# PCI/PXI/ USB-6281 Specifications

2022-10-07

# Contents

# NI 6281 Specifications

## Analog Input

| | |
|---|---|
| Number of channels | 8 differential or 16 single ended |
| ADC resolution | 18 bits |
| DNL | No missing codes guaranteed |
| INL | Refer to the AI Absolute Accuracy section |
| **Sample rate**<br>Single channel maximum<br>Multichannel maximum (aggregate)<br>Minimum | <br>625 kS/s<br>500 kS/s<br>No minimum |
| Timing accuracy | 50 ppm of sample rate |
| Timing resolution | 50 ns |
| Input coupling | DC |
| Input range | ±0.1 V, ±0.2 V, ±0.5 V, ±1 V, ±2 V, ±5 V, ±10 V |
| Maximum working voltage for analog inputs (signal + common mode) | ±11 V of AI GND |

| | |
|---|---|
| CMRR (DC to 60 Hz) | 110 dB |

**Input impedance**

**Device on**

| | |
|---|---|
| AI+ to AI GND | >10 GΩ in parallel with 100 pF |
| AI- to AI GND | >10 GΩ in parallel with 100 pF |

**Device off**

| | |
|---|---|
| AI+ to AI GND | 820 Ω |
| AI- to AI GND | 820 Ω |

| | |
|---|---|
| Input bias current | ±100 pA |

**Crosstalk (at 100 kHz)**

| | |
|---|---|
| Adjacent channels | -75 dB |
| Non-adjacent channels | -95 dB |

| | |
|---|---|
| Small signal bandwidth (-3 dB) | 750 kHz filter off, 40 kHz filter on |
| Input FIFO size | 2,047 samples |
| Scan list memory | 4,095 entries |

**Data transfers**

| | |
|---|---|
| PCI/PXI | DMA (scatter-gather), interrupts, programmed I/O |

| | |
|---|---|
| USB | USB Signal Stream, programmed I/O |

| **Overvoltage protection for all analog input and sense channels** | |
|---|---|
| Device on | ±25 V for up to eight AI pins |
| Device off | ±15 V for up to eight AI pins |

| | |
|---|---|
| Input current during overvoltage condition | ±20 mA maximum/AI pin |

| Range | Filter Off ±15 ppm of Step (±4 LSB for Full-Scale Step) | Filter Off ±4 ppm of Step (±1 LSB for Full-Scale Step) | Filter On ±4 ppm of Step (±1 LSB for Full-Scale Step) |
|---|---|---|---|
| ±5 V, ±10 V | 2 µs | 8 µs | 50 µs |
| ±0.5 V, ±1 V, ±2 V | 2.5 µs | 8 µs | 50 µs |
| ±0.1 V, ±0.2 V | 3 µs | 8 µs | 50 µs |

Table 5. Settling Time for Multichannel Measurements

# Typical Performance Graphs

Figure 1. AI Settling Error versus Time for Different Source Impedances

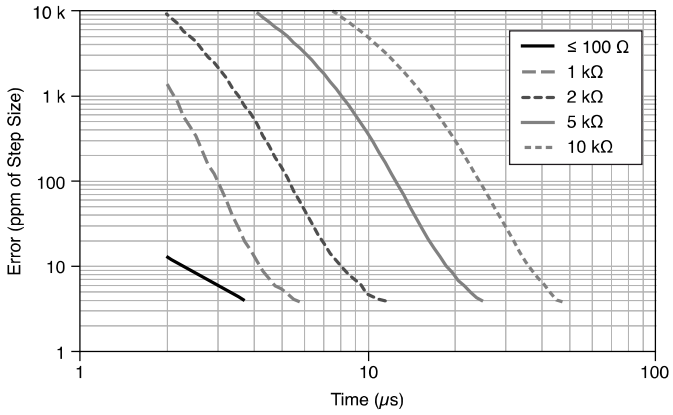


Figure 2. AI Small Signal Bandwidth

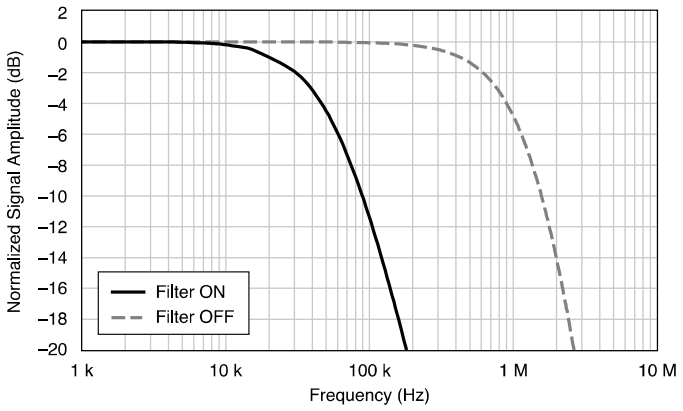
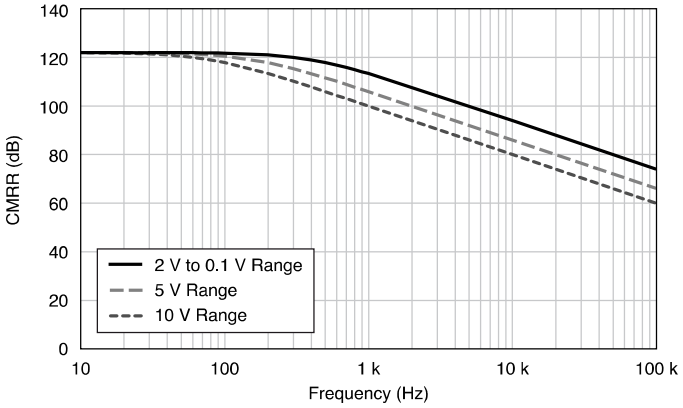



Figure 3. AI CMRR




# AI Absolute Accuracy

## AI Absolute Accuracy (Filter On)

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

| Nominal Range Positive Full Scale | Nominal Range Negative Full Scale | Residual Gain Error (ppm of Reading) | Residual Offset Error (ppm of Range) | Offset Tempco (ppm of Range/°C) | Random Noise, σ (µVrms) | Absolute Accuracy at Full Scale (µV) | Sensitivity (µV) |
|---|---|---|---|---|---|---|---|
| 10 | -10 | 40 | 8 | 11 | 60 | 980 | 24 |
| 5 | -5 | 45 | 8 | 11 | 30 | 510 | 12 |

| Nominal Range Positive Full Scale | Nominal Range Negative Full Scale | Residual Gain Error (ppm of Reading) | Residual Offset Error (ppm of Range) | Offset Tempco (ppm of Range/°C) | Random Noise, σ (µVrms) | Absolute Accuracy at Full Scale (µV) | Sensitivity (µV) |
|---|---|---|---|---|---|---|---|
| 2 | -2 | 45 | 8 | 13 | 12 | 210 | 4.8 |
| 1 | -1 | 55 | 15 | 15 | 7 | 120 | 2.8 |
| 0.5 | -0.5 | 55 | 30 | 20 | 4 | 70 | 1.6 |
| 0.2 | -0.2 | 75 | 45 | 35 | 3 | 39 | 1.2 |
| 0.1 | -0.1 | 120 | 60 | 60 | 2 | 28 | 0.8 |

Table 5. AI Absolute Accuracy (Filter On)

**Note** Sensitivity is the smallest voltage change that can be detected. It is a function of noise.

| | |
|---|---|
| Gain tempco | 17 ppm/°C |
| Reference tempco | 1 ppm/°C |
| INL error | 10 ppm of range |

## AI Absolute Accuracy (Filter Off)

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

| Nominal Range Positive Full Scale | Nominal Range Negative Full Scale | Residual Gain Error (ppm of Reading) | Residual Offset Error (ppm of Range) | Offset Tempco (ppm of Range/°C) | Random Noise, σ (µVrms) | Absolute Accuracy at Full Scale (µV) | Sensitivity (µV) |
|---|---|---|---|---|---|---|---|
| 10 | -10 | 45 | 10 | 11 | 70 | 1,050 | 28.0 |
| 5 | -5 | 50 | 10 | 11 | 35 | 550 | 14.0 |
| 2 | -2 | 50 | 10 | 13 | 15 | 230 | 6.0 |
| 1 | -1 | 60 | 17 | 15 | 12 | 130 | 4.8 |

| Nominal Range Positive Full Scale | Nominal Range Negative Full Scale | Residual Gain Error (ppm of Reading) | Residual Offset Error (ppm of Range) | Offset Tempco (ppm of Range/°C) | Random Noise, σ (µVrms) | Absolute Accuracy at Full Scale (µV) | Sensitivity (µV) |
|---|---|---|---|---|---|---|---|
| 0.5 | -0.5 | 60 | 32 | 20 | 10 | 80 | 4.0 |
| 0.2 | -0.2 | 80 | 47 | 35 | 9 | 43 | 3.6 |
| 0.1 | -0.1 | 120 | 62 | 60 | 9 | 31 | 3.6 |

Table 5. AI Absolute Accuracy (Filter Off)

> **Note** Sensitivity is the smallest voltage change that can be detected. It is a function of noise.

| | |
|---|---|
| Gain tempco | 17 ppm/°C |
| Reference tempco | 1 ppm/°C |
| INL error | 10 ppm of range |

## AI Absolute Accuracy Equation

**AbsoluteAccuracy** = **Reading** · **(GainError)** + **Range** · **(OffsetError)** + **NoiseUncertainty**

- **GainError** = **ResidualAIGainError** + **GainTempco** · **(TempChangeFromLastInternalCal)** + **ReferenceTempco** · **(TempChangeFromLastExternalCal)**
- **OffsetError** = **ResidualAIOffsetError** + **OffsetTempco** · **(TempChangeFromLastInternalCal)** + **INLError**
- **NoiseUncertainty** = $\frac{\text{Random Noise} \cdot 3}{\sqrt{100}}$

for a coverage factor of 3 σ and averaging 100 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 = 100
- CoverageFactor = 3 σ

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

- GainError = 40 ppm + 17 ppm · 1 + 1 ppm · 10 = 67 ppm
- OffsetError = 8 ppm + 11 ppm · 1 + 10 ppm = 29 ppm
- NoiseUncertainty = $\frac{60\ \mu V \quad 3}{\sqrt{100}}$ = 18 µV
- AbsoluteAccuracy = 10 V · (GainError) + 10 V · (OffsetError) + NoiseUncertainty = 980 µV

## Analog Triggers

| | |
|---|---|
| Number of triggers | 1 |
| Source | AI <0..15>, APFI 0 |
| Functions | Start Trigger, Reference Trigger, Pause Trigger, Sample Clock, Convert Clock, Sample Clock Timebase |
| **Source level** | |
| AI <0..15> | ±Full scale |

| | |
|---|---|
| APFI 0 | ±10 V |
| Resolution | 10 bits, 1 in 1,024 |
| Modes | Analog edge triggering, analog edge triggering with hysteresis, and analog window triggering |

**Bandwidth (-3 dB)**

| | |
|---|---|
| AI <0..15> | 700 kHz filter off, 40 kHz filter on |
| APFI 0 | 5 MHz |
| Accuracy | ±1% |

**APFI 0 characteristics**

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

# Analog Output

| | |
|---|---|
| Number of channels | 2 |
| DAC resolution | 16 bits |
| DNL | ±1 LSB |

| | |
|---|---|
| Monotonicity | 16 bit guaranteed |
| Accuracy | Refer to the AO Absolute Accuracy section |

**Maximum update rate**

| | |
|---|---|
| 1 channel | 2.86 MS/s |
| 2 channels | 2.00 MS/s per channel |

| | |
|---|---|
| Timing accuracy | 50 ppm of sample rate |
| Timing resolution | 50 ns |

**Output range (offset ± reference)**

| | |
|---|---|
| Calibrated ranges | ±1 V, ±2 V, ±5 V, ±10 V |
| Offset sources | 0 V, 5 V, APFI 0 , AO <0,1 >[1] |
| Reference sources | 1 V, 5 V, 2 V, 10 V, APFI 0, AO <0,1>[2] |
| Maximum output level | ±11 V |

| | |
|---|---|
| Output coupling | DC |
| Output impedance | 0.2 Ω |
| Output current drive | ±5 mA |
| Overdrive protection | ±25 V |
| Overdrive current | 20 mA |

| | |
|---|---|
| Power-on state[3] | ±5 mV |
| Power-on glitch | 2.3 V peak for 1.2 s |
| Output FIFO size | 8,191 samples shared among channels used |

**Data transfers**

| | |
|---|---|
| PCI/PXI | DMA (scatter-gather), interrupts, 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) | 3 µs |
| Slew rate | 20 V/µs |

**Glitch energy at midscale transition, ±10 V range**

| | |
|---|---|
| Magnitude | 15 mV |
| Duration | 0.5 µs |

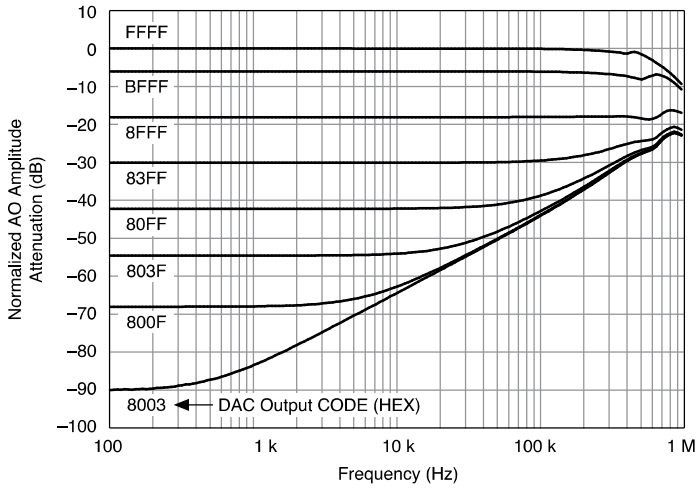
## External Reference

**APFI 0 characteristics**

| | |
|---|---|
| Input impedance | 10 kΩ |
| Coupling | DC |

| | |
|---|---|
| Protection, device on | ±30 V |
| Protection, device off | ±15 V |
| Range | ±11 V |

Figure 4. AO <0,1> External Reference Bandwidth




## AO Absolute Accuracy

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

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

| Nominal Range Positive Full Scale | Nominal Range Negative Full Scale | Residual Gain Error (ppm of Reading) | Gain Tempco (ppm/°C) | Residual Offset Error (ppm of Range) | Offset Tempco (ppm of Range/°C) | Absolute Accuracy at Full Scale (µV) |
|---|---|---|---|---|---|---|
| 10 | -10 | 55 | 15 | 30 | 12 | 1,540 |
| 5 | -5 | 60 | 15 | 30 | 17 | 820 |

| Nominal Range Positive Full Scale | Nominal Range Negative Full Scale | Residual Gain Error (ppm of Reading) | Gain Tempco (ppm/°C) | Residual Offset Error (ppm of Range) | Offset Tempco (ppm of Range/°C) | Absolute Accuracy at Full Scale (µV) |
|---|---|---|---|---|---|---|
| 2 | -2 | 65 | 25 | 40 | 30 | 404 |
| 1 | -1 | 85 | 25 | 57 | 50 | 259 |

Table 5. AO Absolute Accuracy

| | |
|---|---|
| Reference tempco | 1 ppm/°C |
| INL error | 32 ppm of range |

### AO Absolute Accuracy Equation

**AbsoluteAccuracy** = **OutputValue** · **(GainError)** + **Range** · (**OffsetError**)

- **GainError** = **ResidualGainError** + **GainTempco** · (**TempChangeFromLastInternalCal**) + **ReferenceTempco** · (**TempChangeFromLastExternalCal**)
- **OffsetError** = **ResidualOffsetError** + **AOOffsetTempco** · **(TempChangeFromLastInternalCal)** + **INLError**

## Digital I/O/PFI

### Static Characteristics

| | |
|---|---|
| Number of channels | 24 total, 8 (P0.<0..7>), 16 (PFI <0..7>/P1, PFI <8..15>/P2) |
| I/O type | 5 V TTL/CMOS compatible |
| 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[4] |

## 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 | 2,047 samples |

**DI Sample Clock frequency**

| | |
|---|---|
| PCI/PXI | 0 MHz to 10 MHz, system and bus activity dependent |
| USB | 0 MHz to 1 MHz, system and bus activity dependent |

**DO Sample Clock frequency**

**PCI/PXI**

| | |
|---|---|
| Regenerate from FIFO | 0 MHz to 10 MHz |
| Streaming from memory | 0 MHz to 10 MHz, system and bus activity dependent |

**USB**

| | |
|---|---|
| Regenerate from FIFO | 0 MHz to 10 MHz |
| Streaming from memory | 0 MHz to 1 MHz, system and bus activity dependent |

| Data transfers | |
|---|---|
| PCI/PXI | DMA (scatter-gather), interrupts, programmed I/O |
| USB | USB Signal Stream, programmed I/O |
| DI or DO Sample Clock source[5] | Any PFI, RTSI, AI Sample or Convert Clock, AO Sample Clock, Ctr **n** Internal Output, and many other signals |

## 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 | 125 ns, 6.425 µs, 2.56 ms, disable; high and low transitions; selectable per input |

## Recommended Operating Conditions

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

# Electrical Characteristics

| Level | Minimum | Maximum |
|---|---|---|
| Positive-going threshold (VT+) | — | 2.2 V |
| Negative-going threshold (VT-) | 0.8 V | — |
| Delta VT hystersis (VT+ - VT-) | 0.2 V | — |
| $I_{IL}$ input low current ($V_{in}$ = 0 V) | — | -10 µA |
| $I_{IH}$ input high current ($V_{in}$ = 5 V) | — | 250 µA |

# Digital I/O Characteristics

Figure 5. Digital I/O (P0.<0..7>): $I_{oh}$ versus $V_{oh}$

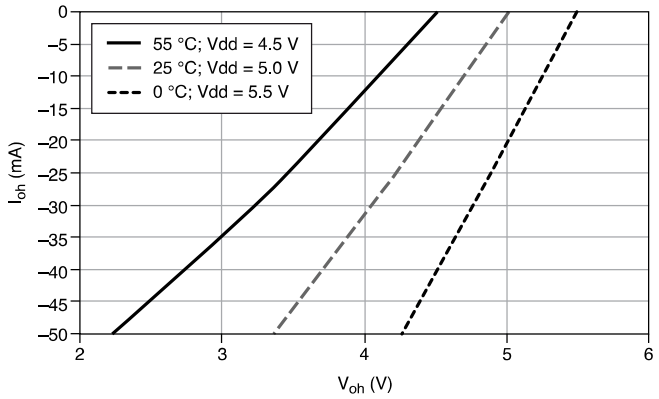



Figure 6. Digital I/O (PFI <0..15>/P1/P2): $I_{oh}$ versus $V_{oh}$

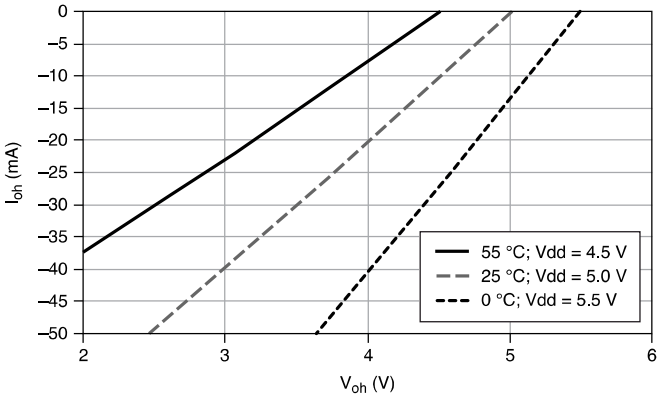


Figure 7. Digital I/O (P0.<0..7>): $I_{ol}$ versus $V_{ol}$

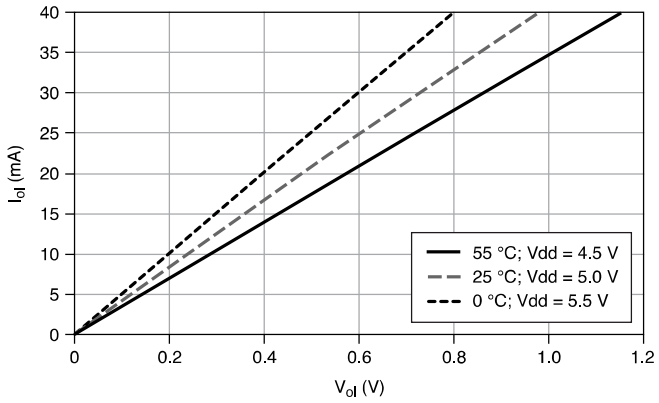
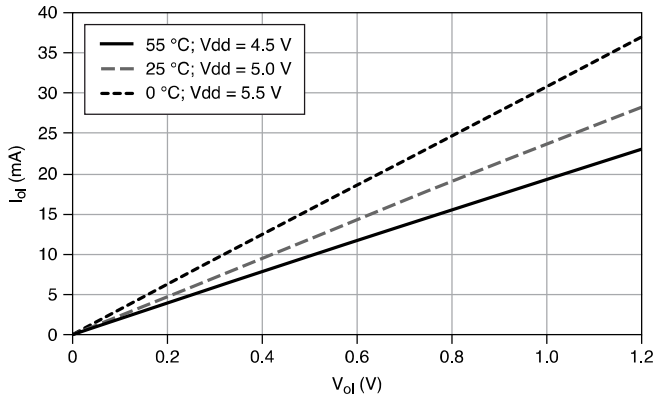



Figure 8. Digital I/O (PFI <0..15>/P1/P2): $I_{ol}$ versus $V_{ol}$




# General-Purpose Counters/Timers

| | |
|---|---|
| Number of counter/timers | 2 |
| Resolution | 32 bits |
| Counter measurements | Edge counting, pulse, 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 | 80 MHz, 20 MHz, 0.1 MHz |
| External base clock frequency | 0 MHz to 20 MHz |
| Base clock accuracy | 50 ppm |
| Inputs | Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down |
| Routing options for inputs | Any PFI, RTSI, PXI_TRIG, PXI_STAR, analog trigger, many internal signals |
| FIFO | 2 samples |

**Data transfers**

| | |
|---|---|
| PCI/PXI | Dedicated scatter-gather DMA controller for each counter/timer; interrupts, programmed I/O |
| USB | USB Signal Stream, programmed I/O |

# Frequency Generator

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

Output can be available on any output PFI or RTSI terminal.

## Phase-Locked Loop (PLL)

> **Note** PCI/PXI devices only.

| | |
|---|---|
| Number of PLLs | 1 |
| Reference signal | PXI_STAR, PXI_CLK10, RTSI <0..7> |
| Output of PLL | 80 MHz Timebase; other signals derived from 80 MHz Timebase including 20 MHz and 100 kHz Timebases |

## External Digital Triggers

| | |
|---|---|
| Source | Any PFI, RTSI, PXI_TRIG, PXI_STAR |
| Polarity | Software-selectable for most signals |
| Analog input function | Start Trigger, Reference Trigger, Pause Trigger, Sample Clock, Convert Clock, Sample Clock Timebase |
| Analog output function | Start Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase |
| Counter/timer function | Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down |
| Digital waveform generation (DO) function | Sample Clock |
| Digital waveform acquisition (DI) function | Sample Clock |

## Device-to-Device Trigger Bus

| | |
|---|---|
| PCI | RTSI <0..7>[6] |
| PXI | PXI_TRIG <0..7>, PXI_STAR |
| USB source | None |
| Output selections | 10 MHz Clock, frequency generator output, many internal signals |
| Debounce filter settings | 125 ns, 6.425 µs, 2.56 ms, disable; high and low transitions; selectable per input |

# Bus Interface

| | |
|---|---|
| PCI/PXI | 3.3 V or 5 V signal environment |
| USB | USB 2.0 Hi-Speed or full-speed[7], [8] |
| DMA channels (PCI/PXI) | 6, can be used for analog input, analog output, digital input, digital output, counter/timer 0, counter/timer 1 |
| USB Signal Stream | 4, can be used for analog input, analog output, digital input, digital output, counter/timer 0, counter/timer 1 |

The PXI device supports one of the following features:

- May be installed in PXI Express hybrid slots
- Or, may be used to control SCXI in PXI/SCXI combo chassis

| M Series Part Number | SCXI Control in PXI/SCXI Combo Chassis | PXI Express Hybrid Slot Compatible |
|---|---|---|
| 191501C-03 | No | Yes |

| M Series Part Number | SCXI Control in PXI/SCXI Combo Chassis | PXI Express Hybrid Slot Compatible |
|---|---|---|
| 191501A-0**x**/191501B-0**x** | Yes | No |

Table 5. PXI/SCXI Combo and PXI Express Chassis Compatibility

# Power Requirements

**PCI/PXI**

**Current draw from bus during no-load condition**[9]

| | |
|---|---|
| +5 V | 0.03 A |
| +3.3 V | 0.78 A |
| +12 V | 0.40 A |
| -12 V | 0.06 A |

**Current draw from bus during AI and AO overvoltage condition**[9]

| | |
|---|---|
| +5 V | 0.03 A |
| +3.3 V | 1.26 A |
| +12 V | 0.43 A |
| -12 V | 0.06 A |

**Caution** USB devices 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 appropriate safety certification marks for country of use.

| | |
|---|---|
| **USB** | |
| Power supply requirements | 11 to 30 VDC, 20 W, locking or non-locking power jack with 0.080 in. diameter center pin, 5/16-32 thread for locking collars |
| Power supply fuse | 2 A, 250 V |

## Current Limits

> **Caution** Exceeding the current limits may cause unpredictable behavior by the device and/or PC/chassis.

| | |
|---|---|
| PCI, +5 V terminal | 1 A max[10] |
| **PXI** | |
| +5 V terminal | 1 A max[10] |
| P0/PFI/P1/P2 and +5 V terminals combined | 2 A max |
| **USB** | |
| +5 V terminal | 1 A max[11] |
| P0/PFI/P1/P2 and +5 V terminals combined | 2 A max |

## Physical Characteristics

| | |
|---|---|
| **Dimensions** | |
| PCI printed circuit board | 10.6 cm × 15.5 cm(4.2 in. × 6.1 in.) |

| | |
|---|---|
| PXI printed circuit board | Standard 3U PXI |
| Mass Termination enclosure (includes connectors) | 18.8 cm × 17.09 cm × 4.45 cm (7.4 in. × 6.73 in. × 1.75 in.) |
| Screw Terminal (includes connectors) | 26.67 cm × 17.09 cm × 4.45 cm(10.5 in. × 6.73 in. × 1.75 in.) |
| USB OEM | Refer to the **NI USB-622x/625x/628x OEM User Guide** |

**Weight**

| | |
|---|---|
| PCI | 158 g (5.6 oz) |
| PXI | 225 g (7.9 oz) |
| USB Mass Termination | 1.04 kg (2 lb4.5 oz) |
| USB Screw Terminal | 1.46 kg (3 lb3.4 oz) |
| USB OEM | 261 g (9.2 oz) |

**I/O connectors**

| | |
|---|---|
| Mass Termination | 1 68-pin SCSI |
| USB OEM | 1 34-pin IDC, 1 50-pin IDC |

| | |
|---|---|
| Screw terminal wiring | 16 AWG to 28 AWG |

# Calibration

**Recommended warm-up time**

| | |
|---|---|
| PCI/PXI/PCI Express/PXI Express | 15 minutes |
| USB | 30 minutes |
| Calibration interval | 2 years |

## Maximum Working Voltage

Connect only voltages that are below these limits.

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

Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as MAINS voltage. MAINS is a hazardous live electrical supply system that powers equipment. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

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

> **Note** Measurement Categories CAT I and CAT O (Other) are equivalent. These test and measurement circuits are not intended for direct connection to the MAINS building installations of Measurement Categories CAT II, CAT III, or CAT IV.

## Environmental

| | |
|---|---|
| **Operating temperature** | |
| PCI/PXI | 0 °C to 55 °C |

| | |
|---|---|
| USB | 0 °C to 45 °C |
| Storage temperature | -20 °C to 70 °C |
| Humidity | 10% RH to 90% RH, noncondensing |
| Maximum altitude | 2,000 m |
| Pollution Degree (indoor use only) | 2 |

Indoor use only.

## 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.) |

**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.) |

## Safety Compliance Standards

This product is designed to meet the requirements of the following electrical equipment safety standards for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA C22.2 No. 61010-1

> **Note** For safety certifications, refer to the product label or the Product Certifications and Declarations section.

## Electromagnetic Compatibility

## CE Compliance CE

- 2011/65/EU; Restriction of Hazardous Substances (RoHS)

## 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.)

## Device Pinouts

Figure 9. NI PCI/PXI-6281 Pinout

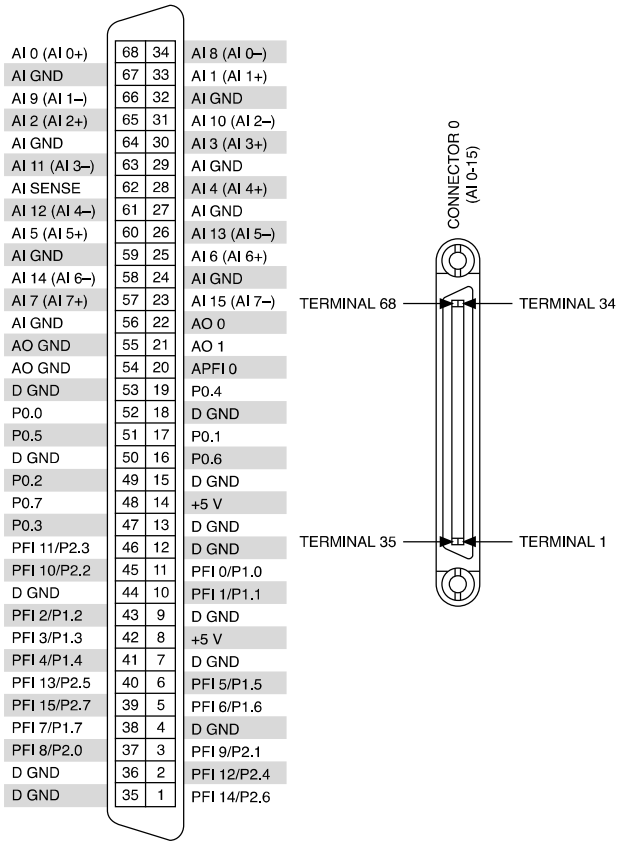


Figure 10. NI USB-6281 Mass Termination Pinout

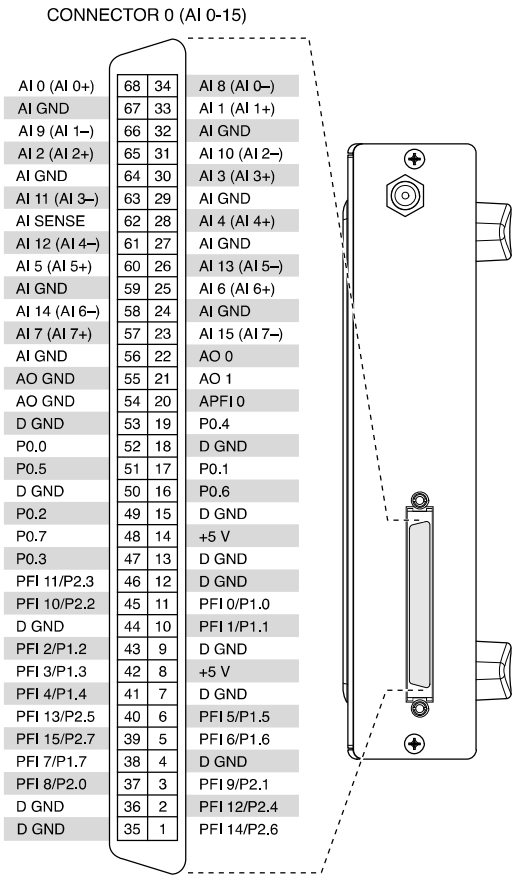
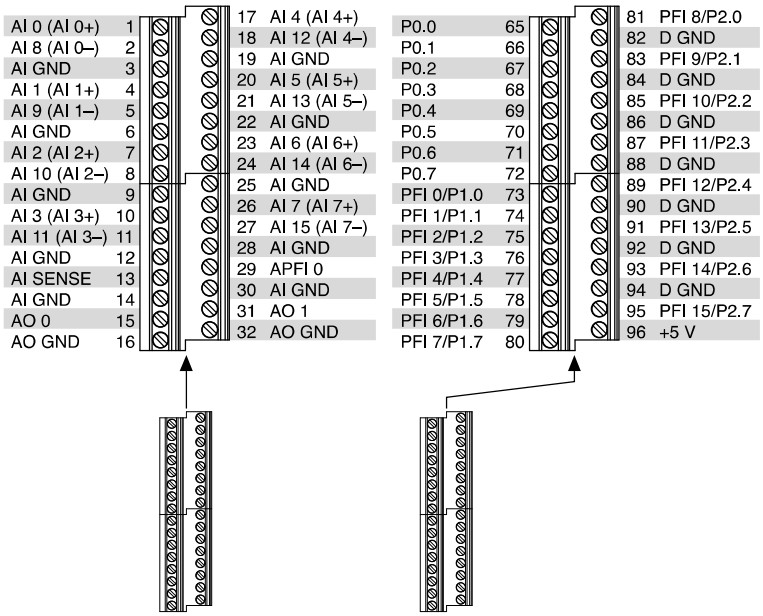



Figure 11. NI USB-6281 Screw Terminal Pinout



[1] An AO channel cannot be a reference or offset to itself.

[2] When the USB Screw Terminal device is powered on, the analog output signal is not defined until after the USB configuration is complete.

[3] For all USB Screw Terminal devices, when powered on, the analog output signal is not defined until after USB configuration is complete.

[4] Stresses beyond those listed under **Input voltage protection** may cause permanent damage to the device.

[5] The digital subsystem does not have its own dedicated internal timing engine. Therefore, a sample clock must be provided from another subsystem on the device or an external source.

[6] In other sections of this document, RTSI refers to RTSI <0..7> for the PCI devices or PXI_TRIG <0..7> for PXI devices.

[7] If you are using an USB M Series device in full-speed mode, device performance will be lower and you will not be able to achieve maximum sample/update rates.

[8] Operating on a full-speed bus may result in lower performance.

[9] Does not include P0/PFI/P1/P2 and +5 V terminals.

[10] Older revisions have a self-resetting fuse that opens when current exceeds this specification. Newer revisions have a traditional fuse that opens when current exceeds this specification. This fuse is not customer-replaceable; if the fuse permanently opens, return the device to NI for repair.

[11] Has a user-replaceable socketed fuse that opens when current exceeds this specification. Refer to the M Series for information about fuse replacement.