# SPECIFICATIONS
# NI 6366/6368

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Specifications listed below are typical at 25 °C unless otherwise noted. Refer to the *X Series User Manual* for more information about NI PXIe-6366/6368, and NI USB-6366 (32 MS and 64 MS) devices.

## Analog Input

Number of channels
- NI 6366 ..... 8 differential
- NI 6368 ..... 16 differential

ADC resolution ..... 16 bits

DNL ..... No missing codes guaranteed

INL ..... Refer to the *AI Absolute Accuracy Table*

Sample rate
- Maximum ..... 2.00 MS/s per channel
- Minimum ..... No minimum
- Timing accuracy ..... 50 ppm of sample rate
- Timing resolution ..... 10 ns

Input coupling ..... DC

Input range ..... ±10 V, ±5 V, ±2 V, ±1 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 powered on
  - AI- to AI GND ..... >100 GΩ in parallel with 10 pF
  - AI+ to AI GND ..... >100 GΩ in parallel with 10 pF

NATIONAL INSTRUMENTS

Device powered 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

Nonadjacent channels ..... -100 dB

Input FIFO size

NI PXIe-6366/6368 ..... 8,182 samples shared among channels used

NI USB-6366 (32 MS) ..... 32 MS shared among channels used

NI USB-6366 (64 MS) ..... 64 MS shared among channels used

Data transfers

NI PXIe-6366/6368 ..... DMA (scatter-gather), programmed I/O

NI USB-6366 ..... USB Signal Stream, programmed I/O

Overvoltage protection (AI+, AI-)

Device powered on ..... ±36 V

Device powered off ..... ±15 V

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

# Analog Triggers

Number of triggers ..... 1

Source

NI 6366 ..... AI <0..7>, APFI 0

NI 6368 ..... AI <0..15>, APFI <0, 1>

Functions ..... Start Trigger, Reference Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase

Source level

AI <0..15> ..... ±full scale

APFI <0, 1> ..... ±10 V

Resolution ..... 16 bits

Modes ..... Analog edge triggering, analog edge triggering with hysteresis, and analog window triggering

Bandwidth (-3 dB)

AI <0..15> ..... 3.4 MHz

APFI <0, 1> ..... 3.9 MHz

Accuracy ..... ±1% of range

APFI <0, 1> characteristics

- Input impedance ..... 10 kΩ
- Coupling ..... DC
- Protection
  - Device powered on ..... ±30 V
  - Device powered off..... ±15 V

# Analog Output

Number of channels

- NI 6366 ..... 2
- NI 6368 ..... 4

DAC resolution ..... 16 bits

DNL ..... ±1 LSB max

Monotonicity ..... 16 bit guaranteed

Accuracy ..... Refer to the *AO Absolute Accuracy Table*

Maximum update rate (simultaneous)

- One channel ..... 3.3 MS/s
- Two channels ..... 3.3 MS/s
- Three channels ..... 3.3 MS/s
- Four channels..... 3.3 MS/s
- Minimum ..... No minimum

Timing accuracy ..... 50 ppm of sample rate

Timing resolution..... 10 ns

Output range ..... ±10 V, ±5 V, ±external reference on APFI <0, 1>

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

- NI PXIe-6366/6368 ..... 1.5 V peak for 200 ms
- NI USB-6366..... 1.5 V peak for 200 ms[1]

[1] Typical behavior. Time period may be longer due to host system USB performance. Time period is longer during firmware updates.

Output FIFO size ..... 8,191 samples shared among channels used

Data transfers

NI PXIe-6366/6368..... DMA (scatter-gather), programmed I/O

NI USB-6366 ..... USB Signal Stream, programmed I/O

AO waveform modes:

- Nonperiodic 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, 1> characteristics

Input impedance..... 10 kΩ

Coupling..... DC

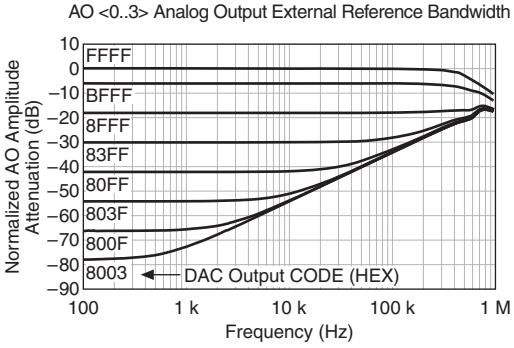
Protection

Device powered on ..... ±30 V

Device powered off..... ±15 V

Range ..... ±11 V

Slew rate ..... 20 V/µs




# Calibration (AI and AO)

Recommended warm-up time..... 15 minutes

Calibration interval ..... 2 years

# AI Absolute Accuracy Table

| Nominal Range | | 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) | Random Noise, σ (μVrms) | Absolute Accuracy at Full Scale* (μV) |
|---|---|---|---|---|---|---|---|---|---|
| Positive Full Scale | Negative Full Scale | | | | | | | | |
| 10 | -10 | 95 | 8 | 5 | 15 | 35 | 46 | 252 | 2498 |
| 5 | -5 | 102 | 8 | 5 | 15 | 36 | 46 | 134 | 1289 |
| 2 | -2 | 102 | 8 | 5 | 15 | 42 | 46 | 71 | 528 |
| 1 | -1 | 120 | 8 | 5 | 15 | 50 | 46 | 61 | 291 |

AbsoluteAccuracy = Reading · (GainError) + Range · (OffsetError) + NoiseUncertainty
GainError = ResidualAIGainError + GainTempco · (TempChangeFromLastInternalCal) + ReferenceTempco · (TempChangeFromLastExternalCal)
OffsetError = ResidualAIOffsetError + OffsetTempco · (TempChangeFromLastInternalCal) + INL_Error

$$\text{NoiseUncertainty} = \frac{\text{RandomNoise} \cdot 3}{\sqrt{10{,}000}}$$ For a coverage factor of 3 σ and averaging 10,000 points

* 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 σ

For example, on the 10 V range, the absolute accuracy at full scale is as follows:
GainError = 95 ppm + 8 ppm · 1 + 5 ppm · 10 GainError = 153 ppm
OffsetError = 15 ppm + 35 ppm · 1 + 46 ppm OffsetError = 96 ppm

$$\text{NoiseUncertainty} = \frac{252\ \mu\text{V} \cdot 3}{\sqrt{10{,}000}}$$ NoiseUncertainty = 7.6 μV

AbsoluteAccuracy = 10 V · (GainError) + 10 V · (OffsetError) + NoiseUncertainty AbsoluteAccuracy = 2,498 μV

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

# AO Absolute Accuracy Table

| Nominal Range | | 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) |
|---|---|---|---|---|---|---|---|---|
| Positive Full Scale | Negative Full Scale | | | | | | | |
| 10 | -10 | 110 | 17 | 5 | 65 | 1 | 64 | 3,066 |
| 5 | -5 | 117 | 8 | 5 | 65 | 1 | 64 | 1,526 |

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

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

GainError = ResidualGainError + GainTempco · (TempChangeFromLastInternalCal) + ReferenceTempco · (TempChangeFromLastExternalCal)

OffsetError = ResidualOffsetError + AOOffsetTempco · (TempChangeFromLastInternalCal) + INL_Error

# Digital I/O/PFI

## Static Characteristics

Number of channels

- NI 6366 ..... 24 total, 8 (P0.<0..7>), 16 (PFI <0..7>/P1, PFI <8..15>/P2)
- NI 6368 ..... 48 total, 32 (P0.<0..31>), 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 typ, 20 kΩ min

Input voltage protection[1] ..... ±20 V on up to two pins

## Waveform Characteristics (Port 0 Only)

Terminals used

- NI 6366 ..... Port 0 (P0.<0..7>)
- NI 6368 ..... Port 0 (P0.<0..31>)

Port/sample size

- NI 6366 ..... Up to 8 bits
- NI 6368 ..... Up to 32 bits

Waveform generation (DO) FIFO ..... 2,047 samples

Waveform acquisition (DI) FIFO ..... 255 samples

DI Sample Clock frequency

- NI PXIe-6366/6368 ..... 0 to 10 MHz, system and bus activity dependent
- NI USB-6366 ..... 0 to 1 MHz, system and bus activity dependent

DO Sample Clock frequency

- NI PXIe-6366/6368
  - Regenerate from FIFO ..... 0 to 10 MHz
  - Streaming from memory ..... 0 to 10 MHz, system and bus activity dependent
- NI USB-6366
  - Regenerate from FIFO ..... 0 to 10 MHz
  - Streaming from memory ..... 0 to 1 MHz, system and bus activity dependent

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

Data transfers

NI PXIe-6366/6368 ..... DMA (scatter-gather), programmed I/O

NI USB-6366 ..... 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 Operation Conditions

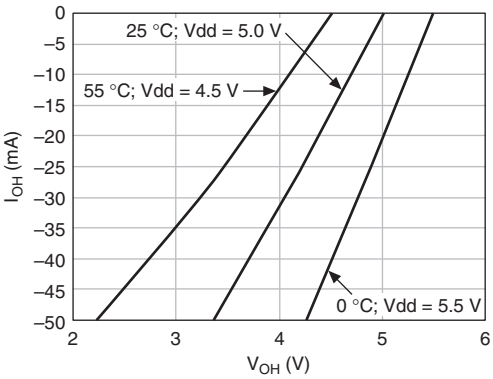
| Level | Min | Max |
|---|---|---|
| Input high voltage ($V_{IH}$) | 2.2 V | 5.25 V |
| Input low voltage ($V_{IL}$) | 0 V | 0.8 V |
| Output high current ($I_{OH}$) | | |
| P0.<0..7> | — | -24 mA |
| PFI <0..15>/P1/P2 | — | -16 mA |
| Output low current ($I_{OL}$) | | |
| P0.<0..7> | — | 24 mA |
|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

## Electrical Characteristics

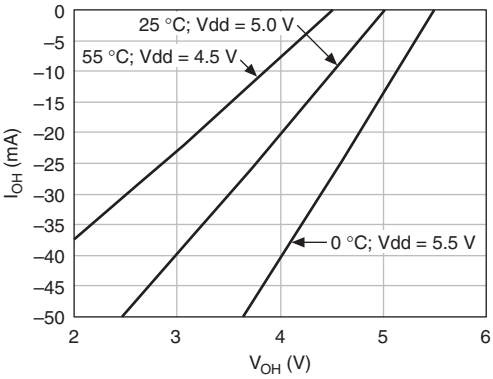
| Level | Min | Max |
|---|---|---|
| Positive-going threshold (VT+) | — | 2.2 V |
| Negative-going threshold (VT-) | 0.8 V | — |
| Delta VT hysteresis (VT+ - VT-) | 0.2 V | — |
| $I_{IL}$ input low current ($V_{in}$ = 0 V) | — | -10 µA |
| $I_{IH}$ input high current ($V_{in}$ = 5 V) | — | 250 µA |

# Digital I/O Characteristics

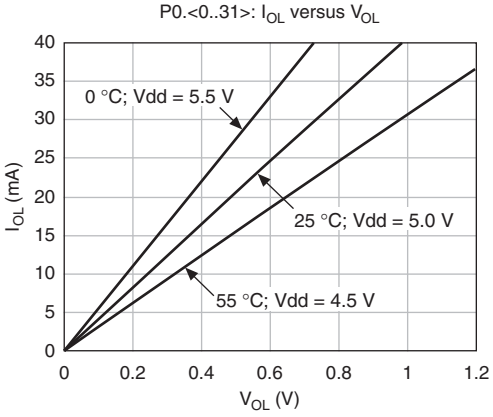
P0.<0..31>: $I_{OH}$ versus $V_{OH}$

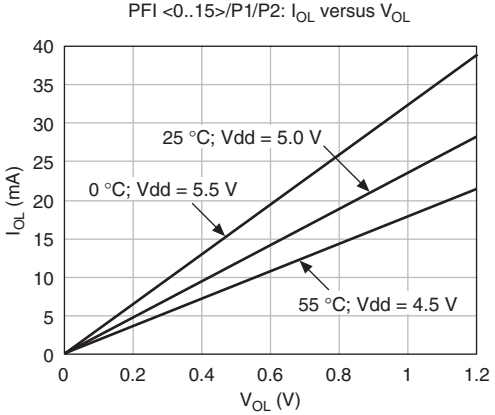



PFI <0..15>/P1/P2: $I_{OH}$ versus $V_{OH}$




P0.<0..31>: $I_{OL}$ versus $V_{OL}$






# General-Purpose Counter/Timers

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

- NI PXIe-6366/6368 ..... 0 MHz to 25 MHz; 0 MHz to 100 MHz on PXIe_DSTAR<A,B>
- NI USB-6366 ..... 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

- NI PXIe-6366/6368 ..... Any PFI, PXIe_DSTAR<A,B>, PXI_TRIG, PXI_STAR, analog trigger, many internal signals
- NI USB-6366 ..... Any PFI, analog trigger, many internal signals

FIFO ..... 127 samples per counter

Data transfers

- NI PXIe-6366/6368 ..... Dedicated scatter-gather DMA controller for each counter/timer, programmed I/O
- NI USB-6366 ..... 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

Reference clock locking frequencies

| Reference Signal | Locking Input Frequency (MHz) | |
|---|---|---|
| | PXIe | USB |
| 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

NI PXIe-6366/6368 ..... Any PFI, PXIe_DSTAR<A,B>, PXI_TRIG, PXI_STAR

NI USB-6366 ..... 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

- NI PXIe-6366/6368 ..... PXI_TRIG <0..7>, PXI_STAR, PXIe_DSTAR<A,B>
- NI USB-6366 ..... None

Output destination

- NI PXIe-6366/6368 ..... PXI_TRIG <0..7>, PXIe-DSTARC
- NI USB-6366 ..... 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

NI PXIe-6366/6368

- 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, analog input, analog output, digital input, digital output, counter/timer 0, counter/timer 1, counter/timer 2, counter/timer 3

All NI PXIe-6366/6368 devices may be installed in PXI Express slots or PXI Express hybrid slots.

NI USB-6366

- USB compatibility ..... USB 2.0 Hi-Speed or full-speed[1]
- 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

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

# Power Requirements

**Caution** The protection provided by the NI 6366/6368 can be impaired if it is used in a manner not described in the *X Series User Manual*.

NI PXIe-6366

+3.3 V ..... 4.75 W

+12 V ..... 15.6 W

NI PXIe-6368

+3.3 V ..... 8.2 W

+12 V ..... 21.8 W

**Caution** NI USB-6366 devices *must* be powered with 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.

NI USB-6366

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

# Current Limits

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

NI PXIe-6366

+5 V terminal (connector 0) ..... 1 A max[1]

NI PXIe-6368

+5 V terminal (connector 0) ..... 1 A max[1]

+5 V terminal (connector 1) ..... 1 A max[1]

P0/PFI/P1/P2 and +5 V terminals combined..... 1.7 A max

NI USB-6366

+5 V terminal..... 1 A max[1]

[1] Has a self-resetting fuse that opens when current exceeds this specification.

# Physical Requirements

Printed circuit board dimensions
NI PXIe-6366/6368 ..... Standard 3U PXI

Enclosure dimensions (includes connectors)
NI USB-6366
- Mass Termination ..... 18.5 × 17.3 × 3.6 cm (7.3 × 6.8 × 1.4 in.)
- 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
- NI PXIe-6366 ..... 168 g (5.9 oz)
- NI PXIe-6368 ..... 241 g (8.5 oz)
- NI USB-6366
  - Mass Termination ..... 967 g (2 lb 2.1 oz)
  - Screw Terminal ..... 1.428 kg (3 lb 2.3 oz)
  - BNC ..... 1.536 kg (3 lb 6.2 oz)

I/O connector
- NI PXIe-6366 ..... 1 68-pin VHDCI
- NI PXIe-6368 ..... 2 68-pin VHDCI
- NI USB-6366
  - Mass Termination ..... 1 68-pin VHDCI
  - Screw Terminal ..... 64 screw terminals
  - BNC ..... 20 BNCs and 30 screw terminals

NI PXIe-6366/6368 and NI USB-6366 Mass Termination mating connectors:

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

NI USB-6366 Screw Terminal/BNC
screw terminal wiring ..... 16 to 24 AWG

If you need to clean the chassis, wipe it with a dry towel.

# Maximum Working Voltage[1]

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

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

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

# Environmental

Operating temperature

- NI PXIe-6366/6368 ..... 0 to 55 °C
- NI USB-6366 ..... 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.

# Shock and Vibration (NI PXIe-6366/6368 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 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.)

# Safety

This product meets the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

**Note** For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

# Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-1 (IEC 61326-1): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

**Note** In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia, and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.

**Note** Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally 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

To obtain product certifications and the Declaration of Conformity (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`.

## 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`.)

# Contact Information

National Instruments corporate headquarters
11500 North Mopac Expressway, Austin, Texas, 78759-3504
512 795 8248
`ni.com/niglobal`

**Figure 1.** NI PXIe-6366 Pinout

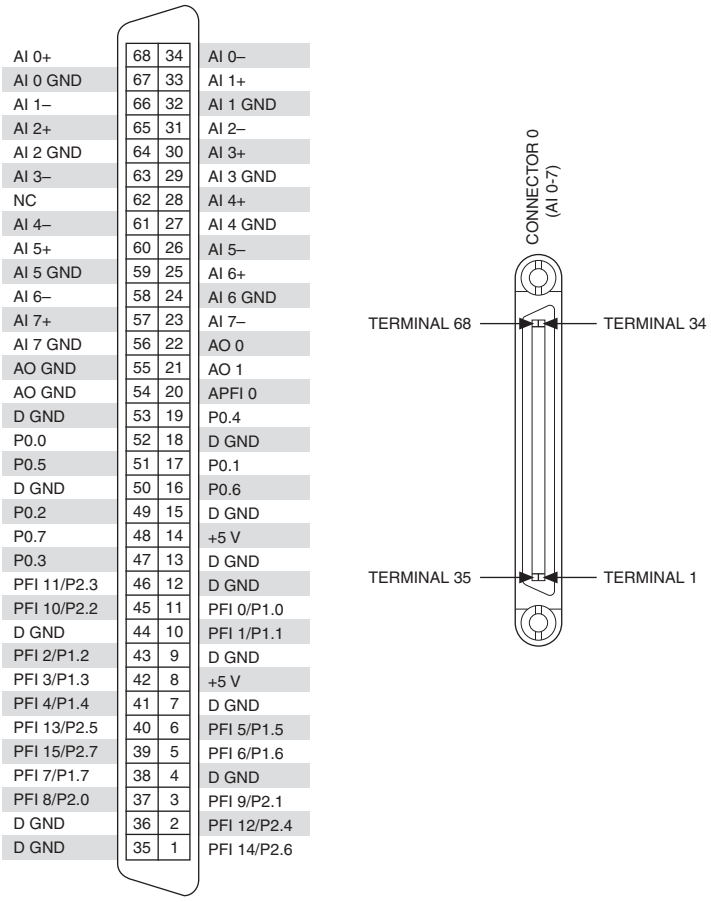


**Figure 2.** NI USB-6366 Mass Termination Pinout

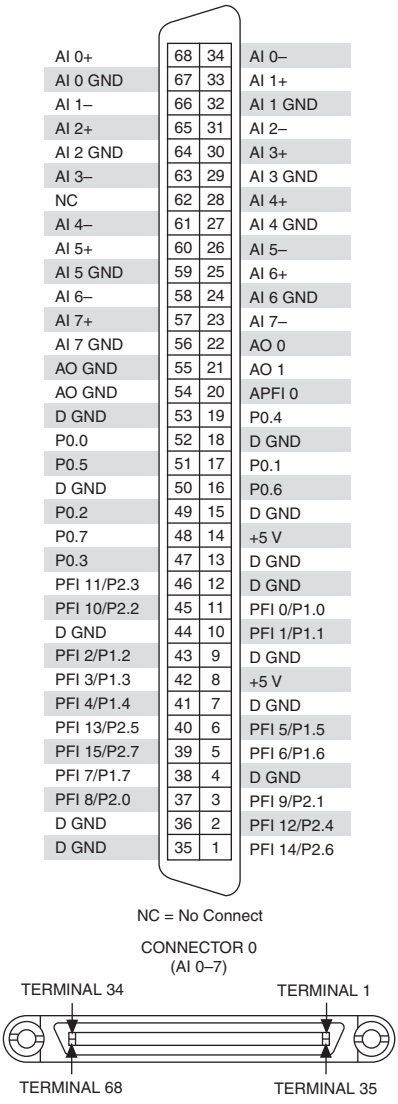
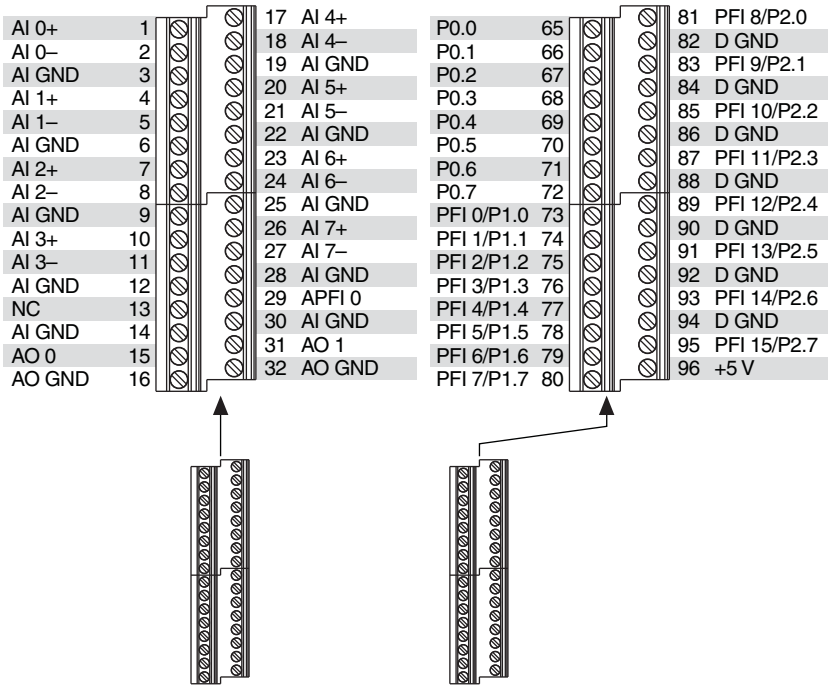


**Figure 3.** NI USB-6366 Screw Terminal Pinout




NC = No Connect

**Figure 4.** NI USB-6366 BNC Front Panel and Pinout

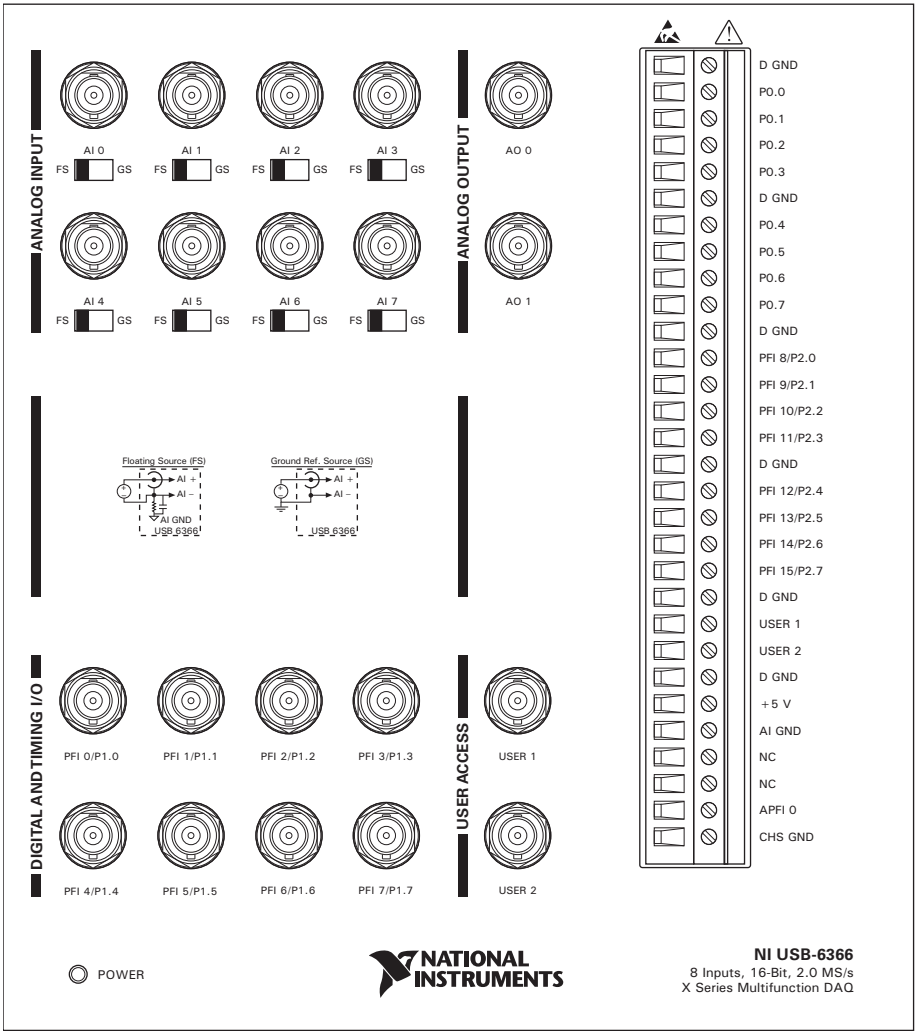


**Figure 5.** NI PXIe-6368 Pinout