PXIe-4081

2022-06-30

Contents

PXIe-4081 Specifications

These specifications apply to the PXIe-4081.

Definitions

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

Characteristics 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.

Conditions

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

Accuracy

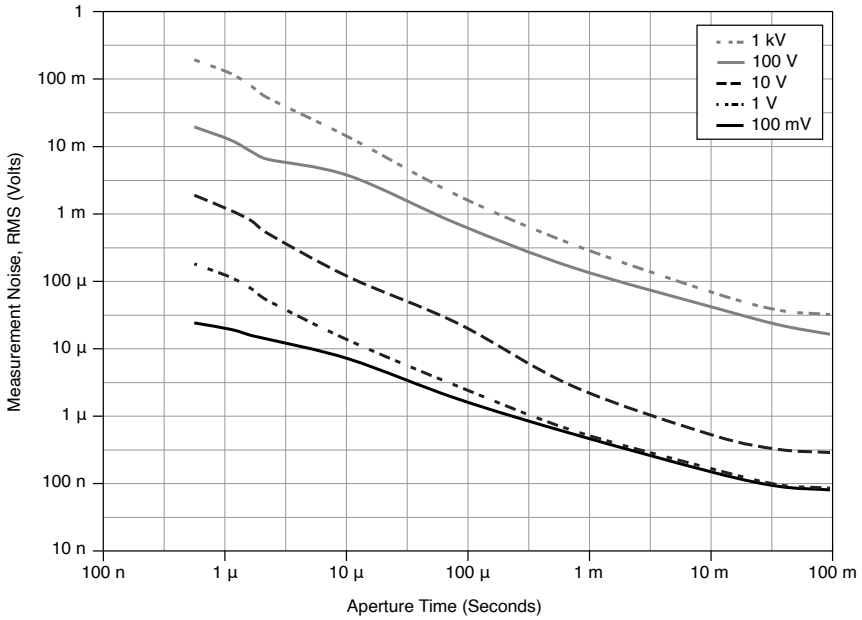
All DC voltage accuracy specifications apply to apertures of ≥100 ms, with Auto Zero and ADC calibration enabled. Assumes offset nulling. Otherwise, add 2 µV to the specifications.

Table 1. DC Voltage ± (ppm of reading + ppm of range)

Range	Input Resistance[1]	24 Hr[2] $T_{selfcal}$ ±1 °C	90 Day $T_{selfcal}$ ±5 °C	2 Year $T_{selfcal}$ ±5 °C	Tempco/°C[3]	
					Without Self-Cal	With Self-Cal
100 mV	10 MΩ ± 2%, >10 GΩ	6 + 5	27 + 7	28 + 8	3 + 2	0.3 + 1
1 V		4.5 + 0.8	15 + 2.5	18 + 2.5	2 + 0.2	0.3 + 0.1
10 V		2 + 0.5	10.5 + 0.5	12 + 0.5	0.3 + 0.02	0.3 + 0.01
100 V	10 MΩ ± 2%	6 + 2	24 + 2.5	26 + 2.5	4 + 0.2	0.3 + 0.1
1000 V[4]		4 + 0.5	24 + 0.5	25 + 0.5	3 + 0.02	0.3 + 0.01

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 + 0.5 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 1000 V
DC voltage input bias current	<30 pA at 23 °C, typical

Resistance Specifications

Accuracy

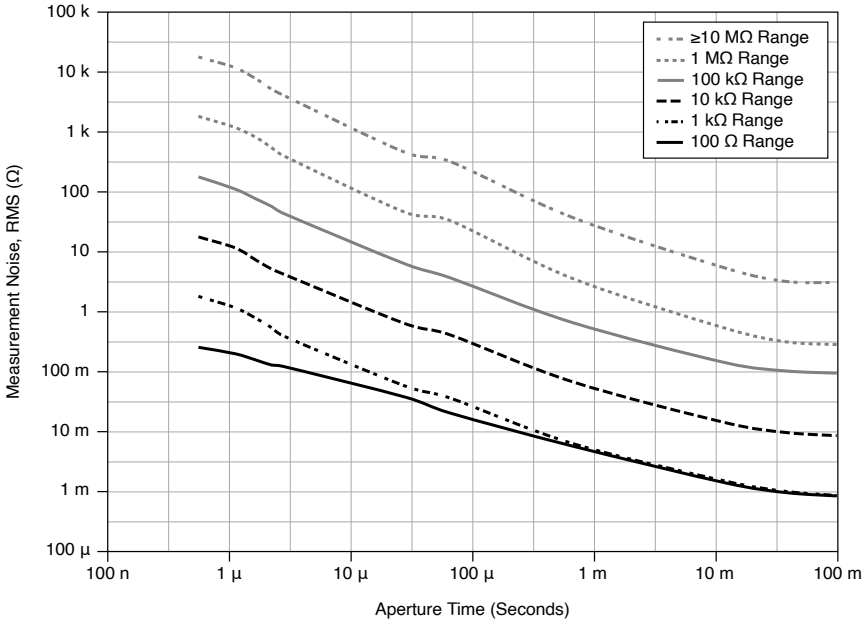
All resistance accuracy specifications apply to apertures of ≥100 ms, with Offset Compensated Ohms (for ranges ≤10 kΩ) or Auto Zero (for ranges ≥ 100 kΩ) and ADC calibration enabled.

Table 2. Resistance (4-Wire and 2-Wire[5]) ± (ppm of reading + ppm of range)

Range	Test Current[6]	Max Test Voltage	24 Hr[7] $T_{selfcal}$ ± 1 °C	90 Day T_{extcal} ± 10 °C, $T_{selfcal}$ ± 5 °C	2 Year T_{extcal} ± 10 °C, $T_{selfcal}$ ± 5 °C	Tempco/°C[8]		2 Year[9] $T_{selfcal}$ ± 5 °C
						Without Self-Cal	With Self-Cal	
100 Ω	1 mA	100 mV	9 + 5	40 + 12	55 + 12	5 + 0.12	0.8 + 0.12	60 + 12
1 kΩ	1 mA	1 V	7 + 0.5	30 + 1.5	45 + 1.5	5 + 0.05	0.8 + 0.05	50 + 1.5
10 kΩ	100 µA	1 V	7 + 0.5	30 + 1.5	45 + 1.5	5 + 0.05	0.8 + 0.05	50 + 1.5
100 kΩ[10]	10 µA	1 V	7 + 1	36 + 2.5	45 + 2.5	5 + 0.2	2 + 0.2	95 + 2.5
1 MΩ	10 µA	10 V	6 + 1	60 + 1	60 + 1	5 + 0.05	2 + 0.05	95 + 1
10 MΩ	1 µA	10 V	60 + 2	130 + 10	130 + 10	20 + 1	20 + 1	800 + 10
100 MΩ[]	1 µA || 10 MΩ	10 V	500+ 6	2600 + 10	3000 + 10	300 + 6	300 + 6	—
5 GΩ[] (typical)	1 µA || 10 MΩ	10 V	1% + 0.2%	5% + 0.2%	5% + 0.2%	0.5% + 0.2%	0.5% + 0.2%	—

Noise

Figure 2. PXIe-4081 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

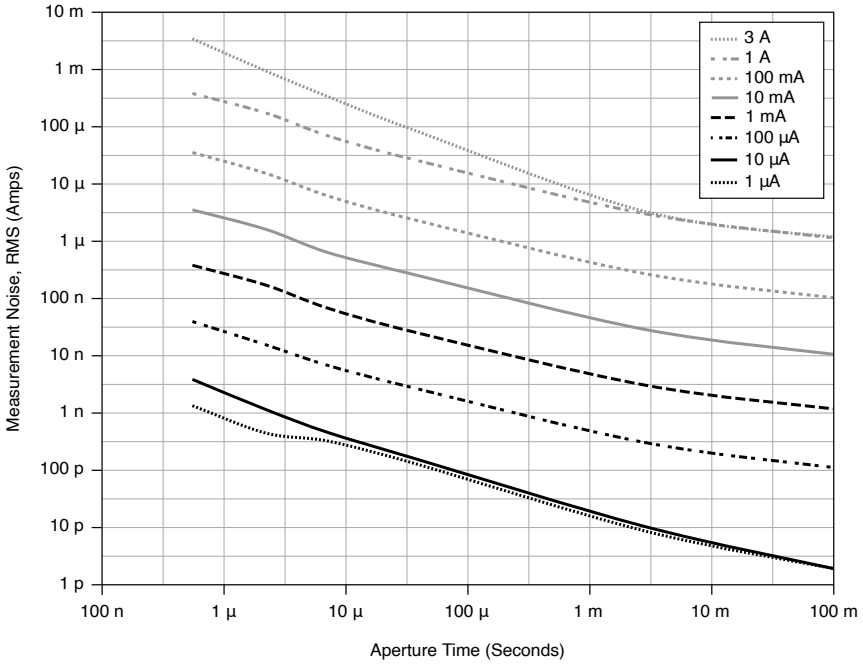
All DC current accuracy specifications apply for apertures ≥100 ms, with Auto Zero and ADC calibration enabled.

Table 3. DC Current ± (ppm of reading + ppm of range)

Range	Burden Voltage, Typical	24 Hr[12] $T_{selfcal}$ ±1 °C	90 Day T_{extcal} ± 10 °C, $T_{selfcal}$ ± 5 °C	2 Year T_{extcal} ± 10 °C, $T_{selfcal}$ ± 5 °C	Tempco/°C	2 Year[13] $T_{selfcal}$ ± 5 °C
1 µA [14]	<55 mV	30 + 20	340 + 40	350 + 40	10 + 5	575 + 140
10 µA[14]	<550 mV	30 + 2	140 + 15	200 + 15	10 + 1	500 + 20
100 µA	<60 mV	10 + 10	105 + 20	175 + 20	5 + 0.2	220 + 20
1 mA	<60 mV	13 + 10	100 + 20	170 + 20	5 + 0.2	220 + 20
10 mA	<60 mV	15 + 10	100 + 20	170 + 20	5 + 0.2	250 + 20
100 mA	<100 mV	18 + 10	175 + 20	180 + 20	10 + 0.2	250 + 20
1 A[15]	<250 mV	25 + 10	275 + 20	350 + 20	16 + 0.2	800 + 20
3 A[15]	<700 mV	25 + 5	250 + 20	350 + 20	16 + 0.2	800 + 20

Noise

Figure 3. PXIe-4081 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 $4/\mathbf{f}_L$ where $\mathbf{f}_L$ is the lowest frequency component of the signal being measured. Signal amplitudes greater than 1% of range.

Table 4. AC Voltage Accuracy ± (% of reading + % of range), 2 Years, T_{extcal} ± 10 °C

Range (rms)	Peak Voltage	1 Hz to 40 Hz[16]	>40 Hz to 20 kHz	>20 kHz to 50 kHz	>50 kHz to 100 kHz	>100 kHz to 300 kHz
50 mV[17]	±105 mV	0.1 + 0.02	0.05 + 0.02	0.07 + 0.02	0.3 + 0.02	0.7 + 0.15
500 mV	±1.05 V	0.1 + 0.005	0.05 + 0.005	0.06 + 0.01	0.2 + 0.01	0.7 + 0.15
5 V	±10.5 V					
50 V	±105 V	0.1 + 0.005	0.12 + 0.05	0.6 + 0.05	3 + 0.15	3 + 0.15
700 V	±1000 V					

Table 5. AC Voltage Tempco/°C ± (% of reading + % of range)

Range (rms)	1 Hz to 40 Hz	>40 Hz to 20 kHz	>20 kHz to 50 kHz	>50 kHz to 100 kHz	>100 kHz to 300 kHz
50 mV	0.001 + 0.0002	0.001 + 0.0002	0.001 + 0.001	0.002 + 0.001	0.02 + 0.01
500 mV					
5 V					

Range (rms)	1 Hz to 40 Hz	>40 Hz to 20 kHz	>20 kHz to 50 kHz	>50 kHz to 100 kHz	>100 kHz to 300 kHz
50 V	0.001 + 0.0002	0.012 + 0.001	0.045 + 0.001	0.1 + 0.01	0.1 + 0.01
700 V					

General

Input impedance	10 MΩ ± 2% in parallel with 90 pF, typical
Input coupling	AC or DC coupled
Overrange	105% of range except 700 V
Maximum Volt-Hertz product	Verified to 2.2×10^7 V-Hz
Maximum DC voltage component	400 V
Common mode rejection ratio (CMRR), 1 kΩ resistance in LO lead	>70 dB (DC to 60 Hz), typical

AC Current Specifications

Accuracy

Note Measurement aperture greater than $4/\mathbf{f}_L$, where $\mathbf{f}_L$ is the lowest frequency component of the signal being measured. Signal amplitudes greater than 1% of range.

Table 6. AC Current Specifications ± (% of reading + % of range), 2 Years, T_{extcal} ± 10 °C

Range (rms)	Peak Current	Burden Voltage (rms at 1 kHz), Typical	1 Hz to 1 kHz	>1 kHz to 5 kHz	5 kHz to 10 kHz [18]	10 kHz to 20 kHz [18]	Tempco/°C
100 µA[19]	±200 µA	<60 mV	0.065 + 0.02	—	—	—	0.002 + 0.0002
1 mA	±2 mA	<60 mV	0.035 + 0.02	0.06 + 0.02	0.19 + 0.02	0.44 + 0.02	0.001 + 0.0001
10 mA	±20 mA	<60 mV	0.035 + 0.02	0.045 + 0.02	0.1 + 0.02	0.17 + 0.02	0.002 + 0.0002
100 mA	±200 mA	<100 mV	0.04 + 0.02	0.07 + 0.02	0.1 + 0.02	0.1 + 0.02	0.001 + 0.0002
1 A	±2 A	<250 mV	0.07 + 0.02	0.4 + 0.02	0.9 + 0.02	1.6 + 0.02	0.002 + 0.0001
3 A	±4.2 A[20]	<700 mV	0.08 + 0.02	0.41 + 0.02	0.9 + 0.02	1.6 + 0.02	0.002 + 0.0001

General

Overrange	105% of range except 3 A

Diode Test Specifications

Range	10 V
Test current[21]	1 µA, 10 µA, 100 µA, 1 mA[22]
Accuracy	Add 20 ppm of reading to 10 VDC voltage specifications.

Frequency and Period Specifications

Note Aperture time set to 150 ms.

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

Frequency Input Voltage Range	Corresponding Digitizer Range[23]	Minimum Peak-to-Peak Signal Amplitude[24]	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	
700 V	1000 V	50 V	1000 V	

Temperature Specifications

All temperature accuracy specifications apply to apertures ≥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[25]	-200 to 600 °C	0.1 °C
Thermistor[26]	-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

Sensor Type	Temperature Range	Accuracy
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

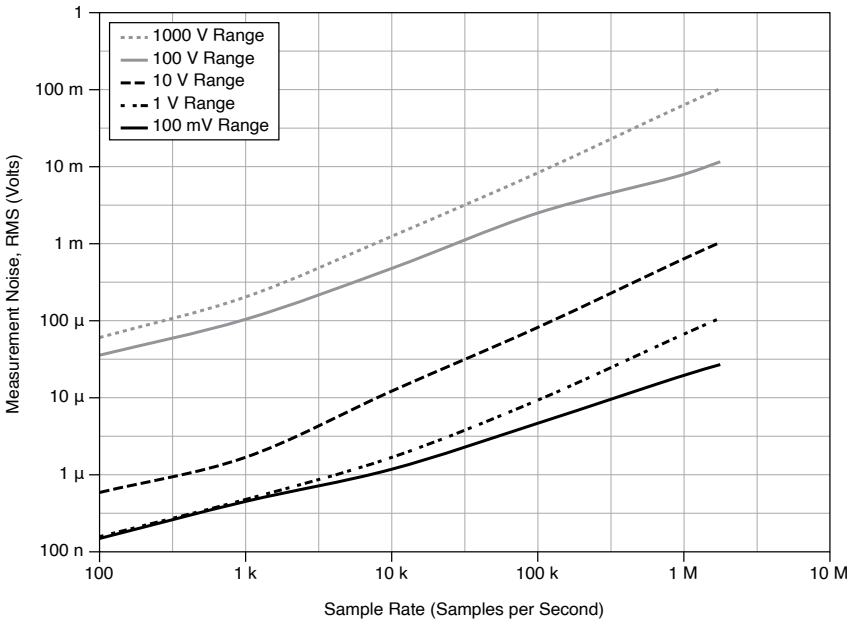
Isolated Digitizer Specifications

Available functions	Voltage and current
Voltage ranges	±100 mV to ±1000 V (DC or AC coupled)
Current ranges	100 µA to 3 A
Sample rate range	10 S/s to 1.8 MS/s
Available sample rates	**r** = (1.8 MS/s) / **y**, where **y** = 1, 2, 3,...1.8 x 10^5
Timebase accuracy	Equal to the PXIe_CLK100 accuracy of the chassis
Digitizer record length	2 samples minimum, unlimited maximum

Table 7. Voltage Mode

Range	Input Resistance[27]	DC Accuracy (ppm/reading + ppm/range) 2 Year, $T_{selfcal}$ ± 5 °C	Analog Bandwidth,[28] Typical	
			±0.1 dB	-3 dB
100 mV	10 MΩ ± 2%, >10 GΩ	125 + 175	60 kHz	300 kHz
1 V		125 + 75	50 kHz	300 kHz
10 V		125 + 75	50 kHz	300 kHz
100 V	10 MΩ ± 2%	125 + 75	20 kHz	250 kHz
1000 V		125 + 75	30 kHz	275 kHz

Figure 4. PXIe-4081 Voltage Waveform Noise, Typical

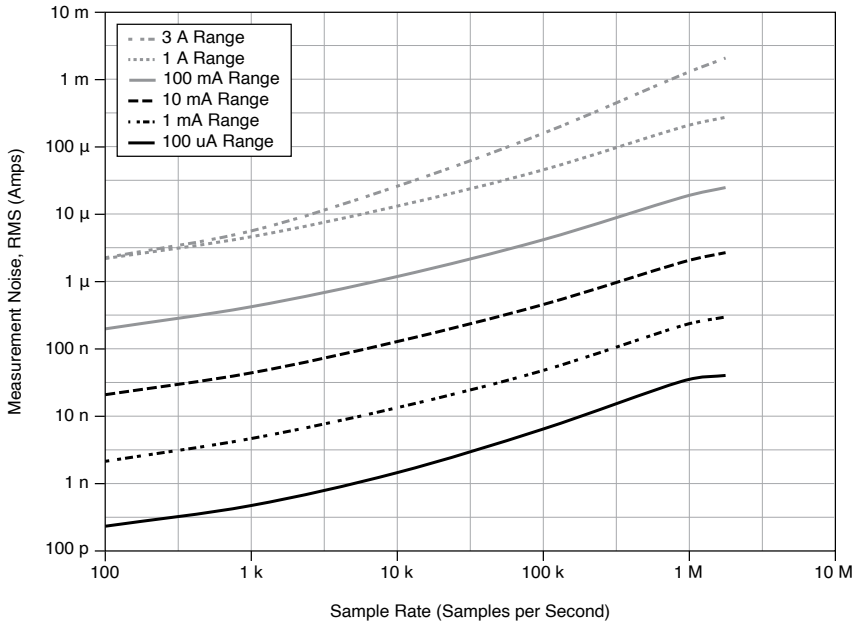


Note With input shorted.

Table 8. Current Mode

Range	Burden Voltage, Typical	DC Accuracy (ppm/reading + ppm/range) 2 Year, $T_{selfcal}$ ± 5 °C	Analog Bandwidth, Typical	
			±0.1 dB	-3 dB
100 µA	<60 mV	230 + 75	50 kHz	350 kHz
1 mA	<60 mV	230 + 75	60 kHz	400 kHz
10 mA	<60 mV	265 + 75	70 kHz	400 kHz
100 mA	<100 mV	265 + 75	80 kHz	400 kHz
1 A	<250 mV	800 + 75	10 kHz	450 kHz
3 A	<700 mV	800 + 75	10 kHz	450 kHz

Figure 5. PXIe-4081 Current Waveform Noise, Typical



Note With input open.

General Specifications

External calibration interval	2 years
Warm-up	60 minutes to rated accuracy
Measurement Category	I[29] (up to 1000 VDC, 700 V_{rms}, 1000 V_{pk}) II (up to 500 VDC or V_{rms})

Caution Do not connect the product to signals or use for measurements within Measurement Categories III or IV.

Attention Ne pas connecter le produit à des signaux dans les catégories de mesure III ou IV et ne pas l'utiliser pour effectuer des mesures dans ces catégories.

Input protection (between terminals or terminal to ground)	1000 VDC or V_{pk}
Current mode fuse	T 3.5 A 1000 V, time-lag Minimum interrupt rating: 10 kA Siba 5019906.3,5

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

Maximum common-mode voltage	500 VDC or V_{rms}

Maximum voltage-to-earth ground

HI	1000 VDC or V_{pk}
LO	500 VDC or V_{rms}
HI SENSE	500 VDC or V_{rms}
LO SENSE	500 VDC or V_{rms}

Caution Take precautions to avoid electrical shock.

Attention Prenez les précautions nécessaires pour éviter tout choc électrique.

Timing

Mode	Trigger Latency		Maximum Reading Rate[30]
	AC Voltage	All Functions Except AC Voltage[31]	
Voltage, current, and resistance	15 µs	<0 µs	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.

Environment

Maximum altitude	2,000 m (800 mbar) (at 25 °C ambient temperature)

Pollution Degree	2

Indoor use only.

Operating Environment

Ambient temperature range	0 °C to 40 °C
Relative humidity range	10% to 90%, noncondensing

Storage Environment

Ambient temperature range	-40 °C to 71 °C
Relative humidity range	5% to 95%, noncondensing

Shock and Vibration

Operating shock	30 g peak, half-sine, 11 ms pulse
Random vibration	
Operating	5 Hz to 500 Hz, 0.3 g_{rms}
Nonoperating	5 Hz to 500 Hz, 2.4 g_{rms}

Compliance and Certifications

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 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 Product Certifications and Declarations section.

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)
- 2011/65/EU; Restriction of Hazardous Substances (RoHS)
- 2014/53/EU; Radio Equipment Directive (RED)
- 2014/34/EU; Potentially Explosive Atmospheres (ATEX)

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.

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.)

[1] In parallel with 90 pF, typical.

[2] Relative to external calibration source.

[3] Accuracy specifications allow for the indicated temperature variation. If the device temperature falls outside of that bounds, apply the Tempco 'Without Self-Cal'. Tempco 'With Self-Cal' describes the stability of the calibration mechanism, and is included for reference.

[4] To account for self-heating effects, add 14 µV to the specification for each volt beyond ±300 V.

[5] Perform offset nulling or add 200 mΩ to reading.

[6] -10% to 0% tolerance, typical.

[7] Relative to external calibration source.

[8] Accuracy specifications allow for the indicated temperature variation. If the device temperature falls outside of that bounds, apply the Tempco 'Without Self-Cal'. Tempco 'With Self-Cal' describes the stability of the calibration mechanism, and is included for reference.

[9] Over full operating temperature range.

[10] Perform offset nulling or add 2 ppm of range to the specifications.

[11] 2-wire resistance measurement only.

[12] Relative to external calibration source.

[13] Over full operating temperature range.

[14] 90 day and 2 year specifications are typical.

[15] To account for self-heating effects, for currents larger than 500 mA, add $\mathbf{I^2}$ x 75 ppm of reading to the specification.

[16] Applies to DC coupled only.

[17] Applies to signals >1 mVrms

[18] Specification typical above 5 kHz

[19] Applies to signals > 9 µArms

[20] Sine wave only.

[21] -10% to 0% tolerance, typical.

[22] Up to 4.5 V measurement for 1 mA test current.

[23] AC Coupled.

[24] 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.

[25] Based on Pt3851 RTD in a 4-wire configuration.

[26] Based on 44004, 44006, and 44007 interchangeable thermistors.

[27] In parallel with 90 pF. When AC coupled, only 10 MΩ available.

[28] Typical AC coupled frequency is 6 Hz (+/- 0.1 dB) and 0.8 Hz (-3 dB).

[29] 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, III, or CAT IV.

[30] 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.

[31] Trigger latency for all functions except AC Voltage assumes Auto Zero, Offset Compensated Ohms, and ADC Calibration are OFF.