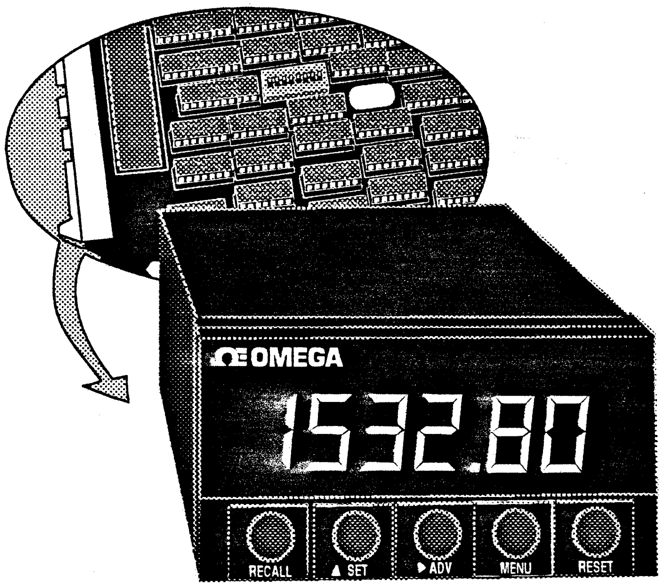
DPF700-232

RS-232 Option Board For the DPF700 Meter



OMEGA®

An OMEGA Technologies Company

Operator's Manual

OMEGA®
An OMEGA Technologies Company

Servicing USA and Canada: Call OMEGA Toll Free

USA
One Omega Drive, Box 4047
Stamford, CT 06907-0047
Telephone: (203) 359-1660
FAX: (203) 359-7700

Canada
976 Bergar
Laval (Quebec) H7L 5A1
Telephone: (514) 856-6928
FAX: (514) 856-6886

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

Servicing Europe: United Kingdom Sales and Distribution Center

25 Swannington Road, Broughton Astley, Leicestershire
LE9 6TU, England
Telephone: 44 (1455) 285520 FAX: 44 (1455) 283912

The OMEGA Complete Measurement and Control Handbooks & Encyclopedias

- Temperature
- Pressure, Strain & Force
- Flow and Level
- pH and Conductivity
- Data Acquisition Systems
- Electric Heaters
- Environmental Monitoring and Control

Call for Your FREE Handbook Request Form Today: (203) 359-RUSH

11681ML-99 Rev. A

JAP0694BRB

PREFACE

MANUAL OBJECTIVES

This manual shows you how to install and use the RS-232 option board with the DPF700 meter.

In this manual we provide information regarding the following:

* Remote programming
* ASCII output (setup data)
* ASCII input
* Interfacing examples
* Communication rate
* Modem operation
* Parity checking
* Timing

Use this manual with your DPF700 manual (M1676).

NOTES and CAUTIONS

Information that is especially important to note is identified by two labels:

* **NOTE**
* **CAUTION**

NOTE: provides you with information that is important to successfully setup and use the option card.

CAUTION: tells you of circumstances or practices that can effect the option card's functionality.

Table of Contents

Figures

Tables

INTRODUCTION

UNPACKING

Remove the Packing List and verify that you have received an RS-232 option card. If you have any questions, contact the OMEGA Customer Service Department at 1-800-622-BEST (800-622-2378) or (203) 359-1660.

Upon receipt of shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

Note: The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary. If you order a configured meter with options, you will receive the meter with option boards installed.

SAFETY CONSIDERATIONS

Caution: Do not expose your RS-232 option card to rain or condensing moisture. Keep away from flammable or explosive atmospheres. As with any electronic instrument, you may encounter high voltage exposure when calibrating or removing parts. Install the card only when ac power is disconnected.

REMOTE PROGRAMMING

The DPF700 may accept an RS-232 card for communications. The card enables the meter to receive setup commands and data, and send measurement values and current setup data to a computer. The meter operates at either 1200 or 9600 baud, 7 data bits, even parity and 1 stop bit. It emulates DCE (data communication equipment) and uses a handshake line while sending data, but none while receiving data. A 4-wire cable is the maximum required for the following communications:

Transmitted data
Received data
Request to send (RTS)
Signal ground

When you connect your meter to a computer, such as an IBM PC, and the meter receives one of 8 commands (P, G, W, R, V, SC, SG and SP) the meter interrupts its program, receives the message, takes appropriate action, and then starts over with a new measurement.
No handshake is required because the meter devotes its full attention to receiving the command data from the computer. In the other direction, the meter sends measurement and confirming setup data to the computer under one of 2 handshake (RTS) modes.

Message Handshake - The RTS line is checked when the device is ready to send measurement data. If the RTS is true, it sends the complete message data without interruption even if the RTS goes false in the middle of transmission. If the RTS is false, it skips sending the data completely and continues with the next measurement.

Character Handshake - The device checks the RTS input before sending each character and sends characters only while the RTS is true.

ASCII OUTPUT

The DPF700 sends measurement data according to the following fixed formats of 9 or 8 characters. Each character is sent as a 7-bit ASCII code character with even parity, and may be blank (ASCII 32)

9-Character Format

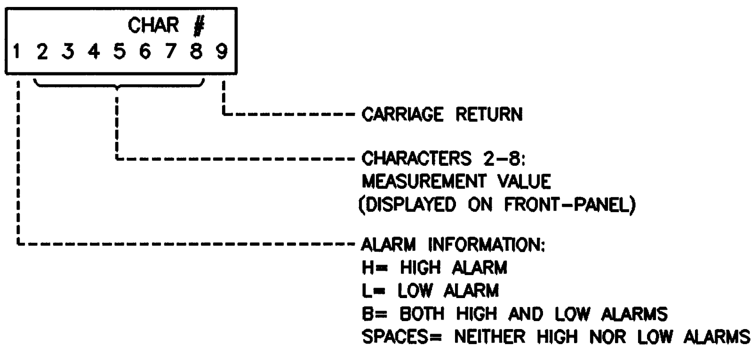


Figure 1. ASCII Output 9-Character Message
(ConFIG=XXXXX0)

As Figure 1 details, the **1st** character represents alarm information and provides one of the following: H = High Alarm, L = Low Alarm, B = Both High and Low Alarms or Space = Neither High nor Low Alarms.

Characters 1 through 8 represent the measurement value as shown on the front-panel. If positive, there are 6 digits and a decimal point; if negative, there is a minus sign with 5 digits and a decimal point. Blanks are sent in place of leading zeros. If the value overflows the 6-digit limit, it is sent in exponential format up to a maximum of 9.99 E9 or -9.9 E9. The **final character** is a carriage return.

ASCII OUTPUT (Continued)

8-Character Format

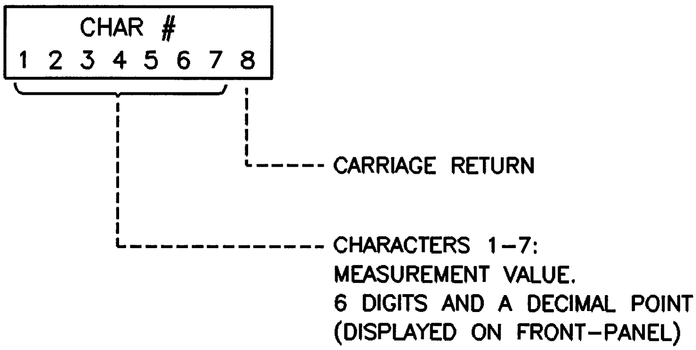


Figure 2. ASCII Output 8-Character (ConFIG=XXXXX1)

Characters 1 through 7 represent the value on the display (6 digits and a decimal point). The **final character**, (character 8), is a carriage return.

Setup Data

'Get' or 'Read' commands send setup data to the computer for verification. Setup data is sent and received as ASCII characters representing the 16 hex characters 0-9; A-F. Each hex character represents 4 bits or 16 pieces of information. The 7-bit ASCII characters are shown with a leading even-parity bit, as shown in Table 1.

Setup Data (Continued)

Table 1. Hex Character/Bit Pattern Information

Hex Character	Bit Pattern	Hex Character	Bit Pattern
0	0011 0000	8	1011 1000
1	1011 0001	9	0011 1001
2	1011 0010	A	0100 0001
3	0011 0011	B	0100 0010
4	1011 0100	C	1100 0011
5	0011 0101	D	0100 0100
6	0011 0110	E	1100 0101
7	1011 0111	F	1100 0110

The setup data consists of a total of 44 nibbles of information that are sent and received in the following order:

Table 2. Setup Order Information

Display	Parameter	# of Nibbles
------	Calibration	2
	Analog Out Scale*	2
	Analog Out Offset*	4
SP HI	Setpoint High	6
SP LO	Setpoint Low	6
OFFSEt	Offset	6
SCALE	Scale	6
------	Gate Time and Time Out	4
------	Analog Output Control*	2
ConFIG	Configuration	2
dEC Pt	Decimal Point	2
Func	Function	2

* Do not confuse with "An LO" and "An HI".

Setup Data (Continued)

Each parameter is sent with the most-significant nibble first. Each bit may have stand-alone significance or may be part of a binary number according to the following formats.

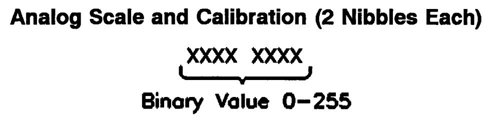


Figure 3. Analog Out Scale Storage Format

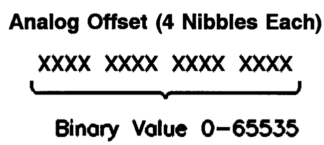


Figure 4. Analog Out Offset Storage Format

Note: 256 generates 0 V (0 mA) and 51200 generates 10 V (20 mA).

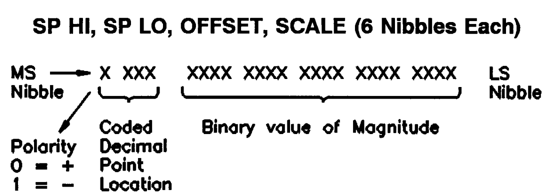


Figure 5. Storage Format

Note: The decimal point value must be 1 through 6 (not 0 or 7).

Example: A01000 = -0409.6
DP=2, - Negative Polarity

Setup Data (Continued)

GATE TIME

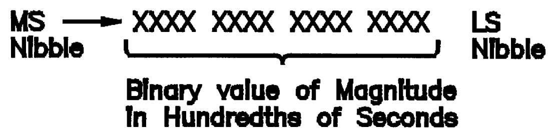


Figure 6. Binary Value

Note: If MS byte is 1111 1111, meter uses 00000000.

CONFIG

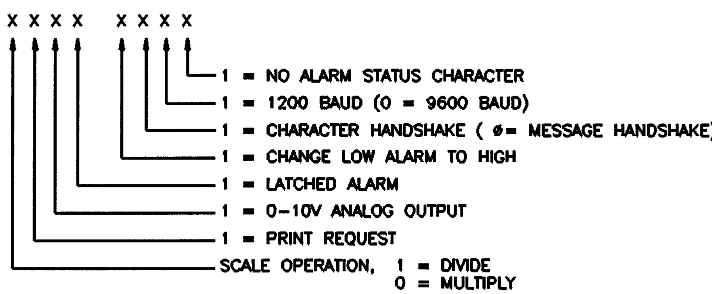


Figure 7. Setup Configuration

Setup Data (Continued)

DEC PT

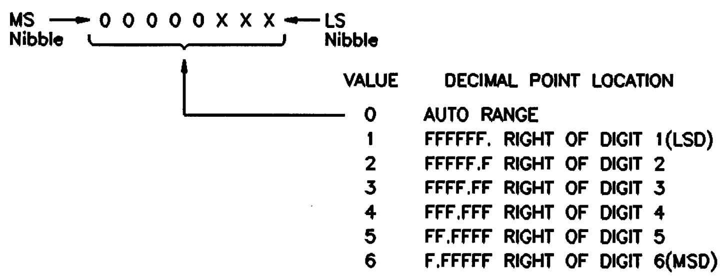


Figure 8. Decimal Point Setup

FUNC

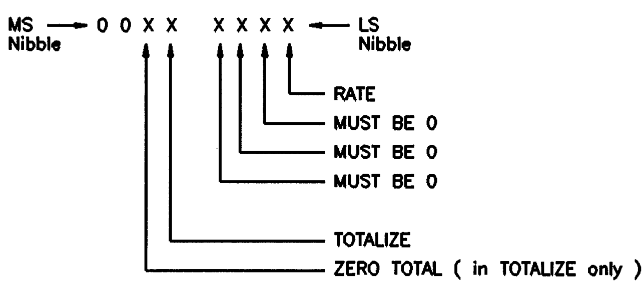


Figure 9. Totalizer Function Setup

Note: One, and only one bit must be a 1 - except for the totalizer bit, which may also have the zero total bit set to a 1.

When the meter receives the totalizer bit, the zero total bit causes the value to be reset to zero; otherwise, the TOTALIZER value is unaffected.

ASCII INPUT

The DPF700 receives commands and setup data. The meter may receive one of 8 commands: P, G, W, R, V, SC, SG, and SP. Each of these commands are explained in detail in the following pages. Each is a single letter preceded by the preamble string of the following 3 characters: @U?. For example, Put reads @U?P. The @ U and ? characters reduce the probability of noise patterns and aid in generating an acceptable command. The Put command is followed by 42 hex characters of desired setup data. All commands are terminated with a carriage return, indicated by <CR>.

```
@U?PXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX<CR>
@U?G<CR>
@U?W<CR>
@U?R<CR>
@U?V<CR>
@U?SC<CR>
@U?SGaa<CR>
@U?SPaadd<CR>
```

'Put' Command @ U?P (setup data) <CR>

Sends setup data to the meter. The meter then stores data into its active memory and starts making measurements using the new setup parameters.

'Get' Command @ U?G <CR>

Sends the current setup parameters from the meter's active memory to the computer. Use the 'Get' command after the 'PUT' command to verify that the meter has correct setup parameters.

'Write' Command @ U?W <CR>

Transfers the setup data in the DPF700's active (volatile) memory to nonvolatile memory. Once the setup data is transferred to the nonvolatile memory it becomes a stored program. A program may be active, but not stored, by executing a 'Put' command or, entered from the keyboard. Stored programs are not affected when you recall the meter or power loss occurs. When power is restored or the recall is complete, stored program data resides in both the active and nonvolatile memory.

'Read' Command @ U?R <CR>

Requests the DPF700 to read (transfer) the setup data from the nonvolatile memory into the active memory for use in the measurements that follow and to send this setup data to the computer.

'Print' Command @U?V <CR>

Works as a print request and sends out one measurement data. This command only works when you select RTS message handshake and the RTS input is false.

Single 'GET' Command @U?SGaa <CR>

Two ASCII characters sends the content of aa address in memory. aa are two ASCII characters of 0 - 9 and A - F. aa is a hexadecimal address of memory. Refer to the Table 3 for available memory location for this command.

ASCII INPUT (Continued)

Table 3. Memory Addresses Accessed by
Single 'GET" and Single 'PUT' Commands

aa	Description
29	Function
2A	Decimal point.
2B	Configuration.
2C	Analog output configuration.
2D	Gate time: low byte
2E	Gate time: High byte
2F	SCALE LSB
	SCALE 2nd byte
	SCALE MSB
32	OFFSET LSB
33	OFFSET 2nd Byte
34	OFFSET MSB
35	Setpoint Low LSB
36	Setpoint Low 2nd Byte
37	Setpoint Low MSB
38	Setpoint High LSB
39	Setpoint High 2nd Byte
3A	Setpoint High MSB
3B	Calibration Number
3C	Analog Output Offset LSB
	Analog Output Offset MSB
3D	Analog Output Scale

ASCII INPUT (Continued)

Single 'PUT' Command @U?SPaadd <CR>

Puts the dd data in the aa memory address. aa and dd are each two ASCII characters, from 0 - 9 or A - F. aa consists of two hexadecimal digits of address and dd consists of two hexadecimal digits of data. Table 3 shows available address locations for this command. **Do not use this command with addresses (aa value) not shown in Table 3.**

Micro Controller Revision Command @U?SC <CR>

This command returns one ASCII character representing the revision number or letter of the micro controller program.

INTERFACING EXAMPLES

The DPF700 can interface to any device with RS-232E communications. The output levels are ±8 V and the inputs may accept up to ±25 V. The pin connections are labeled for the meter to emulate DCE (Data Communications Equipment). Examples are given for connections to an IBM PC with D-25 and D-9 connectors. A 7' cable with two RJ-12 telephone jacks at two ends are provided with RS-232 option. The connector adapter for D-9 and D-25 are optional.

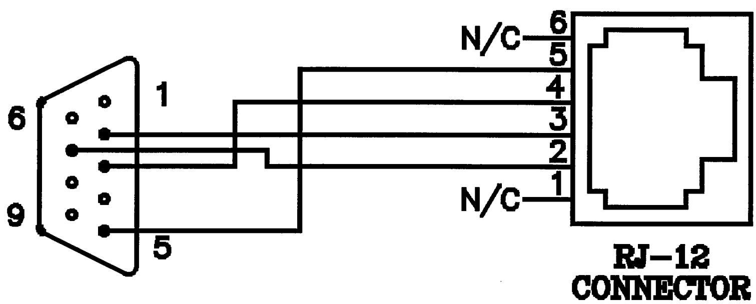


Figure 10. Meter Serial Port to a D-9 Connector

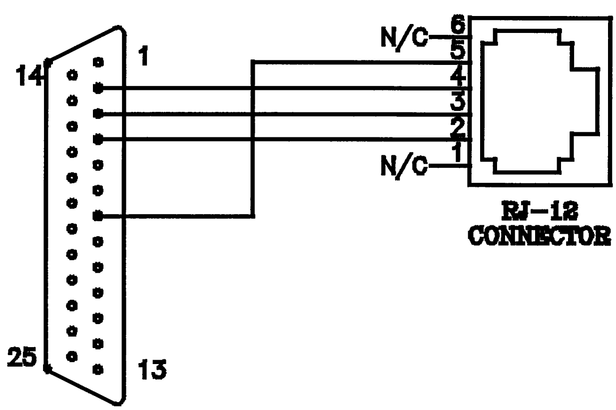


Figure 11. Meter Serial Port to a D-25 Connector

Table 4. Meter to IBM PC - D-9 or D-25 Connector

	IBM PC (DTE) D-25 Connector	**IBM PC (DTE) D-9 Connector**	**Meter (DCE)**	
	NC	NC	J2-1	No Connector
Request to Send	4	7	J2-2	RS-232 RTS
Received Data	3	2	J2-3	RS-232 OUT
Transmitted Data	2	3	J2-4	RS-232 IN
Signal Ground	7	5	J2-5	GND
	NC	NC	J2-6	No Connector

PROGRAMMING CONSIDERATIONS

Communication Rate

If possible, use 9600 baud for communications instead of 1200. 9600 baud has a faster reading rate and less time is spent communicating. The table below details measurement and setup time:

Table 5. Baud Rate Information

	9600 Baud	**1200 Baud**
Measurements (9 Characters)	9.4 msec	75 msec
Setup data (43 Characters)	45.8 msec	360 msec

Modem Operation

You may connect the DPF700 to a freestanding modem, such as the Hayes Smartmodem 1200, to transmit and receive data over phone lines. A typical controller would be an IBM PC with a Hayes Smartmodem 1200B plug-in modem.

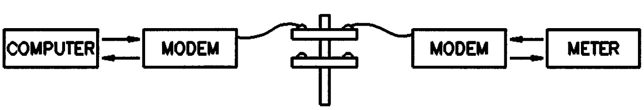


Figure 12. Modem Concept

Use a 1200 baud rate to receive measurement and setup data to be sent from the computer to the meter. Connect an auto answering modem to the meter to gather data from a remote location upon demand. **If you send a command to the meter at 1200 baud while the meter active memory is programmed for 9600 baud, the meter will automatically switch to 1200 baud. This prevents the modem application from being disabled when a setup parameter of 9600 baud is accidentally sent to the meter.**

PARITY CHECKING

Although the DPF700 includes an even parity bit with data sent out on the RS-232C interface, it does not check the data received for even parity.

TIMING

When you send a 'PUT' command to the meter, the command is accompanied by a string of 42 setup characters. The BASIC program statement PRINT #1, @U?P + SETUP$ puts the string into an output buffer for transmission and the BASIC program continues while the data is being transmitted. If, within a few lines, you execute the statement PRINT #1, @U?G, the @U?G is added to the end of the setup string in the buffer (which is still being transmitted). This causes the @U?G characters to be missed because each transmission from the computer must be completely received by the meter and the next measurement started before another command is issued. **A statement FOR J=1 TO 300:NEXT J introduces enough delay to allow separation between commands.**

PROGRAMMING EXAMPLE

```
50    '******************************************************************
60    ' COMMUNICATION  EXAMPLE
100   '          THIS PROGRAM  READS  THE OUTPUT
110   '     ***************************************************
150   CLS
170   PRINT"SET ALL CONFIGURATION  DIGITS TO ZERO"
180   PRINT
200   INPUT "ENTER COM1 (1) OR COM2 (2) RS-232 PORT";W
220   IF W=1 THEN COMM$="COM1" ELSE COMM$="COM2"
240   INPUT "ENTER A SINGLE COMMAND (SC, SPaadd, V, ...";BB$
270   GOSUB  1000
280   PRINT
290   PRINT RES$
330   INPUT "ENTER COMMAND, <CR> TO REPEAT, S TO START
OVER";AA$
340   IF AA$="S"OR AA$="s"THEN 200
345   IF AA$<>""THEN BB$=AA$
350   GOTO 270
450   END
1000  B$=""
1100  CR$=CHR$(13)
1200  CLOSE: OPEN COMM$+":9600,E,7,1,DS,CS,RS"AS #1
1300  IF BB$=""THEN BB$="V"
1350  PRINT #1, "@U?"+BB$+CR$;
1370  PRINT "WAITING .... ";
1400  FOR X=1 TO 20: NEXT X
1500  PRINT ".";
1550  N=N+1
1570  IF N > 1000 THEN RES$="NO ANSWER":GOTO 2000
1600  IF LOC(1)=0 THEN 1400
1650  ON ERROR  GOTO 1400
1700  A$=INPUT$(LOC(1),#1)
1800  B$=B$+A$
1850  Q=INSTR(B$,CR$)
1900  IF Q=0 THEN 1500
1950  RES$=LEFT$(B$,Q-1)
2000  N=0
2100  CLOSE #1
2200  RETURN
```

INDEX

MADE IN USA

WARRANTY

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of **13 months** from date of purchase. OMEGA 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 should malfunction, 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. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being 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 or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

OMEGA is glad to offer suggestions on the use of its various products. Nevertheless, OMEGA only warrants 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, 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.

Every precaution for accuracy has been taken in the preparation of this manual; however, OMEGA ENGINEERING, INC. neither assumes responsibility for any omissions or errors that may appear nor assumes liability for any damages that result from the use of the products in accordance with the information contained in the manual.

SPECIAL CONDITION: Should this equipment be used in or with any nuclear installation or activity, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the equipment in such a manner.

RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA ENGINEERING Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OUR 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.

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

1. P.O. 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 OR **CALIBRATION**, consult OMEGA for current repair/calibration charges. Have the following information available BEFORE contacting OMEGA:

1. P.O. number to cover the COST of the repair/ calibration,
2. Model and serial number of 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 1994 OMEGA ENGINEERING, INC. All rights reserved. This documentation may not be copied, photocopied, reproduced, translated, or reduced to any electronic medium or machine-readable form, in whole or in part, without prior written consent of OMEGA ENGINEERING, INC.

Where Do I Find Everything I Need for Process Measurement and Control? OMEGA...Of Course!

TEMPERATURE

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

PRESSURE/STRAIN FORCE

- Transducers & Strain Gages
- Load Cells & Pressure Gauges
- 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 and 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

M1797/1193