NI 449x Specifications

Français Deutsch 日本語 한국어 简体中文

ni.com/manuals

This document lists specifications for the NI 4492, NI 4495, NI 4496, NI 4497, NI 4498, and NI 4499 Dynamic Signal Acquisition (DSA) analog input devices. These specifications are typical at 25 °C unless otherwise stated. The operating temperature range for the NI 449x is 0 °C to 55 °C. All specifications are subject to change without notice. Visit `ni.com/manuals` for the most current specifications and product documentation.

Caution Refer to the *Read Me First: Safety and Electromagnetic Compatibility* document for important safety and electromagnetic compatibility information. To obtain a copy of this document online, visit `ni.com/manuals`, and search for the document title.

Caution To ensure the specified EMC performance, operate this product only with shielded cables and accessories.

Input Characteristics

Number of simultaneously sampled input channels

- NI 4492 8
- NI 4495/4496/4497/4498/4499 16

Input configuration ..... Pseudodifferential (50 Ω between negative input and chassis ground)

Input coupling

- NI 4495 ..... DC only
- NI 4496/4498 ..... AC only
- NI 4492/4497/4499 ..... AC/DC, selectable per channel

A/D converter (ADC) resolution ..... 24 bits

ADC type ..... Delta-sigma

Sample rates (f_s)

- Range ..... 100 S/s to 204.8 kS/s
- Resolution[1] ..... ≤181.9 µS/s

FIFO buffer size ..... 4,095 samples

Data transfers ..... Direct memory access (DMA)

[1] Depends on the sample rate. Refer to the *Sample Rate and Update Rate, Accuracy and Coercion* section of the *NI Dynamic Signal Acquisition User Manual* for more information.

NATIONAL INSTRUMENTS

Maximum Working Voltage

Input	Voltage (V_{pk})*
Positive terminal (+)	±10
Negative terminal (–)	±1

* Voltages with respect to chassis ground.

Overvoltage Protection

Input	Voltage (V_{pk})*
Positive terminal (+)	±30
Negative terminal (–)	±5

* Voltages with respect to chassis ground.

Signal Range

Gain (dB)	Full-Scale Range (V_{pk})†, ‡
30*	±0.316
20	±1.00
10*	±3.16
0	±10.0

* NI 4498/4499 only.

† Each input channel gain is independently software selectable.

‡ Voltages on the positive terminal with respect to the negative terminal.

AC Coupled Measurement Accuracy (NI 4492/4497/4499)

Gain amplitude accuracy (f_{in} = 1 kHz)

Operating temperature within 5 °C of last self-calibration temperature ..... 0.05 dB max

Over full operating temperature range ..... 0.1 dB max

Offset (residual DC)[1]

25 °C ..... ±10 mV max

55 °C ..... ±50 mV max

[1] Applied DC bias ≤15 V.

AC Coupled Measurement Accuracy (NI 4496/4498)

Gain amplitude accuracy (f_{in} = 1 kHz)

Operating temperature within 5 °C
of last self-calibration temperature ..... 0.1 dB max

Over full operating temperature range..... 0.15 dB max

Offset (residual DC)

Operating temperature within 5 °C
of last self-calibration temperature ..... ±2 mV max

Flatness

Frequency Band	$f_s \geq$ 51.2 kS/s 20 Hz ≤ f_{in} ≤ 20 kHz	$f_s \geq$ 102.4 kS/s 20 kHz < f_{in} ≤ 45 kHz	f_s = 204.8 kS/s 45 kHz < f_{in} ≤ 92.2 kHz
Flatness* (dB)	±0.003	±0.01	±0.05
* Relative to 1 kHz.			

DC Coupled Measurement Accuracy (NI 4492/4495/4497/4499)

Gain amplitude accuracy

Operating temperature within 5 °C
of last self-calibration temperature ..... 0.5% max

Over full operating temperature range..... 1% max

Offset[1]

Operating temperature within 5 °C
of last self-calibration temperature ..... ±500 µV max

Over full operating temperature range..... ±1 mV max

[1] V_{cm} = 0. Nonzero values create additional offset error according to the CMRR specification.

Amplifier Characteristics

Input Impedance

Terminal	Input Impedance
Between positive input and negative input	10 MΩ ‖ 35 pF
Between negative input and chassis ground	50 Ω

Common-Mode Rejection Ratio (CMRR)

Input frequency <20 kHz[1] ..... 40 dB

Dynamic Characteristics

Bandwidth and Alias Rejection

Specification	Low-Frequency Alias Rejection Enabled	Low-Frequency Alias Rejection Disabled (Default)
Alias-free bandwidth (BW) (passband)	DC to $0.4 \cdot f_s$	DC to $0.4535 \cdot f_s$
Alias rejection, minimum	104 dBc	120 dBc
–3 dB BW	$0.484 \cdot f_s$	$0.491 \cdot f_s$

AC Coupling[2]

–3 dB cutoff frequency ..... 0.5 Hz

–0.1 dB cutoff frequency ..... 3.2 Hz

[1] Using the InfiniBand 4x to 8 BNC cable assembly. Does not include effects of additional cabling.

[2] NI 4495 is DC coupled.

Figure 1. Magnitude Response of AC Coupling Circuit

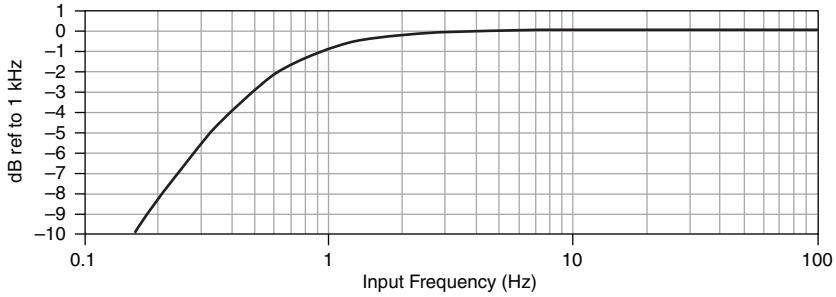
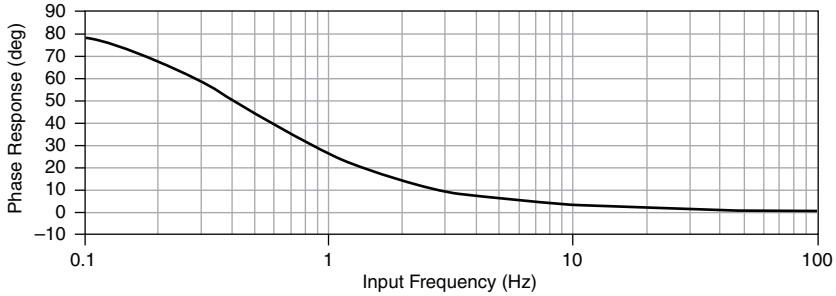


Figure 2. Phase Response of AC Coupling Circuit



Idle Channel Noise (NI 4492/4495/4496/4497)

Gain (dB)	Idle Channel Noise*					
	f_s = 51.2 kS/s		f_s = 102.4 kS/s		f_s = 204.8 kS/s	
	dBV_{rms}†	μV_{rms}	dBV_{rms}†	μV_{rms}	dBV_{rms}†	μV_{rms}
20	–113	2.2	–110	3.2	–106	5.0
0	–97	14	–94	20	–89	35

* Source impedance ≤50 Ω

† dBV_{rms} = dB reference 1 V_{rms}.

Idle Channel Noise (NI 4498/4499)

Gain (dB)	Idle Channel Noise*					
	f_s = 51.2 kS/s		f_s = 102.4 kS/s		f_s = 204.8 kS/s	
	dBV_{rms}†	μV_{rms}	dBV_{rms}†	μV_{rms}	dBV_{rms}†	μV_{rms}
30	–119	1.1	–116	1.6	–113	2.2
20	–115	1.8	–112	2.5	–108	4.0
10	–107	4.5	–104	6.3	–99	11
0	–97	14	–94	20	–89	35

* Source impedance ≤50 Ω.

† dBV_{rms} = dB reference 1 V_{rms}.

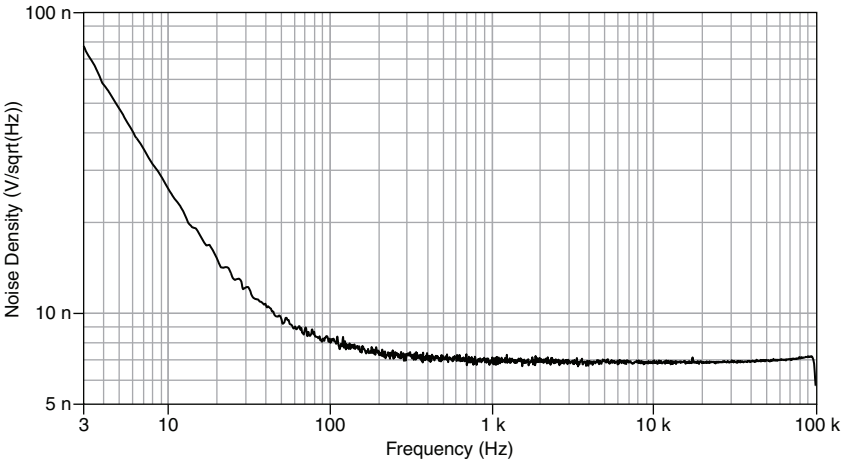
Spectral Noise Density

NI 4492/4495/4496/4497 input voltage

noise density ..... 14 nV/$\sqrt{\text{Hz}}$ at 20 dB gain, 1 kHz

NI 4498/4499 input voltage noise density ..... 7 nV/$\sqrt{\text{Hz}}$ at 30 dB gain, 1 kHz

Figure 3. 30 dB Gain Spectral Noise Density of the NI 4498/4499 with 50 Ω at Input



Representative Measurement FFTs

Test conditions for all FFTs: 10 RMS averages of 65,536 samples using a 7-term Blackman-Harris window. Device: NI 4498/4499 at 0 dB gain. Source: Krohn-Hite Model 4402B.

Figure 4. FFT of –1 dBFS, 1 kHz Tone Acquired at 51.2 kS/s

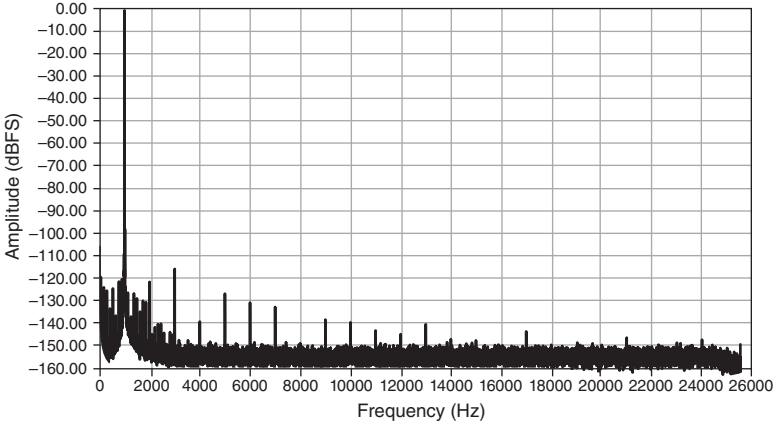


Figure 5. FFT of –1 dBFS, 1 kHz Tone Acquired at 102.4 kS/s

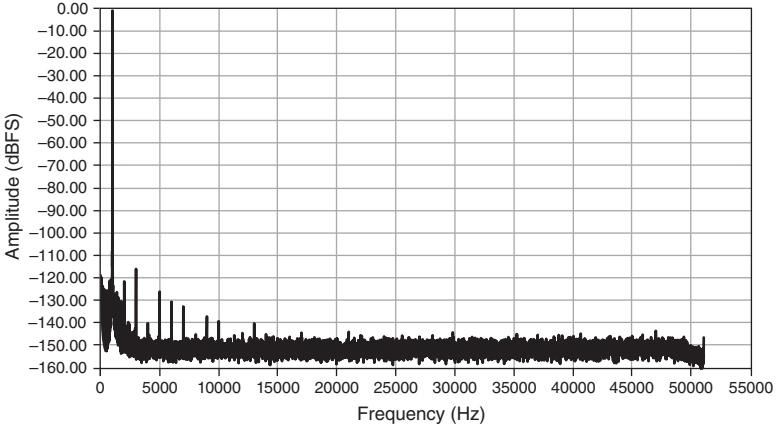
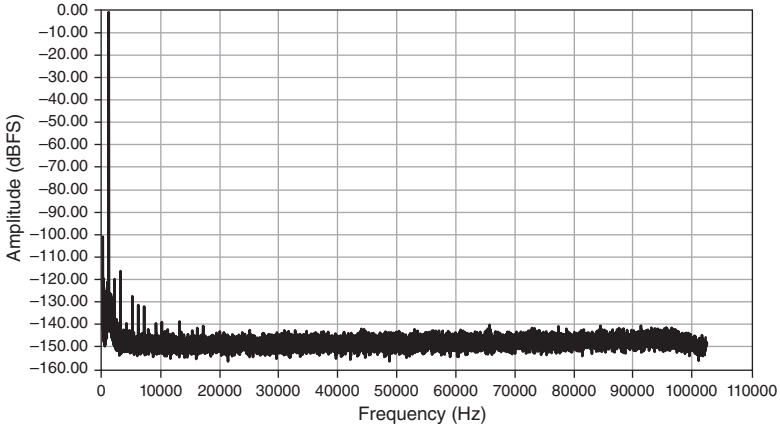


Figure 6. FFT of –1 dBFS, 1 kHz Tone Acquired at 204.8 kS/s



Dynamic Range (NI 4492/4495/4496/4497)

Gain (dB)	Dynamic Range (dBFS)*, Min (Typical)		
	f_s = 51.2 kS/s	f_s = 102.4 kS/s	f_s = 204.8 kS/s
20	106 (110)	103 (107)	99 (103)
0	110 (114)	107 (111)	101 (106)

* 1 kHz input tone, unweighted. Input amplitude is –60 dBFS.

Dynamic Range (NI 4498/4499)

Gain (dB)	Dynamic Range (dBFS)*, Min (Typical)		
	f_s = 51.2 kS/s	f_s = 102.4 kS/s	f_s = 204.8 kS/s
30	102 (106)	99 (103)	95 (100)
20	108 (112)	105 (109)	101 (105)
10	110 (114)	106 (111)	101 (106)
0	110 (114)	107 (111)	101 (106)

* 1 kHz input tone, unweighted. Input amplitude is –60 dBFS.

Spurious Free Dynamic Range (SFDR) (NI 4492/4495/4496/4497)

Gain (dB)	SFDR (dBc)*, †, ‡
20	103
0	106

* f_s = 204.8 kS/s.
† 1 kHz input tone, input amplitude is –1 dBFS.
‡ Measurement includes all harmonics.

Spurious Free Dynamic Range (SFDR) (NI 4498/4499)

Gain (dB)	SFDR (dBc)*, †, ‡
30	102
20	103
10	106
0	108

* f_s = 204.8 kS/s.
† 1 kHz input tone, input amplitude is –1 dBFS.
‡ Measurement includes all harmonics.

Total Harmonic Distortion Plus Noise (THD+N) (NI 4492/4495/4496/4497)

Gain (dB)	THD+N (dBc)*	
	f_s = 51.2 kS/s f_{in} = 20 Hz to 20 kHz†	f_s = 204.8 kS/s f_{in} = 20 Hz to 92.2 kHz‡
20	–94	–78
0	–98	–83

* Input amplitude is –1 dBFS.
† 23.2 kHz measurement bandwidth.
‡ 92.8 kHz measurement bandwidth.

Total Harmonic Distortion Plus Noise (THD+N) (NI 4498/4499)

Gain (dB)	THD+N (dBc)*	
	f_s = 51.2 kS/s f_{in} = 20 Hz to 20 kHz†	f_s = 204.8 kS/s f_{in} = 20 Hz to 92.2 kHz‡
30	–94	–79
0, 10, 20	–98	–86

* Input amplitude is –1 dBFS.

† 23.2 kHz measurement bandwidth.

‡ 92.8 kHz measurement bandwidth.

Intermodulation Distortion (IMD)

Gain (dB)*	IMD (dBc)†
30	–98
0, 10, 20	–104

* 30 dB and 10 dB gain only apply to NI 4498/4499.

† CCIF 14 kHz + 15 kHz, each tone amplitude is –6 dBFS.

Crosstalk

Gain (dB)*	Crosstalk for Adjacent (Nonadjacent) Channels (dBc)†, ‡, **	
	f_{in} = 1 kHz	f_{in} = 92.2 kHz
30	–110 (–110)	–92 (–96)
0, 10, 20	–120 (–120)	–92 (–110)

* 30 dB and 10 dB gain only apply to NI 4498/4499.

† Source impedance ≤1 kΩ.

‡ Input amplitude is –1 dBFS.

** Using the InfiniBand 4x to 8 BNC cable assembly.

ADC Filter Delay

Sample Rate	Filter Delay (Samples)	
	Low-Frequency Alias Rejection Enabled	Low-Frequency Alias Rejection Disabled (Default)
100 S/s ≤ f_s ≤ 200 S/s	33.12	N/A*
200 S/s < f_s ≤ 400 S/s	33.24	
400 S/s < f_s ≤ 800 S/s	33.48	
800 S/s < f_s < 1.0 kS/s	33.97	
1.0 kS/s ≤ f_s ≤ 1.6 kS/s	33.97	64
1.6 kS/s < f_s ≤ 3.2 kS/s	34.94	
3.2 kS/s < f_s ≤ 6.4 kS/s	36.88	
6.4 kS/s < f_s ≤ 12.8 kS/s	40.75	
12.8 kS/s < f_s ≤ 25.6 kS/s	48.5	
25.6 kS/s < f_s ≤ 204.8 kS/s	N/A†	

* Low-Frequency Alias Rejection is always enabled for f_s <1 kS/s.

† Low-Frequency Alias Rejection is always disabled for f_s >25.6 kS/s.

Interchannel Gain Mismatch (NI 4492/4495/4496/4497)

Gain (dB)	AC/DC Coupled Mismatch (dB)*, †		AC Coupled Mismatch (dB)*, †	
	f_{in} = 20 kHz	f_{in} = 92.2 kHz	f_{in} = 2 Hz	f_{in} = 20 Hz
20	<0.011	<0.03	<0.04	<0.011
0	<0.011	<0.02		

* Identical channel configurations.

† Operating temperature within 5 °C of last self-calibration temperature.

Interchannel Phase Mismatch (NI 4492/4495/4496/4497)

Gain (dB)	AC/DC Coupled Mismatch*, †		AC Coupled Mismatch*, †	
	f_{in} = 20 kHz	f_{in} = 92.2 kHz	f_{in} = 2 Hz	f_{in} = 20 Hz
20	<0.20°	<0.90°	<0.8°	<0.08°
0	<0.02°	<0.09°		

* Identical channel configurations.

† Operating temperature within 5 °C of last self-calibration temperature.

Interchannel Gain Mismatch (NI 4498/4499)

Gain (dB)	AC/DC Coupled Mismatch (dB)*, †		AC Coupled Mismatch (dB)*, †	
	f_{in} = 20 kHz	f_{in} = 92.2 kHz	f_{in} = 2 Hz	f_{in} = 20 Hz
30	<0.013	<0.05	<0.04	<0.011
20	<0.011	<0.024		
10	<0.011	<0.02		
0	<0.011	<0.02		

* Identical channel configurations.

† Operating temperature within 5 °C of last self-calibration temperature.

Interchannel Phase Mismatch (NI 4498/4499)

Gain (dB)	AC/DC Coupled Mismatch*, †		AC Coupled Mismatch*, †	
	f_{in} = 20 kHz	f_{in} = 92.2 kHz	f_{in} = 2 Hz	f_{in} = 20 Hz
30	<0.30°	<1.35°	<0.8°	<0.08°
20	<0.12°	<0.54°		
10	<0.06°	<0.28°		
0	<0.02°	<0.09°		

* Identical channel configurations.

† Operating temperature within 5 °C of last self-calibration temperature.

Note All gain and phase mismatch specifications are for the same device and are not applicable between different NI 449x devices.

Phase Linearity

f_{in} = 20 Hz to 20 kHz ..... ±0.01°

f_{in} = 20 Hz to 92.2 kHz ..... ±0.3°

Onboard Calibration Reference

DC level ..... 5.000 V ±2.5 mV

Temperature stability ..... 5 ppm/°C max

Long-term stability ..... 15 ppm/ $\sqrt{1{,}000\ \text{hr}}$

Transducer Electronic Data Sheet (TEDS) Support

Supports Transducer Electronic Data Sheet (TEDS) according to the IEEE 1451 Standard ..... All device inputs (except the NI 4495)

Note For more information about TEDS, go to `ni.com/info` and enter the Info Code `rdteds`.

Maximum cable length ..... 100 ft

IEPE Excitation[1]

Current ..... 0 or 4 mA ±10% (software selectable, per channel)

Compliance ..... 24 V

Note Use the following equation to make sure that your configuration meets the IEPE compliance voltage range.

$$V_{common\text{-}mode} + V_{bias} \pm V_{full\text{-}scale} \text{ must be 1 V to 24 V,}$$

where

$V_{common\text{-}mode}$ is the common-mode voltage seen by the input channel,

V_{bias} is the DC bias voltage of the sensor, and

$V_{full\text{-}scale}$ is the AC full-scale voltage of the sensor.

IEPE open ..... Software readable[2]

IEPE short ..... Software readable[2]

[1] NI 4495 does not support IEPE Excitation.

[2] NI-DAQmx 8.6 or later.

Channel input impedance
with IEPE enabled ..... >250 kΩ at 1 kHz

Current noise ..... 20 pA/$\sqrt{\text{Hz}}$

Frequency Timebase Characteristics

Using external timebase

- Accuracy ..... Equal to accuracy of external timebase

Using internal timebase

- Accuracy ..... ±60 ppm, over operating temperature range, in first year
- Aging ..... 5 ppm, each additional year

Triggers

Analog trigger

- Type ..... Start or reference trigger
- Source ..... Any AI
- Level ..... Full scale, programmable
- Slope ..... Positive (rising) or negative (falling), software selectable
- Resolution ..... 24 bits
- Hysteresis ..... Programmable

Digital trigger

- Type ..... Start or reference trigger
- Source ..... PFI0, PXI_Trig<0..6>
- Compatibility ..... Transistor-transistor logic (5 V TTL)
- Polarity ..... Rising or falling edge
- Minimum pulse width ..... 100 ns

General Specifications

Bus Interface

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

PXI Express ..... 3.3 V diff signal environment

DMA channels 1

Synchronization

PXI ..... CLK_10

PXI Express ..... CLK_10

Power Requirements

Voltage	NI PXIe-4492	NI PXIe-4496
+3.3 V	2000 mA	2000 mA
+12 V	400 mA	810 mA

Voltage	NI PXIe-4497	NI PXIe-4498	NI PXIe-4499
+3.3 V	2100 mA	2000 mA	2100 mA
+12 V	810 mA	930 mA	930 mA

Voltage	NI PXI-4495	NI PXI-4496	NI PXI-4498
+5 V	800 mA	1400 mA	1700 mA
+3.3 V	1700 mA	1700 mA	1700 mA
+12 V	400 mA	400 mA	400 mA
–12 V	100 mA	100 mA	100 mA

Physical

Dimensions (not including connectors)

PXI, PXI Express ..... 16 cm × 10 cm (6.3 in. × 3.9 in.)
3U CompactPCI slot

Analog I/O connectors ..... InfiniBand 4x

Digital trigger connector (PFI 0) ..... SMB

Weight

All except NI 4492 ..... 326 g (11.5 oz)

NI 4492 ..... 167 g (5.9 oz)

Measurement Category[1] I

Caution Do *not* use the NI 449x for connections to signals or for measurements within Categories II, III, or IV.

Caution The protection provided by the 449x can be impaired if it is used in a manner not described in this document.

[1] *Measurement Category* is also referred to as *Installation Category.*

Environmental Specifications

Maximum altitude ..... 2,000 m (800 mbar)

Pollution Degree 2

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.) 0 °C to 45 °C when installed in an NI PXI-1000B DC chassis.

Relative humidity range ..... 10% to 90%, noncondensing
(Tested in accordance with IEC-60068-2-56.)

Storage Environment

Ambient temperature range ..... –20 °C to 70 °C
(Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.)

Relative humidity range ..... 5% to 95%, noncondensing
(Tested in accordance with IEC-60068-2-56.)

Shock and Vibration

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

Operating ..... 5 Hz to 500 Hz, 0.3 g_{rms}

Nonoperating ..... 5 Hz 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.)

Calibration

Self-calibration ..... On software command, the device computes gain and offset corrections relative to high-precision internal reference.

Self-calibration interval ..... Recommended whenever ambient temperature differs from T_{cal} by more than ±5 °C.

External calibration interval ..... 1 year

Warm-up time ..... 15 minutes

Safety

This product meets 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, CSA 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
- AS/NZS CISPR 11: Group 1, 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 generates 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 CE

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

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; 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.

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 *NI and the Environment* 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.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of the product life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste and Electronic Equipment, visit `ni.com/environment/weee`.

电子信息产品污染控制管理办法 （中国 RoHS）

中国客户 National Instruments 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 National Instruments 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`.)

Where to Go for Support

The National Instruments Web site 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.

National Instruments corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. National Instruments also has offices located around the world to help address your support needs. For telephone support in the United States, create your service request at `ni.com/support` and follow the calling instructions or dial 512 795 8248. For telephone support outside the United States, visit the Worldwide Offices section of `ni.com/niglobal` to access the branch office Web sites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

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