8-Channel Voltage Input High Speed USB Data Acquisition Modules
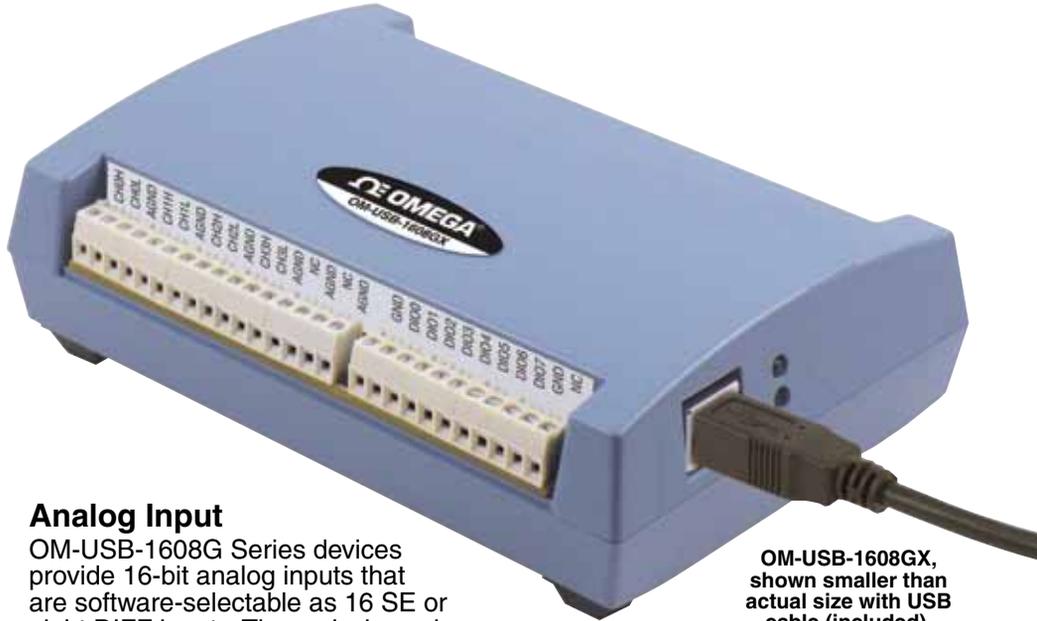
OM-USB-1608G Series

1 YEAR WARRANTY **CE**

✔ **16-Bit High-Speed USB Devices**
✔ **Acquisition Rates Ranging From 250 kS/s to 500 kS/s**
✔ **8 Differential (DIFF) or 16 Single-Ended (SE) Analog Inputs (Software Selectable)**
✔ **Up to 2 Analog Outputs**
✔ **8 Digital I/O Lines**
✔ **Two 32-Bit Counter Input Channels**
✔ **One Timer Output Channel**
✔ **TracerDAQ® Software Included for Acquiring and Displaying Data and Generating Signals**
✔ **Universal Library Includes Support for Visual Studio® and Visual Studio.NET, Including Examples for Visual C++®, Visual C#®, Visual Basic®, and Visual Basic® .NET**
✔ **Comprehensive Drivers for DASYLab® and NI LabVIEW®**
✔ **InstaCal™ Software Utility for Installing, Calibrating, and Testing**
✔ **Supported Operating Systems: Windows® VISTA/7/8/10 (32-bit and 64-bit)**

The OM-USB-1608G Series devices are low-cost, high-speed, analog and digital I/O USB devices. All of these devices offer up to eight differential (DIFF) or 16 single-ended (SE) analog inputs, up to eight digital I/O channels, two counter inputs, and one timer output.

The OM-USB-1608GX-2AO offers two, 16-bit analog output channels with DAC rates up to 500 kS/s.

Everything you need to begin acquiring, viewing, and storing data is included with each OM-USB-1608G Series device, including comprehensive software support.

OM-USB-1608GX, shown smaller than actual size with USB cable (included).

Analog Input
OM-USB-1608G Series devices provide 16-bit analog inputs that are software-selectable as 16 SE or eight DIFF inputs. These devices also support input ranges of ±10V, ±5V, ±2V, and ±1V that are software-selectable per channel

Analog Output
(OM-USB-1608GX-2AO only)
The OM-USB-1608GX-2AO has two 16-bit analog outputs. Both outputs can be updated at a rate of 250 kS/s per channel; one output can be updated at a rate of 500 kS/s. The output range is fixed at ±10V. The outputs default to 0V when the host PC is shut down or suspended, or when a reset command is issued to the device.

Trigger Input
OM-USB-1608G Series devices have an external digital trigger input. The trigger mode is software-selectable for edge or level sensitive mode. You can configure edge-sensitive mode for either rising or falling edge. In level sensitive mode, you can configure for either high or low level. The default setting at power up is edge-sensitive, rising edge.

Retrigger Mode: In retrigger mode, you can set up repetitive analog input trigger events. The trigger is automatically re-armed after it is activated. Use software to set the A/D trigger count (the number of samples you want per trigger).

Digital I/O
Eight bidirectional digital I/O connections are included with OM-USB-1608G Series devices. Each digital channel is individually configurable for input or output. The digital I/O terminals can detect the state of any TTL-level input. You can configure for pull-up (+5V) or pull-down (0V) through a jumper.

Counter Input
Each OM-USB-1608G Series device includes two 32-bit event counters for counting TTL pulses. The counters accept frequency inputs of up to 20 MHz.

Timer Output
OM-USB-1608G Series devices have a PWM timer output that can generate a pulse output with a programmable frequency in the range of 0.0149 Hz to 32 MHz. The timer output parameters are software-selectable.

External Clock I/O
OM-USB-1608G Series devices provide one external clock input and one external clock output for the analog inputs. The OM-USB-1608GX-2AO also has one external clock input and one external clock output for the analog outputs.

Model	Analog Inputs	Sampling Rate	Analog Outputs	Digital I/O	Counters
OM-USB-1608G	16 SE/8 DIFF	Up to 250 kS/s	0	8	2
OM-USB-1608GX	16 SE/8 DIFF	Up to 500 kS/s	0	8	2
OM-USB-1608GX-2AO	16 SE/8 DIFF	Up to 500 kS/s	2	8	2

Software

The OM-USB-1608G modules ship with an impressive array of software, including TracerDAQ®, a full-featured, out-of-the-box data logging, viewing, and analysis application. Driver support and detailed example programs are included for Universal Library programming libraries for Microsoft® Visual Studio® programming languages, and other languages, including DASYLab®, and ULx for NI LabVIEW® (comprehensive library of VIs and example programs compatible with 32-bit and 64-bit LabVIEW 2010 or later) and InstaCal™ installation, calibration and test utility-powerful solutions for programmers and nonprogrammers alike. These modules operate under Microsoft Windows® VISTA/7/8/10 (32-bit and 64-bit) operating systems.

The OM-USB-1608G data acquisition module is supplied with TracerDAQ software which is a collection of four virtual instrument applications used to graphically display and store input data and generate output signals:

• Strip Chart—Log and graph values acquire from analog inputs, digital inputs, temperature inputs and counter inputs
• Oscilloscope—Display values acquired from analog inputs
• Function Generator—Generate waveforms for analog outputs
• Rate Generator—Generate waveforms for counter outputs

TracerDAQ PRO is an enhanced version of TracerDAQ and is available as a purchased upgrade (SWD-TRACERDAQ-PRO). A comparison of some of the features included in TracerDAQ vs TracerDAQ PRO is shown below.

TracerDAQ Strip Chart.
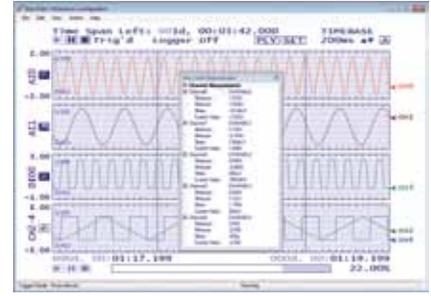
TracerDAQ Pro Strip Chart with Measurements.

Features Comparison

Strip Chart

Feature	TracerDAQ	TracerDAQ Pro
Channel Types	Analog input, temperature input, digital input, event counter	Analog input, temperature input, digital input, event counter
Number of Channels	8	48
Number of Lanes	2	8
Maximum Samples per Channel	32,000	1 million
Alarm Conditions	No	Yes
Measurements Window	No	Yes
Enter Annotations	No	Yes
Software Triggering	No	Yes
Hardware Triggering	No	Yes
Time-of-Day Triggering	No	Yes
Linear Scaling	No	Yes

Oscilloscope

Feature	TracerDAQ	TracerDAQ Pro
Channel Type	Analog input	Analog input
Number of Channels	2	4
Measurements Window	No	Yes
Reference Channel	No	Yes
Math Channel	No	Yes

Rate Generator

Feature	TracerDAQ	TracerDAQ Pro
Channel Type	Counter output	Counter output
Number of Channels	1	20

Function Generator

Feature	TracerDAQ	TracerDAQ Pro
Channel Type	Analog output	Analog output
Number of Channels	1	16
Waveform Types	Sine	Sine, square, triangle, flat, pulse, ramp, random, arbitrary
Duty Cycle	No	Yes
Phase	No	Yes
Gate Ratio	No	Yes
Rate Multiplier	No	Yes
Sweep (Linear and Exponential)	No	Yes

Specifications

ANALOG INPUT

A/D Converter Type: Successive approximation

ADC Resolution: 16-bits

Number of Channels: 8 DIFF, 16 SE; software-selectable

Input Voltage Range: ±10V, ±5V, ±2V, ±1V; software-selectable per channel

Absolute Maximum Input Voltage
CHx Relative to AGND: ±25V maximum (power on); ±15V maximum (power off)

Input Impedance: 1 GΩ (power on); 820 Ω (power off)

Input Bias Current: ±10 nA

Input Bandwidth
All Input Ranges, Small Signal (-3 dB)
OM-USB-1608G: 750 kHz
OM-USB-1608GX and OM-USB-1608GX-2AO: 870 kHz

Input Capacitance: 60 pf

Maximum Working Voltage (Signal + Common Mode): ±10.2 V maximum relative to AGND

Common Mode Rejection Ratio
f_{IN} = 60 Hz, **All Input Ranges:** 86 dB

Crosstalk
Adjacent Differential Mode Channels, DC to 100 kHz: -75 dB

Input Coupling: DC

Sampling Rate (Software-Selectable)
OM-USB-1608G: 0.0149 Hz to 250 kHz
OM-USB-1608GX and OM-USB-1608GX-2AO: 0.0149 Hz to 500 kHz

Trigger Source: TRIG (refer to External Trigger section)

Sample Clock Source: Internal A/D clock or external A/D clock (AICKI terminal)

Burst Mode: Software-selectable using the internal A/D clock; always enabled when using the external clock (AICKI terminal)
OM-USB-1608G: 4 µs
OM-USB-1608GX and OM-USB-1608GX-2AO: 2 µs

Throughput
Software Paced: 33 to 4000 S/s typical, system dependent
Hardware Paced
OM-USB-1608G: 250 kS/s maximum
OM-USB-1608GX and OM-USB-1608GX-2AO: 500 kS/s maximum

Channel Gain Queue: Up to 16 elements; software-selectable range for each channel

Warm-up Time: 15 minutes minimum

ANALOG OUTPUT (OM-USB-1608GX-2AO ONLY)

Number of Channels: 2 (leave unused AOUTx output channels disconnected)

Resolution: 16-bits

Output Range: ±10V (calibrated)

Output Transient
Host computer is reset, powered on, suspended, or a reset command is issued to the device.
Duration: 500 µs
Amplitude: 2V pk-pk

Powered Off
Duration: 10 ms
Amplitude: 7V peak

Differential Non-Linearity: ±0.25 LSB typ; ±1 LSB maximum

Output Current
AOUTx: ±3.5 mA maximum

Output Short-Circuit Protection
AOUTx Connected to AGND: Unlimited duration

Output Coupling: DC

Power On and Reset State
DACs Cleared to Zero-Scale: 0V, ±50 mV (AOUTx defaults to 0V whenever the host computer is reset, powered on, suspended, or a reset command is issued to the device)

Output Noise: 30 µVrms

Sample Clock Source: Internal D/A clock or external D/A clock (AOCKI terminal)

Output Update Rate: 500 kHz/ number of channels in scan

Settling Time
To Rated Accuracy, 10V Step: 40 µs

Slew Rate: 9 V/µs

Throughput
Software Paced: 33 S/s to 4000 S/s typical, system-dependent
Hardware Paced: 500 kS/s maximum, system-dependent

	Gain Error (% of Reading)	Offset Error (µv)	INL Error (% of Range)	Absolute Accuracy at Full Scale (µv)	Gain Temp Coefficient (% Reading/°C)	Offset Temp Coefficient (µV/°C)
Analog Input DC Voltage Measurement–All Values are (±)						
Range						
± 10V	0.024	915	0.0076	4075	0.0014	47
± 5V	0.024	686	0.0076	2266	0.0014	24
± 2V	0.024	336	0.0076	968	0.0014	10
± 1V	0.024	245	0.0076	561	0.0014	5

Range	Noise Performance* Counts	LSBrms
± 10V	6	0.91
± 5V	6	0.91
± 2V	7	1.06
± 1V	9	1.36

* For the peak–to–peak noise distribution test, a differential input channel is connected to AGND at the input terminal block, and 32,000 samples are acquired at the maximum rate available at each setting.

Analog Output Absolute Accuracy	
Range	Absolute Accuracy (±LSB)
± 10V	16.0

Analog Output Relative Accuracy	
Range	Relative Accuracy (INL)
± 10V	4.0 typical

Analog Output Calibrated Absolute Accuracy Components				
Range	% of Reading	Offset (+mV)	Offset Tempco	Gain Tempco (ppm of Range/°C
± 10V	±0.0183	1.831	12.7	13

Settling Time **

OM-USB-1608G			
Range	4 µs Settling Accuracy (% FSR)	6 µs Settling Accuracy (% FSR)	10 µs Settling Accuracy (% FSR)
± 10 V	0.0061	0.0031	0.0015
± 5 V	0.0061	0.0031	0.0015
± 2 V	0.0061	0.0031	0.0015
± 1 V	0.0061	0.0031	0.0015
OM-USB-1608GX and OM-USB-1608GX-2AO			
Range	2 µs Settling Accuracy (% FSR)	4 µs Settling Accuracy (% FSR)	9 µs Settling Accuracy (% FSR)
± 10 V	0.1251	0.0031	0.0015
± 5 V	0.0687	0.0031	0.0015
± 2 V	0.0687	0.0031	0.0015
± 1 V	0.0687	0.0031	0.0015

** Settling time is defined as the expected accuracy after one conversion when switching from a channel with a DC input at one extreme of full scale to another channel with a DC input at the other extreme of full scale. Both input channels are configured for the same input range.

ANALOG INPUT/OUTPUT CALIBRATION

Recommended Warm-Up Time: 15 minutes minimum

Calibration Method: Self-calibration (firmware)

Calibration Interval: 1 year (factory calibration)

AI Calibration Reference
+5V, ±2.5 mV maximum (actual measured values stored in EEPROM)

Tempco: 5 ppm/°C maximum
Long Term Stability: 15 ppm/1000 hours

AOUTx Calibration Procedure (OM-USB-1608GX-2AO)
The analog output terminals are internally routed to the analog input circuit. For best calibration results, disconnect any AOUTx connections at the terminal block prior to performing AOUT calibration.

DIGITAL INPUT/OUTPUT

Digital Type: CMOS

Number of I/O: 8

Configuration: Each bit may be configured as input (power on default) or output

Pull-Up Configuration: The port has 47 kΩ resistors configurable as pull-ups or pull-downs (default) via internal jumper (W1)

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: 2.0V minimum, 5.5V absolute maximum

Input Low Voltage: 0.8V maximum, -0.5V absolute minimum, 0V recommended minimum

Output High Voltage: 4.4V minimum (IOH = -50 µA), 3.76V minimum (IOH = -2.5 mA)

Output Low Voltage: 0.1V maximum (IOL = 50 µA), 0.44V maximum (IOL = 2.5 mA)

Output Current: ±2.5 mA maximum

EXTERNAL TRIGGER

Trigger Source: TRIG input

Trigger Mode: Software configurable 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 maximum

Trigger Pulse Width: 100 ns minimum

Input Type: Schmitt trigger, 33 Ω series resistor and 49.9 kΩ pull-down to ground

Schmitt Trigger Hysteresis: 0.4V to 1.2V

Input High Voltage: 2.2V minimum, 5.5V absolute maximum

Input Low Voltage: 1.5V maximum, -0.5V absolute minimum, 0V recommended minimum

EXTERNAL CLOCK INPUT/ OUTPUT

Terminal Names
OM-USB-1608G and OM-USB-1608GX: AICKI, AICKO,
(OM-USB-1608GX-2AO): AOCKI, AOCKO

Terminal Types
AxCKI: Input, active on rising edge
AxCKO: Output, power on default is 0V, active on rising edge

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

Input Clock Rate
OM-USB-1608G: 250 kHz maximum
OM-USB-1608GX and OM-USB-1608GX-2AO: 500 kHz maximum

Clock Pulse Width
AxCKI: 400 ns minimum
AxCKO: 400 ns minimum

Input Type: Schmitt trigger, 33 Ω series resistor, 47 kΩ pull-down to ground

Schmitt Trigger Hysteresis: 0.4V to 1.2V

Input High Voltage: 2.2V minimum, 5.5V absolute maximum

Input Low Voltage: 1.5V maximum, -0.5V absolute minimum, 0V recommended minimum

Output High Voltage: 4.4V minimum (IOH = -50 µA), 3.76V minimum (IOH = -2.5 mA)

Output Low Voltage: 0.1V maximum (IOL = 50 µA), 0.44V maximum (IOL = 2.5 mA)

Output Current: ±2.5 mA maximum

COUNTER

Terminal Names: CTR0, CTR1

Number of Channels: 2 channels

Resolution: 32-bit

Counter Type: Event counter

Input Type: Schmitt trigger, 33 Ω series resistor, 47 kΩ pull-down to ground

Input Source:
CTR0 (terminal 52)
CTR1 (terminal 51)

Counter Read/Writes Rates (Software-Paced): 33 to 8000 reads/writes per second typical, system dependent

Input High Voltage: 2.2V minimum, 5.5V maximum

Input Low Voltage: 1.5V maximum, -0.5V minimum

Schmitt Trigger Hysteresis: 0.4V minimum, 1.2V maximum

Input Frequency: 20 MHz, maximum

High Pulse Width: 25 ns, minimum

Low Pulse Width: 25 ns, minimum

TIMER OUTPUT

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: 64 MHz

Register Widths: 32-bit

High Pulse Width: 15.625 ns minimum

Low Pulse Width: 15.625 ns minimum

Output High Voltage: 4.4V minimum (IOH = -50 µA), 3.76V minimum (IOH = -2.5 mA)

Output Low Voltage: 0.1V maximum (IOL = 50 µA), 0.44V maximum (IOL = 2.5 mA)

Output Current: ±2.5 mA maximum

MEMORY

Data FIFO: 4 kS analog input/2 kS analog output

Non-Volatile Memory: 32 KB (28 KB firmware storage, 4 KB calibration/user data)

POWER

Supply Current

This is the total quiescent current requirement for the device that includes up to 10 mA for the Status LED. This does not include any potential loading of the digital I/O bits, +5V terminal, or the AOUTx outputs (OM-USB-1608GX-2AO only)

Quiescent Current
OM-USB-1608G and OM-USB-1608GX: 230 mA

OM-USB-1608GX-2AO: 260 mA

+5V User Output Voltage Range (Available at Terminal 42): 4.9V minimum to 5.1V maximum

+5V User Output Current (Available at Terminal 42): 10 mA maximum

ENVIRONMENTAL

Operating Temperature Range: 0 to 55°C (32 to 131°F) maximum

Storage Temperature Range: -40 to 85°C (-40 to 185°F) maximum

Humidity: 0 to 90% RH non-condensing max

MECHANICAL

Dimensions: 127 L × 89.9 W × 35.6 H mm (5.00 × 3.53 × 1.40")

Weight: 160 g (0.35 lb)

USB Cable: 3 m (9.84") maximum

OM-USB-1608GX, shown smaller than actual size.

To Order

Model No.	Description
OM-USB-1608G	16-channel, 250 kS/s USB data acquisition module with two 32-bit counter inputs, one timer output and eight DIO lines
OM-USB-1608GX	16-channel, 500 kS/s USB data acquisition module with two 32-bit counter inputs, one timer output and eight DIO lines
OM-USB-1608GX-2AO	16-channel, 500 kS/s USB data acquisition module with two analog outputs, two 32-bit counter inputs, one timer output and eight DIO lines
SWD-TRACERDAQ-PRO	TracerDAQ Pro software

Comes complete with a 1.8 m (6') USB cable, software and operator's manual on CD.

***Ordering Example: OM-USB-1608G**, 16-channel, 250 kS/s USB data acquisition module with two 32-bit counter inputs, one timer output and eight DIO lines, and **OCW-1,** 1-year extended warranty adds 1 year to standard 1-year warranty.*