# USB-6000 Specifications

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# USB-6000 Specifications

## Definitions

***Warranted*** specifications describe the performance of a model under stated operating conditions and are covered by the model warranty.

***Characteristics*** describe values that are relevant to the use of the model under stated operating conditions but are not covered by the model warranty.

- ***Typical*** specifications describe the performance met by a majority of models.
- ***Nominal*** specifications describe an attribute that is based on design, conformance testing, or supplemental testing.

Specifications are ***Typical*** unless otherwise noted.

## Conditions

Specifications are valid at 25 °C unless otherwise noted.

## Analog Input

| | |
|---|---|
| Number of analog inputs | 8, single-ended |
| Input resolution | 12 bits |
| Maximum sample rate (aggregate), system-dependent | 10 kS/s |
| Converter type | Successive approximation |

| | |
|---|---|
| AI FIFO | 2,047 samples |
| Timing resolution | 125 ns (8 MHz timebase) |
| Timing accuracy | 100 ppm of actual sample rate |
| Input range | ±10 V |
| Working voltage | ±10 V |
| Input impedance | >1 MΩ |
| Overvoltage protection | ±30 V |
| Trigger sources | Software, PFI 1 |
| System noise[1] | 10 mVrms |
| **Absolute accuracy at full scale, single-ended** | |
| Typical at 25 °C | 26 mV |
| Maximum over temperature | 135 mV |

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

> ***Number of readings*** = 100, ***Coverage factor*** = 3 σ.

# Digital I/O

| | |
|---|---|
| Number of digital I/O | 4 |
| **Function** | |
| P0.0/PFI 0 | Static digital I/O or counter source |
| P0.1/PFI 1 | Static digital I/O or AI Start Trigger |
| P0.2 | Static digital I/O |
| P0.3 | Static digital I/O |
| 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 V to 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 V to 5 V |
| Powered off | 0 V to 3.3 V |
| Input voltage protection | ±20 V, for up to 24 hours |

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

| | |
|---|---|
| Minimum $V_{IH}$ | 2.4 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 $V_{OL}$** | |
|---|---|
| At 4 mA | 0.8 V |

| | |
|---|---|
| At 1 mA | 0.2 V |
| **Minimum $V_{OH}$** | |
| At 4 mA | 2.2 V |
| At 1 mA | 2.9 V |
| Maximum $V_{OH}$ | 3.6 V |
| Maximum output current per line | ±4 mA |

## Digital Output (Open Collector)

| | |
|---|---|
| **Maximum $V_{OL}$** | |
| At 4 mA | 0.8 V |
| At 1 mA | 0.2 V |
| Minimum $V_{OH}$ | Dependent on user provided pull-up resistor and pull-up voltage |
| 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 bits |
| Counter measurements | Edge counting, rising or falling |
| Counter direction | Count up |
| Counter source | PFI 0 |
| Maximum input frequency | 5 MHz |
| Minimum high pulse width | 100 ns |
| Minimum low pulse width | 100 ns |

## Bus Interface

| | |
|---|---|
| USB specification | USB Full Speed |

| | |
|---|---|
| USB bus speed | 12 Mb/s |

## Power Requirements

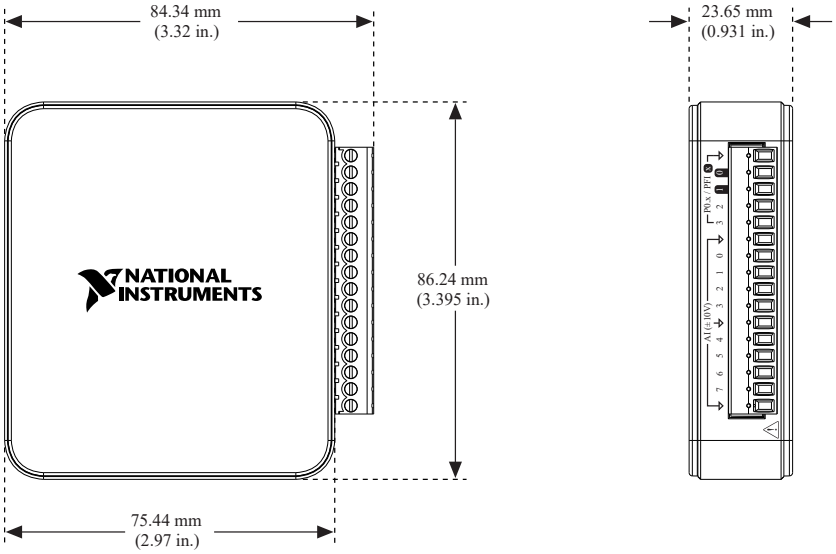
| | |
|---|---|
| From USB, 4.30 VDC to 5.25 VDC | 150 mA maximum |

**Note** A typical bus-powered hub provides 100 mA on its USB lines. The USB-6000 does not work on a bus-powered hub.

## Physical Characteristics

| **Dimensions** | |
|---|---|
| Without screw terminal connector plug | 75.44 mm × 86.24 mm × 23.65 mm<br>(2.97 in. × 3.40 in. × 0.93 in.) |
| With screw terminal connector plug | 84.34 mm × 86.24 mm × 23.65 mm<br>(3.32 in. × 3.40 in. × 0.93 in.) |

**Figure 1.** USB-6000 Dimensions




| | |
|---|---|
| **Weight** | |
| Without screw terminal connector plug | 73 g (2.58 oz) |
| With screw terminal connector plug | 84 g (3 oz) |
| USB connector | USB Micro-B receptacle (1) |
| **I/O connector** | |
| Type | 16-position screw terminal plug (1) |
| Screw-terminal wiring | 1.31 $mm^2$ to 0.08 $mm^2$ (16 AWG to 28 AWG) |
| Torque for screw terminals | 0.22 N · m to 0.25 N · m (2.0 lb. · in. to 2.2 lb. · in.) |

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

# Safety Voltages

Connect only voltages that are within these limits.

| | |
|---|---|
| Channel-to-GND | ±30 V max, 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 this module for connection to signals or for measurements within Measurement 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

| **Temperature (IEC 60068-2-1 and IEC 60068-2-2)** | |
|---|---|
| Operating | 0 °C to 40 °C |
| Storage | -40 °C to 85 °C |
| **Humidity (IEC 60068-2-56)** | |
| Operating | 5% to 90% RH, noncondensing |

| | |
|---|---|
| Storage | 5% to 95% RH, noncondensing |
| Pollution Degree (IEC 60664) | 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.

## Electromagnetic Compatibility

## 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)
- 2011/65/EU; Restriction of Hazardous Substances (RoHS)
- 2014/53/EU; Radio Equipment Directive (RED)
- 2014/34/EU; Potentially Explosive Atmospheres (ATEX)

# 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`.)