

User's Guide



Shop online at

www.omega.com

e-mail: info@omega.com



OMG-PCI-DIO32

32 Channel Digital I/O Board



OMEGAnet® Online Service
www.omega.com

Internet e-mail
info@omega.com

Servicing North America:

USA:
ISO 9001 Certified

One Omega Drive, P.O. 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:

USA 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®
TELEX: 996404 EASYLINK: 62968934 CABLE: OMEGA

Mexico:

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

Servicing Europe:

Benelux:

Postbus 8034, 1180 LA Amstelveen, The Netherlands
TEL: +31 (0)20 3472121 FAX: +31 (0)20 6434643
Toll Free in Benelux: 0800 0993344
e-mail: sales@omegaeng.nl

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

France:

11, rue Jacques Cartier, 78280 Guyancourt, France
TEL: +33 (0)1 61 37 29 00 FAX: +33 (0)1 30 57 54 27
Toll Free in France: 0800 466 342
e-mail: sales@omega.fr

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 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 Engineering, Inc. 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, patient-connected applications.

Contents

INTRODUCTION.....	1
OVERVIEW	1
WHAT'S INCLUDED.....	1
INSTALLATION.....	1
CARD SETUP	1
SOFTWARE INSTALLATION.....	1
<i>Linux Users</i>	1
SYSTEM INSTALLATION	2
TECHNICAL DESCRIPTION.....	3
FEATURES.....	3
WINDOWS SOFTWARE	3
LINUX SOFTWARE	3
3 RD PARTY SOFTWARE SUPPORT	4
50 PIN RIBBON CABLE PIN OUT	5
ELECTRICAL CHARACTERISTICS	6
<i>Pull Ups</i>	7
PROGRAMMING.....	8
APPLICATION PROGRAMMERS INTERFACE (API).....	8
<i>Presetting an Output Port</i>	8
<i>Interrupts</i>	8
<i>Port Configuration</i>	8
<i>Relative Addressing vs. Absolute Addressing</i>	9
PORT ADDRESSING.....	10
<i>Addressing Continued</i>	11
DIRECT HARDWARE CONTROL	13
<i>Reading the Inputs</i>	13
<i>Reading the Outputs</i>	13
<i>Presetting an Output Port</i>	13
<i>Writing the Outputs</i>	13
<i>Port Configuration</i>	13
<i>Interrupts</i>	13
<i>Register Description (for direct hardware control)</i>	14
SPECIFICATIONS.....	15
ENVIRONMENTAL SPECIFICATIONS.....	15
POWER CONSUMPTION	15
MEAN TIME BETWEEN FAILURES (MTBF).....	15
PHYSICAL DIMENSIONS	15

APPENDIX A - TROUBLESHOOTING.....	16
APPENDIX B - HOW TO GET ASSISTANCE.....	17
APPENDIX C - SILK-SCREEN.....	18
APPENDIX D - COMPLIANCE NOTICES	19
FEDERAL COMMUNICATIONS COMMISSION STATEMENT	19
EMC DIRECTIVE STATEMENT	19

Figures

Figure 1-50 Pin Ribbon Cable Pin Out.....	5
Figure 2-Electrical Characteristics	6
Figure 3-API Port/Bit Reference.....	10
Figure 4-API Port/Bit Reference.....	12
Figure 5-Register Description	14

Introduction

Overview

The **OMG-PCI-DIO32** provides the PC with four 8-bit ports that can be defined independently as input or output.

What's Included

The **OMG-PCI-DIO32** is shipped with the following items. If any of these items is missing or damaged, contact the supplier.

- **OMG-PCI-DIO32** Adapter
- Software CD

Installation

Card Setup

The **OMG-PCI-DIO32** is a fully compliant PCI 'Plug and Play' adapter. All card resources (i.e. I/O address, IRQ selection) are auto-assigned by either your system BIOS or your 'Plug and Play' operating system.

Software Installation

For proper operation install software first. To install the software place the CD in your CD-ROM tray and the auto-run program will start. If auto-run is not available browse the CD and choose "index.htm". Choose **Install Software** at the beginning of the CD. Select the **Digital I/O** software drivers and install **SeaIO** prior to installing hardware.

Linux Users

Refer to the installation instructions at the beginning of the CD for details on installing the digital I/O cards in Linux.

System Installation

The **OMG-PCI-DIO32** can be installed in any of the PCI expansion slots.

1. Turn off PC power. Disconnect the power cord.
2. Remove the PC case cover.
3. Locate an available PCI slot and remove the blank metal slot cover.
4. Gently insert the **OMG-PCI-DIO32** into the slot. Make sure that the adapter is seated properly.
5. Replace the screw.
6. Replace the cover.
7. Connect the power cord. Installation is complete.

Technical Description

The **OMG-PCI-DIO32** provides 32 channels of digital I/O configurable as inputs or outputs, which can be utilized for PC based control and automation of equipment. Uses include sensors, switches, satellite antenna control systems, video and audio studio automation, security control systems, and other industrial automation systems.

The **OMG-PCI-DIO32's** 32 channels consist of 4 ports of I/O, each port configurable as either input or output, to suit the task at hand. The status of each of the 4 ports is user selectable as input or output by simply writing a control word to the port register. This gives the user the ability to customize the combination of inputs and outputs as needed.

Features

- 32 Channels of Digital I/O configurable as inputs or outputs
- Implemented as 4 ports of 8 channels each of I/O providing flexible operation
- Terminal Block and cable kit available to simplify field wiring requirements
- Supports all PCI interrupts

Windows Software

The **OMG-PCI-DIO32** ships with the SeaI/O suite of Windows 98/NT/ME/2000 drivers. SeaI/O provides the user with a consistent and straightforward API, allowing the developer to concentrate on the details of the application as opposed to low level driver development. Popular development environments, including Visual C++, Visual Basic, and Delphi, are supported for application development. SeaI/O includes a utility for configuring the driver parameters under Windows, further simplifying installation. Sample applications are included to facilitate rapid application development.

Linux Software

The **OMG-PCI-DIO32** ships with software for Linux, including a kernel-mode driver, API, and the SeaIOTst diagnostic tool. The kernel-mode driver is provided as a module, so future driver upgrades may be performed with minimal (usually zero) downtime. The Linux API is identical to its Windows counterpart, facilitating quick and easy ports of existing SeaI/O-aware applications to the Linux operating system. All source code for the Linux software suite is provided under the GNU Public License (GPL v2.0), to assist in "roll-your-own"-type applications.

3rd Party Software Support

Third party software support for many HMI/MMI and other process control software is included on the product installation CD. For the most up to date information on third party software support, please visit <http://www.omega.com>

50 pin ribbon cable pin out

Description	Pin #	Description	Pin #
Port A		Port C	
A0	47	C0	15
A1	45	C1	13
A2	43	C2	11
A3	41	C3	9
A4	39	C4	7
A5	37	C5	5
A6	35	C6	3
A7	33	C7	1
Port B		Port D	
B0	31	D0	2
B1	29	D1	4
B2	27	D2	6
B3	25	D3	8
B4	23	D4	10
B5	21	D5	12
B6	19	D6	14
B7	17	D7	16
GND	All Even pins from 18		
+5V	49		

Figure 1-50 Pin Ribbon Cable Pin Out

Electrical Characteristics

The Table , below provides the electrical characteristics of each Input/Output. Each port is buffered with a 74LS245 octal bi-directional transceiver. Each input is capable of sinking up to 24 mA, while each output can source up to 15 mA.

Recommended Operating Conditions		
	Min	Max
Input	0 V	5.25 V
Source		15 mA
Sink		24 mA

Electrical Characteristics	
High Level Input Voltage	Min 2 V
Low Level Input Voltage	Max 0.8 V
High Level Output Voltage	Min 2 V at 15 mA
	Typically 3.4 V at 3 mA
Low Level Output Voltage	Max 0.55 V at 24 mA

Figure 2-Electrical Characteristics

Pull Ups

Ten pin bussed resistor packs are installed to provide pull-ups to the input ports. These are installed on all ports. The pull-up resistor packs are rated at 10K ohms. Figure 2 below provides the bussed resistor and corresponding port. The resistors insure that no line is floating which is not connected. This provides consistent biasing on all un-terminated lines.

Bussed Resistor	Corresponding Port
RP1	Port A
RP2	Port B
RP3	Port C
RP4	Port D

Programming

Application Programmers Interface (API)

Most modern operating systems do not allow direct hardware access. The SeaIO driver and API have been included to provide control over the hardware in Windows and Linux environments.

The purpose of this section of the manual is to help the customer with the mapping of the API to the actual inputs for the **OMG-PCI-DIO32** specifically. Complete documentation of the API can be found in its accompanying help file.

Presetting an Output Port:

Each port has an output register associated with it. This register may be written and retains its value whether the port is configured as an input or an output. To preset the value of an output port the program should write to the port when it is configured as an input then configure it as an output. Inputs cannot be written to with relative addressing, absolute addressing must be used. See **Relative Addressing vs. Absolute Addressing** below.

Interrupts:

Interrupt sampling can be set up in the API. **Port A bit zero is the interrupt source(pin 47)**. Refer to the API section in the SeaI/O help file for more detailed information.

Port Configuration:

Each eight-bit port can be configured as inputs or outputs. The API provides a set adapter state call to access the control words. For this device, one control word is used.

Control Word 0 = input 1 = output

Port A – Bit 0

Port B – Bit 1

Port C – Bit 2

Port D – Bit 3

Note: The control panel also allows you to configure the device. Your program can over ride the control panel configuration when executed, but the control panel configuration will be the default on power up. The default settings are based on the settings in the control panel application when last changed and saved after re-booting.

Relative Addressing vs. Absolute Addressing

The SeaIO API makes a distinction between “absolute” and “relative” addressing modes. In absolute addressing mode, the Port argument to the API function acts as a simple byte offset from the base I/O address of the device. For instance, Port #0 refers to the I/O address base + 0; Port #1 refers to the I/O address base + 1.

Relative addressing mode, on the other hand, refers to input and output ports in a logical fashion. With a Port argument of 0 and an API function meant to output data, the first (0th) output port on the device will be utilized. Likewise, with a Port argument of 0 and an API function designed to input data, the first (0th) input port of the device will be utilized.

In all addressing modes, port numbers are zero-indexed; that is, the first port is port #0, the second port is #1, the third #2, and so on.

Given Port A, Port D are inputs and Port B, Port C are outputs, the Tables below he Absolute address, and the relative address. The absolute address will be the same for any configuration, while the relative address will depend on the particular configuration.

Port Addressing

Figures 3 and 4 show the API Port/bit reference numbers for Absolute and Relative Addressing

R = Read

W = Write

R/W = Read or Write

Port	API Port # Absolute Address (function)	API Port # Relative Address (function)	Port Type
A	0 (R/W)	0 (R)	Input Port
B	1 (R/W)	0 (W)	Output Port
C	2 (R/W)	1 (W)	Output Port
D	3 (R/W)	1 (R)	Input Port

Figure 3-API Port/Bit Reference

Addressing Continued

API Bit # Absolute Address (function)	API Bit # Relative Address (function)	Port Bit
0 (R/w)	0 (R)	A0 - Input
1 (R/w)	1 (R)	A1 - Input
2 (R/w)	2 (R)	A2 - Input
3 (R/w)	3 (R)	A3 - Input
4 (R/w)	4 (R)	A4 - Input
5 (R/w)	5 (R)	A5 - Input
6 (R/w)	6 (R)	A6 - Input
7 (R/w)	7 (R)	A7 - Input
8 (R/w)	0 (W)	B0 - Output
9 (R/w)	1 (W)	B1 - Output
10 (R/w)	2 (W)	B2 - Output
11 (R/w)	3 (W)	B3 - Output
12 (R/w)	4 (W)	B4 - Output
13 (R/w)	5 (W)	B5 - Output
14 (R/w)	6 (W)	B6 - Output
15 (R/w)	7 (W)	B7 - Output
16 (R/W)	8 (W)	C0 - Output
17 (R/W)	9 (W)	C1 - Output
18 (R/W)	10(W)	C2 - Output
19 (R/W)	11(W)	C3 - Output
20 (R/W)	12(W)	C4 - Output
21 (R/W)	13(W)	C5 - Output
22 (R/W)	14(W)	C6 - Output
23 (R/W)	15(W)	C7 - Output
24 (R/W)	8 (R)	D0 - Input
25 (R/W)	9 (R)	D1 - Input
26 (R/W)	10 (R)	D2 - Input
27 (R/W)	11 (R)	D3 - Input
28 (R/W)	12 (R)	D4 - Input
29 (R/W)	13 (R)	D5 - Input
30 (R/W)	14 (R)	D6 - Input
31 (R/W)	15 (R)	D7 - Input

Figure 4-API Port/Bit Reference

Direct Hardware Control

In systems where the users program has direct access to the hardware (DOS) the table below gives the mapping and functions that the **OMG-PCI-DIO32** provide. The address of each eight-bit port is calculated as shown in the table on the following page, the cards base address plus an offset.

Reading the Inputs:

The inputs are active high. If an input is driven high (2V to 5.25 V) it will read as a logical one (1), if driven low (0V to 0.8V) it will read as a logical zero (0). If an input is not driven it will read as a one (1) due to the 10K ohm pull up resistors on each port.

Reading the Outputs:

The value that is currently being used to drive the outputs will be returned.

Presetting an Output Port:

Each port has an output register associated with it. This register may be written and retains its value whether the port is configured as an input or an output. To preset the value of an output port the program should write to the port when it is configured as an input then configure it as an output.

Writing the Outputs:

The outputs are active high. Writing a one (1) corresponds to 5V while writing a zero (0) corresponds to 0V, at the output.

Port Configuration:

Each port can be configured as an input or an output by writing to its direction control bit, refer to the table below.

Interrupts

Interrupts can be set up as shown on the following page. **Port A1 bit zero is the interrupt source(pin 47).**

Register Description (for direct hardware control)

Address	Mode	D7	D6	D5	D4	D3	D2	D1	D0
Base+0	RD/WR	PAD7	PAD6	PAD5	PAD4	PAD3	PAD2	PAD1	PAD0
Base+1	RD/WR	PBD7	PBD6	PBD5	PBD4	PBD3	PBD2	PBD1	PBD0
Base+2	RD/WR	PCD7	PCD6	PCD5	PCD4	PCD3	PCD2	PCD1	PCD0
Base+3	RD/WR	PDD7	PDD6	PDD5	PDD4	PDD3	PDD2	PDD1	PDD0
Base+4	RD/WR	{0}	{0}	{0}	{0}	DIRD	DIRC	DIRB	DIRA
Base+5	RD/WR	IRQEN	IRQST	{0}	{0}	{0}	{0}	IRC1	IRC0
Base+6	RD Only	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+7	RD Only	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}

Figure 5-Register Description

Note: All ports are set to input after reset or power up. Interrupt source is Base+0 bit D0. When selecting the Interrupt Mode, always disable interrupts prior to changing or setting states. This will help prevent inadvertent or un-expected interrupts from occurring. When using the high and low level interrupts, a change in state of the input must occur before the interrupt can be cleared. The device providing the input to Base +0, bit D0 must do this.

- PAD0-7 = Port A (Base+0)
- PBD0-7 = Port B (Base+1)
- PCD0-7 = Port C (Base+2)
- PDD0-7 = Port D (Base+3)
- DIRA-D = Port A-D direction control (Base+4)
 - 0 = input
 - 1 = output
- IRC0-1= Interrupt Mode select (Base+5)

IRC1	IRC0	
0	0	Low level
0	1	high level
1	0	falling edge
1	1	rising edge
- IRQEN = enable interrupts (Base+5)
 - 0 = disabled
 - 1 = enabled (disabled after reset or power up).
- IRQST = interrupt status (Base+5)
 - 1 = interrupt pending (reading the bit clears interrupt).

Specifications

Environmental Specifications

Specification	Operating	Storage
Temperature Range	0° to 50° C (32° to 122° F)	-20° to 70° C (-4° to 158° F)
Humidity Range	10 to 90% R.H. Non-Condensing	10 to 90% R.H. Non-Condensing

Power Consumption

Supply line	+5 VDC
Rating	500 mA

Mean Time Between Failures (MTBF)

Greater than 150,000 hours. (Calculated)

Physical Dimensions

Board Length	4.72 inches	(12.00 cm.)
Board Height including Goldfingers	3.30 inches	(8.39 cm.)
Board Height excluding Goldfingers	2.975 inches	(7.56 cm.)

Appendix A - Troubleshooting

Following these simple steps can eliminate most common problems without the need to call Technical Support.

1. Install software **first**. After installing the software then proceed to adding the hardware. This places the required installation files in the correct locations.
2. Identify all I/O adapters currently installed in your system. This includes your on-board serial ports, controller cards, sound cards etc. The I/O addresses used by these adapters, as well as the IRQ (if any) should be identified.
3. Ensure that there is no conflict with currently installed adapters. No two adapters can occupy the same I/O address and may not be allowed to share IRQs.
4. Make sure the adapter is securely installed in a motherboard slot.

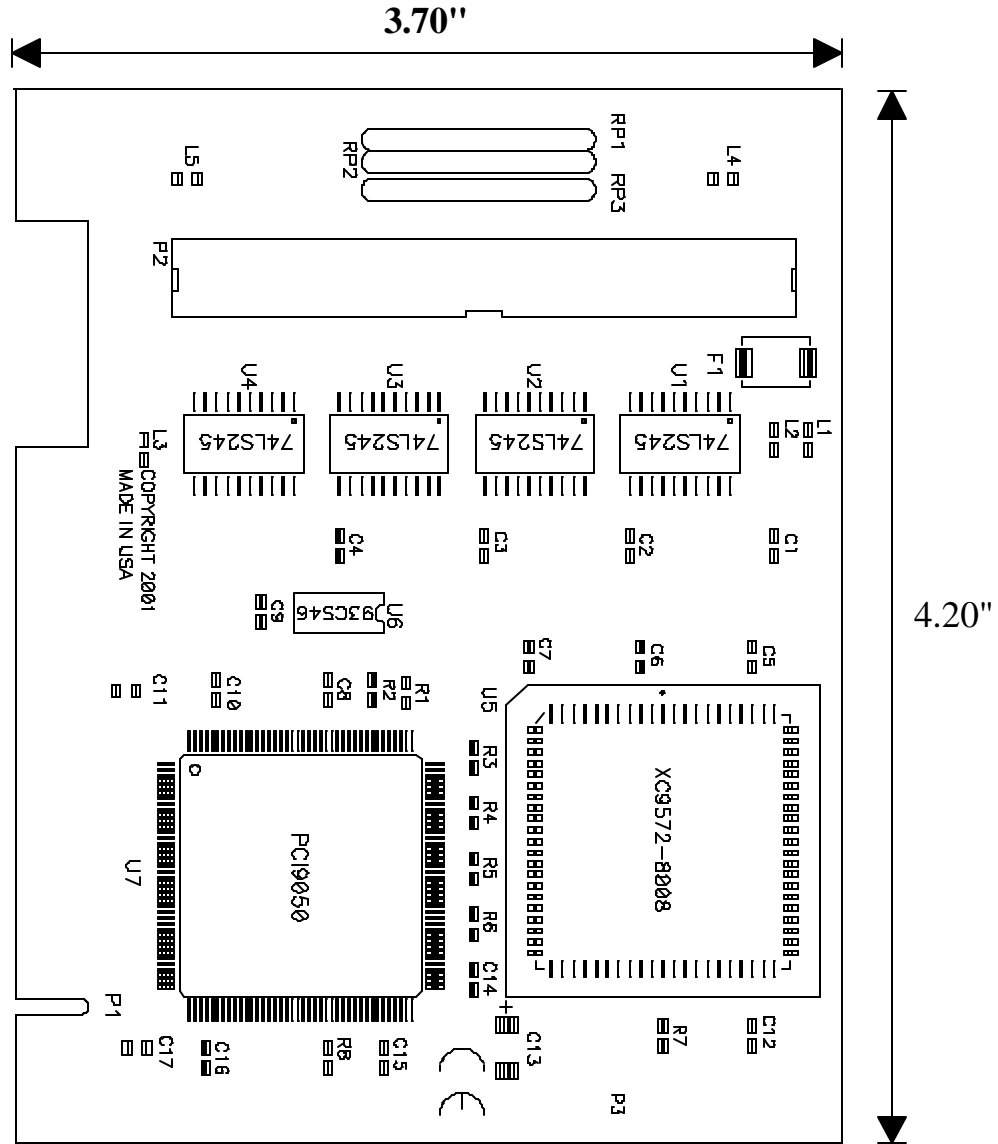
Appendix B - How To Get Assistance

Please refer to Troubleshooting Guide prior to calling Technical Support.

1. Read this manual thoroughly before attempting to install the adapter in your system.
2. When calling for technical assistance, please have your user manual and current adapter settings. If possible, please have the adapter installed in a computer ready to run diagnostics.
3. Omega Engineering maintains a Home page on the Internet. Our home page address is www.omega.com. The latest software updates, and newest manuals are available via our FTP site that can be accessed from our home page.
4. Technical support is available Monday to Friday from 8:30 a.m. to 6:00 p.m. eastern time. Technical support can be reached at 1-800-DAS-IEEE.

RETURN AUTHORIZATION MUST BE OBTAINED FROM OMEGA BEFORE RETURNED MERCHANDISE WILL BE ACCEPTED. AUTHORIZATION CAN BE OBTAINED BY CALLING OMEGA CUSTOMER SERVICE AND REQUESTING AN AUTHORIZED RETURN (AR) NUMBER.

Appendix C - Silk-Screen



Appendix D - Compliance Notices

Federal Communications Commission Statement

FCC - This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference. In such case the user will be required to correct the interference at his own expense.

EMC Directive Statement



Products bearing the CE Label fulfill the requirements of the EMC directive (89/336/EEC) and of the low-voltage directive (73/23/EEC) issued by the European Commission.

To obey these directives, the following European standards must be met:

- **EN55022 Class A** - "Limits and methods of measurement of radio interference characteristics of information technology equipment"
- **EN55024** - 'Information technology equipment Immunity characteristics Limits and methods of measurement'
- **EN60950 (IEC950)** - "Safety of information technology equipment, including electrical business equipment"

Warning

This is a Class A Product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Always use cabling provided with this product if possible. If no cable is provided or if an alternate cable is required, use high quality shielded cabling to maintain compliance with FCC/EMC directives.



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 which wear are not warranted, including but 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 it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS 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 2002 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 www.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