**Data Acquisition Systems**

8-Channel Voltage Input High Speed USB Data Acquisition Modules

OM-USB-1608G Series

- 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
- 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.

**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.

**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.

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### Analog Model

<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>OM-USB-1608G</td>
<td>16 SE/8 DIFF</td>
<td>Up to 250 kS/s</td>
<td>0</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>OM-USB-1608GX</td>
<td>16 SE/8 DIFF</td>
<td>Up to 500 kS/s</td>
<td>0</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>OM-USB-1608GX-2AO</td>
<td>16 SE/8 DIFF</td>
<td>Up to 500 kS/s</td>
<td>2</td>
<td>8</td>
<td>2</td>
</tr>
</tbody>
</table>
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 acquired 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.

### Features Comparison

<table>
<thead>
<tr>
<th>Feature</th>
<th>TracerDAQ</th>
<th>TracerDAQ Pro</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strip Chart</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Channel Types</td>
<td>Analog input, temperature input, digital input, event counter</td>
<td>Analog input, temperature input, digital input, event counter</td>
</tr>
<tr>
<td>Number of Channels</td>
<td>8</td>
<td>48</td>
</tr>
<tr>
<td>Number of Lanes</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Maximum Samples per Channel</td>
<td>32,000</td>
<td>1 million</td>
</tr>
<tr>
<td>Alarm Conditions</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Measurements Window</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Enter Annotations</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Software Triggering</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Hardware Triggering</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Time-of-Day Triggering</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Linear Scaling</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Oscilloscope

<table>
<thead>
<tr>
<th>Feature</th>
<th>TracerDAQ</th>
<th>TracerDAQ Pro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel Type</td>
<td>Analog input</td>
<td>Analog input</td>
</tr>
<tr>
<td>Number of Channels</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Measurements Window</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Reference Channel</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Math Channel</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Rate Generator

<table>
<thead>
<tr>
<th>Feature</th>
<th>TracerDAQ</th>
<th>TracerDAQ Pro</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Channel Type</strong></td>
<td>Counter output</td>
<td>Counter output</td>
</tr>
<tr>
<td><strong>Number of Channels</strong></td>
<td>1</td>
<td>20</td>
</tr>
</tbody>
</table>

### Function Generator

<table>
<thead>
<tr>
<th>Feature</th>
<th>TracerDAQ</th>
<th>TracerDAQ Pro</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Channel Type</strong></td>
<td>Analog output</td>
<td>Analog output</td>
</tr>
<tr>
<td><strong>Number of Channels</strong></td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td><strong>Waveform Types</strong></td>
<td>Sine</td>
<td>Sine, square, triangle, flat, pulse, ramp, random, arbitrary</td>
</tr>
<tr>
<td><strong>Duty Cycle</strong></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Phase</strong></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Gate Ratio</strong></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Rate Multiplier</strong></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Sweep (Linear and Exponential)</strong></td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
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**
- fIN = 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

**Warm-up Time:** 15 minutes minimum

**Analog Output Absolute Accuracy**

<table>
<thead>
<tr>
<th>Range</th>
<th>Absolute Accuracy (±LSB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>±10V</td>
<td>16.0</td>
</tr>
</tbody>
</table>

**Analog Output Relative Accuracy**

<table>
<thead>
<tr>
<th>Range</th>
<th>Relative Accuracy (INL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>±10V</td>
<td>4.0 typical</td>
</tr>
</tbody>
</table>

**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 Absolute Accuracy**

<table>
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**Analog Output Relative Accuracy**

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<td>4.0 typical</td>
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</table>

**Power 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

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### Analog Input DC Voltage Measurement—All Values are (±)

<table>
<thead>
<tr>
<th>Range</th>
<th>Gain Error (% of Reading)</th>
<th>Offset Error (μV)</th>
<th>INL Error (% of Range)</th>
<th>Absolute Accuracy at Full Scale (μV)</th>
<th>Temperature Coefficient (°C)</th>
<th>Offset Temp Coefficient (μV/°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>±10V</td>
<td>0.024</td>
<td>915</td>
<td>0.0076</td>
<td>4075</td>
<td>0.0014</td>
<td>47</td>
</tr>
<tr>
<td>±5V</td>
<td>0.024</td>
<td>686</td>
<td>0.0076</td>
<td>2266</td>
<td>0.0014</td>
<td>24</td>
</tr>
<tr>
<td>±2V</td>
<td>0.024</td>
<td>336</td>
<td>0.0076</td>
<td>968</td>
<td>0.0014</td>
<td>10</td>
</tr>
<tr>
<td>±1V</td>
<td>0.024</td>
<td>245</td>
<td>0.0076</td>
<td>561</td>
<td>0.0014</td>
<td>5</td>
</tr>
</tbody>
</table>

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*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 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:**
- 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

**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**  
**OM-USB-1608GX**  
**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

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**Extended Warranty Program**  
OMEGACARE® extended warranty program is available for models shown on this page. Ask your sales representative for full details when placing an order. OMEGACARE® covers parts, labor and equivalent loaners.

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**To Order**

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

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.