SPECIFICATIONS

NI USB-6001

Low-Cost DAQ USB Device

The following specifications are typical at 25 °C, unless otherwise noted. For more information about the NI USB-6001, refer to the *NI USB-6001/6002/6003 User Guide* available at `ni.com/manuals`.

Analog Input

Number of channels

- Differential....4
- Single-ended....8

ADC resolution....14-bit

Maximum sample rate (aggregate)....20 kS/s

Converter type....Successive approximation

AI FIFO....2,047 samples

Trigger sources....Software, PFI 0, PFI 1

NATIONAL INSTRUMENTS

Input range.....±10 V

Working voltage.....±10 V

Overvoltage protection

- Powered-on.....±30 V
- Powered-off.....±20 V

Input impedance.....>1 GΩ

Input bias current.....±200 pA

Absolute accuracy

- Typical at full scale.....6 mV
- Maximum over temperature, full scale.....26 mV
- System noise.....0.7 mVrms

DNL.....14-bit, no missing codes

INL.....±0.5 LSB

CMRR.....56 dB (DC to 5 kHz)

Bandwidth.....300 kHz

Analog Output

Analog outputs.....2

DAC resolution.....14-bit

Output range.....±10 V

Maximum update rate.....5 kS/s simultaneous per channel, hardware-timed

AO FIFO.....2,047 samples

Trigger sources.....Software, PFI 0, PFI 1

Output current drive.....±5 mA

Short circuit current.....±11 mA

Slew rate.....3 V/µs

Output impedance.....0.2 Ω

Absolute accuracy (no load)

- Typical at full scale.....9.1 mV
- Maximum over temperature, full scale.....34 mV

DNL.....14-bit, no missing codes

INL.....±1 LSB

Power-on state.....0 V

Startup glitch.....-7 V for 10 µs

Timebase

Note The following specifications apply to the sampling accuracy for hardware-timed analog input and analog output.

Timebase frequency.....80 MHz

Timebase accuracy.....±100 ppm

Timing resolution.....12.5 ns

Digital I/O

13 digital lines

- Port 0.....8 lines
- Port 1.....4 lines
- Port 2.....1 lines

Function

- P0.<0..7>.....Static digital input/output
- P1.0.....Static digital input/output
- P1.1/PFI 1.....Static digital input/output, counter source or digital trigger

P1.<2..3>.....Static digital input/output

P2.0/PFI 0.....Static digital input/output, counter source or digital trigger

Direction control.....Each channel individually programmable as input or output

Output driver type.....Each channel individually programmable as open collector or active drive

Absolute maximum voltage range.....-0.3 V to 5. 5 V with respect to D GND

Pull-down resistor.....47.5 kΩ to D GND

Power-on state.....Input

Digital Input

Input voltage range (powered on).....0 to 5 V

Input voltage range (powered off).....0 to 3.3 V

Input voltage protection.....±20 V on two lines per port (maximum of five lines for all ports) for up to 24 hours

Caution Do not leave a voltage above 3.3 V connected on any DIO line for extended periods of time when the device is powered off. This may lead to long term reliability issues.

Minimum V_{IH}.....2.3 V

Maximum V_{IL}.....0.8 V

Maximum input leakage current

At 3.3 V.....0.8 mA

At 5 V.....4.5 mA

Digital Output (Active Drive)

Maximum V_{OL} (4 mA).....0.7 V

Maximum V_{OL} (1 mA).....0.2 V

Minimum V_{OH} (4 mA).....2.1 V

Minimum V_{OH} (1 mA).....2.8 V

Maximum V_{OH}.....3.6 V

Maximum output current per line.....±4 mA

Digital Output (Open Collector)

Maximum V_{OL} (4 mA).....0.8 V

Maximum V_{OL} (1 mA).....0.2 V

Note Minimum V_{OH} dependent on user-provided pull-up resistor and voltage source. Recommended pull-up resistor is 1 kΩ.

Using a 1 kΩ pull-up resistor and 5 V voltage source:

- Minimum V_{OH}.....3.5 V
- Typical V_{OH}.....4.5 V

Maximum output (sinking) current per line.....-4 mA

Maximum pull-up voltage.....5 V

Maximum leakage current

- At 3.3 V.....0.8 mA
- At 5 V.....4.5 mA

Counter

Number of counters.....1

Resolution.....32-bit

Counter measurements.....Edge counting, rising or falling

Counter direction.....Count up

Counter source.....PFI 0 or PFI 1

Maximum input frequency.....5 MHz

Minimum high pulse width.....100 ns

Minimum low pulse width.....100 ns

+5 V Power Source

Output voltage.....+5 V, ±3%

Maximum current.....150 mA

Overcurrent protection.....200 mA

Short circuit current.....50 mA

Overvoltage protection.....±20 V

Bus Interface

USB specification.....USB Full Speed

USB bus speed.....12 Mb/s

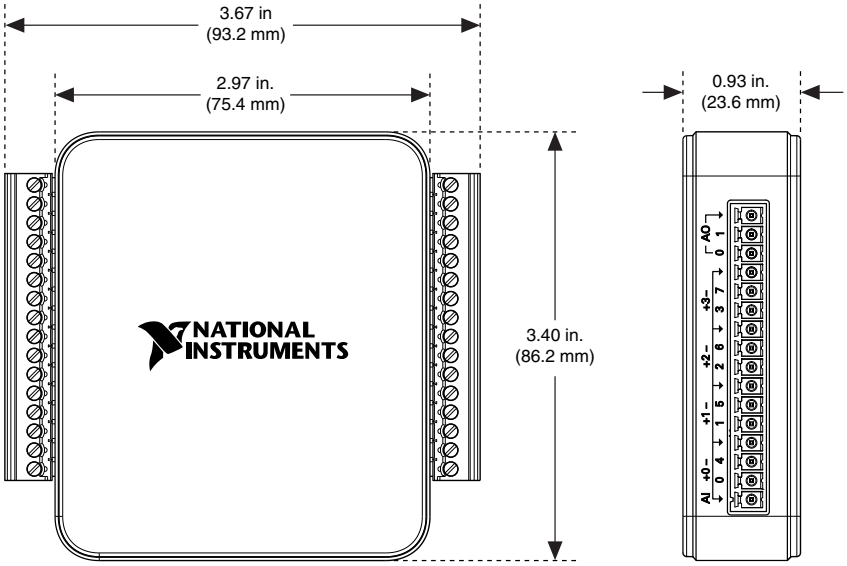
Physical Characteristics

Dimensions

Without screw terminal connector plugs....75.4 mm × 86.2 mm × 23.6 mm, (2.97 in. × 3.40 in. × 0.93 in.)

With screw terminal connector plugs.....93.2 mm × 86.2 mm × 23.6 mm, (3.67 in. × 3.40 in. × 0.93 in.)

Figure 1. NI USB-6001 Dimensions



Weight

Without screw terminal connector plugs....83 g (2.93 oz)

With screw terminal connector plugs.....105 g (3.70 oz)

I/O connectors: USB Micro-B receptacle, (1)

16-position screw terminal plugs

Screw-terminal wiring.....1.31 to 0.08 mm^2 (16 to 28 AWG)

Torque for screw terminals.....0.22 - 0.25 N · m (2.0 - 2.2 lb. · in.)

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

Environmental

Temperature (IEC 60068-2-1 and IEC 60068-2-2)

Operating.....0 to 45 °C

Storage.....-40 to 85 °C

Humidity (IEC 60068-2-56)

Operating.....5 to 95% RH, noncondensing

Storage.....5 to 90% RH, noncondensing

Pollution Degree (IEC 60664).....2

Maximum altitude.....2,000 m

Indoor use only.

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 sensitive 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
- EN 55022 (CISPR 22): Class A emissions
- EN 55024 (CISPR 24): Immunity
- AS/NZS CISPR 11: Group 1, Class A emissions
- AS/NZS CISPR 22: 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 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 This symbol indicates that waste products should be disposed of separately from municipal household waste according to WEEE Directive 2002/96/EC of the European Parliament and the Council on waste electrical and electronic equipment (WEEE). All products at the end of their life cycle must be sent to a WEEE collection and recycling center. Proper WEEE disposal reduces environmental impact and the risk to human health due to potentially hazardous substances used in such equipment. Your cooperation in proper WEEE disposal will contribute to the effective usage of natural resources. For information about the available collection and recycling scheme in a particular country, go to *ni.com/environment/weee*.

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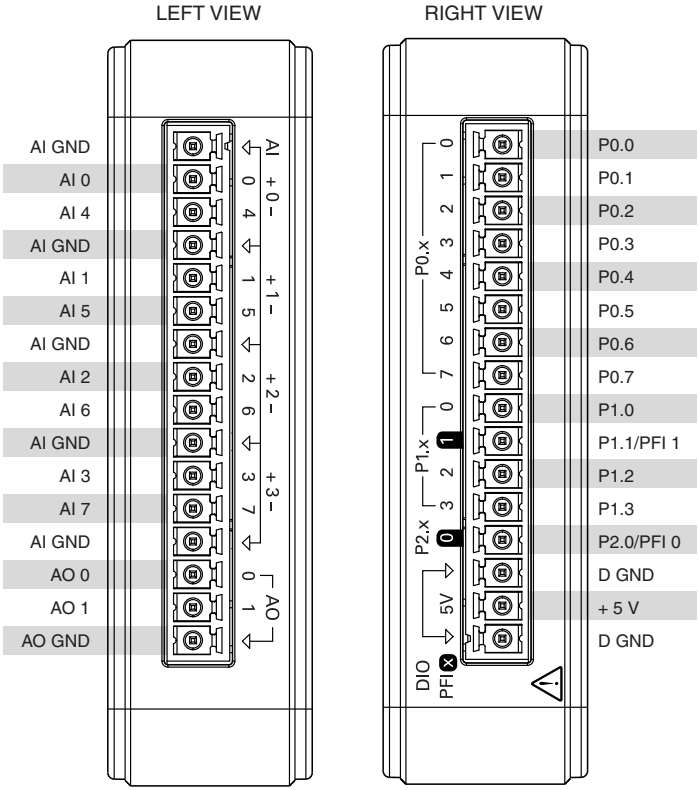
Device Pinout



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