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.

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.

<table>
<thead>
<tr>
<th>No. of Channels</th>
<th>Max Rate Per Channel (kS/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>33.33</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>16.67</td>
</tr>
<tr>
<td>7</td>
<td>14.29</td>
</tr>
<tr>
<td>8</td>
<td>12.50</td>
</tr>
</tbody>
</table>

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.

Analog Input
USB-200 Series devices provide eight 12-bit SE analog inputs. The analog input range is fixed at ±10 V.

USB-200 Series Selection Chart

<table>
<thead>
<tr>
<th>Model</th>
<th>Analog Input</th>
<th>Sample Rate</th>
<th>Analog Output</th>
<th>Signal I/O Connectors</th>
<th>USB Cable and SW CD</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB-201</td>
<td>8 SE (12-bit)</td>
<td>100 kS/s max</td>
<td>–</td>
<td>Screw Terminal</td>
<td>✔</td>
</tr>
<tr>
<td>USB-202</td>
<td>8 SE (12-bit)</td>
<td>100 kS/s max</td>
<td>2</td>
<td>Screw Terminal</td>
<td>✔</td>
</tr>
<tr>
<td>USB-204</td>
<td>8 SE (12-bit)</td>
<td>500 kS/s max</td>
<td>–</td>
<td>Screw Terminal</td>
<td>✔</td>
</tr>
<tr>
<td>USB-205</td>
<td>8 SE (12-bit)</td>
<td>500 kS/s max</td>
<td>2</td>
<td>Screw Terminal</td>
<td>✔</td>
</tr>
<tr>
<td>USB-201-OEM</td>
<td>8 SE (12-bit)</td>
<td>100 kS/s max</td>
<td>–</td>
<td>Header</td>
<td>–</td>
</tr>
<tr>
<td>USB-202-OEM</td>
<td>8 SE (12-bit)</td>
<td>100 kS/s max</td>
<td>2</td>
<td>Header</td>
<td>–</td>
</tr>
<tr>
<td>USB-204-OEM</td>
<td>8 SE (12-bit)</td>
<td>500 kS/s max</td>
<td>–</td>
<td>Header</td>
<td>–</td>
</tr>
<tr>
<td>USB-205-OEM</td>
<td>8 SE (12-bit)</td>
<td>500 kS/s max</td>
<td>2</td>
<td>Header</td>
<td>–</td>
</tr>
</tbody>
</table>
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.

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.

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.

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.
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](#) 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.
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: ±10 V max
- Absolute Maximum Input Voltage: CHx to GND: ±25 V max (power on or power off)
- Input Bias Current: 10 V Input: –12 µA, 0 V Input: 2 µA, –10 V Input: 12 µA
- Input Bandwidth, Small Signal (~3 dB): USB-201/201-OEM: 150 kHz, USB-202/202-OEM: 150 kHz, USB-204/204-OEM: 1 MHz, USB-205/205-OEM: 1 MHz
- Maximum Working Voltage: Input Range Relative to AGND: ±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: ±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 throughputs:
Range: ±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, ±10 mV
Output Drive, Each D/A OUT: 5 mA, sourcing
Slew Rate: 0.8 V/µs typ

Analog Output Accuracy
All values are (±); 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 (±)
Range: 0 V to 5.0 V
% of FS: 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.
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 kΩ 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 µA), 3.76 V min (IOH = ~24 mA)
Output Low Voltage: 0.1 V max (IOL = 50 µA), 0.44 V max (IOL = 24 mA)
Output Current: ±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 µs + 1 pacer clock cycle max
Trigger Pulse Width: 125 ns min
Input Type: Schmitt trigger, 47 kΩ 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 kΩ 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 µA), 3.80 V min (IOH = ~8 mA)
Output Low Voltage: 0.1 V max (IOL = 50 µA), 0.44 V max (IOL = 8 mA)
Output Current: ±28 mA max

Counter
Pin Name: CTR
Counter Type: Event counter
Number of Channels: 1
Input Type: Schmitt trigger, 47 kΩ 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)

Measurement Computing (508) 946-5100
info@mccdaq.com
mccdaq.com
Power
Supply Current: 150 mA typ, 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

1 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

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB-201</td>
<td>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)</td>
</tr>
<tr>
<td>USB-202</td>
<td>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)</td>
</tr>
<tr>
<td>USB-204</td>
<td>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)</td>
</tr>
<tr>
<td>USB-205</td>
<td>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)</td>
</tr>
<tr>
<td>USB-201-OEM</td>
<td>Board-only USB-based DAQ device with eight 12-bit analog inputs, 100 ks/s sampling, and 8 digital I/O lines</td>
</tr>
<tr>
<td>USB-202-OEM</td>
<td>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</td>
</tr>
<tr>
<td>USB-204-OEM</td>
<td>Board-only USB-based DAQ device with eight 12-bit analog inputs, 500 ks/s sampling, and 8 digital I/O lines</td>
</tr>
<tr>
<td>USB-205-OEM</td>
<td>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</td>
</tr>
</tbody>
</table>

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 |