

NI 6132/6133 Specifications

This document lists the I/O terminal summary and specifications for the NI PXI-6132/6133.

For the most current edition of this document, refer to ni.com/manuals. Refer to the *DAQ Quick Start Guide* for more information about accessing documents on the NI-DAQ CD.



Note With NI-DAQmx, National Instruments has revised its terminal names so they are easier to understand and more consistent among NI hardware and software products. The revised terminal names used in this document are usually similar to the names they replace. For a complete list of Traditional NI-DAQ terminal names and their NI-DAQmx equivalents, refer to the *Terminal Name Equivalents* table in the *S Series Help*.

Table 1. I/O Terminal Summary

| Terminal Name | Terminal Type and Direction | Impedance Input/ Output | Protection (Volts) On/Off | Source (mA at V) | Sink (mA at V) | Rise Time (ns) | Bias |
|-------------------------|-----------------------------|---------------------------------------|---------------------------|------------------------------|----------------|----------------|----------------------------|
| AI <0..7> | AI | 100 M Ω in parallel with 10 pF | 35/25 | — | — | — | ± 16 nA ± 35 nA |
| AI GND | — | — | — | — | — | — | — |
| D GND | — | — | — | — | — | — | — |
| +5 V | — | 0.1 Ω 0.45 Ω | Short-circuit to ground | 1 A | — | — | — |
| P0.<0..7> | DIO | — | $V_{CC} + 0.5$ | 13 at ($V_{CC} - 0.4$) | 24 at 0.4 | 1.1 | 50 k Ω pu |
| EXTSTROBE* | DO | — | — | 3.5 at ($V_{CC} - 0.4$) | 5 at 0.4 | 1.5 | 50 k Ω pu |
| PFI 0/ AI START TRIG | DIO | — | $V_{CC} + 0.5$ | 3.5 at ($V_{CC} - 0.4$) | 5 at 0.4 | 1.5 | 50 k Ω pu |
| PFI 1/ AI REF TRIG | DIO | — | $V_{CC} + 0.5$ | 3.5 at ($V_{CC} - 0.4$) | 5 at 0.4 | 1.5 | 50 k Ω pu |
| PFI 2 | DIO | — | $V_{CC} + 0.5$ | 3.5 at ($V_{CC} - 0.4$) | 5 at 0.4 | 1.5 | 50 k Ω pu |

Table 1. I/O Terminal Summary (Continued)

| Terminal Name | Terminal Type and Direction | Impedance Input/Output | Protection (Volts) On/Off | Source (mA at V) | Sink (mA at V) | Rise Time (ns) | Bias |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------------------|---------------------------|------------------------------|----------------|----------------|------------------|
| PFI 3/ CTR 1 SOURCE | DIO | — | $V_{CC} + 0.5$ | 3.5 at ($V_{CC} - 0.4$) | 5 at 0.4 | 1.5 | 50 k Ω pu |
| PFI 4/ CTR 1 GATE | DIO | — | $V_{CC} + 0.5$ | 3.5 at ($V_{CC} - 0.4$) | 5 at 0.4 | 1.5 | 50 k Ω pu |
| CTR 1 OUT | DO | — | — | 3.5 at ($V_{CC} - 0.4$) | 5 at 0.4 | 1.5 | 50 k Ω pu |
| PFI 5 | DIO | — | $V_{CC} + 0.5$ | 3.5 at ($V_{CC} - 0.4$) | 5 at 0.4 | 1.5 | 50 k Ω pu |
| PFI 6 | DIO | — | $V_{CC} + 0.5$ | 3.5 at ($V_{CC} - 0.4$) | 5 at 0.4 | 1.5 | 50 k Ω pu |
| PFI 7/ AI SAMP CLK | DIO | — | $V_{CC} + 0.5$ | 3.5 at ($V_{CC} - 0.4$) | 5 at 0.4 | 1.5 | 50 k Ω pu |
| PFI 8/ CTR 0 SOURCE | DIO | — | $V_{CC} + 0.5$ | 3.5 at ($V_{CC} - 0.4$) | 5 at 0.4 | 1.5 | 50 k Ω pu |
| PFI 9/ CTR 0 GATE | DIO | — | $V_{CC} + 0.5$ | 3.5 at ($V_{CC} - 0.4$) | 5 at 0.4 | 1.5 | 50 k Ω pu |
| CTR 0 OUT | DO | — | — | 3.5 at ($V_{CC} - 0.4$) | 5 at 0.4 | 1.5 | 50 k Ω pu |
| FREQ OUT | DO | — | — | 3.5 at ($V_{CC} - 0.4$) | 5 at 0.4 | 1.5 | 50 k Ω pu |
| AI = Analog Input DIO = Digital Input/Output DO = Digital Output pu = pull-up Note: The tolerance on the 50 k Ω pull-up resistors is large. Actual value might range between 17 k Ω and 100 k Ω . | | | | | | | |

Specifications

The following specifications are typical at 25 °C unless otherwise noted.

Analog Input

Input Characteristics

Number of channels

NI 6132.....4

NI 6133.....8

Type of ADC

Resolution.....14 bits, 1 in 16,384

Pipeline.....0

| | |
|------------------------------------------------------|---------------------------------------|
| Sampling rate | |
| Maximum | 2.5 MS/s per channel |
| Minimum | No minimum |
| Input impedance | |
| AI – to AI GND | 100 M Ω in parallel with 10 pF |
| AI + to AI GND | 100 M Ω in parallel with 10 pF |
| Input bias current | ± 2 pA typ, ± 25 pA max |
| Input offset current..... | ± 1 pA typ, ± 10 pA max |
| Input coupling | DC |
| Max working voltage for all analog input channels | |
| Positive input (AI +) | ± 13 V for all ranges |
| Negative input (AI –)..... | ± 13 V for all ranges |
| Overvoltage protection | |
| (AI +, AI –) | ± 36 V |
| Input current during overvoltage conditions | |
| | ± 20 mA max |
| Input FIFO size | |
| NI 6132 | 16 MS |
| NI 6133 | 16 or 32 MS |
| Data transfers | DMA, interrupts, programmed I/O |
| DMA mode | Scatter-gather |

DC Transfer Characteristics

| | |
|-----------|-----------------------------------------------------|
| INL | ± 0.6 LSB typ, ± 1 LSB max |
| DNL | ± 0.25 typ, ± 0.75 max, no missing codes |

Absolute Accuracy

| Nominal Range at Full Scale (V) | Residual Gain Error (ppm of Reading) | Gain Tempco (ppm/°C) | Reference Tempco | Residual Offset Error (ppm of Range) | Offset Tempco (ppm of Range/°C) | INL Error (ppm of Range) | Random Noise, σ (μ Vrms) | Absolute Accuracy at Full Scale ¹ (μ V) | Sensitivity ² (μ V) |
|---------------------------------|--------------------------------------|----------------------|------------------|--------------------------------------|---------------------------------|--------------------------|--------------------------------------|---------------------------------------------------------|-------------------------------------|
| ±10 | 151 | 25 | 5 | 47 | 39 | 122 | 1080 | 4660 | 432.0 |
| ±5 | 176 | 25 | 5 | 40 | 43 | 122 | 546 | 2440 | 218.4 |
| ±2.5 | 207 | 25 | 5 | 47 | 61 | 122 | 305 | 1370 | 122.0 |
| ±1.25 | 234 | 25 | 5 | 45 | 78 | 122 | 172 | 740 | 68.8 |

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

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

OffsetError = ResidualOffsetError + OffsetTempco · (TempChangeFromLastInternalCal) + INL_Error

NoiseUncertainty = $\frac{\text{RandomNoise} \cdot 3}{\sqrt{100}}$
 For a coverage factor of 3 σ and averaging 100 points.

¹ 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, the absolute accuracy at full scale is as follows:

GainError = 60 ppm + 13 ppm · 1 + 1 ppm · 10

GainError = 83 ppm

OffsetError = 20 ppm + 21 ppm · 1 + 60 ppm

OffsetError = 101 ppm

NoiseUncertainty = $\frac{275 \mu\text{V} \cdot 3}{\sqrt{100}}$

NoiseUncertainty = 83 μ V

AbsoluteAccuracy = 10 V · (GainError) + 10 V · (OffsetError) + NoiseUncertainty

AbsoluteAccuracy = 1920 μ V

² Sensitivity is the smallest voltage change that can be detected. It is a function of noise.

Dynamic Characteristics

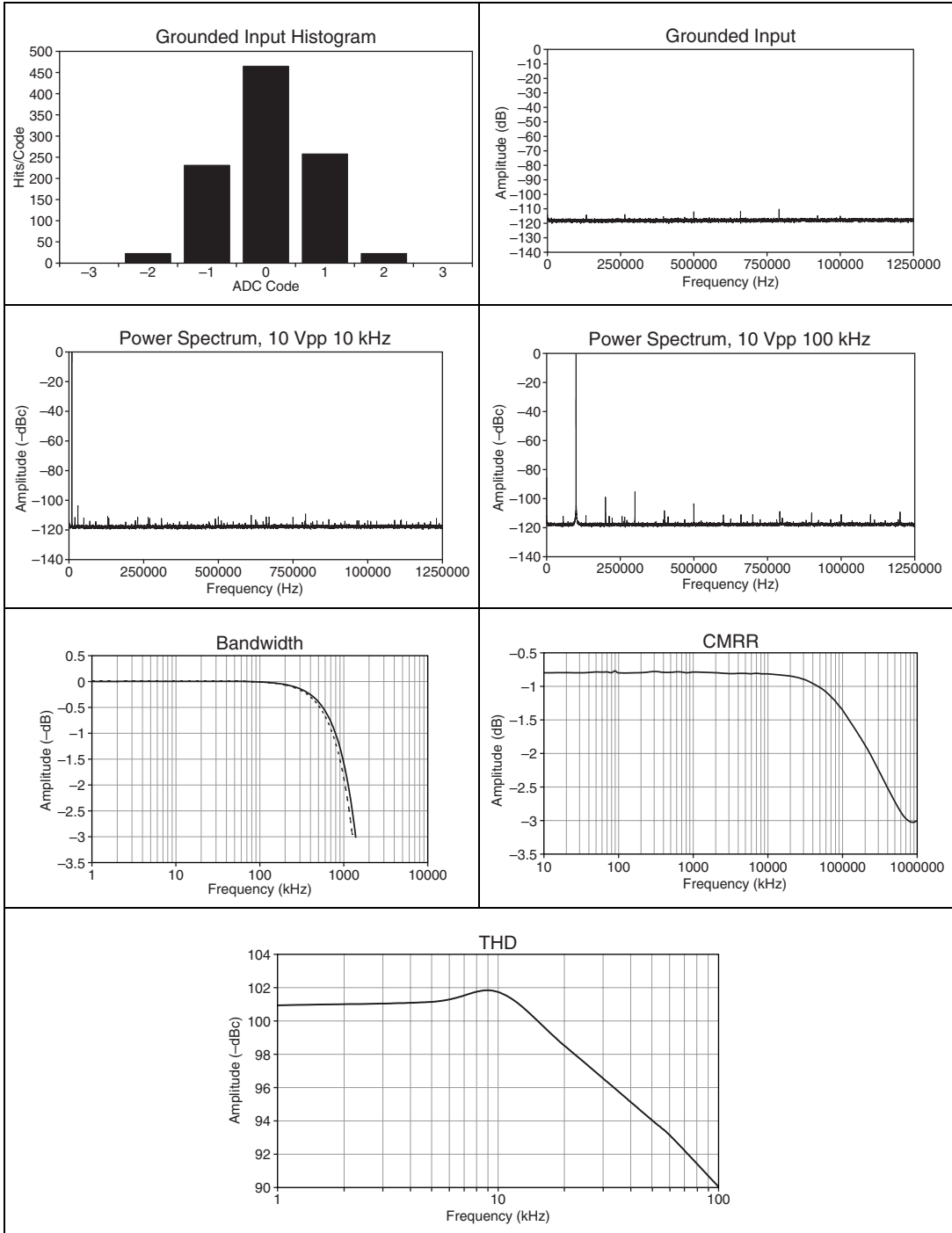
Phase mismatch..... $\pm 2^\circ$ at 1 MHz

Table 2. NI 6132/6133 Analog Input Dynamic Characteristics

| Input Range | Bandwidth ¹ (MHz) | SFDR Typ ² (dB) | CMRR ³ (dB) | System Noise ⁴ (LSB _{rms}) | Crosstalk ⁵ (dB) | THD (dB at 10 kHz) |
|--------------|---------------------------------|-------------------------------|---------------------------|-------------------------------------------------------|--------------------------------|--------------------------|
| ± 10 V | 1.3 | 95 | 70 | 0.78 | -74 | -101.1 |
| ± 5 V | 1.3 | 95 | 70 | 0.79 | -74 | -102.5 |
| ± 2.5 V | 1.25 | 96 | 70 | 0.86 | -74 | -102.2 |
| ± 1.25 V | 1.25 | 94 | 70 | 0.95 | -74 | -102.1 |

¹ -3 dB frequency for input amplitude at 10% of the input range (-20 dB)
² Measured at 100 kHz with twelfth-order bandpass filter after signal source
³ DC to 60 Hz
⁴ LSB_{rms}, including quantization
⁵ DC to 100 kHz

Typical Performance Graphs



Stability

Recommended warm-up time 15 min

Calibration

Level..... 5.000 V (± 2.5 mV)
(actual value stored in EEPROM)

Temperature coefficient ± 5.0 ppm/ $^{\circ}$ C max

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

Digital I/O

Number of channels 8 input/output

Compatibility TTL/CMOS

Table 3. Digital Logic Levels

| Level | Min | Max |
|-----------------------------------------|--------|--------------|
| Input low voltage | 0.0 V | 0.8 V |
| Input high voltage | 2.0 V | 5.0 V |
| Input low current ($V_{in} = 0$ V) | — | -320 μ A |
| Input high current ($V_{in} = 5$ V) | — | 10 μ A |
| Output low voltage ($I_{OL} = 24$ mA) | — | 0.4 V |
| Output high voltage ($I_{OH} = 13$ mA) | 4.35 V | — |

Power-on state..... Input (high-impedance)

Data transfers DMA, interrupts,
programmed I/O

Input buffer 2,044 bytes

Output buffer..... 2,044 bytes

Transfer rate (1 word = 8 bits) 10 Mwords/s

Timing I/O

Number of channels 2 up/down counter/timers,
1 frequency scaler

| | |
|---------------------------------|------------------------------------|
| Resolution | |
| Counter/timers | 24 bits |
| Frequency scaler | 4 bits |
| Compatibility | TTL/CMOS |
| Base clocks available | |
| Counter/timers | 20 MHz, 100 kHz |
| Frequency scaler | 10 MHz, 100 kHz |
| Base clock accuracy | $\pm 0.01\%$ |
| Max source frequency | 20 MHz |
| Min source pulse duration | 10 ns, edge-detect mode |
| Min gate pulse duration | 10 ns, edge-detect mode |
| Data transfers | DMA, interrupts, programmed I/O |
| DMA modes | Scatter-gather |

Triggers

Analog Trigger

| | |
|----------------------------|-----------------------------------------------|
| Source | All analog input channels |
| Level | \pm full-scale |
| Slope | Positive or negative (software-selectable) |
| Resolution | 8 bits, 1 in 256 |
| Hysteresis | Programmable |
| Bandwidth (-3 dB) | 5 MHz internal/external |

Digital Trigger

| | |
|---------------------|------------------------|
| Compatibility | TTL |
| Response | Rising or falling edge |
| Pulse width | 10 ns min |

PXI Trigger Bus

| | |
|---------------------------|---|
| Trigger lines <0..6>..... | 7 |
| Star trigger..... | 1 |

Bus Interface

Type Master, slave

Power Requirement

| | |
|----------------------------------------|---------------------------|
| +5 VDC ($\pm 5\%$) | |
| NI 6132 | 2.2 A |
| NI 6133 | 3.0 A |
| +3.3 V..... | 0.8 A |
| Power available at I/O connector | +4.65 to +5.25 VDC at 1 A |

Physical

| | |
|------------------------------------------------|--------------------------------------------|
| Dimensions (not including connectors) | 16.0 cm by 10.0 cm (6.3 in. by 3.9 in.) |
| I/O connector..... | 68-pin male SCSI-II type |

Maximum Working Voltage

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

Channel-to-earth..... 36 V, Installation Category I

Environmental

| | |
|------------------------------------------|-----------------------------|
| Operating temperature..... | 0 to 50 °C |
| Storage temperature | -20 to 70 °C |
| Humidity | 10 to 90% RH, noncondensing |
| Maximum altitude | 2,000 m |
| Pollution Degree (indoor use only) | 2 |

Safety

The NI 6132/6133 devices are designed to meet 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
- CAN/CSA-C22.2 No. 61010-1



Note For UL and other safety certifications, refer to the product label, or visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

Electromagnetic Compatibility

EmissionsEN 55011 Class A at 10 m
FCC Part 15A above 1 GHz

ImmunityEN 61326:1997 + A2:2001,
Table 1

EMC/EMICE, C-Tick, and FCC Part 15
(Class A) Compliant



Note For EMC compliance, operate this device with shielded cabling.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

Low-Voltage Directive (safety).....73/23/EEC

Electromagnetic Compatibility
Directive (EMC)89/336/EEC



Note Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain 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.

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