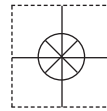


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OMB-NET6220 **12-Channel Ethernet-Based** **Voltage Input Module**



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It is the policy of OMEGA Engineering, Inc. to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

The information contained in this document is believed to be correct, but OMEGA accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

WARNING: These products are not designed for use in, and should not be used for, human applications.

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About this User's Guide

What you will learn from this user's guide

This user's guide describes the Omega Engineering OMB-NET6220 data acquisition device and lists device specifications.

Conventions in this user's guide

For more information on

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 the 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 OMB-NET6220 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: info@omega.com

Introducing the OMB-NET6220

Overview: OMB-NET6220 features

The OMB-NET6220 is 16-bit resolution voltage measurement device that connects to an Ethernet port on a host computer, and can be synchronized with other OMB-NET6000 Series devices.

The OMB-NET6220 provides the following features:

- Up to 12 analog input channels, each with its own internal circuitry to keep the voltage source within the common-mode range.
- Up to eight lines of digital I/O and four 32-bit counters
- An analog input range of ± 10 V

Signal input can be grounded or left floating through the front panel BNC connectors.

Software requirements

- Windows 7 (32- or 64-bit)
- Windows Vista (32- or 64-bit)
- Windows XP SP2 (32-bit)
- Windows 2000 SP4
- Encore Software for OMB-NET6000 Series CD

Hardware requirements

Verify that you have the following items and meet or exceed the minimum requirements listed.

- OMB-NET6220
- OMB-NET-TR-60U power supply and cable
- Ethernet crossover cable

Use the provided Ethernet crossover cable when connecting an OMB-NET6000 Series device directly to the PC. Use a standard Ethernet cable when connecting via a hub/switch. Use a gigabit switch when connecting multiple devices.

- PC requirements:

Minimum:

- CPU: Intel® Pentium® 4, 3.0 GHz or equivalent
- RAM: 1 GB
- Monitor: 1024 × 768 screen resolution

Recommended:

- CPU: Intel® Core™ 2 Duo family
- RAM: at least 2 GB
- Monitor: 1024 × 768 screen resolution

OMB-NET6220 block diagram

The 12 analog input channels on the OMB-NET6220 are set up in three distinct isolated sections. Channels 1 through 4 share *section 1 common* and an isolator; channels 5 through 8 share *section 2 common* and an isolator; and channels 9 through 12 share *section 3 common* and an isolator.

OMB-NET6220 functions are illustrated in Figure 1.

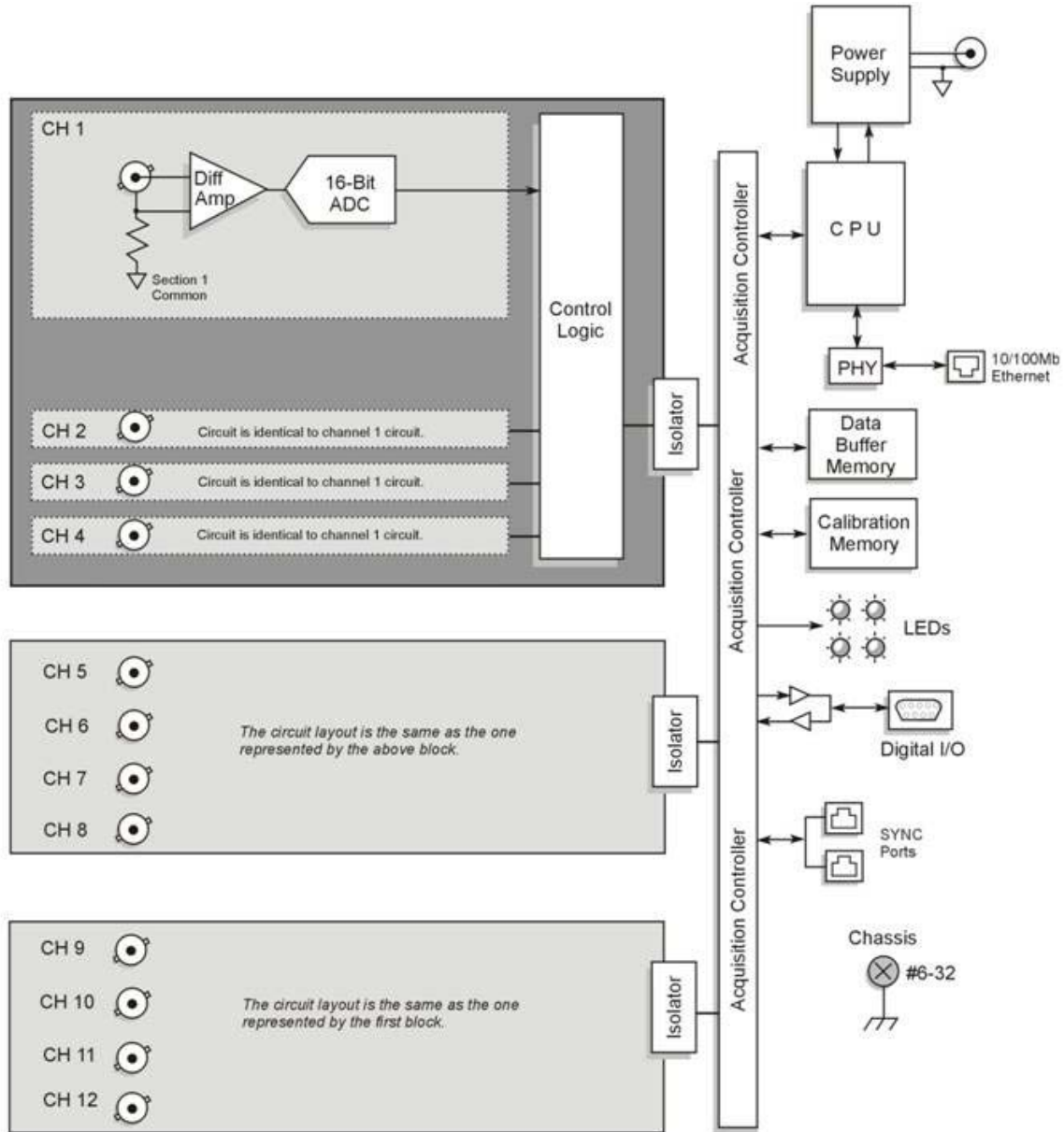


Figure 1. OMB-NET6220 functional block diagram

What comes with your OMB-NET6220 shipment?

The following items are shipped with the OMB-NET6220.

Hardware

- OMB-NET6220



- OMB-NET-TR-60U external power supply, 90 VAC to 264 VAC
- Either a OMB-CA-1 cable (U.S. version) or a OMB-CA-216 cable (European version) for use with OMB-NET-TR-60U

Software

Encore Software for OMB-NET6000 Series installation CD

Documentation

In addition to this hardware user's guide, a *Quick Start* booklet is included with the OMB-NET6220 shipment. This booklet explains how to install and connect the OMB-NET6220 and install the Encore software.

Unpacking the OMB-NET6220

As with any electronic device, take care while handling to avoid damage from static electricity. Before removing the OMB-NET6220 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.

If any components are missing or damaged, notify Omega Engineering immediately by phone, fax, or e-mail.

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

Installing the hardware and software

Refer to the *OMB-NET6220 Quick Start* for instructions on connecting your OMB-NET6220 and configuring it using the Encore software.

Maintenance guidelines

OMB-NET6000 Series devices are essentially maintenance-free and need only a minimal amount of care. They should be treated much like any other high-tech piece of equipment. In general:

- Operate the units in ventilated and relatively dust-free environments.
- Keep the units clear of harsh chemicals and abrasive elements.
- Avoid exposing the products to extreme heat – for example, avoid placing the units near boilers and furnaces.
- Avoid extreme shock and vibration.
- Avoid subjecting the device to liquids and extremely fine air particulate, such as silica dust.
- Never open the device. The device should only be opened by qualified service technicians.
- Use lint-free rags and rubbing alcohol to clean the outer surfaces of an OMB-NET6000 Series device.

Functional Details

Front panel BNC connectors

The OMB-NET6220 front panel has twelve BNC connectors for voltage signal input (Figure 2). The center pin is positive (+) analog input. The outer shell is negative (-) analog input. Additional information is included in chapters 3 and 8.



Figure 2. OMB-NET6220 front panel BNC connectors

Rear panel components

OMB-NET6220 devices have the rear panel components shown in Figure 3.



- | | | |
|-------------------------------|------------------|-------------------------|
| 1 Cable tie mounts | 4 Chassis ground | 7 Power input connector |
| 2 Ethernet connector | 5 Status LEDs | 8 Power switch |
| 3 Digital I/O D-SUB connector | 6 SYNC ports | |

Figure 3. OMB-NET6220 rear panel components

Cable tie mounts

Use the two cable tie mounts for cable strain relief.

Ethernet connector

Connect the 10/100BaseT Ethernet port to the Ethernet port of the host computer or to an Ethernet network. The Ethernet connector has two built in LEDs that indicate traffic flow on the network.

Refer to *Accessories* in the *Specifications* chapter for Ethernet cables available from Omega Engineering.

When connecting the OMB-NET6220 directly to a computer (not to a network hub), use an Ethernet crossover cable. The Ethernet cable length must be less than 3 m (9.8 ft) long in order for the system to be CE compliant.

Digital I/O D-SUB connector

Eight digital I/O lines are accessible via a 9-pin, female D-SUB connector (refer to the [Digital input/output](#) specifications on page 16 for more information).

Chassis ground

Provides a connection point for chassis ground through a #6-32 machine screw.

Status LEDs

Power—LED is *on* when the device is connected to a sufficient power source, and the power switch is in the I (on) position.

Boot—When you power on the device, the **Boot** LED turns on to indicate the first stage of the boot process. When this process completes successfully, the **Boot** LED turns off. If an internal error occurs during this first stage boot process, this LED blinks. Contact Omega Engineering to arrange repair service.

Active—When you power on the device, the **Active** LED is off while the device boots, including network configuration. This LED blinks quickly when the boot process is complete, and then remains on.

When both the **Power** and **Active** LEDs are on, the OMB-NET6220 is in the *ready* state. When the **Active** LED blinks slowly, it indicates communication with a host computer.

Data—The **Data** LED turns on any time the device is acquiring channel data that is available to the host computer control software.

When you power on the OMB-NET6220, the device can take up to two minutes to reach ready state, depending on network settings. Use the following LED sequence to determine when the device is ready:

1. **Power** LED turns on and remains on
2. **Boot** LED turns on, then off
3. **Active** LED blinks, then remains on
4. Device is ready

SYNC connectors

The two synchronization ports can synchronize the pre-trigger data and post-trigger scanning of up to nine OMB-NET6000 Series devices. Use Encore to designate any OMB-NET6000 Series device as a *master unit*, *slave unit*, or *terminating slave unit*.

Up to nine OMB-NET6000 Series devices can be synchronized. The total combined length of the SYNC cables cannot exceed 2.438 m (8 ft).

Refer to the following section, *Synchronization*, for details. Refer to *Accessories* in the *Specifications* chapter for SYNC cables available from Omega Engineering.

Power input connector

Connect to 19 VDC to 30 VDC power supply, such as the OMB-NET-TR-60U, 24VDC universal power supply

Power switch

Switch to power on (I) and power off (O) the device.

Synchronization

To synchronize up to nine OMB-NET6000 Series devices, connect them with synchronization cables as shown in Figure 4. The first device added to the synchronization group is the master, and the last device added is the terminating slave.

Unplug sync cables from devices that are not intended to be part of a Synchronized Device Group. Leaving a sync cable connected to an independent device may cause errors.

Channel-to-channel phase relationships in a multi-device configuration are not necessarily fixed.



Figure 4. OMB-NET6000 Series devices connected for synchronization

After connecting the devices with the sync cables, configure them as a *synchronized device group* using Encore. Each synchronized group consists of one master device and at least one slave device.

The sampled data phase relationship among channels among multiple devices depends on the Channel Sync Skew specification for each device. When using different models in a multi-device system, any differences in the ADC filter delay (*input delay*) should be added.

Refer to the *Synchronizing Devices* topic of the *OMB-NET6000 Series Encore Help* for more information on synchronizing devices.

Caution! Leaving an un-terminated sync cable on a synchronized device can lead to errors.

Stacking plate and handle options

Each OMB-NET6000 Series device chassis is equipped with feet on the lower panel and dimples on the upper panel for quick stacking of units.

To secure units together, use the optional stacking plate kits (OMB-NET-SPK). Each kit contains two stacking plates and eight screws (8-32 x .500 in., Phillips Flat, 82 Degree).

An optional handle kit (OMB-NET-HK) is available to provide a convenient way of carrying a single OMB-NET6000 Series device or a secured stacked set of devices. Each handle kit includes one black molded plastic handle and two mounting screws (1/4-20 x 7/8 in., Phillips Pan Head).

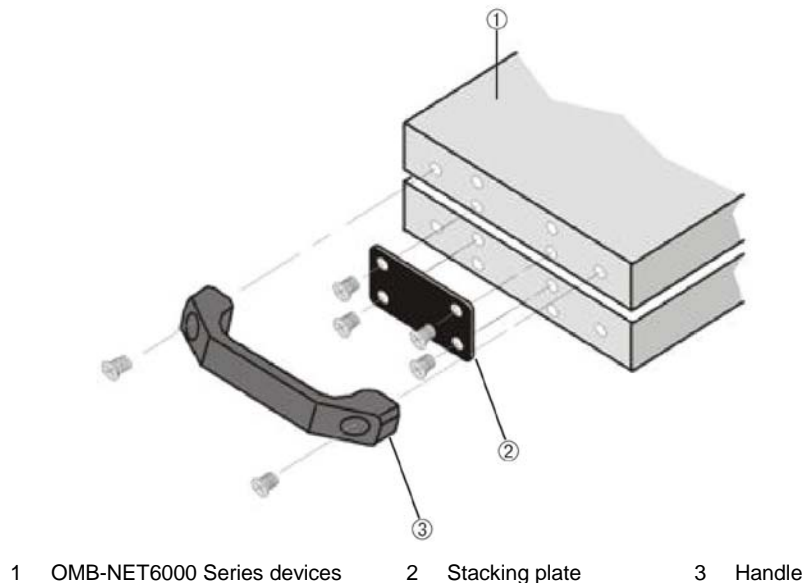


Figure 5. OMB-NET6220 stacking plate assembly

To attach OMB-NET6000 Series devices to each other using stacking plates, complete the following steps:

1. With the hole tapers facing out, align the bottom two holes of a plate with the top two center holes of the lower OMB-NET6000 Series device.
2. Secure the plate with the two #8-32 × .500 in. Phillips screws (provided). Tighten the screws snug, but do not over tighten.
3. Repeat steps 1 and 2 for the second plate on the other side of the OMB-NET6000 Series device.
4. Attach the second device using the remaining four screws.
5. Repeat steps 1 through 4 for each additional device and stacking plate kit and device.

To mount a handle to an OMB-NET6000 Series device, attach the handle to a device using the two outer holes on the device and the two 1/4-20 × 7/8 in. Phillips pan head screws (provided). Tighten the screws snug, but do not over-tighten.

Analog input

For each channel, the OMB-NET6220 includes a BNC connector with the following features:

- positive center pin and negative shell
- overvoltage protection
- an amplifier
- an isolated analog-to-digital converter (ADC)
- a resistor.

The resistor prevents the input voltage from drifting outside the common-mode range.

As illustrated in the Figure 6, each channel is independently protected from overvoltage.

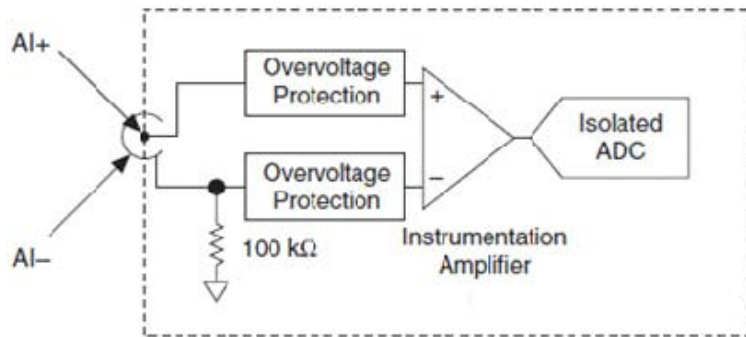


Figure 6. Analog Input Circuit for 1 Channel

The channels share as common ground as follows:

- Channels 1 through 4 share a common ground
- Channels 5 through 8 share a common ground
- Channels 9 through 12 share a common ground

The instrumentation amplifier buffers and conditions the incoming analog signal on each channel. A channel-dedicated 16-bit ADC then samples the signal. Track-and-hold amplifiers (one for each channel) can sample all channels simultaneously.

Refer to [Overvoltage protection](#) on page 15 for more information.

Counter input

The OMB-NET6220 has four 32-bit counter inputs that accept frequency inputs up to 20 MHz. The counter inputs are software-configurable for counter or encoder measurements.

Use Encore to configure the following counter settings:

- **Counter Source**—Select **Internal Clock**, **Timer 1**, **Timer 2**, or **Digital Line 0** through **Digital Line 7** as the source used for the counter. One source can be used in multiple counters.
- **Counter Gate**—Select **Unused** (do not gate the counter), **Internal Clock**, **Timer 1**, **Timer 2**, or **Digital Line 0** through **Digital Line 7** as the gate used for the counter. One gate can be used in multiple counters.
- **Count**—Select from the following settings:
 - **Clear on Read**—The counter counts up and is cleared after each read. By default, the counter counts up and only clears the counter at the start of a new scan command. The value of the counter before it is cleared is latched and returned.
 - **Totalize**—The counter counts up and is cleared at the start of a new scan.
 - **Start Count**—The value used to start counting. The default is *zero*.
 - **Stop Count**—The value used to stop counting. The default is *65535*.
 - **Rollover**—The count rolls over upon reaching the start or stop value.
- **Direction**—Select either **Increment** (count up) or **Decrement** (count down).
- **Detection**—Select **Rising Edge** to detect the count when the signal goes from low to high, or **Falling Edge** to detect the count when the signal goes from high to low.

Encoder settings

Select **Encoder** from the **Measurement Type** list to configure the following encoder settings:

- **Resolution**—Select the encoder resolution—the number of full quadrature cycles per full shaft revolution (360 mechanical degrees) —from the following options:
 - **X1** —One count per cycle (default)
 - **X2**—Two counts per cycle
 - **X4**— Four counts per cycle
- **Sources**—Select one of the digital lines—**Digital Line 0** through **Digital Line 7**— for encoder **Source A**, **Source B**, and **Source C**.

When configured for encoder measurements, the OMB-NET6220 can count *negative* values. When counting down, the encoder continues counting down below 0. This feature is useful to calculate the position of an encoder.

Specifications

All specifications are subject to change without notice.
Typical for $-40\text{ }^{\circ}\text{C}$ to $50\text{ }^{\circ}\text{C}$ unless otherwise specified.

Analog input

Table 1. Analog input specifications

Parameter	Specification
A/D converter type	Successive approximation type
Number of analog channels	12
A/D resolution	16 bits
Input voltage range	$\pm 10\text{ V}$ typ Overflow occurs if $ V_{in} \geq (10.2\text{ V to } 10.6\text{ V})$
Sampling mode	Simultaneous
Data rates (FS)	1 S/s to 100 kS/s (16 software-selectable rates)
Multiple device channel sync skew	10 μs
Single device, channel-to-channel matching (calibrated)	100 ns typ
Overvoltage protection	$\pm 30\text{ V}$
Stability	Gain drift: 10 ppm/ $^{\circ}\text{C}$ Offset drift: 60 $\mu\text{V}/^{\circ}\text{C}$
CMRR ($f_{in}=60\text{ Hz}$)	-73 dB min
Input bandwidth (-3 dB)	420 kHz min
Input impedance	Resistance between any two AI- terminals: 200 k Ω
Input bias current	10 nA
Input noise	RMS: 1.2 LSB Peak-to-peak: 7 LSB
Crosstalk	-80 dB
Settling time (to 2 LSBs)	10 V step: 25 μs 20 V step: 35 μs
No missing codes	15 bits guaranteed
DNL	$\pm 2\text{ LSB max}$
INL	$\pm 6\text{ LSB max}$

Table 2. Accuracy

Measurement condition	% of Reading (Gain Error)	Offset Error
Calibrated, max ($-40\text{ }^{\circ}\text{C}$ to $50\text{ }^{\circ}\text{C}$)	0.2%	$\pm 8.5\text{ mV}$
Calibrated, typ ($25\text{ }^{\circ}\text{C}$, $\pm 5\text{ }^{\circ}\text{C}$)	0.02%	$\pm 1.4\text{ mV}$

Digital input/output

Table 3. Digital I/O specifications

Parameter	Specification
Number of I/O	8 channels programmable as a single port or as individual lines
Power on mode	Inputs pulled low
Connector	DB-9 female (see Figure 7)
Programmable input scanning modes	<ul style="list-style-type: none"> ▪ Asynchronous: Under program control at any time relative to analog scanning. ▪ Synchronous: Data captured synchronously with the analog channels.
Input levels	<ul style="list-style-type: none"> ▪ Low: 0 V to 0.8 V ▪ High: 2.0 V to 5.0 V
Input voltage range without damage	-0.6 V to 5.6 V max
Input pull-down resistor	10 k Ω
Output voltage range	0 V to +3.0 V Can be externally pulled up to 5.6 V without damage
Output resistance	40 Ω
Output levels	See Figure 8
Sampling	1 MHz max continuous
Output timing	Outputs are always written asynchronously

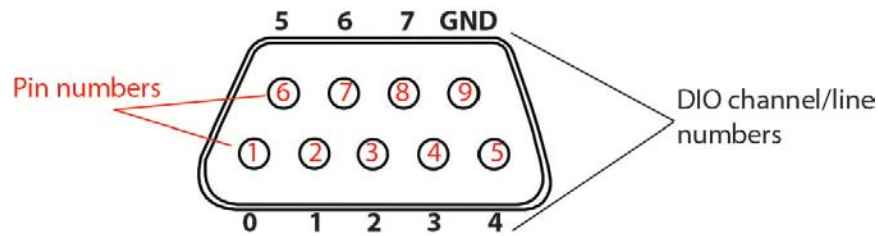


Figure 7. DB9 connector as viewed from the rear panel

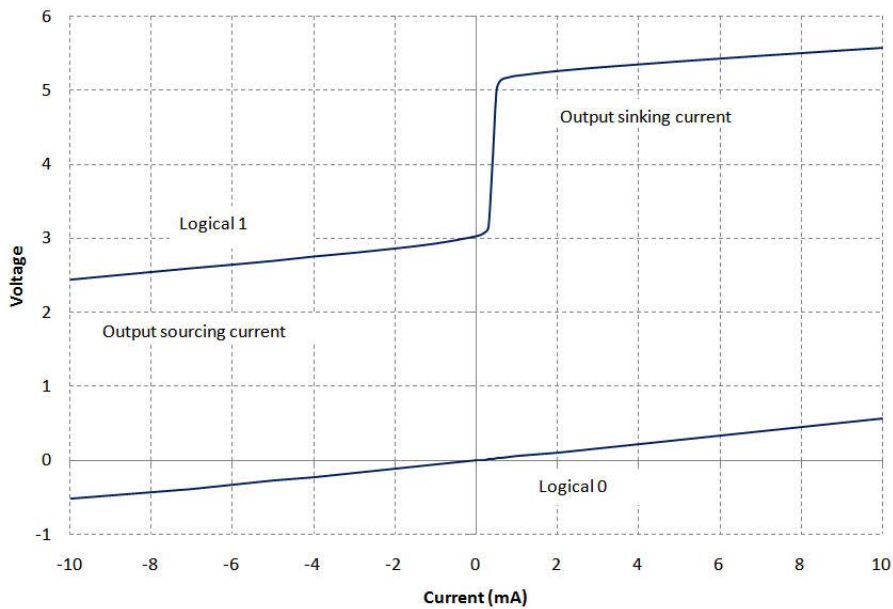


Figure 8. OMB-NET6220 digital output

Counter input

Table 4. Counter specifications

Parameter	Specification
Channels	Up to 4 independent
Resolution	32-bit
Input frequency	20 MHz max
Input characteristics	10 k Ω pull-down
Trigger level	TTL
Minimum pulse width	25 ns high, 25 ns low
Programmable modes	Counter, Encoder
Encoder resolution	x1 (default), x2, and x4
Encoder sources	A, B, and Z; can be assigned to any digital pin x.
Counter source	Internal Clock, Timer 1, Timer 2, and digital pin x. One source can be used in multiple counters.
Counter mode options	Totalize, Clear on Read, Rollover, Stop at the Top, Increment, Decrement, Rising Edge, Falling Edge
Counter gate options	Unused, Internal Clock, Timer 1, Timer 2, and Digital pin x. One gate can be used in multiple counters.

Power

Table 5. Power specifications

Parameter	Specification
Power consumption	5.5 W typ, 6 W max
Power jack	Barrel type: 5.5 mm O.D.; 2.1 mm I.D.

Mechanical

Table 6. Mechanical specifications

Parameter	Specification
Weight	1.36 Kg (3 lb)
Dimensions (L \times W \times H)	276.9 \times 169.8 \times 30.5 mm (10.9 \times 6.685 \times 1.2 in.)

Environmental

The OMB-NET6220 is intended for indoor use only, but can be used outdoors if installed in a suitable enclosure.

Table 7. Environmental specifications

Parameter	Specification
Operating temperature	-40 $^{\circ}$ C to 50 $^{\circ}$ C
Storage temperature	-40 $^{\circ}$ C to 75 $^{\circ}$ C
Ingress protection	IP 40
Operating humidity	10% to 90% RH, noncondensing
Storage humidity	5% to 95% RH, noncondensing
Maximum altitude	2,000 m (6562 ft)
Pollution degree	2

Calibration

The following calibration information applies to hardware calibration, not to be confused with *user* or *software* calibration. When calibrating the OMB-NET6220 with Encore, keep in mind that sample rate affects both the gain and offset of the device, and therefore the device should be software-calibrated at the same sample rate that is intended for measurements.

Table 8. Calibration specifications

Parameter	Specification
Calibration interval	1 year

Contact Omega Engineering for information regarding calibration service.

Accessories

Table 9. OMB-NET6220 accessories

Accessory	Description
OMB-NET-TR-60U	24 VDC @ 0.8 A (max) universal power supply
OMB-CA-1	120 V IEC AC Mains cable (US)
OMB-CA-216	220 V IEC Mains Cable (EU)
OMB-CA-74-1	RJ12 shielded cable, 6-conductor, sync, 0.3 m (1 ft); refer to Note 1
OMB-NET-SPK	Stacking plate kit; includes: <ul style="list-style-type: none"> ▪ 2 stacking plates ▪ 8 screws (#8-32x0.5 in, Phillips Flat, 82 degree)
OMB-NET-HK	Handle kit; includes: <ul style="list-style-type: none"> ▪ A molded black plastic handle ▪ Two screws (#1/4-20x7/8 in, Phillips Pan Head)
OMB-CA-192-7C	Ethernet crossover cable, 2.133 m (7 ft); refer to Notes 2 and 3
OMB-CA-242	Ethernet patch cable, 0.457 m (1.5 ft); refer to Note 2
OMB-CA-242-7	Ethernet patch cable, 2.133 m (7 ft); refer to Note 3

Note 1: Up to nine units can be synchronized. The total combined length of the SYNC cables cannot exceed 2.438 m (8 ft).

Note 2: Ethernet cable length must be <3 m (9.8 ft) in order for the system to be CE Compliant.

Note 3: Ethernet crossover cables should only be used for direct network connections. In particular, attempting to connect a device to a Hub using a crossover cable may prevent that network link from functioning. Some modern routers have become an exception by including logic to detect the crossover cable and allow the network link to function.

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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