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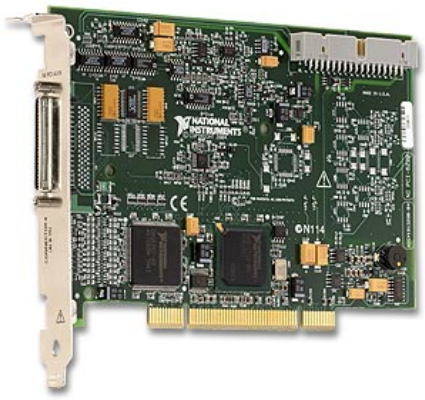
Low-Cost M Series Multifunction Data Acquisition - 16-Bit, 250 kS/s, up to 80 Analog Inputs



- NI recommends high-speed M Series (NI 625x) for 5X faster sampling rates, high-accuracy M Series (NI 628x) for 4X higher resolution, or industrial M Series (NI 623x) for 60 VDC isolation and superior noise rejection
- 16, 32, or 80 analog inputs at 16 bits, 250 kS/s
- Up to 4 analog outputs at 16 bits, 833 kS/s (6 µs full-scale settling time)
- Programmable input range (±10, ±5, ±1, ±0.2 V) per channel
- Up to 48 TTL/CMOS digital I/O lines (up to 32 hardware-timed at 1 MHz)
- Two 32-bit, 80 MHz counter/timers
- Digital triggering
- X1, X2, or X4 quadrature encoder inputs

Overview

NI M Series low-cost multifunction data acquisition (DAQ) devices provide optimized functionality for cost-sensitive applications. They have up to 80 analog inputs, 48 digital I/O lines, four analog outputs, two counter/timers, and digital triggering. Low-cost M Series devices have a one-year calibration interval. For better accuracy, faster speeds, and an extended two-year calibration service, consider high-speed and high-accuracy M Series devices.

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Requirements and Compatibility

OS Information

- Windows 2000/XP
- Windows Vista x64/x86
- Linux®
- Mac OS X
- Windows 7

Driver Information

- NI-DAQmx
- NI-DAQmx Base

Software Compatibility

- ANSI C
- LabVIEW
- LabVIEW SignalExpress
- LabWindows/CVI
- Measurement Studio
- Visual Basic
- Visual Studio .NET

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Comparison Tables

Family	Bus	Analog Inputs	Analog Input Resolution (bits)	Analog Outputs (AO)	AO Resolution (bits)	Max AO Rate (kS/S)	AO Range (V)	Digital I/O	Correlated (clocked) DIO
NI 6220	PCI, PXI	16	16	-	-	-	-	24	8, up to 1 MHz
NI 6221	PCI, PXI, USB	16	16	2	16	833	±10	24	8, up to 1 MHz
NI 6221 (37-pin)	PCI	16	16	2	16	833	±10	10	2, up to 1 MHz

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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.
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- **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.

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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 *M Series User Manual* for more information about NI 622*x* devices.

Analog Input	
Number of channels	
NI 6220/6221	8 differential or 16 single ended

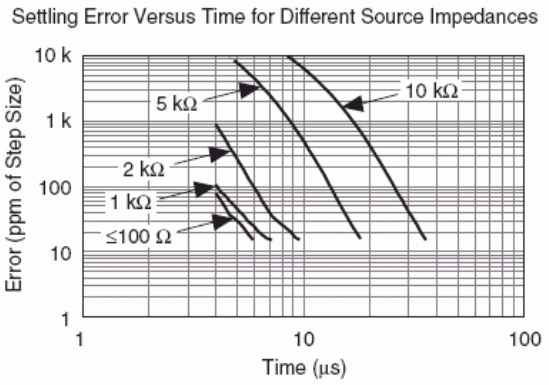
NI 6224/6229	16 differential or 32 single ended
NI 6225	40 differential or 80 single ended
ADC resolution	16 bits
DNL	No missing codes guaranteed
INL	Refer to the *AI Absolute Accuracy Table*
Sampling rate	
Maximum	250 kS/s single channel, 250 kS/s multi-channel (aggregate)
Minimum	No minimum
Timing accuracy	50 ppm of sample rate
Timing resolution	50 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)	92 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	820 Ω
AI- to AI GND	820 Ω
Input bias current	±100 pA
Crosstalk (at 100 kHz)	
Adjacent channels	-75 dB
Non-adjacent channels	-90 dB[1]
Small signal bandwidth (-3 dB)	700 kHz
Input FIFO size	4,095 samples
Scan list memory	4,095 entries
Data transfers	
PCI/PXI devices	DMA (scatter-gather), interrupts, programmed I/O
USB devices	USB Signal Stream, programmed I/O
Overvoltage protection (AI <0..79>, 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

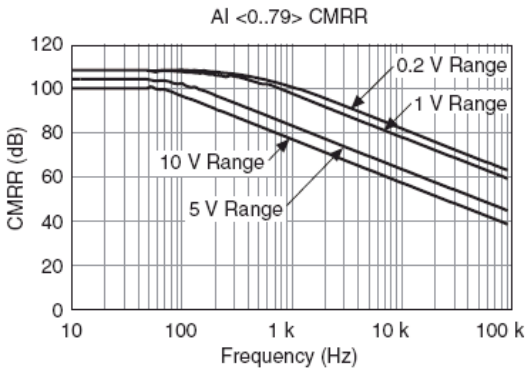
[1] For USB-6225 devices, channel AI <0..15> crosstalk to channel AI <64..79> is -71 dB; applies to channels with 64-channel separation, for example, AI (*x*) and AI (*x* + 64).

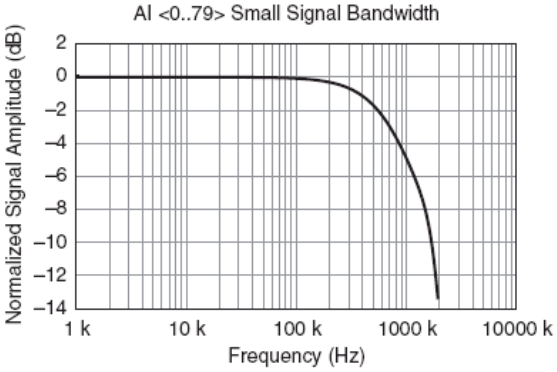
Settling Time for Multichannel Measurements

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

Typical Performance Graphs







Analog Output	
Number of channels	
NI 6220/6224	0
NI 6221/6225	2
NI 6229	4
DAC resolution	16 bits
DNL	±1 LSB
Monotonicity	16 bit guaranteed
Maximum update rate	
1 channel	833 kS/s
2 channels	740 kS/s per channel
3 channels	666 kS/s per channel
4 channels	625 kS/s per channel
Timing accuracy	50 ppm of sample rate
Timing resolution	50 ns
Output range	±10 V
Output coupling	DC
Output impedance	0.2 Ω
Output current drive	±5 mA
Overdrive protection	±25 V
Overdrive current	10 mA
Power-on state	±20 mV^2
Power-on glitch	400 mV for 200 ms
Output FIFO size	8,191 samples shared among channels used
Data transfers	

PCI/PXI devices	DMA (scatter-gather), interrupts, programmed I/O
USB devices	USB Signal Stream, 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

[2] For all USB-6221/6229 Screw Terminal devices, when powered on, the analog output signal is not defined until after USB configuration is complete.

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	Residual Offset Error (ppm of Range)	Offset Tempco (ppm of Range/°C)	INL Error (ppm of Range)	Random Noise, σ (µVrms)	Absolute Accuracy at Full Scale[1] (µV)	Sensitivity[2] (µV)
Positive Full Scale	Negative Full Scale									
10	-10	75	25	5	20	57	76	244	3,100	97.6
5	-5	85	25	5	20	60	76	122	1,620	48.8
1	-1	95	25	5	25	79	76	30	360	12.0
0.2	-0.2	135	25	5	80	175	76	13	112	5.2

AbsoluteAccuracy = Reading · (GainError) + Range · (OffsetError) + NoiseUncertainty

GainError = ResidualAIGainError + GainTempco · (TempChangeFromLastInternalCal) + ReferenceTempco · (TempChangeFromLastExternalCal)

OffsetError = ResidualAIOffsetError + OffsetTempco · (TempChangeFromLastInternalCal) + INL_Error

$$\text{NoiseUncertainty} = \frac{\text{RandomNoise} \cdot 3}{\sqrt{100}}$$ For a coverage factor of 3 σ and averaging 100 points.

[1] 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 = 75 ppm + 25 ppm · 1 + 5 ppm · 10 GainError = 150 ppm

OffsetError = 20 ppm + 57 ppm · 1 + 76 ppm OffsetError = 153 ppm

$$\text{NoiseUncertainty} = \frac{244\ \mu\text{V} \cdot 3}{\sqrt{100}} \qquad \text{NoiseUncertainty} = 73\ \mu\text{V}$$

AbsoluteAccuracy = 10 V · (GainError) + 10 V · (OffsetError) + NoiseUncertainty AbsoluteAccuracy = 3,100 µV

[2] Sensitivity is the smallest voltage change that can be detected. It is a function of noise.

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	Residual Offset Error (ppm of Range)	Offset Tempco (ppm of Range/°C)	INL Error (ppm of Range)	Absolute Accuracy at Full Scale[1] (µV)
Positive Full Scale	Negative Full Scale							
10	-10	90	10	5	40	5	128	3,230

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

AbsoluteAccuracy = OutputValue · (GainError) + Range · (OffsetError)

GainError = ResidualGainError + GainTempco · (TempChangeFromLastInternalCal) + ReferenceTempco · (TempChangeFromLastExternalCal)

OffsetError = ResidualOffsetError + AOOffsetTempco · (TempChangeFromLastInternalCal) + INL_Error

Digital I/O/PFI

Static Characteristics	
Number of channels	
NI 6220/6221 (68-pin)/6225	24 total 8 (P0.<0..7>) 16 (PFI <0..7>/P1, PFI <8..15>/P2)
PCI-6221 (37-pin)	10 total 2 (P0.<0, 1>) 8 (PFI <0..7>/P1)
NI 6224/6229	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[3]	±20 V on up to two pins

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

Waveform Characteristics (Port 0 Only)	
Terminals used	
NI 6220/6221 (68-pin)/6225	Port 0 (P0.<0..7>)
PCI-6221 (37-pin)	Port 0 (P0.<0, 1>)
NI 6224/6229	Port 0 (P0.<0..31>)
Port/sample size	
NI 6220/6221 (68-pin)/6225	Up to 8 bits
PCI-6221 (37-pin)	Up to 2 bits
NI 6224/6229	Up to 32 bits
Waveform generation (DO) FIFO	2,047 samples
Waveform acquisition (DI) FIFO	2,047 samples
DI or DO Sample Clock frequency[4]	0 to 1 MHz
Data transfers	
PCI/PXI devices	DMA (scatter-gather), interrupts, programmed I/O
USB devices	USB Signal Stream, programmed I/O
DO or DI Sample Clock source[5]	Any PFI, RTSI, AI Sample or Convert Clock, AO Sample Clock, Ctr *n* Internal Output, and many other signals

[4] Performance can be dependent on bus latency and volume of bus activity.

[5] The digital subsystem does not have its own dedicated internal timing engine. Therefore, a sample clock must be provided from another subsystem on the device or an external source.

PFI/Port 1/Port 2 Functionality[6]	
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	125 ns, 6.425 µs, 2.56 ms, disable; high and low transitions; selectable per input

[6] Port 2 is not available on PCI-6221 (37-pin) devices.

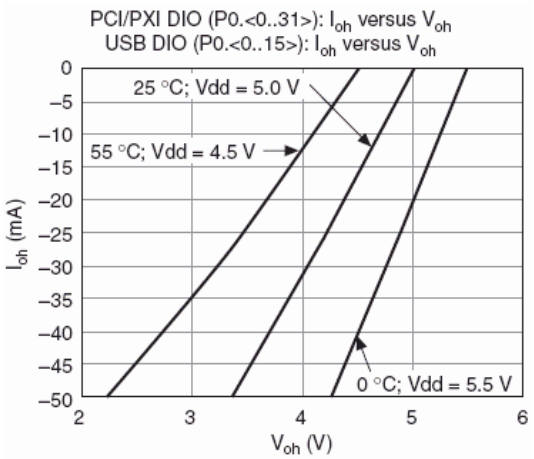
Recommended Operation Conditions, PCI/PXI Devices		
Level	**Min**	**Max**

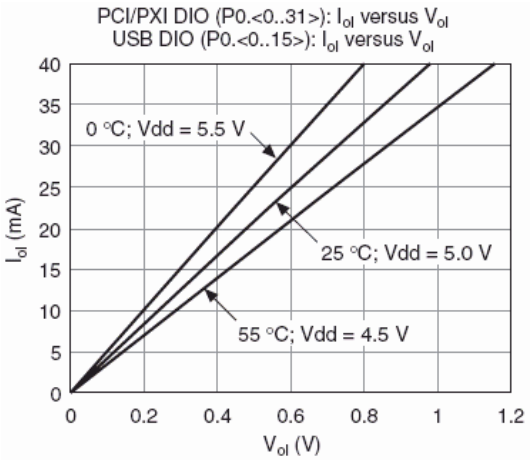
Input high voltage (V_{IH})	2.2 V	5.25 V
Input low voltage (V_{IL})	0 V	0.8 V
Output high current (I_{OH})		
P0.<0..31>	—	-24 mA
PFI <0..15>/P1/P2	—	-16 mA
Output low current (I_{OL})		
P0.<0..31>	—	24 mA
PFI <0..15>/P1/P2	—	16 mA

Recommended Operation Conditions, USB Devices		
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..15>	—	-24 mA
P0.<16..31>	—	-16 mA
PFI <0..15>/P1/P2	—	-16 mA
Output low current (I_{OL})		
P0.<0..15>	—	24 mA
P0.<16..31>	—	16 mA
PFI <0..15>/P1/P2	—	16 mA

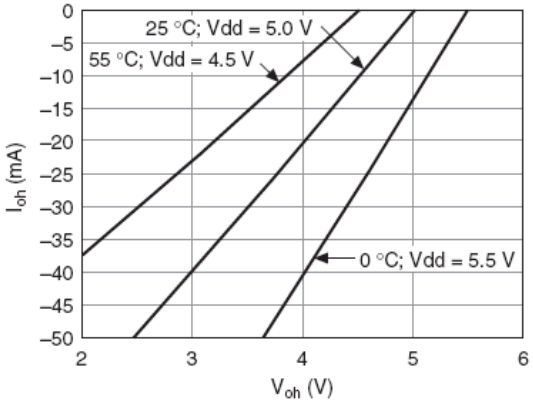
Electrical Characteristics		
Level	**Min**	**Max**
Positive-going threshold (VT+)	—	2.2 V
Negative-going threshold (VT-)	0.8 V	—
Delta VT hysteresis (VT+ - VT-)	0.2 V	—
I_{IL} input low current (V_{in} = 0 V)	—	-10 µA
I_{IH} input high current (V_{in} = 5 V)	—	250 µA

Digital I/O Characteristics[6]

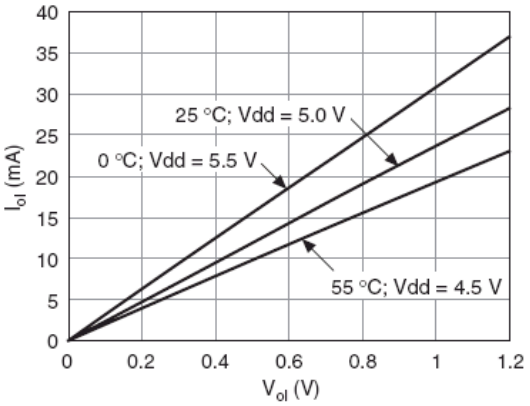




PCI/PXI DIO (PFI <0..15>/P1/P2): I_{oh} versus V_{oh}
USB DIO (PFI <0..15>/P1/P2, P0.<16..31>): I_{oh} versus V_{oh}



PCI/PXI DIO (PFI <0..15>/P1/P2): I_{ol} versus V_{ol}
USB DIO (PFI <0..15>/P1/P2, P0.<16..31>): I_{ol} versus V_{ol}



General-Purpose Counter/Timers	
Number of counter/timers	2
Resolution	32 bits
Counter measurements	Edge counting, pulse, 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	80 MHz, 20 MHz, 0.1 MHz
External base clock frequency	0 MHz to 20 MHz
Base clock accuracy	50 ppm
Inputs	Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down
Routing options for inputs	Any PFI, RTSI, PXI_TRIG, PXI_STAR, analog trigger, many internal signals
FIFO	2 samples
Data transfers	
PCI/PCIe/PXI/PXIe devices	Dedicated scatter-gather DMA controller for each counter/timer; interrupts, programmed I/O
USB devices	USB Signal Stream, programmed I/O
Frequency Generator	
Number of channels	1
Base clocks	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	PXI_STAR, PXI_CLK10, RTSI <0..7>
Output of PLL	80 MHz Timebase; other signals derived from 80 MHz Timebase including 20 MHz and 100 kHz Timebases
External Digital Triggers	
Source	Any PFI, RTSI, PXI_TRIG, PXI_STAR
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
Digital waveform generation (DO) function	Sample Clock
Digital waveform acquisition (DI) function	Sample Clock
Device-To-Device Trigger Bus	
PCI/PCIe devices	RTSI <0..7>[7]
PXI/PXIe devices	PXI_TRIG <0..7>, PXI_STAR
USB devices	None
Output selections	10 MHz Clock; frequency generator output; many internal signals
Debounce filter settings	125 ns, 6.425 µs, 2.56 ms, disable; high and low transitions; selectable per input

[7] In other sections of this document, *RTSI* refers to RTSI <0..7> for PCI devices or PXI_TRIG <0..7> for PXI devices.

Bus Interface

PCI/PXI devices	3.3 V or 5 V signal environment
USB devices	USB 2.0 Hi-Speed or full-speed[8]
DMA channels (PCI/PXI devices)	6, analog input, analog output, digital input, digital output, counter/timer 0, counter/timer 1
USB Signal Stream (USB devices)	4, can be used for analog input, analog output, digital input, digital output, counter/timer 0, counter/timer 1

All PXI-625x devices support one of the following features:

- May be installed in PXI Express hybrid slots
- Or, may be used to control SCXI in PXI/SCXI combo chassis

[8] If you are using a USB M Series device in full-speed mode, device performance will be lower and you will not be able to achieve maximum sampling/update rates.

Table 1. PXI/SCXI Combo and PXI Express Chassis Compatibility

M Series Device	M Series Part Number	SCXI Control in PXI/SCXI Combo Chassis	PXI Express Hybrid Slot Compatible
PXI-6220	191332B-04	No	Yes
PXI-6221	191332B-03	No	Yes
	191332B-13	Yes	No
PXI-6224	191332B-02	No	Yes
PXI-6225	192227A-01	No	Yes
PXI-6229	191332B-01	No	Yes
	191332B-11	Yes	No
Earlier versions of PXI-6220/6221/6224/6229	191332A-0*x*	Yes	No

Power Requirements

Current draw from bus during no-load condition[9]

PCI/PXI devices	
+5 V	0.02 A[10]
+3.3 V	0.25 A[10]
+12 V	0.15 A

Current draw from bus during AI and AO overvoltage condition[9]

PCI/PXI devices	
+5 V	0.02 A[10]
+3.3 V	0.25 A[10]
+12 V	0.25 A

Caution USB-622*x* devices must be powered with NI offered AC adapter or a National Electric Code (NEC) Class 2 DC source that meets the power requirements for the device and has appropriate safety certification marks for country of use.

USB power supply requirements	11 to 30 VDC, 20 W, locking or non-locking power jack with 0.080" diameter center pin, 5/16-32 thread for locking collars

[9] Does not include P0/PFI/P1/P2 and +5 V terminals.

[10] PCI-6221 (37-pin) devices do not use +3.3 V from the bus. The 3.3 V current draw, shown in the *Power Requirements* section, comes from the +5 V instead.

Power Limits

Caution Exceeding the power limits may cause unpredictable behavior by the device and/or PC/chassis.

PCI devices	
+5 V terminal (connector 0)	1 A max[11]
+5 V terminal (connector 1)	1 A max[11]
PXI devices	
+5 V terminal (connector 0)	1 A max[11]
+5 V terminal (connector 1)	1 A max[11]
P0/PFI/P1/P2 and +5 V terminals combined	2 A max
USB devices	
+5 V terminal	1 A max[11]
P0/PFI/P1/P2 and +5 V terminals combined	2 A max
Power supply fuse	2 A, 250 V

[11] Has a self-resetting fuse that opens when current exceeds this specification.

Physical Requirements

Printed circuit board dimensions	
PCI-6220/6221/6224/6225/6229	9.7 x 15.5 cm (3.8 x 6.1 in.)
PXI-6220/6221/6224/6225/6229	Standard 3U PXI
Enclosure dimensions (includes connectors)	
USB-6221/6225/6229 Screw Terminal	26.67 x 17.09 x 4.45 cm (10.5 x 6.73 x 1.75 in.)
USB-6221/6229 BNC	28.6 x 17 x 6.9 cm (11.25 x 6.7 x 2.7 in.)
USB-6225 Mass Termination	18.8 x 17.09 x 4.45 cm (7.4 x 6.73 x 1.75 in.)
USB-6221/6225/6229 OEM	Refer to the *NI USB-622x/625x OEM User Guide*
Weight	
PCI-6220	91 g (3.2 oz)
PCI-6221 (68-pin)	92 g (3.2 oz)
PCI-6221 (37-pin)	95 g (3.3 oz)
PCI-6224	99 g (3.5 oz)
PCI-6225	103 g (3.6 oz)
PCI-6229	101 g (3.5 oz)
PXI-6220	158 g (5.5 oz)
PXI-6221	162 g (5.7 oz)
PXI-6224	170 g (5.9 oz)
PXI-6225	174 g (6.1 oz)
PXI-6229	171 g (6.0 oz)
USB-6221 Screw Terminal	1.2 kg (2 lb 10 oz)
USB-6225/6229 Screw Terminal	1.24 kg (2 lb 11 oz)
USB-6225 Mass Termination	907 g (2 lb)
USB-6221 OEM	131 g (4.6 oz)
USB-6225/6229 OEM	162 g (5.7 oz)
I/O connector	
PCI/PXI-6220/6221 (68-pin)	1 68-pin VHDCI
PCI/PXI-6224/6225/6229	2 68-pin VHDCI
PCI-6221 (37-pin)	1 37-pin D-SUB

USB-6221 Screw Terminal	64 screw terminals
USB-6225/6229 Screw Terminal	128 screw terminals
USB-6221 BNC	21 BNCs and 30 screw terminals
USB-6229 BNC	32 BNCs and 60 screw terminals
USB-6225 Mass Termination	2 68-pin SCSI
USB-6221/6225/6229 Screw Terminal/ USB-6221/6229 BNC screw terminal wiring	16-28 AWG

Maximum Working Voltage[12]

NI 6220/6221/6224/6225/6229 channel-to-earth	11 V, Measurement Category I

Caution Do *not* use for measurements within Categories II, III, or IV.

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

Environmental

Operating temperature	
PCI/PXI devices	0 to 55 °C
USB devices	0 to 45 °C
Storage temperature	-20 to 70 °C
Humidity	10 to 90% RH, noncondensing
Maximum altitude	2,000 m
Pollution Degree (indoor use only)	2
Shock and Vibration (PXI Devices 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} (Tested in accordance with IEC-60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

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 visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

Electromagnetic Compatibility

This product is designed to meet the requirements of the following standards of EMC for electrical equipment for measurement, control, and laboratory use:

- EN 61326 EMC requirements; Minimum Immunity
- EN 55011 Emissions; Group 1, Class A
- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class A

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

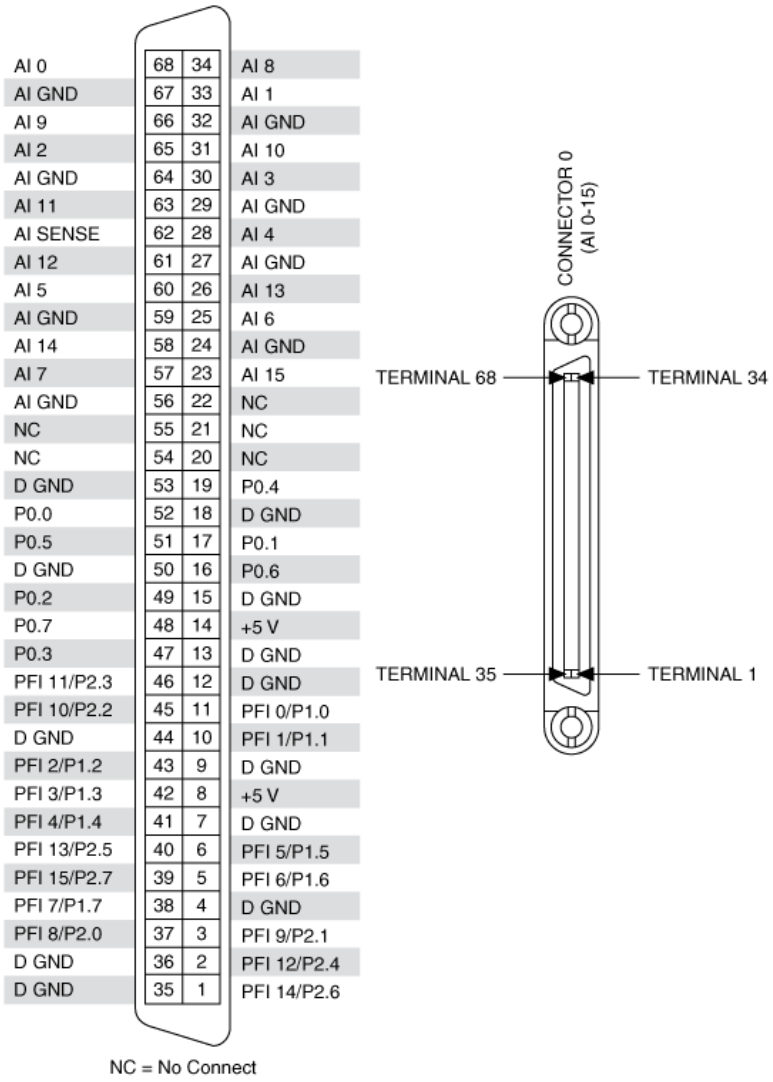
CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

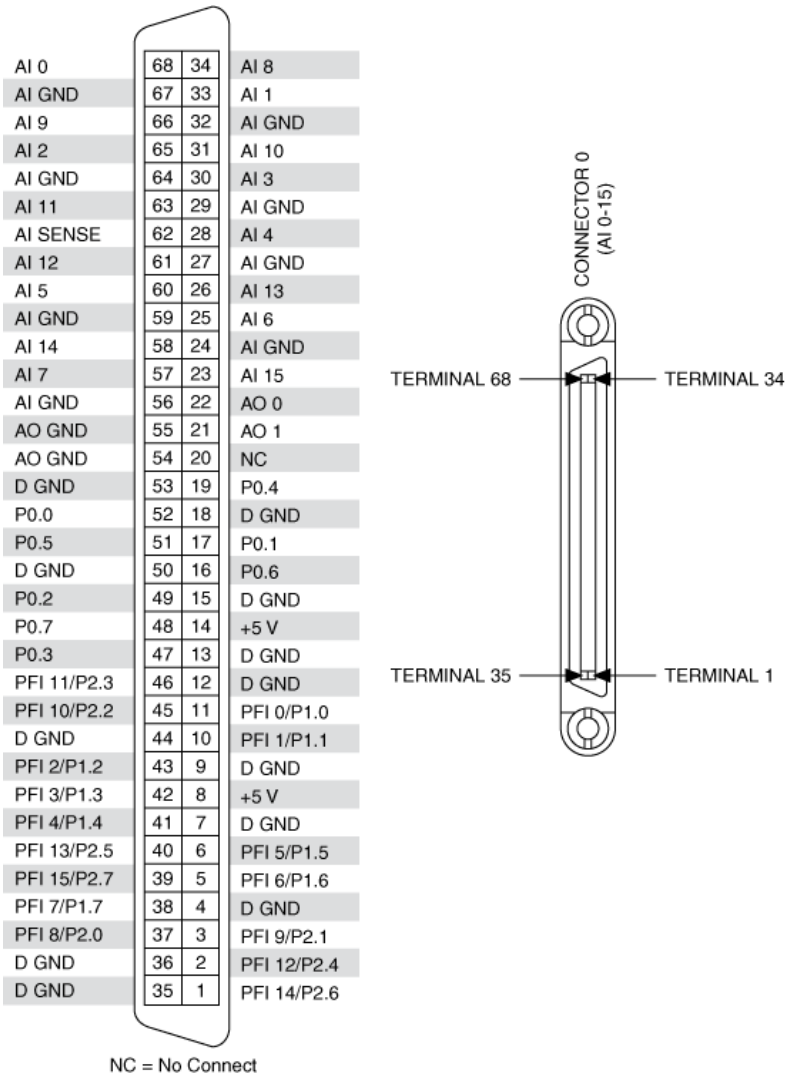
- 73/23/EEC; Low-Voltage Directive (safety)
- 89/336/EEC; Electromagnetic Compatibility Directive (EMC)

Note Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain 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.

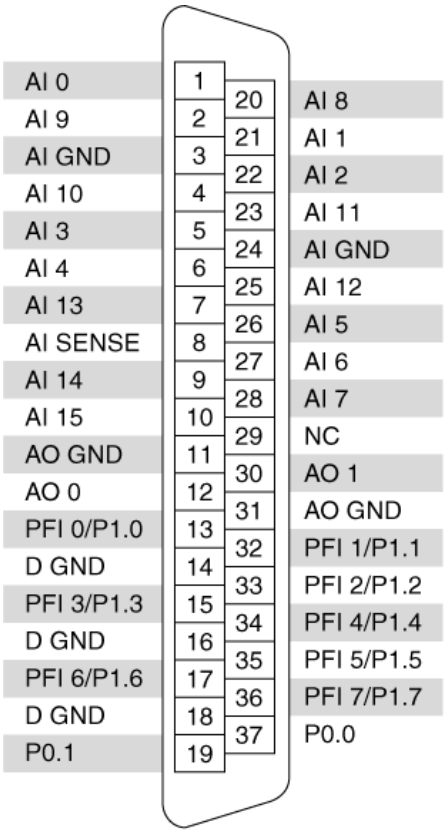
Pinouts/Front Panel Connections



PCI/PXI-6220 Pinout

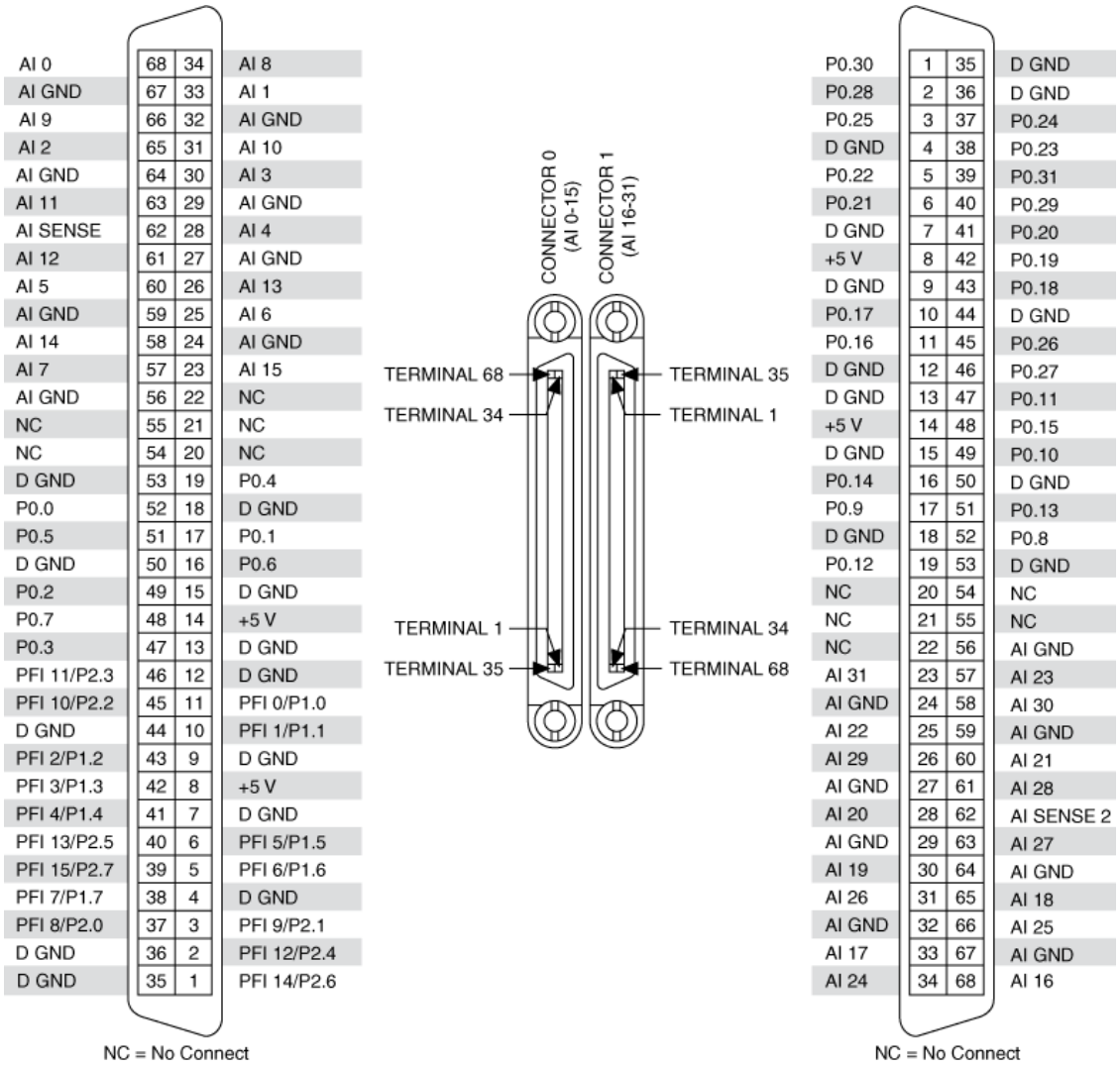


PCI/PXI-6221 (68-Pin) Pinout

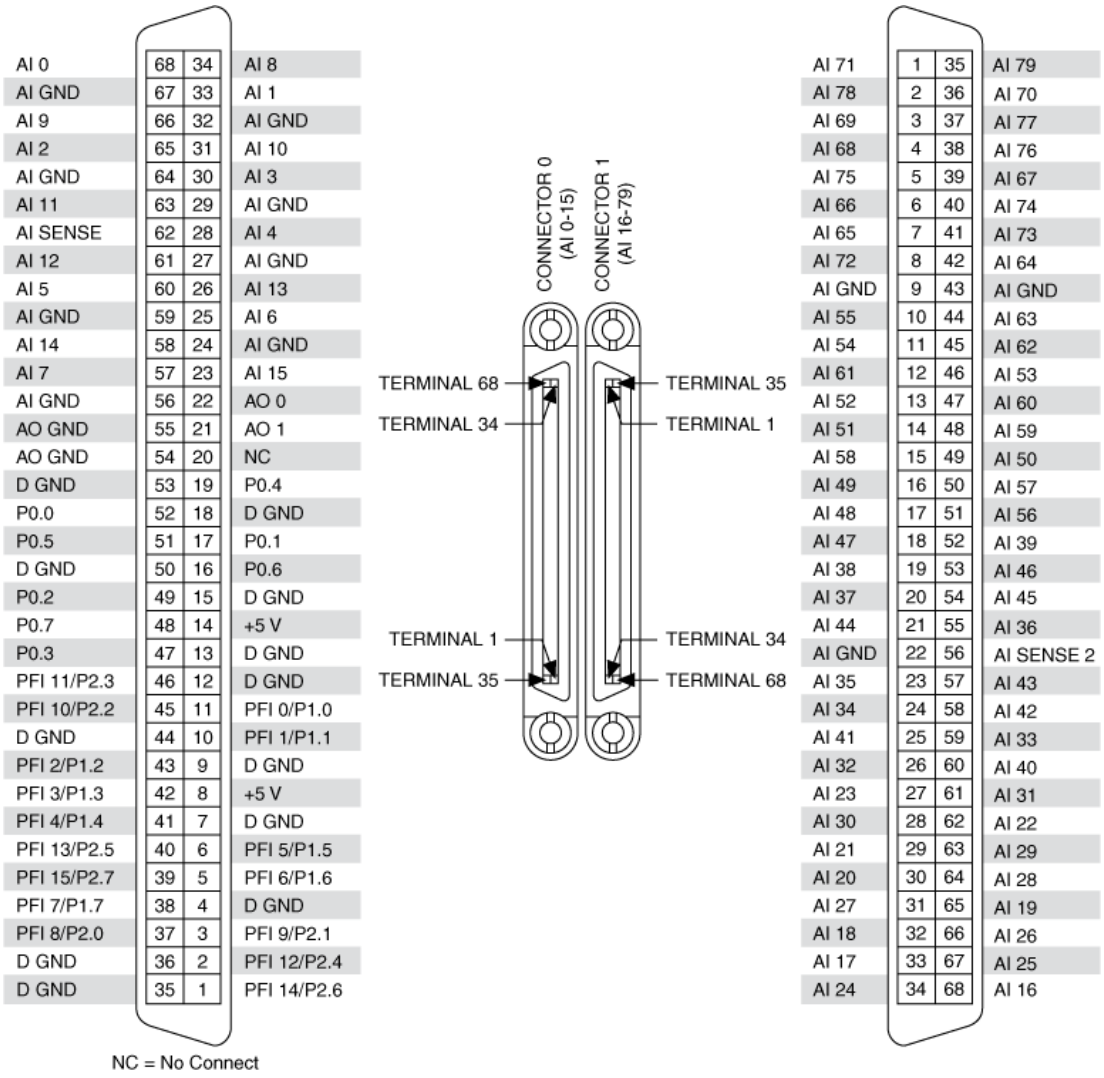


NC = No Connect

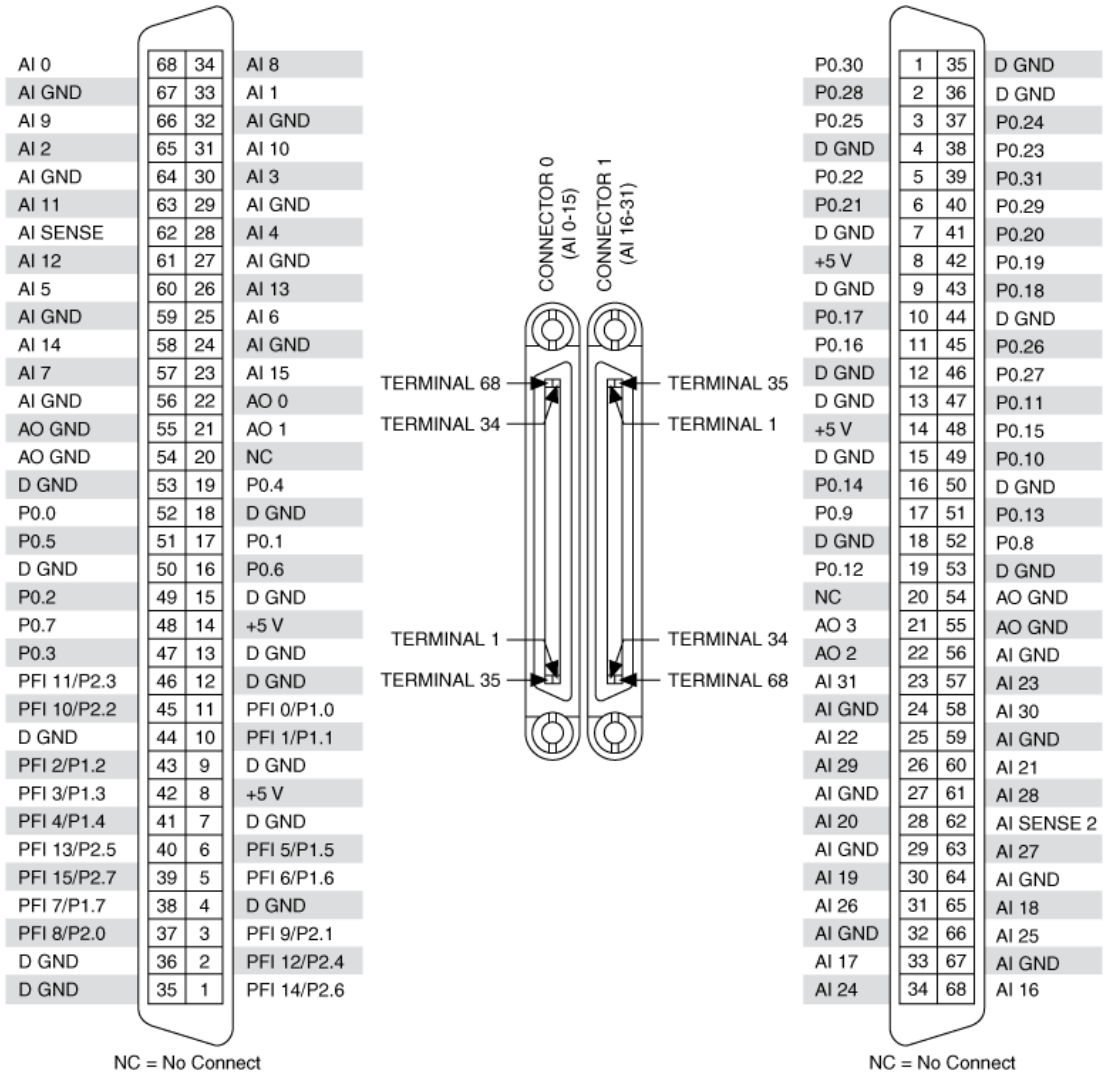
PCI-6221 (37-Pin) Pinout



PCI/PXI-6224 Pinout



PCI/PXI-6225 Pinout



PCI/PXI-6229 Pinout

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