

NI 6236 Specifications

Specifications listed below are typical at 25 °C unless otherwise noted.

Analog Input

Number of channels	4 differential current inputs
Channel type	Current input
ADC resolution	16 bits
DNL	No missing codes guaranteed
INL	Refer to the AI Absolute Accuracy Table
Sampling rate	
Maximum	250 KS/s
Minimum	0 S/s
Timing accuracy	50 ppm of sample rate
Timing resolution	50 ns
Input coupling	DC
Input range	±20 mA
Maximum working voltage for analog inputs	Refer to the Maximum Working Voltage section
Input impedance under normal operating conditions (AI+ to AI-)	
Typical (25 °C)	92 Ω in parallel with 100 pF
Maximum (55 °C)	110 Ω in parallel with 100 pF
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

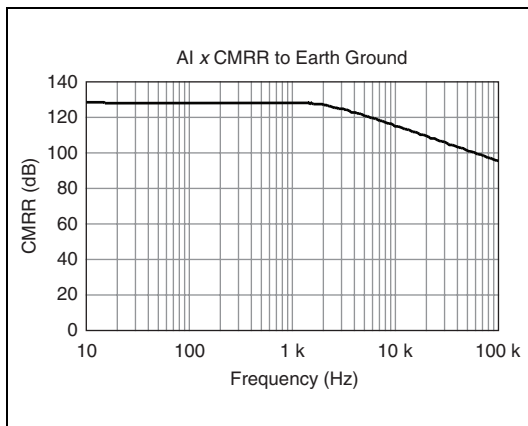
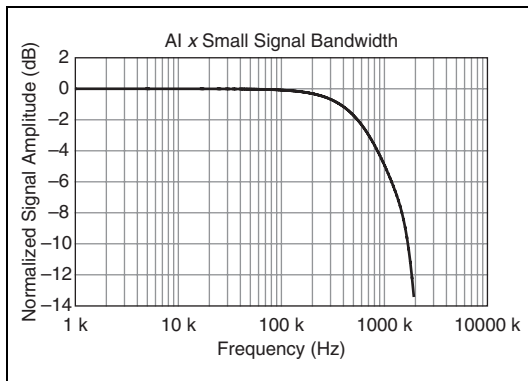
Scan list memory	4,095 entries
Data transfers	DMA (scatter-gather), interrupts, programmed I/O
Overvoltage protection (AI x+ or AI x- with respect to AI GND)	
Device on	±25 V for up to two AI pins
Device off	±15 V for up to two AI pins
Overvoltage protection (AI x+ to AI x-)	±20 V max
Overcurrent protection ¹	±40 mA max

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

¹ Any voltage applied resulting in current flowing above 40 mA can damage the device permanently.

Typical Performance Graphs¹



Analog Output

Number of channels.....	4
Channel type.....	Voltage output
DAC resolution.....	16 bits
DNL.....	±1 LSB
Monotonicity	16 bit guaranteed
Maximum update rate	
1 channel	500 kS/s
2 channels	450 kS/s per channel
3 channels	425 kS/s per channel
4 channels	400 kS/s per channel

Timing accuracy	50 ppm of sample rate
Timing resolution.....	50 ns
Output range	±10 V
Output coupling	DC
Output impedance	0.4 Ω
Output current drive.....	±5 mA
Overdrive protection	±25 V
Overdrive current.....	10 mA
Power-on state.....	±20 mV
Power-on glitch.....	±2 V for 2 ms
Power off glitch ²	±100 mV for 350 ms

Output FIFO size	8,191 samples shared among channels used
Data transfers	DMA (scatter-gather), interrupts, 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.....	3 μs

Calibration (AI and AO)

Recommended warm-up time	15 minutes
Calibration interval	1 year

¹ Small Signal Bandwidth and CMRR graphs also apply to AI <32..79> for the NI 6225.

² When outputting 0 V on power down from the analog output channel.

AI Absolute Accuracy Table

Nominal Range (A)		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 (μ A rms)	Absolute Accuracy at Full Scale ¹ (μ A)	Sensitivity ² (μ A)
Positive Full Scale	Negative Full Scale									
0.02	-0.02	595	35	5	100	79	76	0.6	18.8	0.24

$\text{AbsoluteAccuracy} = \text{Reading} \cdot (\text{GainError}) + \text{Range} \cdot (\text{OffsetError}) + \text{NoiseUncertainty}$
 $\text{GainError} = \text{ResidualGainError} + \text{GainTempco} \cdot (\text{TempChangeFromLastInternalCal}) + \text{ReferenceTempco} \cdot (\text{TempChangeFromLastExternalCal})$
 $\text{OffsetError} = \text{ResidualOffsetError} + \text{OffsetTempco} \cdot (\text{TempChangeFromLastInternalCal}) + \text{INL_Error}$
 $\text{NoiseUncertainty} = \frac{\text{RandomNoise} \cdot 3}{\sqrt{100}}$ 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:

$\text{TempChangeFromLastExternalCal} = 10 \text{ } ^\circ\text{C}$
 $\text{TempChangeFromLastInternalCal} = 1 \text{ } ^\circ\text{C}$
 $\text{number_of_readings} = 100$
 $\text{CoverageFactor} = 3 \sigma$

For example, on the 20 mA range, the absolute accuracy at full scale is as follows:

$\text{GainError} = 595 \text{ ppm} + 35 \text{ ppm} \cdot 1 + 5 \text{ ppm} \cdot 10$ $\text{GainError} = 680 \text{ ppm}$
 $\text{OffsetError} = 100 \text{ ppm} + 79 \text{ ppm} \cdot 1 + 76 \text{ ppm}$ $\text{OffsetError} = 255 \text{ ppm}$
 $\text{NoiseUncertainty} = \frac{0.244 \text{ } \mu\text{A} \cdot 3}{\sqrt{100}}$ $\text{NoiseUncertainty} = 73.2 \text{ nA}$

$\text{AbsoluteAccuracy} = 20 \text{ mA} \cdot (\text{GainError}) + 20 \text{ mA} \cdot (\text{OffsetError}) + \text{NoiseUncertainty}$ $\text{AbsoluteAccuracy} = 18.8 \text{ } \mu\text{A}$

² Sensitivity is the smallest current 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 + AOffsetTempco · (TempChangeFromLastInternalCal) + INL_Error

Digital I/O/PFI

Static Characteristics

Number of channels	10 total
Input	6 (PFI <0..5>/P0.<0..5>)
Output	4 (PFI <6..9>/P1.<0..3>)
Ground reference	D GND
Direction control	Fixed, lines are unidirectional
Input voltage protection ¹	±20 V on up to two pins

PFI/Port 0/Port 1 Functionality

PFI <0..5>/P0.<0..5>	Static digital input, timing input
PFI <6..9>/P1.<0..3>	Static digital output, timing output
Timing output sources	Many AI, AO, counter, timing signals
Debounce filter settings	125 ns, 6.425 μ s, 2.54 ms, disable; high and low transitions; selectable per input

Digital Input Characteristics

Level	Min	Max
V_{IL} input low voltage	0 V	0.8 V
V_{IH} input high voltage	2 V	5.25 V
I_{IL} input low current ($V_{in} = 0$ V)	—	-10 μ A
I_{IH} input high current ($V_{in} = 5$ V)	—	10 μ A

Digital Output Characteristics

Guaranteed output levels

Parameter	Voltage Level	Current Level
V_{OL}	0.4 V	7 mA
	0.6 V	10 mA
V_{OH}	2.8 V	-24 mA
	4.0 V	-6 mA

Maximum operation conditions

Level	Min	Max
I_{OL} output low current P1.<0..3>	—	10 mA
I_{OH} output high current P1.<0..3>	—	-24 mA

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 input PFI, RTSI, PXI_TRIG, PXI_STAR, many internal signals
FIFO	2 samples
Data transfers	Dedicated scatter-gather DMA controller for each counter/timer; interrupts; programmed I/O

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

Isolation Effects

Maximum propagation delay through isolator	
Digital inputs.....	35 ns
Digital outputs.....	45 ns

Propagation delay skew between channels
(inputs and outputs) 15 ns

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 output 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 input 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

Device-To-Device Trigger Bus

PCI devices.....	RTSI <0..7> ¹
PXI devices.....	PXI_TRIG <0..7>, PXI_STAR
Output selections.....	10 MHz Reference Clock; frequency generator output; many internal signals
Debounce filter settings.....	125 ns, 6.425 μ s, 2.54 ms, disabled; high and low transitions; selectable per input

Bus Interface

PCI or PXI.....	3.3 V or 5 V signal environment
-----------------	------------------------------------

PXI-6236 devices can be installed in PXI slots or PXI Express hybrid slots.

DMA channels.....	4, analog input, analog output, counter/timer 0, counter/timer 1
-------------------	---

Power Requirements

Current draw from bus during no-load condition	
+5 V.....	0.5 A
+12 V.....	20 mA

Current draw from bus during AI and AO overvoltage condition	
+5 V.....	0.75 A
+12 V.....	20 mA

Physical Requirements

Printed circuit board dimensions	
NI PCI-6236.....	9.7 cm \times 15.5 cm (3.8 in. \times 6.1 in.)
NI PXI-6236.....	Standard 3U PXI

Weight	
NI PCI-6236.....	110 g (3.8 oz)
NI PXI-6236.....	150 g (5.2 oz)

I/O connector.....	37-pin D-SUB
--------------------	--------------

¹ In other sections of this document, *RTSI* refers to RTSI <0..7> for PCI devices or PXI_TRIG <0..7> for PXI devices.

Maximum Working Voltage¹

Channel-to-earth ground²

Continuous.....	≤30 Vrms/60 VDC Measurement Category I ³
Withstand.....	≤840 Vrms/1200 VDC, verified by a 5 s dielectric withstand test

Channel-to-bus⁴

Continuous.....	≤30 Vrms/60 VDC Measurement Category I ³
Withstand.....	≤1400 Vrms/1950 VDC, verified by a 5 s dielectric withstand test

AI channel to AI GND

(in Figure 1, $ V_a - V_d $).....	≤11 V, Measurement Category I ³
------------------------------------	---

AO channel to AO GND

(in Figure 1, $ V_b - V_d $).....	≤11 V, Measurement Category I ³
------------------------------------	---

Digital channel to D GND

(in Figure 1, $V_c - V_d$).....	≤5.25 V, Measurement Category I ³
----------------------------------	---



Caution This device is rated for Measurement Category I and the voltage across the isolation barrier is limited to no greater than 30 Vrms/60 VDC/42.4 V_{pk} continuous. Do *not* use for measurements within Categories II, III, or IV.

Figure 1 illustrates the maximum working voltage specifications.

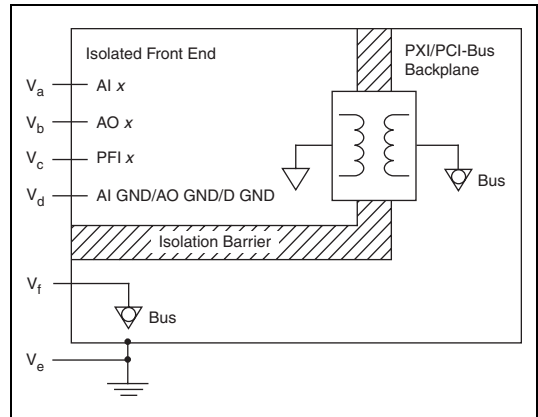


Figure 1. NI 6236 Maximum Working Voltage

Environmental

Maximum altitude2,000 m (at 25 °C
ambient temperature)

Pollution Degree.....2

Indoor use only.

Operating Environment

Ambient temperature range0 to 55 °C (Tested
in accordance with
IEC-60068-2-1 and
IEC-60068-2-2.)

Relative humidity range10% to 90%,
noncondensing (Tested
in accordance with
IEC-60068-2-56.)

Storage Environment

Ambient temperature range-40 to 70 °C (Tested
in accordance with
IEC-60068-2-1 and
IEC-60068-2-2.)

¹ Maximum working voltage refers to the signal voltage plus the common-mode voltage.

² In Figure 1, $|V_a - V_e|$, $|V_b - V_e|$, $|V_c - V_e|$, and $|V_d - V_e|$.

³ Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as MAINS voltage. MAINS is a hazardous live electrical supply system that powers equipment. 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.

⁴ In Figure 1, $|V_a - V_f|$, $|V_b - V_f|$, $|V_c - V_f|$, and $|V_d - V_f|$.

Relative humidity range5% to 95%
 noncondensing (Tested
 in accordance with
 IEC-60068-2-56.)

Shock and Vibration (PXI 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

Operating5 to 500 Hz, 0.3 g_{rms}
 Nonoperating5 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, CAN/CSA-C22.2 No. 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 according to product documentation.

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.

Waste Electrical and Electronic Equipment (WEEE)



EU Customers At the end of their life cycle, all products must be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit ni.com/environment/weee.htm.

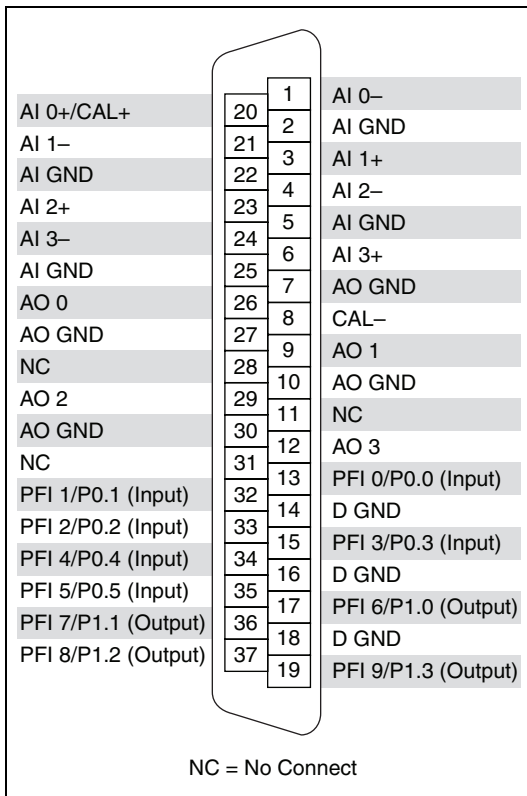


Figure 2. NI 6236 Pinout

National Instruments, NI, ni.com, and LabVIEW are trademarks of National Instruments Corporation. Refer to the *Terms of Use* section on ni.com/legal for more information about National Instruments trademarks. Other product and company names mentioned herein are trademarks or trade names of their respective companies. For patents covering National Instruments products, refer to the appropriate location: **Help»Patents** in your software, the `patents.txt` file on your CD, or ni.com/patents.