SPECIFICATIONS

NI PXIe-4610

Power Amplifier

Français Deutsch 日本語 한국어 简体中文

ni.com/manuals

This document lists specifications for the NI PXIe-4610 Power Amplifier. These specifications are typical at 25 ºC unless otherwise stated. The operating range for the NI PXIe-4610 is 0 ºC to 55 ºC. All accuracies listed are valid for up to two years from the time the device was externally calibrated. All specifications are subject to change without notice. Visit ni.com/manuals for the most current specifications and product documentation.

Caution Electromagnetic interference can adversely affect the accuracy of this product. The inputs and outputs of this device are not protected for electromagnetic interference. As a result, this device may experience performance degradation when connected cables are routed in an environment with 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 cables.

Power Amplifier

Number of power amplifier channels 2

Input Characteristics

Input configuration ..... Differential

Input coupling ..... AC

Signal Range

Input Full-Scale Range		
V_{pk}	V_{rms}	dBV
±1.414	1.0	0.0

NATIONAL INSTRUMENTS

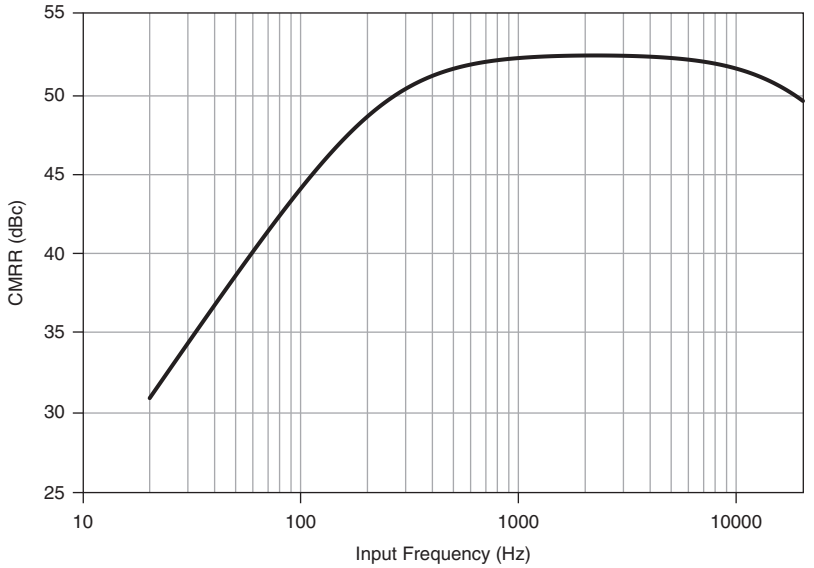
Common-Mode Range

Input	Input Voltage* (V_{pk})
Positive input (+)	±1.414
Negative input (-)	±1.414
* Voltages with respect to chassis ground.	

Common-Mode Rejection Ratio (CMRR)

CMRR* (dBc)	
Typ, 25 °C ±5 °C	**Max, 0 °C to 55 °C**
50	40
* 1 kHz input tone.	

Figure 1. CMRR Magnitude Response (20 Hz to 20 kHz)



Input Impedance

Input Terminals	Input Impedance
Between positive input (+) and chassis ground	10 kΩ || 100 pF
Between negative input (-) and chassis ground	10 kΩ || 100 pF

Overvoltage Protection

Input	Overvoltage* (V_{pk})
Positive input (+)	±42.4
Negative input (-)	±42.4
* Voltages with respect to chassis ground.	

Output Characteristics

Output configuration..... Differential

Output coupling ..... DC

Signal Range

Output Voltage Full-Scale Range		
V_{pk}	V_{rms}	dBV
±14.14	10	20

Output voltage slew rate ..... ±15 V/µs

Output Current Drive	
A_{pk}	A_{rms}
±2.235	1.581

Output current slew rate ..... ±0.5 A/µs

Power

Output Load (Ω)	Amplitude* (dBFS)	Average Power Per Channel (W) Max
50	0.0	2
20	0.0	5
8	-1.0	10
4	-4.4	9
* 0.0 dBFS equals 1 V_{rms} input amplitude.		

Output Impedance

Output Terminals	Output Impedance	
	Typ, 25 °C ±5 °C	Max, 0 °C to 55 °C
Between positive (+) and negative (-) outputs	21 mΩ + 2.0 µH	30 mΩ + 2.4 µH

Protection

Output Terminals	Short-Circuit Duration	Overvoltage (V_{pk})
Positive output (+) to chassis ground.	Indefinite	±42.4
Negative output (-) to chassis ground.	Indefinite	±42.4
Between positive (+) and negative (-) outputs.	Indefinite	±42.4

Transfer Characteristics

Voltage gain 10x

Gain Accuracy

Input Signal Source	Gain Accuracy* (±dB)	
	Typ, 25 °C ±5 °C	Max, 0 °C to 55 °C
Unadjusted	0.019	0.04
Adjusted†	0.011	0.02

* 1 kHz input tone, no load.
† Input signal source gain adjusted using the gain calibration constant stored in the EEPROM.

Output Offset (Residual DC)

Output Offset (±mV)	
Typ, 25 °C ±5 °C	Max, 0 °C to 55 °C
0.3	2.7

Stability

Gain drift..... 9 ppm/ºC

Offset drift ..... 50 µV/ºC

Dynamic Characteristics

Input AC Coupling

Gain (dB)	AC Coupling Cutoff Frequency (Hz)	
	Typ, 25 °C ±5 °C	Max, 0 °C to 55 °C
-0.1	3.78	5.2
-3.0	1.13	1.2

Figure 2. Magnitude Response of AC Coupling Circuit (1 Hz to 1 kHz)

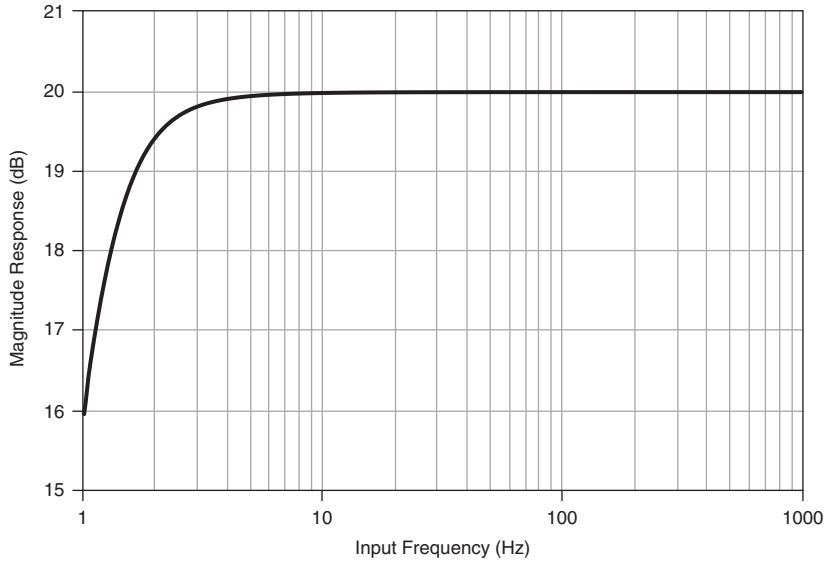
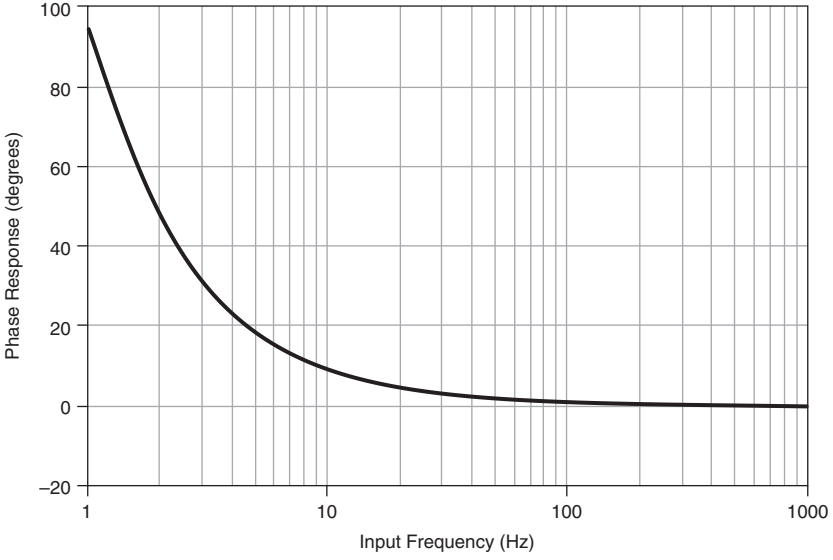


Figure 3. Phase Response of AC Coupling Circuit (1 Hz to 1kHz)



Flatness

20 Hz to 1 kHz Flatness* (dB)	
Typ, 25 °C ±5 °C	**Max, 0 °C to 55 °C**
0.005	0.010
* Flatness peak-to-peak, relative to 1 kHz.	

Output Load	**1 kHz to 20 kHz Flatness* (dB)**	
	Typ, 25 °C ±5 °C	**Max, 0 °C to 55 °C**
No Load	0.015	0.025
8 Ω†	0.010	0.015
4 Ω†	0.030	0.035
* Flatness peak-to-peak, relative to 1 kHz. † Non-inductive load.		

Figure 4. Low-Frequency Flatness (20 Hz to 1 kHz)

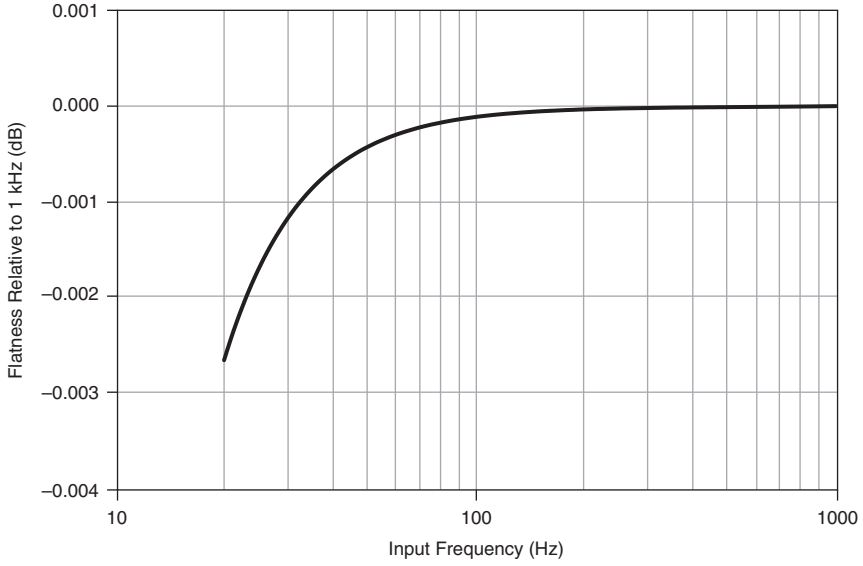


Figure 5. High-Frequency Flatness (1 kHz to 20 kHz)

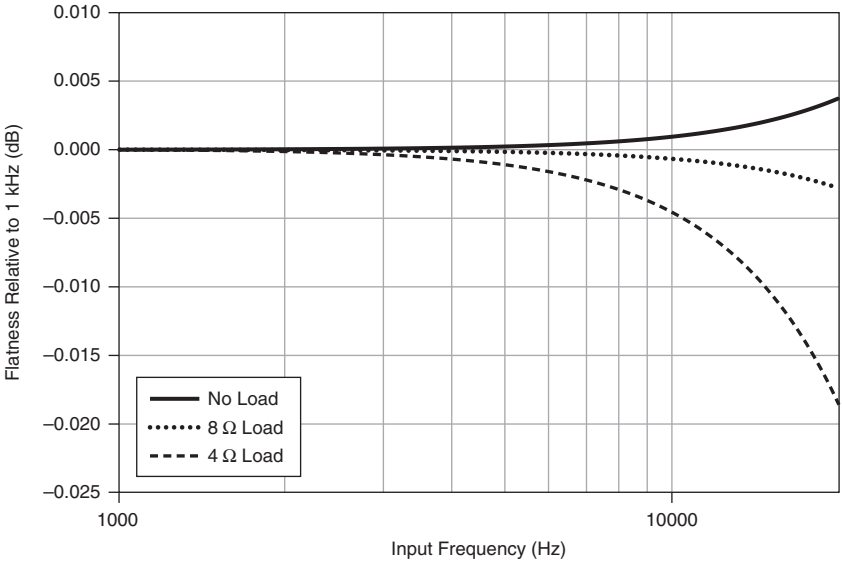
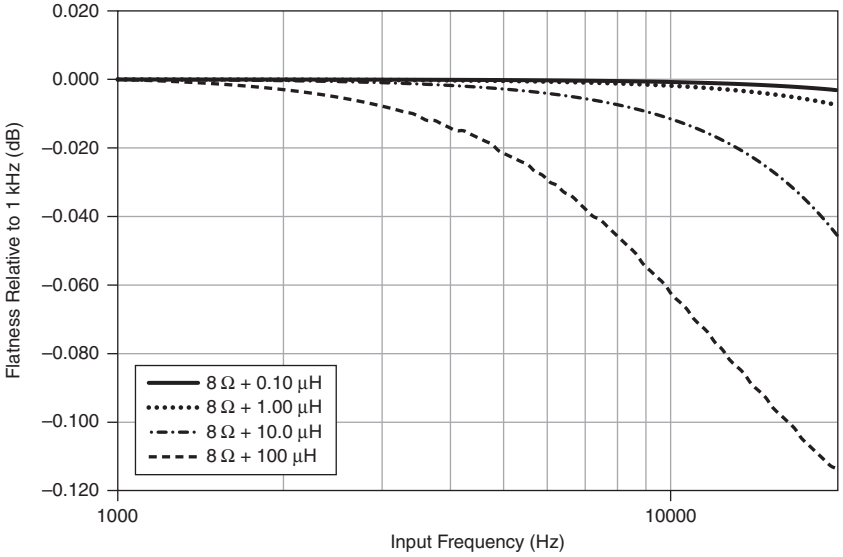


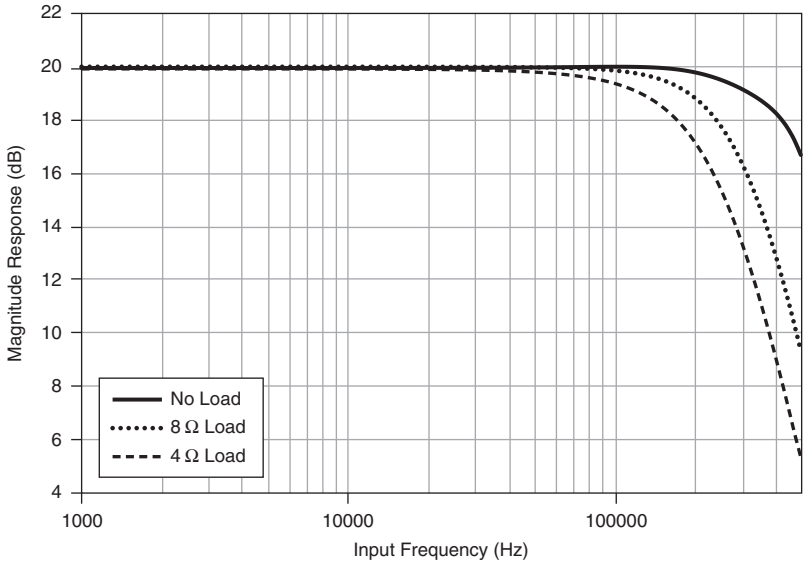
Figure 6. High-Frequency Flatness (1 kHz to 20 kHz), 8 Ω Inductive Load



Output Load	-3.0 dB Small Signal Bandwidth* (kHz)
No Load	480
8 Ω†	270
4 Ω†	200

* -20 dBFS input amplitude.
† Non-inductive load.

Figure 7. Small Signal Magnitude Response (1 kHz to 500 kHz)



Output Noise

Output Noise* (μV_{rms})	
Typ, 25 °C ±5 °C	**Max, 0 °C to 55 °C**
20	32

* Evaluation BW = 20 Hz to 20 kHz.
Signal source impedance ≤50 Ω.

Output Noise Density

Spectral noise density..... 142 nV/$\sqrt{\text{Hz}}$, 1 kHz

Output Switching Noise

Switching noise.....10 mV_{pk-pk}

Switching frequency .....0.2 MHz to 2.0 MHz

Output Dynamic Range

Output Dynamic Range* (dBFS)	
Typ, 25 °C ±5 °C	**Max, 0 °C to 55 °C**
114	110

* 1 kHz input tone, -60 dBFS input amplitude.
Evaluation BW = 20 Hz to 20 kHz.
Signal source impedance ≤50 Ω.

Representative FFTs

Measurement conditions for all FFTs:

- Source: Audio Precision SYS-2722, balanced output, 40 Ω source impedance.
- Analyzer: NI PXI-4461, -10 dB gain, differential input.
- Acquisition: 10 RMS averages of 88,000 samples acquired at 88 kS/s using a 7-term Blackman-Harris window.

Figure 8. FFT of -1.0 dBFS, 1 kHz, No Load

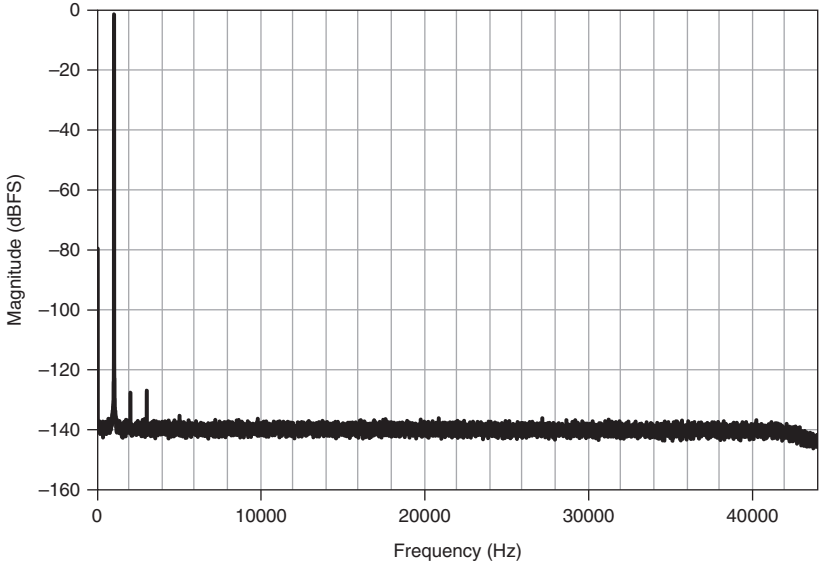


Figure 9. FFT of -1.0 dBFS, 1 kHz, 8 Ω Load, 10 W

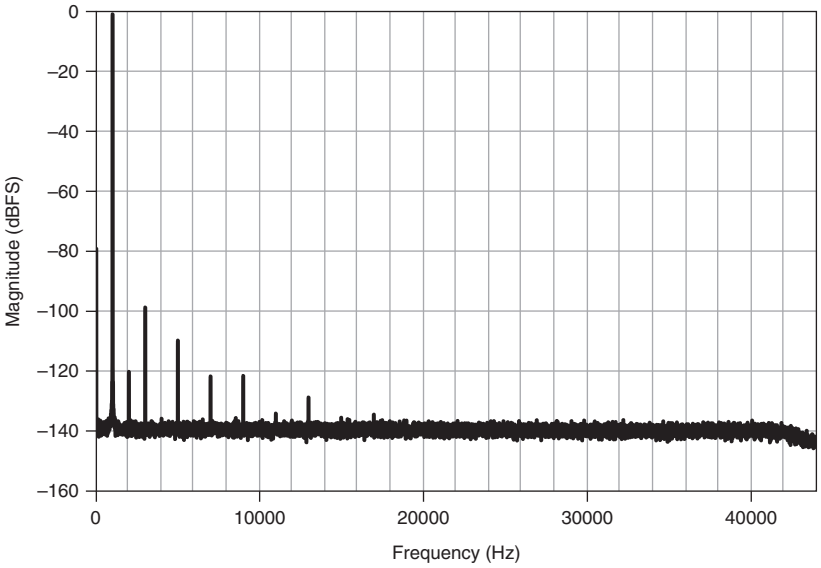
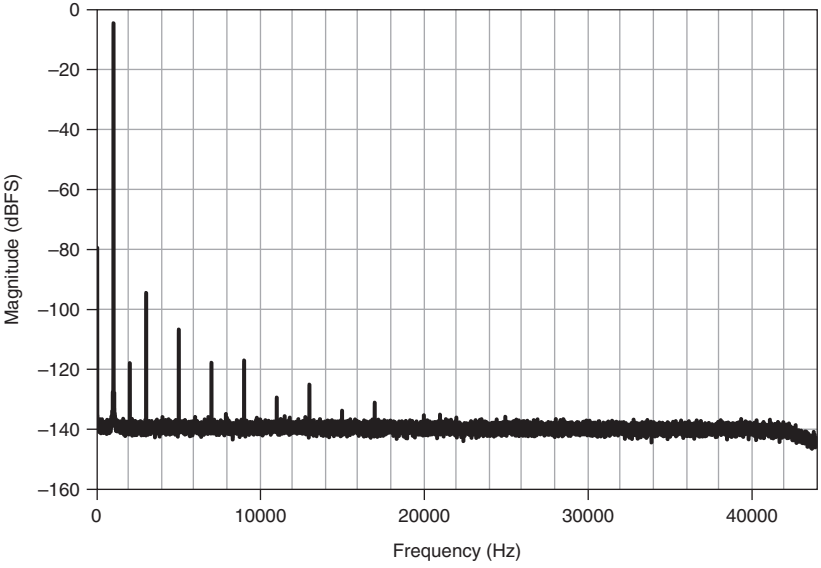


Figure 10. FFT of -4.4 dBFS, 1 kHz, 4 Ω Load, 9 W

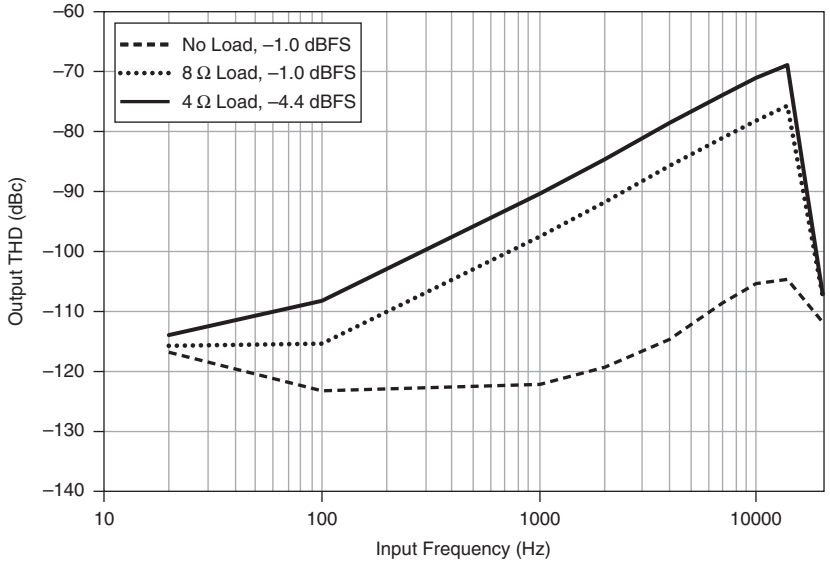


Output Total Harmonic Distortion (THD)

Output Load	Output THD (dBc)		
	1 kHz*	20 Hz to 10 kHz*	20 Hz to 20 kHz†
No Load	-110	-100	-97
8 Ω‡	-90	-75	-69
4 Ω**	-84	-69	-63

* Evaluation BW = 22 kHz, 15 harmonics.
† Evaluation BW = 44 kHz, 15 harmonics.
‡ -1.0 dBFS input amplitude, 10 W.
** -4.4 dBFS input amplitude, 9 W.

Figure 11. Output Total Harmonic Distortion (THD)



Crosstalk, Channel Separation

Output Load	Crosstalk* (dBc)
No Load	-114
8 Ω†	-100
4 Ω‡	-97

* Signal source impedance ≤50 Ω.
† 1 kHz input tone, -1.0 dBFS input amplitude, 10 W.
‡ 1 kHz input tone, -4.4 dBFS input amplitude, 9 W.

General Specifications

Bus Interface

PXI Express ..... 3.3 V differential signal environment

Power Requirements

Voltage (V)	Current (A)
+3.3	3.0
+12	2.0

Physical

Input connectors ..... BNC female

Output connectors ..... 2-terminal detachable screw-terminal

Weight ..... 201 g (7.1 oz)

Measurement Category ..... I[1]

Caution Do not use the NI PXIe-4610 for connections to signals or for measurements within Categories II, III, or IV.

Caution The protection provided by the NI PXIe-4610 can be impaired if it is used in a manner not described in this document.

[1] Measurement Categories CAT I and CAT O 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.

Environmental

Operating Environment

Ambient temperature range ..... 0 ºC to 55 ºC
(Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.)

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

Maximum altitude..... 2,000 m

Pollution Degree 2

Indoor use only.

Storage Environment

Ambient temperature range ..... -20 ºC to 70 ºC
(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

External calibration interval..... 2 years

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 61326-2-1 (IEC 61326-2-1): 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 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 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 *Minimize Our Environmental Impact* 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`.

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