
PXle-7868 Specifications

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NI PXIe-7868R Specifications

The following specifications are typical at 25 °C unless otherwise noted.

Analog Input

Number of channels	6
Input modes (software-selectable; selection applies to all channels)	DIFF, NRSE, RSE
Type of ADC	Successive approximation register (SAR)
Resolution	16 bits
Conversion time	1 μ s
Maximum sampling rate (per channel)	1 MS/s
Input impedance	
Powered on	1.25 G Ω 2 pF
Powered off/overload	4 k Ω minimum
Input signal range (software-selectable)	\pm 1 V, \pm 2 V, \pm 5 V, \pm 10 V
Input bias current	\pm 5 nA
Input offset current	\pm 5 nA
Input coupling	DC
Overvoltage protection	

Powered on	±42 V maximum
Powered off	±35 V maximum

Table 1. AI Operating Voltage Ranges Over Temperature

Range (V)	Measurement Voltage, AI+ to AI-			Maximum Working Voltage (Signal + Common Mode)
	Minimum (V) ^[1]	Typical (V)	Maximum (V)	
±10	±10.37	±10.5	±10.63	±12 V of ground
±5	±5.18	± 5.25	±5.32	±10 V of ground
±2	±2.07	±2.1	±2.13	±8.5 V of ground
±1	±1.03	±1.05	±1.06	±8 V of ground

AI Absolute Accuracy

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.

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 = 10,000
- CoverageFactor = 3 σ

Table 2. AI Absolute Accuracy (Calibrated)

Specifications	Range				
	±20 V	±10 V	±5 V	±2 V	±1 V
Residual Gain Error (ppm of Reading)		104.4	105.9	110.6	118.4

Specifications	Range				
	± 20 V	± 10 V	± 5 V	± 2 V	± 1 V
Gain Tempco (ppm/ $^{\circ}$ C)		20	20	20	20
Reference Tempco (ppm/ $^{\circ}$ C)		4	4	4	4
Residual Offset Error (ppm of Range)		16.4	16.4	16.4	16.4
Offset Tempco (ppm of Range/ $^{\circ}$ C)		4.18	4.17	4.41	4.63
INL Error (ppm of range)		42.52	46.52	46.52	50.52
Random Noise, σ (μ V _{rms})		263	156	90	74
Absolute Accuracy at Full Scale (μ V)		2,283	1,170	479	252

Table 3. AI Absolute Accuracy (Uncalibrated)

Specifications	Range				
	± 20 V	± 10 V	± 5 V	± 2 V	± 1 V
Residual Gain Error (ppm of Reading)		2,921	3,021	3,021	3,021
Gain Tempco (ppm/ $^{\circ}$ C)		20	20	20	20
Reference Tempco (ppm/ $^{\circ}$ C)		4	4	4	4
Residual Offset Error (ppm of Range)		661	671	700	631

Specifications	Range				
	±20 V	±10 V	±5 V	±2 V	±1 V
Offset Tempco (ppm of Range/°C)		4.18	4.17	4.41	4.63
INL Error (ppm of range)		42.52	46.52	46.52	50.52
Random Noise, σ (μV_{rms})		263	156	90	74
Absolute Accuracy at Full Scale (μV)		36,895	19,018	7,667	3,769

Calculating Absolute Accuracy

$$\text{AbsoluteAccuracy} = \text{Reading} \times (\text{GainError}) + \text{Range} \times (\text{OffsetError}) + \text{NoiseUncertainty}$$

$$\text{GainError} = \text{ResidualGainError} + \text{GainTempco} \times (\text{TempChangeFromLastInternalCal}) + \text{ReferenceTempco} \times (\text{TempChangeFromLastExternalCal})$$

$$\text{OffsetError} = \text{ResidualOffsetError} + \text{OffsetTempco} \times (\text{TempChangeFromLastInternalCal}) + \text{INL_Error}$$

$$\text{NoiseUncertainty} = \frac{\text{RandomNoise} \times \text{CoverageFactor}}{\sqrt{\text{number_of_readings}}}$$

Refer to the following equation for an example of calculating absolute accuracy for a 10 V reading.

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 = 10,000
- CoverageFactor = 3 σ

$$\text{GainError} = 104.4 \text{ ppm} + 20 \text{ ppm} \times 1 + 4 \text{ ppm} \times 10$$

$$\text{GainError} = 164.4 \text{ ppm}$$

$$\text{OffsetError} = 16.4 \text{ ppm} + 4.18 \text{ ppm} \times 1 + 42.52 \text{ ppm}$$

$$\text{OffsetError} = 63.1 \text{ ppm}$$

$$\text{NoiseUncertainty} = \frac{263 \mu\text{V} \times 3}{\sqrt{10,000}}$$

$$\text{NoiseUncertainty} = 7.89 \mu\text{V}$$

$$\text{AbsoluteAccuracy} = 10 \text{ V} \times (\text{GainError}) + 10 \text{ V} \times (\text{OffsetError}) + \text{NoiseUncertainty}$$

$$\text{AbsoluteAccuracy} = 2,283 \mu\text{V}$$

DC Transfer Characteristics

INL	Refer to the AI Accuracy Table
DNL	± 0.4 LSB typical, ± 0.9 LSB maximum
No missing codes	16 bits guaranteed
CMRR, DC to 60 Hz	-100 dB

Dynamic Characteristics

Bandwidth	
Small signal	1 MHz
Large signal	500 kHz

Table 4. Settling Time

Range (V)	Step Size (V)	Accuracy		
		± 16 LSB	± 4 LSB	± 2 LSB
± 20				
± 10	± 20.0	1.50 μs	4.00 μs	7.00 μs
	± 2.0	0.50 μs	0.50 μs	1.00 μs
	± 0.2	0.50 μs	0.50 μs	0.50 μs
± 5	± 10	1.50 μs	3.50 μs	7.50 μs
	± 1	0.50 μs	0.50 μs	1.00 μs
	± 0.1	0.50 μs	0.50 μs	0.50 μs
± 2	± 4	1.00 μs	3.50 μs	8.00 μs
	± 0.4	0.50 μs	0.50 μs	1.00 μs

Range (V)	Step Size (V)	Accuracy		
		± 16 LSB	± 4 LSB	± 2 LSB
± 1	± 0.04	0.50 μ s	0.50 μ s	0.50 μ s
	± 2	1.00 μ s	3.50 μ s	12.00 μ s
	± 0.2	0.50 μ s	0.50 μ s	2.00 μ s
	± 0.02	0.50 μ s	0.50 μ s	0.50 μ s
Crosstalk		-80 dB, DC to 100 kHz, at 50 Ω		

Analog Output

Output type	Single-ended, voltage output
Number of channels	18
Resolution	16 bits
Update time	1 μ s
Maximum update rate	1 MS/s
Type of DAC	Enhanced R-2R
Range	± 10 V
Output coupling	DC
Output impedance	0.5 Ω
Current drive	± 2.5 mA
Protection	Short circuit to ground

Overvoltage protection	
Powered on	±15 V maximum
Powered off	±10 V maximum
Power-on state	User-configurable
Power-on glitch	1 V for 1 μ s
Power-down glitch	3.7 V peak, decays to 0 V in 7 ms

Table 5. AO Operating Voltage Ranges for Over Temperature

Range (V)	Measurement Voltage, AO+ to AO GND		
	Minimum (V) ^[2]	Typical (V)	Maximum (V)
±10	±10.1	±10.16	±10.22

AO Absolute Accuracy

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.

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

- TempChangeFromLastExternalCal = 10 °C
- TempChangeFromLastInternalCal = 1 °C

Table 6. AO Absolute Accuracy (Calibrated)

Specifications	±10 V Range
Residual Gain Error (ppm of Reading)	87.3
Gain Tempco (ppm/°C)	12.6
Reference Tempco (ppm/°C)	4

Specifications	±10 V Range
Residual Offset Error (ppm of Range)	41.1
Offset Tempco (ppm of Range/°C)	7.8
INL Error (ppm of range)	61
Absolute Accuracy at Full Scale (μV)	2,498

Table 7. AO Absolute Accuracy (Uncalibrated)

Specifications	±10 V Range
Residual Gain Error (ppm of Reading)	2,968.6
Gain Tempco (ppm/°C)	12.6
Reference Tempco (ppm/°C)	4
Residual Offset Error (ppm of Range)	1,004.1
Offset Tempco (ppm of Range/°C)	7.8
INL Error (ppm of range)	61
Absolute Accuracy at Full Scale (μV)	40,941

Calculating Absolute Accuracy

$AbsoluteAccuracy = OutputValue \times (GainError) + Range \times (OffsetError)$

$GainError = ResidualGainError + GainTempco \times (TempChangeFromLastInternalCal) + ReferenceTempco \times (TempChangeFromLastExternalCal)$

$OffsetError = ResidualGainError + AOffsetTempco \times (TempChangeFromLastInternalCal) + INL_Error$

Refer to the following equation for an example of calculating absolute accuracy for a 10 V reading.

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

- $TempChangeFromLastExternalCal = 10\text{ }^{\circ}C$
- $TempChangeFromLastInternalCal = 1\text{ }^{\circ}C$

$GainError = 87.3\text{ ppm} + 12.6\text{ ppm} \times 1 + 4\text{ ppm} \times 10$

$GainError = 139.9\text{ ppm}$

$OffsetError = 41.1\text{ ppm} + 7.8\text{ ppm} \times 1 + 61\text{ ppm}$

$OffsetError = 109.9\text{ ppm}$

$AbsoluteAccuracy = 10\text{ V} \times (GainError) + 10\text{ V} \times (OffsetError)$

$AbsoluteAccuracy = 2,498\text{ }\mu V$

DC Transfer Characteristics

INL	Refer to the AO Accuracy Table
DNL	± 0.5 LSB typical, ± 1 LSB maximum
Monotonicity	16 bits, guaranteed

Dynamic Characteristics

Table 8. Settling Time

Step Size (V)	Accuracy		
	± 16 LSB	± 4 LSB	± 2 LSB
± 20.0	5.3 μ s	6.5 μ s	7.8 μ s
± 2.0	3.2 μ s	3.9 μ s	4.4 μ s
± 0.2	1.8 μ s	2.8 μ s	3.8 μ s
Slew rate	10 V/ μ s		
Noise	250 μ V RMS, DC to 1 MHz		
Glitch energy at midscale transition	± 10 mV for 3 μ s		

5V Output

Output voltage	4.75 V to 5.1 V
Output current	0.5 A maximum
Overvoltage protection	± 30 V

Overcurrent protection	650 mA
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Digital I/O

Table 9. Channel Frequency

Connector	Number of Channels	Maximum Frequency
Connector 0	16	10 MHz
Connector 1	32	80 MHz
Compatibility	LVTTTL, LVCMOS	
Logic family	Fixed	
Voltage level	3.3 V	

Table 10. Digital Input Logic Levels

Logic Family	Input Low Voltage (V_{IL}) Maximum	Input High Voltage (V_{IH}) Minimum
3.3 V	0.80 V	2.00 V
Minimum input	-0.3 V	
Maximum input	3.6 V	
Input leakage current	±15 μ A maximum	
Input impedance	50 k Ω typical, pull-down	

Table 11. Digital Output Logic Levels

Logic Family	Current	Output Low Voltage (V_{OL}) Maximum	Output High Voltage (V_{OH}) Minimum
3.3 V	100 μ A	0.20 V	3.00 V

Logic Family	Current	Output Low Voltage (V _{OL}) Maximum	Output High Voltage (V _{OH}) Minimum
	4 mA	0.40 V	2.40 V

Maximum DC output current per channel	
Source	4.0 mA
Sink	4.0 mA
Output impedance	50 Ω
Power-on state ^[3]	Programmable, by line
Protection ^[4]	± 15 V, single line
Direction control of digital I/O channels	Per channel
Minimum I/O pulse width	6.25 ns
Minimum sampling period	5 ns

External Clock

Direction	Input into device
Maximum input leakage	± 15 μ A
Characteristic impedance	50 Ω
Power-on state	Tristated
Minimum input	-0.3 V

Maximum input	3.6 V
Logic level	3.3 V
Maximum input frequency	80 MHz

Reconfigurable FPGA

FPGA type	Kintex-7 325T
Number of flip-flops	407,600
Number of LUTs	203,800
Embedded Block RAM	16,020 kbits
Number of DSP48 slices	840
Timebase	40 MHz, 80 MHz, 120 MHz, 160 MHz, or 200 MHz
Default timebase	40 MHz
Timebase reference source	Onboard clock, phase-locked to PXI Express100 MHz (PXIe_CLK100)
Onboard clock timebase accuracy	±100 ppm, 250 pspeak-to-peak jitter
Data transfers	DMA, interrupts, programmed I/O

Onboard DRAM

Memory size	1 Bank; 512 MB
Maximum theoretical data rate	800 MB/s streaming

Synchronization Resources

Input/output source	PXI_Trig<0..7>
Input source	PXI_Star, PXIe_DStarA, PXIe_DStarB, PXI_Clk10, PXIe_Clk100, External Clock 1
Output source	PXIe_DStarC

Bus Interface

Form factor	x4 PXI Express, specification v1.0 compliant
Slot compatibility	x4, x8, and x16 PXI Express or PXI Express hybrid slots
Data transfers	DMA, interrupts, programmed I/O
Number of DMA channels	16

Power Requirements

Power requirements are dependent on the digital output loads and configuration of the LabVIEW FPGA VI used in your application.

+3.3 V	3 A
+12 V	2 A

Physical Characteristics

If you need to clean the device, wipe it with a dry, clean towel.



Tip For two-dimensional drawings and three-dimensional models of the device and connectors, visit ni.com/dimensions and search by model number.

Dimensions	18.5 cm × 17.3 cm × 3.6 cm (7.3 in. × 6.8 in. × 1.4 in.)
Weight	176.3 g (6.22 oz)
I/O connectors	3 × 68-pin VHDCI

Maximum Working Voltage

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

Channel-to-earth	±12 V, Measurement Category I
Channel-to-channel	±24 V, Measurement Category I

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.



Caution Do not use the NI PXIe-7868R for connection to signals in Measurement Categories II, III, or IV.



Note Measurement Categories CAT I and CAT O (Other) are equivalent. These test and measurement circuits are not intended for direct connection to the MAINS building installations of Measurement Categories CAT II, CAT III, or CAT IV.

Safety

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

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA C22.2 No. 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 61326-1 (IEC 61326-1): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- EN 55022 (CISPR 22): Class A emissions
- EN 55024 (CISPR 24): Immunity
- AS/NZS CISPR 11: Group 1, Class A emissions
- AS/NZS CISPR 22: Class A emissions

- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions



Note In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.



Note Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.



Note For EMC declarations and certifications, and additional information, refer to the [Online Product Certification](#) section.

CE Compliance

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

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

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

Shock and Vibration

Operational shock	30 g PK, half-sine, 11 ms pulse (Tested in accordance with IEC 60068-2-27. Meets MIL-PRF-28800F Class 2 limits.)
Random vibration	
Operating	5 Hz to 500 Hz, 0.3 g RMS
Non-operating	5 Hz to 500 Hz, 2.4 g RMS (Tested in accordance with IEC 60068-2-64. Meets MIL-PRF-28800F Class 3.)

Environmental

Refer to the manual for the chassis you are using for more information about meeting these specifications.

Operating temperature (IEC 60068-2-1, IEC 60068-2-2)	0 °C to 55 °C
Storage temperature (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 71 °C
Operating humidity (IEC 60068-2-56)	10% RH to 90% RH, noncondensing
Storage humidity (IEC 60068-2-56)	5% RH to 95% RH, noncondensing
Pollution Degree	2
Maximum altitude	2,000 m


Indoor use only.

Environmental Management


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

For additional environmental information, refer to the **Engineering a Healthy Planet** 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.

EU and UK Customers

-  **Waste Electrical and Electronic Equipment (WEEE)**—At the end of the product life cycle, all NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit ni.com/environment/weee.

电子信息产品污染控制管理办法（中国 RoHS）

-  **中国 RoHS**—NI 符合中国电子信息产品中限制使用某些有害物质指令(RoHS)。关于 NI 中国 RoHS 合规性信息，请登录 ni.com/environment/rohs_china。(For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

Calibration

Recommended warm-up time	15 minutes
Calibration interval	1 year
Onboard calibration reference	

DC level ^[5]	5.000 V (± 2 mV)
Temperature coefficient	± 4 ppm/ $^{\circ}$ C maximum
Long-term stability	± 25 ppm/1,000 h



Note Refer to Calibration Certifications at ni.com/calibration to generate a calibration certificate for the NI PXIe-7868R

Worldwide Support and Services

The NI website is your complete resource for technical support. At ni.com/support, you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

Visit ni.com/services for NI Factory Installation Services, repairs, extended warranty, and other services.

Visit ni.com/register to register your NI product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

A Declaration of Conformity (DoC) is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electromagnetic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting ni.com/certification. If your product supports calibration, you can obtain the calibration certificate for your product at ni.com/calibration.

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websites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.