

# USB-1608FS

## Simultaneous USB DAQ Device



The USB-1608FS features simultaneous sampling of 8 analog inputs, and also provides 8 DIO lines and a 32-bit event counter

### Features

- Eight single-ended analog inputs
- 16-bit resolution
- Simultaneous sampling
- 100 kS/s aggregate sample rate (50 kS/s max for any channel)
- Eight digital I/O
- 32-bit event counter
- External clock I/O
- External digital trigger input

### Supported Operating Systems

- Windows® 11/10/8/7/Vista®/XP 32/64-bit
- Linux®

### Overview

The USB-1608FS device provides simultaneous sampling with a sample rate of 50 kS/s maximum for any one channel, and up to 100 kS/s aggregate for multiple channels. The device also features a 32-bit event counter, 8 digital I/O lines, external digital triggering, and a bidirectional clock. An OEM version is available for embedded applications.

### Analog Input

The USB-1608FS has a dedicated A/D converter per analog channel for simultaneous sampling. It offers software-selectable analog input ranges for  $\pm 10$  V,  $\pm 5$  V,  $\pm 2$  V, and  $\pm 1$  V.

### Simultaneous Sampling

Each analog input channel has a dedicated 16-bit A/D converter for true simultaneous sampling of all 8 inputs.

### Sample Rates

With hardware paced mode, the maximum throughput rate is 50 kS/s for any one channel, up to 100 kS/s maximum aggregate for multiple channels.

Use burst scan mode to run any number of channels at the maximum rate of 50 kS/s up to the full capacity of the 32K sample FIFO. The maximum sampling rate is 200 kS/s aggregate for all channels.

### Channel-Gain Queue

The channel-gain queue lets you configure a list of channels and gains for each scan. Each channel can have a different gain setting. The gain settings are stored in a channel-gain queue list that is written to local memory on the device.

The channel-gain queue can contain up to eight unique, consecutive channels listed in increasing order.

### Digital I/O

Each of the eight digital I/O channels is individually-configurable for input or output. When configured for input, the digital I/O terminals can detect the state of any TTL-level input.

### Pull-Up/Down Configuration

The USB-1608FS has a user-configurable internal jumper to configure the digital bits for pull-up (default) or pull-down.

### Counter Input

The USB-1608FS has a 32-bit event counter that can accept a signal up to 1 MHz. The internal counter increments when the TTL levels transition from low to high.

### External Clock I/O

Each USB-1608FS has a bidirectional external clock terminal. When configured for input, A/D conversions can be paced by an external source.

The USB-1608FS supports TTL-level input signals up to 50 kHz.

When configured for output, the USB-1608FS can pace A/D conversions on a second device and acquire data from all input channels simultaneously.

### Trigger Input

The USB-1608FS provides an external digital trigger input and a trigger mode that is edge sensitive and software-selectable for rising or falling edge.

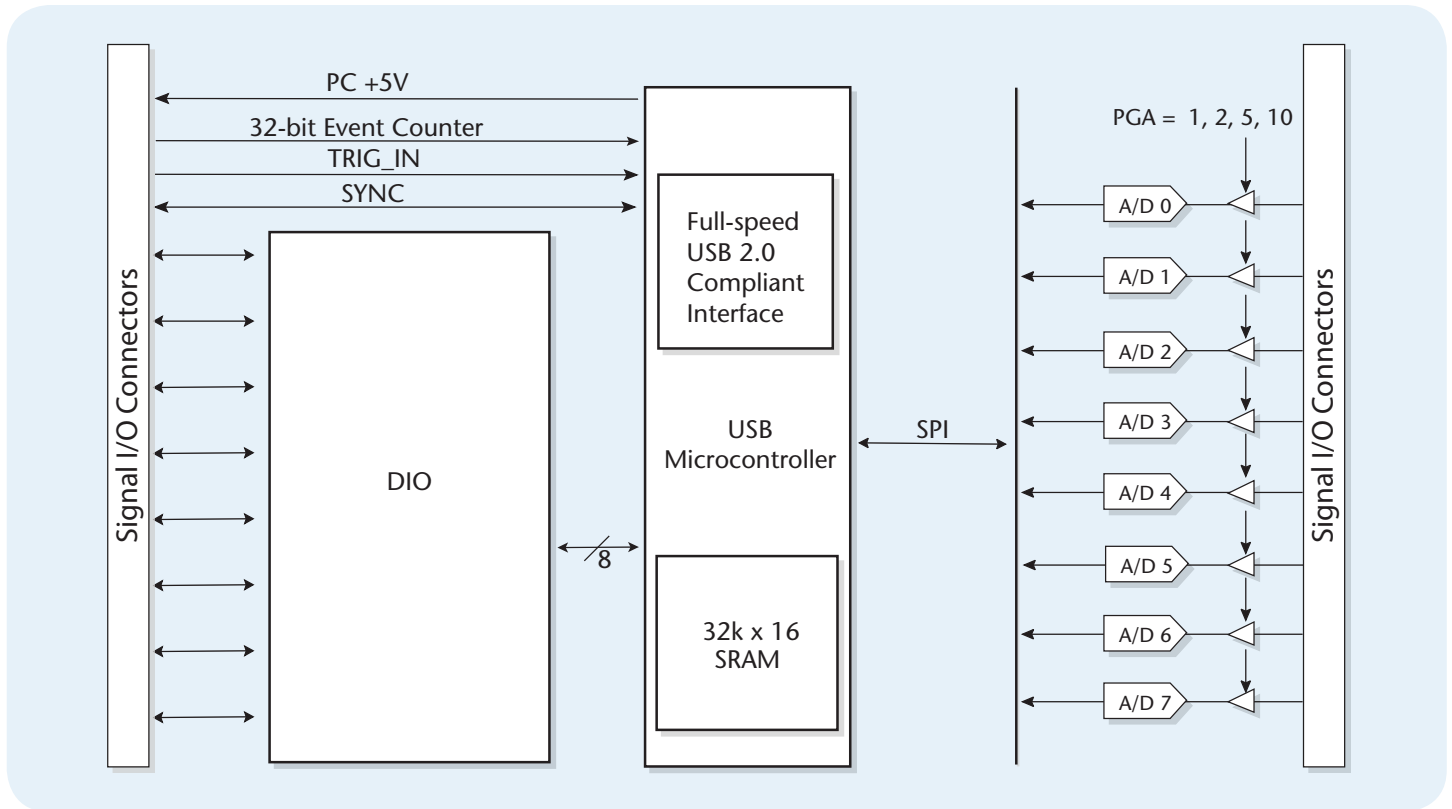
### Calibration

The USB-1608FS is factory-calibrated using a NIST-traceable calibration process. Specifications are guaranteed for one year.

The USB-1608FS also supports field calibration for users to calibrate the device locally with the InstaCal utility.

# USB-1608FS

## Block Diagram



### Software Support

The USB-1608FS device is supported by the software in the table below.

#### Ready-to-Run Applications

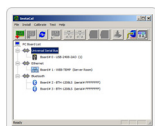
[DAQami™](#)



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

DAQami is included with the free MCC DAQ Software bundle.

[InstaCal™](#)



An interactive installation, configuration, and test utility for MCC hardware. Windows OS

InstaCal is included with the free MCC DAQ Software bundle (CD/download).

[TracerDAQ™](#) and  
[TracerDAQ Pro](#)



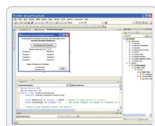
Virtual strip chart, oscilloscope, function generator, and rate generator applications used to generate, acquire, analyze, display, and export data. Supported features may vary by hardware. The Pro version provides enhanced features. Windows OS

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™  
\(UL\)](#)



Library for developing applications in C, C++, VB, C# .Net, VB .Net, and Python. Windows OS

The UL is included with the free MCC DAQ Software bundle (CD/download).

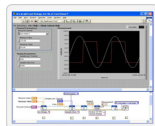
[Linux® driver](#)



Open-source Linux drivers are available for most MCC devices. Example programs are also provided.

#### 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 for NI LabVIEW is included with the free MCC DAQ Software bundle (CD/download).

[DASYLab®](#)



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

DASYLab is available as a purchased software download. An evaluation version is available for 28 days.

[MATLAB® driver](#)



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.

Visit [www.MathWorks.com](http://www.MathWorks.com) for more information about the Data Acquisition Toolbox.

# USB-1608FS

## Specifications



### Specifications

All specifications are subject to change without notice. Typical for 25 °C unless otherwise specified.

#### Analog Input

**A/D converter type:** 16-bit successive approximation type  
**Channels:** 8 single-ended  
**Input configuration:** Individual A/D per channel  
**Sampling method:** Simultaneous  
**Absolute maximum input voltage (CHx IN relative to GND):** ±15 V max  
**Input impedance:** 100 MΩ min  
**Input ranges:** ±10 V, ±5 V, ±2 V, ±1 V; software-selectable per channel  
**Sample rate (hardware paced):** 0.6 S/s to 50 kS/s, software-selectable  
**Throughput**  
**Software paced:** 500 S/s all channels  
**Hardware paced (system-dependent):** (100 kS/s)/(# of channels) max, 50 kS/s max for any channel  
**Burst scan ≤ 32,768 total samples (uses onboard FIFO):**  
 (200 kS/s)/(# of channels) max, 50 kS/s max for any channel  
**Gain queue:** Up to eight elements; one gain element per unique, consecutive channel; software-selectable  
**Resolution:** 16 bits  
**No missing codes:** 15 bits  
**Crosstalk (signal DC to 25 kHz):** -80 dB  
**CAL output:** 0.625 V, 1.25 V, 2.5 V, 5 V  
**CAL output accuracy:** 0.5% typ, 1.0% max (actual values used for calibration are measured and stored in EEPROM)  
**CAL current:** ±5 mA max  
**Trigger source (software-selectable):** External digital - TRIG\_IN

#### Accuracy

Calibrated Absolute Accuracy	
Range	Accuracy
±10 V	5.66 mV
±5 V	2.98 mV
±2 V	1.31 mV
±1 V	0.68 mV

Accuracy Components – all values are (±)			
Range	Gain Error (% of Reading)	Gain Error at Full Scale	Offset
±10 V	0.04	4.00 mV	1.66 mV
±5 V	0.04	2.00 mV	0.98 mV
±2 V	0.04	0.80 mV	0.51 mV
±1 V	0.04	0.40 mV	0.28 mV

Noise Performance*		
Range	Typical Counts	Least Significant Bit <small>Root Mean Square</small> (LSB <sub>RMS</sub> )
±10 V	10	1.52
±5 V	10	1.52
±2 V	11	1.67
±1 V	14	2.12

\* Noise distribution is determined by gathering 50 kS with inputs tied to ground at the user connector. Samples are gathered at the maximum specified sample rate of 50 kS/s per channel.

#### Digital Input/Output

**Digital type:** CMOS  
**Number of I/O:** 8 (DIO0 through DIO7)  
**Configuration:** Independently configured for input or output  
**Pull-up/pull-down configuration:** All pins pulled up to 5 V via 47 kΩ resistors (default). Hardware revisions E and later have a user-configurable jumper.  
**Input high voltage threshold:** 2.0 V min  
**Input high voltage limit:** 5.5 V absolute max  
**Input low voltage threshold:** 0.8 V max  
**Input low voltage limit:** -0.5 V absolute min; 0 V recommended min  
**Output high voltage (IOH = -2.5 mA):** 3.8 V min  
**Output low voltage (IOL = 2.5 mA):** 0.44 V max  
**Power on and reset state:** Input

#### External Trigger

**Trigger source:** External digital: TRIG\_IN  
**Trigger mode (software-selectable):** Edge sensitive: user configurable for CMOS compatible rising or falling edge  
**Trigger latency:** 10 μs max  
**Trigger pulse width:** 1 μs 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 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

#### External Clock I/O

**Pin name:** SYNC  
**Pin type:** Bidirectional  
**Direction (software-selectable)**  
**Input:** Receives A/D pacer clock from external source;  
**Output:** Outputs internal A/D pacer clock  
**Input clock rate:** 50 kHz max  
**Clock pulse width:** 1 μs min input, 5 μs min output  
**Input clock mode:** Edge sensitive, rising edge  
**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 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  
**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)

#### 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  
**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  
**Input Frequency:** 1 MHz max  
**High pulse width:** 500 ns min  
**Low pulse width:** 500 ns min

#### Power

**Supply Current**  
**USB enumeration:** < 100 mA  
**Including DIO and SYNC output loading:** < 500 mA  
**+5 V USB power available (connected to externally-powered root port hub or a self-powered hub):** 4.5 V min, 5.25 V max  
**Output current (total amount of current that can be sourced from the USB +5 V and digital outputs):** 300 mA max

#### USB

**Device type:** USB 2.0 (full-speed)  
**Device compatibility:** USB 1.1, USB 2.0

# USB-1608FS

## Ordering



### Environmental

**Operating temperature range:** 0 °C to 70 °C

**Storage temperature range:** -40 °C to 70 °C

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

### Mechanical

**Dimensions (L × W × H):** 79 × 82 × 27 mm (3.10 × 3.20 × 1.05 in.)

**USB cable length:** 3 m (9.84 ft) max

**User connection length:** 3 m (9.84 ft) max

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## Order Information

### Hardware

Part No.	Description
USB-1608FS	USB-based DAQ device with 8 simultaneous 16-bit 100 kS/s/ch analog inputs and 8 digital I/O. Includes a USB cable and MCC DAQ software.

## Software also Available from MCC

Part No.	Description
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