

USB-1208HS Series

13-Bit Multifunction High-Speed DAQ Devices



Features

- Low cost, multifunction USB devices with 4 differential or 8 single-ended analog inputs (software-selectable)
- 13-bit analog input resolution
- Sample rates up to 1 MS/s
- Up to 4 analog outputs
- 16 digital I/O lines
- Two 32-bit counter input channels
- One timer output
- No external power required

Software

Supported Operating Systems

- Windows 8/7/Vista®/XP 32/64-bit
 - Universal library (UL), ULx for NI LabVIEW™
- Linux®
 - Third-party support
- Android™
 - UL for Android

Ready-to-Run Applications

- InstaCal™ (install, configure, and test)
- DAQami™ Advanced Data Logging Application (acquire, view, and log)
- TracerDAQ® (acquire, view, log, and generate)

Supported Programming Environments

- Visual Studio® and Visual Studio .NET, including examples for Visual C++®, Visual C#®, Visual Basic®, and Visual Basic .NET, and other IDEs
- Java® (Android only) including examples and demo apps
- LabVIEW (Windows only)
- DASyLab®
- MATLAB® (Data Acquisition Toolbox™)

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.

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



All USB-1208HS Series devices provide eight single-ended or four differential analog inputs at up to a 1 MS/s sampling rate, and 16 digital I/O. The USB-1208HS-2AO includes two analog output channels, and the USB-1208HS-4AO includes four analog output channels.

USB-1208HS Series Selection Chart

Model	Analog Inputs	Sampling Rate	Analog Outputs	Digital I/O	Counters
USB-1208HS	8 SE/4 DIFF	Up to 1 MS/s	0	16	2
USB-1208HS-2AO	8 SE/4 DIFF	Up to 1 MS/s	2	16	2
USB-1208HS-4AO	8 SE/4 DIFF	Up to 1 MS/s	4	16	2

Analog Input

In DIFF mode, each device supports software-selectable ranges from ± 5 V to ± 20 V. In SE mode, software-selectable ranges from ± 2.5 V to ± 10 V, and 0 V to 10 V are supported.

Sample Rate

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

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/1208HS-4AO also have an external clock input terminal that supports input signals (1 MHz max) 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/1208HS-4AO also have a clock output terminal to output the D/A sampling clock.

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

The USB-1208HS-2AO/1208HS-4AO maximum update rate for analog outputs depends on several factors, including the speed of your USB port.

The USB-1208HS-2AO provides two 12-bit analog outputs, and the USB-1208HS-4AO provides four 12-bit analog outputs. Both devices offer an output range of ± 10 V. When updating continuously from computer memory, each analog output updates at a maximum rate of 1 MS/s.

USB-1208HS Series

General Information & Software Support



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).

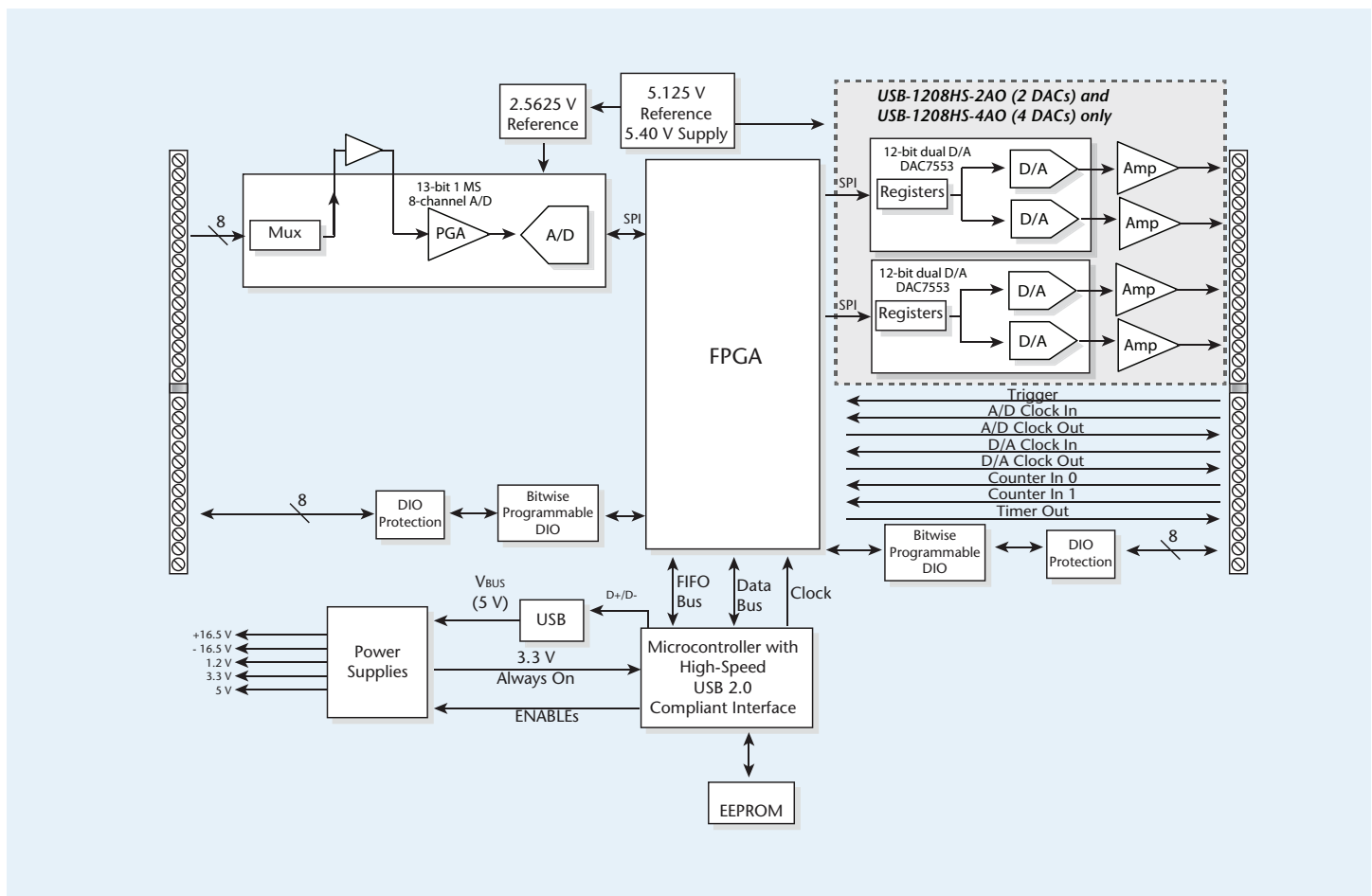
Counter Input

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.

USB-1208HS Series Block Diagram



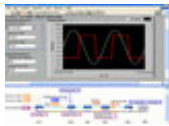
USB-1208HS Series

Specifications



Software Support

USB-1208HS 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).
DAQami		Advanced data logging application with drag-and-drop software interface that is used to acquire, view, and log data. DAQami can be configured to log analog channels and to view that data in real-time or post-acquisition on user-configurable displays. Windows OS DAQami is available as a purchased software 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).
UL for Android		Programming library of function calls for Java programmers who develop apps for Android-based tablets and phones. 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 (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
MATLAB Driver		High-level language and interactive environment for numerical computation, visualization, and programming. The Data Acquisition Toolbox, provided by The Mathworks, allows users to acquire data from most MCC PCI and USB devices. Visit www.MathWorks.com for more information on MATLAB Data Acquisition Toolbox support.

USB-1208HS Series

Specifications



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 x W x H): 127.00 x 88.90 x 35.56 mm (5.00 x 3.50 x 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 M Ω 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
 Sampling 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 μ s
 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	Calibrated Absolute Accuracy (LSB)	Noise Performance*	
		Typical Counts	LSBrms
DIFF mode			
±20 V	±9.55 typ, ±13.18 max	3	0.45
±10 V	±4.59 typ, ±6.23 max	3	0.45
±5 V	±2.25 typ, ±2.75 max	3	0.45
SE mode			
±10 V	±5.10 typ, ±8.06 max	5	0.91
±5 V	±2.63 typ, ±4.03 max	5	0.91
±2.5 V	±1.59 typ, ±2.70 max	5	0.91
0 V to 10 V	±3.29 typ, ±5.13 max	5	0.91

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

Input Settling Time in μ s, Typical $\pm$ Full-Scale Channel Switch, Same-Range to Same-Range			
Range	± 1 LSB	± 4 LSB	± 8 LSB
± 10 V	1.5	1.1	1.0
± 5 V	2.1	1.1	1.0
± 2.5 V	2.2	1.1	1.0
0 V to 10 V	2.6	1.1	1.0

Analog Output

(USB-1208HS-2AO/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
 Calibrated: ± 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 AOCLKI (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 k Ω , CL=200 pF), 5 μ s max.
 Absolute Accuracy: $\pm 0.1\%$
 Slew Rate: 6.7 V/ μ s 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 Configuration: The port has 47 k Ω resistors configurable as pull-ups or pull-downs by an internal jumper (default setting is pull-down.)
 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 μ A), 3.76 V min (IOH = -24 mA)
 Output Low Voltage: 0.1 V max (IOL = 50 μ A), 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 μ s + 1 clock cycle max
 Trigger Pulse Width: 100 ns min
 Input Type: Schmitt Trigger, 33 Ω series resistor and 47 k Ω 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

USB-1208HS Series

Specifications & Ordering



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 k Ω 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 min (IOH = -50 μ A), 3.76 V min (IOH = -24 mA)

Output Low Voltage: 0.1 V max (IOL = 50 μ A), 0.44 V max (IOL = 24 mA)

Output Current: ± 24 mA max per terminal (see *Power* section for additional information)

Counters

Counter Terminal names: CTR0, CTR1

Counter Type: Event counter

Number of Channels: 2

Input Type: Schmitt trigger, 33 Ω series resistor, 47 k Ω 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 reads/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 is idle low with 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 μ A), 3.76 V min (IOH = -24 mA)

Output Low Voltage: 0.1 V max (IOL = 50 μ A), 0.44 V max (IOL = 24 mA)

Output Current: ± 24 mA max per pin

Ordering Information

Part No.	Description
USB-1208HS	High-speed USB-based 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.
USB-1208HS-2AO	High-speed USB-based 13-bit DAQ device with eight SE or four DIFF analog inputs, two 12-bit analog outputs, two 32-bit external event counters, a 32-bit PWM timer output, and 16 digital I/O lines.
USB-1208HS-4AO	High-speed USB-based 13-bit DAQ device with eight SE or four DIFF analog inputs, four 12-bit analog outputs, two 32-bit external event counters, a 32-bit PWM timer output, and 16 digital I/O lines.

Memory

Data FIFO

USB-1208HS: 4 kS analog input

USB-1208HS-2AO/1208HS-4AO: 4 kS analog input/4 kS analog output

Non-Volatile Memory: 32 KB (16 KB firmware storage, 16 KB calibration/user data)

Power

Operating Modes: Bus-powered, USB 5 V supply

Supply Current (total current consumption for the USB-1208HS Series, including 5 V, and digital output and analog output currents)

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 less than this value and each load must meet the individual specification for the terminal.

Digital Output Power Calculation: Power per

output = Iout * 5 V (for example, @ 24 mA,

P = 0.024 * 5 = 120 mW/output)

Analog Output Power Calculation: Power per

output = (Iout * 16.5 V)/0.78 (for example,

@ 3 mA, P = (0.003 * 16.5)/0.78 = 63.5 mW/output)

5 V Output Power Calculation: Power (W) = Iout * 5 V

5 V Output Voltage Range (output voltage range assumes input power is within specified limits)

Run Mode: 4.25 V min, 5.25 V max

Suspend Mode, Enumeration: 0 V

5 V Output Current

Run Mode, No Other Output Loads: 265 mA max (1.325 W).

Fuses (on USB Supply): 0452.750 - Littelfuse 0.750A NANO2® Slo-Blo® Sub-miniature Surface Mount Fuse. Spare fuse mounted in holder on PCB.

USB Specifications

USB Device Type: USB 2.0 (high-speed)

USB Device Compatibility: USB 1.1, 2.0

USB Cable Length: 5 meters max

USB Cable Type (included): A-B cable, UL type AWM 2725 or equivalent (min 24 AWG VBUS/GND, min 28 AWG D+/D-)

Software also Available from MCC

Part No.	Description
DAQami	Easy-to-use advanced data logging software to acquire, view, and log data
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