

# User's Guide



[www.omega.com](http://www.omega.com)  
[e-mail:info@omega.com](mailto:info@omega.com)



## **DMD-465 Bridgesensor AC Powered Signal Conditioner**



<b>OMEGAnet® On-Line Service</b> <a href="http://www.omega.com">http://www.omega.com</a>	<b>Internet e-mail</b> <a href="mailto:info@omega.com">info@omega.com</a>
---	--

**Servicing North America:**

**USA:**  
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](mailto:info@omega.com)

**Canada:**  
976 Bergar  
Laval (Quebec) H7L 5A1  
Tel: (514) 856-6928 FAX: (514) 856-6886  
e-mail: [info@omega.ca](mailto:info@omega.ca)

**For immediate technical or application assistance:**

**USA and Canada:** Sales Service: 1-800-826-6342 / 1-800-TC-OMEGASM  
Customer Service: 1-800-622-2378 / 1-800-622-BESTSM  
Engineering Service: 1-800-872-9436 / 1-800-USA-WHENSM  
TELEX: 996404 EASYLINK: 62968934 CABLE: OMEGA

**Mexico and Latin America:**  
Tel: (95) 800-826-6342 FAX: (95) 203-359-7807  
En Español: (95) 203-359-7803 e-mail: [espanol@omega.com](mailto:espanol@omega.com)

**Servicing Europe:**

**Benelux:** Postbus 8034, 1180 LA Amstelveen, The Netherlands  
Tel: (31) 20 6418405 FAX: (31) 20 6434643  
Toll Free in Benelux: 0800 0993344  
e-mail: [nl@omega.com](mailto:nl@omega.com)

**Czech Republic:** ul. Rude armady 1868, 733 01 Karvina-Hranice  
Tel: 420 (69) 6311899 FAX: 420 (69) 6311114  
Toll Free: 0800-1-66342  
e-mail: [czech@omega.com](mailto:czech@omega.com)

**France:** 9, rue Denis Papin, 78190 Trappes  
Tel: (33) 130-621-400 FAX: (33) 130-699-120  
Toll Free in France: 0800-4-06342  
e-mail: [france@omega.com](mailto:france@omega.com)

**Germany/Austria:** Daimlerstrasse 26, D-75392 Deckenpfronn, Germany  
Tel: 49 (07056) 3017 FAX: 49 (07056) 8540  
Toll Free in Germany: 0130 11 21 66  
e-mail: [info@omega.de](mailto:info@omega.de)

**United Kingdom:**  
ISO 9001 Certified  
One Omega Drive, River Bend Technology Centre  
Northbank, Irlam, Manchester  
M44 5EX, England  
Tel: 44 (161) 777-6611 FAX: 44 (161) 777-6622  
Toll Free in the United Kingdom: 0800-488-488  
e-mail: [info@omega.co.uk](mailto:info@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.

## Features

- Rugged, Compact and Fully Encapsulated
- Complete System - Just Add AC Power
- Ready to Use with Screwdriver Wiring
- Stable and Accurate

## Applications

- Weighing with Load Cells
- Long Term Structural Monitoring
- Process Control Pressure Transducers
- Low Frequency Strain Measurements

## Transducer Excitation

Transducer bridge excitation is provided by an AC line powered, adjustable, well regulated, low noise power supply. The excitation voltage is adjusted by means of a molded-in potentiometer, which allows the output voltage to be varied from 4 to 15 Volts. The output ripple is extremely low and the line and load regulation are 0.05%.

The sense lines minimize variations in output voltage with changes in load current or lead resistance. It should be noted that if the sense feature is not being used, terminal 1 must be connected to terminal 2. Terminals 3 and 4 must be connected also. The supply will provide up to 150mA of output current. These features make the unit ideal for use with most common strain gage bridge circuits of 120, 350, and 500 Ohms.

The supply has short circuit protection to protect it against short term faults. The output recovers automatically from short circuit conditions once the short is removed.

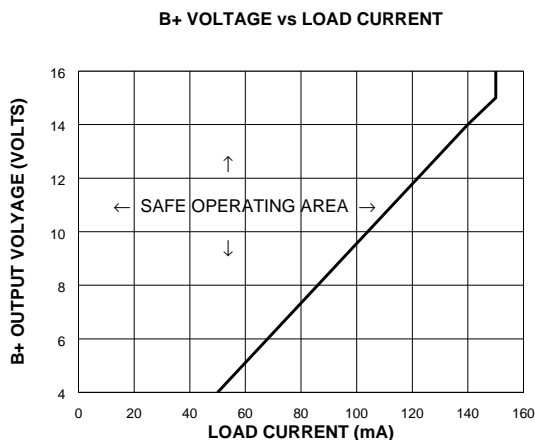


FIGURE 1. Bridge Supply - Safe Operation

## Description

The Model 465 is a self contained, AC powered, signal conditioning module for bridge type instrumentation. It contains a precision differential instrumentation amplifier with filtered output and a highly regulated, low noise, adjustable output bridge excitation source. The unit is completely encapsulated for use in rugged environments.

## Safe Operation in the Unsafe Area

The curve (Figure 1) describes the region of safe operating output current at each voltage setting level. If excitation is desired at the 4 Volt level with 150mA, this can be accomplished by using a resistor of at least 2 Watts in size in series with the bridge. The right value resistor would drop 11 Volts allowing 4 Volts at 150mA across the bridge while minimizing internal heating of the Model 465. The + sense line would regulate the supply to the required 4 Volts. Normal operation of single bridges at 10 Volts and under 100mA (all 120, 350, and 500 Ohm bridges) can be accomplished within the safe operating area.

## Instrumentation Amplifier

The built-in amplifier is a true differential input, low noise, low drift, instrumentation amplifier. It has a high common mode rejection ratio (CMRR) and is provided with an output offset that is potentiometer adjustable. The minimum gain setting of the amplifier is 40 and the maximum gain using the built-in potentiometer is 250. The gain may be adjusted up to a maximum of 1,000 by means of an external resistor connected across terminals 12 and 13. The size of the external resistor can be calculated using the gain formula in the specifications. When doing this the coarse gain potentiometer should be turned fully clockwise. The fine gain pot can then be used for final gain adjustment. The output offset adjustment range is  $\pm 0.5V$ .

The amplifier can withstand input voltages up to 15 Volts without damage. The output of the amplifier is filtered to be 3 dB down at 3 Hz using a double pole Butterworth response filter to minimize the effects of high frequency electrical and physical noise on the system. The output of the amplifier is  $\pm 10$  Volts at 5mA making it compatible with modern data acquisition techniques and systems.

## Specifications

(Typical @ 25°C unless noted)

<b>Amplifier</b>	
Gain Range with external R	40 - 250 to 1,000
Gain Temperature Coefficient	200 ppm/°C
Gain Potentiometer Hysteresis	0.2% of span max.
Gain Equation <i>Note: G is the desired voltage gain in V/V</i>	$R_g = \frac{G - 1}{40 \text{ k}\Omega} - \frac{1}{150\Omega}$
Drift (RTI)	2 ±20/G μV/°C
Input Bias Current	±30 nA
<b>Input Impedance</b>	
Differential	3,000 megohms
Common Mode	6 megohms
<b>Output Noise (RTO)</b> at gain = 100 1 Hz to 100 Hz	120 μV RMS
<b>Common Mode Rejection</b>	
Gain = 40 (DC)	96 dB
Rated Output (2k load)	±10V
Common Mode Voltage	±6.5V
Output Impedance (DC)	0.01 ohms
Dynamic Response	0.3s to 0.1%
DC to -3 dB two pole Butterworth Filter	3 Hz
Max. Input Voltage	±15V
<b>Bridge Supply</b>	
Input	115 VAC ±10% 50 to 60 Hz (100, 220 & 230 VAC available)
Output Voltage	4 to 15 Volts
Output Current	5 to 150 mA
(see output voltage vs current curve)	
Load & Line Regulation 0.05% V <sub>OUT</sub> = 12V, I <sub>L</sub> = 5 to 100 mA	
Output Noise	0.5 mV RMS
Drift	200 ppm/°C max.
B+ Potentiometer Hysteresis	0.3% of output max.
Short Circuit Current	750 mA
Line Isolation	1,500 VDC
<b>Mechanical</b>	
Operating Temperature	0°C to 70°C
Storage Temperature	-25°C to +85°C
Weight	18 oz. (510 grams)
Size	3.75"L x 2.0"W x 2.87"H 9.53 x 5.1 x 7.62 (cm)

## Getting Started with the Model 465

### I. Hook Up Procedure

- A. Connect the +out of your load cell to the +INPUT, pin 10.
- B. Connect the -out of your load cell to the -INPUT, pin 11.

Note: If the ±SENSE are not used in your load cell application, the connections in step C & D need to be followed. If the ±SENSE are going to be used, do not jumper them as described in steps C & D.

- C. Connect B+, pin 4, to the +excitation of your load cell and jumper the +SENSE, pin 3, to B+, pin 4.
- D. Connect B-, pin 2, to the -excitation of your load cell and jumper the -SENSE, pin 1, to B-, pin 2.
- E. Connect the VAC power supply to the AC input lines, pins 6 and 7.

### II. Turn On Procedure

- A. Verify that the hook up procedure is complete.
- B. Verify the correct AC voltage is applied to the 465; i.e. 100, 115, 220, 230.
- C. Turn on the AC source supply to the 465.
- D. Set the required EXCITATION supply voltage to the load cell by adjusting B+ ADJUST, Pot B

### III. Calibration Procedure for Zero Adjustment

- A. Jumper the + and - input terminals, pins 10 and 11, together.
- B. Connect a volt meter across the output, pins 8 and 9.
- C. Adjust the OUTPUT OFFSET, Pot A, potentiometer for zero.

### IV. Full Scale Voltage Adjustment

- A. Remove the jumper between the + and - input terminals and apply a known load to your load cell, in most cases it would be 100% of full scale.
- B. Adjust the COARSE GAIN, Pot D, and FINE GAIN, Pot C, potentiometers for the desired FULL SCALE output.
- C. Calibration is now complete. However, the user should recheck the ZERO & FULL SCALE output before continuing.

## Typical Bridge Application

Figure 2 shows a typical load cell application using a standard 350 Ohm bridge. Typical bridge output is 2 or 3mV/Volt of excitation. With the power supply excitation voltage at 10 Volts an output of 20 or 30mV from the bridge can be obtained. The common mode voltage of the bridge (the instrumentation amplifier input signal level) is 5 Volts. This is well within the 6.5 Volt common mode voltage range of the amplifier.

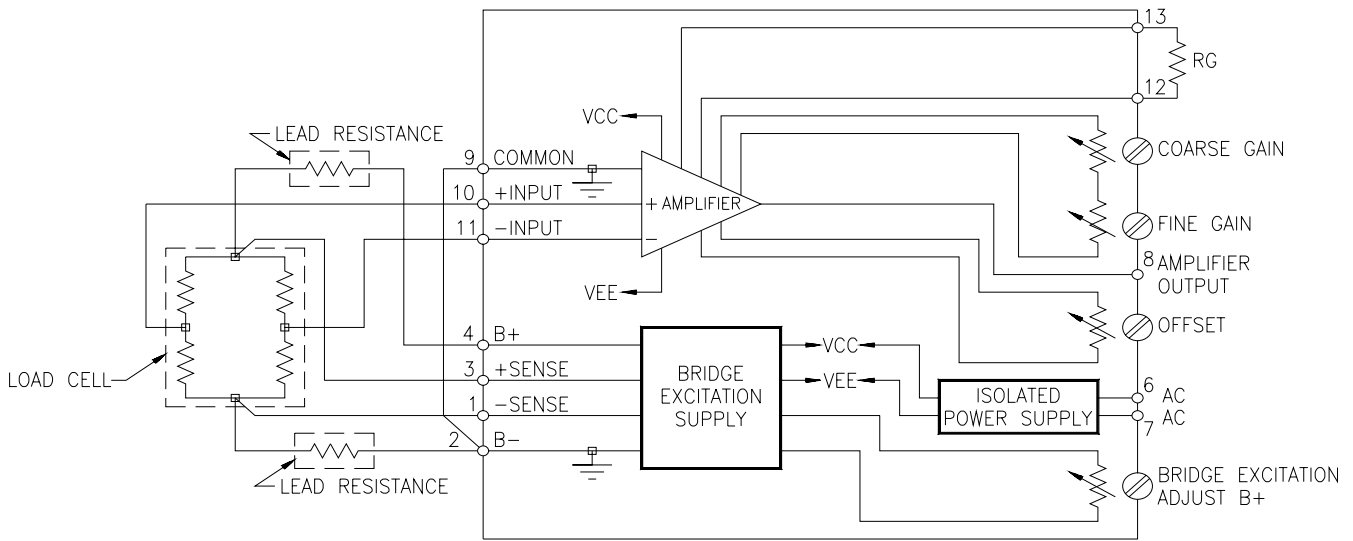


FIGURE 2. Typical load Cell Application

The gain must be set between 300 and 600 depending on the output of the bridge. The built-in potentiometer set to a gain of 200 would achieve an output voltage of 4 to 6 Volts. For a higher level output an external resistor must be used. The value of that resistor can be calculated using the gain formula. It can also be arrived at empirically using a calibrated input signal equal to the maximum input signal expected and a resistance substitution box to adjust the gain until the desired full scale output voltage is achieved.

Assuming a standard 350 Ohm bridge is used, the current required from the excitation supply (set at 10 Volts) would be 28.6mA. If the leads were long enough to have 10 Ohms of internal resistance there would be a drop of over 0.25 Volts in both the plus and common side of the bridge. To eliminate this potential error (especially where the current might vary during the course of a measurement) the sense lines are connected to measure and regulate the voltage right at the bridge rather than at the output of the supply thereby eliminating this potential source of error. The decision of whether to use the sense leads or not depends entirely on the lead length, its resistance and the effect of that error on the measurement.

### Application Suggestions

The Model 465 is designed to eliminate many of the ordinary problems associated with bridge type measurements. Since the whole system is in one case the common problem of ground loops or circulating currents caused by poor wiring practices is eliminated. It is recommended that lead lengths be kept to a minimum. The use of shielded twisted pairs for the input leads is recommended for most applications.

To minimize self heating errors the use of minimum excitation power is suggested as is sufficient heatsinking of the transducer wherever possible. For optimum stability a one hour warm-up is recommended. Avoid large temperature changes or stray magnetic fields.

The output leads should be kept short to minimize capacitive loading on the output of the amplifier. The Model 465 Bridgesensor is ready to wire into your system, have power applied, and to start making measurements for you.

### Mechanical Specifications

Specifically designed for rugged field use the Model 465 is completely encapsulated in epoxy using a vacuum potting system to insure a complete seal against corrosive environments. It is similarly protected against shock and vibration and will provide years of reliable and accurate operation.

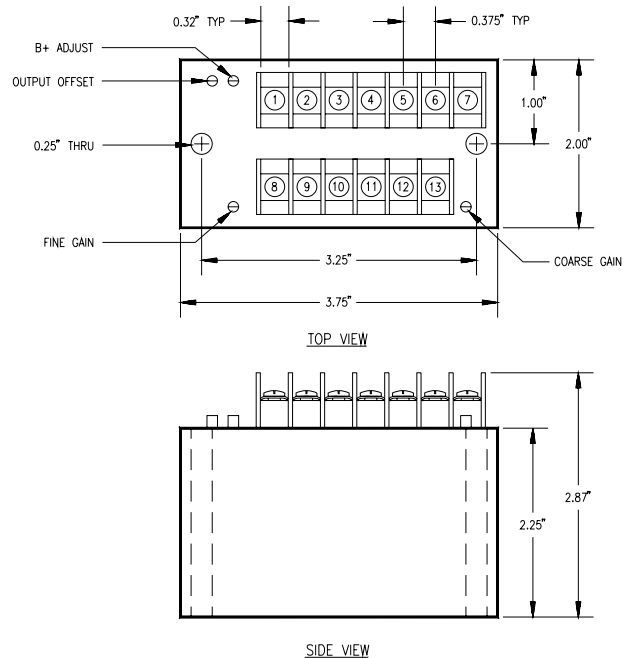


FIGURE 3

Terminal Strip Assignments			
Screw Terminal	Function	Screw Terminal	Function
1	-SENSE	8	OUTPUT
2	B-	9	AMPLIFIER CMN
3	+SENSE	10	+INPUT
4	B+	11	-INPUT
5	NOT USED	12	EXT. GAIN
6	AC	13	EXT. GAIN
7	AC		



## 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 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 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 1999 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!**

## **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**

- ☑ Transducer & Strain Gauges
- ☑ 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 & 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