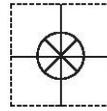


.1 YEAR
WARRANTY

OMEGA
CARE
Extended Warranty
Program

CE



User's Guide

Shop online at

omega.com[®]

ΩOMEGA[®]

omega.com

e-mail: info@omega.com

For latest product manuals:

omegamanual.info



ISO 9001
CERTIFIED
CORPORATE QUALITY

STAMFORD, CT

ISO 9001
CERTIFIED
CORPORATE QUALITY

MANCHESTER, UK

OM-USB-1208HS SERIES High Speed Multifunction USB Data Acquisition Modules



OMEGAnet® Online Service
omega.com

Internet e-mail
info@omega.com

Servicing North America:

U.S.A.:
ISO 9001 Certified

Omega Engineering, Inc., One Omega Drive, P.O. Box 4047
Stamford, CT 06907-0047 USA
Toll Free: 1-800-826-6342 TEL: (203) 359-1660
FAX: (203) 359-7700 e-mail: info@omega.com

Canada:

976 Bergar
Laval (Quebec), H7L 5A1 Canada
Toll-Free: 1-800-826-6342 TEL: (514) 856-6928
FAX: (514) 856-6886 e-mail: info@omega.ca

For immediate technical or application assistance:

U.S.A. and Canada: Sales Service: 1-800-826-6342/1-800-TC-OMEGA®
Customer Service: 1-800-622-2378/1-800-622-BEST®
Engineering Service: 1-800-872-9436/1-800-USA-WHEN®

**Mexico/
Latin America:**

En Español: 001 (203) 359-7803 FAX: 001 (203) 359-7807
info@omega.com.mx e-mail: espanol@omega.com

Servicing Europe:

Benelux:

Managed by the United Kingdom Office
Toll-Free: 0800 099 3344 TEL: +31 20 347 21 21
FAX: +31 20 643 46 43 e-mail: sales@omegaeng.nl

Czech Republic:

Frystatska 184
733 01 Karviná, Czech Republic
Toll-Free: 0800-1-66342 TEL: +420-59-6311899
FAX: +420-59-6311114 e-mail: info@omegashop.cz

France:

Managed by the United Kingdom Office
Toll-Free: 0800 466 342 TEL: +33 (0) 161 37 29 00
FAX: +33 (0) 130 57 54 27 e-mail: sales@omega.fr

Germany/Austria:

Daimlerstrasse 26
D-75392 Deckenpfronn, Germany
Toll-Free: 0800 6397678 TEL: +49 (0) 7056 9398-0
FAX: +49 (0) 7056 9398-29 e-mail: info@omega.de

United Kingdom:
ISO 9001 Certified

OMEGA Engineering Ltd.
One Omega Drive, River Bend Technology Centre, Northbank
Irlam, Manchester M44 5BD United Kingdom
Toll-Free: 0800-488-488 TEL: +44 (0) 161 777-6611
FAX: +44 (0) 161 777-6622 e-mail: sales@omega.co.uk

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.

Table of Contents

Preface

| | |
|---|----------|
| About this User's Guide | 4 |
| What you will learn from this user's guide..... | 4 |
| Conventions in this user's guide | 4 |
| Where to find more information | 4 |

Chapter 1

| | |
|---|----------|
| Introducing the OM-USB-1208HS Series | 5 |
| Software features | 6 |

Chapter 2

| | |
|---|----------|
| Installing a OM-USB-1208HS Series Device | 7 |
| What comes with your shipment?..... | 7 |
| Hardware | 7 |
| Documentation..... | 7 |
| Unpacking..... | 7 |
| Installing the software | 7 |
| Installing the hardware | 7 |
| Calibrating a OM-USB-1208HS Series Device..... | 8 |

Chapter 3

| | |
|--------------------------------------|----------|
| Functional Details | 9 |
| Analog input acquisition modes | 9 |
| Software paced mode..... | 9 |
| Hardware paced mode..... | 9 |
| External components | 9 |
| USB connector..... | 10 |
| LEDs..... | 10 |
| Screw terminals..... | 10 |
| Signal connections..... | 11 |
| Analog input | 11 |
| Analog output | 12 |
| External clock I/O..... | 12 |
| Digital I/O..... | 12 |
| Counter I/O | 13 |
| Timer output | 13 |
| Trigger input | 14 |
| Power outputs | 14 |
| Ground..... | 14 |

Chapter 4

| | |
|---|-----------|
| Specifications | 15 |
| Analog input | 15 |
| Analog output (OM-USB-1208HS-2AO, OM-USB-1208HS-4AO)..... | 17 |
| External trigger..... | 18 |
| External clock input/output..... | 18 |
| Timer | 19 |
| Memory | 19 |
| Power..... | 20 |
| USB specifications | 20 |
| Environmental | 21 |
| Main connector and pinout | 21 |

About this User's Guide

What you will learn from this user's guide

This user's guide describes the Omega Engineering OM-USB-1208HS Series data acquisition devices 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-USB-1208HS Series 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-USB-1208HS Series

The OM-USB-1208HS Series includes the following devices:

- OM-USB-1208HS
- OM-USB-1208HS-2AO
- OM-USB-1208HS-4AO

These devices are USB 2.0 high-speed devices supported under popular Microsoft® Windows® operating systems. The OM-USB-1208HS Series is compatible with both USB 1.1 and USB 2.0 ports, although the speed of the module maybe limited when using USB 1.1 ports.

Each OM-USB-1208HS Series device provides the following features:

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

The OM-USB-1208HS-2AO also provides two 12-bit analog output channels, and the OM-USB-1208HS-4AO provides four 12-bit analog output channels.

OM-USB-1208HS Series functions are illustrated in the block diagram shown here.

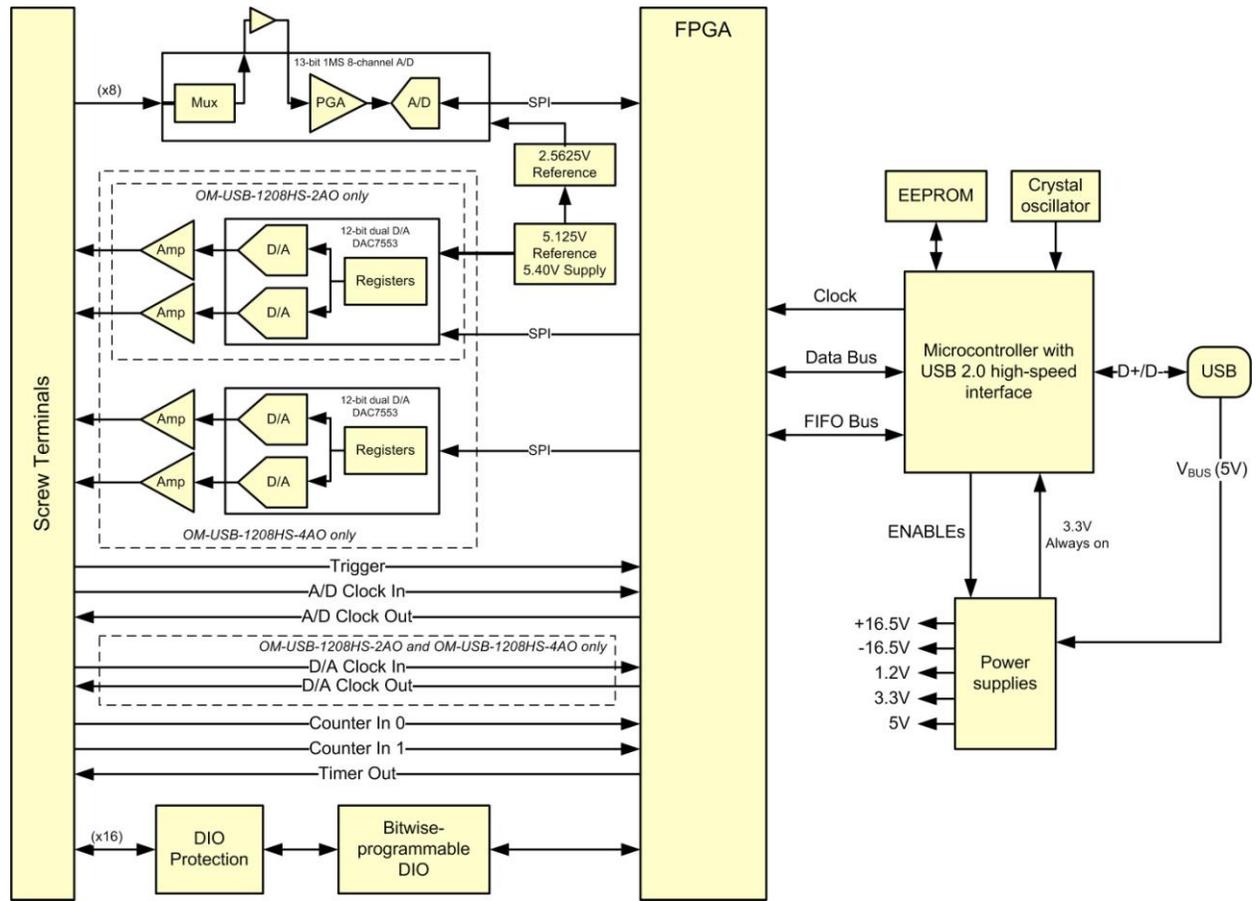


Figure 1. Functional block diagram

Software features

For information on the features of InstaCal and the other software included with your OM-USB-1208HS Series hardware, refer to the *OMB-DAQ-2400*, *OM-USB*, *OM-WEB*, and *OM-WLS Series Data Acquisition Software User's Guide* that shipped with the device.

Installing a OM-USB-1208HS Series Device

What comes with your shipment?

Verify that the following hardware components are included in the shipment:

Hardware

- OM-USB-1208HS Series device — OM-USB-1208HS, OM-USB-1208HS-2AO, or OM-USB-1208HS-4AO
- USB cable

Documentation

In addition to this hardware user's guide, the *OMB-DAQ-2400*, *OM-USB*, *OM-WEB*, and *OM-WLS Series Data Acquisition Software User's Guide* booklet ships with the OM-USB-1208HS Series hardware. This booklet provides an overview of the software you received with the device.

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.

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: das@omega.com

Installing the software

Refer to the *OMB-DAQ-2400*, *OM-USB*, *OM-WEB*, and *OM-WLS Series Data Acquisition Software User's Guide* for instructions on installing the software on the *Software for OMB-DAQ-2400*, *OM-USB*, *OM-WEB*, and *OM-WLS Series Data Acquisition Modules* CD. This booklet is available in PDF at <http://www.omega.com/manuals/manualpdf/M4803.pdf>.

Installing the hardware

Install the software before you install your hardware

The driver needed to run your board is installed with the software. Therefore, you need to install the software before you install your hardware.

To connect a OM-USB-1208HS Series device to your system, turn on your computer and connect the USB cable to an available USB port on the computer or to an external USB hub connected to the computer. Connect the other end of the USB cable to the USB connector on the device. No external power is required.

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

A green **Status** LED indicates the device status. When the LED is on, the device is powered and ready for operation. When the LED is off, the device is not powered or did not initialize. Figure 2 on page 9 shows the location of the **Status** LED.

Caution! Do not disconnect **any** device from the USB bus while the computer is communicating with a OM-USB-1208HS Series device, or you may lose data and/or your ability to communicate with the device.

If the Status LED is off

If the **Status** LED is on but then turns off, the computer has lost communication with the OM-USB-1208HS Series device. To restore communication, disconnect the USB cable from the computer and then reconnect it. This should restore communication, and the LED should turn on.

Calibrating a OM-USB-1208HS Series Device

OM-USB-1208HS Series devices are shipped fully calibrated. Calibration coefficients are stored in EEPROM. Return the device to Omega Engineering when calibration is required. The normal calibration interval is once per year.

Functional Details

Analog input acquisition modes

OM-USB-1208HS Series devices acquire analog input data in two modes – software paced and hardware paced.

Software paced mode

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

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

Hardware paced mode

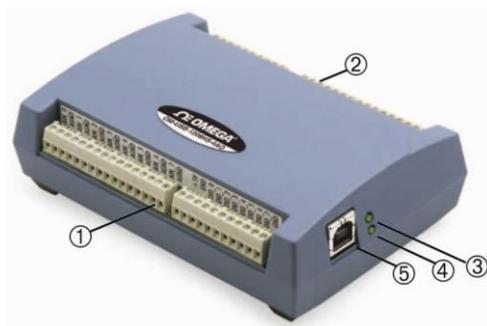
You acquire data from up to eight channels in continuous scan mode. The analog data is continuously acquired, converted to digital values, and written to an onboard FIFO buffer on the device until you stop the scan. The FIFO buffer is serviced in blocks as the data is transferred from the device FIFO buffer to the memory buffer on your computer.

The maximum sampling rate is 1 MS/s aggregate from one to eight channels. You can start a continuous scan with either a software command or external hardware trigger event.

External components

OM-USB-1208HS Series hardware have the following external components, as shown in Figure 2.

- Screw terminals
- USB connector
- LEDs



- | | | | |
|---|------------------------------|---|---------------|
| 1 | Screw terminal pins 1 to 28 | 4 | Activity LED |
| 2 | Screw terminal pins 29 to 56 | 5 | USB connector |
| 3 | Status LED | | |

Figure 2. OM-USB-1208HS Series components

USB connector

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

LEDs

OM-USB-1208HS Series devices have two LEDs – **Status** and **Activity**. The **Status** LED turns on when the device is detected and installed on the computer.

- The **Activity** LED blinks when data is transferred, and is off otherwise.

Refer to Figure 2 for the location of each LED.

Screw terminals

The device screw terminals provide the following connections:

- Eight analog input connections (**AIN0** to **AIN7**)
- 16 digital I/O connections (**DIO0** to **DIO15**)
- Four analog output connections (**AOUT0** to **AOUT3**)
- 10 analog ground connections (**AGND**)
- Six digital ground connections (**GND**)
- One external clock input (**AICKI**) and one external clock output (**AICKO**) for analog inputs
- One external clock input (**AOCKI**) and one external clock output (**AOCKO**) for analog outputs
- One digital trigger input (**TRIG**)
- Two counter inputs (**CTR0**, **CTR1**)
- One timer output (**TMR**)
- Two 5 V power output connections (**+5 V**)

Use 16 AWG to 30 AWG for signal connections. SE pinout locations are shown in Figure 3. Diff pinout locations are shown in Figure 4.

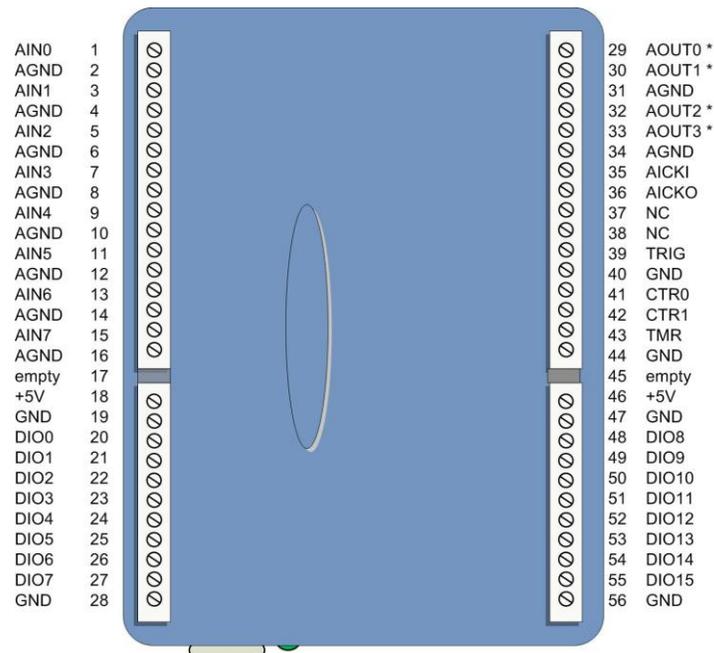


Figure 3. SE mode pinout

* Pins 29 and 30 are "NC" on the OM-USB-1208HS. Pins 32 and 33 are "NC" on the OM-USB-1208HS and OM-USB-1208HS-2AO.

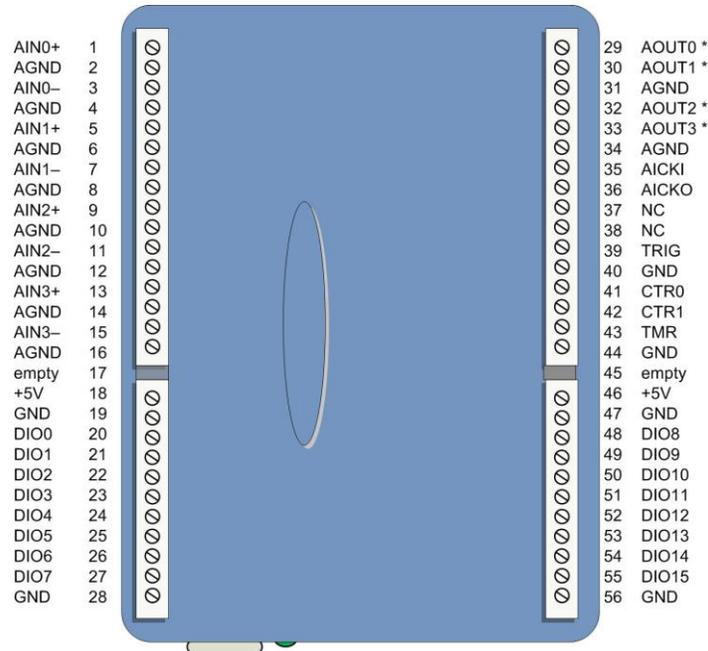


Figure 4. DIFF mode pinout

* Pins 29 and 30 are "NC" on the OM-USB-1208HS. Pins 32 and 33 are "NC" on the OM-USB-1208HS and OM-USB-1208HS-2AO.

Signal connections

Analog input

You can configure the analog inputs for SE or DIFF mode.

With SE mode, connect up to eight inputs to screw terminals **AIN0** to **AIN7**. Refer to Figure 3 on page 10 for the location of these pins. SE mode requires two wires:

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

In SE mode, the input voltage ranges are ± 10 V, ± 5 V, ± 2.5 V, 0 to 10 V.

With DIFF mode, connect up to four DIFF inputs to screw terminals **AIN0+/AIN0-** to **AIN3+/AIN3-**. Refer to Figure 4 for the location of these pins. DIFF mode requires two wires plus a ground reference:

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

In DIFF mode, the input voltage ranges are ± 20 V, ± 10 V, and ± 5 V. The voltage level on each AINx input is limited to ± 14 V.

For more information on analog signal connections

For more information on analog input connections, refer to the *OMB-DAQ-2400*, *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

You can connect up to four analog output connections to screw terminals **AOUT0** to **AOUT3**. Refer to Figure 3 on page 10 for the location of these pins.

Each channel can be software-paced at rates up to 5,000 updates per second (system-dependent), or hardware-paced at rates up to 1 MS/s.

Each analog output on the OM-USB-1208HS-2AO and OM-USB-1208HS-2AO has a fixed ± 10 V output range. The outputs default to 0 V at power up.

External clock I/O

Use the **AICKI** and **AOCKI** terminals to receive a sampling clock from an external source.

Use the **AICKO** terminal to output the internal A/D sampling clock. Use the **AOCKO** terminal to output the internal D/A sampling clock. When using an external clock, a pulse output generated by the external clock rising edge is also available at these terminals.

Refer to Figure 3 on page 10 for the location of these pins.

Digital I/O

You can connect up to 16 digital I/O lines to screw terminals **DIO0** through **DIO15**. Refer to Figure 3 on page 10 for the location of these pins.

The 16 DIO terminals have 47 k resistors that you can configure for pull-up/pull-down using a jumper inside the case. The default configuration is pull-down.

You can use the digital I/O terminals to detect the state of any TTL-level input. Refer to the schematic shown in Figure 5.

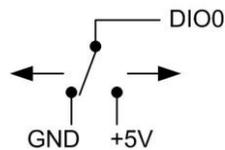


Figure 5. Schematic showing switch detection by digital channel DIO0

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).

Internal pull-up/pull-down capability

Each of the 16 DIO bits on the has a 47 k Ω pull-up/pull-down resistor. To configure these bits for either a +5 V pull-up or a 0 V pull-down option, you must open the device case to access the three-pin jumper labeled **W34**.

The pull-up/pull-down voltage is common to all of the internal 47 k Ω resistors.

To open the case and set the W34 jumper, do the following.

1. Turn the device over and rest the top of the housing on a flat, stable surface.
2. Peel off the four rubber feet on the bottom of the device to access the screws.

3. Remove the four screws from the bottom of the device.
4. Hold both the top and bottom sections together, turn the device over and rest it on the surface, then carefully remove the top section of the case to expose the circuit board.
5. Configure jumper **W34** for either pull-up or pull-down. The jumper is configured by default for pull-down (see Figure 6 and Figure 7).

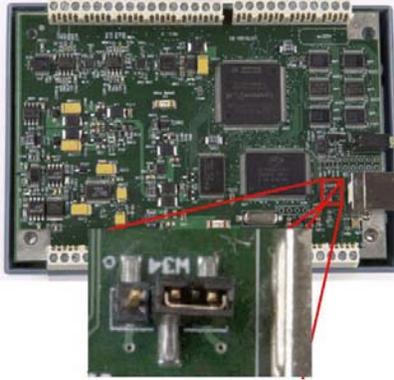


Figure 6. W34 jumper location (default pull-down setting shown)

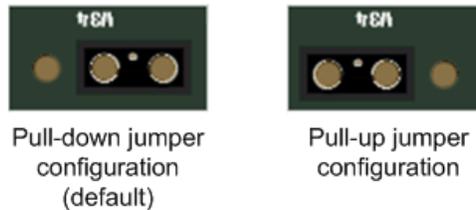


Figure 7. W34 jumper – pull-down and pull-up configurations

6. Replace the top section of the case, and fasten it to the bottom section with the four screws. Replace the rubber feet onto each screw.

For more information on digital signal connections

For more information on digital signal connections and digital I/O techniques, refer to the *OMB-DAQ-2400, 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).

Counter I/O

The terminals provide connections to each 32-bit counter input channel (**CTR0** and **CTR1**). Each counter can count frequencies of up to 20 MHz. Refer to Figure 3 on page 10 for the location of these pins

Timer output

Use the **TMR** terminal to connect to the pulse width modulation (PWM) timer output.

You can set the following timer output parameters through software:

- pulse frequency
- duty cycle (pulse width divided by the pulse period)
- number of pulses to generate
- time delay before starting the timer output after it's enabled
- resting state of the output (*idle high* or *idle low*)

The timer can generate a pulse output with a programmable frequency range of 0.00931 Hz up to 20 MHz.

Both the period and time delay ranges are 50 ns to 107.4 seconds. Figure 8 shows the timer output schematic.

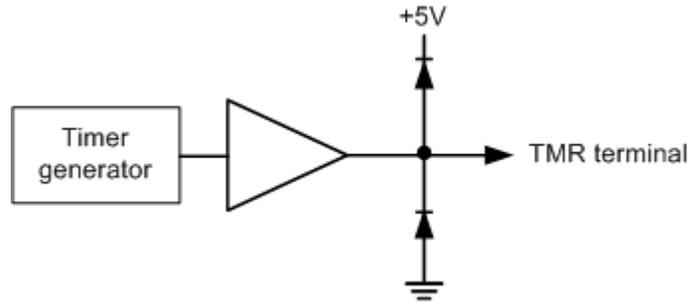


Figure 8. PWM timer output schematic

Refer to Figure 3 on page 10 for the location of the **TMR** pin.

Trigger input

The **TRIG** connection is an external digital trigger input. The trigger mode is software-selectable for:

- Level-sensitive or edge-sensitive
- Rising or falling edge
- High or low level

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

Refer to Figure 3 on page 10 for the location of the **TRIG** pin.

Retrigger

The acquisition uses the trigger settings for positive edge/negative edge and level-sensitive/edge-sensitive, but automatically re-arms the trigger after it is activated

Power outputs

You can use the two **+5V** connections to supply power to external devices or circuitry. These terminals can output up to 285 mA.

Caution! The **+5V** terminals are outputs. Do not connect to an external power supply or you may damage the device and possibly the computer.

Ground

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

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

Refer to Figure 3 on page 10 for the location of the **AGND** and **GND** pins.

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. Analog input specifications

| Parameter | Condition | Specification |
|--|--|--|
| A/D converter | | Analog Devices AD7329 13-bit successive approximation type |
| Input ranges | Software-selectable per channel | <ul style="list-style-type: none"> ▪ DIFF: ± 20 V, ± 10 V, ± 5 V (The voltage level on each individual AIN input is limited to ± 14 V.) ▪ SE: ± 10 V, ± 5 V, ± 2.5 V, 0 V to 10 V |
| Number of channels | | 4 DIFF, 8 SE Software-selectable |
| Input configuration | | Multiplexed |
| Channel gain queue | 8 unique consecutive elements | Software-selectable range for each channel |
| <i>Absolute maximum input voltage</i> | <i>CHx IN to GND</i> | <i>± 25 V max (power on)</i> <i>± 12 V max (power off)</i> |
| Input impedance | | 35 M Ω min |
| Input bandwidth (-3 dB) | All input ranges | 2 MHz typ |
| Input leakage current | | ± 250 nA typ |
| Input capacitance | | 32 pF typ |
| Offset error drift | | 5 ppm/ $^{\circ}$ C typ |
| Gain error drift | | 25 ppm/ $^{\circ}$ C typ |
| Maximum working voltage (signal + common mode) | ± 20 V | ± 14 V |
| | ± 10 V | ± 11 V |
| | ± 5 V | ± 5.5 V |
| Sampling rate | | 1 S/s to 1 MS/s, software-selectable |
| Sample clock source | | Internal A/D clock or AICKI |
| Burst mode | | Software-selectable, burst rate = 1 μ s |
| Throughput | Software paced | 33 S/s to 4000 S/s typ, system dependent |
| | Scan to PC memory | 1 MS/s max |
| Resolution | | 13 bits |
| <i>A/D no missing codes (uncalibrated)</i> | <i>DIFF mode</i> | <i>13 bits</i> |
| | <i>SE mode</i> | <i>12 bits</i> |
| <i>CMRR</i> | <i>60hz</i> | <i>74 dB typ</i> |
| <i>Crosstalk</i> | <i>SE mode, all ranges, 250 kHz input signal</i> | <i>-62 dB typ</i> |
| | <i>DIFF mode, all ranges, 250 kHz input signal</i> | <i>-78 dB typ</i> |

Table 2. Calibrated absolute accuracy

| Range | Accuracy (mV) |
|--------------------|-----------------------|
| ±20 V (DIFF mode) | ±9.55 typ, ±13.18 max |
| ±10 V (DIFF mode) | ±4.59 typ, ±6.23 max |
| ±5 V (DIFF mode) | ±2.25 typ, ±2.75 max |
| ±10 V (SE mode) | ±5.10 typ, ±8.06 max |
| ±5 V (SE mode) | ±2.63 typ, ±4.03 max |
| ±2.5 V (SE mode) | ±1.59 typ, ±2.70 max |
| 0 – 10 V (SE mode) | ±3.29 typ, ±5.13 max |

Table 3 summarizes the noise performance for OM-USB-1208HS Series hardware. Noise distribution is determined by gathering 50 kS with inputs tied to ground at the user connector. Samples are gathered at the maximum specified sampling rate of 1 MS/s.

Table 3. Noise performance

| Range | Typical counts | LSBrms |
|--------------------|----------------|--------|
| ±20 V (DIFF mode) | 3 | 0.45 |
| ±10 V (DIFF mode) | 3 | 0.45 |
| ±5 V (DIFF mode) | 3 | 0.45 |
| ±10 V (SE mode) | 5 | 0.91 |
| ±5 V (SE mode) | 5 | 0.91 |
| ±2.5 V (SE mode) | 5 | 0.91 |
| 0 – 10 V (SE mode) | 5 | 0.91 |

Table 4. Input settling time in μ s, typical

| Condition | Range | ±1 LSB | ±4 LSB | ±8 LSB |
|--|-------------|--------|--------|--------|
| + full-scale to –full-scale channel switch, same range to same range | ±10 V | 1.5 | 1.1 | 1.0 |
| | ±5 V | 2.1 | 1.1 | 1.0 |
| | ±2.5 V | 2.2 | 1.1 | 1.0 |
| | 0 V to 10 V | 2.6 | 1.1 | 1.0 |

Analog output (OM-USB-1208HS-2AO, OM-USB-1208HS-4AO)

Table 5. Analog output specifications

| Parameter | Condition | Specification |
|---------------------------------|--|--|
| D/A converter | | Texas Instruments DAC7553 |
| Number of channels | | OM-USB-1208HS-2AO: 2 independent OM-USB-1208HS-4AO: 4 independent |
| Resolution | | 12 bits |
| Output range | Calibrated | ± 10 V |
| | Uncalibrated | ± 10.2 V |
| Output transient | Host PC is reset, powered on, suspended, or a reset command is issued to device. | Duration: 3 ms typ Amplitude: 6 V p-p typ |
| D/A update rate | Software paced | 33 to 5000 S/s typ, system dependent |
| | Hardware paced | 1 MHz max (per channel) |
| Sample clock source | | Internal D/A clock or AOCKI |
| Monotonicity | | 12 bits |
| Output current | | ± 3 mA max per channel |
| Output short-circuit protection | Output connect to GND | Unlimited duration (10 mA typ) |
| Output coupling | | DC |
| Power up and reset state | | 0 V |
| Output noise | | 0.53 mV rms |
| Settling time (to 0.05%) | 20 V output step, (RL=5 k Ω , CL=200 pf) | 5 μ S max |
| Absolute accuracy | | $\pm 0.1\%$ |
| Slew rate | | 6.7 V/ μ s typ |
| Offset error drift | | 10 ppm/ $^{\circ}$ C typ |
| Gain error drift | | 65 ppm/ $^{\circ}$ C typ |

Digital input/output

Table 6. Digital I/O specifications

| | |
|--|--|
| Digital type | CMOS |
| Number of I/O | 16 |
| Configuration | Each bit may be configured as input (power on default) or output |
| Pull-up configuration | The port has 47 k Ω resistors configurable as pull-up or pull-down with an internal jumper. The default setting is pull-down. |
| 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 | 2.0 V min 5.5 V absolute max |
| Input low voltage | 0.8 V max -0.5 V absolute min 0 V recommended min |
| Output high voltage | 4.4 V min (IOH = -50 μ A) 3.76 V min (IOH = -24 mA) |
| Output low voltage | 0.1 V max (IOL = 50 μ A) 0.44 V max (IOL = 24 mA) |
| Output current | ± 24 mA max per terminal (see " Power " section for additional information) |

External trigger

Table 7. External trigger specifications

| Parameter | Specification |
|----------------------------|--|
| Trigger source | TRIG input |
| Trigger mode | Software-selectable for edge or level sensitive, rising or falling edge, high or low level. Power on default is edge sensitive, rising edge. |
| Trigger latency | 1 μ s + 1 clock cycle max |
| Trigger pulse width | 100 ns min |
| Input type | Schmitt Trigger, 33 Ω series resistor and 47 k Ω pull-down to ground |
| Schmitt trigger hysteresis | 0.4 V to 1.2 V |
| Input high voltage | 2.2 V min 5.5 V absolute max |
| Input low voltage | 1.5 V max -0.5 V absolute min 0 V recommended min |

External clock input/output

Table 8. External clock I/O specifications

| Parameter | Specification |
|----------------------------|---|
| Terminal names | OM-USB-1208HS: AICKI, AICKO OM-USB-1208HS-2AO: AICKI, AICKO, AOCKI, AOCKO OM-USB-1208HS-4AO: AICKI, AICKO, AOCKI, AOCKO |
| Terminal types | AxCKI: Input, active on rising edge AxCKO: Output, power on default is 0 V, 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 D/A clock, if supported) or pulse generated from AxCKI when in external clock mode |
| Input clock rate | 1 MHz max |
| Clock pulse width | AxCKI: 400 ns min AxCKO: 400 ns min |
| Input type | Schmitt trigger, 33 Ω series resistor, 47 k Ω pull-down to ground |
| Schmitt trigger hysteresis | 0.4 V to 1.2 V |
| Input high voltage | 2.2 V min 5.5 V absolute max |
| Input low voltage | 1.5 V max -0.5 V absolute min 0 V recommended min |
| Output high voltage | 4.4 V min (IOH = -50 μ A) 3.76 V min (IOH = -24 mA) |
| Output low voltage | 0.1 V max (IOL = 50 μ A) 0.44 V max (IOL = 24 mA) |
| Output current | \pm 24 mA max per terminal (see " Power " section for additional information) |

Counters

Table 9. Counter specifications

| Parameter | Specification |
|---|---|
| Counter terminal names | CTR0, CTR1 |
| Counter type | Event counter |
| Number of channels | 2 |
| Input type | Schmitt trigger, 33 Ω series resistor, 47 k Ω pull-down to ground |
| Schmitt trigger hysteresis | 0.4 V to 1.2 V |
| Input high voltage | 2.2 V min 5.5 V absolute max |
| Input low voltage | 1.5 V max -0.5 V absolute min 0 V recommended min |
| Resolution | 32 bits |
| Maximum input frequency | 20 MHz |
| Counter read/write rates (software paced) | 33 to 8000 reads/writes per second typ, system dependent |
| High pulse width | 25 ns min |
| Low pulse width | 25 ns min |

Timer

Table 10. Timer specifications

| Parameter | Specification |
|--------------------------|--|
| 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 | 40 MHz |
| Register widths | 32 bits |
| High pulse width | 20 ns min |
| Low pulse width | 20 ns min |
| Output high voltage | 4.4 V min (IOH = -50 μ A) 3.76 V min (IOH = -24 mA) |
| Output low voltage | 0.1 V max (IOL = 50 μ A) 0.44 V max (IOL = 24 mA) |
| Output current | \pm 24 mA max per pin (see " Power " section for additional information) |

Memory

Table 11. Memory specifications

| Parameter | Specification |
|---------------------|--|
| Data FIFO | OM-USB-1208HS: 4 kS analog input OM-USB-1208HS-2AO: 4 kS analog input/4 kS analog output OM-USB-1208HS-4AO: 4 kS analog input/4 kS analog output |
| Non-volatile memory | 32 KB (16 KB firmware storage, 16 KB calibration/user data) |

Power

Table 12. Power specifications

| Parameter | Condition | Specification |
|--|---------------------------------|--|
| Operating modes | | Bus-powered, USB 5 V supply |
| Supply current (see Note 1) | Suspend mode | <2.5 mA |
| | Enumeration | <100 mA |
| | Run mode | <500 mA |
| Power consumption excluding analog and digital outputs | Run mode | OM-USB-1208HS: 1.05 W max (210 mA input current) OM-USB-1208HS-2AO: 1.125 W max (225 mA input current) OM-USB-1208HS-4AO: 1.175 W max (235 mA input current) |
| Power available for +5 V, AICKO, AOCKO, TMR, analog outputs, and digital I/O | Run mode | OM-USB-1208HS: 1.45 W max OM-USB-1208HS-2AO: 1.375 W max OM-USB-1208HS-4AO: 1.325 W max The total power consumption for all external loads must be less than this value, and each load must meet the individual specification for the terminal. |
| Digital output power calculation | | Power per output = $I_{out} \times 5 \text{ V}$ (for example, @ 24 mA, $P = 0.024 \times 5 = 120 \text{ mW} / \text{output}$) |
| Analog output power calculation (OM-USB-1208HS-2AO/OM-USB-1208HS-4AO) | | Power per output = $(I_{out} \times 16.5 \text{ V}) / 0.78$ (for example, @ 3 mA, $P = (0.003 \times 16.5) / 0.78 = 63.5 \text{ mW/output}$) |
| +5 V output power calculation | | Power (W) = $I_{out} \times 5 \text{ V}$ |
| +5 V output voltage range (see Note 2) | Run mode | 4.5 V min, 5.25 V max |
| | Suspend mode, enumeration | 0 V |
| +5 V output current | Run mode, no other output loads | OM-USB-1208HS: 290 mA max (1.45 W) OM-USB-1208HS-2AO: 275 mA max (1.375 W) OM-USB-1208HS-4AO: 265 mA max (1.325 W) |
| Fuses | On USB supply | 0452.750 - Littelfuse 0.750A NANO2® Slo-Blo® Subminiature Surface Mount Fuse. Spare fuse mounted in holder on PCB. |

Note 1: This is the total current consumption for OM-USB-1208HS Series hardware, including +5 V, digital output and analog output currents (if supported).

Note 2: Output voltage range assumes input power is within specified limits.

USB specifications

Table 13. USB specifications

| Parameter | Specification |
|--------------------------|--|
| USB device type | USB 2.0 (high-speed) |
| USB device compatibility | USB 1.1, 2.0 |
| USB cable length | 3 meters max |
| USB cable type | A-B cable, UL type AWM 2527 or equivalent (min 24 AWG VBUS/GND, min 28 AWG D+/D-). |

Environmental

Table 14. Environmental specifications

| Parameter | Specification |
|-----------------------------|--------------------------|
| Operating temperature range | 0 °C to 50 °C |
| Storage temperature range | -40 °C to 85 °C |
| Humidity | 0% to 90% non-condensing |

Mechanical

Table 15. Mechanical specifications

| Parameter | Specification |
|------------|---|
| Dimensions | 127 × 89.9 × 35.6 mm (5.00 × 3.53 × 1.40 in.) |

Main connector and pinout

Table 16. Main connector specifications

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

Table 17. Main connector single-ended pinout

| Pin | Signal name | Pin | Signal name |
|-----|-------------|-----|--------------------|
| 1 | AIN0 | 29 | AOUT0 ¹ |
| 2 | AGND | 30 | AOUT1 ¹ |
| 3 | AIN1 | 31 | AGND |
| 4 | AGND | 32 | AOUT2 ² |
| 5 | AIN2 | 33 | AOUT3 ² |
| 6 | AGND | 34 | AGND |
| 7 | AIN3 | 35 | AICKI |
| 8 | AGND | 36 | AICKO |
| 9 | AIN4 | 37 | AOCKI ³ |
| 10 | AGND | 38 | AOCKO ³ |
| 11 | AIN5 | 39 | TRIG |
| 12 | AGND | 40 | GND |
| 13 | AIN6 | 41 | CTR0 |
| 14 | AGND | 42 | CTR1 |
| 15 | AIN7 | 43 | TMR |
| 16 | AGND | 44 | GND |
| 17 | empty | 45 | empty |
| 18 | +5V | 46 | +5V |
| 19 | GND | 47 | GND |
| 20 | DIO0 | 48 | DIO8 |
| 21 | DIO1 | 49 | DIO9 |
| 22 | DIO2 | 50 | DIO10 |
| 23 | DIO3 | 51 | DIO11 |
| 24 | DIO4 | 52 | DIO12 |
| 25 | DIO5 | 53 | DIO13 |
| 26 | DIO6 | 54 | DIO14 |
| 27 | DIO7 | 55 | DIO15 |
| 28 | GND | 56 | GND |

¹ OM-USB-1208HS-2AO and OM-USB-1208HS-4AO only; NC (no connection) on the OM-USB-1208HS.

² OM-USB-1208HS-4AO only; NC (no connection) on the OM-USB-1208HS AND OM-USB-1208HS-2AO.

³ OM-USB-1208HS-2AO and OM-USB-1208HS-4AO only; NC (no connection) on the OM-USB-1208HS.

Table 18. Main connector differential pinout

| Pin | Signal name | Pin | Signal name |
|-----|-------------|-----|--------------------|
| 1 | AIN0 + | 29 | AOUT0 ¹ |
| 2 | AGND | 30 | AOUT1 ¹ |
| 3 | AIN0 - | 31 | AGND |
| 4 | AGND | 32 | AOUT2 ² |
| 5 | AIN1 + | 33 | AOUT3 ² |
| 6 | AGND | 34 | AGND |
| 7 | AIN1 - | 35 | AICKI |
| 8 | AGND | 36 | AICKO |
| 9 | AIN2 + | 37 | AOCKI ³ |
| 10 | AGND | 38 | AOCKO ³ |
| 11 | AIN2 - | 39 | TRIG |
| 12 | AGND | 40 | GND |
| 13 | AIN3 + | 41 | CTR0 |
| 14 | AGND | 42 | CTR1 |
| 15 | AIN3 - | 43 | TMR |
| 16 | AGND | 44 | GND |
| 17 | empty | 45 | empty |
| 18 | +5V | 46 | +5V |
| 19 | GND | 47 | GND |
| 20 | DIO0 | 48 | DIO8 |
| 21 | DIO1 | 49 | DIO9 |
| 22 | DIO2 | 50 | DIO10 |
| 23 | DIO3 | 51 | DIO11 |
| 24 | DIO4 | 52 | DIO12 |
| 25 | DIO5 | 53 | DIO13 |
| 26 | DIO6 | 54 | DIO14 |
| 27 | DIO7 | 55 | DIO15 |
| 28 | GND | 56 | GND |

¹ OM-USB-1208HS-2AO and OM-USB-1208HS-4AO only; NC (no connection) on the OM-USB-1208HS.

² OM-USB-1208HS-4AO only; NC (no connection) on the OM-USB-1208HS AND OM-USB-1208HS-2AO.

³ OM-USB-1208HS-2AO and OM-USB-1208HS-4AO only; NC (no connection) on the OM-USB-1208HS.

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.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

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.

OMEGA is a registered trademark of OMEGA ENGINEERING, INC.

© Copyright 2011 OMEGA ENGINEERING, INC. All rights reserved. This document may not be copied, photocopied, reproduced, translated, or reduced to any electronic medium or machine-readable form, in whole or in part, without the prior written consent of OMEGA ENGINEERING, INC.

Where Do I Find Everything I Need for Process Measurement and Control?

OMEGA...Of Course!

Shop online at omega.comSM

TEMPERATURE

- ☑ Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- ☑ Wire: Thermocouple, RTD & Thermistor
- ☑ Calibrators & Ice Point References
- ☑ Recorders, Controllers & Process Monitors
- ☑ Infrared Pyrometers

PRESSURE, STRAIN AND FORCE

- ☑ Transducers & Strain Gages
- ☑ Load Cells & Pressure Gages
- ☑ Displacement Transducers
- ☑ Instrumentation & Accessories

FLOW/LEVEL

- ☑ Rotameters, Gas Mass Flowmeters & Flow Computers
- ☑ Air Velocity Indicators
- ☑ Turbine/Paddlewheel Systems
- ☑ Totalizers & Batch Controllers

pH/CONDUCTIVITY

- ☑ pH Electrodes, Testers & Accessories
- ☑ Benchtop/Laboratory Meters
- ☑ Controllers, Calibrators, Simulators & Pumps
- ☑ Industrial pH & Conductivity Equipment

DATA ACQUISITION

- ☑ Data Acquisition & Engineering Software
- ☑ Communications-Based Acquisition Systems
- ☑ Plug-in Cards for Apple, IBM & Compatibles
- ☑ Data Logging Systems
- ☑ Recorders, Printers & Plotters

HEATERS

- ☑ Heating Cable
- ☑ Cartridge & Strip Heaters
- ☑ Immersion & Band Heaters
- ☑ Flexible Heaters
- ☑ Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- ☑ Metering & Control Instrumentation
- ☑ Refractometers
- ☑ Pumps & Tubing
- ☑ Air, Soil & Water Monitors
- ☑ Industrial Water & Wastewater Treatment
- ☑ pH, Conductivity & Dissolved Oxygen Instruments