USB-1208HS Series
13-Bit Multifunction High Speed DAQ Devices

All USB-1208HS Series devices provide eight singled-ended or four differential analog inputs at up to a 1 MS/s sampling rate, and 16 digital I/O.

Overview
USB-1208HS Series devices are low-cost, 13-bit devices that offer four differential (DIFF) or eight single-ended (SE) analog inputs, 16 digital I/O channels, two counter inputs, and one timer output. A digital trigger lets you start analog input or output conversions.

The USB-1208HS-2AO includes two analog outputs and the USB-1208HS-4AO includes four analog outputs.

Analog Input
Each device supports software-selectable ranges from ±5 V to ±20 V in differential mode, and software-selectable ranges from ±2.5 V to ±10 V, and 0 V to 10 V in single-ended mode.

Sample Rate
USB-1208HS Series devices can sample at a maximum of 1 MS/s in hardware paced mode.

External Clock I/O
Each device has an external clock input terminal that supports input signals up to 1 MHz to pace A/D conversions from an external source.

The USB-1208HS-2AO/USB-1208HS-4AO also have an external clock input terminal that supports input signals up to 1 MHz to pace D/A conversions from an external source.

Each device has a clock output terminal to output the A/D sampling clock. The USB-1208HS-2AO/USB-1208HS-4AO also have a clock output terminal to output the D/A sampling clock.

Analog Output
The USB-1208HS-2AO provides two 12-bit analog outputs, and the USB-1208HS-4AO provides four 12-bit analog outputs. The output range is ±10 V. Each output can update at a maximum rate of 1 MS/s.

Digital I/O
Users can program each of the 16 TTL-level digital I/O lines for either input or output. Each USB-1208HS Series device has a user-configurable internal jumper to configure the digital bits for pull-up or pull-down (default).

Counter Input
Each device supports two 32-bit TTL-level counters that accept frequency inputs of up to 20 MHz.

Timer Output
USB-1208HS Series devices include a pulse width modulation (PWM) timer output with a software-selectable frequency range up to 20 MHz.

Calibration
USB-1208HS Series devices are factory-calibrated using a NIST-traceable calibration process. Specifications are guaranteed for one year. For calibration beyond one year, return the device to the factory for recalibration.

Features
- Up to 8 analog inputs
- 13-bit resolution
- Sample rates up to 1 MS/s
- Up to 4 analog outputs
- 16 digital I/O lines
- Two 32-bit counters
- One timer output
- USB bus powered

Supported Operating Systems
- Windows® 10/8/7/Vista® XP, 32/64-bit
- Linux®
- Android™

USB-1208HS Series Selection Chart

<table>
<thead>
<tr>
<th>Model</th>
<th>Analog Inputs</th>
<th>Sampling Rate</th>
<th>Analog Outputs</th>
<th>Digital I/O</th>
<th>Counters</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB-1208HS</td>
<td>8 SE/4 DIFF</td>
<td>Up to 1 MS/s</td>
<td>0</td>
<td>16</td>
<td>2</td>
</tr>
<tr>
<td>USB-1208HS-2AO</td>
<td>8 SE/4 DIFF</td>
<td>Up to 1 MS/s</td>
<td>2</td>
<td>16</td>
<td>2</td>
</tr>
<tr>
<td>USB-1208HS-4AO</td>
<td>8 SE/4 DIFF</td>
<td>Up to 1 MS/s</td>
<td>4</td>
<td>16</td>
<td>2</td>
</tr>
</tbody>
</table>
USB-1208HS Series
Software

Software Support
USB-1208HS Series devices are supported by the software in the table below.

<table>
<thead>
<tr>
<th>Ready-to-Run Applications</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>DAQami™</td>
<td>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. 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.</td>
</tr>
</tbody>
</table>

| InstaCal™                 | An interactive installation, configuration, and test utility for MCC hardware. Windows OS. InstaCal is included with the free MCC DAQ Software bundle. |

| 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. TracerDAQ Pro is available as a purchased software download. |

<table>
<thead>
<tr>
<th>General-Purpose Programming Support</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>UL for Linux®</td>
<td>Library for developing applications in C, C++, and Python on Linux. UL for Linux is available on GitHub <a href="https://github.com/mccdaq/uldaq">https://github.com/mccdaq/uldaq</a>. Open-source, third-party Linux drivers are also available for supported MCC devices.</td>
</tr>
<tr>
<td>UL for Android™</td>
<td>Library of Java classes for programmers who develop apps for Android-based mobile devices. 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.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Application-Specific Programming Support</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ULx for NI LabVIEW™</td>
<td>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.</td>
</tr>
<tr>
<td>DASYLab®</td>
<td>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.</td>
</tr>
<tr>
<td>MATLAB® driver</td>
<td>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 <a href="http://www.MathWorks.com">www.MathWorks.com</a> for more information about the Data Acquisition Toolbox.</td>
</tr>
</tbody>
</table>
USB-1208HS Series
Specifications

**General**

**Environment**
- Operating temperature range: 0 °C to 50 °C
- Storage temperature range: –40 °C to 85 °C
- Humidity: 0% to 90% non-condensing

**Communications:** USB 2.0 (high-speed)

**Acquisition data buffer:** 4 kS

**Vibration:** MIL STD 810E Category 1 and 10

**Signal I/O connector:** 2 banks of screw-terminal blocks

**Dimensions (L × W × H):** 127.00 × 88.90 × 35.56 mm (5.00 × 3.50 × 1.40 in.)
- Weight: 431 g (0.95 lb)

**Analog Input**

**A/D converter:** Successive approximation type

**Input ranges:** Software-selectable per channel
- **DIFF:** ±20 V, ±10 V, ±5 V (the voltage level on each individual AIN input is limited to ±14 V)
- **SE:** ±10 V, ±5 V, ±2.5 V, 0 – 10 V

**Number of channels:** 4 DIFF/8 SE (software-selectable)

**Input configuration:** Multiplexed

**Channel gain queue:** 8 unique consecutive elements, software-selectable range for each channel

**Absolute maximum input voltage:** CHx IN to GND
- Power on: ±25 V max
- Power off: ±12 V max

**Input impedance:** 35 MΩ min

**Input bandwidth (–3 dB):** All input ranges, 2 MHz typ

**Input leakage current:** ±250 nA typ

**Input capacitance:** 32 pf typ

**Offset error drift:** 5 ppm/°C typ

**Gain error drift:** 25 ppm/°C typ

**Maximum working voltage (signal + common mode)**
- ±20 V: ±14 V
- ±10 V: ±11 V
- ±5 V: ±5.5 V

**Sample rate:** 1 S/s to 1 MS/s, software-selectable

**Sample clock source:** Internal A/D clock or AICKI

**Burst mode:** Software-selectable, burst rate = 1 µs

**Throughput**
- Software-paced: 33 S/s to 4000 S/s typ, system-dependent
- Hardware-paced: 1 MS/s max

**Resolution:** 13 bits

**A/D no missing codes (uncalibrated)**

**DIFF mode:** 13 bits

**SE mode:** 12 bits

**CMRR:** 60 Hz, 74 dB typ

**Crosstalk**
- **SE mode (all ranges, 250 kHz input signal):** –62 dB typ
- **DIFF mode (all ranges, 250 kHz input signal):** –78 dB typ

**Voltage Range**

<table>
<thead>
<tr>
<th>Voltage Range</th>
<th>Calibrated Absolute Accuracy (LSB)</th>
<th>Noise Performance*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Typical Counts</td>
<td>LBrms</td>
</tr>
<tr>
<td><strong>DIFF mode</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>±20 V</td>
<td>±9.55 typ, ±13.18 max</td>
<td>3</td>
</tr>
<tr>
<td>±10 V</td>
<td>±4.59 typ, ±6.23 max</td>
<td>3</td>
</tr>
<tr>
<td>±5 V</td>
<td>±2.25 typ, ±2.75 max</td>
<td>3</td>
</tr>
<tr>
<td><strong>SE mode</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>±10 V</td>
<td>±5.10 typ, ±8.06 max</td>
<td>5</td>
</tr>
<tr>
<td>±5 V</td>
<td>±2.63 typ, ±4.03 max</td>
<td>5</td>
</tr>
<tr>
<td>±2.5 V</td>
<td>±1.59 typ, ±2.70 max</td>
<td>5</td>
</tr>
<tr>
<td>0 V to 10 V</td>
<td>±3.29 typ, ±5.13 max</td>
<td>5</td>
</tr>
</tbody>
</table>

*Noise distribution is determined by gathering 50 kS with inputs tied to ground at the user connector. Samples are gathered at the max rate of 1 MS/s.
Specifications

### USB-1208HS Series

<table>
<thead>
<tr>
<th>Input Settling Time in μs, Typical</th>
<th>±Full-Scale Channel Switch, Same-Range to Same-Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>±1 LSB</td>
</tr>
<tr>
<td>±10 V</td>
<td>1.5</td>
</tr>
<tr>
<td>±5 V</td>
<td>2.1</td>
</tr>
<tr>
<td>±2.5 V</td>
<td>2.2</td>
</tr>
<tr>
<td>0 V to 10 V</td>
<td>2.6</td>
</tr>
</tbody>
</table>

**Analog Output (USB-1208HS-2AO/USB-1208HS-4AO Only)**

D/A converter: Texas Instruments DAC7553

- **Number of channels**: USB-1208HS-2AO: 2 independent
- **USB-1208HS-4AO**: 4 independent
- **Resolution**: 12 bits
- **Output range**: ±10 V
- **Uncalibrated**: ±10.2 V
- **Output transient**: Host PC is reset, powered on, suspended, or a reset command is issued to device.
- **Duration**: 3 ms typ
- **Amplitude**: 6 V p-p typ
- **D/A update rate**: Software paced: 33 S/s to 5000 S/s typ, system-dependent
- **Hardware paced**: 1 MHz max (per channel)
- **Sample clock source**: Internal D/A clock or AOCKI (AO external clock input pin)
- **Monotonicity**: 12 bits
- **Output current**: ±3 mA max per channel
- **Output short-circuit protection**: Output connect to GND, unlimited duration (10 mA typ)
- **Output coupling**: DC
- **Power up and reset state**: 0 V
- **Output noise**: 0.53 mV rms
- **Settling time (to 0.05%)**: 20 V output step, (RL=5 kΩ, CL=200 pF), 5 μs max.
- **Absolute accuracy**: ±0.1%
- **Slew rate**: 6.7 V/μs typ
- **Offset error drift**: 10 ppm/C° typ
- **Gain error drift**: 65 ppm/C° typ

**Digital I/O**

- **Digital type**: CMOS
- **Number of I/O**: 16
- **Configuration**: Each bit may be configured as input (power on default) or output
- **Pull-up/down configuration**: The port has 47 kΩ resistors; jumper configurable
- **Digital I/O transfer rate (system paced)**: 33 to 8000 port reads/writes or single-bit reads/writes per second typ, system-dependent
- **Input high voltage**: 2.0 V min, 5.5 V absolute max
- **Input low voltage**: 0.8 V 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 per terminal

**External Scan Trigger Input**

- **Trigger source**: TRIG input (can trigger an A/D scan, a D/A scan, or both)
- **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 clock cycle max
- **Trigger pulse width**: 100 ns min
- **Input type**: Schmitt Trigger, 33 Ω series resistor and 47 kΩ pull-down to ground
- **Schmitt trigger hysteresis**: 0.4 V to 1.2 V
- **Input high voltage**: 2.2 V min, 5.5 V absolute max
- **Input low voltage**: 1.5 V max, -0.5 V absolute min, 0 V recommended min

**External Scan Clock I/O**

- **Terminal names**: USB-1208HS: AICKI, AICKO
- **USB-1208HS-2AO/1208HS-4AO**: AICKI, AICKO, AOCKI, AOCKO
- **Terminal types**: AxCKI: Input, active on rising edge
- **AxCKO**: Output, power on default is 0 V, active on rising edge

**Terminal descriptions**

AxCKI: Receives sampling clock from external source
AxCKO: Outputs internal sampling clock (D/A or A/D clock) or pulse generated from AxCKI when in external clock mode

- **Input clock rate**: 1 MHz max
- **Clock pulse width**: AxCKI: 400 ns min
- **AxCKO**: 400 ns min
- **Input type**: Schmitt trigger, 33 Ω series resistor, 47 kΩ pull-down to ground
- **Schmitt trigger hysteresis**: 0.4 V to 1.2 V
- **Input high voltage**: 2.2 V min, 5.5 V absolute max
- **Input low voltage**: 1.5 V max, -0.5 V absolute min, 0 V recommended min
- **Output high voltage**: 4.4 V V (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 per terminal

**Counters**

- **Counter terminal names**: CTR0, CTR1
- **Counter type**: Event counter
- **Number of channels**: 2
- **Input type**: Schmitt trigger, 33 Ω series resistor, 47 kΩ pull-down to ground
- **Schmitt trigger hysteresis**: 0.4 V to 1.2 V
- **Input high voltage**: 2.2 V min, 5.5 V absolute max
- **Input low voltage**: 1.5 V max, -0.5 V absolute min, 0 V recommended min
- **Resolution**: 32 bits
- **Max input frequency**: 20 MHz
- **Counter read/write rates (software paced)**: 33 to 8000 read/writes per second typ, system-dependent
- **High pulse width**: 25 ns min
- **Low pulse width**: 25 ns min

**Timer**

- **Timer terminal name**: TMR
- **Timer type**: PWM output with count, period, delay, and pulse width registers
- **Output value**: Default state idle low, pulses high, software-selectable output invert
- **Internal clock frequency**: 40 MHz
- **Register widths**: 32 bits
- **High pulse width**: 20 ns min
- **Low pulse width**: 20 ns 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 per pin

**Power**

- **Operating modes**: Bus-powered, USB 5 V supply
- **Supply current**
  - Suspend mode: <2.5 mA
  - Enumeration: <100 mA
  - Run mode: <500 mA
- **Power consumption, excluding analog and digital outputs**
  - **Run mode**: USB-1208HS: 1.05 W max (210 mA input current)
    - USB-1208HS-2AO: 1.125 W max (225 mA input current)
    - USB-1208HS-4AO: 1.175 W max (235 mA input current)
  - **Power available for 5 V, AICKO, AOCKO, TMR, analog outputs, digital I/O**
    - **Run mode**: USB-1208HS: 1.45 W max
      - USB-1208HS-2AO: 1.375 W max
      - USB-1208HS-4AO: 1.325 W max
    - **The total power consumption for all external loads must be < this value; each load must meet the individual specification for the terminal.**
- **Digital output power calculation**: Power per output = Iout * 16.5 V/0.78 (example: @24 mA, 3 = (0.024 * 5 = 120 mW/output)
- **Analog output power calculation**: Power per output = (Iout * 16.5 V)/0.78 (example: @ 3 mA, P = (0.003 * 16.5)/0.78 = 63.5 mW/output)
- **5 V output power calculation**: Power (W) = (Iout * 5 V)/0.78 (example: 1000 mW/output)

Fuses (on USB supply): 04.52.750 - Littlefuse 0.750A NANO2® Silo-BlO® Subminiature Surface Mount Fuse. Spare fuse mounted in holder on PCB.
## USB-1208HS Series

### Ordering

## Order Information

### Hardware

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
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<td>High-speed 13-bit DAQ device with eight SE or four DIFF analog inputs, two 32-bit external event counters, a 32-bit PWM timer output, and 16 digital I/O lines.</td>
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### Software also Available from MCC

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<td>DAQami</td>
<td>Data acquisition companion software for acquiring data and generating signals</td>
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<tr>
<td>TracerDAQ Pro</td>
<td>Out-of-the-box virtual instrument suite with strip chart, oscilloscope, function generator, and rate generator – professional version</td>
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<tr>
<td>DASYLab</td>
<td>Icon-based data acquisition, graphics, control, and analysis software</td>
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