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Last Revised: 2009-11-25 13:52:00.0

NI X Series Multifunction Data Acquisition

Overview

NI X Series devices for PCI Express and PXI Express are the most advanced data acquisition devices ever designed by National Instruments. They feature significant improvements in onboard timing and triggering and optimizations for use with multicore PCs. X Series devices integrate high-performance analog, digital, and counter/timer functionality onto a single device, making them well-suited for a broad range of applications, from basic data logging to control and test automation.

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Requirements and Compatibility

OS Information

Windows Vista x64/x86
PharLap
Real-Time OS
Windows 7 x64
Windows XP
Windows 7

Driver Information

NI-DAQmx

Software Compatibility

ANSI C/C++
LabVIEW
LabVIEW Real-Time Module
LabVIEW SignalExpress
Visual Studio .NET
Measurement Studio
Visual Basic
LabWindows/CVI

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Comparison Tables

Bus	Model Number	Analog Inputs (AI)	Max AI Sampling Rate (1-channel)	Max Total AI Throughput	Analog Outputs (AO)	Max AO Update Rate	Digital I/O Lines	Max Digital I/O Rate	Triggering
PCI Express	6320	16	250 kS/s	250 kS/s	0	-	24	1 MHz	Digital
PCI Express	6321	16	250 kS/s	250 kS/s	2	900 kS/s	24	1 MHz	Digital
PCI Express	6323	32	250 kS/s	250 kS/s	4	900 kS/s	48	1 MHz	Digital
PCI Express, PXI Express	6341	16	500 kS/s	500 kS/s	2	900 kS/s	24	1 MHz	Digital
PCI Express	6343	32	500 kS/s	500 kS/s	4	900 kS/s	48	1 MHz	Digital
PCI Express	6351	16	1.25 MS/s	1 MS/s	2	2.86 MS/s	24	10 MHz	Analog, Digital
PCI Express	6353	32	1.25 MS/s	1 MS/s	4	2.86 MS/s	48	10 MHz	Analog, Digital

Bus	Model Number	Analog Inputs (AI)	Max AI Sampling Rate (1-channel)	Max Total AI Throughput	Analog Outputs (AO)	Max AO Update Rate	Digital I/O Lines	Max Digital I/O Rate	Triggering
PCI Express, PXI Express	6361	16	2 MS/s	1 MS/s	2	2.86 MS/s	24	10 MHz	Analog, Digital
PCI Express, PXI Express	6363	32	2 MS/s	1 MS/s	4	2.86 MS/s	48	10 MHz	Analog, Digital
PXI Express	6356	8 simultaneous	1.25 MS/s/channel	10 MS/s	2	3.33 MS/s	24	10 MHz	Analog, Digital
PXI Express	6358	16 simultaneous	1.25 MS/s/channel	20 MS/s	4	3.33 MS/s	48	10 MHz	Analog, Digital
PXI Express	6366	8 simultaneous	2 MS/s/channel	16 MS/s	2	3.33 MS/s	24	10 MHz	Analog, Digital
PXI Express	6368	16 simultaneous	2 MS/s/channel	32 MS/s	4	3.33 MS/s	48	10 MHz	Analog, Digital

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Application and Technology

NI-STC3 Timing and Synchronization Technology

NI X Series multifunction data acquisition (DAQ) devices include the NI-STC3, an ASIC designed by NI for advanced timing, triggering, and synchronization. This technology includes the following:

- Four counter/timers with more functionality than ever before, such as the ability to create a finite pulse train with a single counter
- A 100 MHz timebase for faster triggering response and more precise generation of analog and digital sample clocks
- Independent analog and digital timing engines
- Retriggerable measurement tasks for analog I/O, digital I/O, and counter/timers

Native PCI Express Interface

In contrast to a PCI-to-PCI Express bridge chip, which limits the bandwidth of the device to that of the PCI bus and introduces latency, X Series devices use a native x1 PCI Express interface that provides up to 250 MB/s in each direction. National Instruments has also optimized this interface for low latency in single-point control applications. You can use X Series PCI Express boards in any PCI Express slot from x1 up to x16.

Software Enhancements

X Series devices are compatible with NI-DAQmx Version 9.0 or later driver software. More than a basic driver, NI-DAQmx includes the NI Measurement & Automation Explorer (MAX) configuration utility, the DAQ Assistant for rapid development of basic applications, and hundreds of example programs for NI LabVIEW and text-based languages. NI-DAQmx also includes LabVIEW SignalExpress LE basic data-logging software.

NI-DAQmx 9.0 introduces the ability to synchronize multiple X Series devices with a single NI-DAQmx task, which previously took several tasks and manual routing of clocks and triggers. This version also introduces the fastest, easiest way to acquire measurement data to disk in the Technical Data Management Streaming (TDMS) format with the new Configure Logging VI.

With NI-DAQmx and intuitive LabVIEW graphical programming, you can easily develop applications that take advantage of today's multicore systems so you can perform acquisition, signal processing, and data logging on different CPU cores.

Simultaneous Sampling X Series

Because of the added bandwidth provided by PCI Express, the X Series offers simultaneous sampling options using the same channel counts and connectivity as multiplexed devices. The higher bandwidth of the PCI Express bus also alleviates the need to have several megabytes of onboard memory for simultaneous sampling devices.

Unlike multiplexed devices that reduce sampling rates as you add more channels, you can use simultaneous sampling devices to maintain sampling rates as you expand the number of channels. Simultaneous sampling X Series devices are available with up to 16 differential channels per device and with PXI Express, you can sample more than 200 channels simultaneously.

Applications

Acquisition and Visualization

X Series devices include analog, digital, and counter circuitry for the most common types of static and waveform measurements. With LabVIEW, you can easily acquire the data and view it on a variety of graphs and displays. You can use configuration-based wizards called Express VIs to take measurements and perform signal processing with minimal programming.

Data Logging

Whether you are validating a new hardware design, monitoring conditions on a factory floor, or recording temperature changes during a scientific experiment, you need to take measurements, visualize your data, and often log it to disk. With X Series multifunction DAQ, you can develop a user-defined measurement system by using intuitive graphical programming software and incorporating the exact visualization, analysis, and data-logging capabilities your application requires.

Control Systems

If you need to control the temperature of a room, the speed of a motor, or the pressure of hydraulic fluids, you can use X Series DAQ hardware to connect sensors and actuators to your computer and build the control system that meets your exact application needs. The low-latency PCI Express bus improves single-point I/O performance, and with LabVIEW software and NI-DAQmx driver software, you can easily take sensor measurements, compare values to a setpoint, and update output signals. X Series devices also have four counter/timers for performing quadrature encoder measurements, pulse-width modulation, pulse train generation, frequency measurements, and much more, making them ideal for basic motor control.

Test Automation

X Series DAQ hardware provides analog inputs, analog outputs, hardware-timed digital I/O, and four counter/timers on a single device, making it a cost-effective option for basic device under test characterization and test automation. With NI-DAQmx software, you can easily synchronize acquisition or generation on multiple subsystems, such as an analog input and analog output channel. In addition, you can easily synchronize two or more X Series devices for further expansion by using a RTSI cable for PCI Express devices or over the PXI Express backplane for PXI Express modules.

Compatible Accessories

All X Series devices use either a single or dual-stack 68-pin VHDCI female connector, depending on the number of analog and digital channels on the device. National Instruments offers several options for cables, from 0.5 to 10 m and from low-cost to high-performance with shielding. Connector blocks are available with screw terminal, BNC, or custom connector types.

For measurements requiring signal conditioning, you can use X Series with SCXI signal conditioning modules.

Upgrading

Because X Series devices use the same VHDCI connector and NI-DAQmx driver software as NI M Series devices, upgrading is easy. You can reuse your code and preserve your investment in accessories. The pinouts for X Series devices are backward-compatible with M Series devices.

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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 PCIe-6323			
NI PCIe-6323 Each NI PCIe-6323 requires: 2 Cables, 2 Connector Blocks	781045-01		
		Connector 0:	
		Cable: Shielded - SHC68-68-EPM Cable (2m) ***Also available: Unshielded*	192061-02
		Connector Block: Screw Terminals - SCB-68 ***Also available: BNC Termination*	776844-01
		Connector 1:	
		Cable: Shielded - SHC68-68-EPM Cable (2m) ***Also available: Unshielded*	192061-02
		Connector Block: Screw Terminals - SCB-68 ***Also available: BNC Termination*	776844-01

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Software Recommendations

NI LabVIEW Professional Development System for Windows

Easy-to-use graphical development environment

Tight integration with a wide range of measurement hardware

Rapid user interface development for displaying live data

Extensive signal processing, analysis, and math functionality

Source code control integration and code complexity metrics

Support for Windows 2000/XP/Vista/7 (32-bit) and Windows Vista/7 (64-bit)

NI LabWindows™/CVI for Windows

Real-time advanced 2D graphs and charts with support for Windows Vista/XP/2000

Complete hardware compatibility with IVI, VISA, DAQ, GPIB, and serial

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 LabVIEW SignalExpress for Windows

Quickly configure projects without programming

Control over 400 PC-based and stand-alone instruments

Log data from more than 250 data acquisition devices

Perform basic signal processing, analysis, and file I/O

Scale your application with automatic LabVIEW code generation

Create custom reports or easily export data to LabVIEW, DIAdem or Microsoft Excel

NI Measurement Studio Professional Edition

Base analysis and instrumentation components for Microsoft Visual Basic, Visual C#, and Visual C++

Cross-platform communication with network variables

Scientific user interface controls

Code-generating DAQ Assistant and Instrument I/O Assistant

Acquire data from GPIB, serial, Ethernet, and plug-in data acquisition devices

Requires Microsoft Visual Studio 2008/2005/.NET 2003 or Visual Studio 6.0

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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. NI offers a number of calibration services to help maintain the ongoing accuracy of your measurement hardware. These services allow you to be completely confident in your measurements, and help you maintain compliance to standards like ISO 9001, ANSI/NCSL Z540-1 and ISO/IEC 17025. 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 600 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit ni.com/alliance.

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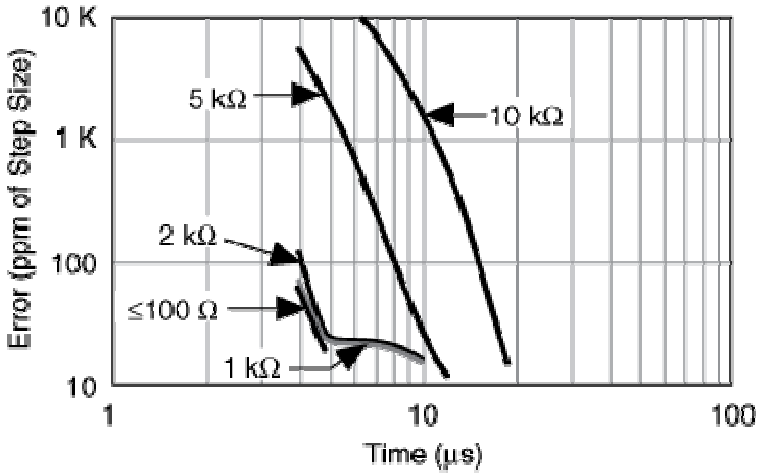
Detailed Specifications

Specifications listed below are typical at 25 °C unless otherwise noted. Refer to the *X Series User Manual* for more information about NI PCIe-6320/6321/6323 devices.

Analog Input	
Number of channels	
NI 6320/6321	8 differential or 16 single ended
NI 6323	16 differential or 32 single ended
ADC resolution	16 bits
DNL	No missing codes guaranteed
INL	Refer to the *AI Absolute Accuracy Table*
Sampling rate	
Maximum	250 kS/s single channel, 250 kS/s multi-channel (aggregate)
Minimum	No minimum
Timing accuracy	50 ppm of sample rate
Timing resolution	10 ns
Input coupling	DC
Input range	±10 V, ±5 V, ±1 V, ±0.2 V
Maximum working voltage for analog inputs (signal + common mode)	±11 V of AI GND
CMRR (DC to 60 Hz)	100 dB
Input impedance	
Device on	
AI+ to AI GND	>10 GΩ in parallel with 100 pF
AI– to AI GND	>10 GΩ in parallel with 100 pF
Device off	
AI+ to AI GND	1200 Ω

AI– to AI GND	1200 Ω
Input bias current	±100 pA
Crosstalk (at 100 kHz)	
Adjacent channels	–75 dB
Non-adjacent channels	–90 dB
Small signal bandwidth (–3 dB)	700 kHz
Input FIFO size	4,095 samples
Scan list memory	4,095 entries
Data transfers	DMA (scatter-gather), programmed I/O
Overvoltage protection (AI <0..31>, AI SENSE, AI SENSE 2)	
Device on	±25 V for up to two AI pins
Device off	±15 V for up to two AI pins
Input current during overvoltage condition	±20 mA max/AI pin
Settling Time for Multichannel Measurements	
Accuracy, full scale step, all ranges	
±90 ppm of step (±6 LSB)	4 µs convert interval
±30 ppm of step (±2 LSB)	5 µs convert interval
±15 ppm of step (±1 LSB)	7 µs convert interval
Analog triggers	None
Typical Performance Graphs	

Settling Error Versus Time for Different Source Impedances



Analog Output

Number of channels	
NI 6320	0
NI 6321	2
NI 6323	4
DAC resolution	16 bits
DNL	±1 LSB
Monotonicity	16 bit guaranteed
Maximum update rate	
1 channel	900 kS/s
2 channels	840 kS/s per channel
3 channels	775 kS/s per channel
4 channels	719 kS/s per channel
Timing accuracy	50 ppm of sample rate
Timing resolution	10 ns
Output range	±10 V
Output coupling	DC
Output impedance	0.2 Ω

Output current drive	±5 mA
Overdrive protection	±15 V
Overdrive current	15 mA
Power-on state	±20 mV
Power-on/off glitch	2 V for 500 ms
Output FIFO size	8,191 samples shared among channels used
Data transfers	DMA (scatter-gather), programmed I/O
AO waveform modes:	
Non-periodic waveform	
Periodic waveform regeneration mode from onboard FIFO	
Periodic waveform regeneration from host buffer including dynamic update	
Settling time, full scale step 15 ppm (1 LSB)	6 µs
Slew rate	15 V/µs
Glitch energy	
Magnitude	100 mV
Duration	2.6 µs

Calibration (AI and AO)

Recommended warm-up time	15 minutes
Calibration interval	1 year

AI Absolute Accuracy Table

Nominal Range		Residual Gain Error (ppm of Reading)	Gain Tempco (ppm/°C)	Reference Tempco (ppm/°C)	Residual Offset Error (ppm of Range)	Offset Tempco (ppm of Range/°C)	INL Error (ppm of Range)	Random Noise, σ (μV_{rms})	Absolute Accuracy at Full Scale (µV)
Positive Full Scale	Negative Full Scale								

Nominal Range		Residual Gain Error (ppm of Reading)	Gain Tempco (ppm/°C)	Reference Tempco (ppm/°C)	Residual Offset Error (ppm of Range)	Offset Tempco (ppm of Range/°C)	INL Error (ppm of Range)	Random Noise, σ (μV_{rms})	Absolute Accuracy at Full Scale (µV)
Positive Full Scale	Negative Full Scale								
10	–10	65	7.3	5	13	24	60	229	2260
5	–5	72	7.3	5	13	25	60	118	1170
1	–1	78	7.3	5	17	37	60	26	260
0.2	– 0.2	105	7.3	5	27	93	60	12	72

AI Absolute Accuracy Formulas

AbsoluteAccuracy = Reading · (GainError) + Range · (OffsetError) + NoiseUncertainty
GainError = ResidualGainError + GainTempco · (TempChangeFromLastInternalCal) + ReferenceTempco · (TempChangeFromLastExternalCal)
OffsetError = ResidualOffsetError + OffsetTempco · (TempChangeFromLastInternalCal) + INL_Error
NoiseUncertainty = (RandomNoise · 3) / √ 100, for a coverage factor of 3 σ and averaging 100 points.

Absolute accuracy at full scale on the analog input channels is determined using the following assumptions:

TempChangeFromLastExternalCal = 10 °C
TempChangeFromLastInternalCal = 1 °C
number_of_readings = 100
CoverageFactor = 3 σ

For example, on the 10 V range, the absolute accuracy at full scale is as follows:

GainError = 65 ppm + 7.3 ppm · 1 + 5 ppm · 10
GainError = 122 ppm

OffsetError = 13 ppm + 24 ppm · 1 + 60 ppm

OffsetError = 97 ppm

NoiseUncertainty = (229 µV · 3) / √ 100
NoiseUncertainty = 69 µV

AbsoluteAccuracy = 10 V · (GainError) + 10 V · (OffsetError) + NoiseUncertainty
AbsoluteAccuracy = 2,260 µV

Accuracies listed are valid for up to one year from the device external calibration.

AO Absolute Accuracy Table

Nominal Range		Residual Gain Error (ppm of Reading)	Gain Tempco (ppm/°C)	Reference Tempco (ppm/°C)	Residual Offset Error (ppm of Range)	Offset Tempco (ppm of Range/°C)	INL Error (ppm of Range)	Absolute Accuracy at Full Scale (µV)
Positive Full Scale	Negative Full Scale							
10	–10	80	11.3	5	53	4.8	128	3,271

Absolute Accuracy Formulas

Absolute Accuracy at full scale numbers is valid immediately following internal calibration and assumes the device is operating within 10 °C of the last external calibration.

AbsoluteAccuracy = OutputValue · (GainError) + Range · (OffsetError)
GainError = ResidualGainError + GainTempco · (TempChangeFromLastInternalCal) + ReferenceTempco · (TempChangeFromLastExternalCal)
OffsetError = ResidualOffsetError + OffsetTempco · (TempChangeFromLastInternalCal) + INL_Error

Accuracies listed are valid for up to one year from the device external calibration.

Digital I/O/PFI

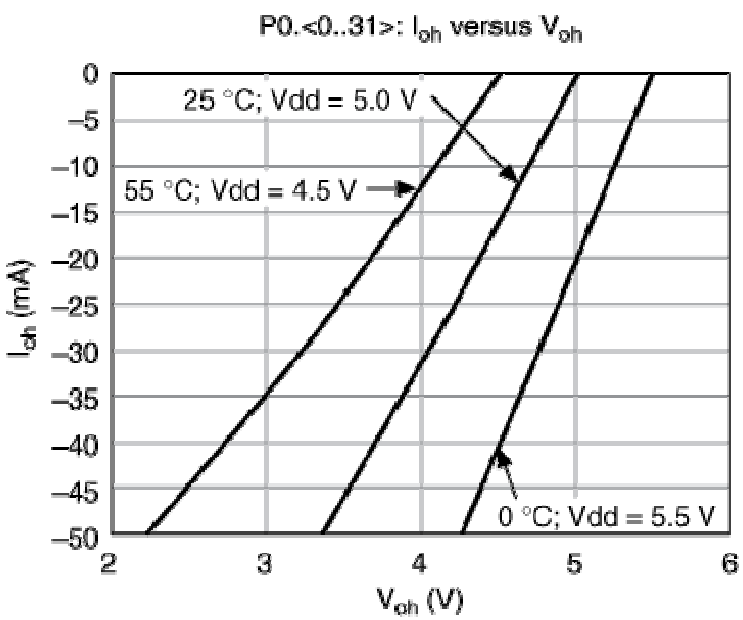
Static Characteristics	
Number of channels	
NI 6320/6321	24 total, 8 (P0.<0..7>) 16 (PFI <0..7>/P1, PFI <8..15>/P2)
NI 6323	48 total, 32 (P0.<0..31>) 16 (PFI <0..7>/P1, PFI <8..15>/P2)
Ground reference	D GND
Direction control	Each terminal individually programmable as input or output
Pull-down resistor	50 kΩ typical, 20 kΩ minimum
Input voltage protection [1]	±20 V on up to two pins
Waveform Characteristics (Port 0 Only)	
Terminals used	
NI 6320/6321	Port 0 (P0.<0..7>)
NI 6323	Port 0 (P0.<0..31>)
Port/sample size	
NI 6320/6321	Up to 8 bits
NI 6323	Up to 32 bits
Waveform generation (DO) FIFO	2,047 samples
Waveform acquisition (DI) FIFO	255 samples
DO or DI Sample Clock frequency	0 to 1 MHz, system and bus activity dependent
Data transfers	DMA (scatter-gather), programmed I/O
Digital line filter settings	160 ns, 10.24 µs, 5.12 ms, disable
PFI/Port 1/Port 2 Functionality	
Functionality	Static digital input, static digital output, timing input, timing output
Timing output sources	Many AI, AO, counter, DI, DO timing signals
Debounce filter settings	90 ns, 5.12 µs, 2.56 ms, custom interval, disable; programmable high and low transitions; selectable per input
Recommended Operation Conditions	

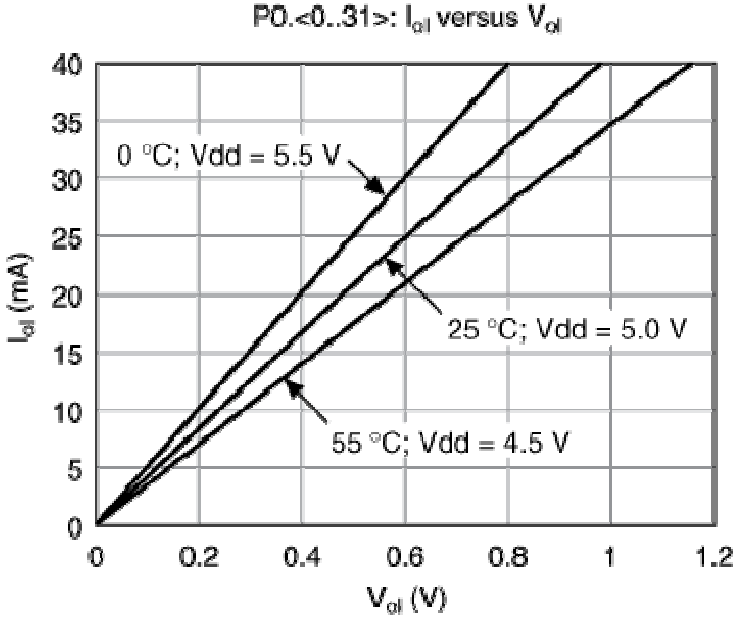
Level	Min	Max
Input high voltage (V_{IH})	2.2 V	5.25 V
Input low voltage (V_{IL})	0 V	0.8 V
Output high current (I_{OH})		
P0.<0..31>	—	–24 mA
PFI <0..15>/P1/P2	—	–16 mA
Output low current (I_{OL})		
P0.<0..31>	—	24 mA
PFI <0..15>/P1/P2	—	16 mA

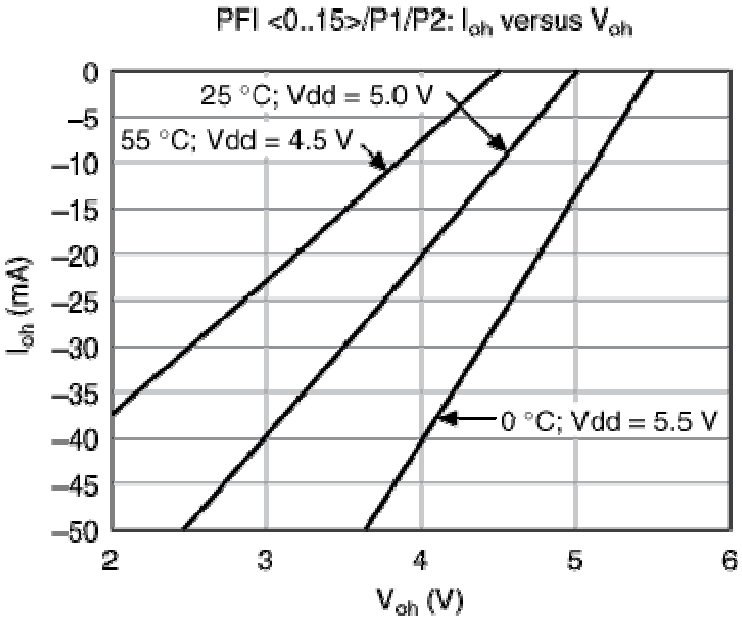
Electrical Characteristics

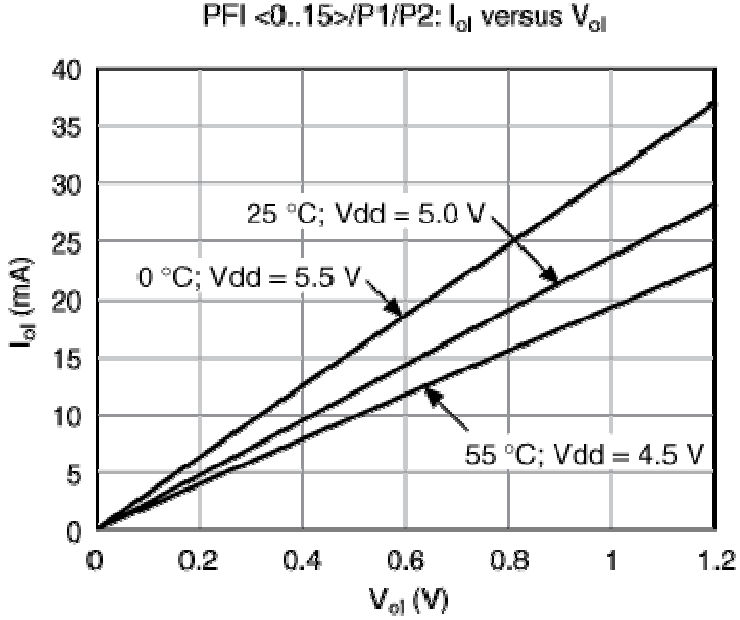
Level	Min	Max
Positive-going threshold (VT+)	—	2.2 V
Negative-going threshold (VT–)	0.8 V	—
Delta VT hysteresis (VT+ – VT–)	0.2 V	—
I_{IL} input low current (V_{in} = 0 V)	—	–10 µA
I_{IH} input high current (V_{in} = 5 V)	—	250 µA

Digital I/O Characteristics









General-Purpose Counter/Timers

Number of counter/timers	4
Resolution	32 bits
Counter measurements	Edge counting, pulse, pulse width, semi-period, period, two-edge separation
Position measurements	X1, X2, X4 quadrature encoding with Channel Z reloading; two-pulse encoding
Output applications	Pulse, pulse train with dynamic updates, frequency division, equivalent time sampling
Internal base clocks	100 MHz, 20 MHz, 0.1 MHz
External base clock frequency	0 MHz to 25 MHz
Base clock accuracy	50 ppm
Inputs	Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down, Sample Clock
Routing options for inputs	Any PFI, RTSI, many internal signals
FIFO	127 samples per counter

Data transfers	Dedicated scatter-gather DMA controller for each counter/timer, programmed I/O
Frequency Generator	
Number of channels	1
Base clocks	20 MHz, 10 MHz, 100 kHz
Divisors	1 to 16
Base clock accuracy	50 ppm
Output can be available on any PFI or RTSI terminal.	
Phase-Locked Loop (PLL)	
Number of PLLs	1
Reference signal	RTSI <0..7>, PFI <0..15>
Input frequency	10 MHz, 20 MHz
Output of PLL	100 MHz Timebase; other signals derived from 100 MHz Timebase including 20 MHz and 100 kHz Timebases
External Digital Triggers	
Source	Any PFI, RTSI
Polarity	Software-selectable for most signals
Analog input function	Start Trigger, Reference Trigger, Pause Trigger, Sample Clock, Convert Clock, Sample Clock Timebase
Analog output function	Start Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase
Counter/timer functions	Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down, Sample Clock
Digital waveform generation (DO) function	Start Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase
Digital waveform acquisition (DI) function	Start Trigger, Reference Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase

Device-To-Device Trigger Bus	
NI PCIe-632x	RTSI <0..7>
Output selections	10 MHz Clock, frequency generator output, many internal signals
Debounce filter settings	90 ns, 5.12 µs, 2.56 ms, custom interval, disable; programmable high and low transitions; selectable per input
Bus Interface	
Form factor	x1 PCI Express, specification v1.1 compliant
Slot compatibility	x1, x4, x8, and x16 PCI Express slots [2]
DMA channels	8, analog input, analog output, digital input, digital output, counter/timer 0, counter/timer 1, counter/timer 2, counter/timer 3
Power Requirements	
Without disk drive power connector installed	
+3.3 V	1.4 W
+12 V	8.6 W
With disk drive power connector installed	
+3.3 V	1.4 W
+12 V	3 W
+5 V	15 W
Current Limits	
Caution Exceeding the current limits may cause unpredictable behavior by the device and/or PC.	
Without disk drive power connector installed	
P0/PFI/P1/P2 and +5 V terminals combined	1 A max
With disk drive power connector installed	
+5 V terminal (connector 0)	1 A max

+5 V terminal (connector 1)	1 A max
P0/PFI/P1/P2 combined	1 A max
Physical Requirements	
Printed circuit board dimensions	9.9 × 16.8 cm (3.9 × 6.6 in.) (half-length)
Weight	
NI PCIe-6320/6321	104 g (3.6 oz)
NI PCIe-6323	114 g (4.0 oz)
I/O connector	
NI 6320/6321	1 68-pin VHDCI
NI 6323	2 68-pin VHDCI
Mating connectors	
68-Pos Right Angle Single Stack PCB-Mount VHDCI (Receptacle), MOLEX 71430-0013 68-Pos Right Angle Dual Stack PCB-Mount VHDCI (Receptacle), MOLEX 74337-0016 68-Pos Offset IDC Cable Connector (Plug) (SHC68-*), MOLEX 71425-3001	
Disk drive power connector (NI PCIe-6341/6343)	Standard ATX peripheral connector (not serial ATA)
Maximum Working Voltage [3]	
Channel to earth	11 V, Measurement Category I
Caution Do *not* use for measurements within Categories II, III, or IV.	
Environmental	
Operating temperature	0 to 50 °C
Storage temperature	–40 to 70 °C
Humidity	10 to 90% RH, noncondensing
Maximum altitude	2,000 m
Pollution Degree (indoor use only)	2

Safety

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 product according to the documentation.

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)

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

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.

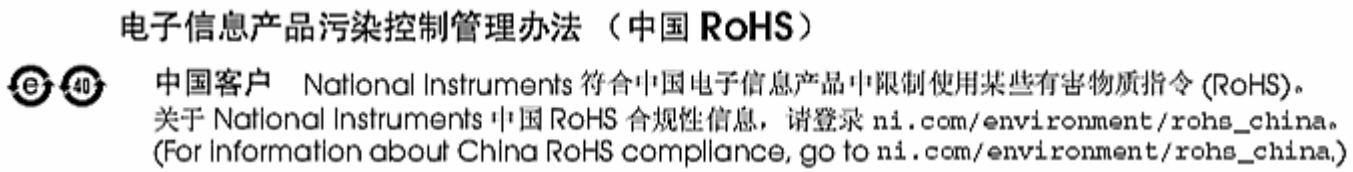
Environmental Management

National Instruments is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial not only to the environment but also 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 and Electronic Equipment, visit ni.com/environment/weee.htm.



[1] Stresses beyond those listed under *Input voltage protection* may cause permanent damage to the device.

[2] Some motherboards reserve the x16 slot for graphics use. For PCI Express guidelines, refer to ni.com/pciexpress.

[3] *Maximum working voltage* refers to the signal voltage plus the common-mode voltage.

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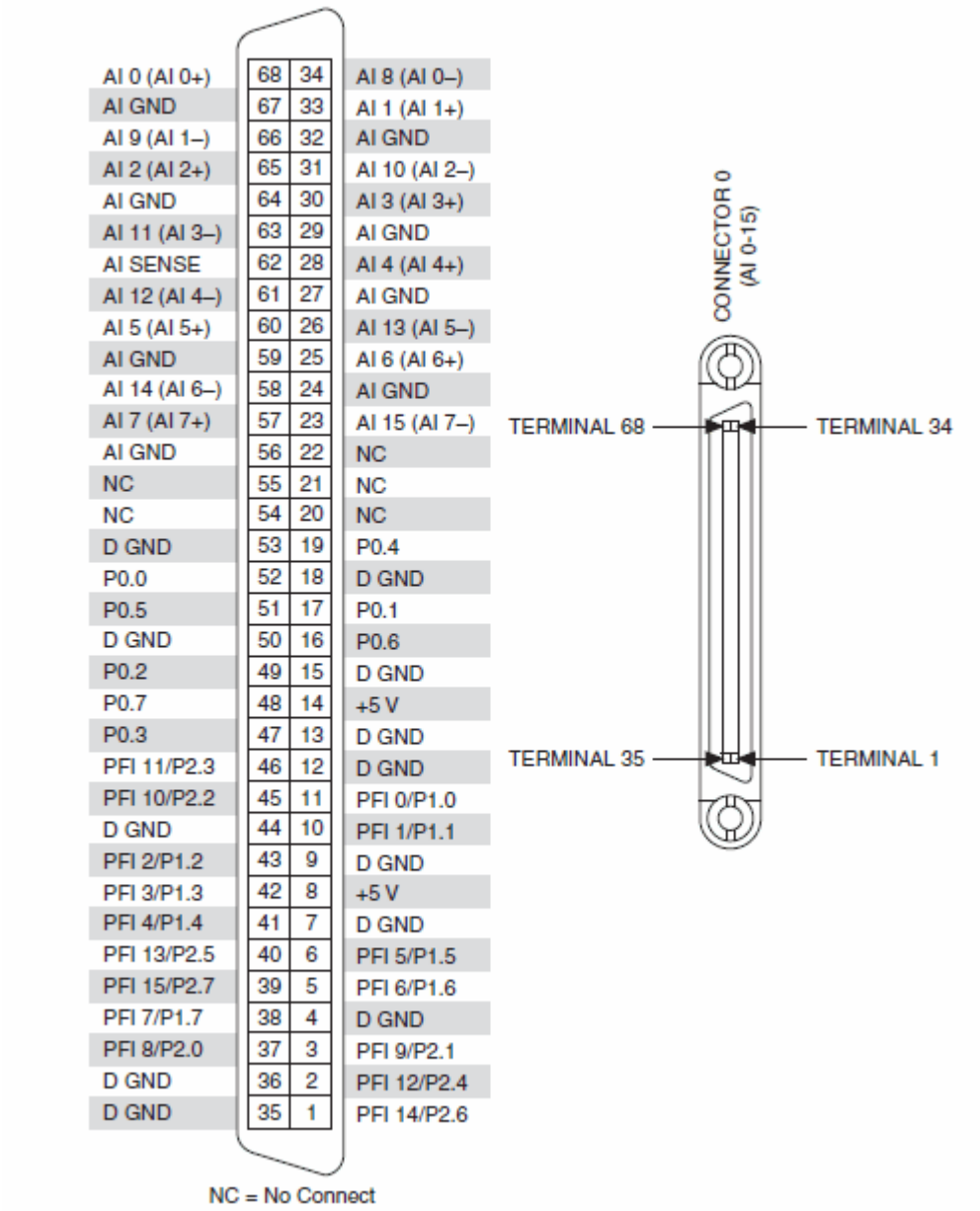
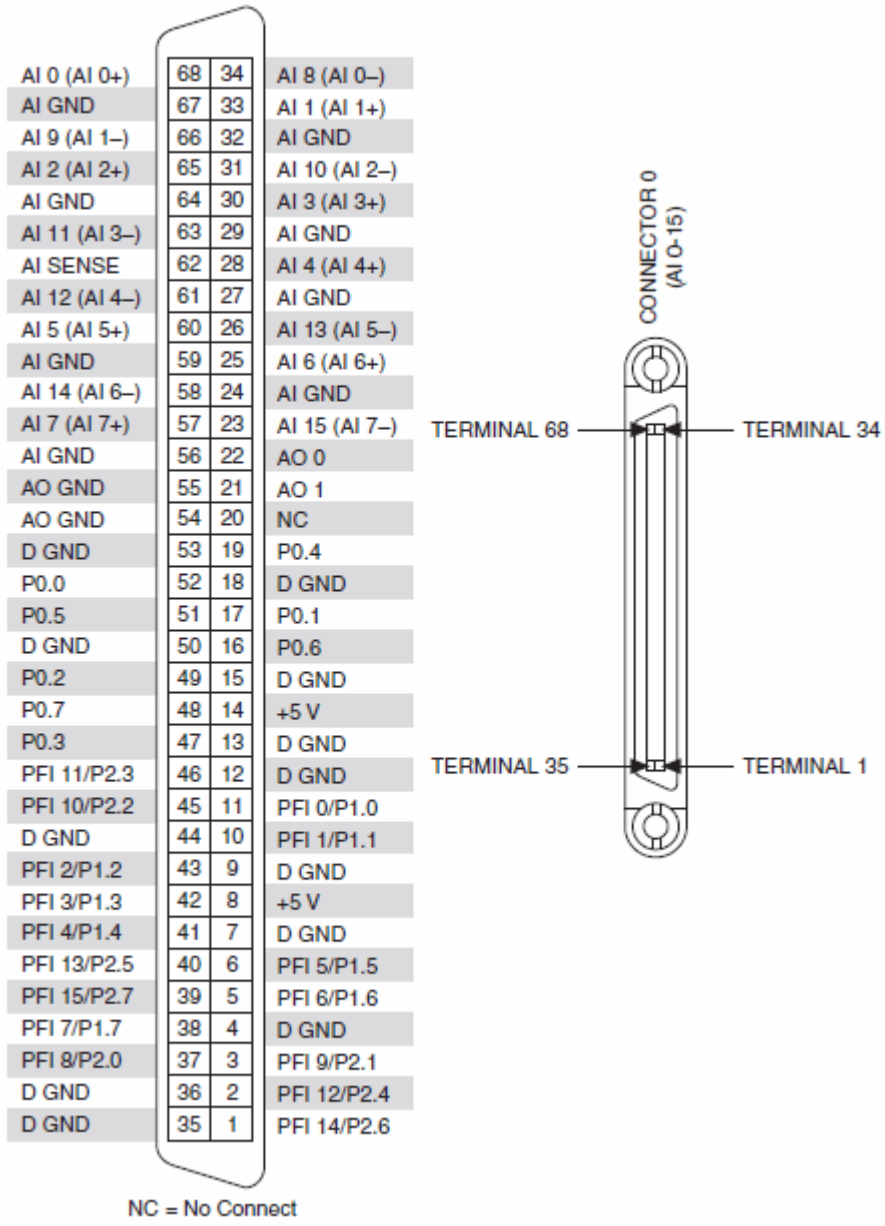
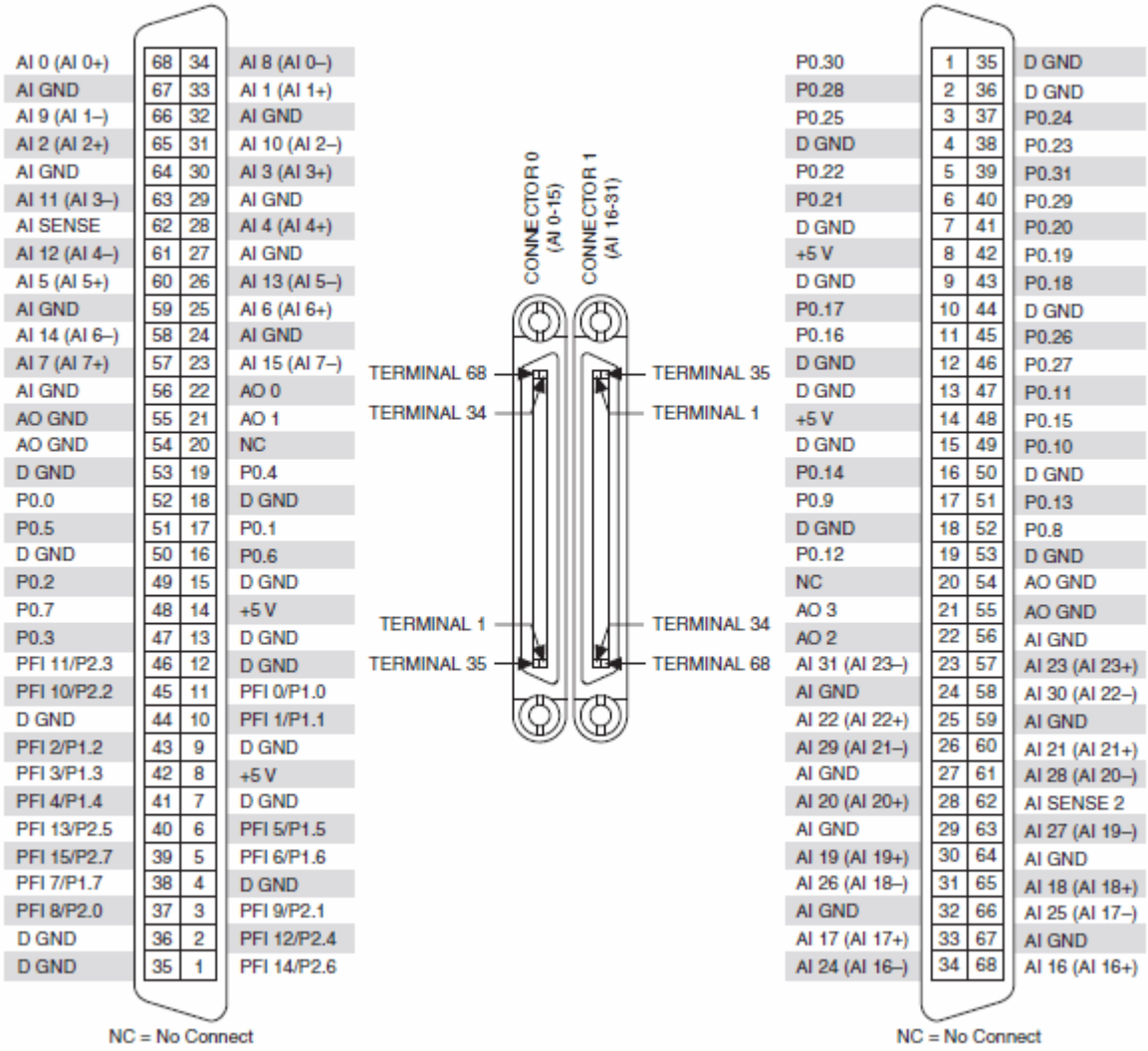
Pinouts/Front Panel Connections



PCIe-6320 pinout



PCIe-6321 pinout



PCIe-6323 pinout

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