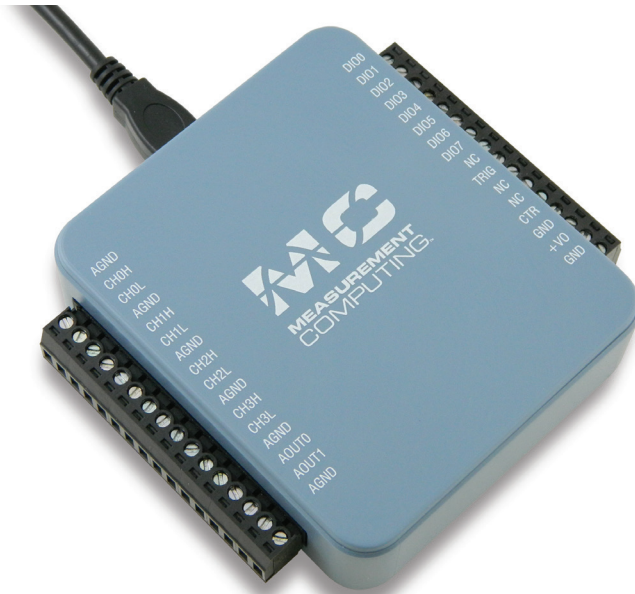


# USB-230 Series

## 16-Bit Multifunction DAQ Devices



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

### 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  $\pm 10$  V.

### Sample Rate

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

Maximum Sample Rate Per Channel (kS/s)*		
No. of Channels	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 also apply to 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  $\pm 10$  V.

### Digital I/O

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

Digital input voltage ranges from 0 V to 5 V are supported, 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  $\pm 4$  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.

### 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 bit-configurable digital I/O lines
- One 32-bit counter input
- Micro-USB Type B connector (no external power required)

### Software

#### Supported Operating Systems

- Windows 10/8/7/Vista/XP 32/64-bit

### Digital Trigger Input

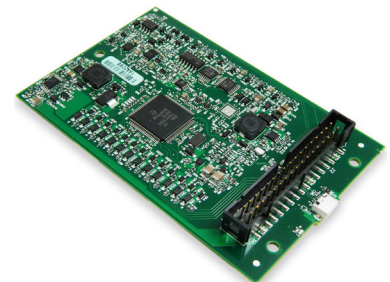
USB-230 Series devices include an external digital trigger input that is software-selectable for rising edge or falling edge detection.

### 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

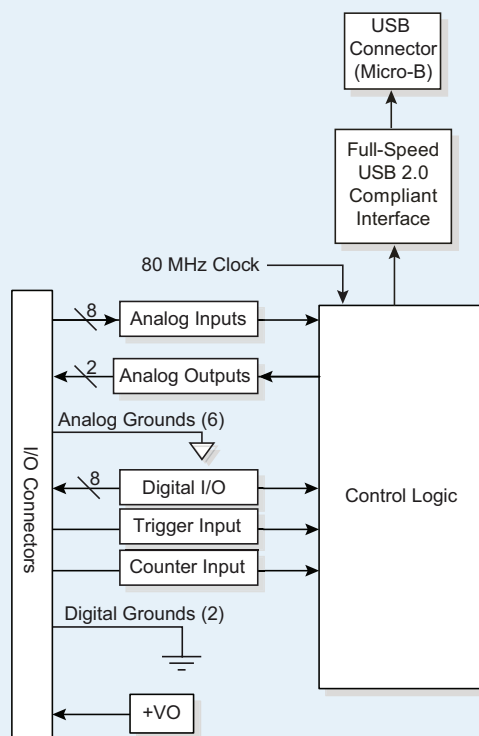
USB-230 Series devices are supported by the software in the table below.

Ready-to-Run Applications	
<a href="#">DAQami™</a>	 <p>Data acquisition companion software with drag-and-drop interface that is used to acquire, view, and log data, and generate signals. DAQami can be configured to log analog, digital, and counter channels, and to view that data in real-time or post-acquisition on user-configurable displays. Logged data can be exported for use in Excel® or MATLAB®. Windows OS</p> <p>DAQami is included with the free MCC DAQ Software bundle (CD/download). Install DAQami and try the fully-functional software for 30 days. After 30 days, all features except for data logging and data export will continue to be available – data logging and data export features can be unlocked by purchasing the software.</p>
<a href="#">InstaCal™</a>	 <p>An interactive installation, configuration, and test utility for MCC hardware. Windows OS</p> <p>InstaCal is included with the free MCC DAQ Software bundle (CD/download).</p>
<a href="#">TracerDAQ™ and TracerDAQ Pro</a>	 <p>Virtual strip chart, oscilloscope, function generator, and rate generator applications used to generate, acquire, analyze, display, and export data. Supported features may vary by hardware. The Pro version provides enhanced features. Windows OS</p> <p>TracerDAQ is included with the free MCC DAQ Software bundle (CD/download).</p> <p>TracerDAQ Pro is available as a purchased software download.</p>
General-Purpose Programming Support	
<a href="#">Universal Library™ (UL)</a>	 <p>Library for developing applications in C, C++, VB, C# .Net, VB .Net, and Python. Windows OS</p> <p>The UL is included with the free MCC DAQ Software bundle (CD/download).</p>
Application-Specific Programming Support	
<a href="#">ULx for NI LabVIEW™</a>	 <p>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</p> <p>ULx for NI LabVIEW is included with the free MCC DAQ Software bundle (CD/download).</p>
<a href="#">DASYLab®</a>	 <p>Icon-based data acquisition, graphics, control, and analysis software that allows users to create complex applications in minimal time without text-based programming. Windows OS</p> <p>DASYLab is available as a purchased software download. An evaluation version is available for 28 days.</p>
<a href="#">MATLAB® driver</a>	 <p>High-level language and interactive environment for numerical computation, visualization, and programming. The Mathworks Data Acquisition Toolbox™ allows users to acquire data from most MCC PCI and USB devices.</p> <p>Visit <a href="http://www.MathWorks.com">www.MathWorks.com</a> for more information about the Data Acquisition Toolbox.</p>

# USB-230 Series

## Specifications

### 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:  $\pm 10$  V

Working voltage:  $\pm 10$  V

Overvoltage protection

Power on:  $\pm 30$  V max

Power off:  $\pm 20$  V max

Input impedance:  $>1$  G $\Omega$

Input bias current:  $\pm 200$  pA, typ

INL:  $\pm 1.8$  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:  $\pm 10$  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:  $\pm 10$  V

Number of channels: 2

Update rate: 5 kS/s simultaneous per channel max, hardware-paced

Trigger sources: Software, TRIG

Output current drive:  $\pm 5$  mA

Short circuit current:  $\pm 11$  mA

Slew rate: 3 V/ $\mu$ s

Output impedance: 0.2  $\Omega$

Absolute accuracy (No Load)

Typical at full scale: 8.6 mV

Maximum over temperature, full scale: 32 mV

INL:  $\pm 4$  LSB

DNL: 16 bits No Missing Codes

Power-on state: 0 V

Startup glitch:  $-7$  V for 10  $\mu$ s

### Timebase

The following specifications apply to hardware-paced analog input and analog output sampling accuracy.

Timebase frequency: 80 MHz

Timebase accuracy:  $\pm 100$  ppm

Timing resolution: 12.5 ns

### Digital Input/Output

Compatibility: LVTTTL, 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 k $\Omega$  to digital ground (GND).

Absolute maximum voltage range:  $-0.3$  V to 5 V with respect to digital ground (GND)

# USB-230 Series

## Ordering



### 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:**  $\pm 20$  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:**  $\pm 4$  mA

### 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,  $\pm 3\%$

**Maximum current:** 150 mA

**Overcurrent protection:** 200 mA

**Short circuit current:** 50 mA

**Overvoltage protection:**  $\pm 20$  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  $\times$  2C + 28 AWG  $\times$  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<sup>2</sup>)

**Torque for screw terminals:** 0.22 to 0.25 N · m (2.0 to 2.2 lb. · in.)

**OEM versions:** One 2  $\times$  17 0.1 in. pitch header labeled J2

#### Dimensions (L $\times$ W $\times$ H)

**Standard versions**

**With screw terminal connector plugs:**

93.2  $\times$  86.2  $\times$  23.6 mm (3.67  $\times$  3.40  $\times$  0.93 in.)

**Without screw terminals:** 75.4  $\times$  86.2  $\times$  23.6 mm (2.97  $\times$  3.40  $\times$  0.93 in.)

**OEM versions:** 98 mm  $\times$  64 mm  $\times$  12 mm (3.90 in.  $\times$  2.50 in.  $\times$  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)

## Order Information

### Hardware

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. Rev 4
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
DAQami	Data acquisition companion software for acquiring data and generating signals
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