching mechanical relay outputs. You can use the eight differential, isolated, ±30 VDC digital inputs to read the status of sensors, actuators, and logic devices. You can use the bipolar digital input channels to read from both sinking and sourcing devices. NI 6521 devices register a logic low if the voltage is between ±4 V, and they register a logic high if the voltage is less than -11 V or greater than +11 V.

These devices offer three single-pole double-throw (SPDT) Form C relays and five single-pole single-throw (SPST) Form A relays. You can use NI 6521 relay outputs to switch devices requiring up to 150 V AC/DC. NI 6521 relay outputs have a maximum current rating of 2 A and maximum switching power of 60 W.

Note: The switching current is limited by the maximum switching power and maximum voltage (current = power/voltage).

NI 6521 devices offer completely programmable configuration and do not require setting up jumpers or DIP switches. These devices are ideal for use with a programmable automation controller (PAC) for automotive test, industrial monitoring, and control applications. With high-current drive, high-voltage outputs, and isolation, you can connect the digital I/O module directly to a wide array of industrial electronic devices, sensors, and actuators. NI 6521 devices take advantage of NI-DAQmx measurement services software (Version 7.5 or later) to speed up application development with many helpful features such as the DAQ Assistant, automatic code generation, and high-performance multithreaded streaming technology.

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Requirements and Compatibility

OS Information

- Windows 2000/XP
- Windows NT
- Windows Vista x64/x86

Driver Information

- NI-DAQmx

Software Compatibility

- LabVIEW
- LabWindows/CVI
- Measurement Studio

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Application and Technology

Hardware

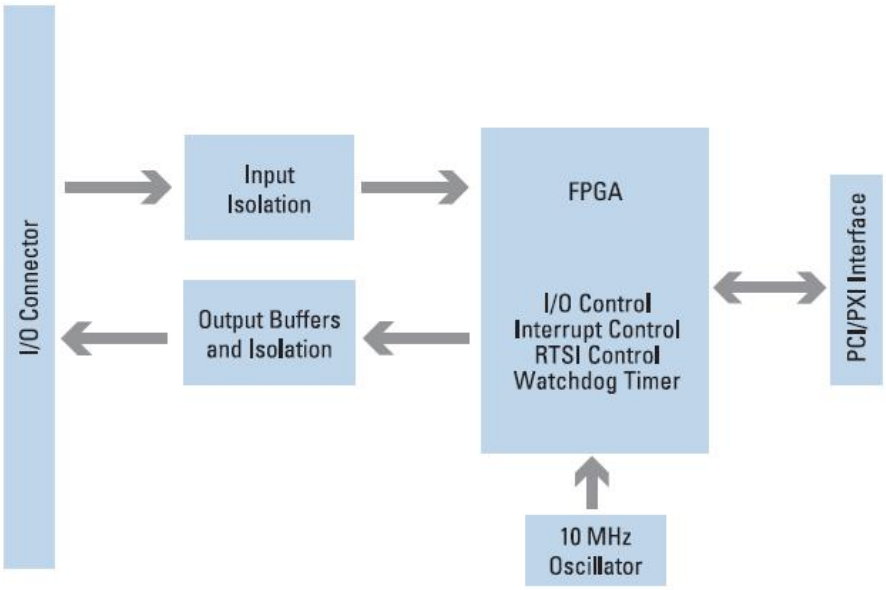
High-Reliability Industrial Feature Set
NI 6521 devices offer a set of high-reliability features designed for demanding automation applications:

- Isolation delivers an extended voltage range for direct connection to industrial sensors and actuators
- Programmable power-up states provide safe operation when connected to pumps/valves/motors/relays
- Watchdog timer detects computer or application crashes and ensures safe recovery to known digital I/O states
-

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- Change detection triggers your application and returns I/O data after a digital event to minimize processor usage
- Programmable input filters eliminate glitches/spikes and remove noise

Direct Sensor Connection with Isolation
Isolation, a form of built-in signal conditioning, provides several advantages such as an extended voltage range for direct connection to industrial sensors and actuators. Isolation also improves signal quality and protects computer circuitry. NI 6521 devices offer channel-to-channel isolation where every channel is physically and electrically separated from the others. This isolation breaks ground loops, improves common-mode voltage and noise rejection, and permits the two parts of the circuit to be at different voltage levels. Many industrial applications require isolation to protect the electronics from transient voltage spikes and provide greater common-mode noise rejection in electrically noisy environments containing machinery and inductive loads.



NI 6521 Hardware Block Diagram

Take Advantage of Glitch-Free Startup with Programmable Power-Up States

Using programmable power-up states, you can configure the initial NI 6521 output states in software to ensure glitch-free operation when connected to industrial actuators such as pumps, valves, motors, and relays. NI 6521 devices hold these known safe I/O states after receiving power, while your computer boots and your software application can begin running. Programmable power-up states are glitch-free, meaning the outputs never go through an incorrect state during power up. You can configure each output line as logic high or logic low. NI 6521 devices store the settings in onboard nonvolatile memory and implement the power-up states automatically after power is applied to the device.

Implement Fault Detection and Recovery with Watchdog Timers
Watchdog timers are an innovative technology that provide protection against a wide variety of fault conditions:

- Computer crash – total OS crash
- Application crash – software application ceases to respond
- Driver crash – device driver ceases to respond
- PCI bus failure – communications cease to respond

With watchdogs, the digital outputs go to a safe state when a fault condition is detected. Watchdogs are important whenever the module is connected to actuators such as pumps, valves, motors, and relays. NI 6521 devices monitor the software application; if the application fails to reset the watchdog timer within the time limit, the device automatically sets the output lines to a user-defined safe state. NI 6521 devices remain in the watchdog state until the watchdog timer is disarmed by the application and new I/O values are written, the NI 6521 is reset, or the computer is restarted.

Trigger Your Application with Change Detection
With change detection, you can automatically trigger your software application to perform a digital read operation upon a digital change of state. A digital change of state is defined as the rising edge (0 to 1 transition) or falling edge (1 to 0 transition) on one or more digital lines. To minimize the effects of noisy input lines, use programmable input filters in combination with change detection to eliminate spurious change detection events caused by noise or glitches. NI-DAQmx also includes multithreaded streaming technology so digital change detection events can occur independent of other data acquisition activities such as analog input or output events. Using change detection, you can monitor for digital events with minimal processor usage. No polling is necessary because the digital I/O module generates an interrupt to automatically wake up your application. Using NI-DAQmx software technology, NI 6521 devices notify the software application when the event is detected, causing the application to automatically perform a read operation.

Eliminate Noise with Programmable Input Filters
Programmable input filters remove noise, glitches, and spikes on input, and provide debouncing for digital switches and relays. This feature is important for applications in noisy industrial environments to prevent false readings caused by noise. You can configure the programmable input filter for each digital line by setting the filter time in seconds. Any digital noise, glitch, or spike that is shorter than half of the specified filter time is blocked by the digital I/O device, preventing invalid readings and false triggers for change detection events.

Relay Forms
Relays are classified by the number of poles and number of throws. The pole of a relay is the terminal common to every path. Each position where the pole can connect is called a throw. A relay can be made of n poles and m throws. A single-pole single-throw (SPST) relay has one pole and one throw. A single-pole double-throw (SPDT) relay has one pole and two throws.



Single-Pole Single-Throw (SPST) Relay



Single-Pole Double-Throw (SPDT) Relay

Figure 2. Relay Diagrams

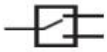
Form	Symbol	Description
Form A		SPST relay with a normally open default state
Form C		SPDT relay that breaks the connection with one throw before making contact with the other (break-before-make)

Table 1. Relay Descriptions

Nonlatching Relays

A nonlatching relay has a power-off initial position of normally closed (NC). This position is maintained by the force of a spring or permanent magnet while no current flows. The normally open (NO) contact is maintained by the force of a magnetic field while current flows through the coil. When the current stops, the relay reverts back to its initial NC position. Nonlatching relays return to the default NC position in case of a fault or power failure. This feature is particularly useful when controlling a motor or valve where the motor or valve needs to be turned off in case of power failure or fault.

Software

NI-DAQmx Software Technology

NI 6521 devices require and are shipped with NI-DAQmx Version 7.5 or later driver software. NI-DAQmx software is also available for download from ni.com/downloads. With NI-DAQmx, you can use your NI digital I/O device in NI LabVIEW, ANSI C, Microsoft Visual C++, and the Microsoft .NET languages C# and Visual Basic .NET. Using NI-DAQmx technology, you can access the full functionality and state-of-the-art hardware technology of your NI 6521 digital I/O devices. NI-DAQmx technology speeds up your development with many features such as automatic code generation to make configuration and programming easy. NI 6521 devices take full advantage of key NI-DAQmx software technologies such as multithreaded streaming technology for dramatic improvements in I/O performance and ease of use.

- Use the DAQ Assistant to guide you to fast, accurate measurements with no programming.
- Use automatic code generation to create your application in LabVIEW, C, Visual Basic .NET, or C#.
- Take advantage of multithreaded streaming technology for 1,000X performance improvements.
- Use automatic timing, triggering, and synchronization technology to make advanced applications easy.
- Visit ni.com for more than 3,000 free software downloads to jump-start your project.
- Use the NI-DAQmx functions for software configuration of all digital I/O features without hardware switches/jumpers.
- Develop your application with easy and open programming in LabVIEW, ANSI C, Microsoft Visual C++, C#, and Visual Basic .NET.

Low-Cost 37-Pin Accessories

Several low-cost, high-voltage accessory options are available for connecting to the 37-pin D-Sub connector of NI 6521 devices. NI 6521 devices are shipped with an accessory safety kit for keying connectors.

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Ordering Information

For a complete list of accessories, visit the product page on ni.com.

Products	Part Number	Recommended Accessories	Part Number
NI PXI-6509			
NI PXI-6521 Requires: 1 Cable , 1 Connector Block ;	779313-01	**Cable:** Shielded - SH37F-37M Cable (1m)	778621-01
		Connector Block: Spring-Screw_Terminals - CB-37F-HVD ***Also Available: [Custom]*	779491-01
NI PCI-6521			
NI PCI-6521 Requires: 1 Cables , 1 Connector Blocks ;	779312-01	**Cables:** Shielded - SH37F-37M Cable (1m)	778621-01
		Connector Blocks: Spring-Screw_Terminals - CB-37F-HVD ***Also Available: [Custom]*	779491-01

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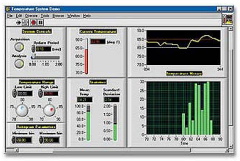
Software Recommendations

LabVIEW Professional Development System for Windows

- Advanced software tools for large project development
- Automatic code generation using DAQ Assistant and Instrument I/O Assistant

NI LabWindows™/CVI for Windows

- Real-time advanced 2D graphs and charts
- Complete hardware compatibility with IVI, VISA, DAQ, GPIB, and serial



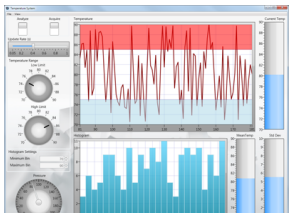
Tight integration with a wide range of hardware

- Advanced measurement analysis and digital signal processing
- Open connectivity with DLLs, ActiveX, and .NET objects
- Capability to build DLLs, executables, and MSI installers



- Analysis tools for array manipulation, signal processing statistics, and curve fitting
- Simplified cross-platform communication with network variables
- Measurement Studio .NET tools (included in LabWindows/CVI Full only)
- The mark LabWindows is used under a license from Microsoft Corporation.

NI Measurement Studio Enterprise Edition



- Customizable graphs and charts for WPF, Windows Forms, and ASP.NET Web Forms UI design
- Enterprise analysis libraries for spectral measurements, linear algebra, statistics curve fitting
- Hardware integration support with native .NET data acquisition and instrument control libraries
- Automatic code generation for all NI-DAQmx data acquisition hardware
- LabWindows™/CVI ANSI C development environment
- Support for Microsoft Visual Studio .NET 2012/2010/2008

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Support and Services

System Assurance Programs

NI system assurance programs are designed to make it even easier for you to own an NI system. These programs include configuration and deployment services for your NI PXI, CompactRIO, or Compact FieldPoint system. The NI Basic System Assurance Program provides a simple integration test and ensures that your system is delivered completely assembled in one box. When you configure your system with the NI Standard System Assurance Program, you can select from available NI system driver sets and application development environments to create customized, reorderable software configurations. Your system arrives fully assembled and tested in one box with your software preinstalled. When you order your system with the standard program, you also receive system-specific documentation including a bill of materials, an integration test report, a recommended maintenance plan, and frequently asked question documents. Finally, the standard program reduces the total cost of owning an NI system by providing three years of warranty coverage and calibration service. Use the online product advisors at ni.com/advisor to find a system assurance program to meet your needs.

Calibration

NI measurement hardware is calibrated to ensure measurement accuracy and verify that the device meets its published specifications. To ensure the ongoing accuracy of your measurement hardware, NI offers basic or detailed recalibration service that provides ongoing ISO 9001 audit compliance and confidence in your measurements. To learn more about NI calibration services or to locate a qualified service center near you, contact your local sales office or visit ni.com/calibration.

Technical Support

Get answers to your technical questions using the following National Instruments resources.

- **Support** - Visit ni.com/support to access the NI KnowledgeBase, example programs, and tutorials or to contact our applications engineers who are located in NI sales offices around the world and speak the local language.
- **Discussion Forums** - Visit forums.ni.com for a diverse set of discussion boards on topics you care about.
- **Online Community** - Visit community.ni.com to find, contribute, or collaborate on customer-contributed technical content with users like you.

Repair

While you may never need your hardware repaired, NI understands that unexpected events may lead to necessary repairs. NI offers repair services performed by highly trained technicians who quickly return your device with the guarantee that it will perform to factory specifications. For more information, visit ni.com/repair.

Training and Certifications

The NI training and certification program delivers the fastest, most certain route to increased proficiency and productivity using NI software and hardware. Training builds the skills to more efficiently develop robust, maintainable applications, while certification validates your knowledge and ability.

- **Classroom training in cities worldwide** - the most comprehensive hands-on training taught by engineers.
- **On-site training at your facility** - an excellent option to train multiple employees at the same time.
- **Online instructor-led training** - lower-cost, remote training if classroom or on-site courses are not possible.
- **Course kits** - lowest-cost, self-paced training that you can use as reference guides.
- **Training memberships** and training credits - to buy now and schedule training later.

Visit ni.com/training for more information.

Extended Warranty

NI offers options for extending the standard product warranty to meet the life-cycle requirements of your project. In addition, because NI understands that your requirements may change, the extended warranty is flexible in length and easily renewed. For more information, visit ni.com/warranty.

OEM

NI offers design-in consulting and product integration assistance if you need NI products for OEM applications. For information about special pricing and services for OEM customers, visit ni.com/oem.

Alliance

Our Professional Services Team is comprised of NI applications engineers, NI Consulting Services, and a worldwide National Instruments Alliance Partner program of more than 700 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit ni.com/alliance.

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Detailed Specifications

This document lists specifications for the NI 6521 device. All specifications are subject to change without notice. These specifications are typical at 25 °C unless otherwise noted.

Certification	UL listed
Maximum working voltage	
Channel-to-channel	150 V
Channel-to-earth	150 V, Measurement Category II

Caution This module is rated for Measurement Category II and is intended to carry signal voltages no greater than 150 V. This module can withstand up to 1,500 V impulse voltage. Do *not* use this module for connection to signals or for measurements within Categories III or IV. Do *not* connect to MAINS supply circuits greater than 150 VAC. Refer to the *NI 6520/6521 User Guide* for more information about measurement categories.

When hazardous voltages (>42.4 V_{pk}/60 VDC) are present on any signal, all signals must be considered hazardous. Ensure that external wiring or any circuits connected to the device are properly insulated from human contact.

Caution This product must be used with special keyed cables and accessories. Refer to the *Accessories* section of this document and the *37-Pin High-Voltage Accessory Safety Kit Installation Guide* shipped with your device for more information.

Caution The PCI-6521 must be installed in a PC that adequately grounds the front panel bracket to the chassis of the PC.

Caution Do *not* remove covers from the PCI-6521. Doing so can result in electrical shock or death.

Caution Use the PXI-6521 in a PXI chassis with properly installed PXI filler panels.

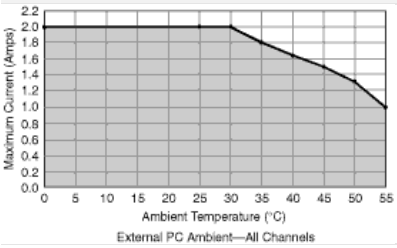
Do *not* remove the filler panels from the PXI-6521. Doing so can result in electrical shock or death.

Digital I/O	
Number of channels	16 (eight optically isolated digital input channels and eight non-latching relay output channels)
Data transfers	Interrupts, programmed I/O
I/O connector	37-pin keyed male D-SUB
Isolated Inputs	
Number of input channels	8 (each bipolar and isolated from other channels)
Configuration	8-channel optically isolated digital inputs
Input voltage range	–30 VDC to 30 VDC, P0.*X*+ to P0.*X*–; 150 V, channel-to-earth [1]
Isolation	
Channel-to-channel	60 VDC continuous [2]
Channel-to-bus	150 V continuous [3]
Channel-to-earth	150 V continuous [4]

Digital logic levels		
Level	**Min**	**Max**
Input low voltage	0 VDC	±4 VDC
Input high voltage	±11 VDC	±30 VDC

Input current	
11 V inputs	4.5 mA/channel max
30 V inputs	12.5 mA/channel max

Propagation delay	45 µs typ
Electromechanical Relay Outputs	
Number of channels	8
Configuration	3-channel SPDT, non-latching; 5-channel SPST, non-latching
Relay types	3 non-latching SPDT (Form C), 5 non-latching SPST (Form A)
Power-on state	De-energized, default; user-programmable to de-energized or energized
Note The response time of programmable power-up states is 400 ms.	
Default power-off state	Relays de-energized
Caution The maximum switching current is limited by the maximum switching power, the maximum voltage, and must not exceed 60 W/60 VA.	
Contact rating	
Maximum switching power	60 W/60 VA
Maximum voltage (AC)	150 VAC, CAT II
Maximum voltage (DC)	150 VDC, CAT II
Maximum current	
PXI-6521 (per channel)	2 A [5]
PCI-6521 (per channel)	Refer to the following figure
Maximum Current for Ambient Temperatures ≤ 55 °C	



DC path resistance	
Initial	< 0.2 Ω typ
End of life	≥1.0 Ω typ
Relay operate time	2 ms typ, 4 ms max
Expected relay life	
Mechanical	100,000,000 cycles
Electrical	
30 VDC, 1 ADC resistive	500,000 cycles
30 VDC, 2 ADC resistive	100,000 cycles
125 VAC, 0.2 AAC resistive	300,000 cycles
125 VAC, 0.5 AAC resistive	100,000 cycles
Power Requirement	
PXI-6521	
3.3 V (±5%)	100 mA max
5 V (±5%)	300 mA typ, 500 mA max
PCI-6521	
5 V (±5%)	400 mA typ, 600 mA max
Physical Characteristics	
PXI-6521	
Dimensions	16 cm × 10 cm (6.3 in. × 3.9 in.)
Weight	150.0 g (5.0 oz)
PCI-6521	
Dimensions	17.5 cm × 9.9 cm (6.9 in. × 3.9 in.)

Weight	170.0 g (6.0 oz)

Accessories

(PXI-6521 Only) TB-2621, High-Voltage CAT II 150 V 37-Pin Front-Mounting PXI Terminal Block	779444-01
SH37F-37M-2 37-Pin Female-to-Male Shielded I/O Cable, 2 m	778621-02
SH37F-37M-1 37-Pin Female-to-Male Shielded I/O Cable, 1 m	778621-01
CB-37F-HVD 37-Pin High-Voltage DIN Rail Mountable Terminal Block	779491-01
37-Pin High-Voltage Accessory Safety Kit	779445-01
TB-37F-37CP 37-Pin Crimp and Poke Terminals	779185-01

Environmental

The NI 6521 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)
Pollution Degree	2
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)
Shock and Vibration (PXI-6521 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 g_{rms}
Nonoperating	5 to 500 Hz, 2.4 g_{rms}

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 Standards

This product is designed to meet 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.

CE Compliance CE

This product meets the essential requirements of applicable European Directives, as amended for CE marking, 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 module number or product line, and click the appropriate link in the Certification column.

Environmental Management

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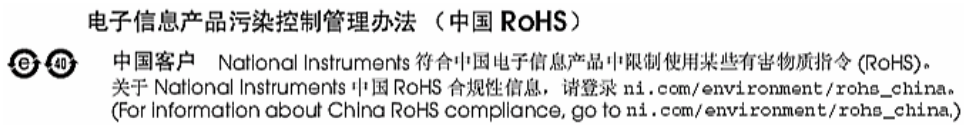
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For additional environmental information, refer to the *NI and the Environment* Web page at ni.com/environment. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included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



[1] The voltage added on P0.*X*+ can reach up to 150 VDC. The voltage added on P0.*X*– can reach up to 150 VDC. However, the voltage drop from P0.*X*+ to P0.*X*– should be limited within ±30 VDC.

[2] Verified by 620 Vrms dielectric withstand test, 5 s.

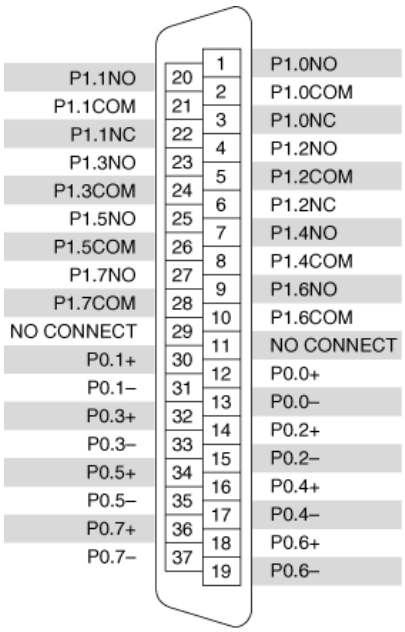
[3] Verified by 1,400 Vrms dielectric withstand test, 5 s.

[4] Verified by 850 Vrms dielectric withstand test, 5 s.

[5] All relay channels–external PXI chassis ambient, up to 55 °C.

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Pinouts/Front Panel Connections



NI 6521 Pin Assignments

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