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User's Guide

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OM-NET-1608
8-Channel Multifunction Ethernet Data Acquisition Module

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Table of Contents

About this User's Guide

What you will learn from this user's guide

This user's guide describes the Omega Engineering OM-NET-1608 data acquisition device and lists device specifications.

Conventions in this user's guide

For more information about ...

Text presented in a box signifies additional information and helpful hints related to the subject matter you are reading.

Caution! Shaded caution statements present information to help you avoid injuring yourself and others, damaging your hardware, or losing your data.

bold text **Bold** text is used for the names of objects on a screen, such as buttons, text boxes, and check boxes.

italic text *Italic* text is used for the names of manuals and help topic titles, and to emphasize a word or phrase.

Where to find more information

Additional information about OM-NET-1608 hardware is available on our website at www.omega.com. You can also contact Omega Engineering by phone, fax, or email with specific questions.

- Phone: (203) 359-1660
- Fax: (203) 359-7700
- Email: das@omega.com

Introducing the OM-NET-1608

The OM-NET-1608 is compatible with both TCP/IP (IPv4 only) and *user datagram protocol* (UDP) network protocols.

The OM-NET-1608 provides the following features:

- Four differential (DIFF) or eight single-ended (SE) analog input channels (16-bit)
- Sample rates up to 250 kS/s aggregate
- Two analog output channels (16-bit)
- Eight individually configurable digital I/O channels
- One counter channel (32-bit) that counts TTL pulses
- Screw terminals for field wiring connections

The OM-NET-1608 is powered by a 5 volt power adapter.

Ethernet interface

The OM-NET-1608 has one built-in 10/100 BASE-T auto-negotiation, high-speed communication port.

With the Ethernet interface, you can remotely access and configure your OM-NET-1608 from anywhere on the network. Only one computer can control the OM-NET-1608 at one time. The networking protocols are TCP/IP and UDP.

A unique *media access control* (MAC) address is assigned to each device at the factory.

You configure the Ethernet connection settings through software. A network name in the format `E-1608-xxxxxx`, is assigned to the OM-NET-1608, where `xxxxxx` represents the lower six characters of the device MAC address.

Functional block diagram

OM-NET-1608 functions are illustrated in the block diagram shown here.

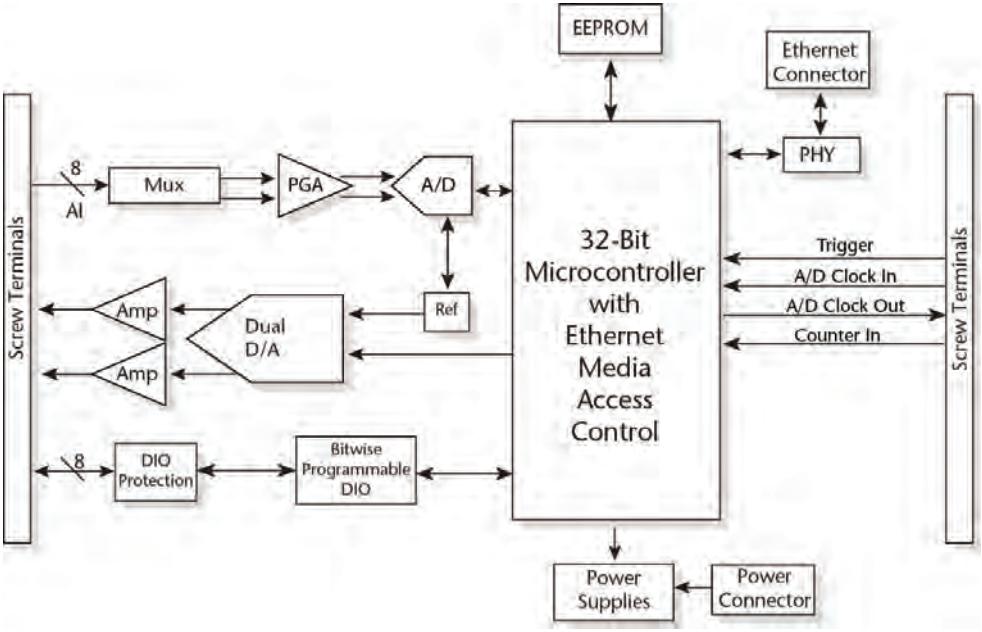


Figure 1. Functional block diagram

Installing the OM-NET-1608

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 *Software User's Guide* for instructions on installing the software. Refer to the device product page on the Omega Engineering website for information about the included and optional software supported by the OM-NET-1608.

Install the software before you install your device

The driver needed to run the OM-NET-1608 is installed with the software. Therefore, you need to install the software package you plan to use before you install the hardware.

Connecting the external power adapter

Power to the OM-NET-1608 is provided with the 5 V external power adapter (PS-5V1AEPS). Connect the adapter cord to the power connector on the OM-NET-1608 device, and plug the AC adapter into an electrical outlet.

The **Power** LED turns on when 5 V power is supplied to the OM-NET-1608. If the voltage supply is less than 3.3 V or more than 5.9 V, the **POWER** LED does not turn on.

Refer to Figure 2 on page 11 for the location of the **Power** LED.

Connecting the OM-NET-1608

The OM-NET-1608 requires a TCP/IP and UDP connection to a network or computer. Use the standard Ethernet cable provided to connect the OM-NET-1608 to a 10Base-T- or 100Base-TX compatible Ethernet port, hub, or switch.

When connecting the OM-NET-1608 for the first time, make sure that you connect to a local network with DHCP enabled.

If you are unsure whether you have access to a local network or that DHCP is enabled on that network, you should use a direct connection to a Windows PC.

It may take a minute or two to detect the device and assign the address. The green **Link/ activity** LED on the lower left of the Ethernet connector turns on when there is a valid Ethernet link, and blinks when network activity is detected.

Once the OM-NET-1608 is physically connected to the local network or PC, you can run the software (InstaCal for example) to establish a connection. If a connection cannot be established, make sure the device is using the default configuration by following the instructions in the Restoring factory default network settings on page 10.

Once a connection is established and you can communicate to the device, you can change the configuration for other network scenarios.

Configuring network settings

The following OM-NET-1608 network settings are software-selectable. Only one user at a time can connect to the OM-NET-1608 to configure network options on the device. For typical local networks, the default settings are recommended.

Address mode settings

The address mode setting determines whether the default IP parameters (IPv4 address, subnet mask, and gateway) are assigned to the OM-NET-1608 or an auto-addressing method is used to assign these parameters.

DHCP or link-local enabled (default)

If connected to a network with a DHCP server, the service automatically assigns IP addresses to the OM-NET-1608.

If the connected network does not have a DHCP server, the address stored in the default IP address is assigned to the OM-NET-1608.

If the OM-NET-1608 is directly connected to a Windows PC, a link-local address is assigned to the device. A link-local address is valid only for communications between the OM-NET-1608 and the PC to which it is connected.

DHCP Only

Enables configuration by a DHCP server if one is available. The OM-NET-1608 is assigned an IP address shortly after it is powered up and attached to the network.

Link Local Only

The OM-NET-1608 is assigned a link-local IP address by the Windows PC to which it is connected. A link-local address is valid only for communications between the OM-NET-1608 and the PC to which it is connected.

Static

The default **IPv4 Address** is manually configured on the OM-NET-1608.

IP address settings

The default settings of the following IP address are assigned to the OM-NET-1608 when automatic addressing is disabled or not available (DHCP or Link Local for example)

- **IPv4 address** – The IP address that is stored on the device. The default IPv4 address is 192.168.0.101.
- **Subnet mask** – The Subnet mask that is stored on the OM-NET-1608 . The subnet mask determines the number of bits of the IP address that is used for the host portion of the address vs. the number of bits used for the network portion. The default subnet mask is 255.255.255.000
- **Gateway** – The gateway IP address that is stored on the OM-NET-1608. The gateway address of the device that bridges subnets within a network. The default gateway is 192.168.0.1

Connection code

A number between 0 (default) and 999999999. Change this number from its default of 0 to prevent other users from connecting to and configuring the device. The device remains visible to other users on the network, but connection by another user is not allowed.

Setting up the OM-NET-1608 for communication across networks

In order to communicate with the OM-NET-1608 from a computer connected to a different network – such as over the Internet – you must change the network configuration of the network router.

In the following procedure, the OM-NET-1608 is installed on the *host* LAN, and the computer is installed on the *client* LAN.

Caution! This procedure should only be performed by a network administrator or computer professional. Incorrect settings can significantly disrupt a network.

1. Assuming you have successfully connected to a local network, determine the IP address of the device. If the address was assigned by DHCP, it is recommended you change it to a static address by setting the default address to the address assigned and setting the device network configuration to static.
2. Configure the firewall/router to forward incoming traffic to the following ports to the IP address assigned to the device:
   - UDP:54211 (discovery)
   - TCP:54211 (commands)
   - TCP:54212 (scan data)
3. On the computer connected to the client LAN, manually enter the WAN address of the host router, and specify the ports that were forwarded to connect to the remote OM-NET-1608.

If the ports listed above are not available on your router, you can use the following guidelines to select different ports: The first port must be configured for both UDP and TCP. The second port must be adjacent to the first and configured for TCP. For example, you could use 54221 (TCP and UDP) and 54222 (TCP).

Configuring network alarms

You can use software to configure any digital output bit and/or each analog output channel to generate specific values to indicate when the device is connected and/or disconnected.

The settings can also be used to initialize an output to a specific value when the device connects or disconnects from the network.

Restoring factory default network settings

To reset the network configuration settings to the factory default values, complete the following steps (refer to Device components on page 11 for the location of this button):

1. Remove power from the device.
2. Press and hold the **Factory reset** button while re-applying power.
3. Hold the button for at least four seconds until both the **Power** and **Activity** LEDs blink , indicating that the settings have been restored to the factory defaults.
4. Release the button so the device continues startup with the default settings. If the button is released before the two LEDs blink, the settings are not affected and the device starts up normally.

If InstaCal is open when default settings are restored, click the **Refresh Boards** button on the InstaCal toolbar to reflect the changes.

Calibrating the hardware

Omega Engineering performs the initial factory calibration. Contact Omega Engineering for details about how to return your device and have it calibrated to the factory specifications. The recommended calibration interval is one year.

Field calibration is not supported.

Functional Details

Analog input modes

The OM-NET-1608 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 1000 S/s to 5000 S/s on local networks (lower over the Internet or wireless networks).

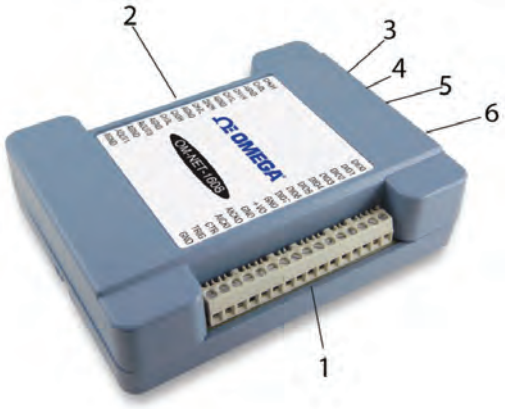
Hardware paced

You can acquire data from up to eight 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 sample rate in hardware paced-mode from one to eight channels is 250 kS/s aggregate on local hardwired networks (may be lower over the Internet or local wireless networks).

Device components

Device components are shown in Figure 2. Note that each screw terminal location is unpopulated.



1	Screw terminal pins 17 to 32	4	Power LED (top) and Activity LED (bottom)
2	Screw terminal pins 1 to 16	5	Ethernet connector with Link/activity LED (left) and Speed LED (right)
3	Factory reset button	6	External power connector

Figure 2. OM-NET-1608 external components

Ethernet connector

The OM-NET-1608 has one 10/100 BASE-T, auto-negotiation, high-speed communication port. The port connector is an RJ-45, eight-position connector. The Ethernet port accepts CAT-5 shielded or unshielded twisted pair cable. The maximum communication distance without using a repeater is 100 meters. You can send

your data 100 meters at data speeds of up to 100 Mbps using only one Ethernet cable connected to your computer.

External power connector

Connect the 5 V external power adapter (OM-NET-PS) to this connector to provide 5 V external power to the OM-NET-1608.

LEDs

The **Power** LED is steady green when external power between 3.3V to 5.9 V is supplied to the OM-NET-1608.

The **Power** LED turns off when:

- Power is not supplied by the external supply (make sure that the supply is fully connected to the power connector)
- The input power is outside of the specified voltage range of the external supply (3.3V to 5.9 V), causing a power fault

The OM-NET-1608 has an onboard voltage supervisory circuit that monitors the 5 V external power supply.

The **Activity** LED is on when there is a valid host connection, and blinks when a command is received or an analog input scan is running.

Ethernet connector LEDS

The green **Link/ activity** LED on the lower left of the Ethernet connector is on when there is a valid Ethernet link, and blinks when network activity is detected.

The yellow **Speed** LED on the lower right of the Ethernet connector is on when the transmission speed is 100 Mbps, and off when the transmission speed is 10 Mbps or there is no link.

Factory reset button

Use the factory reset button to reset network configuration settings to the factory default values.

Refer to Restoring factory default network settings on page 10 to learn about resetting these values.

Screw terminals

The OM-NET-1608 device screw terminals provide the following connections:

- Eight SE or four DIFF (**CH0 H/ CH0 L** to **CH3 H/ CH3 L**) analog input connections
- Eight digital I/O connections (**DIO0** to **DIO7**)
- Two analog output connections (**AOUT0** , **AOUT1**)
- One external clock input (**AICKI**) and one external clock output (**AICKO**) for analog inputs
- One digital trigger input (**TRIG**)
- One counter input (**CTR**)
- One power output (**+VO**)
- Six analog ground (**AGND**) and three digital ground (**GND**) connections

The OM-NET-1608 pinout locations are shown in Figure 3 below.

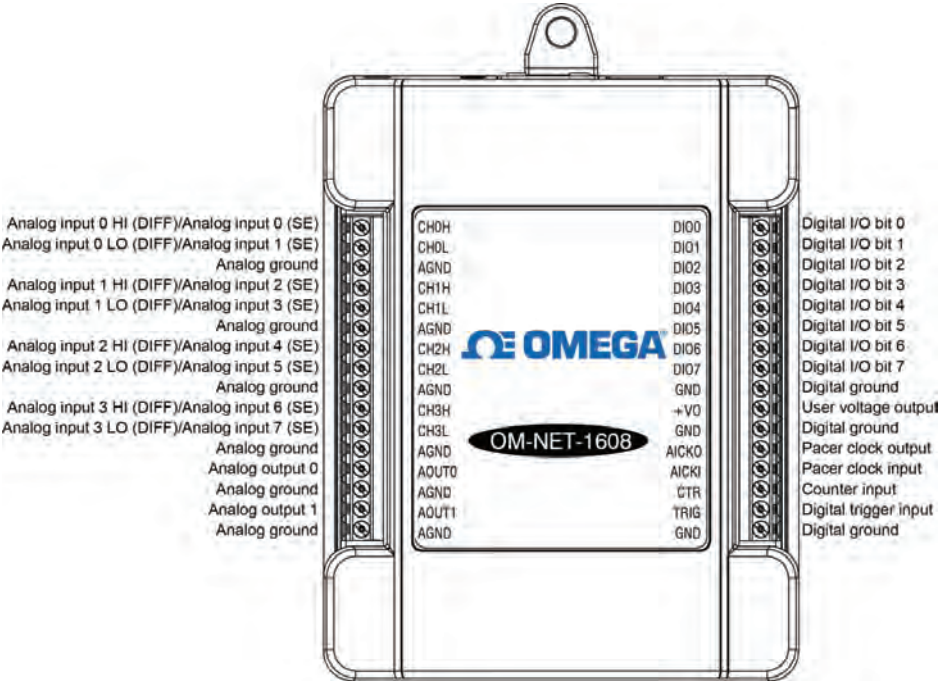


Figure 3. OM-NET-1608 pinout

Signal connections

Analog input

You can configure the analog inputs for SE or DIFF mode. The input voltage range is software selectable for ±10 V, ±5 V, ±2 V, or ±1 V.

With SE mode, connect up to eight inputs to **CH0 x** to **CH3 x**. SE mode requires two wires:

- Connect one wire to the signal you want to measure (**CH# x**).
- Connect one wire to the analog ground reference (**AGND**).

With DIFF mode, connect up to four differential inputs to **CH0 H/ CH0 L** to **CH3 H/ CH3 L**. DIFF mode requires two wires plus a ground reference:

- Connect one wire to the high/positive signal (**CHxH**).
- Connect one wire to the low/negative signal (**CHxL**).
- Connect one wire to the analog ground reference (**AGND**).

Floating voltage source

When connecting DIFF voltage inputs to a *floating* voltage source, make sure the DIFF input channel has a DC return path to ground. To create this path, connect a resistor from each low channel input to an AGND pin. A value of approximately 100 kΩ can be used for most applications.

Leave unused input channels either floating or tied to an AGND terminal. Source impedances should be kept as small as possible to avoid settling time and accuracy errors.

Figure 4 shows DIFF channels 0-3 connected to a ground path resistor.

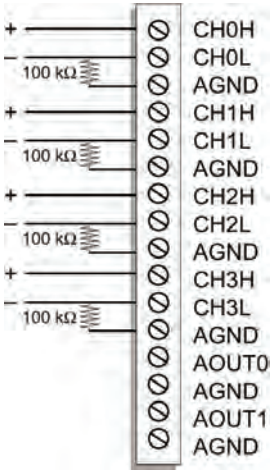


Figure 4. DIFF connections with ground path resistor

Channel-Gain queue

The channel-gain queue feature allows you to configure a list of channels, modes, and gains for each scan. The settings are stored in a channel-gain queue list that is written to local memory on the device.

The channel-gain queue list contains one or more channel numbers, modes, and range settings. You can configure up to 8 elements. The channels can be listed in any order, and can include duplicate channels for sampling at different ranges.

An example of a 4-element list is shown in the table below.

Sample channel gain queue list (SE mode)

Element	Channel	Range
0	CH5	BIP5V
1	CH1	BIP10V
2	CH3	BIP1V
3	CH5	BIP5V

Carefully match the gain to the expected voltage range on the associated channel or an over range condition may occur. Although this condition does not damage the device, it does produce a useless full-scale reading, and can introduce a long recovery time due to saturation of the input channel.

For more information about digital signal connections

For general information about digital signal connections and digital I/O techniques, refer to the *OMB-DAQ-2400, OMB-DAQ-TC-RACK, OM-NET, OM-USB, OM-WEB, and OM-WLS Series General Guide to Signal Connections* (available on our web site at www.omega.com/manuals/manualpdf/M4830.pdf).

Analog output

Two 16-bit analog outputs are available at AOUT0 and AOUT1.

Each analog output channel has an output range of ±10 V. Throughput is system-dependent.

The D/A is software-paced. Each 16-bit analog output (**AOUT0** and **AOUT1**) can be updated simultaneously at rates from 1000 S/s to 5000 S/s. This is the typical throughput when the device and host are both hard-wired to the same local network. Typical throughput is not guaranteed if a wireless connection is involved or data is sent over the Internet.

External clock I/O

The OM-NET-1608 provides one external clock input (**AICKI**) and one clock output (**AICKO**) for analog inputs.

- You can connect an external clock signal to **AICKI**.
- When using the internal clock, **AICKO** outputs the ADC scan clock.

Digital I/O

You can connect up to eight digital I/O lines to **DIO0** through **DIO7**. Each digital channel is individually configurable for input or output. The digital I/O terminals can detect the state of any TTL-level input and offer advanced BiCMOS output.

Refer to the schematic shown in Figure 5.

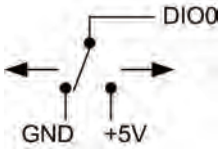
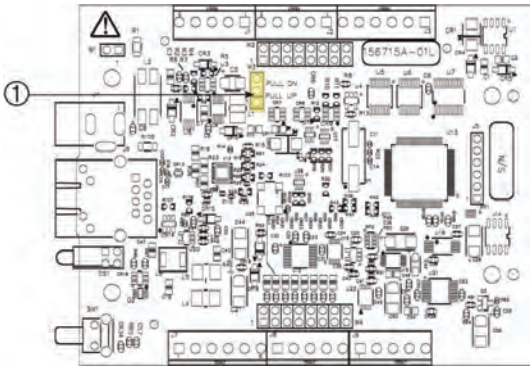


Figure 5. Schematic showing switch detection by digital channel DIO0

If you set the switch to the +5 V input, DIO0 reads *TRUE* (1). If you move the switch to GND, DIO0 reads *FALSE* (0).

Pull-up/ down configuration

Unconnected inputs are pulled high by default to 5 V through 47 kΩ resistors via jumper **W3** on the circuit board (see Figure 6).



1 W3 pull-up/ pull-down jumper

Figure 6. W3 jumper location

The pull-up/pull-down voltage is common to all 47 kΩ resistors. Jumper W3 is configured by default for pull-up.

Figure 7 shows the jumper configured for pull-up and pull-down.

Caution! The discharge of static electricity can damage some electronic components. Before touching the board, ground yourself using a wrist strap or touch the computer chassis or other grounded object to eliminate any stored static charge.

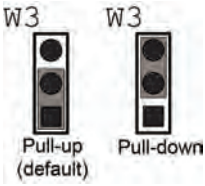


Figure 7. W3 jumper configurations

For more information about signal connections

For general information about digital signal connections and digital I/O techniques, refer to the *OMB-DAQ-2400, OMB-DAQ-TC-RACK, OM-NET, OM-USB, OM-WEB, and OM-WLS Series General Guide to Signal Connections* (available on our web site at www.omega.com/manuals/manualpdf/M4830.pdf).

Trigger input

The **TRIG** terminal is an external digital trigger input. The trigger mode is software selectable for edge or level sensitive.

- Edge sensitive mode is configurable for rising or falling edge.
- Level sensitive mode is configurable for high or low level.

The default setting at power up is edge sensitive, rising edge.

Counter input

The **CTR** terminal is a 32-bit event counter that can accept frequency inputs up to 10 MHz. The internal counter increments when the TTL levels transition from low to high.

Power output

The **+VO** terminal can output up to 10 mA maximum. You can use this terminal to supply power to external devices or circuitry.

Ground

The analog ground (**AGND**) terminals provide a common ground for all analog channels.

The digital ground (**GND**) terminals provide a common ground for the digital, counter, timer, and clock channels and the power terminal.

Mechanical drawings

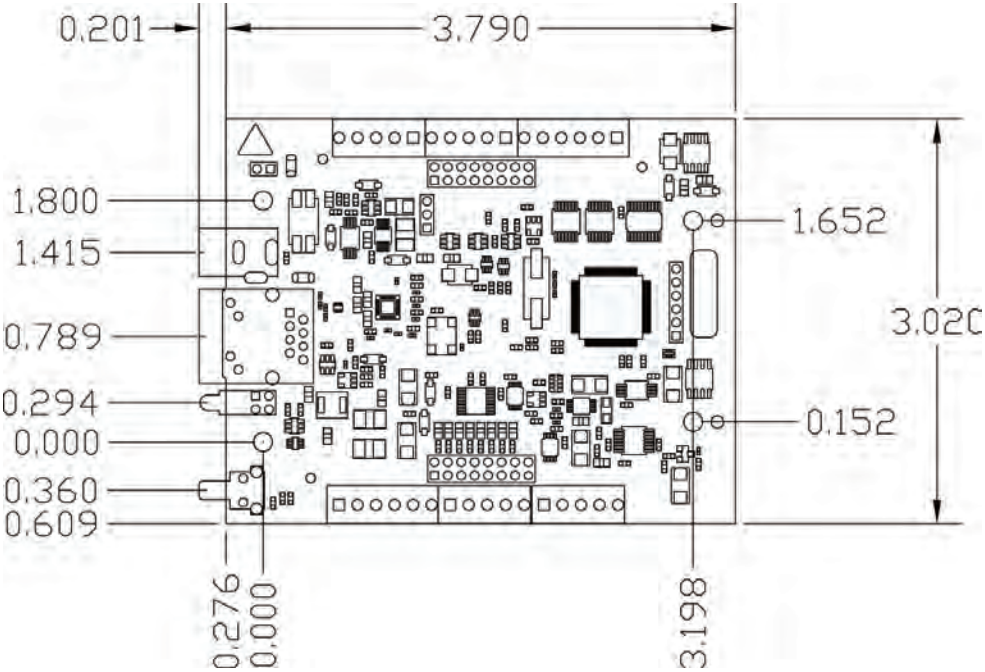


Figure 8. OM-NET-1608 device circuit board dimensions

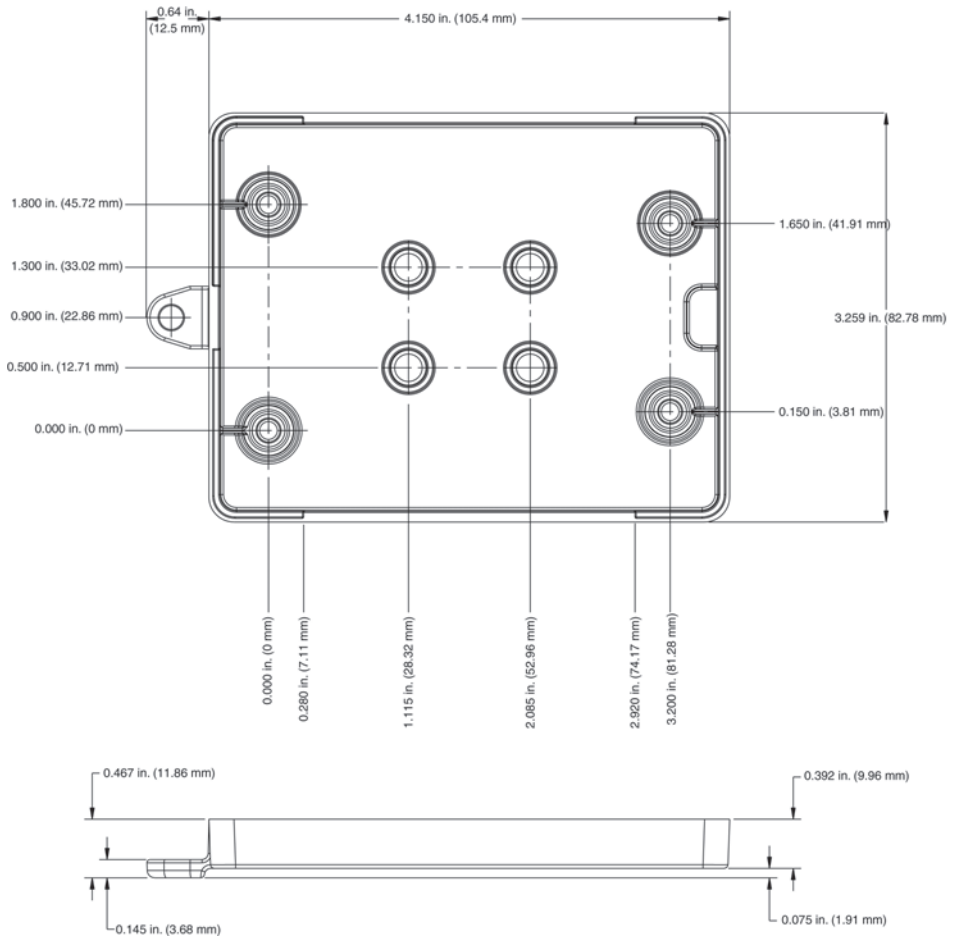


Figure 9. OM-NET-1608 bottom enclosure dimensions

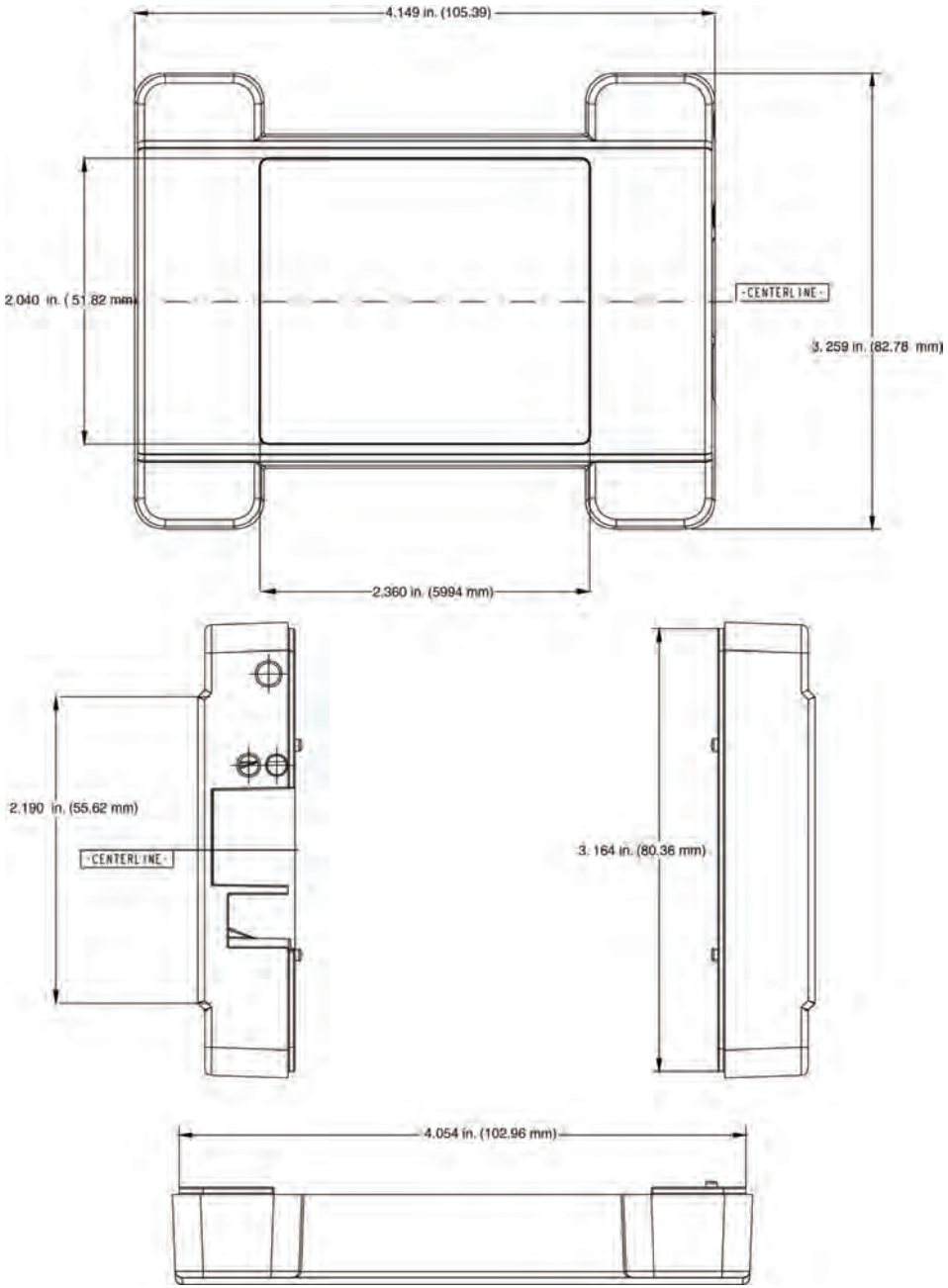


Figure 10. OM-NET-1608 top enclosure dimensions

Specifications

All specifications are subject to change without notice.
Typical for 25°C unless otherwise specified.
Specifications in *italic* text are guaranteed by design.

Analog input

Table 1. General analog input specifications

Parameter	Condition	Specification
A/D converter type		Successive approximation
ADC resolution		16 bits
Number of channels		4 differential, 8 single-ended Software-selectable
Input voltage range		±10 V, ±5 V, ±2 V, ±1 V; software-selectable per channel
Absolute max input voltage	*CHx relative to AGND*	■ *±20 V max (power on)* ■ *±12 V max (power off)*
Input impedance		■ *1 GΩ (power on)* ■ *1200 Ω (power off)*
Input bias current		*±10 nA*
Input bandwidth	All input ranges, small signal (–3 dB)	700 kHz
Input capacitance		*60 pf*
Max working voltage (signal + common mode)	±10 V range	±10.2 V max relative to AGND
	±5 V range	±10.2 V max relative to AGND
	±2 V range	±9.5 V max relative to AGND
	±1 V range	±9.0 V max relative to AGND
Common mode rejection ratio	(f_{IN} = 60 Hz, all input ranges)	86 dB
Crosstalk	Adjacent differential mode channels, DC to 10 kHz	–75 dB
Input coupling		DC
Sample rate		0.019 Hz to 250 kHz Software-selectable
Trigger source		TRIG (see External trigger on page 24)
Sample clock source		Internal A/D clock or external A/D clock (AICKI pin)
Internal sample clock stability		±50 ppm
Internal sample clock timebase		80 MHz timer with 32-bit period (available frequencies are 80 MHz / integer period)
Throughput	Software paced	1000 to 5000 S/s typ, on local network (Note 1)
	Hardware paced	250 kS/s max
Channel gain queue	Up to 8 elements	Software-selectable channel and range for each queue element
Warm-up time		15 minutes min

Note 1: This is the typical throughput when the device and host are both connected by Ethernet to the same local network. The throughput can vary significantly if a wireless connection is involved or data is sent over the internet and is not guaranteed.

Accuracy

Analog input DC voltage measurement accuracy

Table 2. DC Accuracy components and specifications. All values are (±)

Range	Gain error (% of reading)	Offset error (µV)	INL error (% of range)	Absolute accuracy at Full Scale (µV)	Gain temperature coefficient (% reading/°C)	Offset temperature coefficient (µV/°C)
±10 V	0.024	915	0.0076	4075	0.0014	47
±5 V	0.024	686	0.0076	2266	0.0014	24
±2 V	0.024	336	0.0076	968	0.0014	10
±1 V	0.024	245	0.0076	561	0.0014	5

Noise performance

For the peak-to-peak noise distribution test, a differential input channel is connected to AGND at the input terminal block, and 16384 samples are acquired at the maximum rate available at each setting.

Table 3. Noise performance specifications

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

Settling time

Settling time is defined as the accuracy that can be expected 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.

Table 4. Input settling time specifications in µS, typical

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

Analog output

Table 5. Analog output specifications

Parameter	Condition	Specification
Number of channels		2
Resolution		16 bits
Output ranges	Calibrated	±10 V
Output transient	Powered on	Duration: 5 ms Amplitude: 2 V p-p
	Powered off	Duration: 400 ms Amplitude: 10 V p-p
Differential non-linearity	16-bit monotonic	±0.35 LSB typ ±1 LSB max
Output current	AOUTx pins	±3.5 mA max (Note 2)
Output coupling		DC
Power on and reset state		DACs cleared to uncalibrated zero-scale: 0 V, ±50 mV unless the alarm function is enabled for the output (Note 3)
Alarm functionality		Either or both outputs may be configured to go to defined values when an Ethernet connection with a host is established or lost.
Output update rate		1000 to 5000 S/s typ, on local network (Note 4)
Slew rate		*5 V/µs*
Throughput	Software paced	1000 to 5000 S/s typ, on local network (Note 4)

Note 2: Leave unused AOUTx output channels disconnected.

Note 3: AOUTx defaults to 0 V whenever the device is powered on or a reset command is issued to the device, unless the alarm functionality is enabled for the output.

Note 4: This is the typical throughput when the device and host are both connected by Ethernet to the same local network. The throughput can vary significantly, and typical throughput is not guaranteed if a wireless connection is involved or data is sent over the internet.

Table 6. Calibrated absolute accuracy specifications

Range	Absolute accuracy (±LSB)
±10 V	18.7

Table 7. Calibrated absolute accuracy omponents specifications

Range	% of reading	Offset (±mV)	Offset tempco (µV/°C)	Gain tempco (ppm of range/°C
±10 V	± 0.024	2.2	30.1	13.2

Table 8. Relative accuracy specifications (±LSB)

Range	Relative accuracy (INL)
±10 V	4.0 typ

Analog input/output calibration

Table 9. Analog input/output calibration specifications

Parameter	Specification
Recommended warm-up time	15 minutes min
Calibration method	Factory
Calibration interval	1 year (factory calibration)

Digital input/output

Table 10. Digital input/output specifications

Parameter	Specification
Digital type	5 V TTL input / advanced BiCMOS output
Number of I/O	8
Configuration	Independently configured for input or output
Pull-up configuration	All pins pulled up to 5 V using 47 K resistors (default). Can be changed to pull-down using an internal jumper.
Digital I/O transfer rate (system-paced)	100 to 5000 port reads/writes or single bit reads/writes per second typ, on local network (Note 5)
Alarm functionality	Any combination of DIO bits may be configured to become outputs and go to defined values when an Ethernet connection with a host is established or lost.
Power on and reset state	All bits are input unless the alarm functionality is enabled for them.
Input high voltage threshold	2.0 V min
Input high voltage limit	5.5 V absolute max
Input low voltage threshold	0.8 V max
Input low voltage limit	–0.5 V absolute min 0 V recommended min
Output high voltage	3.8 V typ at no load 3.0 V min (IOH = –3 mA) 2.0 V min (IOH = –32 mA)
Output low voltage	0.15 V typ at no load 0.55 V max (IOL = 64 mA)
Power on and reset state	Input

Note 5: This is the typical throughput when the device and host are both connected by Ethernet to the same local network. The throughput can vary significantly, and typical throughput is not guaranteed if a wireless connection is involved or data is sent over the internet.

External trigger

Table 11. External trigger specifications

Parameter	Condition	Specification
Trigger source	External digital	TRIG
Trigger mode	Software-selectable	Edge or level sensitive: user configurable for CMOS compatible rising or falling edge, high or low level.
Trigger latency		2 µs + 1 pacer clock cycle max
Trigger pulse width		1 µs min
Input type		Schmitt trigger, 47 kΩ pull-down to ground
Schmitt trigger hysteresis		1.01 V typ 0.6 V min 1.5 V max
Input high voltage threshold		2.43 V typ 1.9 V min 3.1 V max
Input high voltage limit		5.5 V absolute max
Input low voltage threshold		1.42 V typ 1.0 V min 2.0 V max
Input low voltage limit		–0.5 V absolute min 0 V recommended min

External clock input/output

Table 12. External clock I/O specifications

Parameter	Specification
Terminal names	AICKI, AICKO
Terminal types	AICKI: Input (receives A/D pacer clock from external source)
	AICKO: Output (outputs internal A/D pacer clock)
Input clock rate	250 kHz max
Clock pulse width	AICKI: 1 µs min
	AICKO: 1.8 µs min
Clock mode	Edge-sensitive, rising
Input type	Schmitt trigger, 47 kΩ pull-down to ground
Schmitt trigger hysteresis	1.01 V typ 0.6 V min 1.5 V max
Input high voltage threshold	2.43 V typ 1.9 V min 3.1 V max
Input high voltage limit	5.5 V absolute max
Input low voltage threshold	1.42 V typ 1.0 V min 2.0 V max
Input low voltage limit	–0.5 V absolute min 0 V recommended min
Output high voltage	4.4 V min (IOH = –50 µA) 3.80 V min (IOH = –8 mA)
Output low voltage	0.1 V max (IOL = 50 µA) 0.44 V max (IOL = 8 mA)

Counter

Table 13. Counter specifications

Parameter	Specification
Pin name	CTR
Counter type	Event counter
Number of channels	1
Input type	Schmitt trigger, 47 kΩ pull-down to ground
Input source	CTR screw terminal
Resolution	32 bits
Schmitt trigger hysteresis	1.01 V typ 0.6 V min 1.5 V max
Input high voltage threshold	2.43 V typ 1.9 V min 3.1 V max
Input high voltage limit	5.5 V absolute max
Input low voltage threshold	1.42 V typ 1.0 V min 2.0 V max
Input low voltage limit	–0.5 V absolute min 0 V recommended min
Input frequency	10 MHz max
High pulse width	*50 ns min*
Low pulse width	*50 ns min*

Memory

Table 14. Memory specifications

Parameter	Specification
Data FIFO (analog input)	49,152 samples
Non-volatile memory	2,048 bytes (768 bytes for calibration, 256 bytes for user, 1,024 bytes for network settings)

Power

Table 15. Power specifications

Parameter	Condition	Specification
External power supply		5V, 1A
Supply current	Quiescent current	330 mA typical (Note 6) 710 mA max including all external loading
User output voltage range	Available at +VO terminal	4.40 V min to 5.25 V max, assumes supplied AC adapter is used
User output current	Available at +VO terminal	10 mA max

Note 6: This is the total quiescent current requirement for the device that includes the LEDs. This does not include any potential loading of the digital I/O bits, +VO terminal, or the AOUTx outputs.

Network

Ethernet connection

Table 16. Ethernet connection specifications

Parameter	Specification
Ethernet type	*100 Base-TX* *10 Base-T*
Communication rates	*10/100 Mbps, auto-negotiated*
Connector	*RJ-45, 8 position*
Cable length	*100 meters max*
Additional parameters	*HP Auto-MDIX support*

Network interface

Table 17. Factory default specifications

Parameter	Specification
Protocols used	TCP/IP (IPv4 only), UDP
Network ports used	UDP:54211 (discovery) UDP:6234 (bootloader only) TCP:54211 (commands) TCP:54212 (scan data)
Network IP configuration	DHCP + link-local, DHCP, static, link-local
Network name	`E-1608-xxxxxx`, where `xxxxxx` are the lower 6 digits of the device MAC address
Network name publication	By NBNS (responds to b-node broadcasts, therefore only available on the local subnet)

Network factory default settings

Table 18. Factory default specifications

Parameter	Specification
Factory default IP address	192.168.0.101
Factory default subnet mask	255.255.255.0
Factory default Gateway	192.168.0.1
Factory default DHCP setting	DHCP + link-local enabled

Network security

Table 19. Factory default specifications

Parameter	Specification
Security implementation	TCP sockets are not opened unless application sends the correct PIN code (stored in non-volatile memory, may be changed by user, default value 0000)
Number of concurrent sessions	1
Vulnerabilities	TCP Sequence Number Approximation Vulnerability

LED displays and the factory reset button

Table 20. LED and button configurations

Parameter	Specification
Power LED (top)	3.3 V < V_{ext} < 5.9 V: On V_{ext} < 3.3 V, V_{ext} > 5.9 V: Off (power fault)
Activity LED (bottom)	On when there is a valid host connection and blinks when a command is received or an AInScan is running.

Parameter	Specification
Ethernet connector LEDS	■ Left (green): Link/activity indicator; on when there is a valid Ethernet link and blinks when network activity is detected. ■ Right (yellow): Speed indicator; on for 100 Mbps, off for 10 Mbps or no link.
Factory reset button	Used to reset the network configuration settings to the factory default values. ■ Press the button when applying power to the device and continue to hold for 4 seconds; the device LEDs stay off, and then both the Power and Activity LEDs blink once indicating that the settings have been restored to the defaults. ■ Release the button so the device continues startup with the default settings. If the button is released before the two LEDs blink, the settings are not affected and the device starts up normally.

Environmental

Table 21. 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 22. Mechanical specifications

Parameter	Specification
Dimensions (L × W × H)	117.9 × 82.8 × 29.0 mm (4.64 × 3.26 × 1.14 in.)

Screw terminal connector

Table 23. Screw terminal connector specifications

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

Table 24. Screw terminal pinout

Pin	Signal name	Pin description	Pin	Signal name	Pin description
1	CH0H	Channel 0 high (SE channel 0)	17	DIO0	Digital I/O bit 0
2	CH0L	Channel 0 low (SE channel 1)	18	DIO1	Digital I/O bit 1
3	AGND	Analog ground	19	DIO2	Digital I/O bit 2
4	CH1H	Channel 1 high (SE channel 2)	20	DIO3	Digital I/O bit 3
5	CH1L	Channel 1 low (SE channel 3)	21	DIO4	Digital I/O bit 4
6	AGND	Analog ground	22	DIO5	Digital I/O bit 5
7	CH2H	Channel 2 high (SE channel 4)	23	DIO6	Digital I/O bit 6
8	CH2L	Channel 2 low (SE channel 5)	24	DIO7	Digital I/O bit 7
9	AGND	Analog ground	25	GND	Digital ground
10	CH3H	Channel 3 high (SE channel 6)	26	+VO	User voltage output
11	CH3L	Channel 3 low (SE channel 7)	27	GND	Digital ground
12	AGND	Analog ground	28	AICKO	External clock pacer output
13	AOUT0	Analog output 0	29	AICKI	External clock pacer input
14	AGND	Analog ground	30	CTR	Counter input
15	AOUT1	Analog output 1	31	TRIG	Digital trigger input
16	AGND	Analog ground	32	GND	Digital ground

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