PXIe-7866 Specifications

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Contents

PXIe-7866 Specifications

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

Analog Input

Number of channels	2
Input modes (software-selectable; selection applies to all channels)	DIFF, NRSE[1], RSE
Type of ADC	Successive approximation register (SAR)
Resolution	16 bits
Conversion time	1 µs
Maximum sampling rate (per channel)	1 MS/s
Input impedance	
Powered on	1.25 GΩ ‖ 2 pF
Powered off/overload	4 kΩ minimum

Input signal range (software-selectable)	±1 V, ±2 V, ±5 V, ±10 V
Input bias current	±5 nA
Input offset current	±5 nA
Input coupling	DC
Overvoltage protection	

[1] Operating channels in NRSE input mode while outside of the specified voltage range may impact accuracy of other channels.

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

Table 12. AI Operating Voltage Ranges Over Temperature

Range (V)	Measurement Voltage, AI+ to AI-			Maximum Working Voltage (Signal + Common Mode)
	Minimum (V)[2]	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

[2] The minimum measurement voltage range is the largest voltage the PXIe-7866 is guaranteed to accurately measure.

Table 13. AI Absolute Accuracy (Calibrated)

Specifications	Range			
	±10 V	±5 V	±2 V	±1 V
Residual Gain Error (ppm of Reading)	104.4	105.9	110.6	118.4
Gain Tempco (ppm/°C)	20	20	20	20
Reference Tempco (ppm/°C)	4	4	4	4
Residual Offset Error (ppm of Range)	16.4	16.4	16.4	16.4
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)	2,283	1,170	479	252

Table 14. AI Absolute Accuracy (Uncalibrated)

Specifications	Range			
	±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/°C)	20	20	20	20
Reference Tempco (ppm/°C)	4	4	4	4
Residual Offset Error (ppm of Range)	661	671	700	631

Specifications	Range			
	±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

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

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

$$OffsetError = ResidualOffsetError + OffsetTempco \times (TempChangeFromLastInternalCal) + INL\_Error$$

$$NoiseUncertainty = \frac{RandomNoise \times CoverageFactor}{\sqrt{number\_of\_readings}}$$

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

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

$$GainError = 164.4\ \ ppm$$

$$OffsetError = 16.4\ ppm + 4.18\ \ ppm\ 1 + 42.52\ \ ppm$$

$$OffsetError = 63.1\ ppm$$

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

$$NoiseUncertainty = 7.89\ \mu V$$

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

AbsoluteAccuracy = 2,283 µV

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 15. Settling Time

Range (V)	Step Size (V)	Accuracy		
		±16 LSB	±4 LSB	±2 LSB
±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
	±0.04	0.50 µs	0.50 µs	0.50 µs
±1	±2	1.00 µs	3.50 µs	12.00 µs

Range (V)	Step Size (V)	Accuracy		
		±16 LSB	±4 LSB	±2 LSB
	±0.2	0.50 µs	0.50 µs	2.00 µs
	±0.02	0.50 µs	0.50 µs	0.50 µs

Crosstalk	-80 dB, DC to 100 kHz, at 50 Ω

Analog Output

Output type	Single-ended, voltage output
Number of channels	24
Resolution	16 bits
Update time	1 µs
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	1.6 V for 2 µs
Power-down glitch	0.4 V peak, decays to 0 V in 200 ms

Table 16. AO Operating Voltage Ranges for Over Temperature

Range (V)	Measurement Voltage, AO+ to AO GND		
	Minimum (V)[3]	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 17. 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
Residual Offset Error (ppm of Range)	41.1

[3] The minimum measurement voltage range is the largest voltage the PXIe-7866 is guaranteed to accurately measure.

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

Table 18. 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 × (GainError) + Range × (OffsetError)
GainError = ResidualGainError + GainTempco × (TempChangeFromLastInternalCal) + ReferenceTempco × (TempChangeFromLastExternalCal)
OffsetError = ResidualGainError + AOOffsetTempco × (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 °C
- TempChangeFromLastInternalCal = 1 °C

GainError = 87.3 ppm + 12.6 ppm × 1 + 4 ppm × 10
GainError = 139.9 ppm
OffsetError = 41.1 ppm + 7.8 ppm × 1 + 61 ppm
OffsetError = 109.9 ppm
AbsoluteAccuracy = 10 V × (GainError) + 10 V × (OffsetError)
AbsoluteAccuracy = 2,498 µV

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 19. Settling Time

Step Size (V)	Accuracy		
	±16 LSB	±4 LSB	±2 LSB
±20.0	5.3 µs	6.5 µs	7.8 µs
±2.0	3.2 µs	3.9 µs	4.4 µs
±0.2	1.8 µs	2.8 µs	3.8 µs

Slew rate	10 V/µs
Noise	250 µV RMS, DC to 1 MHz
Glitch energy at midscale transition	±10 mV for 3 µs

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

Digital I/O

Table 20. Channel Frequency

Connector	Number of Channels	Maximum Frequency
Connector 1	32	20 MHz

Compatibility	TTL, LVTTL, LVCMOS
Logic family	Fixed
Voltage level	
Digital input	5 V, 3.3 V
Digital output	3.3V

Table 21. Digital Input Logic Levels

Logic Level	Input Low Voltage (V_{IL}) Maximum	Input High Voltage (V_{IH}) Minimum
5 V	0.80 V	2.00 V
3.3 V	0.80 V	2.00 V

Minimum input	-0.2 V
Maximum input	5.5 V
Input leakage current	±85 µA maximum
Input impedance	
5 V input	74 kΩ typical, pull-down

3.3 V input	50 kΩ typical, pull-down

Table 22. Digital Output Logic Levels

Logic Level	Current	Output Low Voltage (V_{OL}) Maximum	Output High Voltage (V_{OH}) Minimum
3.3 V	100 µA	0.20 V	3.00 V
	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[4]	Programmable, by line
Protection[5]	±15 V, per line
Direction control of digital I/O channels	Per channel
Minimum I/O pulse width	25 ns
Minimum sampling period	5 ns

External Clock

Direction	Input into device
Maximum input leakage	±85 µA
Characteristic impedance	50 Ω

[4] Tristate by default.

[5] Only protects up to 20 lines simultaneously. NI recommends minimizing long-term over/under-voltage exposure to the Digital I/O. Prolonged DC voltage stresses that violate the maximum and minimum digital input voltage ratings may reduce device longevity. Over/under-voltage stresses are considered prolonged if the cumulative time in the abnormal condition exceeds 1 year.

Power-on state	Tristated
Minimum input	-0.2 V
Maximum input	5.5 V
Logic level	5 V, 3.3 V
Maximum input frequency	20 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 ps peak-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	2.25 A
+12 V	1.65 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	21.4 cm × 13.0 cm × 2.1 cm(8.43 in. × 5.12 in. × 0.83 in.)
Weight	177.6 g (6.26 oz)
I/O connectors	3 × 68-pin VHDCI

Safety Voltages

Connect only voltages that are below these limits.

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

Caution Do not connect the PXIe-7866 to signals or use for measurements within Measurement Categories II, III, or IV.

Attention Ne connectez pas le PXIe-7866 à des signaux et ne l'utilisez pas pour effectuer des mesures dans les catégories de mesure II, III ou IV.

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.

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

Safety Compliance Standards

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 safety certifications, refer to the product label or the Product Certifications and Declarations section.

Electromagnetic Compatibility Standards

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
- AS/NZS CISPR 11: Group 1, Class A emissions

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 In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use in non-residential locations.

Environmental Characteristics

Temperature	
Operating	0 °C to 55 °C
Storage	-40 °C to 71 °C
Humidity	
Operating	10% RH to 90% RH, noncondensing
Storage	5% RH to 95% RH, noncondensing

Pollution Degree	2
Maximum altitude	2,000 m

Shock and Vibration	
Operating vibration	5 Hz to 500 Hz, 0.3 g RMS
Non-operating vibration	5 Hz to 500 Hz, 2.4 g RMS

Operating shock	30 g, half-sine, 11 ms pulse

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.)

Environmental Standards

This product meets the requirements of the following environmental standards for electrical equipment.

- IEC 60068-2-1 Cold
- IEC 60068-2-2 Dry heat
- IEC 60068-2-78 Damp heat (steady state)
- IEC 60068-2-64 Random operating vibration

- IEC 60068-2-27 Operating shock

Note To verify marine approval certification for a product, refer to the product label or visit ni.com/certification and search for the certificate.

CE Compliance CE

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)
- 2015/863/EU; Restriction of Hazardous Substances (RoHS)

Calibration

Recommended warm-up time	15 minutes
Calibration interval	1 year
Onboard calibration reference	
DC level[6]	5.000 V (±2 mV)
Temperature coefficient	±4 ppm/°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 PXIe-7866

[6] Actual value stored in Flash memory

Product Certifications and Declarations

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for NI products, visit ni.com/product-certifications, search by model number, and click the appropriate link.

NI Services

Visit ni.com/support to find support resources including documentation, downloads, and troubleshooting and application development self-help such as tutorials and examples.

Visit ni.com/services to learn about NI service offerings such as calibration options, repair, and replacement.

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

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