USB-230 Series

16-Bit Multifunction DAQ Devices

Features

- Low cost 16-bit USB DAQ devices with four differential/eight single-ended analog inputs
- Sample rates up to 100 kS/s
- Two 16-bit analog outputs
- Eight individually-configurable digital I/O lines
- One 32-bit counter input
- Micro-USB Type B connector (no external power required)
- Available with enclosure and detachable screw terminal plugs, or as a board-only OEM version with header connectors (no case, CD, or Micro-USB cable included)

Software

Supported Operating Systems

- Windows 8/7/Vista/XP 32/64-bit

Ready-to-Run Applications

- InstaCal (install, configure, and test)
- TracerDAQ (acquire, view, log, and generate)

Supported Programming Environments

- Visual Studio® and Visual Studio .NET, including examples for Visual C++®, Visual C#®, Visual Basic®, Visual Basic .NET, and other IDEs
- LabVIEW
- DASYLab

Overview

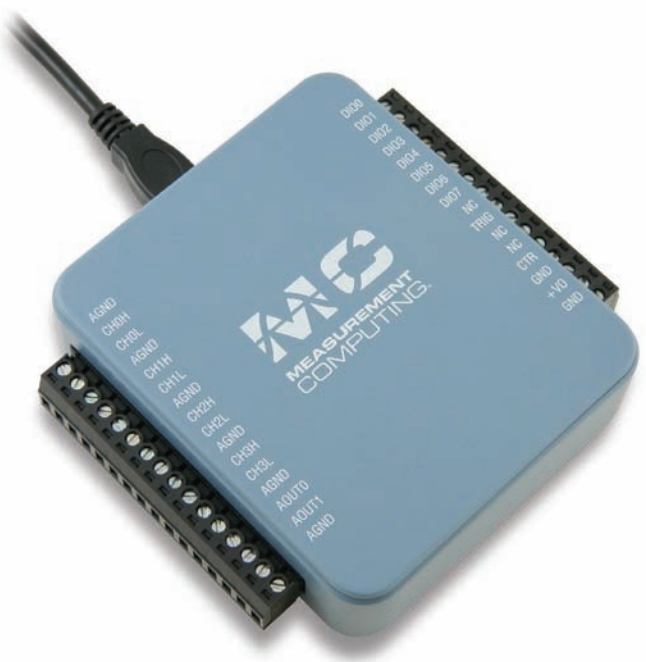
USB-230 Series devices provide improved cost/performance compared to our similarly priced 16-bit DAQ devices. Each device offers eight analog inputs, two analog outputs, eight DIO channels, and one counter input.

Analog Input

All USB-230 Series devices provide four differential (DIFF)/eight 16-bit single-ended (SE) analog inputs with a fixed analog input range of ±10 V.

Sample Rate

The maximum continuous sample rate is an aggregate rate for USB-230 Series devices. The following table lists the maximum rate per channel when scanning from one to eight channels.



USB-230 Series devices provide eight SE/four DIFF analog inputs, two simultaneously updating analog outputs, 8 digital I/O, and one counter input.

No. of Channels	Max Rate Per Channel (kS/s)*	
	USB-231	USB-234
1	50	100
2	25	50
3	16.67	33.33
4	12.5	25
5	10	20
6	8.33	16.67
7	7.14	14.29
8	6.25	12.50

* Sample rates apply to standard and OEM versions

Analog Output

USB-230 Series devices provide two 16-bit analog outputs. One or both outputs can be updated at a rate up to 5 kS/s per channel. The output range is fixed at ±10 V.

Digital I/O

Eight TTL-level digital I/O lines are included with USB-230 Series devices. Each digital channel is software-selectable for input or output.

Digital input voltage ranges from 0 V to 5 V are permitted, with thresholds of 0.8 V (low) and 2.3 V (high).

When used in output mode, each digital channel allows for 3.3 V operation with a source/sink current limit of ±4 mA.

All DIO lines are set to high-impedance inputs at system startup and reset. The device does not drive the signal high or low. Each line has a weak pull-down resistor connected to it.

All digital I/O updates and samples are software-paced.

Digital Trigger Input

USB-230 Series devices include an external digital trigger input that is software-selectable for rising edge or falling edge detection.

USB-230 Series

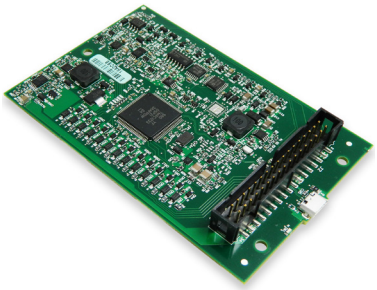
General Information & Software Support

Counter Input

USB-230 Series devices support one 32-bit edge counter (rising) that accepts inputs up to 5 MHz.

OEM Versions

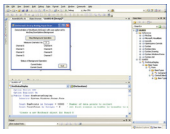
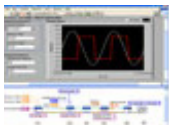
USB-230 Series OEM versions have board-only form factors with a header connector for OEM and embedded applications. All devices can be further customized to meet customer needs.



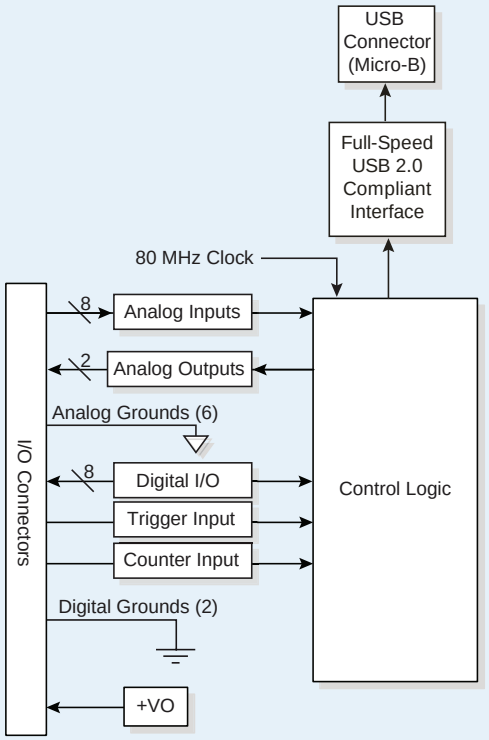
The OEM versions have the same specifications as the standard devices, but come in a board-only form factor with a header connector instead of screw terminals.

Software Support

USB-230 Series devices are supported by the software in the table below.

Ready-to-Run Applications		
InstaCal™		An interactive utility that configures and tests MCC hardware. Windows® OS InstaCal is included with the free MCC DAQ Software bundle (CD/download).
TracerDAQ® and TracerDAQ Pro		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		
Universal Library (UL)		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).
Application-Specific Programming Support		
ULx for NI LabVIEW™		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).
DASYLab® Driver		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

USB-230 Series Block Diagram



Specifications

These specifications apply to both USB-230 Series standard and OEM versions unless noted otherwise.

Analog Input

A/D Converter Type: Successive approximation
ADC Resolution: 16 bits
Sample Rate (Maximum Aggregate)
USB-231: 50 kS/s
USB-234: 100 kS/s
Number Of Channels: 8 single-ended or 4 differential; software-selectable
Input Voltage Range: ±10 V
Working Voltage: ±10 V
Overvoltage Protection
Power On: ±30 V max
Power Off: ±20 V max
Input Impedance: >1 GΩ
Input Bias Current: ±200 pA, typ
INL: ±1.8 LSB
DNL: 16 bits no missing codes
CMRR: 56 dB (DC to 5 kHz)
Input Bandwidth: 300 kHz
Trigger Sources: Software, TRIG

Absolute Accuracy (Analog Input DC Voltage Measurement Accuracy)

Range: ±10 V
At Full Scale (Typical at 25 °C): 6 mV
At Full Scale (Maximum Over Temperature): 26 mV
System Noise: 0.4 mVrms

Analog Output

Resolution: 16 bits, 1 in 65,536
Output Range: ±10 V
Number of Channels: 2
Update Rate: 5 kS/s simultaneous per channel max, hardware-paced
Trigger Sources: Software, TRIG
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: 8.6 mV
Maximum Over Temperature, Full Scale: 32 mV
INL: ±4 LSB
DNL: 16 bits No Missing Codes
Power-On State: 0 V
Startup Glitch: –7 V for 10 µs

Timebase

The following specifications apply to hardware-paced analog input and analog output sampling accuracy.
Timebase Frequency: 80 MHz
Timebase Accuracy: ±100 ppm
Timing Resolution: 12.5 ns

Digital Input/Output

Compatibility: LVTTL, 3.3 V LVCMOS
Number of Channels: 8 (DIO0 through DIO7)
Configuration: Each bit can be configured as input (power on default) or output
Pull-Down Resistor: 47.5 kΩ to digital ground (GND).
Absolute Maximum Voltage Range: –0.3 V to 5 V with respect to digital ground (GND)

Digital Input

Input Voltage Range
Power On: 0 V to 5 V
Power Off: 0 V to 3.3 V
Do not leave a voltage above 3.3 V connected on the DIO line when the device is not powered. This can cause long-term reliability issues.
Input Voltage Protection: ±20 V on two lines per port (maximum of five lines for all ports) for up to 24 hours
Input High Voltage: 2.3 V min
Input Low Voltage: 0.8 V max
Input Leakage Current
At 3.3 V: 0.8 mA max
At 5 V: 4.5 mA max

Digital Output

Output Low Voltage
4 mA: 0.7 V max
1 mA: 0.2 V max
Output High Voltage: 3.6 V max
4 mA: 2.1 V min
1 mA: 2.8 V min
Maximum Output Current Per Line: ±4 mA

USB-230 Series
Specifications & Ordering

External Digital Trigger
Trigger Source: TRIG input
Trigger Mode: Software-selectable for rising or falling edge. Power on default is rising edge.
Input High Voltage: 2.3 V min
Input Low Voltage: 0.8 V max

Counter
Pin Name: CTR
Number of Counters: 1
Resolution: 32 bits
Counter Type: Edge counter (rising)
Counter Direction: Count up
Counter Source: CTR
Input Frequency: 5 MHz max
High Pulse Width: 100 ns min
Low Pulse Width: 100 ns min

LED Electrical Characteristics
Output Low Voltage
IOL = 8 mA: 0.4 V max
IOL = 18 mA: 1.2 V typ
External Pull-Up Voltage: 5.25 V max
Maximum Sinking Current: 18 mA max

Memory
Data FIFO: 2,047 samples (4096 bytes)
Non-Volatile Memory
Up to 256 kB microcontroller integrated Flash
2 kB microcontroller integrated EEPROM

Power Requirements
From USB: 4.50 to 5.25 VDC
A typical bus-powered hub provides 100 mA on its USB lines. The USB-230 Series devices do not work on bus-powered hubs.
Idle USB Current: 165 mA
Maximum Load USB Current: <500 mA
The maximum power draw from all output terminals should be kept under 0.9 W to avoid overloading the USB port

Power Output
Output Voltage: 5 V, ±3%
Maximum Current: 150 mA
Overcurrent Protection: 200 mA
Short Circuit Current: 50 mA
Overvoltage Protection: ±20 V

USB Specifications
Device Type: USB 2.0 full speed (12 Mb/s)
Device Compatibility: USB 1.1, USB 2.0
Connector Type: USB micro-B receptacle
USB Cable Type: A-micro-B cable, UL type AWM 2725 or equivalent
(28 AWG × 2C + 28 AWG × 2C + AB)
USB Cable Length: 3 m (9.84 ft) max

Environmental
Operating Temperature Range: 0 °C to 45 °C
Storage Temperature Range: –40 °C to 85 °C
Operating Humidity Range: 5% to 95% RH, non-condensing
Storage Humidity Range: 5% to 90% RH, non-condensing
Pollution Degree (IEC 60664): 2
Maximum Altitude: 2,000 m (6561.68 ft.)

Calibration
USB-230 Series devices are factory-calibrated. Specifications are guaranteed for one year. For calibration beyond one year, return the device to the factory for recalibration.

Mechanical
Signal I/O Connector
Standard Versions: Two 16-position screw terminal plugs
Wire Gauge Range: 16 AWG to 28 AWG (1.31 to 0.08 mm^2)
Torque For Screw Terminals: 0.22 to 0.25 N · m (2.0 to 2.2 lb. · in.)
OEM Versions: One 2 × 17 0.1 in. pitch header labeled J2
Dimensions (L × W × H)
Standard Versions
With Screw Terminal Connector Plugs: 93.2 × 86.2 × 23.6 mm (3.67 ×3.40 × 0.93 in.)
Without Screw Terminals: 75.4 × 86.2 × 23.6 mm (2.97 ×3.40 × 0.93 in.)
OEM Versions: 98 mm × 64 mm × 12 mm (3.90 in. × 2.50 in. × 0.50 in.) max
Weight
Standard Versions
With Screw Terminal Connector Plugs: 105 g (3.70 oz)
Without Screw Terminals: 83 g (2.93 oz)
OEM Versions: 31 g (1.10 oz)

Ordering Information

Part No.	Description
USB-231	USB-based DAQ device with eight SE/4 DIFF 16-bit analog inputs, 50 kS/s sampling, two 16-bit analog outputs, and 8 digital I/O lines. Includes USB cable and MCC DAQ software CD.
USB-234	USB-based DAQ device with eight SE/4 DIFF 16-bit analog inputs, 100 kS/s sampling, two 16-bit analog outputs, and 8 digital I/O lines. Includes USB cable and MCC DAQ software CD. Document Revision 2
USB-231-OEM	Board-only USB-based DAQ device with eight SE/4 DIFF 16-bit analog inputs, 50 kS/s sampling, two 16-bit analog outputs, and 8 digital I/O lines
USB-234-OEM	Board-only USB-based DAQ device with eight SE/4 DIFF 16-bit analog inputs, 100 kS/s sampling, two 16-bit analog outputs, and 8 digital I/O lines

Software also Available from MCC

Part No.	Description
TracerDAQ Pro	A virtual strip chart, oscilloscope, function generator, and rate generator applications used to generate, acquire, analyze, display, and export data – professional version with enhanced features.
DASYLab	Icon-based data acquisition, graphics, control, and analysis software that allows users to create complex applications in minimal time without text-based programming.