

# SPECIFICATIONS

# PXIe-4080

PXIe, 6½-Digit, ±300 V, Onboard 1.8 MS/s Isolated Digitizer, PXI Digital Multimeter

These specifications apply to the PXIe-4080.

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## Definitions

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*Warranted* specifications describe the performance of a model under stated operating conditions and are covered by the model warranty.

The following characteristic specifications describe values that are relevant to the use of the model under stated operating conditions but are not covered by the model warranty.

- *Typical* specifications describe the performance met by a majority of models.
- *Nominal* specifications describe an attribute that is based on design, conformance testing, or supplemental testing.

Specifications are *Warranted* unless otherwise noted.

$T_{\text{extcal}}$  is the device temperature at last external calibration.

$T_{\text{selfcal}}$  is the device temperature at last self-calibration.

## Conditions

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Specifications are valid under the following conditions unless otherwise noted. Refer to each section for additional conditions that apply.

- Self-calibration performed within the last 24 hours
- Calibration interval of 2 years
- 60 minutes warm-up time

## DC Voltage Specifications

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### Accuracy

All DC voltage accuracy specifications apply to apertures of  $\geq 100$  ms, with Auto Zero and ADC calibration enabled. Assumes offset nulling. Otherwise, add 2  $\mu\text{V}$  to the specifications.

**Table 1.** DC Voltage  $\pm$  (ppm of reading + ppm of range)

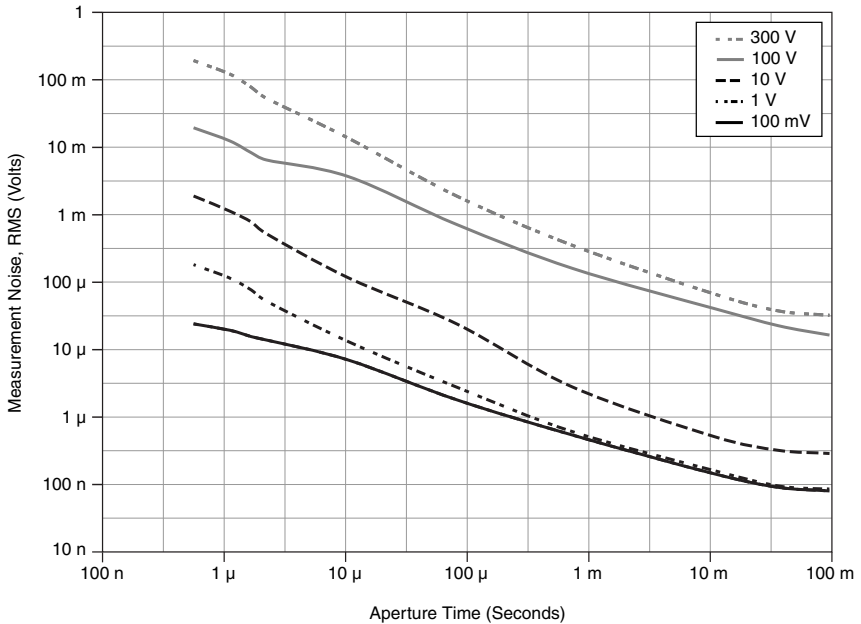
Range	Input Resistance <sup>1</sup>	24 Hr <sup>2</sup> T <sub>selfcal</sub> $\pm 1$ °C	90 Day T <sub>selfcal</sub> $\pm 5$ °C	2 Year T <sub>selfcal</sub> $\pm 5$ °C	Tempco/°C	
					Without Self-Cal	With Self-Cal
100 mV	10 M $\Omega$ $\pm$ 2%, >10 G $\Omega$	10 + 10	40 + 20	45 + 20	4 + 5	0.3 + 0.3
1 V		6 + 2	20 + 6	25 + 6	2 + 1	0.3 + 0.3
10 V		4 + 2	20 + 6	25 + 6	1 + 1	0.3 + 0.3
100 V	10 M $\Omega$ $\pm$ 2%	6 + 2	30 + 6	35 + 6	4 + 1	0.3 + 0.3
300 V		6 + 6	30 + 20	35 + 20	4 + 1	0.3 + 0.3

<sup>1</sup> In parallel with 150 pF, typical

<sup>2</sup> Relative to external calibration source.

# Noise

**Figure 1. DC Voltage Noise, Typical**



**Note** With input shorted, Normal DC Noise Rejection, and Auto Zero ON. For apertures less than 100 ms, add five times the typical rms noise to the accuracy specification.

## General

ADC Linearity	0.5 ppm of reading + 1 ppm of range
Effective Common-Mode Rejection Ratio (CMRR) (1 kΩ resistance in LO lead)	>140 dB (DC), 100 ms aperture; >170 dB (>46 Hz) with high-order DC noise rejection, 100 ms aperture, typical
Overrange	105% of range except 300 V
DC voltage input bias current	<30 pA at 23 °C, typical

# Resistance Specifications

## Accuracy

All resistance accuracy specifications apply to apertures of  $\geq 100$  ms, with Offset Compensated Ohms (for ranges  $\leq 10$  k $\Omega$ ) or Auto Zero (for ranges  $\geq 100$  k $\Omega$ ) and ADC calibration enabled.

**Table 2.** Resistance (4-Wire and 2-Wire<sup>3</sup>)  $\pm$  (ppm of reading + ppm of range)

Range	Test Current <sup>4</sup>	Max Test Voltage	24 Hr <sup>5</sup> $T_{\text{selfcal}} \pm 1^\circ\text{C}$	90 Day $T_{\text{selfcal}} \pm 5^\circ\text{C}$	2 Year $T_{\text{selfcal}} \pm 5^\circ\text{C}$	Tempco/ $^\circ\text{C}$	
						Without Self-Cal	With Self-Cal
100 $\Omega$	1 mA	100 mV	15 + 10	50 + 15	80 + 15	5 + 1	0.8 + 1
1 k $\Omega$	1 mA	1 V	12 + 2	50 + 3	80 + 3	5 + 0.1	0.8 + 0.1
10 k $\Omega$	100 $\mu\text{A}$	1 V	12 + 2	50 + 3	80 + 3	5 + 0.1	0.8 + 0.1
100 k $\Omega$ <sup>6</sup>	10 $\mu\text{A}$	1 V	15 + 2	90 + 6	95 + 6	5 + 0.5	2 + 0.5
1 M $\Omega$	10 $\mu\text{A}$	10 V	20 + 2	90 + 10	95 + 10	5 + 1	2 + 1
10 M $\Omega$	1 $\mu\text{A}$	10 V	100 + 2	800 + 10	800 + 10	20 + 3	20 + 3
100 M $\Omega$ <sup>7</sup>	1 $\mu\text{A}$    10 M $\Omega$	10 V	500 + 10	3000 + 10	3000 + 10	300 + 10	300 + 10

<sup>3</sup> Perform offset nulling or add 200 m $\Omega$  to reading.

<sup>4</sup> -10% to 0% tolerance, typical.

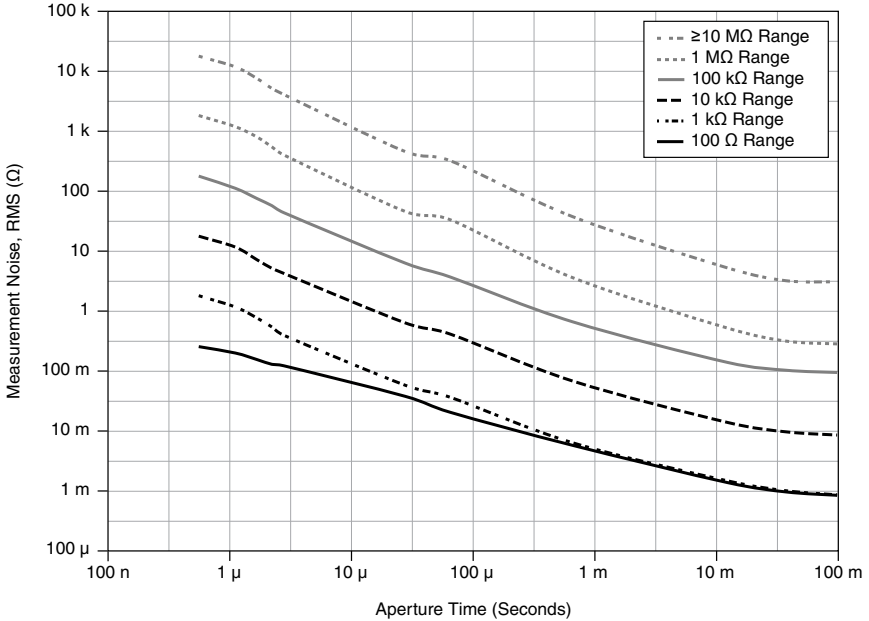
<sup>5</sup> Relative to external calibration source.

<sup>6</sup> Perform offset nulling or add 2 ppm of range to the specifications.

<sup>7</sup> 2-wire resistance measurement only. Use tempco outside  $T_{\text{extcal}} \pm 10^\circ\text{C}$ . Typical accuracy is 5% between 105 M $\Omega$  and 1.05 G $\Omega$ .

# Noise

**Figure 2. PXIe-4080 Resistance Noise, Typical**



**Note** With input shorted, Normal DC Noise Rejection, and Auto Zero ON. For apertures less than 100 ms, add five times the typical rms noise to the accuracy specification.

## General

Maximum 4-wire lead resistance

Use the lesser of 10% of range or 1 kΩ

## DC Current Specifications

### Accuracy

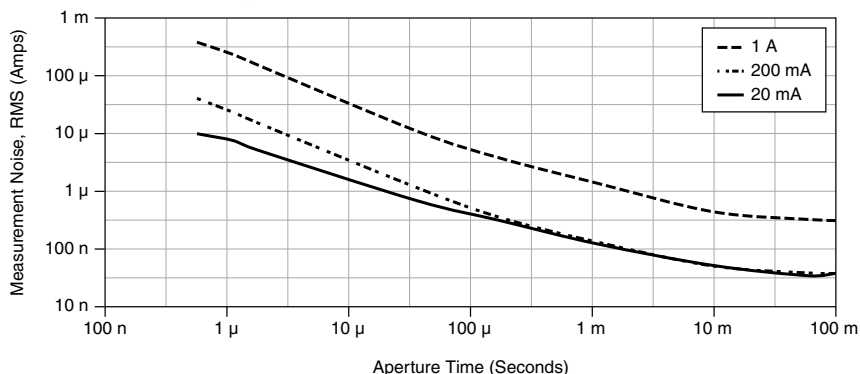
All DC current accuracy specifications apply for apertures  $\geq 100$  ms, with Auto Zero and ADC calibration enabled.

**Table 3.** DC Current  $\pm$  (ppm of reading + ppm of range)

Range	Burden Voltage, Typical	24 hour <sup>8</sup> $T_{\text{selfcal}} \pm 1^\circ\text{C}$	2 Year $T_{\text{selfcal}} \pm 5^\circ\text{C}$	Tempco/ $^\circ\text{C}$
20 mA	<20 mV	20 + 15	450 + 200	8 + 10
200 mA	<200 mV	20 + 15	550 + 20	8 + 1
1 A	<800 mV	20 + 15	700 + 50	8 + 2

## Noise

**Figure 3.** PXIe-4080 DC Current Noise, Typical



**Note** With input open, Normal DC Noise Rejection, and Auto Zero ON. For apertures less than 100 ms, add five times the typical rms noise to accuracy specification.

## General

Overrange

105% of range except 1 A range.

## AC Voltage Specifications

### Accuracy



**Note** Measurement aperture greater than  $4/f_L$  where  $f_L$  is the lowest frequency component of the signal being measured. Signal amplitudes greater than 1% of range.

<sup>8</sup> Relative to external calibration source.

**Table 4.** AC Voltage Accuracy  $\pm$  (% of reading + % of range), 2 Years,  $T_{\text{extcal}} \pm 10\text{ }^{\circ}\text{C}$ ,  $T_{\text{selfcal}} \pm 5\text{ }^{\circ}\text{C}$

Range (rms)	Peak Voltage	1 Hz to 40 Hz <sup>9</sup>	>40 Hz to 20 kHz	>20 kHz to 50 kHz	>50 kHz to 100 kHz	>100 kHz to 300 kHz
50 mV <sup>10</sup>	$\pm 105\text{ mV}$	0.1 + 0.04	0.05 + 0.04	0.09 + 0.04	0.5 + 0.08	3 + 0.1
500 mV	$\pm 1.05\text{ V}$	0.1 + 0.01	0.05 + 0.02	0.09 + 0.02	0.5 + 0.02	3 + 0.05
5 V	$\pm 10.5\text{ V}$					
50 V	$\pm 105\text{ V}$					
300 V	$\pm 450\text{ V}$					
Tempco/ $^{\circ}\text{C}$		0.001 + 0.001	0.001 + 0.001	0.001 + 0.001	0.001 + 0.001	0.01 + 0.01

## General

Input impedance 1 M $\Omega$   $\pm$  2% in parallel with 150 pF, typical

Input coupling AC or DC coupled

Overrange 105% of range except 300 V

Maximum Volt-Hertz product Verified to  $2.2 \times 10^7$  V-Hz

Maximum DC voltage component 250 V

Common mode rejection ratio (CMRR), 1 k $\Omega$  resistance in LO lead >70 dB (DC to 60 Hz), typical

## AC Current Specifications

### Accuracy



**Note** Measurement aperture greater than  $4/f_L$ , where  $f_L$  is the lowest frequency component of the signal being measured. Signal amplitudes greater than 1% of range.

<sup>9</sup> Applies to DC coupled only.

<sup>10</sup> Applies to signals  $>2\text{ mV}$



**Table 5. AC Current Specifications ± (% of reading + % of range), 2 Years, Full operating temperature range**

Range (rms)	Peak Current	Burden Voltage (rms), Typical	1 Hz to 20 kHz <sup>11</sup>	Tempco/°C
10 mA	±20 mA	<10 mV	0.04 + 0.02	0.001 + 0.0001
100 mA	±200 mA	<100 mV	0.04 + 0.02	0.001 + 0.0001
1 A	±2 A	<800 mV	0.1 + 0.02	0.001 + 0.0001

## General

Overrange 105% of range except 1 A

## Diode Test Specifications

Range	10 V
Test current <sup>12</sup>	1 μA, 10 μA, 100 μA, 1 mA <sup>13</sup>
Accuracy	Add 20 ppm of reading to 10 VDC voltage specifications.

## Frequency and Period Specifications



**Note** Aperture time set to 150 ms.

Frequency range	15 Hz to 500 kHz
Period measurement range	2 μs to 66.67 ms

<sup>11</sup> Specification is typical above 5 kHz.

<sup>12</sup> -10% to 0% tolerance, typical.

<sup>13</sup> Up to 4.5 V measurement for 1 mA test current.

AC Input Voltage Range	Corresponding Isolated Digitizer Range	Minimum Peak-to-Peak Signal Amplitude <sup>14</sup>	Maximum Peak-to-Peak Signal Amplitude	Accuracy
50 mV	100 mV	5 mV	200 mV	Refer to the PXIe_CLK100 accuracy of the chassis.
500 mV	1 V	50 mV	2 V	
5 V	10 V	500 mV	20 V	
50 V	100 V	5 V	200 V	
300 V	300 V	50 V	450 V	

## Temperature Specifications

All temperature accuracy specifications apply to apertures  $\geq 100$  ms, Auto Zero, and ADC calibration enabled. Use lowest possible resistance or voltage range for each temperature. Add probe accuracy and cold junction accuracy where applicable.

Sensor Type	Temperature Range	Accuracy
RTD <sup>15</sup>	-200 to 600 °C	0.1 °C
Thermistor <sup>16</sup>	-80 to 150 °C	0.08 °C
J Thermocouple	-210 to 1200 °C	0.2 °C
K Thermocouple	-200 to 1200 °C	0.3 °C
N Thermocouple	-200 to 1300 °C	0.4 °C
T Thermocouple	-200 to 400 °C	0.3 °C
E Thermocouple	-200 to 1000 °C	0.2 °C
R Thermocouple	-50 to 1760 °C	0.8 °C
S Thermocouple	-50 to 1760 °C	0.8 °C
B Thermocouple	400 to 1820 °C	0.8 °C

<sup>14</sup> Square wave input. Minimum required peak-to-peak signal level is valid only for frequencies up to the -3 dB bandwidth. For higher frequencies, the signal amplitude must be increased. Refer to the Digitizer Voltage Mode for bandwidths.

<sup>15</sup> Based on Pt3851 RTD in a 4-wire configuration.

<sup>16</sup> Based on 44004, 44006, and 44007 interchangeable thermistors.

# Isolated Digitizer Specifications

Available functions	Voltage and current
Voltage ranges	$\pm 100$ mV to $\pm 300$ V (DC or AC coupled)
Current ranges	$\pm 20$ mA to $\pm 1$ A
Sample rate range	10 S/s to 1.8 MS/s
Available sample rates	$r = (1.8 \text{ MS/s}) / y$ , where $y = 1, 2, 3, \dots, 1.8 \times 10^5$
Timebase accuracy	Equal to the PXIe_CLK100 accuracy of the chassis
Digitizer record length	2 samples minimum, unlimited maximum

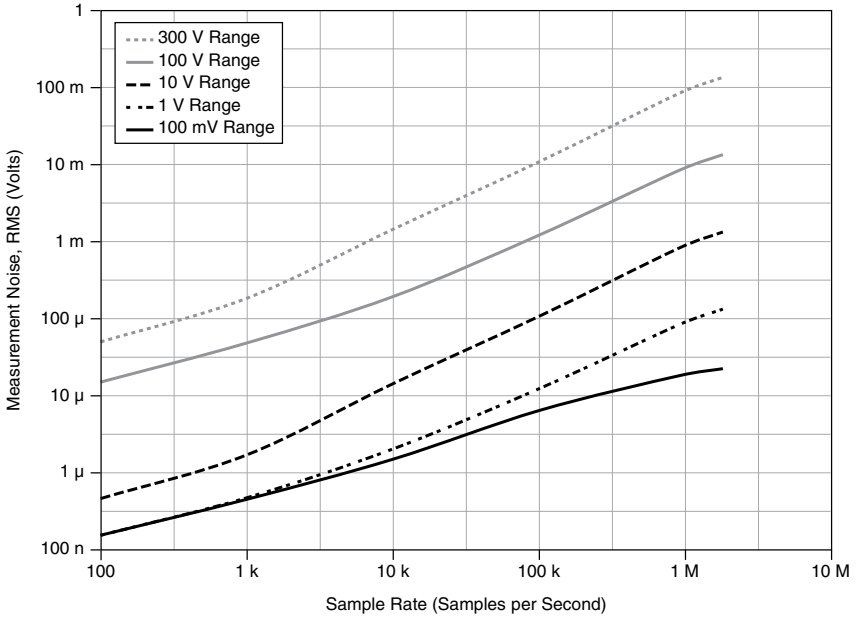
**Table 6. Voltage Mode**

Range	Input Resistance <sup>17</sup>	DC Accuracy, (ppm/ reading + ppm/range) 2 year, T <sub>selfcal</sub> $\pm 5$ °C	Analog Bandwidth, <sup>18</sup> Typical	
			$\pm 0.1$ dB	-3 dB
100 mV	1 M $\Omega$ $\pm 2\%$ , >10 G $\Omega$	125 + 175	40 kHz	240 kHz
1 V		125 + 75	40 kHz	240 kHz
10 V		125 + 75	40 kHz	240 kHz
100 V	1 M $\Omega$ $\pm 2\%$	125 + 75	30 kHz	240 kHz
300 V		125 + 75	30 kHz	240 kHz

<sup>17</sup> Input impedance in parallel with 150 pF, typical. When AC coupled, only 1 M $\Omega$  available.

<sup>18</sup> Typical AC coupled frequency is 6 Hz ( $\pm 0.1$  dB) and 0.8 Hz (-3 dB).

**Figure 4. PXIe-4080 Voltage Waveform Noise, Typical**

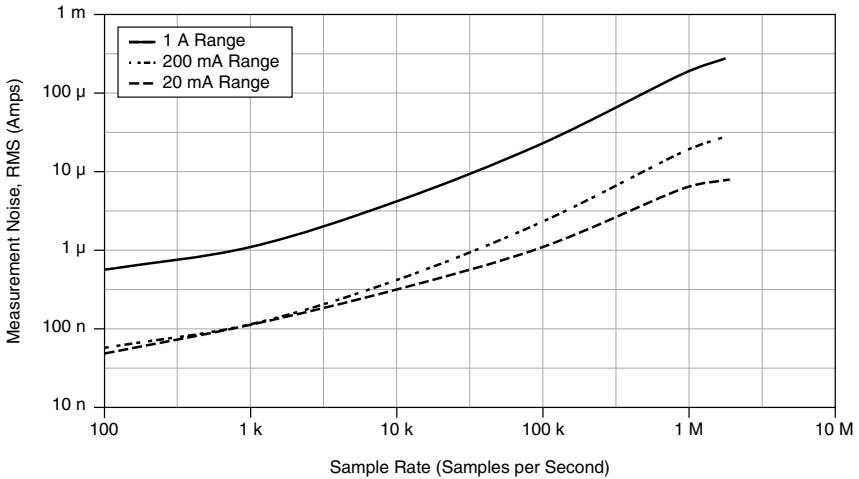


**Note** With input shorted.

**Table 7. Current Mode**

Range	Burden Voltage, Typical	DC Accuracy, (ppm/reading + ppm/range) 2 year, $T_{selfcal} \pm 5^\circ\text{C}$	Analog Bandwidth, Typical	
			$\pm 0.1$ dB	-3 dB
20 mA	<20 mV	450 + 200	60 kHz	300 kHz
200 mA	<200 mV	550 + 80	60 kHz	300 kHz
1 A	<800 mV	700 + 75	60 kHz	300 kHz

**Figure 5. PX1e-4080 Current Waveform Noise, Typical**



**Note** With input open.

## General Specifications

External calibration interval	2 years
Warm-up	60 minutes to rated accuracy
Measurement Category	II



**Caution** Do not use this device for connection to signals or for measurements within Measurement Categories III or IV.

Input protection (between terminals or terminal to ground)	300 VDC or $AC_{rms}$
Current mode fuse	T 1 A 400 V, time-lag user-replaceable Minimum interrupt rating: 500 A Littelfuse 0477001.MXP
Maximum common-mode voltage	300 VDC or $AC_{rms}$
Maximum voltage to earth ground	
HI	300 VDC or $AC_{rms}$
LO	300 VDC or $AC_{rms}$

HI SENSE 300 VDC or AC<sub>rms</sub>

LO SENSE 300 VDC or AC<sub>rms</sub>



**Fuse** When this fuse symbol is marked on a device, take proper precautions.



**Hazardous Voltage** This icon denotes a warning advising you to take precautions to avoid electrical shock.

## Timing

Mode	Trigger Latency		Maximum Reading Rate <sup>19</sup>
	AC Voltage	All Functions Except AC Voltage <sup>20</sup>	
Voltage, current, and resistance	15 $\mu$ s	<0 $\mu$ s	20 kS/s
Voltage and current digitizer			1.8 MS/s

## Power

Power consumption <9 W from PXI Express backplane

+12 V load 0.55 A max

+ 3.3 V load 0.55 A max

## Physical Characteristics

Dimensions 3U, one-slot, PXI/cPCI module;  
2.0 cm x 13.0 cm x 21.6 cm  
(0.8 in. x 5.1 in. x 8.5 in.), nominal

Weight 340 g (12 oz), nominal



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

<sup>19</sup> Maximum Reading Rate assumes minimum aperture time, Auto Zero is OFF, Offset Compensated Ohms is OFF, ADC Calibration is OFF, Number of Averages is 1, and Settle Time is 0 seconds. Varying these settings will vary the reading rate.

<sup>20</sup> Trigger latency for all functions except AC Voltage assumes Auto Zero, Offset Compensated Ohms, and ADC Calibration are OFF.

# Environment

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Maximum altitude	2,000 m (800 mbar) (at 25 °C ambient temperature)
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Pollution Degree	2
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Indoor use only.

## Operating Environment

Ambient temperature range	0 °C to 55 °C (Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2. Meets MIL-PRF-28800F Class 3 low temperature limit and MIL-PRF-28800F Class 2 high temperature limit.)
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Relative humidity range	10% to 90%, noncondensing (Tested in accordance with IEC 60068-2-56.)
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## Storage Environment

Ambient temperature range	-40 °C to 71 °C (Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2. Meets MIL-PRF-28800F Class 3 limits.)
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Relative humidity range	5% to 95%, noncondensing (Tested in accordance with IEC 60068-2-56.)
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## Shock and Vibration

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Operating shock	30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC 60068-2-27. Meets MIL-PRF-28800F Class 2 limits.)
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Random vibration

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Operating	5 Hz to 500 Hz, 0.3 g <sub>rms</sub> (Tested in accordance with IEC 60068-2-64.)
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Nonoperating	5 Hz to 500 Hz, 2.4 g <sub>rms</sub> (Tested in accordance with IEC 60068-2-64. Test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)
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# Compliance and Certifications

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**Caution** Electromagnetic interference can adversely affect the measurement accuracy of this product. The input terminals of this device are not protected for electromagnetic interference. As a result, this device may experience reduced measurement accuracy or other temporary performance degradation when connected cables are routed in an environment with radiated or conducted radio frequency electromagnetic interference. To limit radiated emissions and to ensure that this device functions within specifications in its operational electromagnetic environment, take precautions when designing, selecting, and installing measurement probes and cables.

## 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 UL and other safety certifications, refer to the product label or the [Product Certifications and Declarations](#) 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, 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)

## 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/certification](https://ni.com/certification), search by model number or product line, and click the appropriate link in the Certification column.

## 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 *Minimize Our Environmental Impact* web page at [ni.com/environment](https://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 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](https://ni.com/environment/weee).

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