

USB-1608GX-2AO

Multifunction DAQ Device

User's Guide

Introducing the USB-1608GX-2AO

The USB-1608G is a USB 2.0 high-speed device that provides the following features:

- 16 single-ended (SE) or eight differential (DIFF) analog input channels
- Two analog output channels
- Eight individually configurable digital I/O channels
- Two counter channels (32-bit) that count TTL pulses
- One timer output channel (32-bit)
- Screw terminals for field wiring connections

The USB-1608GX-2AO is powered by the +5 volt USB supply from your computer; no external power is required. A USB cable is shipped with the device.

The USB-1608GX-2AO device is compatible with both USB 1.1 and USB 2.0 ports. The speed of the device may be limited when using a USB 1.1 port due to the difference in transfer rates on the USB 1.1 versions of the protocol (low-speed and full-speed).

Functional block diagram

USB-1608GX-2AO functions are illustrated in the block diagram shown here.

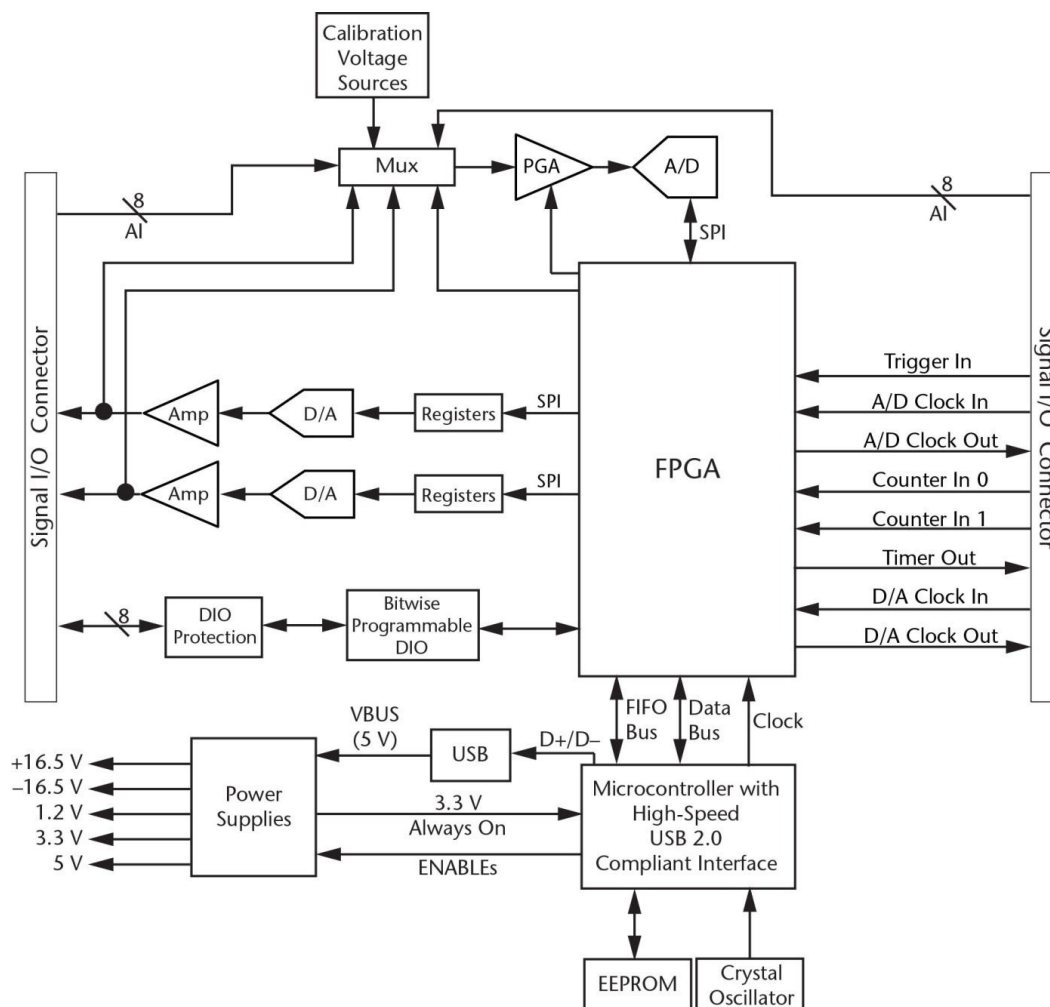


Figure 1. Functional block diagram

Installing the USB-1608GX-2AO

Unpacking

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the device from its packaging, ground yourself using a wrist strap or by simply touching the computer chassis or other grounded object to eliminate any stored static charge.

Contact us immediately if any components are missing or damaged.

Installing the software

Refer to the MCC DAQ Quick Start for instructions on installing the software on the MCC DAQ CD. Refer to the device product page on the Measurement Computing website for information about the included and optional software supported by the USB-1608GX-2AO.

Install the software before you install your device

The driver needed to run the USB-1608GX-2AO is installed with the software. Therefore, you need to install the software package you plan to use before you install the hardware.

Installing the hardware

To connect a USB-1608GX-2AO to your system, turn on your computer and connect the USB cable to an available USB port on the computer or to an external USB hub connected to the computer. Connect the other end of the USB cable to the USB connector on the device. No external power is required.

When you connect the device for the first time, a **Found New Hardware** dialog opens when the operating system detects the device. The dialog closes after the device is installed.

A green **Status** LED indicates the device status. When the LED is on, the device is powered and ready for operation. When the LED is off, the device is not powered or did not initialize. Figure 3 on page 9 shows the location of the **Status** LED. If the **Status** LED is on but then turns off, the computer has lost communication with the device. To restore communication, disconnect the USB cable from the computer and then reconnect it. This should restore communication, and the LED should turn on.

Caution! Do not disconnect any device from the USB bus while the computer is communicating with the USB-1608GX-2AO, or you may lose data and/or your ability to communicate with the device.

Calibrating

Self-calibration

The USB-1608GX-2AO supports self-calibration with InstaCal. Calibrate the device whenever the ambient temperature changes by more than ± 10 °C from the last self-calibration.

Factory calibration

The Measurement Computing Manufacturing Test department performs the initial factory calibration. Contact Measurement Computing for details about how to return your device and have it calibrated to the factory specifications.

Firmware updates

Your DAQ device contains firmware that can be updated in the field if required. Firmware is available for download at www.mccdaq.com/firmware.aspx. We recommend that you check this page periodically to see if an update to your device firmware is available.

Functional Details

Analog input modes

The USB-1608GX-2AO device can acquire analog input data in two basic modes – software paced and hardware paced.

Software paced

You can acquire one analog sample at a time in software paced mode. You initiate the A/D conversion with a software command. The analog value is converted to digital data and returned to the computer. Repeat this procedure until you have the total number of samples that you want.

The sample rate in software paced mode is system-dependent and can range from 33 S/s to 4000 S/s.

Hardware paced

You can acquire data from up to 16 channels in hardware paced mode. The analog data is continuously acquired, converted to digital values, and written into the FIFO buffer on the device until you stop the scan. The FIFO buffer is serviced in blocks as the data is transferred from the FIFO buffer to the computer memory buffer. You start a continuous scan with either a software command or with an external hardware trigger event.

The maximum sampling rate in hardware paced mode from one to 16 channels is 500 kS/s aggregate.

Burst mode

When using the onboard pacer, you can enable burst mode for more precise timing between samples. When burst mode is enabled, each successive channel in a scan is sampled at the maximum A/D rate. This ensures that samples from each channel are taken as close as possible to the same absolute point in time. When burst mode is disabled, data is sampled at evenly spaced intervals, allowing maximum settling time and best amplitude accuracy. Multi-channel scanning with burst mode enabled and disabled is shown in Figure 2.

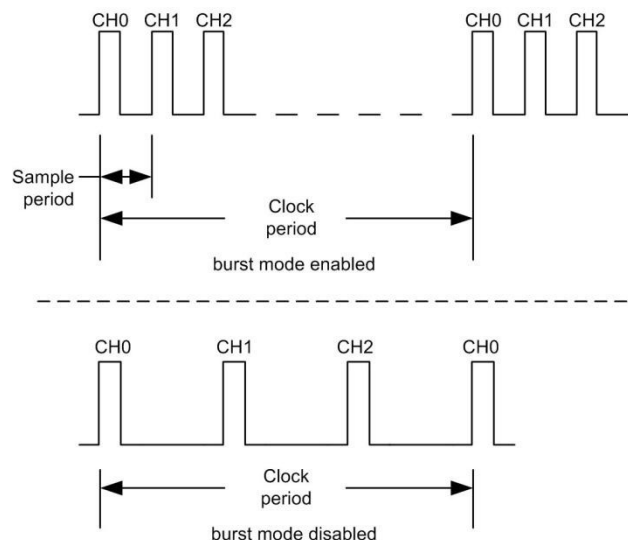


Figure 2. Multi-channel scan with burst mode enabled and disabled

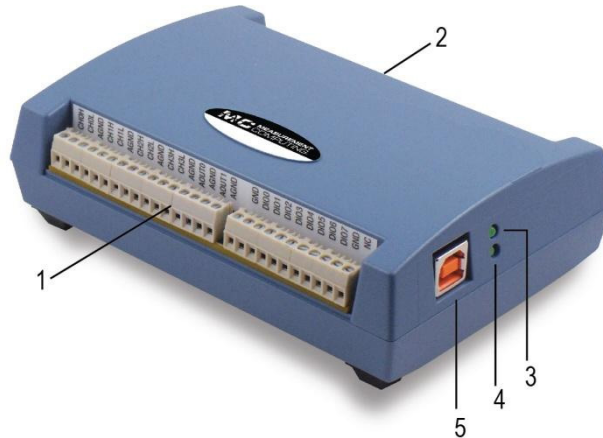
The burst mode sample period is 2 μ s.

You can trigger the acquisition with the external trigger, and control the clock period with the internal or external A/D pacer clock. Pacing from the external clock always operates with burst mode enabled.

External components

The USB-1608GX-2AO has the following external components (see Figure 3):

- USB connector
- LEDs
- Screw terminals



- | | | | |
|---|------------------------------|---|---------------|
| 1 | Screw terminal pins 1 to 27 | 4 | Activity LED |
| 2 | Screw terminal pins 28 to 54 | 5 | USB connector |
| 3 | Status LED | | |

Figure 3. External components

USB connector

The USB connector provides +5 V power and communication. No external power supply is required.

LEDs

The USB-1608GX-2AO has two LEDs – **Status** and **Activity**.

- The **Status** LED turns on when the device is detected and installed on the computer.
- The **Activity** LED blinks when data is transferred, and is off otherwise.

Figure 3 shows the location of each LED.

Screw terminals

The screw terminals provide the following connections:

- 16 SE (**CH0** to **CH15**) or eight DIFF (**CH0H/CH0L** to **CH7H/CH7L**) analog inputs
- Eight digital I/O bits (**DIO0** to **DIO7**)
- Two analog outputs (**AOUT0**, **AOUT1**)
- One external clock input (**AICKI**) and one external clock output (**AICKO**) for analog inputs
- One external clock input (**AOCKI**) and one external clock output (**AOCKO**) for analog outputs
- One digital trigger input (**TRIG**)
- Two counter inputs (**CTR0**, **CTR1**)
- One timer output (**TMR**)
- One power output (**+5V**)
- Analog ground (**AGND**) and digital ground (**GND**) connections

The single-ended mode pinout is shown in Figure 4, and the differential mode pinout is shown in Figure 5.

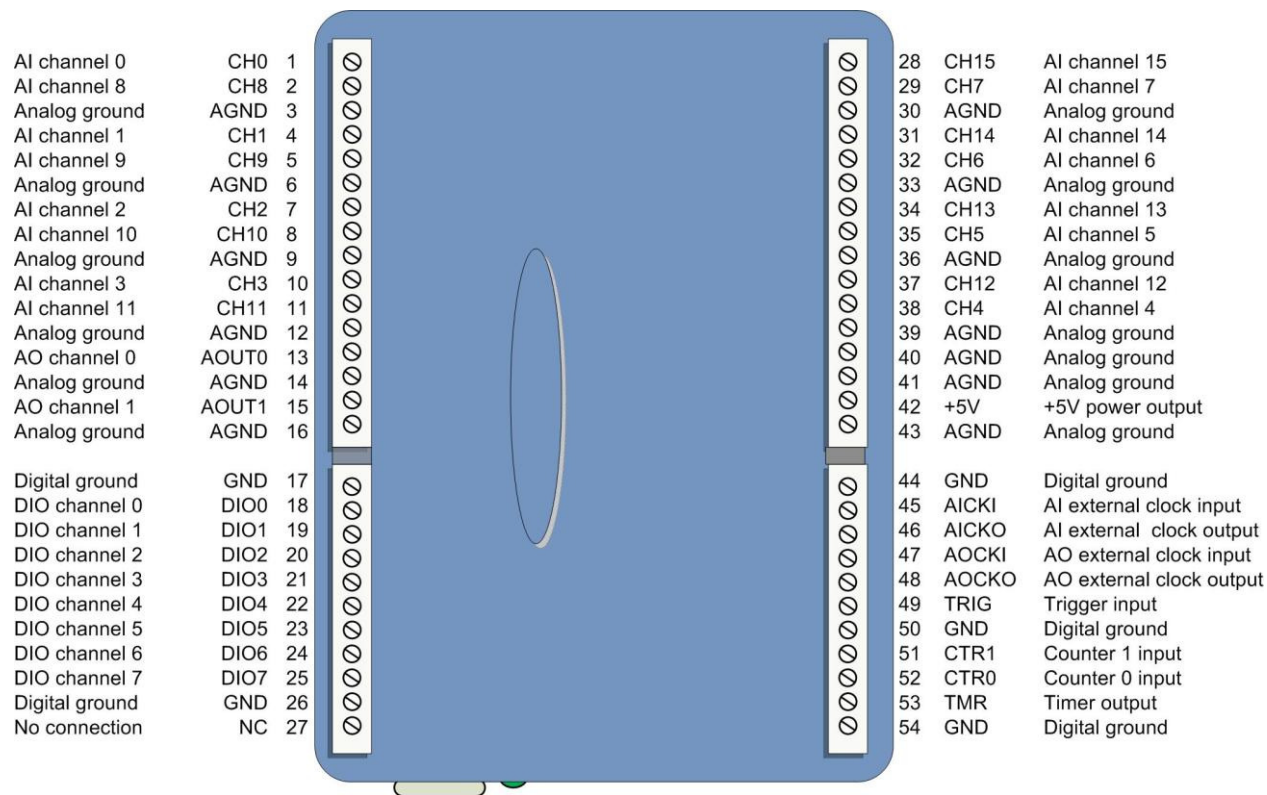


Figure 4. SE mode pinout

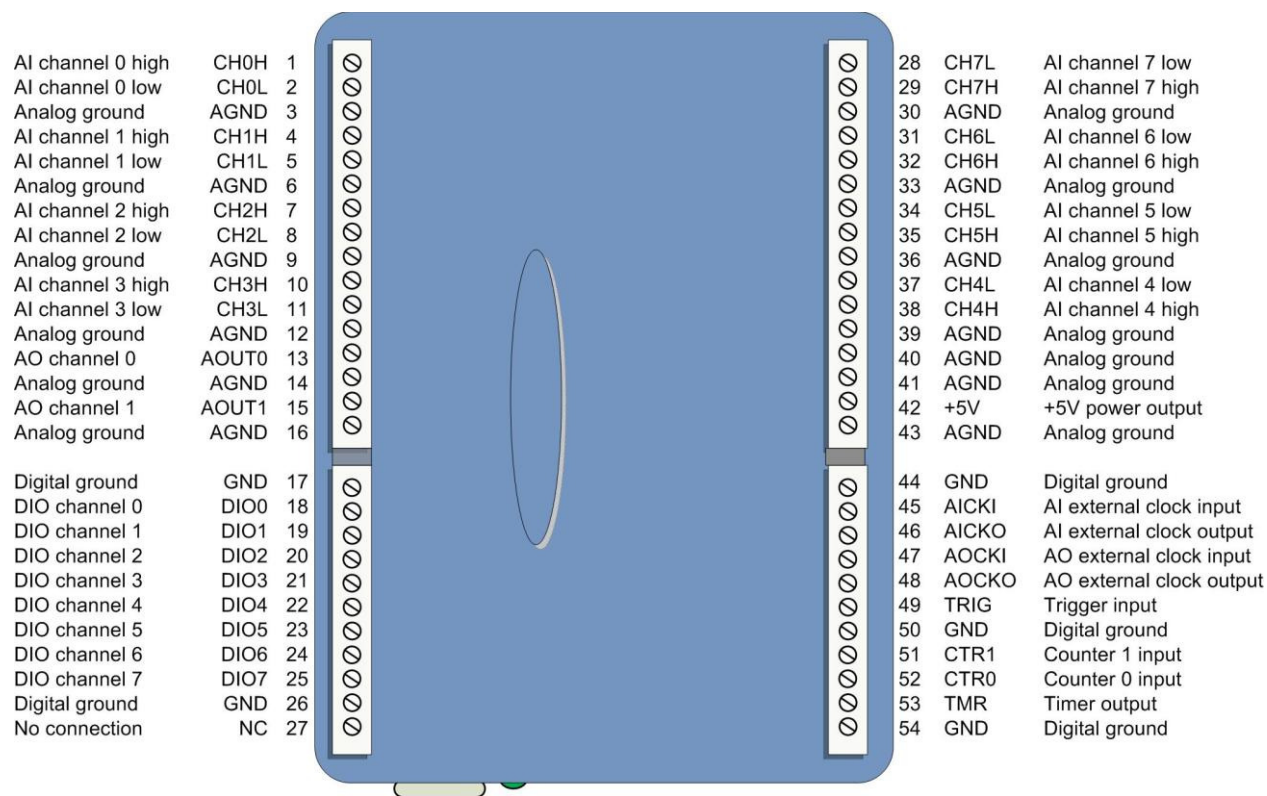


Figure 5. DIFF mode pinout

Environmental

Table 18. Environmental specifications

Parameter	Specification
Operating temperature range	0 °C to 55 °C max
Storage temperature range	-40 °C to 85 °C max
Humidity	0% to 90% non-condensing max

Mechanical

Table 19. Mechanical specifications

Parameter	Specification
Dimensions (L × W × H)	127 × 89.9 × 35.6 mm (5.00 × 3.53 × 1.40 in.)
User connection length	3 m (9.84 ft) max

Screw terminal connector

Table 20. Screw terminal connector specifications

Parameter	Specification
Connector type	Screw terminal
Wire gauge range	16 AWG to 30 AWG

Differential mode pinout

Table 21. 8-channel differential mode pinout

Pin	Signal name	Pin description	Pin	Signal name	Pin description
1	CH0H	AI channel 0 HI	28	CH7L	AI channel 7 LO
2	CH0L	AI channel 0 LO	29	CH7H	AI channel 7 HI
3	AGND	Analog ground	30	AGND	Analog ground
4	CH1H	AI channel 1 HI	31	CH6L	AI channel 6 LO
5	CH1L	AI channel 1 LO	32	CH6H	AI channel 6 HI
6	AGND	Analog ground	33	AGND	Analog ground
7	CH2H	AI channel 2 HI	34	CH5L	AI channel 5 LO
8	CH2L	AI channel 2 LO	35	CH5H	AI channel 5 HI
9	AGND	Analog ground	36	AGND	Analog ground
10	CH3H	AI channel 3 HI	37	CH4L	AI channel 4 LO
11	CH3L	AI channel 3 LO	38	CH4H	AI channel 4 HI
12	AGND	Analog ground	39	AGND	Analog ground
13	AOUT0	AO channel 0	40	AGND	Analog ground
14	AGND	Analog ground	41	AGND	Analog ground
15	AOUT1	AO channel 1	42	+5V	+5V power output
16	AGND	Analog ground	43	AGND	Analog ground
	empty			empty	
17	GND	Digital ground	44	GND	Digital ground
18	DIO0	DIO channel 0	45	AICKI	AI clock input
19	DIO1	DIO channel 1	46	AICKO	AI clock output
20	DIO2	DIO channel 2	47	AOCKI	AO clock input
21	DIO3	DIO channel 3	48	AOCKO	AO clock output
22	DIO4	DIO channel 4	49	TRIG	Trigger input
23	DIO5	DIO channel 5	50	GND	Digital ground
24	DIO6	DIO channel 6	51	CTR1	Counter 1 input
25	DIO7	DIO channel 7	52	CTR0	Counter 0 input
26	GND	Digital ground	53	TMR	Timer output
27	NC	No connection	54	GND	Digital ground

Single-ended mode pinout

Table 22. 16-channel single-ended mode pinout

Pin	Signal name	Pin description	Pin	Signal name	Pin description
1	CH0	AI channel 0	28	CH15	AI channel 15
2	CH8	AI channel 8	29	CH7	AI channel 7
3	AGND	Analog ground	30	AGND	Analog ground
4	CH1	AI channel 1	31	CH14	AI channel 14
5	CH9	AI channel 9	32	CH6	AI channel 6
6	AGND	Analog ground	33	AGND	Analog ground
7	CH2	AI channel 2	34	CH13	AI channel 13
8	CH10	AI channel 10	35	CH5	AI channel 5
9	AGND	Analog ground	36	AGND	Analog ground
10	CH3	AI channel 3	37	CH12	AI channel 12
11	CH11	AI channel 11	38	CH4	AI channel 4
12	AGND	Analog ground	39	AGND	Analog ground
13	AOUT0	AO channel 0	40	AGND	Analog ground
14	AGND	Analog ground	41	AGND	Analog ground
15	AOUT1	AO channel 1	42	+5V	+5V power output
16	AGND	Analog ground	43	AGND	Analog ground
	empty			empty	
17	GND	Digital ground	44	GND	Digital ground
18	DIO0	DIO channel 0	45	AICKI	AI clock input
19	DIO1	DIO channel 1	46	AICKO	AI clock output
20	DIO2	DIO channel 2	47	AOCKI	AO clock input
21	DIO3	DIO channel 3	48	AOCKO	AO clock output
22	DIO4	DIO channel 4	49	TRIG	Trigger input
23	DIO5	DIO channel 5	50	GND	Digital ground
24	DIO6	DIO channel 6	51	CTR1	Counter 1 input
25	DIO7	DIO channel 7	52	CTR0	Counter 0 input
26	GND	Digital ground	53	TMR	Timer output
27	NC	No connection	54	GND	Digital ground