

1 YEAR
WARRANTY

OMEGA CARESM
Extended Warranty
Program



User's Guide

Shop online at

omega.com[®]

Ω OMEGA

omega.com

e-mail: info@omega.com

*For latest product manuals:
omegamanual.info*

ISO 9001
CERTIFIED
CORPORATE QUALITY

STAMFORD, CT

ISO 9002
CERTIFIED
CORPORATE QUALITY

MANCHESTER, UK



USB-4711A **150 kS/s, 12-Bit Multifunction** **USB Data Acquisition Module**



| | |
|---|---|
| OMEGAnet® Online Service omega.com | Internet e-mail info@omega.com |
|---|---|

Servicing North America:

U.S.A.:
ISO 9001 Certified
One Omega Drive, Box 4047
Stamford, CT 06907-0047
Tel: (203) 359-1660
FAX: (203) 359-7700
e-mail: info@omega.com

Canada:
976 Bergar
Laval (Quebec) H7L 5A1, Canada
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:
En Español: (001) 203-359-7803
FAX: (001) 203-359-7807
e-mail: espanol@omega.com
info@omega.com.mx

Servicing Europe:

Czech Republic: Frystatska 184, 733 01 Karviná, Czech Republic
Tel: +420 (0)59 6311899
FAX: +420 (0)59 6311114
Toll Free: 0800-1-66342
e-mail: info@omegashop.cz

Germany/Austria: Daimlerstrasse 26, D-75392 Deckenpfronn, Germany
Tel: +49 (0)7056 9398-0
FAX: +49 (0)7056 9398-29
Toll Free in Germany: 0800 639 7678
e-mail: info@omega.de

United Kingdom:
ISO 9002 Certified
One Omega Drive, River Bend Technology Centre
Northbank, Irlam, Manchester
M44 5BD United Kingdom
Tel: +44 (0)161 777 6611
FAX: +44 (0)161 777 6622
Toll Free in United Kingdom: 0800-488-488
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.

USB-4711A

**150 kS/s, 12-bit,
Multifunction USB
Data Acquisition
Module**

User Manual

Contents

| | | | |
|-----------------|----------|--|-----------|
| Chapter | 1 | Introduction | 2 |
| | 1.1 | Features | 2 |
| | 1.2 | Software Overview..... | 3 |
| | 1.2.1 | More on the CD | 3 |
| Chapter | 2 | Installation | 6 |
| | 2.1 | Unpacking | 6 |
| | 2.2 | Driver Installation | 7 |
| | 2.3 | Hardware Installation | 9 |
| | 2.4 | Hardware Uninstallation | 9 |
| | | Figure 2.1:Unplug or Eject Hardware Dialog | 10 |
| | | Figure 2.2:Stop a Hardware device dialog box | 10 |
| Chapter | 3 | Signal Connections | 12 |
| | 3.1 | Overview | 12 |
| | 3.2 | I/O Connectors | 12 |
| | 3.2.1 | Pin Assignment | 12 |
| | | Figure 3.1:I/O Connector Pin Assignment | 13 |
| | 3.2.2 | I/O Connector Signal Description | 14 |
| | | Table 3.1:I/O Connector Signal Description | 14 |
| | 3.2.3 | LED Indicator Status Description | 15 |
| | | Table 3.2:LED Indicator Status Description | 15 |
| | 3.3 | Analog Input Connections..... | 16 |
| | 3.3.1 | Single-ended Channel Connections | 16 |
| | | Figure 3.2:Single-Ended Input Channel Connection ... | 16 |
| | 3.3.2 | Differential Input Connections | 17 |
| | | Figure 3.3:Differential Input Channel Connection | 17 |
| | 3.4 | Analog Output Connections (Voltage)..... | 18 |
| | | Figure 3.4:Analog Output Channel Connections | 18 |
| | 3.5 | Trigger Source Connections..... | 18 |
| | 3.5.1 | Internal Pacer Trigger Connection | 18 |
| | 3.5.2 | External Trigger Source Connection | 18 |
| | 3.6 | Field Wiring Considerations | 19 |
| Appendix | A | Specifications | 22 |
| | A.1 | Analog Input..... | 22 |
| | A.2 | Analog Output | 22 |
| | A.3 | Non-Isolated Digital Input/Output | 23 |
| | A.4 | Event/Frequency Input | 23 |
| | A.5 | Pulse Output | 23 |
| | A.6 | General | 23 |

1

Introduction

This chapter will provide information on the features of the DAS module, a quick start guide for installation, and some brief information on software and accessories for USB-4711A Module.

Sections include:

- Features
- Software Overview

Chapter 1 Introduction

Thank you for buying the USB-4711A data acquisition module. The USB-4711A is a powerful data acquisition (DAS) module for the USB port. It features a unique circuit design and complete functions for data acquisition and control.

1.1 Features

USB-4711A has the most requested measurement & control functions:

- 16 single-ended/ 8 differential or combination analog input channels
- 12-bit resolution A/D converter, with up to 150 kS/s sampling rate
- 8 digital input & 8 digital output channels (TTL Level)
- 2 analog output channels
- 16-bit programmable counter/timer x 1
- Pulse output channel x 1
- Programmable gain for each analog input channel
- Automatic channel/gain scanning
- Onboard 1K samples FIFO buffer for AI channels
- Bus-powered
- Device status LED indicator
- Removable on-module wiring terminal
- Supports high-speed USB 2.0
- Auto calibration function
- Hot swappable

Note: The USB chip on your system may have a limitation on the number of USB devices it will support. Normally, only five USB-4711A devices can be supported.

Note: The power output of an USB port is 500 mA, while the USB-4711A requires 360 mA (typical). This means that if an USB hub is used, it will need an external power supply to support more than one USB-4711A device.

1.2 Software Overview

Omega offers a rich set of DLL drivers, third-party driver support and application software on the companion CD-ROM to help fully exploit the functions of your device. The Device Drivers feature a complete I/O function library to help boost your application performance and work seamlessly with development tools such as Visual C++, Visual Basic.

1.2.1 More on the CD

For instructions on how to begin programming in each development tool, some tutorial chapters are included in the Device Drivers Manual for your reference. Please refer to the corresponding sections in these chapters on the Device Drivers Manual to begin your programming efforts. You can also look at the example source code provided for each programming tool, since they can get you very well oriented.

The Device Drivers Manual can be found on the companion CD-ROM. Alternatively, if you have already installed the Device Drivers on your system, The Device Drivers Manual can be readily accessed through the Start button:

Start/Programs/Omega USB-4700 Series/ Device Driver's Manual

After you install the examples, the example source code can be found under the corresponding installation folder such as the default installation path:

Program Files/Omega/USB-4700/Examples

2

Installation

Sections include:

- Unpacking
- Driver Installation
- Hardware Installation
- Hardware Uninstallation

Chapter 2 Installation

2.1 Unpacking

After receiving your USB-4711A package, please inspect its contents first. The package should contain the following items:

- USB-4711A Module
- Shielded USB 2.0 Cable (1.8 m)
- Companion CD-ROM (DLL driver included)

The USB-4711A Module harbors certain electronic components vulnerable to *electrostatic discharge* (ESD). ESD could easily damage the integrated circuits and certain components if preventive measures are not carefully paid attention to. ***Before removing the module from the anti-static plastic bag, you should take following precautions to ward off possible ESD damage:***

- Touch the metal part of your computer chassis with your hand to discharge static electricity accumulated on your body. One can also use a grounding strap.
- Make contact between the antistatic bag and ground before opening.

After taking out the module, you should first:

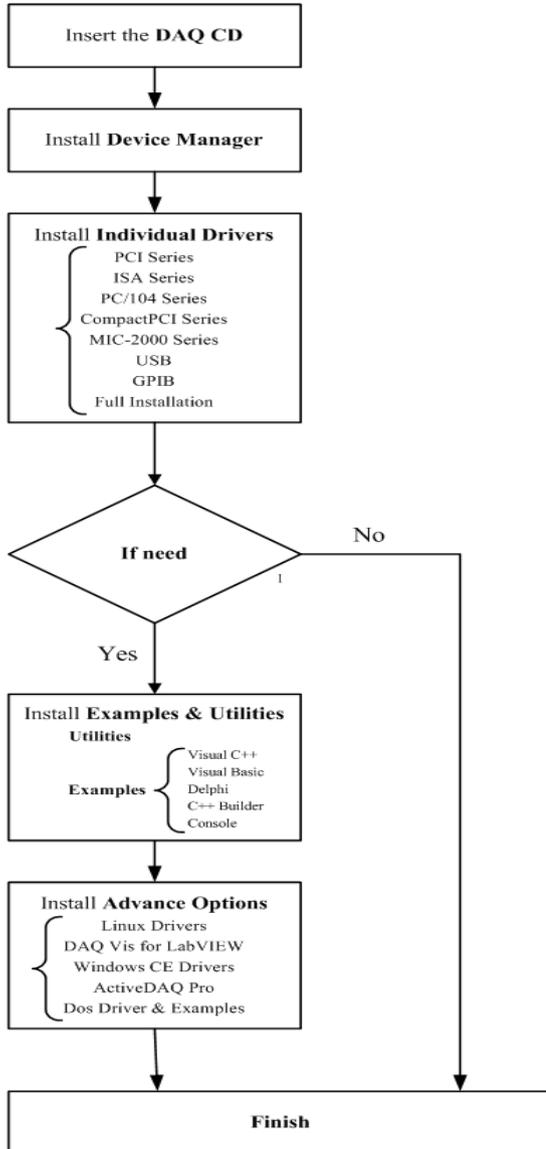
Inspect the module for any possible signs of external damage (loose or damaged components, etc.). If the module is visibly damaged, please notify our service department or our local sales representative immediately. Avoid using a damaged module with your system.

- Avoid physical contact with materials that could hold static electricity such as plastic, vinyl and Styrofoam.

2.2 Driver Installation

We recommend you install the software driver before you install the USB-4711A module into your system, since this will guarantee a smooth installation process.

The 32-bit DLL driver Setup program for the USB-4711A module is included on the companion CD-ROM that is shipped with your module package. Please follow the steps on the following page to install the driver software:



For further information on driver-related issues, an online version of the Device Drivers Manual is available by accessing the following path:
Start/Programs/Omega USB-4700 Series/ Device Driver's Manual

2.3 Hardware Installation

Note: Make sure you have installed the software driver before you install the module (please refer to Section 2.2 Driver Installation)

After the DLL driver installation is completed, you can now go on to install the USB-4711A module in any USB port that supports the USB 1.1/2.0 standard, on your computer. Please follow the steps below to install the module on your system.

Step 1: Touch the metal part on the surface of your computer to neutralize the static electricity that might be in your body.

Step 2: Plug your USB module into the selected USB port. Use of excessive force must be avoided; otherwise the module might get damaged.

Note: In case you installed the module without installing the DLL driver, Win2000/XP will recognize your module as an “unknown device”. After reboot, it will prompt you to provide necessary driver. You should ignore the prompting messages and set up the driver according to the steps described in Sec.2.2.

After your module is installed, you can configure it using the Device Manager. The Device Driver's Manual can be found at:
Start/Programs/Omega USB-4700 Series/ Device Driver's Manual

2.4 Hardware Uninstallation

Though the USB modules are hot swappable, we still recommend you to follow the hardware un-installation procedure to avoid any unpredictable damages to your device or your system.

Step1: Close the applications of the USB module.

Step2: Right click the “Unplug or Eject Hardware” icon on your task bar.



Figure 2.1: Unplug or Eject Hardware Dialog

Step3: Select “USB-4711A Device” and press “Stop” Button.



Figure 2.2: Stop a Hardware device dialog box

Step4: Unplug your USB device from the USB port.

Note: Please make sure that you have closed the application before unplugging the USB device, otherwise unexpected system error or damage may occur.

3

Signal Connections

This chapter provides useful information on how to connect input and output signals to the USB-4711A via the I/O connectors.

Sections include:

- Overview
- I/O Connectors
- Analog Input Connections
- Analog Output Connections
- Trigger Source Connections
- Field Wiring Considerations

Chapter 3 Signal Connections

3.1 Overview

Maintaining good signal connections is one of the most important factors in ensuring that your application system is sending and receiving data correctly. A good signal connection can avoid unnecessary and costly damage to your PC and other hardware devices.

3.2 I/O Connectors

USB-4711A is equipped with plug-in screw-terminal connectors that facilitate connection to the module without terminal boards or cables.

3.2.1 Pin Assignment

Figure 3.1 on next page shows the pin assignments for the five 10-pin I/O connectors on USB-4711A.

Warning: The two ground references AGND and DGND should be used separately for their designated purpose. Do not connect them together.

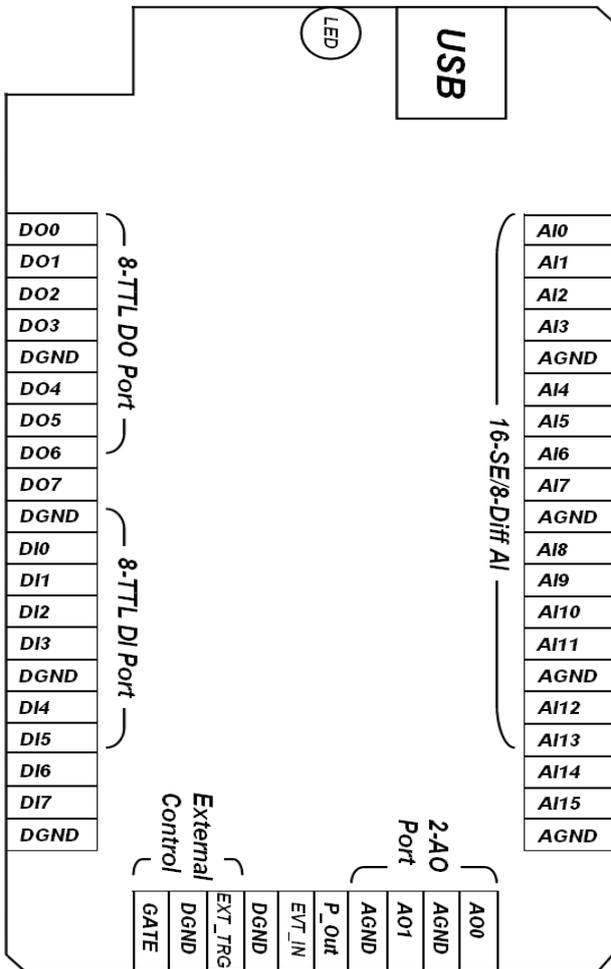


Figure 3.1: I/O Connector Pin Assignment

3.2.2 I/O Connector Signal Description

Table 3.1: I/O Connector Signal Description

| Signal Name | Reference | Direction | Description |
|-------------|-----------|-----------|--|
| AI<0...15> | AGND | Input | Analog Input Channels 0 through 15. |
| AIGND | - | - | Analog Input Ground. |
| AO0 AO1 | AGND | Output | Analog Output Channels 0/1. |
| AOGND | - | - | Analog Output Ground. The analog output voltages are referenced to these nodes. |
| DI<0..7> | DGND | Input | Digital Input channels. |
| DO<0..7> | DGND | Output | Digital Output channels. |
| DGND | - | - | Digital Ground. This pin supplies the reference for the digital channels at the I/O connector. |
| GATE | DGND | Input | A/D External Trigger Gate. When GATE is connected to +5 V, it will disable the external trigger signal to input. |
| EXT_TRG | DGND | Input | A/D External Trigger. This pin is external trigger signal input for the A/D conversion. A low-to-high edge triggers A/D conversion to start. |
| EVT_IN | DGND | Input | External events input channel. |
| P_OUT | DGND | Output | Pulse output channel |

3.2.3 LED Indicator Status Description

The USB Module is equipped with a LED indicator to show the current status of the device. When you plug the USB device into the USB port, the LED indicator will blink five times and then stay lit to indicate that it is on. Please refer to the following table for detailed LED indicator status information.

Table 3.2: LED Indicator Status Description

| LED Status | Description |
|--|--------------------------|
| On | Device ready for work |
| Off | Device not ready to work |
| Slow Blinking (5 times) | Device initialization |
| Fast Blinking (Depends on data transfer speed). | Device working |

3.3 Analog Input Connections

USB-4711A supports 16 single-ended/ 8 differential (or combination) analog inputs. Each individual input channel is software-selected.

3.3.1 Single-ended Channel Connections

The single-ended input configuration has only one signal wire for each channel, and the *measured voltage* (V_m) is the voltage of the wire as referenced against the common ground.

A signal source without a local ground is also called a “floating source”. It is fairly simple to connect a single-ended channel to a floating signal source. In this mode, USB-4711A provides a reference ground for external floating signal sources.

Figure 3.2 shows a single-ended channel connection between a floating signal source and an input channel on USB-4711A.

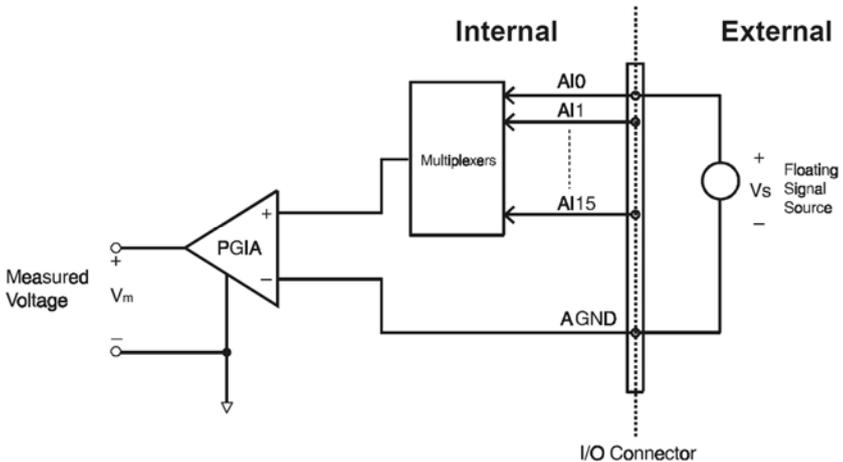


Figure 3.2: Single-Ended Input Channel Connection

3.3.2 Differential Input Connections

The differential input channels operate with two signal wires for each channel, and the voltage difference between both signal wires is measured. On USB-4711A, when all channels are configured to differential input, up to 8 analog channels are available.

If one side of the signal source is connected to a local ground, the signal source is ground-referenced. Therefore, the ground of the signal source and the ground of the card will not be exactly of the same voltage. The difference between the ground voltages forms a commonmode voltage (V_{cm}).

To avoid the ground loop noise effect caused by common-mode voltages, you can connect the signal ground to the *Low* input. Figure 3-3 shows a differential channel connection between a grounded-reference signal source and an input channel on USB-4711A. With this connection, the PGIA rejects a common-mode voltage V_{cm} between the signal source and USB-4711A ground, shown as V_{cm} in Figure 3-3.

Note: In differential input mode, the input channel n should be used with channel $n+1$.

$$(n=0,2,4\dots14)$$

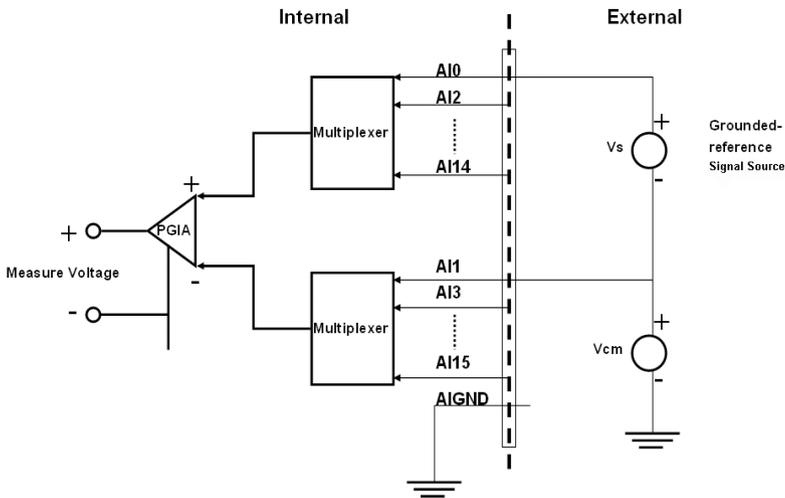


Figure 3.3: Differential Input Channel Connection

3.4 Analog Output Connections (Voltage)

USB-4711A provides two analog output channels, AO0 and AO1. Figure 3-3 shows how to make analog output connections on USB-4711A.

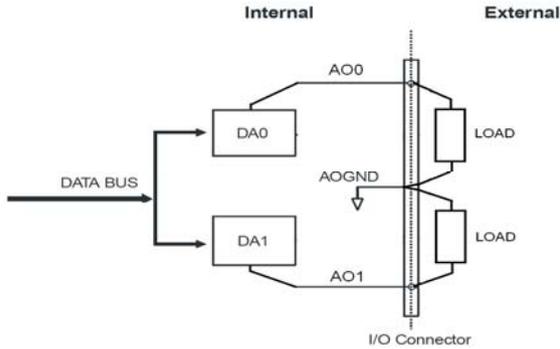


Figure 3.4: Analog Output Channel Connections

3.5 Trigger Source Connections

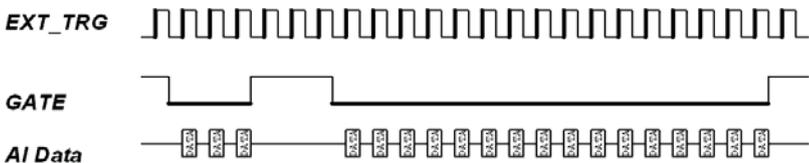
3.5.1 Internal Pacer Trigger Connection

USB-4711A provides two 16-bit counters connected to a 10 MHz clock. Counter 0 is a counter that counts events from an input channel. Counter 1 is a 16-bit timer for pacer triggering. A low-to-high edge from the Counter 1 output will trigger an A/D conversion on USB-4711A.

3.5.2 External Trigger Source Connection

In addition to pacer triggering, USB-4711A also allows external triggering for A/D conversions. When GATE is connected to a +5V DC source, the external trigger function is thereby disabled. And the external trigger function will be enabled once the +5V DC source is removed.

External Trigger Mode :



3.6 Field Wiring Considerations

- When you use USB-4711A to acquire data from outside, noises in the environment might significantly affect the accuracy of your measurements if due cautions are not taken. The following measures will be helpful to reduce possible interference running signal wires between signal sources and the USB-4711A.
- The signal cables must be kept away from strong electromagnetic sources such as power lines, large electric motors, circuit breakers or welding machines, since they may cause strong electromagnetic interference. Keep the analog signal cables away from any video monitor, since it can significantly affect a data acquisition system.
- If the cable travels through an area with significant electromagnetic interference, you should adopt individually shielded, twisted-pair wires as the analog input cable. This type of cable has its signal wires twisted together and shielded with a metal mesh. The metal mesh should only be connected to one point at the signal source ground.
- Avoid running the signal cables through any conduit that might have power lines in it.
- If you have to place your signal cable parallel to a power line that has a high voltage or high current running through it, try to keep a safe distance between them. Or place the signal cable in a right angle to the power line to minimize the undesirable effect.

A

Specifications

Appendix A Specifications

A.1 Analog Input

| | | | | | | | |
|---------------------------------------|---------------------------------------|-------------------|---------------|--------------|-----------------|--------|--------|
| Channels | 16-ch Single-ended/ 8-ch differential | | | | | | |
| Resolution | 12bits | FIFO Size | | 1024 samples | | | |
| Sampling Rate | 150kS/s | | | | | | |
| Input Range and Gain List | Gain | 0.5 | 1 | 2 | 4 | 8 | |
| | Gain Code | 4 | 0 | 1 | 2 | 3 | |
| | Unipolar | -- | -- | -- | -- | -- | |
| | Bipolar | ±10 | ±5 | ±2.5 | ±1.25 | ±0.625 | |
| Drift | Gain | 0.5 | 1 | 2 | 4 | 8 | |
| | Zero($\mu V/^\circ C$) | ±30 | | | | | |
| | Gain(ppm/ $^\circ C$) | 30 | 30 | 30 | 30 | 30 | |
| Small Signal Bandwidth for PGA | Gain | 0.5 | 1 | 2 | 4 | 8 | |
| | Bandwidth (MHz) | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | |
| Common Mode Voltage | ±11V (Operational) | | Input Protect | 30V max. | Input Impedence | | 1GW |
| Accuracy | DC | Gain | 0.5 | 1 | 2 | 4 | 8 |
| | | INLE(LSB) | 1 | 1 | 1 | 1 | 2 |
| | | DNLE(LSB) | 1 | 1 | 1 | 1 | 1 |
| | | Gain Error (%FSR) | 0.1 | 0.1 | 0.2 | 0.2 | 0.4 |
| | AC | SINAD | 68dB | THD | -88dB | ENOB | 11bits |

A.2 Analog Output

| | | | | | | | |
|----------------------------|---------------------|-----------|---------------------------------------|-------|--|--|--|
| Channels | 2 | | | | | | |
| Resolution | 12 bits | FIFO Size | | N/A | | | |
| Throughput | 2k Hz | | | | | | |
| Operating Mode | Single output | | | | | | |
| Output Range | 0~5, 0~10, ±5, ±10V | | | | | | |
| Accuracy | DC | INLE | | ±1LSB | | | |
| | | DNLE | | ±1LSB | | | |
| Dynamic Performance | Slew Rate | | 0.125V/ μs | | | | |
| | Settling Time | | 150 μs (to $\pm 1/2$ LSB of FSB) | | | | |
| Driving Capability | 5mA | | | | | | |
| Output Impedence | 0.1 Ω max. | | | | | | |

A.3 Non-Isolated Digital Input/Output

| | | |
|------------------------|--------------------|------------------------------|
| Input Channels | 8 Non-Isolated TTL | |
| Input Voltage | Low | 0.0 Vdc (min)/ 1.0Vdc (max.) |
| | High | 2.0 Vdc (min)/ 5.0Vdc (max.) |
| Output channels | 8 Non-Isolated TTL | |
| Output Voltage | Low | 0.4Vdc/ -6mA (Sink) |
| | High | 2.4 Vdc/ 6mA (Source) |

A.4 Event/Frequency Input

| | |
|-----------------|--|
| Channel | 1 (Event Or Frequency) |
| VIH | 2.0Vdc (Min) / 5.0Vdc (Max) |
| VIL | 0.0Vdc (Min) / 1.0Vdc (Max) |
| Input BW | In SW AI Mode : (+/- 0.05% Of FR In Frequency Cal.) Event/Frequency Input : 0.1 Hz ~ 10K Hz (Max) In FAI Mode : (+/- 0.05% Of FR In Frequency Cal.) Event/Frequency Input : 0.1 Hz ~ 1K Hz (Max) (For Maintain AI Performance) |

A.5 Pulse Output

| | |
|-------------------------------|------------------------------------|
| Channel | 1 (Non-Isolation TTL) |
| VIH | 2.4Vdc / 6mA (Source) |
| VIL | 0.4Vdc / -6mA (Sink) |
| Output Frequency Range | 2 Hz ~ 10K Hz (+/- 0.05% Of FSR) |

A.6 General

| | | |
|---------------------------|---|---|
| I/O Connector Type | Detachable 10-pin screw terminal * 5 | |
| Dimensions | 132 x 80 x 32mm (5.2" x 3.2" x 1.3") | |
| Power Consumption | 360mA @ +5.0V typical; 450mA @ +5.0V max. | |
| Temperature | Operation | 0~60° C (32~140° F) (refer to IEC 68-2-1,2) |
| | Storage | -20~70° C (-4~158° F) |
| Relative Humidity | 5~95% RH non-condensing (refer to IEC 68-2-1,2) | |

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 2007 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.com*

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
- ☑ Datalogging 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