# PXIe-6356 and USB-6356 Specifications

2025-08-22

# Contents

# PXIe-6356 and USB-6356 Specifications

## PXIe-6356 and USB-6356 Specifications

The following specifications are typical at 25 °C, unless otherwise noted. For more information about the PXIe-6356 and USB-6356, refer to the ***X Series User Manual*** available from ni.com/manuals.

## USB-6356 Screw Terminal Pinout

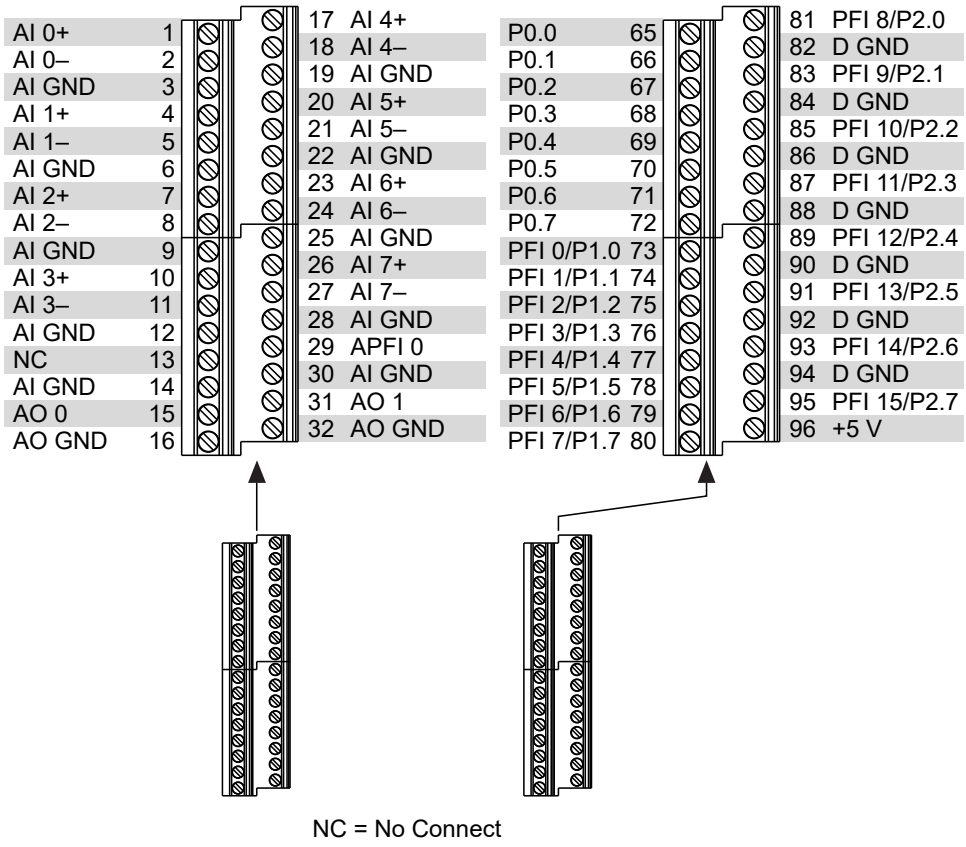



Table 2. Default Counter/Timer Terminals

| Counter/Timer Signal | Default PFI Terminal |
|---|---|
| CTR 0 SRC | PFI 8 |
| CTR 0 GATE | PFI 9 |

| Counter/Timer Signal | Default PFI Terminal |
|---|---|
| CTR 0 AUX | PFI 10 |
| CTR 0 OUT | PFI 12 |
| CTR 0 A | PFI 8 |
| CTR 0 Z | PFI 9 |
| CTR 0 B | PFI 10 |
| CTR 1 SRC | PFI 3 |
| CTR 1 GATE | PFI 4 |
| CTR 1 AUX | PFI 11 |
| CTR 1 OUT | PFI 13 |
| CTR 1 A | PFI 3 |
| CTR 1 Z | PFI 4 |
| CTR 1 B | PFI 11 |
| CTR 2 SRC | PFI 0 |
| CTR 2 GATE | PFI 1 |
| CTR 2 AUX | PFI 2 |
| CTR 2 OUT | PFI 14 |
| CTR 2 A | PFI 0 |
| CTR 2 Z | PFI 1 |
| CTR 2 B | PFI 2 |
| CTR 3 SRC | PFI 5 |
| CTR 3 GATE | PFI 6 |
| CTR 3 AUX | PFI 7 |
| CTR 3 OUT | PFI 15 |
| CTR 3 A | PFI 5 |
| CTR 3 Z | PFI 6 |
| CTR 3 B | PFI 7 |
| FREQ OUT | PFI 14 |

Table 3. Signal Descriptions

| Signal | Reference | Description |
|---|---|---|
| AI GND | — | Analog Input Ground—These terminals are the bias current return point for AI DIFF measurements. All ground references—AI GND, AO GND and D GND—are connected on the device. Though AI GND, AO GND, and D GND are connected on the device, they are connected by small traces to reduce crosstalk between subsystems. Each ground has a slight difference in potential. |
| AI <0..7>+, AI <0..7>- | — | Analog Input Channels—For differential measurements, AI+ and AI- are the positive and negative inputs of a differential analog input channel. |
| AO <0,1> | AO GND | Analog Output Channels—These terminals supply voltage output. |
| AO GND | — | Analog Output Ground—AO GND is the reference for AO. All ground references—AI GND, AO GND, and D GND—are connected on the device. Though AI GND, AO GND, and D GND are connected on the device, they are connected by small traces to reduce crosstalk between |

| Signal | Reference | Description |
|---|---|---|
| | | subsystems. Each ground has a slight difference in potential. |
| D GND | — | Digital Ground—D GND supplies the reference for port 0, port 1, port 2 digital channels, PFI, and +5 V. All ground reference—AI GND, AO GND, D GND—are connected on the device, they are connected by small traces to reduce crosstalk between subsystems. Each ground has a slight difference in potential. |
| P0.<0..7> | D GND | Port 0 Digital I/O Channels—You can configure each signal individually as an input or output. |
| APFI 0 | AO GND or AI GND | Analog Programmable Function Interface Channels—Each APFI signal can be used as AO external reference inputs for AO, or as an analog trigger input. APFI are referenced to AI GND when they are used as analog trigger inputs. APFI are referenced to AO GND when they are used as AO external offset or reference inputs. |
| +5 V | D GND | +5 V Power Source—These terminals provide a fused +5 V |

| Signal | Reference | Description |
|---|---|---|
| | | power source. |
| PFI <0..7>/P1.<0..7>,<br>PFI <8..15>/P2.<0..7> | D GND | Programmable Function Interface or Digital I/O Channels—Each of these terminals can be individually configured as a PFI terminal or a digital I/O terminal.<br><br>As an input, each PFI terminal can be used to supply an external source for AI, AO, DI, and DO timing signals or counter/timer inputs. As a PFI output, you can route many different internal AI, AO, DI, or DO timing signals to each PFI terminal. You can also route the counter/timer outputs to each PFI terminal. As a port 1 or port 2 digital I/O signal, you can individually configure each signal as an input or output. |
| NC | — | No connect—Do not connect signals to this terminal. |

# USB-6356 BNC Pinout

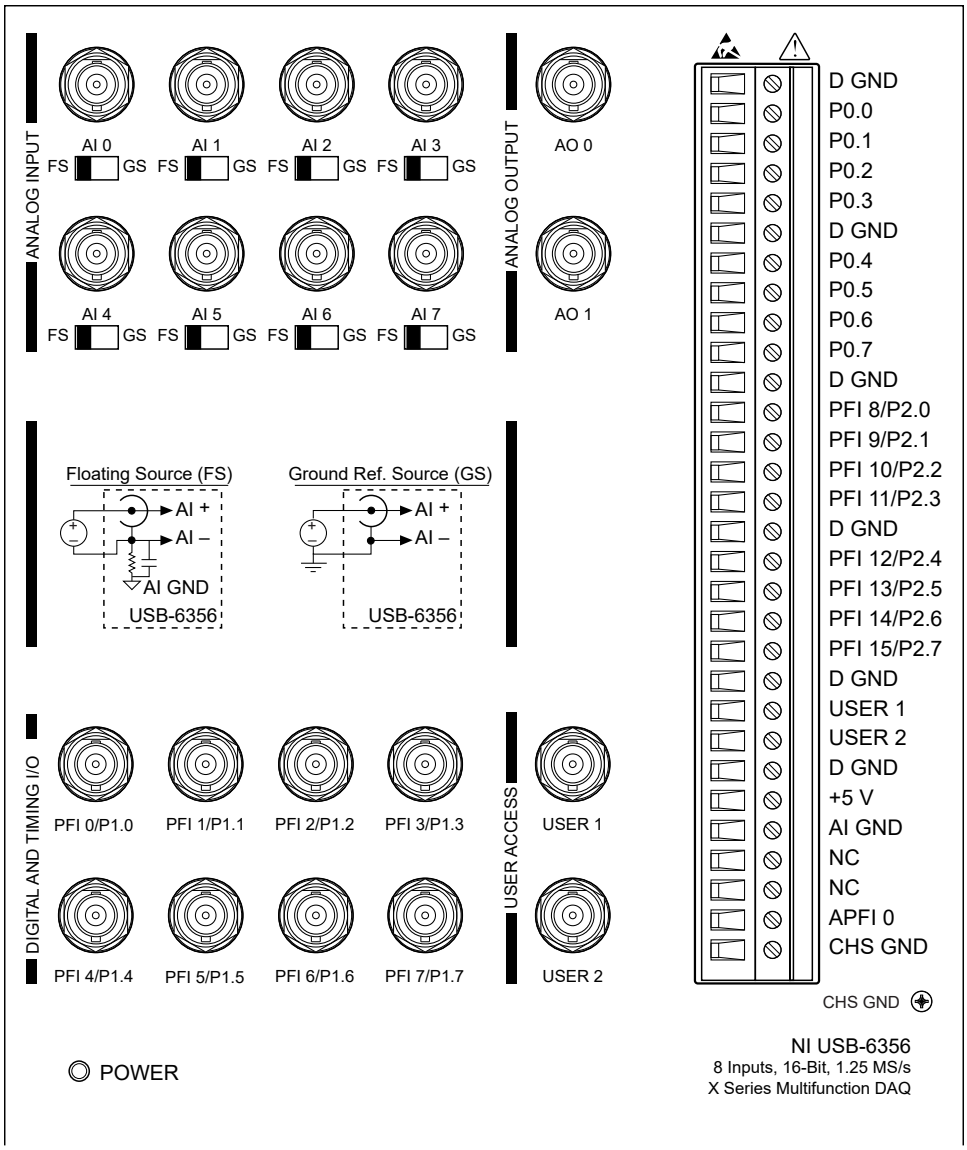



Table 4. Default Counter/Timer Terminals

| Counter/Timer Signal | Default PFI Terminal |
|---|---|
| CTR 0 SRC | PFI 8 |
| CTR 0 GATE | PFI 9 |
| CTR 0 AUX | PFI 10 |
| CTR 0 OUT | PFI 12 |
| CTR 0 A | PFI 8 |
| CTR 0 Z | PFI 9 |
| CTR 0 B | PFI 10 |

| Counter/Timer Signal | Default PFI Terminal |
|---|---|
| CTR 1 SRC | PFI 3 |
| CTR 1 GATE | PFI 4 |
| CTR 1 AUX | PFI 11 |
| CTR 1 OUT | PFI 13 |
| CTR 1 A | PFI 3 |
| CTR 1 Z | PFI 4 |
| CTR 1 B | PFI 11 |
| CTR 2 SRC | PFI 0 |
| CTR 2 GATE | PFI 1 |
| CTR 2 AUX | PFI 2 |
| CTR 2 OUT | PFI 14 |
| CTR 2 A | PFI 0 |
| CTR 2 Z | PFI 1 |
| CTR 2 B | PFI 2 |
| CTR 3 SRC | PFI 5 |
| CTR 3 GATE | PFI 6 |
| CTR 3 AUX | PFI 7 |
| CTR 3 OUT | PFI 15 |
| CTR 3 A | PFI 5 |
| CTR 3 Z | PFI 6 |
| CTR 3 B | PFI 7 |
| FREQ OUT | PFI 14 |

Table 5. Signal Descriptions

| Signal | Reference | Description |
|---|---|---|
| AI GND | — | Analog Input Ground—These terminals are the bias current |

| Signal | Reference | Description |
|---|---|---|
| | | return point for AI DIFF measurements. All ground references—AI GND and D GND—are connected on the device. Though AI GND and D GND are connected on the device, they are connected by small traces to reduce crosstalk between subsystems. Each ground has a slight difference in potential. |
| AI <0..7> | — | Analog Input Channels—For differential measurements, the BNC pin and shield are the positive and negative inputs of the differential analog input channel.<br><br>To measure a floating signal source, move the switch under the BNC connector to the FS position.<br><br>To measure a ground-referenced signal source, move the switch under the BNC connector to the GS position.<br><br>Refer to the ***X Series User Manual*** for information about single-ended measurement options. |
| AO <0,1> | — | Analog Output Channels—These terminals supply voltage output. |

| Signal | Reference | Description |
|---|---|---|
| D GND | — | Digital Ground—D GND supplies the reference for port 0, port 1, port 2 digital channels, PFI, and +5 V. All ground references—AI GND and D GND—are connected on the device. Though AI GND and D GND are connected on the device, they are connected by small traces to reduce crosstalk between subsystems. Each ground has a slight difference in potential. |
| P0.<0..7> | D GND | Port 0 Digital I/O Channels—You can configure each signal individually as an input or output. |
| APFI 0 | AI GND | Analog Programmable Function Interface Channels—Each APFI signal can be used as AO external reference inputs for AO, or as an analog trigger input. APFI are referenced to AI GND when they are used as analog trigger inputs. APFI are referenced to an analog ground when they are used as AO external offset or reference inputs. |
| +5 V | D GND | +5 V Power Source—These terminals provide a fused +5 V power source. |

| Signal | Reference | Description |
|---|---|---|
| PFI <0..7>/P1.<0..7>,<br>PFI <8..15>/P2.<0..7> | D GND | Programmable Function Interface or Digital I/O Channels—Each of these terminals can be individually configured as a PFI terminal or a digital I/O terminal.<br><br>As an input, each PFI terminal can be used to supply an external source for AI, AO, DI, and DO timing signals or counter/timer inputs. As a PFI output, you can route many different internal AI, AO, DI, or DO timing signals to each PFI terminal. You can also route the counter/timer outputs to each PFI terminal. As a port 1 or port 2 digital I/O signal, you can individually configure each signal as an input or output. |
| NC | — | No connect—Do not connect signals to this terminal. |
| USER <1,2> | — | User-Defined Channels—The USER BNC connectors allow you to use a BNC connector for a digital or timing I/O signal of your choice. The USER BNC connectors are internally routed to the USER screw terminals. |
| CHS GND | — | Chassis Ground—This terminal connects to the device metal |

| Signal | Reference | Description |
|---|---|---|
| | | enclosure. You can connect your cable's shield wire to CHS GND for a ground connection. |

# PXIe-6356 Pinout

| | | | |
|---|---|---|---|
| AI 0+ | 68 | 34 | AI 0– |
| AI 0 GND | 67 | 33 | AI 1+ |
| AI 1– | 66 | 32 | AI 1 GND |
| AI 2+ | 65 | 31 | AI 2– |
| AI 2 GND | 64 | 30 | AI 3+ |
| AI 3– | 63 | 29 | AI 3 GND |
| NC | 62 | 28 | AI 4+ |
| AI 4– | 61 | 27 | AI 4 GND |
| AI 5+ | 60 | 26 | AI 5– |
| AI 5 GND | 59 | 25 | AI 6+ |
| AI 6– | 58 | 24 | AI 6 GND |
| AI 7+ | 57 | 23 | AI 7– |
| AI 7 GND | 56 | 22 | AO 0 |
| AO GND | 55 | 21 | AO 1 |
| AO GND | 54 | 20 | APFI 0 |
| D GND | 53 | 19 | P0.4 |
| P0.0 | 52 | 18 | D GND |
| P0.5 | 51 | 17 | P0.1 |
| D GND | 50 | 16 | P0.6 |
| P0.2 | 49 | 15 | D GND |
| P0.7 | 48 | 14 | +5 V |
| P0.3 | 47 | 13 | D GND |
| PFI 11/P2.3 | 46 | 12 | D GND |
| PFI 10/P2.2 | 45 | 11 | PFI 0/P1.0 |
| D GND | 44 | 10 | PFI 1/P1.1 |
| PFI 2/P1.2 | 43 | 9 | D GND |
| PFI 3/P1.3 | 42 | 8 | +5 V |
| PFI 4/P1.4 | 41 | 7 | D GND |
| PFI 13/P2.5 | 40 | 6 | PFI 5/P1.5 |
| PFI 15/P2.7 | 39 | 5 | PFI 6/P1.6 |
| PFI 7/P1.7 | 38 | 4 | D GND |
| PFI 8/P2.0 | 37 | 3 | PFI 9/P2.1 |
| D GND | 36 | 2 | PFI 12/P2.4 |
| D GND | 35 | 1 | PFI 14/P2.6 |

NC = No Connect

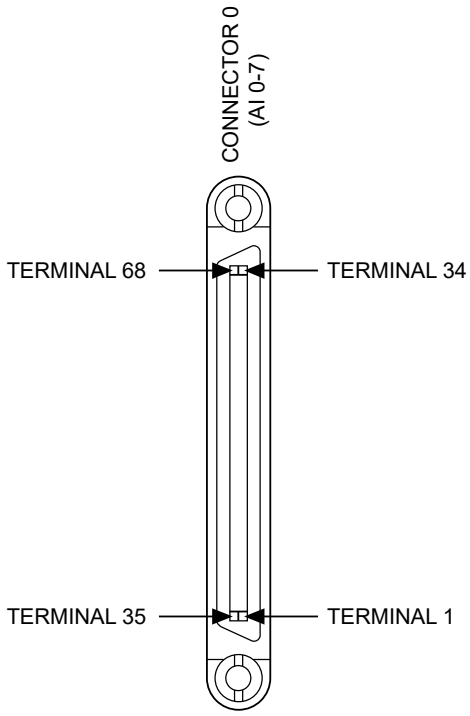


Table 6. Default Counter/Timer Terminals

| Counter/Timer Signal | Default PFI Terminal |
|---|---|
| CTR 0 SRC | PFI 8 |
| CTR 0 GATE | PFI 9 |
| CTR 0 AUX | PFI 10 |
| CTR 0 OUT | PFI 12 |
| CTR 0 A | PFI 8 |
| CTR 0 Z | PFI 9 |
| CTR 0 B | PFI 10 |
| CTR 1 SRC | PFI 3 |
| CTR 1 GATE | PFI 4 |
| CTR 1 AUX | PFI 11 |
| CTR 1 OUT | PFI 13 |
| CTR 1 A | PFI 3 |
| CTR 1 Z | PFI 4 |
| CTR 1 B | PFI 11 |
| CTR 2 SRC | PFI 0 |
| CTR 2 GATE | PFI 1 |
| CTR 2 AUX | PFI 2 |
| CTR 2 OUT | PFI 14 |
| CTR 2 A | PFI 0 |
| CTR 2 Z | PFI 1 |
| CTR 2 B | PFI 2 |
| CTR 3 SRC | PFI 5 |
| CTR 3 GATE | PFI 6 |
| CTR 3 AUX | PFI 7 |
| CTR 3 OUT | PFI 15 |

| Counter/Timer Signal | Default PFI Terminal |
|---|---|
| CTR 3 A | PFI 5 |
| CTR 3 Z | PFI 6 |
| CTR 3 B | PFI 7 |
| FREQ OUT | PFI 14 |

Table 7. Signal Descriptions

| Signal | Reference | Description |
|---|---|---|
| AI GND | — | Analog Input Ground—These terminals are the bias current return point for AI DIFF measurements. All ground references—AI GND, AO GND and D GND—are connected on the device. Though AI GND, AO GND, and D GND are connected on the device, they are connected by small traces to reduce crosstalk between subsystems. Each ground has a slight difference in potential. |
| AI <0..7>+, AI <0..7>- | — | Analog Input Channels—For differential measurements, AI+ and AI- are the positive and negative inputs of a differential analog input channel. |
| AO <0,1> | AO GND | Analog Output Channels—These terminals supply voltage output. |
| AO GND | — | Analog Output |

| Signal | Reference | Description |
|---|---|---|
| | | Ground—AO GND is the reference for AO. All ground references—AI GND, AO GND, and D GND—are connected on the device. Though AI GND, AO GND, and D GND are connected on the device, they are connected by small traces to reduce crosstalk between subsystems. Each ground has a slight difference in potential. |
| D GND | — | Digital Ground—D GND supplies the reference for port 0, port 1, port 2 digital channels, PFI, and +5 V. All ground reference—AI GND, AO GND, D GND—are connected on the device, they are connected by small traces to reduce crosstalk between subsystems. Each ground has a slight difference in potential. |
| P0.<0..7> | D GND | Port 0 Digital I/O Channels—You can configure each signal individually as an input or output. |
| APFI 0 | AO GND or AI GND | Analog Programmable Function Interface Channels—Each APFI signal can be used as AO external reference inputs for AO, or as an analog trigger input. APFI are referenced to AI GND when they are used as |

| Signal | Reference | Description |
|---|---|---|
| | | analog trigger inputs. APFI are referenced to AO GND when they are used as AO external offset or reference inputs. |
| +5 V | D GND | +5 V Power Source—These terminals provide a fused +5 V power source. |
| PFI <0..7>/P1.<0..7>,<br>PFI <8..15>/P2.<0..7> | D GND | Programmable Function Interface or Digital I/O Channels—Each of these terminals can be individually configured as a PFI terminal or a digital I/O terminal.<br><br>As an input, each PFI terminal can be used to supply an external source for AI, AO, DI, and DO timing signals or counter/timer inputs. As a PFI output, you can route many different internal AI, AO, DI, or DO timing signals to each PFI terminal. You can also route the counter/timer outputs to each PFI terminal. As a port 1 or port 2 digital I/O signal, you can individually configure each signal as an input or output. |
| NC | — | No connect—Do not connect signals to this terminal. |

# Analog Input

| | |
|---|---|
| Number of channels | 8 differential |
| ADC resolution | 16 bits |
| DNL | No missing codes guaranteed |
| INL | Refer to the ***AI Absolute Accuracy*** section. |

| **Sample rate** | |
|---|---|
| Single channel maximum | 1.25 MS/s |
| Minimum | No minimum |

| | |
|---|---|
| Timing resolution | 10 ns |
| Timing accuracy | 50 ppm of sample rate |
| Input coupling | DC |
| Input range | ±1 V, ±2 V, ±5 V, ±10 V |

| **Maximum working voltage for all analog inputs** |
|---|

| | |
|---|---|
| Positive input (AI+) | ±11 V for all ranges, Measurement Category I |
| Negative input (AI-) | ±11 V for all ranges, Measurement Category I |

**Caution** Do not use for measurements within Categories II, III, and IV.

| | |
|---|---|
| CMRR (at 60 Hz) | 75 dB |
| Bandwidth | 1 MHz |
| THD | -80 dBFS |
| **Input impedance** | |
| **Device on** | |
| AI+ to AI GND | >100 GΩ in parallel with 100 pF |
| AI- to AI GND | >100 GΩ in parallel with 100 pF |
| **Device off** | |
| AI+ to AI GND | 2 kΩ |
| AI- to AI GND | 2 kΩ |

| | |
|---|---|
| Input bias current | ±10 pA |

| | |
|---|---|
| **Crosstalk (at 100 kHz)** | |
| Adjacent channels | -80 dB |
| Non-adjacent channels | -100 dB |

| | |
|---|---|
| **Input FIFO size** | |
| PXIe | 8,182 samples shared among channels used |
| USB (32 MS) | 32 MS shared among channels used |
| USB (64 MS) | 64 MS shared among channels used |

| | |
|---|---|
| **Data transfers** | |
| PXIe | DMA (scatter-gather), programmed I/O |
| USB | USB Signal Stream, programmed I/O |

| | |
|---|---|
| **Overvoltage protection for all analog input channels** | |
| Device on | ±36 V |
| Device off | ±15 V |

| | |
|---|---|
| Input current during overvoltage conditions | ±20 mA max/AI pin |

# Analog Triggers

| | |
|---|---|
| Number of triggers | 1 |
| Source | AI <0..7>, APFI 0 |
| Functions | Start Trigger, Reference Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase |
| **Source level** | |
| AI <0..7> | ±Full scale |
| APFI 0 | ±10 V |

| | |
|---|---|
| Resolution | 16 bits |
| Modes | Analog edge triggering, analog edge triggering with hysteresis, and analog window triggering |
| **Bandwidth (-3 dB)** | |
| AI <0..7> | 3.4 MHz |
| APFI 0 | 3.9 MHz |

| | |
|---|---|
| Accuracy | ±1% of range |

| **APFI 0 characteristics** | |
|---|---|
| Input impedance | 10 kΩ |
| Coupling | DC |
| Protection, power on | ±30 V |
| Protection, power off | ±15 V |

## AI Absolute Accuracy

Table 8. AI Absolute Accuracy

| Nominal Range Positive Full Scale | Nominal Range Negative Full Scale | Residual Gain Error (ppm of Reading) | Offset Tempco (ppm of Range/°C) | Random Noise, σ (µVrms) | Absolute Accuracy at Full Scale (µV) |
|---|---|---|---|---|---|
| 10 | -10 | 114 | 35 | 252 | 2,688 |
| 5 | -5 | 120 | 36 | 134 | 1,379 |
| 2 | -2 | 120 | 42 | 71 | 564 |
| 1 | -1 | 138 | 50 | 61 | 313 |

**Note** For more information about absolute accuracy at full scale, refer to the AI Absolute Accuracy Example section.

| | |
|---|---|
| Gain tempco | 8 ppm/°C |

| | |
|---|---|
| Reference tempco | 5 ppm/°C |
| Residual offset error | 15 ppm of range |
| INL error | 46 ppm of range |

**Note** Accuracies listed are valid for up to two years from the device external calibration.

AI Absolute Accuracy Equation

$$AbsoluteAccuracy = Reading \cdot (GainError) + Range \cdot (OffsetError) + NoiseUncertainty$$

- $GainError = ResidualGainError + GainTempco \cdot (TempChangeFromLastInternalCal) + ReferenceTempco \cdot (TempChangeFromLastExternalCal)$
- $OffsetError = ResidualOffsetError + OffsetTempco \cdot (TempChangeFromLastInternalCal) + INLError$
- $NoiseUncertainty = \frac{\text{Random Noise} \cdot 3}{\sqrt{10,000}}$
  for a coverage factor of 3 σ and averaging 10,000 points.

AI Absolute Accuracy Example

Absolute accuracy at full scale on the analog input channels is determined using the following assumptions:

- $TempChangeFromLastExternalCal = 10\ °C$
- $TempChangeFromLastInternalCal = 1\ °C$
- $number\_of\_readings = 10,000$
- $CoverageFactor = 3\ \sigma$

For example, on the 10 V range, the absolute accuracy at full scale is as follows:

- ***GainError*** = 114 ppm + 8 ppm · 1 + 5 ppm · 10 = 172 ppm
- ***OffsetError*** = 15 ppm + 35 ppm ·1 + 46 ppm = 96 ppm
- ***Noise Uncertainty*** = $\frac{252\ \mu V \cdot 3}{\sqrt{10,\ 000}}$ = 7.6 µV
- ***AbsoluteAccuracy*** = 10 V · (***GainError***) + 10 V · (***OffsetError***) + ***NoiseUncertainty*** = 2688 µV

# Analog Output

| | |
|---|---|
| Number of channels | 2 |
| DAC resolution | 16 bits |
| DNL | ±1 LSB, max |
| Monotonicity | 16 bit guaranteed |
| Accuracy | Refer to the ***AO Absolute Accuracy*** section. |
| **Maximum update rate (simultaneous)** | |
| 1 channel | 3.3 MS/s |
| 2 channels | 3.3 MS/s |

| | |
|---|---|
| Minimum update rate | No minimum |
| Timing accuracy | 50 ppm of sample rate |
| Timing resolution | 10 ns |
| Output range | ±10 V, ±5 V, ±external reference on APFI 0 |
| Output coupling | DC |
| Output impedance | 0.4 Ω |
| Output current drive | ±5 mA |
| Overdrive protection | ±25 V |
| Overdrive current | 10 mA |
| Power-on state | ±5 mV |
| **Power on/off glitch** | |
| PXIe | 1.5 V peak for 200 ms |
| USB | 1.5 V peak for 200 ms, typical behavior[1] |

1. Time period may be longer due to host system USB performance. Time period will be longer during firmware updates.

| | |
|---|---|
| Output FIFO size | 8,191 samples shared among channels used |
| **Data transfers** | |
| PXIe | DMA (scatter-gather), programmed I/O |
| USB | USB Signal Stream, programmed I/O |

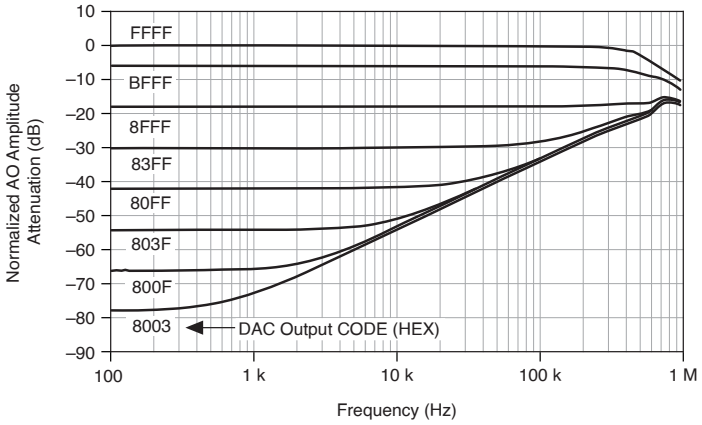
| | |
|---|---|
| AO waveform modes | Non-periodic waveform, periodic waveform regeneration mode from onboard FIFO, periodic waveform regeneration from host buffer including dynamic update |
| Settling time, full-scale step, 15 ppm (1 LSB) | 2 µs |
| Slew rate | 20 V/µs |
| Glitch energy at midscale transition, ±10 V range | 6 nV · s |

## External Reference

| **APFI 0 characteristics** | |
|---|---|
| Input impedance | 10 kΩ |
| Coupling | DC |

| | |
|---|---|
| Protection, device on | ±30 V |
| Protection, device off | ± 15 V |
| Range | ±11 V |
| Slew rate | ±20 V/µs |

Figure 1. Analog Output External Reference Bandwidth




## AO Absolute Accuracy

Absolute accuracy at full-scale numbers is valid immediately following self calibration and assumes the device is operating within 10 °C of the last external calibration.

Table 9. AO Absolute Accuracy

| Nominal Range Positive Full Scale | Nominal Range Negative Full Scale | Residual Gain Error (ppm of Reading) | Gain Tempco (ppm/°C) | Reference Tempco (ppm/°C) | Residual Offset Error (ppm of Range) | Offset Tempco (ppm of Range/°C) | INL Error (ppm of Range) | Absolute Accuracy at Full Scale (µV) |
|---|---|---|---|---|---|---|---|---|
| 10 | -10 | 129 | 17 | 5 | 65 | 1 | 64 | 3,256 |
| 5 | -5 | 135 | 8 | 5 | 65 | 1 | 64 | 1,616 |

**Note** Accuracies listed are valid for up to two years from the device external calibration.

# Digital I/O/PFI

## Static Characteristics

| | |
|---|---|
| Number of channels | 24 total, 8 (P0.<0..7>), 16 (PFI <0..7>/P1, PFI <8..15>/P2) |
| Ground reference | D GND |
| Direction control | Each terminal individually programmable as input or output |
| Pull-down resistor | 50 kΩ typical, 20 kΩ minimum |
| Input voltage protection | ±20 V on up to two pins |

**Caution** Stresses beyond those listed under the ***Input voltage protection*** specification may cause permanent damage to the device.

## Waveform Characteristics (Port 0 Only)

| | |
|---|---|
| Terminals used | Port 0 (P0.<0..7>) |
| Port/sample size | Up to 8 bits |
| Waveform generation (DO) FIFO | 2,047 samples |

| | |
|---|---|
| Waveform acquisition (DI) FIFO | 255 samples |
| **DI Sample Clock frequency** | |
| PXIe | 0 to 10 MHz, system and bus activity dependent |
| USB | 0 to 1 MHz, system and bus activity dependent |
| **DO Sample Clock frequency** | |
| **PXIe** | |
| Regenerate from FIFO | 0 to 10 MHz |
| Streaming from memory | 0 to 10 MHz, system and bus activity dependent |
| **USB** | |
| Regenerate from FIFO | 0 to 10 MHz |
| Streaming from memory | 0 to 1 MHz, system and bus activity dependent |
| **Data transfers** | |
| PXIe | DMA (scatter-gather), programmed I/O |
| USB | USB Signal Stream, programmed I/O |

| | |
|---|---|
| Digital line filter settings | 160 ns, 10.24 µs, 5.12 ms, disable |

## PFI/Port 1/Port 2 Functionality

| | |
|---|---|
| Functionality | Static digital input, static digital output, timing input, timing output |
| Timing output sources | Many AI, AO, counter, DI, DO timing signals |
| Debounce filter settings | 90 ns, 5.12 µs, 2.56 ms, custom interval, disable; programmable high and low transitions; selectable per input |

## Recommended Operating Conditions

| | |
|---|---|
| **Input high voltage ($V_{IH}$)** | |
| Minimum | 2.2 V |
| Maximum | 5.25 V |
| **Input low voltage ($V_{IL}$)** | |
| Minimum | 0 V |
| Maximum | 0.8 V |
| **Output high current ($I_{OH}$)** | |
| P0.<0..7> | -24 mA maximum |
| PFI <0..15>/P1/P2 | -16 mA maximum |

| Output low current ($I_{OL}$) | |
|---|---|
| P0.<0..7> | 24 mA maximum |
| PFI <0..15>/P1/P2 | 16 mA maximum |

## Digital I/O Characteristics

| | |
|---|---|
| Positive-going threshold (VT+) | 2.2 V maximum |
| Negative-going threshold (VT-) | 0.8 V minimum |
| Delta VT hysteresis (VT+ - VT-) | 0.2 V minimum |
| $I_{IL}$ input low current ($V_{IN}$ = 0 V) | -10 µA maximum |
| $I_{IH}$ input high current ($V_{IN}$ = 5 V) | 250 µA maximum |

Figure 2. P0.<0..7>: $I_{OH}$ versus $V_{OH}$

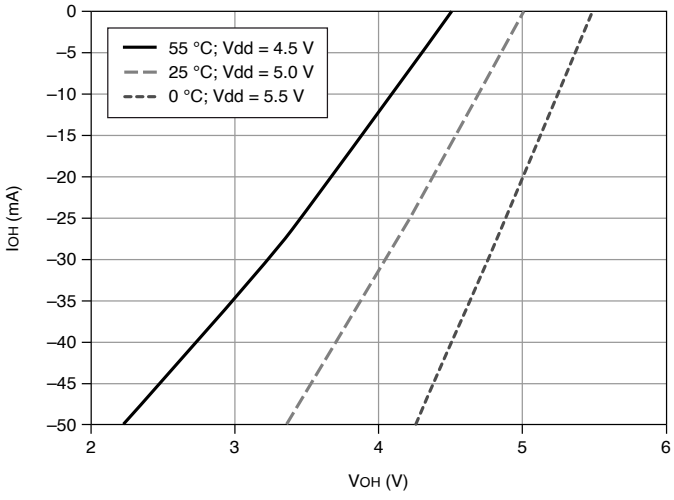


Figure 3. P0.<0..7>: $I_{OL}$ versus $V_{OL}$

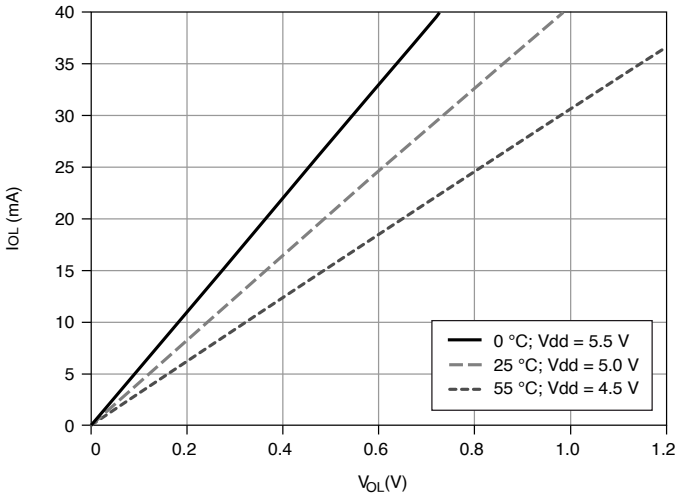



Figure 4. PFI <0..15>/P1/P2: $I_{OH}$ versus $V_{OH}$

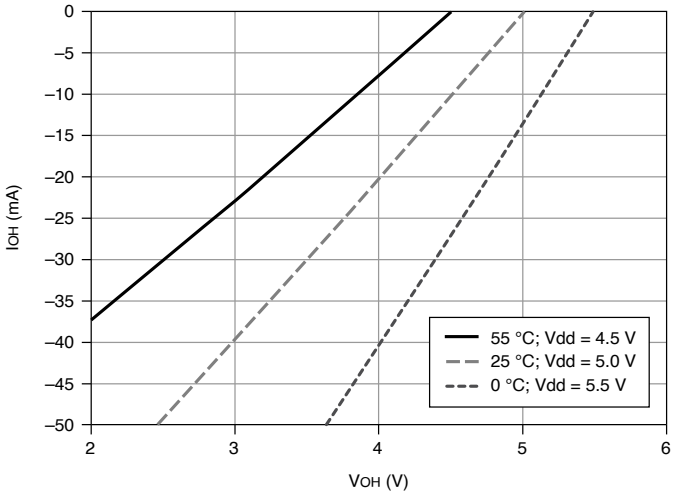
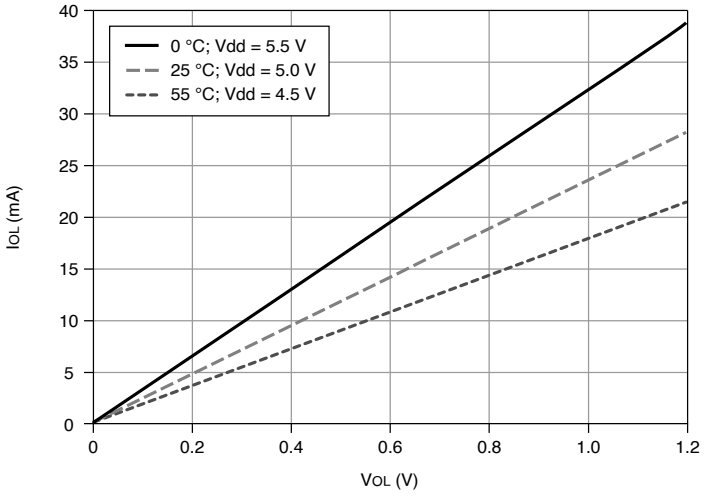



Figure 5. PFI <0..15>/P1/P2: $I_{OL}$ versus $V_{OL}$



# General-Purpose Counters

| | |
|---|---|
| Number of counter/ timers | 4 |
| Resolution | 32 bits |
| Counter measurements | Edge counting, pulse, pulse width, semi-period, period, two-edge separation |
| Position measurements | X1, X2, X4 quadrature encoding with Channel Z reloading; two-pulse encoding |
| Output applications | Pulse, pulse train with dynamic updates, frequency division, equivalent time sampling |
| Internal base clocks | 100 MHz, 20 MHz, 100 kHz |
| **External base clock frequency** | |
| PXIe | 0 MHz to 25 MHz; 0 MHz to 100 MHz on PXIe_DSTAR<A,B> |
| USB | 0 MHz to 25 MHz |

| | |
|---|---|
| Base clock accuracy | 50 ppm |
| Inputs | Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down, Sample Clock |

| Routing options for inputs | |
|---|---|
| PXIe | Any PFI, PXIe_DSTAR<A,B>, PXI_TRIG, PXI_STAR, analog trigger, many internal signals |
| USB | Any PFI, analog trigger, many internal signals |

| | |
|---|---|
| FIFO | 127 samples per counter |

| Data transfers | |
|---|---|
| PXIe | Dedicated scatter-gather DMA controller for each counter/timer, programmed I/O |
| USB | USB Signal Stream, programmed I/O |

## Frequency Generator

| | |
|---|---|
| Number of channels | 1 |
| Base clocks | 20 MHz, 10 MHz, 100 kHz |
| Divisors | 1 to 16 |
| Base clock accuracy | 50 ppm |

Output can be available on any PFI terminal.

# Phase-Locked Loop (PLL)

| | |
|---|---|
| Number of PLLs | 1 |

Table 10. Reference Clock Locking Frequencies

| Reference Signal | PXI Express Locking Input Frequency (MHz) | USB Locking Input Frequency (MHz) |
|---|---|---|
| PXIe_DSTAR<A,B> | 10, 20, 100 | — |
| PXI_STAR | 10, 20 | — |
| PXIe_CLK100 | 100 | — |
| PXI_TRIG <0..7> | 10, 20 | — |
| PFI <0..15> | 10, 20 | 10 |

| | |
|---|---|
| Output of PLL | 100 MHz Timebase; other signals derived from 100 MHz Timebase including 20 MHz and 100 kHz Timebases |

# External Digital Triggers

| Source | |
|---|---|
| PXIe | Any PFI, PXIe_DSTAR<A,B>, PXI_TRIG, PXI_STAR |
| USB | Any PFI |

| | |
|---|---|
| Polarity | Software-selectable for most signals |

| | |
|---|---|
| Analog input function | Start Trigger, Reference Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase |
| Analog output function | Start Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase |
| Counter/timer functions | Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down, Sample Clock |
| Digital waveform generation (DO) function | Start Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase |
| Digital waveform acquisition (DI) function | Start Trigger, Reference Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase |

## Device-to-Device Trigger Bus

| **Input source** | |
|---|---|
| PXIe | PXI_TRIG <0..7>, PXI_STAR, PXIe_DSTAR<A,B> |
| USB | None |
| **Output destination** | |
| PXIe | PXI_TRIG <0..7>, PXIe_DSTARC |
| USB | None |

| | |
|---|---|
| Output selections | 10 MHz Clock, frequency generator output, many internal signals |
| Debounce filter settings | 90 ns, 5.12 µs, 2.56 ms, custom interval, disable; programmable high and low transitions; selectable per input |

# Bus Interface

| **PXIe** | |
|---|---|
| Form factor | x1 PXI Express peripheral module, specification rev 1.0 compliant |
| Slot compatibility | x1 and x4 PXI Express or PXI Express hybrid slots |
| DMA channels | 8, can be used for analog input, analog output, digital input, digital output, counter/timer 0, counter/timer 1, counter/timer 2, counter/timer 3 |

All PXIe devices may be installed in PXI Express slots or PXI Express hybrid slots.

| **USB** | |
|---|---|
| USB compatibility | USB 2.0 Hi-Speed or full-speed[2] |
| USB Signal Stream | 8, can be used for analog input, analog output, digital input, digital output, counter/timer 0, counter/timer 1, counter/timer 2, counter/timer 3 |

2. Operating on a full-speed bus results in lower performance and you might not be able to achieve maximum sampling/update rates.

# Power Requirements

**Caution** The protection provided by the device can be impaired if the device is used in a manner not described in the ***X Series User Manual***.

| **PXIe** | |
|---|---|
| +3.3 V | 4.7 W |
| +12 V | 15.4 W |

| **USB** | |
|---|---|
| Power supply requirements | 11 to 30 VDC, 30 W, 2 positions 3.5 mm pitch pluggable screw terminal with screw locks similar to Phoenix Contact MC 1,5/2-STF-3,5 BK |
| Power input mating connector | Phoenix Contact MC 1,5/2-GF-3,5 BK or equivalent |

**Caution** The USB device must be powered with an NI offered AC adapter or a National Electric Code (NEC) Class 2 DC source that meets the power requirements for the device and has the appropriate safety certification marks for country of use.

# Current Limits

**Note** Exceeding the current limits may cause unpredictable device behavior.

| | |
|---|---|
| PXIe, +5 V terminal (connector 0) | 1 A max[3] |

3. Has a self-resetting fuse that opens when current exceeds this specification.

| | |
|---|---|
| USB, +5 V terminal | 1 A max[3] |

# Physical Characteristics

| | |
|---|---|
| PXIe printed circuit board dimensions | Standard 3U PXI |

Table 11. PXIe Mating Connectors

| Manufacturer, Part Number | Description |
|---|---|
| MOLEX 71430-0011 | 68-Pos Right Angle Single Stack PCB-Mount VHDCI (Receptacle) |
| MOLEX 74337-0016 | 68-Pos Right Angle Dual Stack PCB-Mount VHDCI (Receptacle) |
| MOLEX 71425-3001 | 68-Pos Offset IDC Cable Connector (Plug) (SHC68-*) |

| | |
|---|---|
| USB screw terminal/BNC screw terminal wiring | 16-24 AWG |

| | |
|---|---|
| **USB enclosure dimensions (includes connectors)** | |
| Screw terminal | 26.4 × 17.3 × 3.6 cm (10.4 × 6.8 × 1.4 in.) |
| BNC | 20.3 × 18.5 × 6.8 cm (8.0 × 7.3 × 2.7 in.) |
| **Weight** | |
| PXIe | 168 g (5.9 oz) |

| | |
|---|---|
| USB Screw Terminal | 1.428 kg (3 lb 3.4 oz) |
| USB BNC | 1.536 kg (3 lb 6.2 oz) |
| **I/O connector** | |
| PXIe | 1 68-pin VHDCI |
| USB Screw Terminal | 64 screw terminals |
| USB BNC | 20 BNCs and 30 screw terminals |

## Calibration

| | |
|---|---|
| Recommended warm-up time | 15 minutes |
| Calibration interval | 2 years |

## Maximum Working Voltage

***Maximum working voltage*** refers to the signal voltage plus the common-mode voltage.

| | |
|---|---|
| Channel to earth | 11 V, Measurement Category I |

**Caution** Do not use for measurements within Categories II, III, or IV.

# Shock and Vibration

| | |
|---|---|
| Operational shock | 30 g peak, half-sine, 11 ms pulse<br><br>(Tested in accordance with IEC 60068-2-27. Test profile developed in accordance with MIL-PRF-28800F.) |
| **Random vibration** | |
| Operating | 5 to 500 Hz, 0.3 $g_{rms}$ |
| Nonoperating | 5 to 500 Hz, 2.4 $g_{rms}$<br><br>(Tested in accordance with IEC 60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.) |

# Environmental

| | |
|---|---|
| **Operating temperature** | |
| PXIe | 0 to 55 °C |
| USB | 0 to 45 °C |

| | |
|---|---|
| Storage temperature | -40 to 70 °C |
| Operating humidity | 10 to 90% RH, noncondensing |
| Storage humidity | 5 to 95% RH, noncondensing |

| | |
|---|---|
| Pollution Degree | 2 |
| Maximum altitude | 2,000 m |

Indoor use only.

## 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.

## EMC Standards

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
- ICES-001: Class A emissions

**Note** Group 1 equipment 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** In Europe, Australia, New Zealand, and Canada (per CISPR 11) Class A

> equipment is intended for use in non-residential locations.

## 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)

## 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.)