

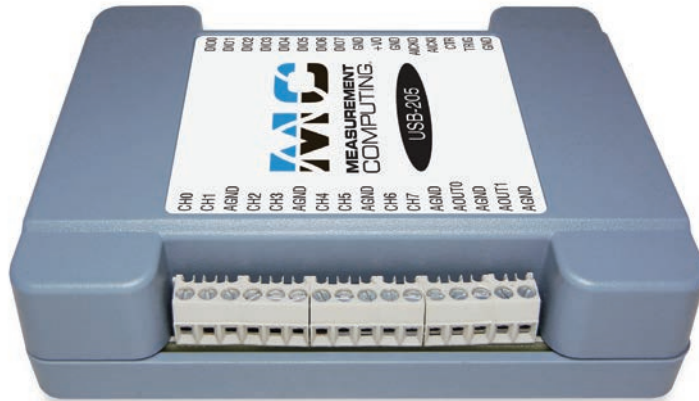
# USB-200 Series

## 12-Bit Multifunction DAQ Devices



### Features

- Low-cost USB DAQ devices with eight 12-bit analog inputs
- Sample rates up to 500 kS/s
- Two 12-bit analog outputs available on USB-202/205 standard and OEM
- Eight 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 with header connectors
- ACC-205 DIN-rail kit available



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.

### Software

#### Supported Operating Systems

- Windows 8/7/Vista®/XP 32/64-bit
  - Universal library (UL), ULx for NI LabVIEW™
- Linux® open-source driver support
- Android™
  - UL for Android

#### Ready-to-Run Applications

- InstaCal™ (install, configure, test)
- DAQami™ Advanced Data Logging Application (acquire, view, and log)
- TracerDAQ® (acquire, view, log, and generate)

#### Supported Programming Environments

- Visual Studio® and Visual Studio .NET, including examples for Visual C++®, Visual C#®, Visual Basic®, and Visual Basic .NET, other IDEs
- Java® (Android only) including examples and demo apps
- LabVIEW (Windows only)
- DASyLab®
- MATLAB® (Data Acquisition Toolbox) - USB-201, USB-204 only (standard and OEM)

### 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.

### 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	USB-204, USB-205
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

\* Sample rates apply to standard and OEM versions

USB-200 Series Selection Chart						
Model	Analog Input	Sample Rate	Analog Output	Digital Output Current	Signal I/O Connectors	USB Cable and SW CD
USB-201	8 SE (12-bit)	100 kS/s max	–	$\pm 24$ mA per pin	Screw Terminal	✓
USB-202	8 SE (12-bit)	100 kS/s max	2	$\pm 24$ mA per pin	Screw Terminal	✓
USB-204	8 SE (12-bit)	500 kS/s max	–	$\pm 24$ mA per pin	Screw Terminal	✓
USB-205	8 SE (12-bit)	500 kS/s max	2	$\pm 24$ mA per pin	Screw Terminal	✓
USB-201-OEM	8 SE (12-bit)	100 kS/s max	–	$\pm 24$ mA per pin	Header	–
USB-202-OEM	8 SE (12-bit)	100 kS/s max	2	$\pm 24$ mA per pin	Header	–
USB-204-OEM	8 SE (12-bit)	500 kS/s max	–	$\pm 24$ mA per pin	Header	–
USB-205-OEM	8 SE (12-bit)	500 kS/s max	2	$\pm 24$ mA per pin	Header	–









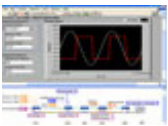


# USB-200 Series

## Software Support



### Software Support

USB-200 Series devices are supported by the software in the table below.

Ready-to-Run Applications		
<a href="#">InstaCal</a>		An interactive utility that configures and tests MCC hardware. Windows® OS  InstaCal is included with the free MCC DAQ Software bundle (CD/download).
<a href="#">DAQami</a>		Advanced data logging application with drag-and-drop software interface that is used to acquire, view, and log data. DAQami can be configured to log analog channels and to view that data in real-time or post-acquisition on user-configurable displays. Windows OS  DAQami is available as a purchased software download.
<a href="#">TracerDAQ and TracerDAQ Pro</a>		A virtual strip chart, oscilloscope, function generator, and rate generator applications used to generate, acquire, analyze, display, and export data. The Pro version provides enhanced features. Windows OS  TracerDAQ is included with the free MCC DAQ Software bundle (CD/download). TracerDAQ Pro is available as a purchased software download.
General-Purpose Programming Support		
<a href="#">Universal Library (UL)</a>		Programming library of function calls for C, C++, VB, C# .Net, and VB .Net using Visual Studio and other IDEs. Windows OS  The UL is included with the free MCC DAQ Software bundle (CD/download).
<a href="#">UL for Android</a>		Programming library of function calls for Java programmers who develop apps for Android-based tablets and phones. UL for Android communicates with select MCC DAQ devices. Supports Android project development on Windows, Linux, Mac OS X  UL for Android is included with the free MCC DAQ Software bundle (CD/download).
<a href="#">Linux Driver</a>		Open-source Linux drivers are available for most MCC devices. Example programs are also provided.
Application-Specific Programming Support		
<a href="#">ULx for NI LabVIEW</a>		A comprehensive library of VIs and example programs for NI LabVIEW that is used to develop custom applications that interact with most MCC devices. Windows OS  ULx is included with the free MCC DAQ Software bundle (CD/download).
<a href="#">DASyLab Driver</a>		Icon-based data acquisition, graphics, control, and analysis software that allows users to create complex applications in minimal time without text-based programming.  DASyLab is available as a purchased software download. Windows OS
<a href="#">MATLAB Driver</a>  (USB-201 and USB-204 standard and OEM only)		High-level language and interactive environment for numerical computation, visualization, and programming. The Data Acquisition Toolbox, provided by The Mathworks, allows users to acquire data from most MCC PCI and USB devices.  Visit <a href="http://www.MathWorks.com">www.MathWorks.com</a> for more information on MATLAB Data Acquisition Toolbox support.

# USB-200 Series

## Specifications



### Specifications

These specifications apply to both USB-200 Series standard and OEM versions unless noted otherwise.

#### 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-201/202: 150 kHz

USB-204/205: 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-201/202: 0.016 S/s to 100 kS/s, software-selectable

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

**External Pacer**

USB-201/202: 100 kS/s max

USB-204/205: 500 kS/s max

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

USB-204/205: 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/ $^{\circ}$ C):** 0.016

**Offset Temperature Coefficient (mV/ $^{\circ}$ 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-201/202: 100 kHz max

USB-204/205: 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 B calibration storage, 256 B UL user data, 1 KB system data)

# USB-200 Series

## Specifications & Ordering



### Power

**Supply Current:** 150 mA typ, 500 mA max (including user voltage, DIO and AICKO loading)  
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.

**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

**Standard Versions:** Two banks of screw-terminal blocks

**OEM Versions:** Two 2 × 8 0.1 in. pitch headers, labeled W1 and W3

#### Dimensions (L × W × H)

**Standard Versions:** 117.86 × 82.80 × 28.96 mm (4.64 × 3.26 × 1.14 in.) max

**OEM Versions:** 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 +-) max

## 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

\* USB-200 standard devices only

## Software also Available from MCC

DAQami	Easy-to-use advanced data logging software to acquire, view, and log data
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 that allows users to create complex applications in minimal time without text-based programming.