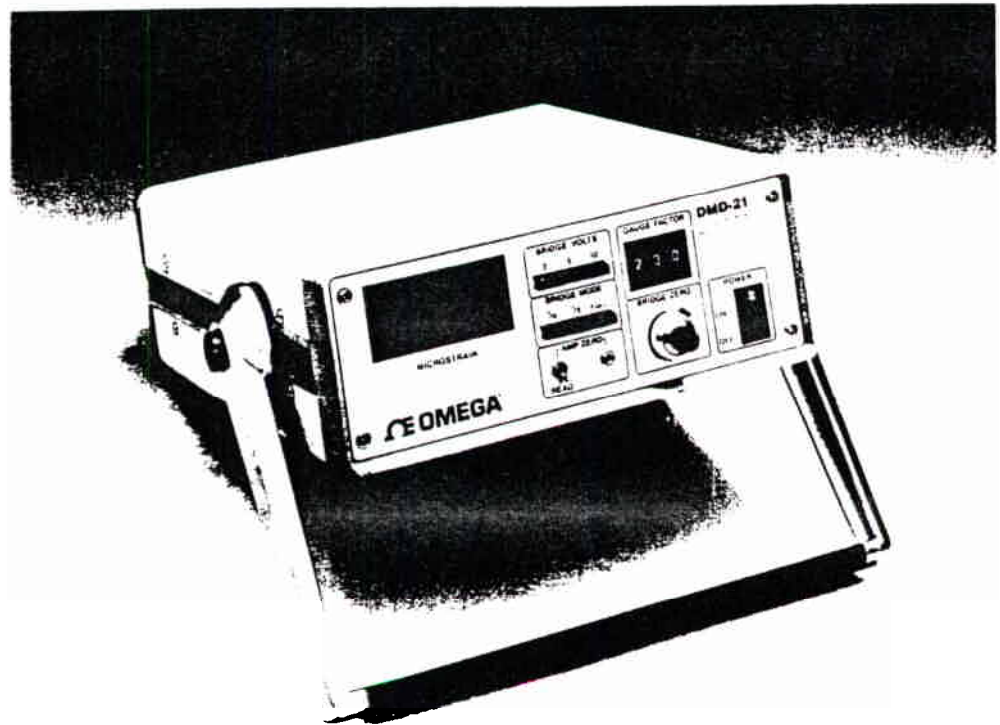


# ® DMD-21

## ® Single Channel Digital Strain Indicator



Operator's Manual  
M1244/0991

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DMD-21

SINGLE CHANNEL DIGITAL STRAIN INDICATOR

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# 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 customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. Our 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; 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.

There are no warranties except as stated herein. There are no other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and of fitness for a particular purpose. OMEGA ENGINEERING, INC. is not responsible for any damages or losses caused to other equipment, whether direct or indirect, incidental, special or consequential, which the purchaser may experience as a result of the installation or use of the product. The buyer's sole remedy for any breach of this agreement by OMEGA ENGINEERING, INC. or any breach of any Warranty by OMEGA ENGINEERING, INC. shall not exceed the purchase price paid by the purchaser to OMEGA ENGINEERING, INC. for the unit or units or equipment directly affected by such breach.

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.

## RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA ENGINEERING Customer Service Department. Call toll free in the USA: 1-800-622-2378, FAX: 203-359-7811; International: 203-359-1666 FAX: 203-359-7807.

BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, YOU MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OUR CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAY). The assigned AR number should then be marked on the outside of the return package and on all 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 you are having with the product.

FOR NON-WARRANTY REPAIRS OR CALIBRATION consult OMEGA for current repair/calibration charges. Have the following information available BEFORE contacting OMEGA:

1. Your P.O. number to cover the COST of the repair/calibration,
2. Model and serial number of product,
3. Repair instructions and/or specific problems you are having with the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. That way our customers get the latest in technology and engineering.

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## SECTION 1 GENERAL DESCRIPTION

The OMEGA DMD-21 Digital Strain Indicator, which operates on either 115VAC or 230VAC, is a single input meter which may be used for  $\frac{1}{4}$ ,  $\frac{1}{2}$ , or full bridge inputs. Readings are given directly in microstrains on the  $4\frac{1}{2}$  digit display. The front panel gage factor dial covers the range of gage factors likely to be encountered in use, but gage factors outside this range maybe easily accommodated by setting the gage factor to 2.00 and calculating the strain (see Section 4). A Precision Two-State Zero Adjustment is provided ensuring ease of zero setting together with ease of re-setting for subsequent tests. An analog output is provided on the rear panel for connection to a recorder. Refer to Figure 3-2 in Section 3.2.

The bridge circuits are energized from an internal source supplying 2V, 5V or 10VDC. Bridge Voltage and Bridge Mode are selected by push-button operation on the front panel. An Amplifier Zero Control is situated on the front panel together with an Amp Zero/Read Switch.

Inside the DMD-21 are two (2) 8.4 Volt, 1.2AH Ni-Cad batteries which allow the user to have a portable unit. It is advisable to turn off the DMD-21 while recharging the batteries (charging time is 6 hours). Once the batteries are fully charged, they last for up to 40 hours before they need to be recharged again.

The handle on the DMD-21 doubles as a multi-position bench stand. Press both buttons on the sides of the handle to change the angle of the stand.

Figure 1-1 shows the DMD-21 Digital Strain Indicator.

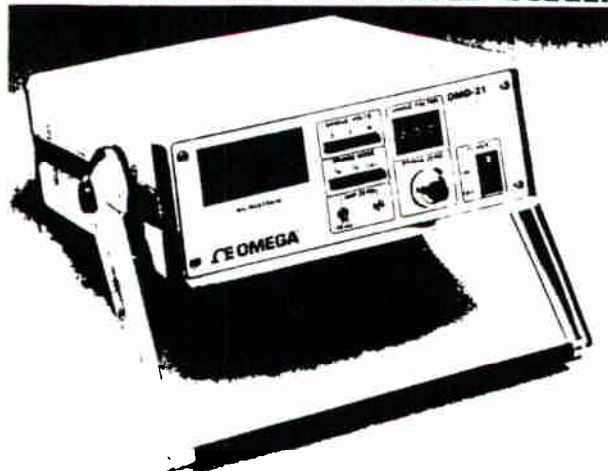


Figure 1-1. DMD-21

## SECTION 2 UNPACKING

Remove the Packing List and verify that all equipment has been received. If there are any questions about the shipment, please call the OMEGA Customer Service Department at 1-800-622-2378 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.

Make sure the following items are in the shipping box.

Qty	Description
1	DMD-21 Digital Strain Indicator (including integral battery pack and recharger)
1	Power Cord
1	Operator's Manual

## SECTION 3 PARTS OF THE DMD-21

### 3.1 FRONT OF THE DMD-21

Figure 3-1 shows the front of the DMD-21. Following the figure is a description of each part of the strain indicator.



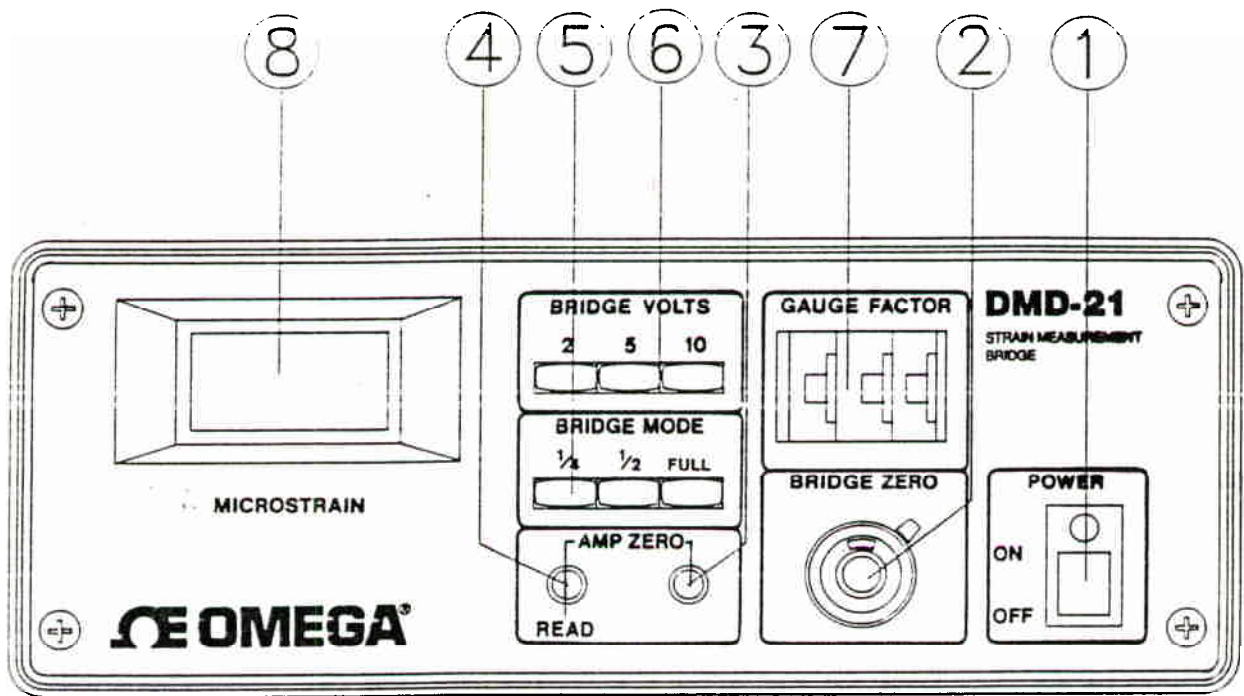


Figure 3-1. Front of the DMD-21

KEY	DESCRIPTION
1	Main Power Switch. A small LED lit indicates that power is on.
2	Bridge Zero fine adjusting knob. The outer ring knob locks setting.
3	Amp Zero Control Screw.
4	Amp Zero Switch switchable to either Amp Zero or Read.
5	Bridge Mode pushbuttons setting to either $\frac{1}{4}$ , $\frac{1}{2}$ , or full configuration.
6	Bridge Volts pushbuttons setting to either 2, 5 or 10 volts.
7	Gage Factor Number; Value set by user (from 1.00 to 2.99 in 0.01 steps).
8	LCD Display ( $4\frac{1}{2}$ digits).

### 3.2 REAR OF THE DMD-21

Figure 3-2 shows the rear of the DMD-21. Following the figure is a description of each part of the strain indicator.

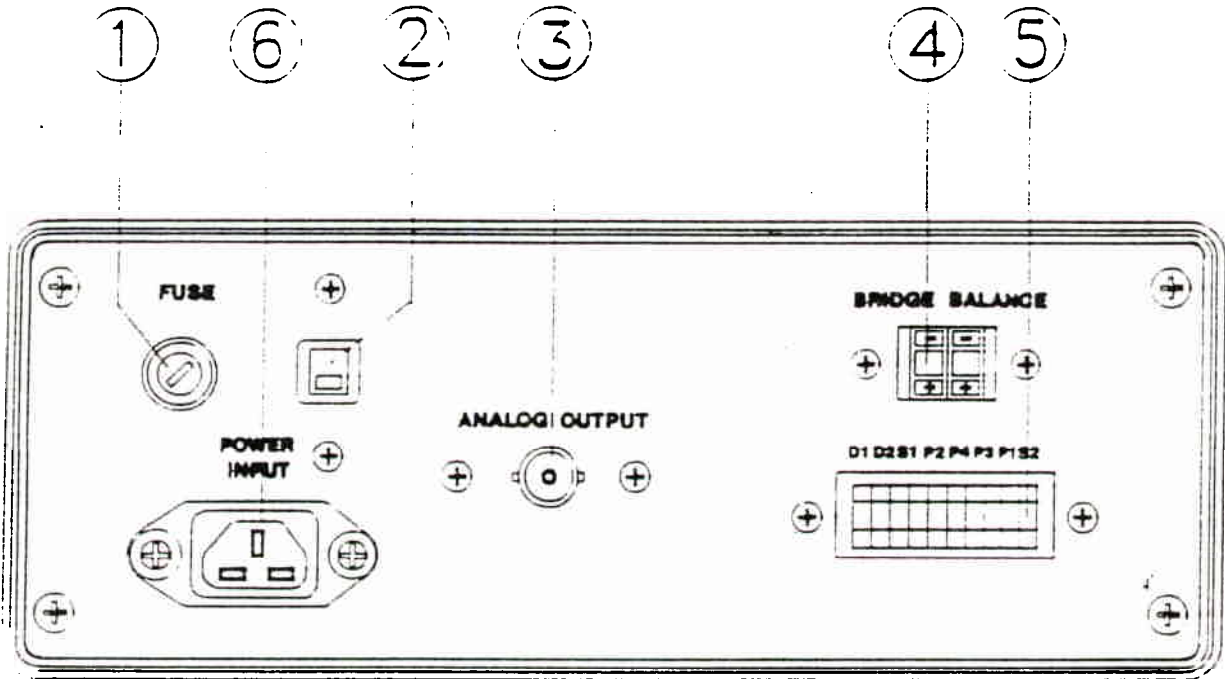


Figure 3-2. Rear of the DMD-21

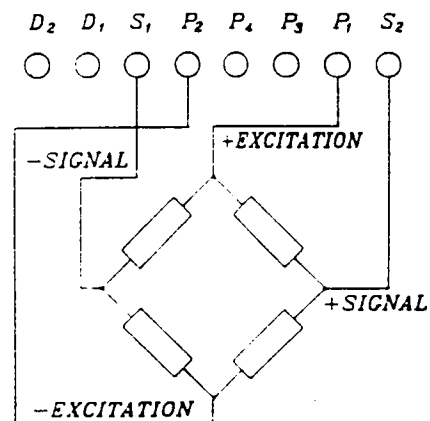
KEY	DESCRIPTION
1	Fuse (500mA anti-surge type)
2	Voltage Selector Switch (115V/230V)
3	Analog Output Connector (BNC Connection)
4	Bridge Balance
5	Interface Connector for strain gages
6	Power Cord Socket

## SECTION 4 WIRING

1. Make sure the Voltage Selector Switch (Figure 3-2, #2) is set to the appropriate voltage for your country.
2. Connect the strain gages to be measured to the terminals at the rear of the instrument as shown in Figures 4-1 through 4-5 and as described below.

### 4.1 FULL BRIDGE CONFIGURATION

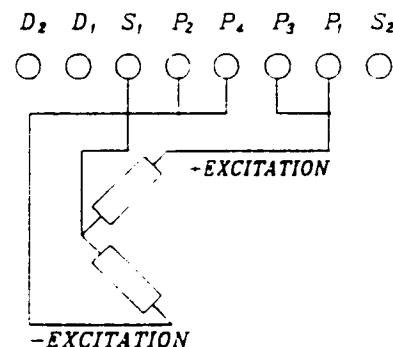
Positive Supply to P1  
 Negative Supply to P2  
 Negative Signal to S1  
 Positive Signal to S2  
 No connections to P3 and P4  
 Minimum gage resistance is 120 ohms



**FIGURE 4-1**  
**FULL BRIDGE OR mV/V TRANSDUCER**

### 4.2 HALF BRIDGE CONFIGURATION

Positive Supply to P1  
 Negative Supply to P2  
 Strain Gage junction to S1  
 Jumper P1 to P3 and P2 to P4  
 Minimum gage resistance is 80 ohms



**FIGURE 4-2**  
**HALF BRIDGE**



### 4.3 QUARTER BRIDGE CONFIGURATION

(Single gage, three-wire connection)

Strain Gage terminal 1 to P1

Strain Gage terminal 2 to S1

Strain Gage terminal 2 to D1 or D2

Jumper P1 to P3

Jumper P2 to P4

Use D1 for 120 ohm gages or

D2 for 350 ohm gages

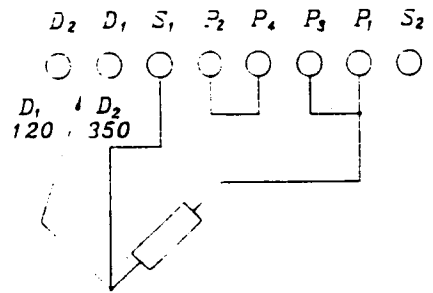


FIGURE 4-3  
THREE WIRE QUARTER BRIDGE

### 4.4 OTHER CONFIGURATIONS

For other resistance values, use the half bridge arrangement with an external resistor (R1). In this case, connect the active gage between terminals P1 and S1 and the external resistor between S1 and P2. Jumper P1 to P3 and P2 to P4 on the rear panel. Jumper S1 to D1 for 120 ohm gages. Jumper S1 to D2 for 350 ohm gages. Refer to Figures 4-4 and 4-5.

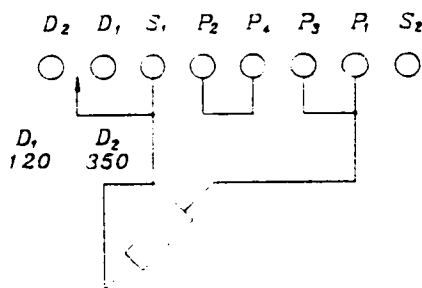


Figure 4-4. Two-Wire Quarter Bridge

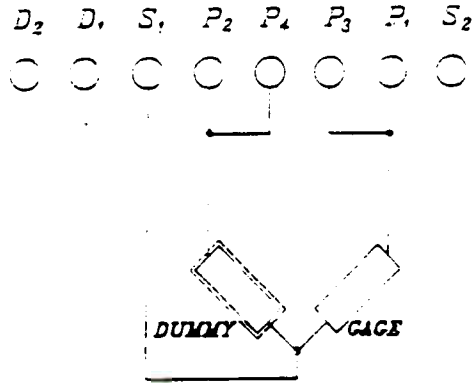


Figure 4-5. Quarter Bridge other than 120 ohms or 350 ohms

4.5 INTERNAL CIRCUIT

P1 = + Excitation

P2 = - Excitation

S1 = - Signal

S2 = + Signal

P3 =  $\frac{1}{2}$  Bridge Completion Resistor

P4 =  $\frac{1}{2}$  Bridge Completion Resistor

D1 = 120 ohm,  $\frac{1}{2}$  Bridge Completion Resistor

D2 = 350 ohm,  $\frac{1}{2}$  Bridge Completion Resistor

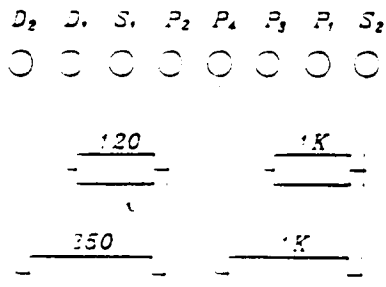


Figure 4-6. Internal Circuit

## SECTION 5 OPERATION

### 5.1 INTRODUCTION TO OPERATION

1. An output of approximately 2 volts full scale is available at the rear BNC Socket of the DMD-21, suitable for the connection of an oscilloscope or other high impedance recording or display device. The available dynamic response of this output extends beyond 20kHz. This output may also be used to supply a Recorder provided the recorder is fitted with a suitable amplifier containing a gain control enabling the signal to be set to a specific value of strain for a given trace width.
2. For optimum accuracy, the indicator should be left on for approximately ten minutes before final adjustment of zero is made. If tests are being conducted over a period of time, without being able to restore the original zero conditions of the specimen or structure, then the reading on the zero dials should be noted, so that the indicator may be set to the same zero condition when re-connecting. Record reading here: \_\_\_\_\_.
3. The Gage Factor control should be set to the value appropriate to the gages in use. If gages are used whose gage factor is outside the provided range, then set the dial to 2.00 and correct the strain readings by simple arithmetic proportion.



5. Set front panel switch Figure 3-1, #4 to Amp Zero and adjust adjacent zero screw (Figure 3-1, #3) until you see 0.00 on the digital display then set switch to the "READ" position and adjust for zero on the display by using the Coarse Zero control (Figure 3-2, #4) at the rear of the instrument and the Bridge Zero knob (Figure 3-1, #2) on the front panel. When you have zeroed the instrument lock the control in place using the black outer knob. If further readings are to be taken at a later date, record the setting of the Bridge Balance Number and the Bridge Zero Dial. Record Values here: \_\_\_\_\_ (front); \_\_\_\_\_ (rear).
6. For dynamic measurements, the signal available at the BNC socket (Figure 3-1, #3) on the rear panel may be connected to an amplifier or a Recorder. The output at this socket is 0 to  $\pm 2$  volts which is equivalent to  $\pm 20,000$  microstrain. The frequency response is DC to 20 kHz.
7. To use the DMD-21 to monitor Strain Gage Transducers, whose calibration is known in terms of millivolts per volt.
  - a. Set volts to 10 volts.
  - b. Set bridge mode to  $\frac{1}{4}$  bridge.
  - c. Set the gage factor dial (Figure 3-1, #7) to 2.00.
  - d. Set front panel switch to amplifier ZERO (Figure 3-1, #4) and adjust ZERO Screw (Figure 3-1, #3).
  - e. Set front panel switch to READ (Figure 3-1, #4) and adjust rear panel and front panel zero knobs (respectively Figure 3-1, #2 and Figure 3-2, #4) until zero is shown on the Digital Volt Meter.
  - f. Apply load to Transducer and note reading on the display (Figure 3-1, #8). 2,000 microstrain on the display indicates a signal of 1.0 millivolt per volt.
8. Note that once the Amplifier Zero Screw has been adjusted in step 5, it will only need occasional re-adjusting.



## 5.2 PROCEDURE TO USE THE DMD-21

1. Connect Strain Gages in accordance with Section 4.
2. Select the correct bridge mode (Figure 3-1, #5) on the front panel.
3. Select bridge excitation voltage (Figure 3-1, #6) on the front panel.
4. Set the bridge zero (Figures 3-1, #2 & 3-2, #4) accurately. Refer to Step 5 in Section 5.1.
5. Set the gage factor dial to the gage factor for the gages in use, apply strain and note reading on the liquid crystal display (Figure 3-1, #8) on the front panel. Note that the range of the instrument is  $\pm 19999$  microstrain and therefore no range switch is required.

## SECTION 6 RECHARGEABLE BATTERIES REPLACEMENT

To replace batteries:

1. Turn off the DMD-21, and unplug.
2. Unscrew the 4 screws from the top cover and remove top cover.
3. Disconnect the 4 leads to the batteries.
4. Unscrew the 2 screws holding the battery clamp and remove clamp.
5. Remove old batteries and replace with fresh 8.4 Volt, 1.2 AH Ni-Cad rechargeable batteries.
6. Follow steps 1 through 4 in reverse order.

## SECTION 7 ACCESSORIES

The DMD-21 may be used in conjunction with the DMD-21SB 10-Channel Switch and Balance Unit. Use of the DMD-21SB extends the range of the instrument to 10 inputs each with its own zero adjustment. Refer to the operator's manual for the DMD-21SB for more details.

## SECTION 8 SPECIFICATIONS

CHANNELS: 1

RANGE:  $\pm$  19999 microstrain

LINEARITY: 0.02% full scale

GAGE RESISTANCE:  $\frac{1}{4}$  bridge: 120 or 350 ohm  
 $\frac{1}{2}$  bridge: at least 80 ohms  
Full bridge: at least 120 ohms

GAGE FACTOR RANGE: 1.00 to 2.99 in 0.01 steps

BRIDGE VOLTAGE: 2VDC, 5VDC or 10 VDC

BRIDGE MODES:  $\frac{1}{4}$ ,  $\frac{1}{2}$  or Full Bridge

BRIDGE ZERO: Coarse adjustment is in 9 overlapping steps up to 10,000 microstrains,  $\pm$  2% resistance imbalanced is covered. Fine adjustment is by a locking 10 turn front panel control with a range of 1 to 700 microstrains.

ZERO DRIFT: Less than 0.5 microstrain/ $^{\circ}$ C

GAIN DRIFT: Less than 0.005%/ $^{\circ}$ C

INPUT IMPEDANCE: 1000 Megohms

GAGE CONNECTIONS: Screw terminals are at the rear and provide for  $\frac{1}{4}$ ,  $\frac{1}{2}$  or full bridge connections

ANALOG OUTPUT:  $\pm$  2VDC. Equivalent to  $\pm$  20,000 microstrain

FREQUENCY RESPONSE: DC to 20k Hz

POWER: 115/230VAC, 50/60 Hz. Slide switch at rear. Battery: two (2) 8.4V, 1.2 AH Ni-Cad rechargeable batteries built-in. Full charge of up to 40 hours use.

WEIGHT: 11 pounds (5 kg)

DIMENSIONS: 11.81"L x 4.33"W x 17.72"D (300 x 110 x 450 mm)

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