

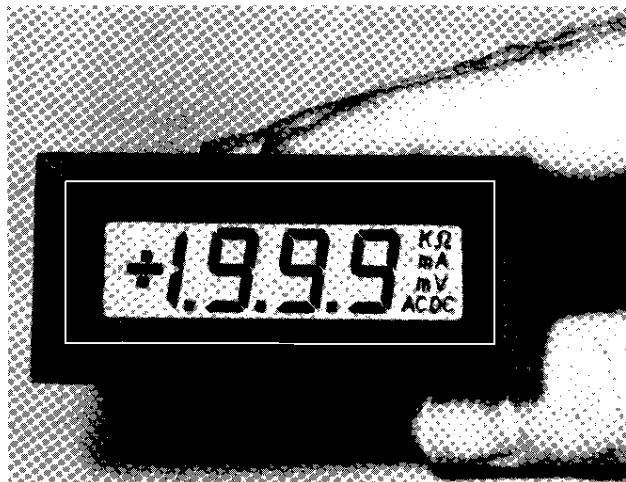
# DM-3100U2, -U3\*

## 3½ Digit, AC/DC-Powered LCD DPM's with Descriptors

*\* -U3 Model is no longer available*

### FEATURES

- Dual-powered, 9-15 Vdc or AC (115 VAC DM-3100U2, 230 VAC DM-3100U3)
  - .5" High Liquid Crystal Display
  - 3½ digits, ratiometric reference for drift correction
  - Programmable Descriptor Labels: A, mA, V, mV,  $\Omega$ , K $\Omega$ , AC, DC
  - Balanced Differential Inputs, 5 pA bias current, autozeroing with 80 dB CMR noise rejection, transformer-isolated 300V
  - Low profile model accepts optional 4-20 mA inputs
- Internal user-options:**
1. Offset pot for 4-20 mA and other applications
  2. Accepts shunts for  $\pm 20 \mu\text{A}$  to  $\pm 2\text{A}$  FS ranges
  3. Accepts attenuators for  $\pm 2\text{V}$  to  $\pm 1\text{KV}$  FS ranges
  4. Digital Ohmmeter, 2K $\Omega$  to 10 M $\Omega$ , FSR



### GENERAL DESCRIPTION

The DM-3100U2 and DM-3100U3 Digital Panel Meters use 3½ Liquid Crystal Display Digits and accept either AC or dc power inputs. The DM-3100U2 uses 115 VAC power, 47 to 440 Hz or 9 to 15 Vdc at 3 to 7 mA. The DM-3100U3 is identical to the DM-3100U2 but uses 230 VAC power, 47 to 440 Hz or 9 to 15 Vdc at 3 to 7 mA.

Both models use .5" high LCD's and use Datel-Intersil's low profile DPM case. The input section is balanced differential for excellent noise rejection and uses a high impedance (1000 M $\Omega$ ) CMOS front end with low 5 pA bias currents.

The standard voltage range is  $\pm 1.999\text{ Vdc}$  with autopolarity, but may be changed with user-supplied internal components to  $\pm 1000\text{ Vdc}$ . The user may also install an internal shunt resistor to measure from  $\pm 20 \mu\text{A}$  to  $\pm 2\text{A}$  FSR. Digital ohmmeter operation is also a user-option

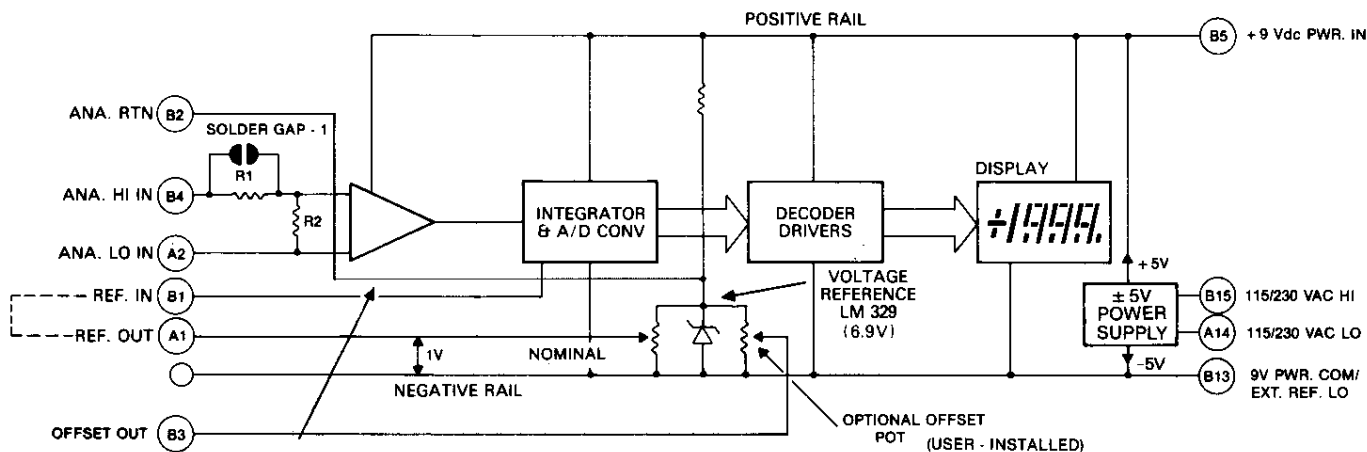
from 1.999 K $\Omega$  FSR to 10M $\Omega$  FSR. Finally, the user may install an internal offset pot for 4-20 mA and other applications.

Both meters are autozeroed and accept external ratiometric reference inputs to reduce drift errors in instrumentation systems.

The LCD display on both meters contains Descriptor unit labels (A, mA, V, mV,  $\Omega$ , K $\Omega$ , AC, DC) which are pin-programmable for dedicated VOM, DVM applications.

The AC supply in both meters produces an additional filtered DC output of approximately 12 Vdc @ 5 mA for customer use. A suggested application is to charge standby NiCad batteries. Since this power output pin is also used for power input when dc-powered, the NiCads may be left continuously connected so the meter will continue operating if there is an AC power failure.

### SIMPLIFIED BLOCK DIAGRAM



IMPORTANT: Note connection to cathode of reference zener diode.

## ANALOG INPUT

**Configuration**

True, balanced differential bipolar

**Full Scale Input Range**

-1.999 Vdc to +1.999 Vdc. Input pad area will accept user-installed range change

**Input Bias Current**

5 pA typical, 50 pA maximum

**Displayed Accuracy @ +25°C**

Adjustable to  $\pm 0.1\%$  of reading,  $\pm 1$  count

**Resolution**

1 mV

**Temperature Drift of Zero**

Autozeroed  $\pm 1$  count over 0 to +50°C

**Temperature Drift of Gain**

$\pm 50$  ppm of Reading/°C typ.  $\pm 100$  ppm of Reading/°C max.

**Input Impedance**

100 Megohms, minimum

**Input Overvoltage**

$\pm 250$  Volts dc 175 VRMS continuous max.  $\pm 300$  Volts intermittent max.

**Common Mode Rejection**

80 dB, DC to 60 Hz, 1 Kilohm unbalance

**Common Mode Voltage Range**

Within +Vs - 5V and -Vs +1V where +Vs is the positive rail (Pin B5) and -Vs is the negative rail (Pin B13). -Vs is approximately equal to -5V below PWR. COM.

**Reference**

Internal, referred to the negative rail (-Vs).

External, user-supplied reference optional for ratiometric operation

**External Ref. Range**

+100mV to +2V referred to -Vs.

**Ramp-up Time (Integration Period)**

83.3 mS

**Analog Return/Ohms LO (Pin B2)**

This pin may be used as a low-noise bias current return for some floating inputs.

Analog Return is approximately +6.9V above -Vs. Do not connect Analog Return to +5V or +9V power.

**Reference In/Out (Pins B1/A1)**

Normally, REF. IN and REF. OUT should be jumpered together. An external floating source referred to EXT. REF. LO (Pin B13) may be substituted for ratiometric operation.

**Decimal Points**

Connect selected pin to DECIMAL POINT COMMON (Pin B11). Connect unused decimal points or Descriptors to Backplane Out (Pin B10)

**Offset Out (Pin B3)**

0 to +6.9V referred to -Vs (Pin B13) requires installation of optional offset pot supplied by user.

**Display Test (Pin B6)**

Connect this input to Pin B5 to test all display segments

**Horizontal Polarity In (Pin A11)****Horizontal Polarity Out (Pin B11)**

Normally these inputs are jumpered together to continuously display the horizontal portion of the polarity sign. Omit the jumper for applications not requiring sign display. See Backplane Out.

**Vertical Polarity In (Pin A12)****Vertical Polarity Out (Pin B12)**

Jumper these inputs when HORIZ. POL. is jumpered for automatic sign display with bipolar inputs. For reverse sensing applications VERT. POL. OUT may be jumpered to HORIZ. POL. IN (no other connections). This will display a minus sign with positive inputs and no sign (implied positive) with negative inputs. See Backplane Out

**Backplane Out (Pin B10)**

Connect all unused Polarity, Decimal Points and Descriptors to Backplane Out. For VOM or DVM applications, a 470 k $\Omega$  resistor may be used for each Decimal Point or Descriptor to A11. A rotary switch pole to B11 will then select the desired Descriptor and/or Decimal Point.

**Descriptors**

Electrical units are displayed by connecting to the Descriptor Common. Descriptors displayed are as follows:

"mA"	(Pin A3)-"m"	portion only
"k $\Omega$ "	(Pin A4)-"k"	portion only
"k $\Omega$ "	(Pin A5)-" $\Omega$ "	portion only
"mA"	(Pin A6)-"A"	portion only
"mV"	(Pin A7)-"V"	portion only
"DC"	(Pin A8)	
"AC"	(Pin A9)	
"mV"	(Pin A10)-"m"	portion only

**IMPORTANT NOTE:** The descriptors display labels only. They do not select functions. This meter does not directly measure ohms, mA, AC, etc. without first adding user-installed internal or external components.

## POWER CONNECTIONS

**AC Power****115 VAC (Model DM-3100U2) or 230 VAC (Model DM-3100U3)**

Connect AC Hot to Pin B15. Connect AC Neutral to Pin A14. Earth ground may be connected to Pin B13 if the input is isolated from earth ground. Make no connection to Pin B13 if input ground loops will result.

**DC Power****(Both DM-3100U2 and U3)**

Connect +9 to 15 Vdc to Pin B5. Connect Power Common to Pin B13. When AC-powered, Pins B9/B13 produce +12 Vdc @ 5 mA max., filtered for optional customer external use.

## POWER REQUIREMENTS

**AC**

1/4 watt, max., 115 or 230 VAC.

**DC**

+9 to +15 Vdc, filtered @ 9 mA typ., 20mA max. Logic spikes must be less than 50 mV

**Calibration**

A multiturn screwdriver pot adjusts the full scale reading (gain). Zero is automatic (autozeroing). Suggested recalibration in stable conditions is 90 days.

## PHYSICAL-ENVIRONMENTAL

**Low Profile Case Outline Dimensions**

2.53"W x 3.25"D x 0.94"H (64.3 x 82.5 x 23.8 mm)

**Cutout Dimensions**

2.56"W x 0.97"H min. (65.1 x 24.6 mm)

**Mounting Method**

Through a front panel cutout secured by 2 side case "L" brackets and screws (supplied). Panel thickness up to 0.62" (15.9 mm)

**Weight**

Approximately 5 ounces (142g)

**Connector**

Double-sided edgeboard PC type, solder tab, gold-plated fingers. 15-pin, 0.1"

**Mounting Position**

Any

**Operating temperature range**

0 to +50°C

**Storage Temperature Range \***

0°C to +55°C

**Altitude**

0 to 15,000 feet (4900m)

**Relative Humidity**

20% to 80% non-condensing

\*WARNING: Avoid long exposure to high temperatures. Store at room temperature.

## Ordering Information

**DM-3100U2-1:** +/- 2Vdc Input Range (Supplied With Free Connector)

**RN-3100/4100:** Range-Change Accessory Kit for DM-Series Meters

## DISPLAY

**Number of Digits**

3 decimal digits and most significant "1" digit (3½ digits)

**Decimal Points**

Selectable decimal points are included for scale multipliers

**Display Type**

Field effect liquid crystal displays (LCD) requiring room light for viewing. Black digits against a light background

**Display Height**

0.5 inches (12.7 mm)

**Overscale**

Inputs exceeding the full scale range blank the display, leaving a "1" MSD and sign

**Autopolarity**

A minus sign is automatically displayed for negative inputs, and may also be blanked

**Sampling Rate**

Factory set at 3 conversions per second. May be rewired up to 20 conversions/second

**Descriptors**

k $\Omega$ , mA, mV, ACDC. This field of function labels is positioned to the right of the decimal digits. Individual unit descriptors may be selected for display

## I/O CONNECTIONS

**Analog HI Input (Pin B4)****Analog LO Input (Pin A2)**

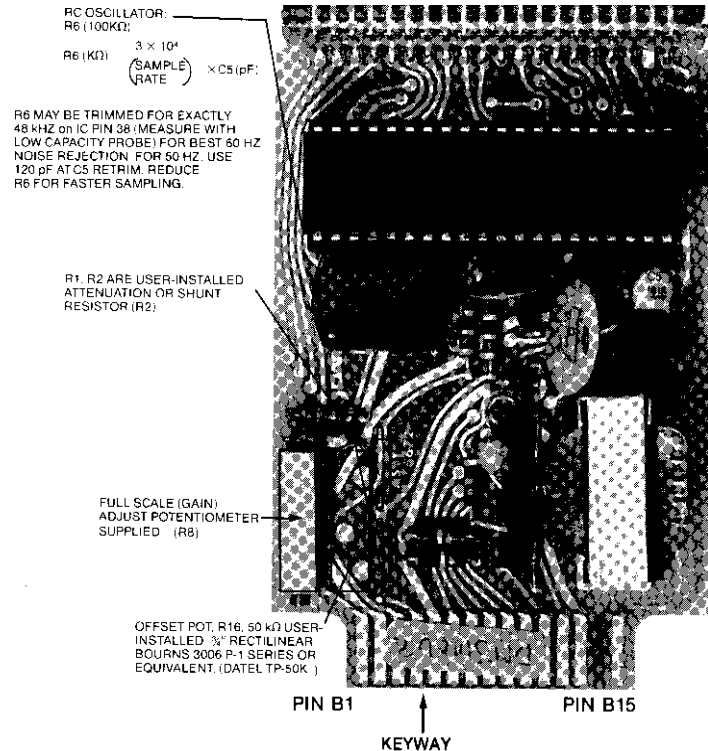
Differential input voltages are connected between these inputs. A bias current path to POWER COMMON (if 5V-powered) or ANALOG RETURN from both these inputs must be externally provided. External circuits must constrain these inputs to be within the common mode voltage range.

## DM-3100U2, DM-3100U3 COMPONENT LOCATIONS \*

\* Refer to DATEL RN-3100/4100 Range-Change Accessory Kit data sheet for detailed modification instructions and R1 & R2 locations.

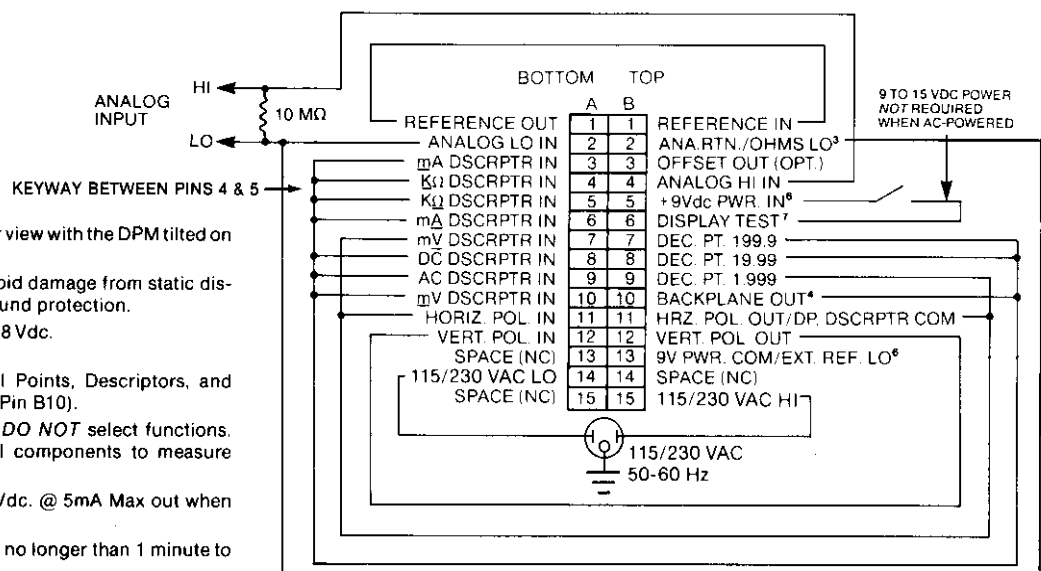
## NOTES:

- (1) R1, R2 ARE USER-INSTALLED ATTENUATION OR (R2) SHUNT RESISTORS. BEFORE INSTALLING RESISTORS AT R1, OPEN SOLDER GAP (SG1) ON COMP. SIDE OF BOARD WITH A SOLDERING IRON. NOTE THAT, IF R1 IS LATER REMOVED, THE USER MUST CLOSE THE SOLDER GAP.
- (2) ALL UNUSED DESCRIPTORS AND DECIMAL POINTS MUST BE CONNECTED TO B10 (BACKPLANE OUT).



## INPUT/OUTPUT CONNECTIONS WITH SINGLE-ENDED INPUT

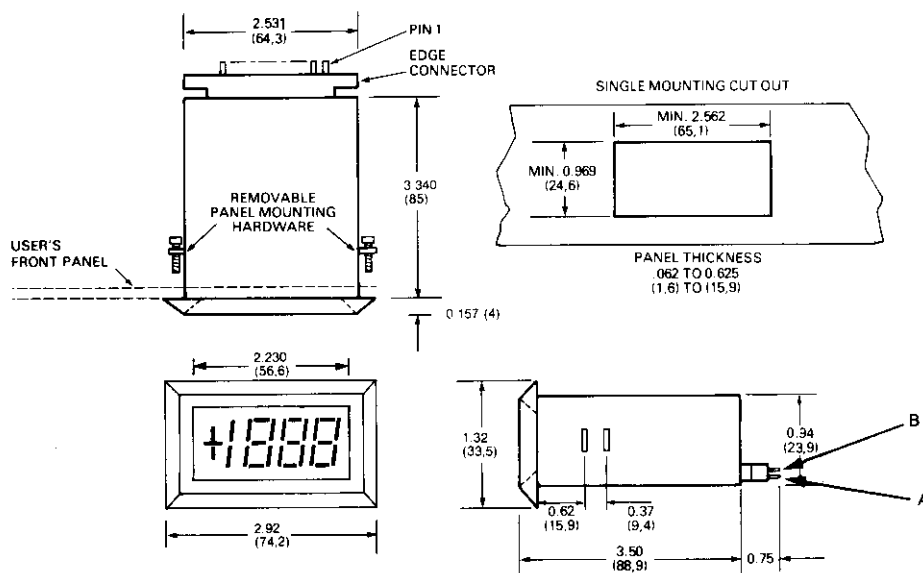
## DM-3100U2, DM-3100U3



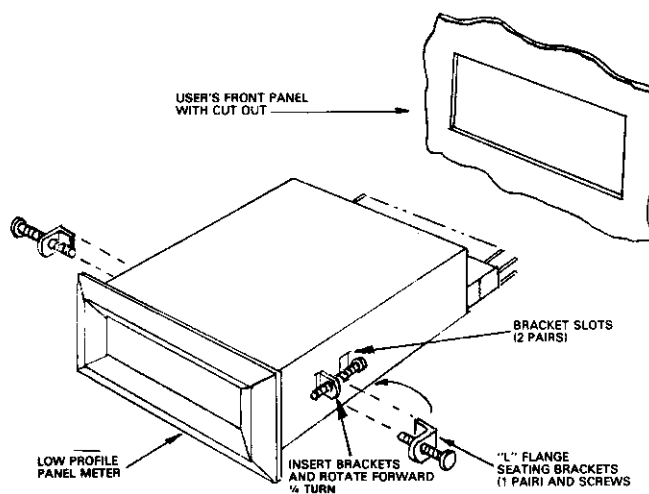
## NOTES:

1. This shows the connector rear view with the DPM tilted on its side.
2. CAUTION: CMOS inputs. Avoid damage from static discharge. Handle only with ground protection.
3. ANALOG RETURN = +Vs - 2.8 Vdc.
4. Connect all unused Decimal Points, Descriptors, and Signs to BACKPLANE OUT (Pin B10).
5. Descriptors A3 through A10 DO NOT select functions. Users must install additional components to measure Ohms, mA, etc.
6. 5B/13B = Approximately 12 Vdc. @ 5mA Max out when AC powered.
7. Hold meter in DISPLAY TEST no longer than 1 minute to prevent damage to display.

## MECHANICAL DIMENSIONS INCHES (MM)



## PANEL MOUNTING



## PANEL INSTALLATION INSTRUCTIONS

The low profile case is retained in a front panel cutout by sliding the DPM housing in through the cutout opening and securing the housing from the rear using 2 "L" brackets and screws. Proceed as follows:

1. After determining the correct position, form a cutout in the mounting panel. Refer to the cutout drawing for proper dimensions.
2. Install the panel meter from the front (display) side of the mounting panel as shown.
3. There are two pairs of slots in the side of the case to receive the L-brackets and retaining screws. Most applications will use the front pair of slots. For panels thicker than about 0.25 inches (6 mm), use the rear slot pair.
4. A thin plastic molding may cover the selected slots. This can be broken through with the L brackets in the next step or can be removed using a screwdriver or knife before panel mounting.
5. Assemble the supplied 4-40 screws into the L brackets as shown, turning the screw until several threads are engaged.
6. **Using the screw as a lever**, push the short side of the bracket into the slot as shown and **rotate the**

**screw backwards** ¼ turn until the screw is parallel to the case side and the L bracket is fully captured in the case.

7. Lightly tighten the screws against the front panel.

## CIRCUIT BOARD ACCESS

If access to the internal circuit board is required, bow the rear cover plate backward by prying up in the center with a small screwdriver or knife blade, to release the two catches in the side of the case. When reinstalling the circuit board, first be sure the front filter is flush against the inside of the housing. The circuit board engages a pair of guide tracks which are molded inside the case. When reinstalling the rear cover plate, be sure the trim pot access hole is to the lower left when facing the rear. Compress the cover plate slightly so that it snaps into the two retaining slot catches at the rear sides.

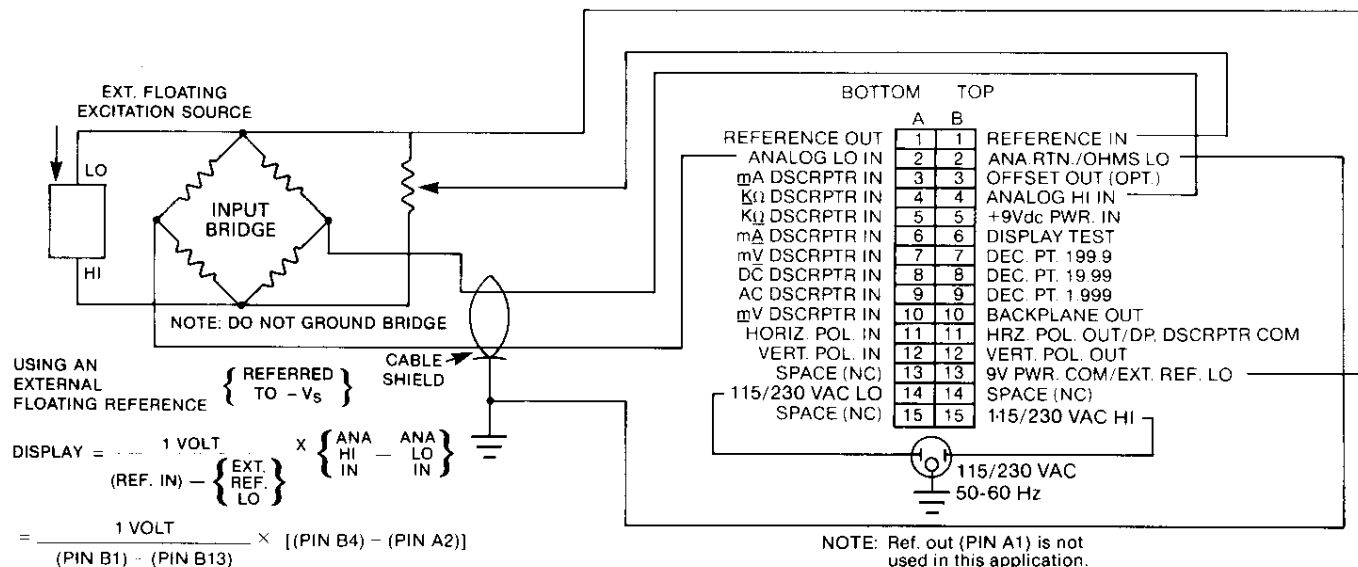
If a second user-fabricated circuit board is installed in the upper pair of board guide tracks, the upper connector slot (if used) in the rear cover plate may be opened by using a knife from inside the cover.

## DIFFERENTIAL INPUT WITH SAMPLE RATIOMETRIC CONNECTIONS

The DM-3100U2, -U3 has a reference in-out loop which makes possible ratiometric measurements. Representative connections are illustrated below. Ratiometric operation eliminates changes in the DPM reading due to voltage variations in the bridge's external excitation source. The input gain on the DM-3100U2, -U3 varies inversely with voltage at Reference In—as REF IN voltage increases meter gain decreases. Meter input gain thus can be made to compensate for variations in the bridge excitation source voltage. (The DPM is set for unity gain when REF IN V equals +1V as referred to EXT. REF. LO).

For all applications,  $V_{IN} = 2 V_{REF}$  at full scale (1999 counts). For small values of  $V_{REF}$  (100 mV or lower), increased display noise, nonlinearity, rollover and CMR errors will be apparent. Avoid  $V_{REF}$  inputs beyond about 2V to prevent integrator saturation with full scale inputs. Variable  $V_{REF}$  is not intended for wide gain changes as in multimeter applications. Instead, it should be used for drift correction, scaling to engineering units, or for modest amounts of gain.

DM-3100U2, U3

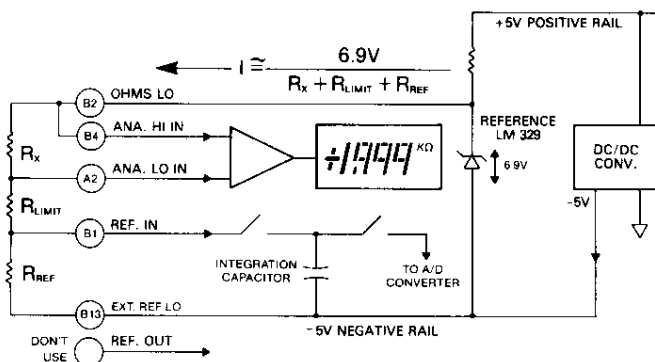


## DIGITAL OHMMETER CONNECTIONS

The digital ohmmeter circuit uses the DM-3100U2, -U3's ratiometric capability. An external reference resistor of known resistance, accuracy, and temperature drift is connected in series with the unknown resistance. A constant, stable volt-

age from the DPM's internal reference diode is applied to the resistor pair to produce a constant current. This current develops two voltage drops across the resistors which are proportional only to the ratio of the resistances since the current through them is identical.

The chart below lists recommended  $R_{REF}$  and  $R_{LIMIT}$  resistance values corresponding to different ohmmeter ranges. Values of  $R_{LIMIT}$  were selected to limit the current through  $R_{REF}$  and  $R_x$  to 1 milliampere maximum.



$$\text{DISPLAY} = \frac{E_{IN}}{V_{REF}} \times 1V = \frac{I R_x}{I R_{REF}} \times 1V = \frac{R_x}{R_{REF}} \times 1V$$

RANGE	RESOLUTION	<sup>1</sup> R <sub>LIMIT</sub>	<sup>1</sup> R <sub>REF</sub>	DECIMAL POINT <sup>2</sup>
19.99 MΩ	10 kΩ	22 MΩ	10 MΩ	B8 to B11
1.999 MΩ	1 kΩ	3.6 MΩ	1 MΩ	B9 to B11
199.9 kΩ	100 Ω	360 kΩ	100 kΩ	B7 to B11
19.99 kΩ	10 Ω	36 kΩ	10 kΩ	B8 to B11
1.999 kΩ	1 Ω	6.2 kΩ	1 kΩ	B9 to B11

- <sup>1</sup>R<sub>Limit</sub> and <sup>1</sup>R<sub>Ref</sub> should be metal film, High Stability Resistors (AS RN60C).
- All unused decimal points must be connected together to B11 (BACK-PLANE OUT).

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