

# USB-200 Series

## 12-Bit Multifunction DAQ Devices



### Features

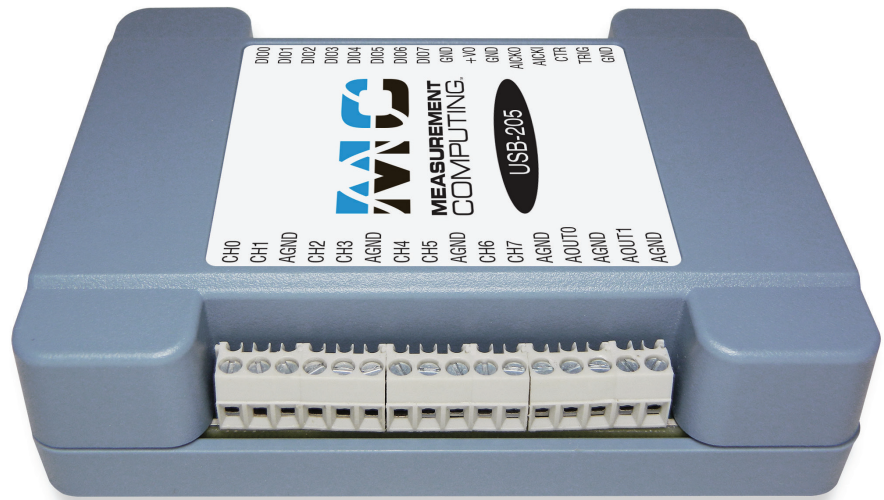
- Low cost, USB DAQ devices with eight 12-bit single-ended analog inputs
- Provides 12-bit analog input resolution
- Sample rates up to 500 kS/s
- Two 12-bit analog outputs (USB-202/202-OEM, USB-205/205-OEM)
- Eight individually-configurable high-drive (24 mA) digital I/O lines
- One 32-bit event counter input
- External pacer I/O
- No external power required
- Available with enclosure and screw terminals or as board-only OEM versions with header connectors
- ACC-205 DIN-rail kit available separately

### Software

- TracerDAQ® software for acquiring and displaying data and generating analog signals
- Universal Library includes support for Visual Studio® and Visual Studio® .NET, including examples for Visual C++®, Visual C#®, Visual Basic®, and Visual Basic® .NET
- Universal Library for Android includes support and examples for the Android 3.1 platform (API level 12) and later
- InstaCal software utility for installing, configuring, and testing
- ULx for NI LabVIEW™
- DAQami easy-to-use data acquisition software to acquire, view, and log data
- DAQFlex open-source software framework - includes support for Linux®, and Mac® platforms
- Comprehensive drivers for DASyLab®
- Supported by MATLAB® Data Acquisition Toolbox™

### Overview

The USB-200 Series provides improved cost/performance compared to our similarly priced 12-bit DAQ devices. Each device provides eight single-ended (SE) analog inputs, eight DIO channels, one event counter, and external pacer I/O. The USB-202/205 also provide two analog output channels.



The USB-205 (shown above) provides eight SE analog inputs, two analog outputs, a maximum sample rate of 500 kS/s, 8 digital I/O, and one event counter input.

USB-200 Series Selection Chart					
Model	Analog Input	Sample Rate	Analog Output	Signal I/O Connectors	USB Cable and SW CD
USB-201	8 SE (12-bit)	100 kS/s max	–	Screw Terminal	✓
USB-202	8 SE (12-bit)	100 kS/s max	2	Screw Terminal	✓
USB-204	8 SE (12-bit)	500 kS/s max	–	Screw Terminal	✓
USB-205	8 SE (12-bit)	500 kS/s max	2	Screw Terminal	✓
USB-201-OEM	8 SE (12-bit)	100 kS/s max	–	Header	–
USB-202-OEM	8 SE (12-bit)	100 kS/s max	2	Header	–
USB-204-OEM	8 SE (12-bit)	500 kS/s max	–	Header	–
USB-205-OEM	8 SE (12-bit)	500 kS/s max	2	Header	–

### Analog Input

USB-200 Series devices provide eight 12-bit SE analog inputs. The analog input range is fixed at  $\pm 10$  V.

### Sample Rate

The maximum continuous scan rate is an aggregate rate. The following table lists the maximum rate per channel when scanning from one to eight channels.

No. of Channels	Max Rate Per Channel (kS/s)	
	USB-201, USB-202 Standard and OEM	USB-204, USB-205 Standard and OEM
1	100	500
2	50	250
3	33.33	166.67
4	25	125
5	20	100
6	16.67	83.33
7	14.29	71.43
8	12.50	62.50

# USB-200 Series

## General Information



### Analog Output (USB-202/205 only)

The USB-202 and USB-205 standard and OEM versions have two 12-bit analog output channels. Both outputs can be updated simultaneously at a rate up to 125 S/s per channel. One output can be updated at a rate up to 250 S/s. The output range is fixed at 0 V to 5 V.

### External Pacer I/O

Each USB-200 Series device provides one external clock input and one clock output for the analog input pacer. You can connect an external clock signal to the external clock input terminal. When using the internal clock, each device outputs the ADC sample clock.

### Digital I/O

USB-200 Series devices provide eight TTL-level digital I/O lines. Each digital channel is software-selectable for input or output. When configured for input, you can use the digital I/O terminals to detect the state of any TTL-level input.

### Pull-Up/Pull-Down Configuration

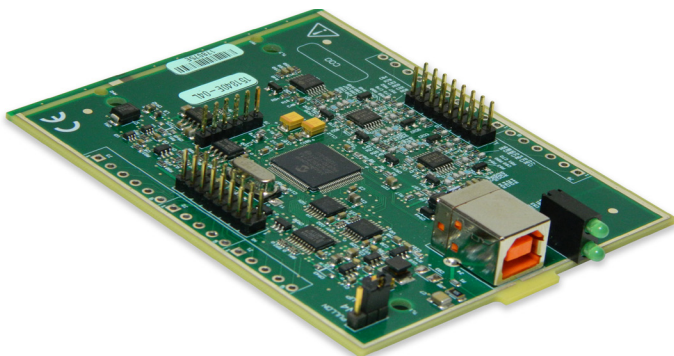
Each USB-200 Series device has a user-configurable internal jumper to configure the digital bits for pull-up or pull-down (default).

### Event Counter Input

Each USB-200 Series device supports one 32-bit TTL-level event counter that accepts inputs up to 1 MHz.

### USB-200 OEM Versions

OEM versions have board-only form factors with header connectors for OEM and embedded applications. All devices can be further customized to meet customer needs.



*The OEM versions have the same specifications as the standard devices, but come in a board-only form factor with header connectors instead of screw terminals.*

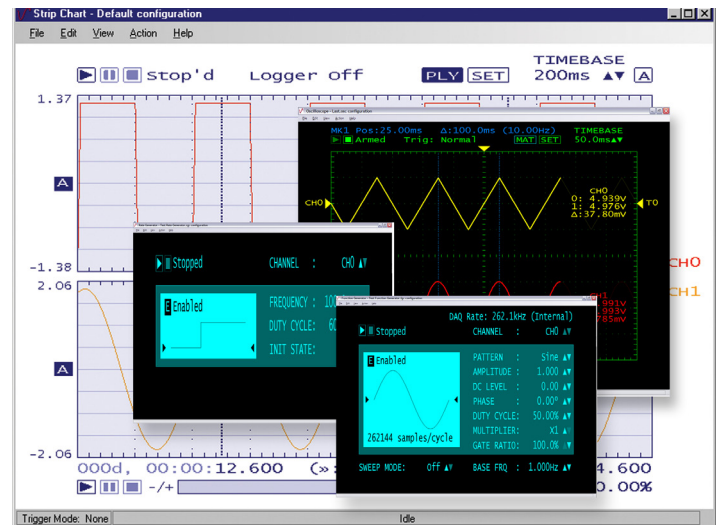
### MCC DAQ Software

USB-200 Series standard devices ship with the MCC DAQ software CD, which includes the InstaCal software utility for installing, calibrating, and testing Measurement Computing hardware. OEM customers can download this software from [www.mccdaq.com/software.aspx](http://www.mccdaq.com/software.aspx).

In addition to InstaCal, MCC DAQ software also includes the following software packages:

### TracerDAQ

TracerDAQ is an out-of-the-box application that can generate, acquire, analyze, display, and export data within seconds of installing Measurement Computing data acquisition hardware. TracerDAQ includes a strip chart, an oscilloscope, a function generator, and a rate generator, all of which are accessed through a common, easy-to-use interface.



*TracerDAQ provides four virtual instrument applications used to graphically display and store input data.*

### Universal Library

The Universal Library (UL) is a set of programming libraries for developing applications with Visual Studio programming languages (and others) for use with Measurement Computing hardware. UL includes a complete function library that simplifies the configuration and operation of your measurement device. UL supports Visual Studio and Visual Studio .NET, and includes 32- and 64-bit driver support for Windows 8/7/Vista/XP.

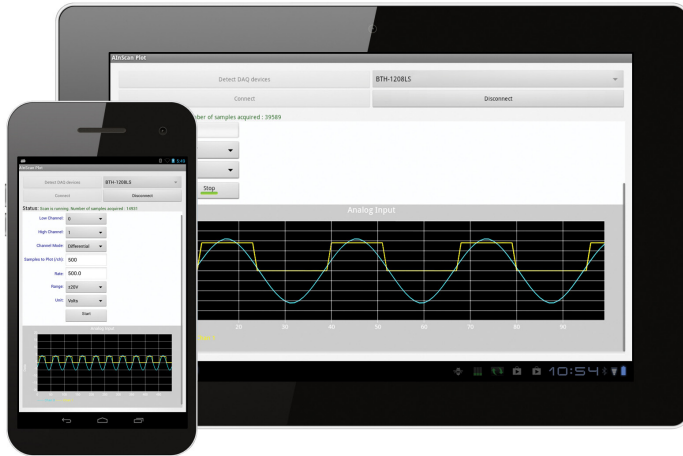
# USB-200 Series

## General Information



### Universal Library for Android

UL for Android is a software API used to develop apps that communicate with supported Measurement Computing DAQ devices over the Android 3.1 platform (API level 12) and later for Android-based tablets, phones, and mini-PCs.



The UL for Android includes example projects and detailed documentation to help users develop, deploy, and run apps on Android-based devices. Refer to [5 Steps to Creating and Deploying Android Data Acquisition Apps](#) (Step 3) for a description of each example.

### ULx for NI LabVIEW

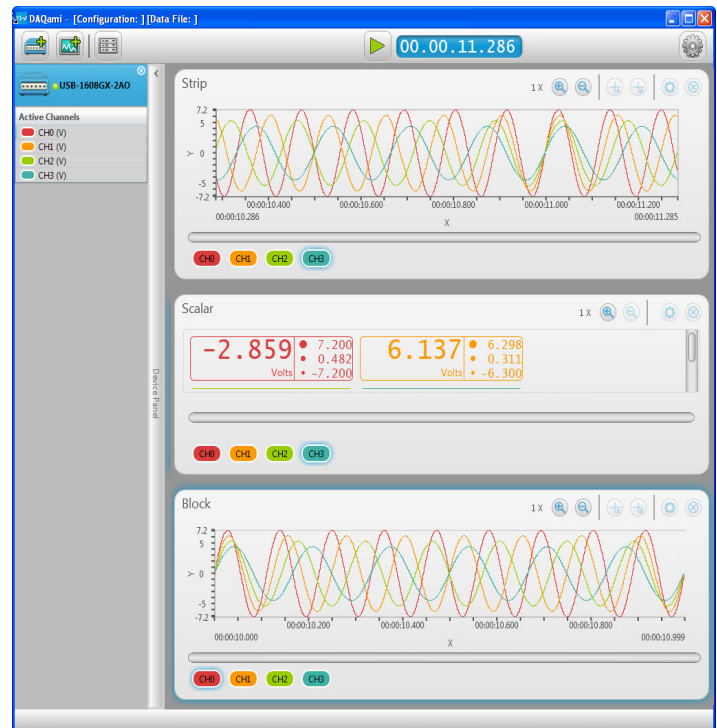
ULx for NI LabVIEW is a comprehensive library of graphical functions and example programs comprising all the power of the Universal Library and InstaCal. ULx for NI LabVIEW is compatible with LabVIEW 8.5 and later, and allows quick development of LabVIEW instrumentation, acquisition, and control applications with Measurement Computing hardware.

### Software Available for Download

The following software is available for download from [www.mccdaq.com/software](http://www.mccdaq.com/software).

#### DAQami

DAQami gives users an easy-to-use drag-and-drop interface that makes acquiring, viewing, and logging data a quick and simple task. Users simply select a supported device, configure device channels and other analog input options, and then select one or more displays to plot the data. When a DAQami acquisition is run, the program acquires and logs data from the selected channels, and plots the data on the displays for viewing.



DAQami users can quickly acquire and log up to 1 million samples per channel for viewing on three different displays. Data can also be exported to a .csv file.

### DAQFlex

For DAQ programming in virtually any OS, the DAQFlex framework combines a small footprint driver with a message-based command protocol. The simplicity of the driver is enabled with a message-based protocol that offers an efficient yet powerful interface to DAQ devices and a common command set that simplifies application development.

### Software Available Separately

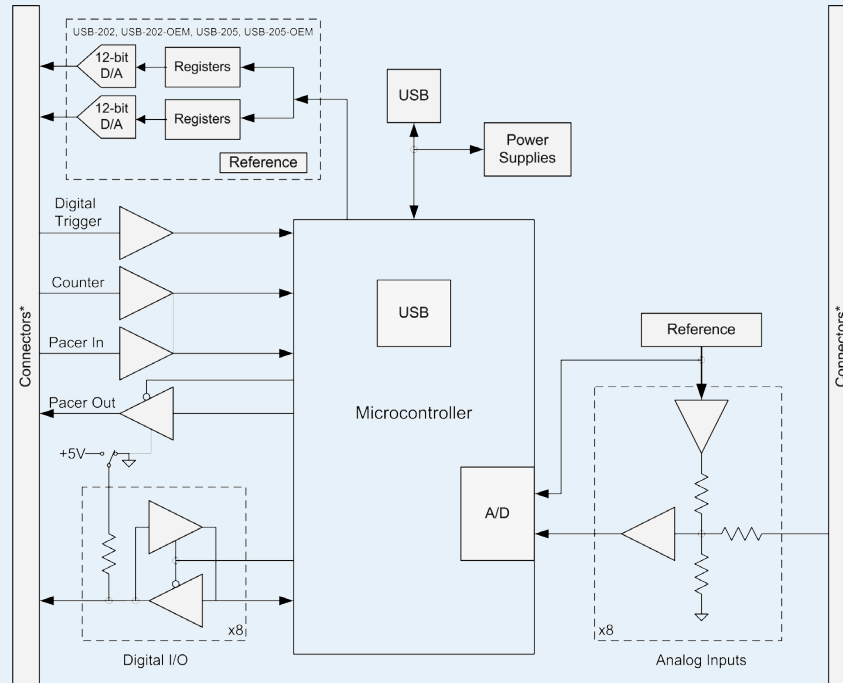
#### TracerDAQ Pro

TracerDAQ Pro is available as a purchased upgrade to TracerDAQ, and supports more active channels, more samples per channel, and a selection of options and enhancements designed to address many test and measurement applications.

# USB-200 Series

## Specifications

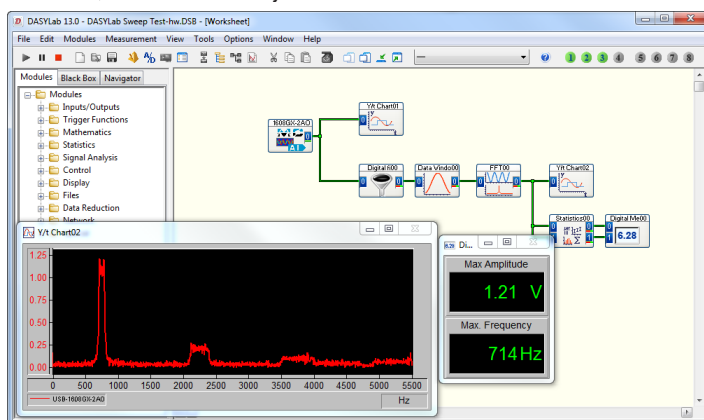
USB-200 Series Block Diagram



\* Screw terminal connectors on USB-201, USB-202, USB-204, and USB-205  
Header connectors on USB-201-OEM, USB-202-OEM, USB-204-OEM, and USB-205-OEM

## DASYLab

DASYLab is an icon-based data acquisition, graphics, control, and analysis software package offering real-time analysis and control. DASYLab lets you create custom graphical user interfaces without programming. Compared to other graphical programming environments, DASYLab has a very short user-learning curve. Many applications can be configured in a few minutes, rather than days or weeks.



DASYLab gives users the ability to create applications by simply dragging-and-dropping functional icons on a worksheet, connecting the icons together, and running the program. DASYLab supports most MCC data acquisition hardware.

## Specifications

### Analog Input

A/D Converter Type: Successive approximation

ADC Resolution: 12 bits

Number of Channels: 8 SE

Input Voltage Range:  $\pm 10$  V max

Absolute Maximum Input Voltage

CHx to GND:  $\pm 25$  V max (power on or power off)

Input Impedance: 1 M $\Omega$  (power on or power off)

Input Bias Current

10 V Input:  $-12$   $\mu$ A

0 V Input: 2  $\mu$ A

$-10$  V Input: 12  $\mu$ A

Input Bandwidth, Small Signal ( $-3$  dB)

USB-201/201-OEM: 150 kHz

USB-202/202-OEM: 150 kHz

USB-204/204-OEM: 1.0 MHz

USB-205/205-OEM: 1.0 MHz

Maximum Working Voltage

Input Range Relative to AGND:  $\pm 10.1$  V max

Crosstalk (Adjacent Channels, DC to 10 kHz):  $-75$  dB

Input Coupling: DC

Sample Rate

Internal Pacer

USB-201/201-OEM, USB-202/202-OEM: 0.016 S/s to 100 kS/s, software-selectable

USB-204/204-OEM, USB-205/205-OEM: 0.016 S/s to 500 kS/s, software-selectable

External Pacer

USB-201/201-OEM, USB-202/202-OEM: 100 kS/s max

USB-204/204-OEM, USB-205/205-OEM: 500 kS/s max



# USB-200 Series

## Specifications



### Sample Clock Source

Internal A/D clock

Pacer input terminal AICKI

**Channel Queue:** Up to eight unique, ascending channels

### Throughput

**Software Paced:** 33 S/s to 4000 S/s typ, system dependent

**Hardware Paced**

USB-201/201-OEM, USB-202/202-OEM: 100 kS/s max, system dependent

USB-204/204-OEM, USB-205/205-OEM: 500 kS/s max, system dependent

**Warm-Up Time:** 15 minutes min

## Accuracy

### Analog Input DC Voltage Measurement Accuracy

**Range:**  $\pm 10$  V

**Gain Error (% of Reading):** 0.098

**Offset Error:** 11 mV

**Absolute accuracy at Full Scale:** 20.8 mV

**Gain Temperature Coefficient (% Reading/°C):** 0.016

**Offset Temperature Coefficient (mV/°C):** 0.87

### Noise Performance

For the peak to peak noise distribution test, the input channel is connected to AGND at the input terminal block, and 12,000 samples are acquired at the maximum throughput.

**Range:**  $\pm 10$  V

**Counts:** 5

**LSBrms:** 0.76

### Analog Input Calibration

**Recommended Warm-Up Time:** 15 minutes min

**Calibration Method:** Factory

**Calibration Interval:** 1 year

### Analog Output (USB-202/202-OEM, USB-205/205-OEM)

**Resolution:** 12 bits, 1 in 4,096

**Output Range:** 0 V to 5.0 V

**Number of Channels:** 2

**Throughput, Software Paced:** 250 S/s single channel typ, PC dependent

Maximum throughput when scanning is machine dependent.

**Power On and Reset Voltage, Initializes to 000h code:** 0 V,  $\pm 10$  mV

**Output Drive, Each D/A OUT:** 5 mA, sourcing

**Slew Rate:** 0.8 V/ $\mu$ s typ

### Analog Output Accuracy

All values are ( $\pm$ ); accuracy tested at no load.

**Range:** 0 V to 5.0 V

**Accuracy (LSB):** 5.0 typ, 45.0 max

### Analog Output Accuracy Components

All values are ( $\pm$ )

**Range:** 0 V to 5.0 V

**% of FSR:** 0.08 typ, 0.72 max

**Gain Error at FS (mV):** 4.0 typ, 36.0 max

**Offset (mV):** 1.0 typ, 9.0 max

Zero-scale offsets may result in a fixed zero-scale error producing a “dead-band” digital input code region. Changes in digital input code at values less than 0x040 may not produce a corresponding change in the output voltage.

The offset error is tested and specified at code 0x040.

**Accuracy at FS (mV):** 5.0 typ, 45.0 max

## Digital I/O

**Digital Type:** TTL

**Number of I/O:** 8

**Configuration:** Each bit may be configured as input (power on default) or output

**Pull-Up Configuration:** The port has 47 k $\Omega$  resistors that may be configured as pull-up or pull-down with an internal jumper. The factory configuration is pull-down.

**Digital I/O Transfer Rate (System-Paced):** 33 to 4000 port reads/writes per second typical, system dependent

**Input Low Voltage Threshold:** 0.8 V max

**Input High Voltage Threshold:** 2.0 V min

**Input Voltage Limits:** 5.5 V absolute max, -0.5 V absolute min, 0 V recommended min

**Output High Voltage:** 4.4 V min (IOH = -50  $\mu$ A), 3.76 V min (IOH = -24 mA)

**Output Low Voltage:** 0.1 V max (IOL = 50  $\mu$ A), 0.44 V max (IOL = 24 mA)

**Output Current:**  $\pm 24$  mA max

### External Digital Trigger

**Trigger Source:** TRIG input

**Trigger Mode:** Software-selectable for edge or level sensitive, rising or falling edge, high or low level. Power on default is edge sensitive, rising edge.

**Trigger Latency:** 1  $\mu$ s + 1 pacer clock cycle max

**Trigger Pulse Width:** 125 ns min

**Input Type:** Schmitt trigger, 47 k $\Omega$  pull-down to ground

**Schmitt Trigger Hysteresis:** 1.01 V typ, 0.6 V min, 1.5 V max

**Input High Voltage Threshold:** 2.43 V typ, 1.9 V min, 3.1 V max

**Input Low Voltage Threshold:** 1.42 V typ, 1.0 V min, 2.0 V max

**Input Voltage Limits:** 5.5 V absolute max, -0.5 V absolute min, 0 V recommended min

### External Pacer Input/Output

**Terminal Names:** AICKI, AICKO

**Terminal Types**

AICKI: Input, active on rising edge

AICKO: Output, power on default is 0 V, active on rising edge

**Terminal Descriptions**

AICKI: Receives pacer clock from external source

AICKO: Outputs internal pacer clock

**Input Clock Rate:**

USB-201/201-OEM, USB-202/202-OEM: 100 kHz max

USB-204/204-OEM, USB-205/205-OEM: 500 kHz max

**Clock Pulse Width**

AICKI: 400 ns min

AICKO: 400 ns min

**Input Type:** Schmitt trigger, 47 k $\Omega$  pull-down to ground

**Schmitt Trigger Hysteresis:** 1.01 V typ, 0.6 V min, 1.5 V max

**Input High Voltage Threshold:** 2.43 V typ, 1.9 V min, 3.1 V max

**Input Low Voltage Threshold:** 1.42 V typ, 1.0 V min, 2.0 V max

**Input Voltage Limits:** 5.5 V absolute max, -0.5 V absolute min, 0 V recommended min

**Output High Voltage:** 4.4 V min (IOH = -50  $\mu$ A), 3.80 V min (IOH = -8 mA)

**Output Low Voltage:** 0.1 V max (IOL = 50  $\mu$ A), 0.44 V max (IOL = 8 mA)

**Output Current:**  $\pm 8$  mA max

### Counter

**Pin Name:** CTR

**Counter Type:** Event counter

**Number of Channels:** 1

**Input Type:** Schmitt trigger, 47 k $\Omega$  pull-down to ground

**Input Source:** CTR screw terminal

**Resolution:** 32 bits

**Maximum Input Frequency:** 1 MHz

**Counter Read/Write Rates (Software Paced):** 33 to 4,000 reads/writes per second typ, system dependent

**High Pulse Width:** 25 ns min

**Low Pulse Width:** 25 ns min

**Schmitt Trigger Hysteresis:** 1.01 V typ, 0.6 V min, 1.5 V max

**Input High Voltage Threshold:** 2.43 V typ, 1.9 V min, 3.1 V max

**Input High Voltage Limit:** 5.5 V absolute max

**Input Low Voltage Threshold:** 1.42 V typ, 1.0 V min, 2.0 V max

**Input Low Voltage Limit:** -0.5 V absolute min, 0 V recommended min

### Memory

**Data FIFO:** 12 K (12,288) analog input samples

**Non-Volatile Memory:** 2 KB (768 KB calibration storage, 256 KB UL user data, 1 KB DAQFlex user data)

# USB-200 Series

## Specifications



### Power

**Supply Current:** 150 mA typ<sup>1</sup>, 500 mA max (including user voltage, DIO and AICKO loading)

**User Voltage Output Terminal (+VO):** 4.5 V min, 5.25 V max

**User Voltage Output Current:** 100 mA max

### Environment

**Operating Temperature:** 0 °C to 55 °C

**Storage Temperature:** -40 °C to 85 °C

**Relative Humidity:** 0% to 90% non-condensing

### Mechanical

#### Signal I/O Connector

USB-201/201/204/205: Two banks of screw-terminal blocks

USB-201-OEM/202-OEM/204-OEM/205-OEM: two 2 × 8 0.1 in. pitch headers, labeled W1 and W3

#### Dimensions (L × W × H):

USB-201/202/204/205: 117.86 × 82.80 × 28.96 mm (4.64 × 3.26 × 1.14 in.) max

USB-201-OEM/202-OEM/204-OEM/205-OEM: 98.30 × 76.71 × 14.61 mm (3.87 × 3.02 × 0.575 in.) max

### USB Specifications

**USB Device Type:** USB 2.0 (full-speed, 12 Mbps)

**USB Device Compatibility:** USB 1.1, 2.0

**USB Cable Type:** A-B cable, UL type AWM 2725 or equivalent (minimum 24 AWG VBUS/GND, minimum 28 AWG D+/D-)

**USB Cable Length:** 3 m (9.84 ft) max

<sup>1</sup> Total quiescent current requirement for the device, which includes up to 10 mA for the Status LED. This value does not include any potential loading of the digital I/O bits, AICKO, or user voltage.

## Ordering Information

Part No.	Description
USB-201	USB-based DAQ device with eight 12-bit analog inputs, 100 kS/s sampling, and 8 digital I/O lines (includes USB cable and MCC DAQ software CD)
USB-202	USB-based DAQ device with eight 12-bit analog inputs, 100 kS/s sampling, two 12-bit analog outputs, and 8 digital I/O lines (includes USB cable and MCC DAQ software CD)
USB-204	USB-based DAQ device with eight 12-bit analog inputs, 500 kS/s sampling, and 8 digital I/O lines (includes USB cable and MCC DAQ software CD)
USB-205	USB-based DAQ device with eight 12-bit analog inputs, 500 kS/s sampling, two 12-bit analog outputs, and 8 digital I/O lines (includes USB cable and MCC DAQ software CD)
USB-201-OEM	Board-only USB-based DAQ device with eight 12-bit analog inputs, 100 kS/s sampling, and 8 digital I/O lines
USB-202-OEM	Board-only USB-based DAQ device with eight 12-bit analog inputs, 100 kS/s sampling, two 12-bit analog outputs, and 8 digital I/O lines
USB-204-OEM	Board-only USB-based DAQ device with eight 12-bit analog inputs, 500 kS/s sampling, and 8 digital I/O lines
USB-205-OEM	Board-only USB-based DAQ device with eight 12-bit analog inputs, 500 kS/s sampling, two 12-bit analog outputs, and 8 digital I/O lines

## Accessories

ACC-205 DIN-rail kit



## Software

TracerDAQ Pro	Out-of-the-box virtual instrument suite with strip chart, oscilloscope, function generator, and rate generator – professional version
DASYLab	Icon-based data acquisition, graphics, control, and analysis software