NI 446*x* Specifications

Français Deutsch 日本語 한국어 简体中文

ni.com/manuals

This document lists specifications for the NI PCI/PXI-4461 and NI PCI/PXI-4462 (NI 446*x*) Dynamic Signal Acquisition (DSA) devices. These specifications are typical at 25 °C unless otherwise stated. The operating range for the PXI-446*x* is 0 to 55 °C, and the operating range for the PCI-446*x* is 0 to 50 °C. All accuracies listed are valid for up to one year from the time of the device external calibration. All specifications are subject to change without notice. Visit ni.com/manuals for the most current specifications and product documentation.

Caution The inputs of this sensitive test and measurement product are not protected for electromagnetic interference for functional reasons. As a result, this product may experience reduced measurement accuracy or other temporary performance degradation when cables are attached in an environment with electromagnetic interference present. Refer to the Declaration of Conformity (DoC) for this product for details of the standards applied to assess electromagnetic compatibility performance. To obtain the DoC, visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

Analog Input

This section lists the NI 446*x* analog input (AI) specifications.

Input Characteristics

Number of simultaneously sampled input channels

- NI 4461 2
- NI 4462 4

Input configuration ..... Differential or pseudodifferential (50 Ω between negative input and chassis ground), each channel independently software selectable

Input coupling ..... AC or DC, each channel independently software selectable

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

ADC type ..... Delta-sigma

Sample rates (f_s), samples-per-second (S/s) ..... 1 kS/s to 204.8 kS/s in 181.9 µS/s increments, maximum

ADC modulator oversample rate

- 1.0 kS/s ≤ f_s ≤ 51.2 kS/s ..... 128 f_s
- 51.2 kS/s < f_s ≤ 102.4 kS/s ..... 64 f_s
- 102.4 kS/s < f_s ≤ 204.8 kS/s ..... 32 f_s

Sample Clock Timebase Rate

Ratio between sample rate (f_s) and sample clock timebase rate

Sample Rate (f_s)	Sample Clock Timebase Rate	
	Low-Frequency Alias Rejection Enabled (Default)	Low-Frequency Alias Rejection Disabled
1.0 kS/s ≤ f_s ≤ 1.6 kS/s	16,384 f_s	512 f_s
1.6 kS/s < f_s ≤ 3.2 kS/s	8,192 f_s	
3.2 kS/s < f_s ≤ 6.4 kS/s	4,096 f_s	
6.4 kS/s < f_s ≤ 12.8 kS/s	2,048 f_s	
12.8 kS/s < f_s ≤ 25.6 kS/s	1,024 f_s	
25.6 kS/s < f_s ≤ 51.2 kS/s	512 f_s	
51.2 kS/s < f_s ≤ 102.4 kS/s	256 f_s	256 f_s
102.4 kS/s < f_s ≤ 204.8 kS/s	128 f_s	128 f_s

FIFO buffer size .....2,047 samples

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

Input Common Mode Range

Gain (dB)	Input	Differential*	Pseudodifferential*
≥0	+	±12 V_{pk}	±12 V_{pk}
	–	±12 V_{pk}	±10 V_{pk}
<0	+	±42.4 V_{pk}	±42.4 V_{pk}
	–	±42.4 V_{pk}	±10 V_{pk}

* Voltages with respect to chassis ground

Input Overvoltage Protection

Differential configuration ..... ±42.4 V_{pk}

Pseudodifferential configuration

Positive terminal..... ±42.4 V_{pk}

Negative terminal (shield)..... ±10.0 V_{pk}

Input Signal Range

Gain (dB)	Full-Scale Range (V_{pk})*
30	±0.316
20	±1.00
10	±3.16
0	±10.0
–10	±31.6
–20	±42.4

* Each input channel gain is independently software selectable.

Transfer Characteristics

AI Offset (Residual DC)

Gain (dB)	DC-Coupled Offset*, †, Max, T_{cal}‡ ±5 °C (±mV)	DC-Coupled Offset*, Max, Over Operating Temperature Range (±mV)
30	0.1	1
20	0.2	2
10	0.5	3
0	0.7	7
–10	5	30
–20	7	70

* Source impedance ≤ 50 Ω.

† Listed offset is valid 24 hours following a self calibration.

‡ T_{cal} = ambient temperature at which last self calibration was performed.

AI Gain Amplitude Accuracy

1 kHz input tone

T_{cal} ±5 °C ..... ±0.03 dB max

(T_{cal} = ambient temperature at which last self calibration was performed.)

(Listed accuracy is valid 24 hours following a self calibration.)

Over operating temperature range ..... ±0.2 dB max

Amplifier Characteristics

Input Impedance

Input Impedance	Differential Configuration	Pseudodifferential Configuration
Between positive input and chassis ground	1 MΩ ‖ 217 pF	1 MΩ ‖ 217 pF
Between negative input and chassis ground	1 MΩ ‖ 229 pF	50 Ω

Common-Mode Rejection Ratio (CMRR)

Gain (dB)	DC-Coupled CMRR (dBc)*, †	AC-Coupled CMRR (dBc)†, ‡
30	105	70
20	101	
10	90	
0	80	
–20, –10	60	65

* ≤ 1 kHz

† Differential configuration

‡ 50 or 60 Hz

Dynamic Characteristics[1]

Specification	Low-Frequency Alias Rejection Enabled (Default)	Low-Frequency Alias Rejection Disabled
Alias-free bandwidth (BW) (passband)	DC to 0.4 f_s	DC to 0.4535 f_s
Alias rejection, minimum	104 dBc	120 dBc
Alias rejection by frequency	Input frequency > 0.6 f_s	0.5465 f_s < input frequency < 127.4535 f_s, where 1.0 kS/s ≤ f_s ≤ 51.2 kS/s 0.5465 f_s < input frequency < 63.4535 f_s, where 51.2 kS/s < f_s ≤ 102.4 kS/s 0.5465 f_s < input frequency < 31.4535 f_s, where 102.4 kS/s < f_s ≤ 204.8 kS/s
–3 dB BW	0.484 f_s	0.491 f_s

AC coupling

–3 dB cutoff frequency ..... 3.4 Hz

–0.1 dB cutoff frequency ..... 22.6 Hz

[1] Test system equipped with a liquid crystal display (LCD) monitor for AI noise and distortion measurements to avoid possible magnetic interference caused by cathode ray tube (CRT)-based monitors.

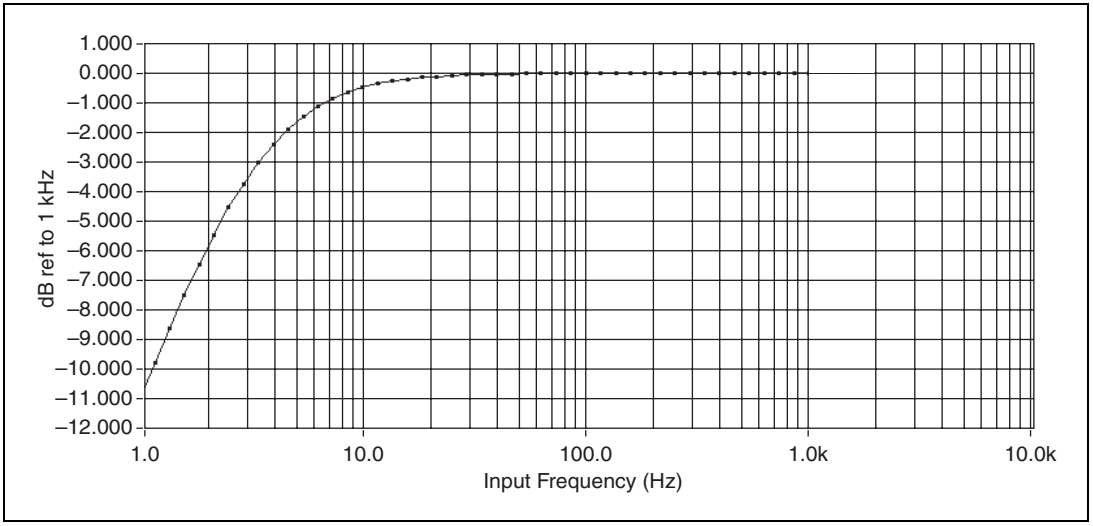

Figure 1. Magnitude Response of AC Coupling Circuit (1 Hz to 1 kHz)

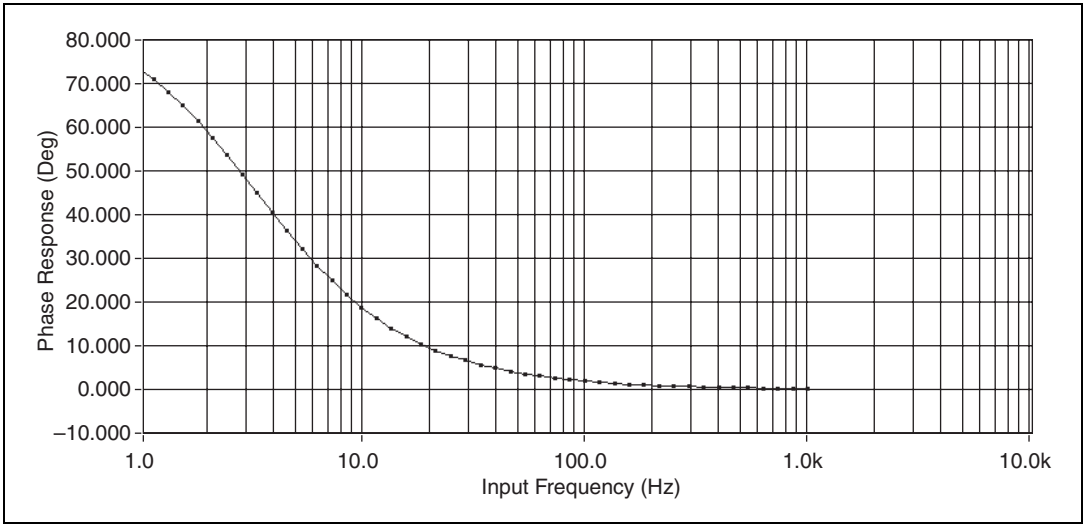

Figure 2. Phase Response of AC Coupling Circuit (1 Hz to 1 kHz)

ADC Filter Delay

Low-Frequency Alias Rejection Enabled (Default)		Low-Frequency Alias Rejection Disabled	
Sample Rate (kS/s)	**Filter Delay (Samples)**	**Sample Rate (kS/s)**	**Filter Delay (Samples)**
$1.0 \le f_s \le 1.6$	32.96875	$1.0 \le f_s \le 1.6$	63
$1.6 < f_s \le 3.2$	33.9375	$1.6 < f_s \le 3.2$	
$3.2 < f_s \le 6.4$	35.875	$3.2 < f_s \le 6.4$	
$6.4 < f_s \le 12.8$	39.75	$6.4 < f_s \le 12.8$	
$12.8 < f_s \le 25.6$	47.5	$12.8 < f_s \le 25.6$	
$25.6 < f_s \le 204.8$	63	$25.6 < f_s \le 204.8$	

AI Flatness

	DC-Coupled Flatness* (dB), Max (Typical)		
Gain (dB)	**20 Hz to 20 kHz**	**20 Hz to 45 kHz**	**20 Hz to 92.2 kHz**
0, 10, 20, 30	±0.006 (±0.003)	±0.03 (±0.02)	±0.1 (±0.08)
–20, –10	±0.2 (±0.1)	±0.6 (±0.33)	±1 (±0.55)

* Relative to 1 kHz

AI Spectral Noise Density

AI spectral noise density
(with EAR turned on).....8 nV/$\sqrt{\text{Hz}}$ at 30 dB gain, 1 kHz

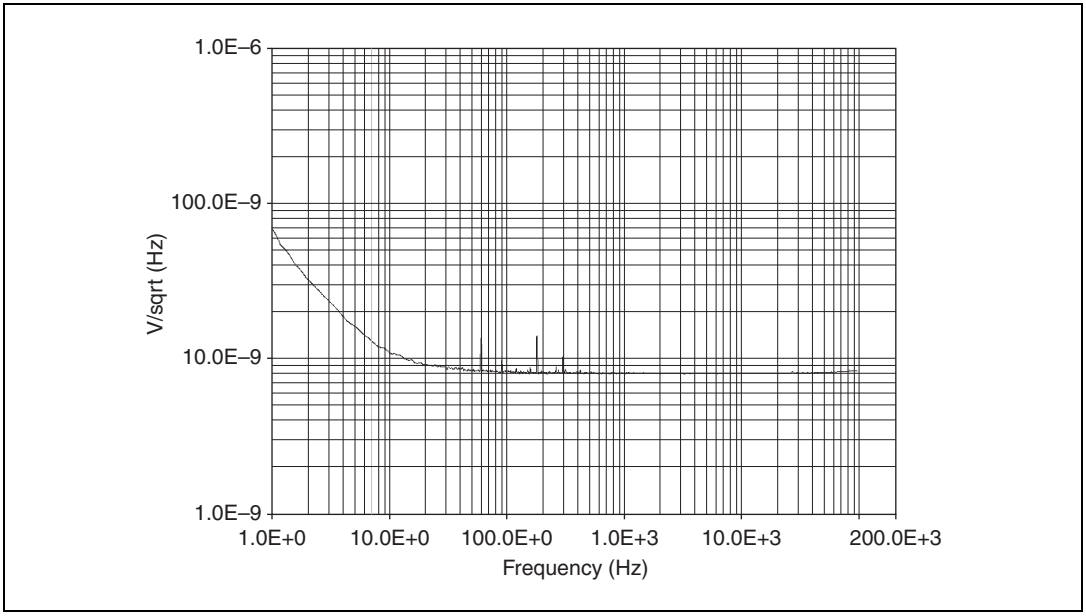

Figure 3. AI Spectral Noise Density (30 dB Gain)

AI Idle Channel Noise

Sample Rate (kS/s)	Idle Channel Noise*, †	
	dBV_{rms}	**μV_{rms}**
1.0 kS/s ≤ f_s < 51.2 kS/s	–118 dBV_{rms}	1.3 μV_{rms}
51.2 kS/s ≤ f_s < 102.4 kS/s	–115 dBV_{rms}	1.8 μV_{rms}
102.4 kS/s ≤ f_s ≤ 204.8 kS/s	–111 dBV_{rms}	2.8 μV_{rms}

* Source impedance ≤ 50 Ω

† 30 dB gain

AI Spurious Free Dynamic Range (SFDR)

Gain Setting (dB)	SFDR (dBc)*, †, ‡
30	106
0, 10, 20	108
–20, –10	110

* f_s = 204.8 kS/s

† 1 kHz input tone, input amplitude is the lesser of –1 dBFS or 8.91 V_{pk}.

‡ Measurement includes all harmonics.

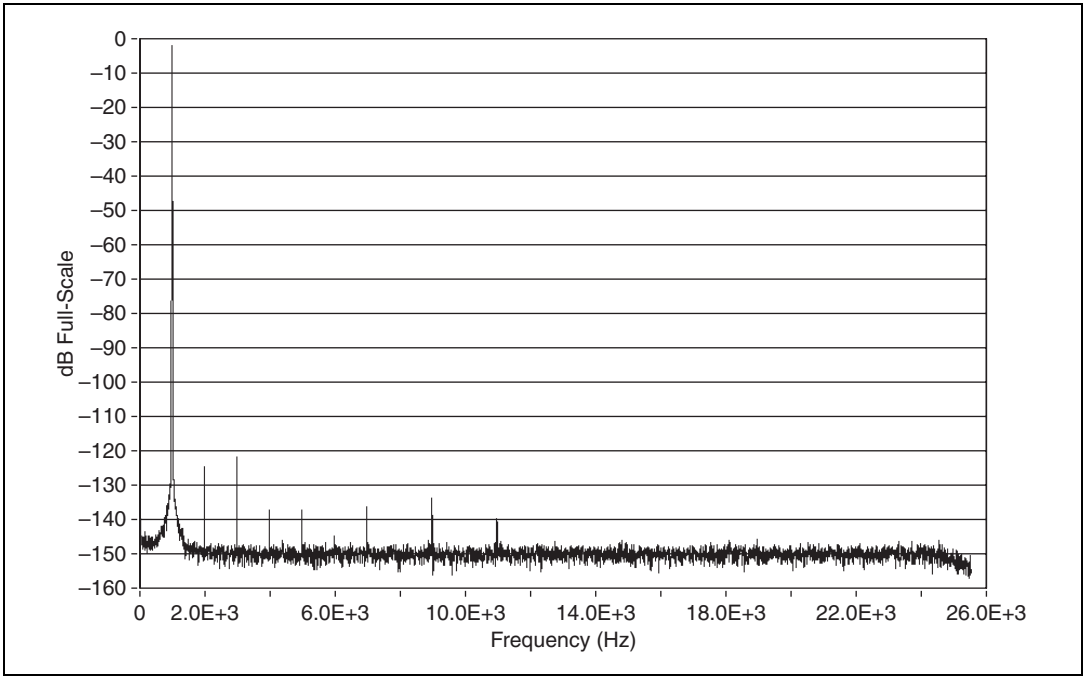

Figure 4. SFDR 51.2 kS/s (–1 dBFS, 0 dB Gain, 1 kHz Sine Wave Input)

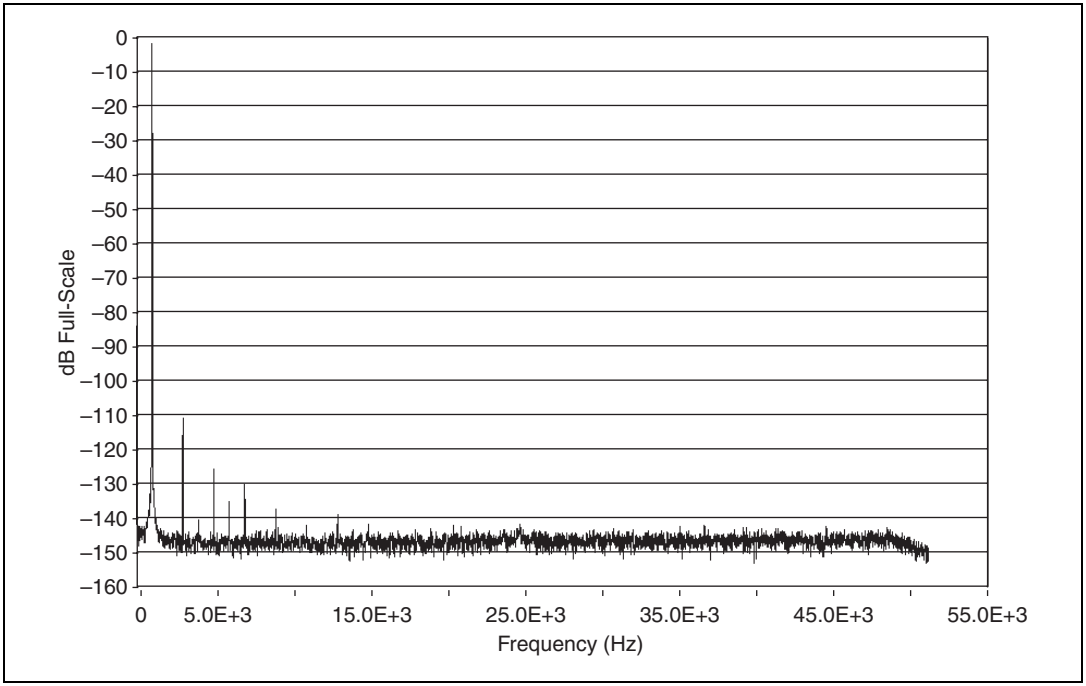

Figure 5. SFDR 102.4 kS/s (–1 dBFS, 0 dB Gain, 1 kHz Sine Wave Input)

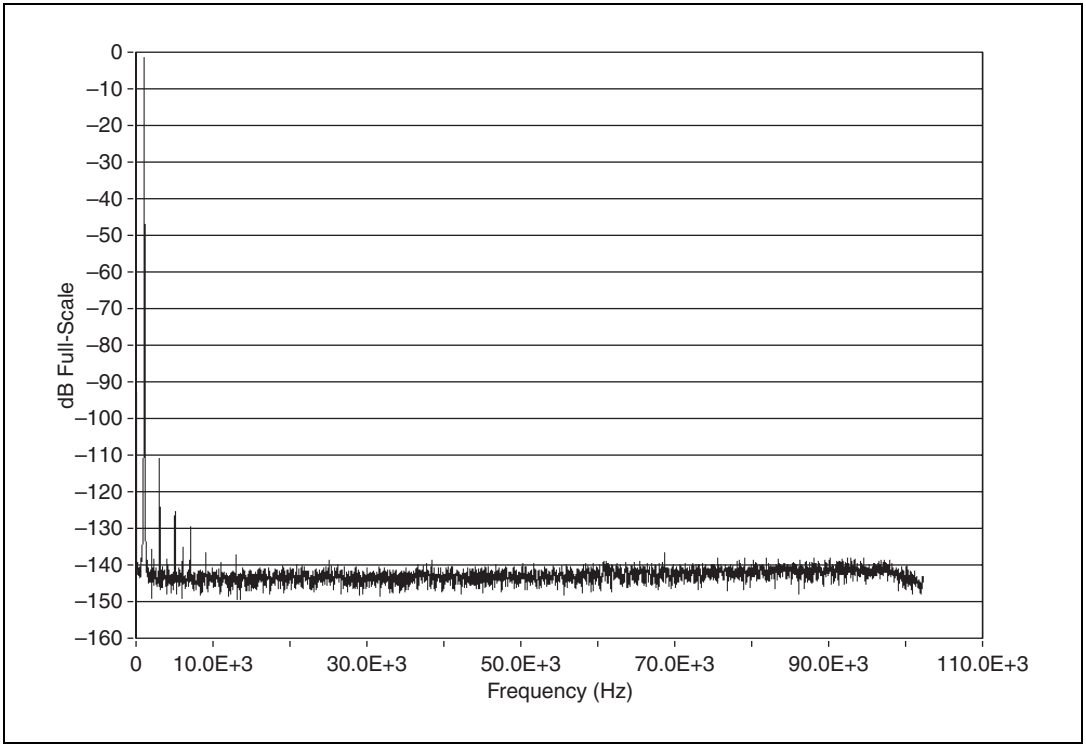

Figure 6. SFDR 204.8 kS/s (–1 dBFS, 0 dB Gain, 1 kHz Sine Wave Input)

AI Dynamic Range

Gain Setting (dB)	Dynamic Range (dBFS)*, Min (Typical)		
	1 kS/s ≤ f_s ≤ 51.2 kS/s	**51.2 kS/s < f_s ≤ 102.4 kS/s**	**102.4 kS/s < f_s ≤ 204.8 kS/s**
30	103 (105)	100 (102)	96 (98)
20	111 (113)	108 (110)	104 (106)
10	114 (117)	111 (114)	106 (110)
0	116 (118)	113 (114)	107 (110)
–10	107 (108)	104 (105)	101 (102)
–20	105 (107)	102 (104)	98 (101)

* 1 kHz input tone, –60 dBFS input amplitude

AI Total Harmonic Distortion (THD), Balanced Source

Gain (dB)	THD (dBc)*, †	
	20 Hz to 20 kHz	20 Hz to 92.2 kHz
30	–100	–97
20	–109	–106
0, 10	–107	–104
–10	–108	–107
–20	–107	–106

* f_s = 204.8 kS/s, 92.8 kHz BW, differential configuration

† Input amplitude is the lesser of –1 dBFS or 8.91 V_{pk}.

AI THD, Unbalanced Source

Gain (dB)	THD (dBc)*, †	
	20 Hz to 20 kHz	20 Hz to 92.2 kHz
30	–100	–93
20	–106	–94
10	–105	–92
0	–97	–87
–10	–90	–88
–20	–91	–89

* f_s = 204.8 kS/s, 92.8 kHz BW

† Input amplitude is the lesser of –1 dBFS or 8.91 V_{pk}.

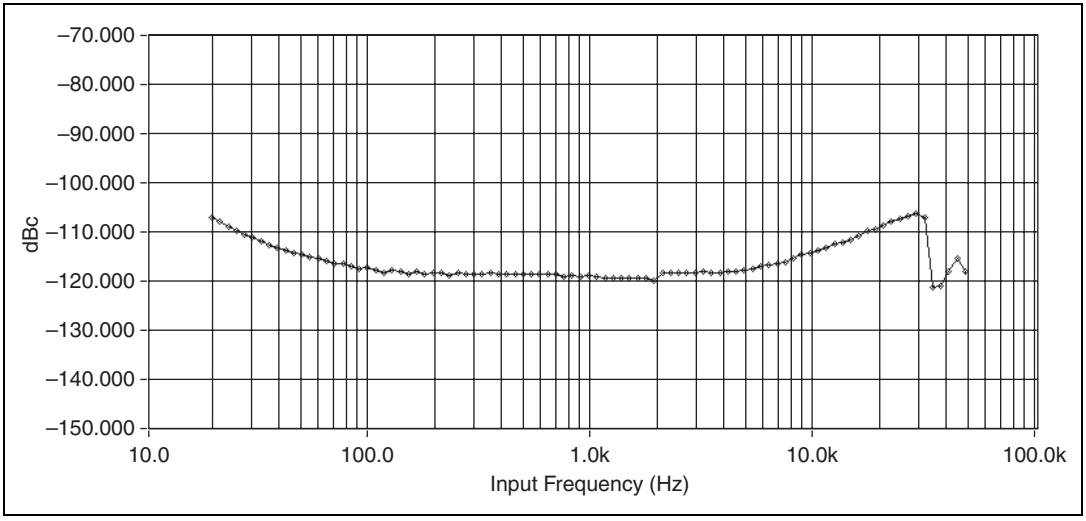

Figure 7. AI THD (Balanced Source with Differential Configuration, 204.8 kS/s, 0 dB Gain)

AI THD Plus Noise (THD+N), Balanced Source

Gain (dB)	THD+N (dBc)*	
	51.2 kS/s 20 Hz to 20 kHz†	204.8 kS/s 20 Hz to 92.2 kHz‡
30	–103	–94
20	–107	–95
10	–108	–96
0	–107	–96
–10	–96	–91

Gain (dB)	THD+N (dBc)*	
	51.2 kS/s 20 Hz to 20 kHz†	204.8 kS/s 20 Hz to 92.2 kHz‡
–20	–94	–88

* Input amplitude is the lesser of –1 dBFS or 8.91 V_{pk}, differential configuration.

† 23.2 kHz measurement BW

‡ 92.8 kHz measurement BW

AI THD+N, Unbalanced Source

Gain (dB)	THD+N (dBc)*	
	51.2 kS/s 20 Hz to 20 kHz†	204.8 kS/s 20 Hz to 92.2 kHz‡
30	–103	–91
20	–107	–93
10	–108	–91
0	–104	–87
–10	–94	–86
–20	–93	–86

* Input amplitude is the lesser of –1 dBFS or 8.91 V_{pk}.

† 23.2 kHz measurement BW

‡ 92.8 kHz measurement BW

AI Intermodulation Distortion (IMD)

Gain (dB)	IMD (dBc)*
20, 30	–109
10	–107
0	–104
–20, –10	–111

* CCIF 14 kHz + 15 kHz, each tone amplitude is the lesser of –6 dBFS or 5 V_{pk}.

Crosstalk, Input Channel Separation

Gain (dB)	Crosstalk for Adjacent (Nonadjacent) Channels (dBc)*, †	
	1 kHz Signal	92.2 kHz
30	–130 (–140)	–110 (–124)
0, 10, 20	–138 (–145)	–110 (–124)
–20, –10	–96 (–124)	–60 (–108)

* Source impedance ≤ 50 Ω

† Input amplitude is the lesser of –1 dBFS or 8.91 V_{pk}.

AI Interchannel Gain Mismatch

Gain (dB)	DC-Coupled Mismatch (dB)*		AC-Coupled Mismatch (dB)*
	20 Hz to 20 kHz	20 Hz to 92.2 kHz	20 Hz
30	0.004	0.008	0.004
0, 10, 20	0.003	0.003	
–20, –10	0.04	0.25	0.006

* Identical channel configurations

AI Interchannel Phase Mismatch

Gain (dB)	DC-Coupled Mismatch (deg)*		AC-Coupled Mismatch (deg)*
	20 Hz to 20 kHz	20 Hz to 92.2 kHz	20 Hz
30	0.10	0.60	0.08
20	0.04	0.15	
0, 10	0.015	0.08	
–20, –10	0.7	1	

* Identical channel configurations

Note All gain and phase mismatch specifications are for the same device and are not applicable between different NI 446*x* devices.

AI Phase Linearity

Gain (dB)	Linearity (deg)	
	20 Hz to 20 kHz	20 Hz to 92.2 kHz
0, 10, 20, 30	±0.01	±0.03
–20, –10	±0.10	±1

Onboard Calibration Reference

DC level ..... 5.000 V ±2.5 mV

Temperature coefficient ..... ±5 ppm/°C max

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

Integrated Electronic Piezoelectric (IEPE)

Current ..... 0 mA, 4 mA ±15%, or 10 mA ±15%, each channel independently software selectable

Compliance ..... 24 V min

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

$V_{common\text{-}mode} + V_{bias} + V_{full\text{-}scale}$ must be 0 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.

Channel input impedance
with IEPE enabled ..... (1 MΩ ‖ 240 pF), pseudodifferential

Current noise ..... <300 pA/$\sqrt{\text{Hz}}$

Transducer Electronic Data Sheet (TEDS) Support

The PCI-4461, PCI-4462, PXI-4461 (revision M or later), and PXI-4462 inputs support Transducer Electronic Data Sheet (TEDS) according to the IEEE 1451 Standard. For more information about TEDS, go to `ni.com/info` and enter the info code `rdteds`.

Analog Output (NI 4461 Only)

This section lists the NI 4461 analog output (AO) specifications.

Output Characteristics

Number of output channels ..... 2, simultaneously sampled

Output configuration ..... Differential or pseudodifferential (50 Ω to chassis ground on shield), each channel independently software selectable

DAC resolution ..... 24 bits

DAC type ..... Delta-sigma

Update rates (f_s) ..... 1 kS/s to 204.8 kS/s in 181.9 µS/s increments, maximum

DAC modulator oversample rate

1.0 kS/s ≤ f_s ≤ 1.6 kS/s ..... 8,192 f_s

1.6 kS/s < f_s ≤ 3.2 kS/s ..... 4,096 f_s

3.2 kS/s < f_s ≤ 6.4 kS/s ..... 2,048 f_s

6.4 kS/s < f_s ≤ 12.8 kS/s ..... 1,024 f_s

12.8 kS/s < f_s ≤ 25.6 kS/s ..... 512 f_s

25.6 kS/s < f_s ≤ 51.2 kS/s ..... 256 f_s

51.2 kS/s < f_s ≤ 102.4 kS/s ..... 128 f_s

102.4 kS/s < f_s ≤ 204.8 kS/s ..... 64 f_s

FIFO buffer size ..... 1,023 samples

Data transfers ..... DMA

Output Signal Range

Attenuation (dB)	Full-Scale Range (V_{pk})*
40	±0.1
20	±1.0
0	±10.0

* Each output channel range is independently software selectable.

Transfer Characteristics

AO Offset (Residual DC)

Attenuation (dB)	Maximum Offset*, T_{cal} ± 5 °C† (±mV)	Maximum Offset, Over Operating Temperature Range (±mV)
20, 40	1	2
0	1	10

* Listed offset is valid 24 hours following a self calibration.

† T_{cal} = ambient temperature at which last self calibration was performed.

Gain (Amplitude Accuracy)

Specifications valid at any attenuation setting with a 1 kHz output signal.

T_{cal} ±5 °C ..... ±0.04 dB max

(T_{cal} = ambient temperature at which last self calibration was performed.)

(Listed accuracy is valid 24 hours following a self calibration.)

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

Voltage Output

Output coupling.....DC

Short circuit protection.....Indefinite protection between positive and negative

Minimum working load.....600 Ω

Output Impedance

Output Impedance	Differential Configuration	Pseudodifferential Configuration
Between positive output and chassis ground	2.4 kΩ	70 Ω
Between negative output and chassis ground	2.4 kΩ	50 Ω
Between positive and negative outputs	22 Ω	22 Ω

Dynamic Characteristics[1]

Image rejection.....75 dB min < 768 kHz, 66 dB min > 768 kHz

–3 dB BW.....0.487 f_s

DAC filter delay (samples), for update rate

1.0 kS/s ≤ f_s ≤ 1.6 kS/s.....36.6

1.6 kS/s < f_s ≤ 3.2 kS/s.....36.8

3.2 kS/s < f_s ≤ 6.4 kS/s.....37.4

6.4 kS/s < f_s ≤ 12.8 kS/s.....38.5

12.8 kS/s < f_s ≤ 25.6 kS/s.....40.8

25.6 kS/s < f_s ≤ 51.2 kS/s.....43.2

51.2 kS/s < f_s ≤ 102.4 kS/s.....48.0

102.4 kS/s < f_s ≤ 204.8 kS/s.....32.0

AO Flatness

All attenuation settings relative to 1 kHz

20 Hz to 20 kHz.....±0.008 dB max

20 Hz to 92.1 kHz.....±0.1 dB max

AO Idle Channel Noise

	Maximum Idle Channel Noise					
	102.5 kS/s (30 kHz BW)*		204.8 kS/s (80 kHz BW)*		204.8 kS/s (500 kHz BW)*	
Attenuation (dB)	dB V_{rms}	μ V_{rms}	dB V_{rms}	μ V_{rms}	dB V_{rms}	μ V_{rms}
40	–106	5	–101	9	–87	45
20	–106	5	–101	9	–86	50
0	–96	16	–93	23	–73	224

* Noise equivalent bandwidth

AO Spurious Free Dynamic Range (SFDR)

Attenuation (dB)	SFDR (dBc)*, †, ‡
40	87
20	94
0	98

* f_s = 204.8 kS/s

† 1 kHz output frequency, –1 dBFS output amplitude

‡ Measurement includes all harmonics.

AO Dynamic Range

	Minimum Dynamic Range (dBFS)*		
Attenuation (dB)	102.5 kS/s (30 kHz BW)†	204.8 kS/s (80 kHz BW)†	204.8 kS/s (500 kHz BW)†
40	83	78	64
20	103	98	83
0	113	110	90

* 1 kHz output frequency, –60 dBFS output amplitude

† Noise equivalent bandwidth

[1] Test system equipped with an LCD monitor for AO noise and distortion measurements to avoid possible magnetic interference caused by CRT-based monitors.

AO THD

Attenuation (dB)	THD (dBc)*		
	102.5 kS/s 20 Hz to 20 kHz†	204.8 kS/s 20 Hz to 20 kHz‡	204.8 kS/s 20 Hz to 92.1 kHz‡
40	–99	–92	–92
20	–98	–95	–93
0	–97	–94	–83

* –1 dBFS output amplitude
† 30 kHz measurement BW
‡ 92.8 kHz measurement BW

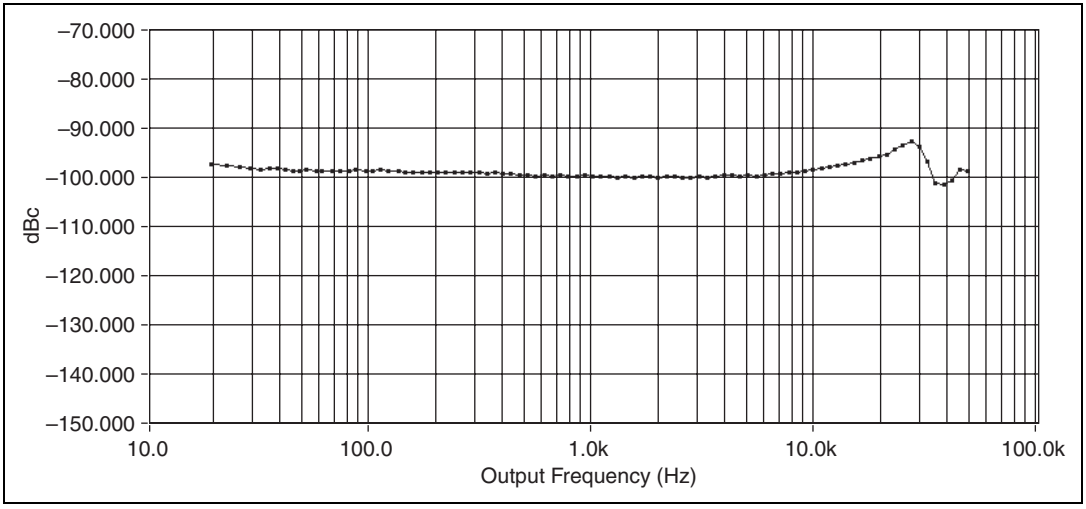

Figure 8. AO THD (204.8 kS/s, 0 dB Gain, 65,536 Samples, 92.8 kHz Measurement BW)

AO THD+N

Attenuation (dB)	THD+N (dBc)*		
	102.5 kS/s 20 Hz to 20 kHz†	204.8 kS/s 20 Hz to 80 kHz‡	204.8 kS/s 20 Hz to 92.1 kHz**
40	–83	–76	–63
20	–98	–92	–79
0	–97	–86	–68

* –1 dBFS output amplitude
† 30 kHz measurement BW
‡ 80 kHz measurement BW
** 500 kHz measurement BW

AO Intermodulation Distortion (IMD)

Attenuation (dB)	IMD (dBc)*
40	–99
20	–104
0	–104

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

Crosstalk, Output to Input Channel Separation

Gain (dB)	Crosstalk (dBc)*, †	
	1 kHz Signal	92.1 kHz
30	–151	–118
20	–150	–118
10	–144	–115
0	–137	–111
–20, –10	–87	–51

* Source impedance ≤ 50 Ω

† Output amplitude is the lesser of –1 dBFS or 8.91 V_{pk}.

Crosstalk, Output Channel Separation

All attenuation settings (0, 20, and 40 dB)

1 kHz signal .....No measurable crosstalk

92.1 kHz signal .....–110 dBc

AO Interchannel Gain Mismatch

All attenuation settings

20 Hz to 92.1 kHz .....0.03 dB

AO Interchannel Phase Mismatch

All attenuation settings

20 Hz to 20 kHz .....0.1°

20 Hz to 92.1 kHz .....0.2°

Note All gain and phase mismatch specifications are for the same device and are not applicable between different NI 446*x* devices.

AO Phase Linearity

Attenuation (dB)	Linearity (deg)	
	20 Hz to 20 kHz	20 Hz to 92.1 kHz
0	±0.1	±1.7
20	± 0.1	±1.6
40	±0.1	±1.8

Internal Frequency Timebase Characteristics

Accuracy ..... ±20 ppm, over operating temperature range

Aging ..... 8 ppm in first year; 5 ppm max/year after first year

Triggers

Analog trigger

- Purpose ..... Start trigger
- Source
  - NI 4461 ..... AI0 or AI1
  - NI 4462 ..... AI0, AI1, AI2, or AI3
- Level ..... Full scale, programmable
- Slope ..... Positive (rising) or negative (falling), software selectable
- Resolution ..... 24 bits
- Hysteresis ..... Programmable

Digital Trigger

- Purpose ..... Start or reference trigger
- Source ..... PFI0, PXI_Trig<0..6>
- Compatibility ..... Transistor-transistor logic (5V TTL)
- Polarity ..... Rising or falling edge
- Minimum pulse width ..... 10 ns

General Specifications

This section lists general specification information for the NI 446*x*.

Bus Interface

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

DMA channels

- NI 4461 ..... 2, analog input and analog output
- NI 4462 ..... 1, analog input

Synchronization

PXI

- CLK_10 ..... Multiple, full chassis
- PXI_STAR ..... Up to 14 devices per chassis

PCI

- RTSI ..... Up to 3 devices across ribbon cable

Power Requirements

Voltage	NI PXI-4461	NI PCI-4461	NI PXI-4462	NI PCI-4462
+5 V	990 mA	2,200 mA	990 mA	1,900 mA
+3.3 V	1,430 mA	1,750 mA	1,750 mA	2,300 mA
+12 V	170 mA	40 mA	130 mA	100 mA
–12 V	110 mA	40 mA	70 mA	40 mA

Physical

Dimensions (not including connectors)

PCI ..... 17.5 cm × 9.9 cm (6.9 in. × 3.9 in.) PCI slot

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

Analog I/O connectors ..... BNC female

Digital trigger connector ..... SMB male

Weight

PCI ..... 226.8 g (8.0 oz)

PXI ..... 241 g (8.5 oz)

Measurement Category[1] I

Caution Do *not* use the NI 446*x* for connections to signals or for measurements within Categories II, III, or IV.

Environmental

Operating Environment

Ambient temperature range

PXI-446*x* ..... 0 to 55 °C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.)

PCI-446*x* ..... 0 to 50 °C (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.)

Altitude ..... 2,000 m (at 25 °C ambient temperature)

Pollution Degree (indoor use only) 2

Storage Environment

Ambient temperature range ..... –20 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 (PXI Only)

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.)

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

Random vibration

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

Nonoperating .....5 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.

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 (IEC 61326): 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 For the standards applied to assess the EMC of this product, refer to the *Online Product Certification* section.

Note For EMC compliance, operate this product according to the documentation.

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 life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, 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`.)

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