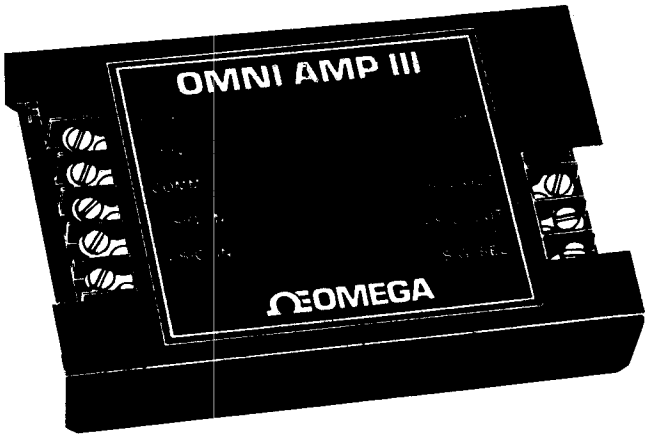
OMNI-AMP™ III

DC Signal Amplifier



OMEGA®

An OMEGA Technologies Company

Operator's Manual

GENERAL DESCRIPTION

OMEGA's Omni-Amp™III Signal Amplifer is a general purpose instrumentation amplifier. Differential inputs and selectable gains of 10, 100 and 1000 allow it to be used to amplify a variety of signals including thermocouples and pressure transducers. A temperature transducer is built into the unit to provide a means of measuring the temperature of the terminal block. This feature allows cold junction compensation correction values to be determined when a thermocouple is used as a signal input. A brief discussion on "cold junction compensation" and how to use the terminal block temperature sensor is located under the heading "temperature transducer".

INPUT CONNECTION

The input signal is brought in through the five (5) point terminal block. Three (3) terminals are used for the inputs. These are labelled "+ SIG. IN", "- SIG. IN", and "COMM." Refer to the Component Layout. Connect the input signal to the "+" and "-" terminals. Some typical connection configurations are shown in Figure 1.

Normally the "-" input terminal should be connected to the "COMM." terminal. If it is desired to isolate the source from the Omni-Amp III ground (COMM.), then the "-" input should be connected to the "COMM." terminal through a resistor as shown in Figure 1a. The value of this resistor may range from 0 ohms (no isolation) to 1 mOhm (maximum isolation).

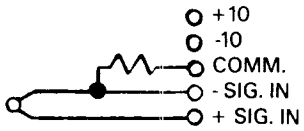
The positive and negative 10 volt power supplies are brought out through the terminal strip for use with strain gauges and bridge type transducers. The current drain from each supply should be limited to 65 mA maximum. For example, the resistance of a transducer circuit connected between the positive 10 volt supply and common should be at least 150 ohms. An example of this type of input is shown in Figure 1c.

The range of the input signal is a function of the selected gain. The output is limited to ±9 volts. The input must be kept below the level which would produce an output higher than ±9 volts. For example, with a gain of 100, the input should be limited to 9/100 = 90 mV. Higher inputs will cause distortion (clipping) of the output signal.

OUTPUT CONNECTION

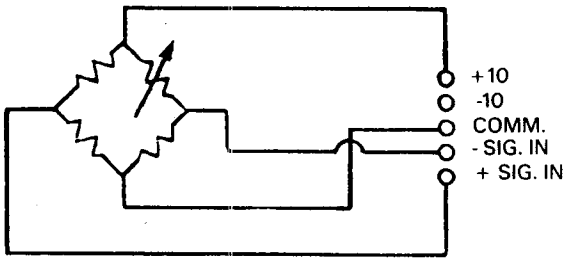
Output signal connection is made at the "+ SIG. OUT" and "- SIG. OUT" terminals on the three (3) point terminal strip. The negative output terminal is tied internally to the input ground ("COMM.") terminal.

The third terminal on the output connector, "SIG. SEL.", is used to select either the amplifier output or the temperature transducer output. When left open, the amplifier output is selected. To select the temperature transducer, connect this control terminal to ground. When the Omni-Amp III is used with a computer interface, this terminal would be connected to one of the digital outputs.

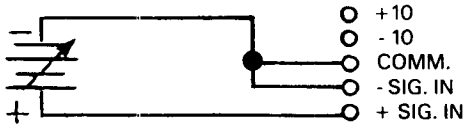


a) Isolated Thermocouple

b) Grounded Junction Thermocouple



c) 4-Wire Bridge



d) Variable Voltage Source

Figure 1. Typical Input Connections

TEMPERATURE TRANSDUCER

When using thermocouples, it is necessary to use cold junction compensation to acquire accurate temperature readings. A temperature transducer has been provided to make this possible.The transducer is mounted on the input terminal strip so that the temperature of the thermocouple junction may be determined.

The transducer will generate a voltage which is directly proportional to the temperature of the terminal strip. The voltage, in millivolts, is two (2) times the temperature in degrees Kelvin. Therefore,

$°C = (V/2) - 273$

where V = voltage from transducer (in millivolts).

To select the temperature transducer at the output, the "SIG.SEL." terminal must be connected to ground (see Output Connections). This configuration allows the Omni-Amp III to be controlled by a computer interface by connecting the signal select terminal to one of the digital outputs.

GAIN SELECTION

The gain is selectable (x10, x100 or x1000) with an internal jumper. Select the desired gain by placing the jumper in the position indicated in Table 1. Only one jumper should be installed.

The "Zero" potentiometer (R23) may need to be adjusted when the gain is changed. Refer to the Calibration section, steps 4 and 5, for this procedure.

TABLE 1 GAIN SELECTION

GAIN	JUMPER POSITION
x10	W5
x100	W4
x1000	W3

BATTERY OPERATION

OMNI-AMP III Amplifiers will operate on two 9 volt batteries. To use battery power, move jumpers W1 and W2 to the B-C position. Attach the positive lead from the first battery to E-2. Attach the negative lead from the second battery to E3. Attach the two remaining leads (one from each battery) to E1.

When using battery power, the positive and negative supplies are not connected to the input terminal strip. This prevents battery drain by low impedance strain gauges. A separate battery should be used to excite bridge type transducers.

The maximum swing of the output signal is limited to ±8 volts when using battery power.

Under normal use, a pair of 9 volt batteries should last approximately 70 hours. Longer operation times can be achieved with heavy-duty batteries.

CALIBRATION

OMNI-AMP III Amplifiers are calibrated before leaving the factory. However, if the unit need recalibration, the following procedure is recommended. A function generator, an adjustable voltage source, an AC voltmeter, a DC voltmeter, and a temperature probe (or thermometer) are required. The calibration will only be as accurate as the equipment used. Refer to the Component Layout potentiometer locations.

1. Set the gain for x1000. Connect the positive and negative input terminals together. Connect the output to the AC voltmeter.
2. Apply a 60 Hz, 500 mV sine wave to the input terminals. Note that the same signal should be going to both terminals because they are tied together. The ground side of the input signal should be attached to the "COMM." input terminal.
3. Adjust the "CMRR" potentiometer for minimal AC output.
4. Ground both input terminals by connecting them to the "COMM." terminal. Connect the DC voltmeter to the outputs.
5. Adjust the "ZERO" potentiometer for zero (0) volts DC at the output.
6. Repeat steps 1 through 5.
7. For the following steps, the "- SIG. IN" terminal should be connected to the "COMM." terminal and the DC voltmeter should be connected to the output.
8. Apply 500 mV to the positive input terminal. With gain set to x10, (W5 selected) adjust the "x10" pot for 5 volts at the output.
9. Set the gain to x100 (W4 selected) and zero the amplifier using steps 4 and 5 above.
10. Apply 50 mV to the positive input terminal. Adjust the "x100" potentiometer for 5 volts at the output.
11. Set the gain to x1000 (W3 selected) and zero the amplifier using steps 4 and 5 above.
12. Apply 5 mV to the positive input terminal. Adjust the "x1000" potentiometer for 5 volts at the output.
13. Connect the "SIG. SELECT" terminal to the "-SIG. OUT" terminal to select the temperature transducer output. Connect the DC voltmeter to the output.
14. Measure the temperature of the temperature transducer using the temperature probe.
15. Adjust the "TEMP." potentiometer for the correct output. The output, V, in millivolts should be:

    $V = (T + 273) \times 2$

    where T is the temperature in degrees C of the transducer measured with the temperature probe.

SPECIFICATIONS

INPUT CONFIGURATION: Differential

INPUT IMPEDANCE: 16M ohm

GAIN: 10x, 100x, 1000x; jumper configured

MAXIMUM INPUT:

At gain setting	max. input
10	±900 mV
100	± 90 mV
1000	± 9 mV

MAXIMUM OVER VOLTAGE INPUT: ±30 Vdc

MAXIMUM OUTPUT: ±9 Vdc

DRIFT: 0.004%, 0.01%, 0.075% FS/C (10x, 100x, 1000x)

COMMON MODE REJECTION RATIO: 88 dB, 120 dB, 105 dB @ 60 Hz (10x, 100x, 1000x)

±10 VOLT SUPPLIES: 65 mA maximum

POWER: 12 Vac (115 Vac transformer and line cord included) or two 9 volt batteries (MN1604)

DIMENSIONS: 1.1" H × 5.5" W × 3.5" D

FREQUENCY CUTOFF: 10 kHz, except for gain of 1000 which has a 1 kHz cutoff

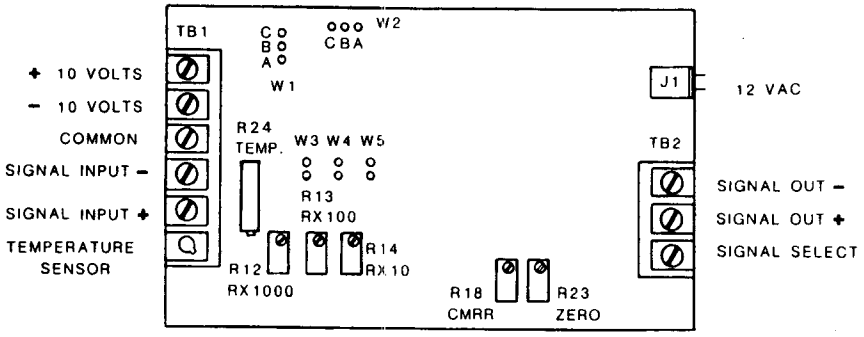
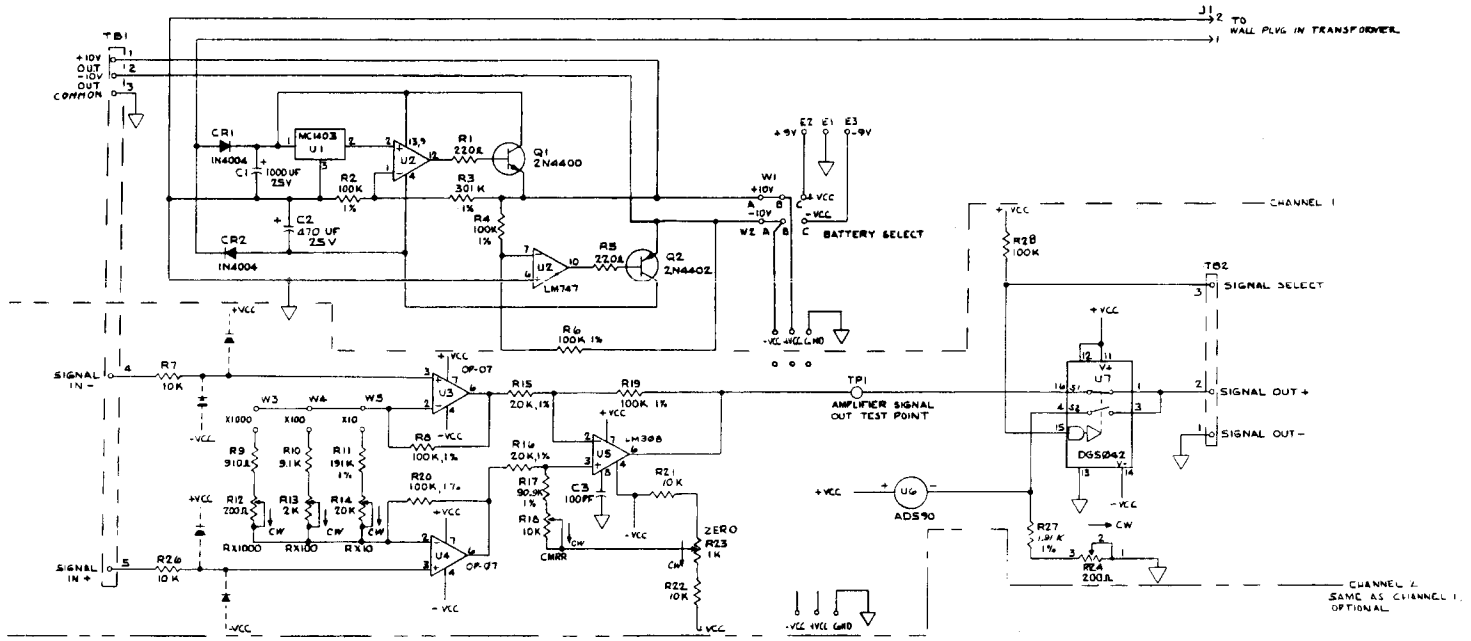


Figure 2. Component Layout


J1
2
TO
WALL PLUG IN TRANSFORMER
1
TB1
+10V OUT
-10V OUT
COMMON
CR1
IN4004
C1
1000 UF 25V
MC1403 U1
U2
R1 220Ω
Q1 2N4400
R2 100K 1%
R3 301K 1%
R4 100K 1%
C2 470 UF 25V
CR2
IN4004
U2
LM747
R5 220Ω
Q2 2N4402
R6 100K 1%
+9V
E2
E1
E3
-9V
W1
+10V
-10V
W2
+VCC
-VCC
BATTERY SELECT
-VCC +VCC GND
CHANNEL 1
+VCC
R28 100K
TB2
SIGNAL SELECT
SIGNAL IN -
R7 10K
OP-07
U3
W3
W4
W5
X1000
X100
X10
R9 910Ω
R10 9.1K
R11 191K 1%
R12 200Ω
R13 2K
R14 20K
CW
RX1000
RX100
RX10
R8 100K, 1%
R20 100K, 1%
R15 20K, 1%
R19 100K 1%
TP1
AMPLIFIER SIGNAL OUT TEST POINT
R16 20K, 1%
R17 90.9K 1%
R18 10K
CMRR
U5
LM308
C3 100PF
R21 10K
ZERO
R23 1K
R22 10K
U7
DG5242
SIGNAL OUT +
SIGNAL OUT -
U6
AD590
R27 1.91K 1%
R24 200Ω
SIGNAL IN +
R26 10K
U4
OP-07
-VCC +VCC GND
CHANNEL 2
SAME AS CHANNEL 1
OPTIONAL

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

MADE IN THE 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 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.

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.