

# DM-4101N

## 4½ Digit Differential LED

### Digital Panel Meter

#### FEATURES

- Low Cost, Low Profile 4½ Digit DPM
- Balanced Differential Inputs
- Pin-for-pin replacement for DM-4100N<sup>1</sup>
- 1000 Megohm CMOS Input with 5 pA bias currents
- 20% brighter LED display
- Autozeroing with ratiometric reference for drift correction
- +5 Vdc input power — provides -5 Vdc @ 15 mA to power user circuits
- Low Profile case

<sup>1</sup>The DM-4101N is a pin-for-pin replacement for the DM-4100N, except that it provides ±5V Out for user circuits instead of ±15V Out.



#### GENERAL DESCRIPTION

The DM-4101N is a 4½ digit DPM (digital panel meter) offering high performance in a compact low-profile package. Analog voltages from ±1.9999 Vdc are converted to a digital code by an internal dual slope A/D converter. Other built-in circuits decode the digital signal, and cause it to be displayed on .3" high, red LED displays.

The DM-4101N is a pin-for-pin replacement<sup>1</sup> for the DM-4100N, offering improved performance at a lower price. The DM-4101N differs from the DM-4100N in having full differential analog inputs, which provide 86 dB of Common Mode Rejection. In addition, the display driver circuit on the DM-4101N has been improved to provide a 20% brighter LED display.

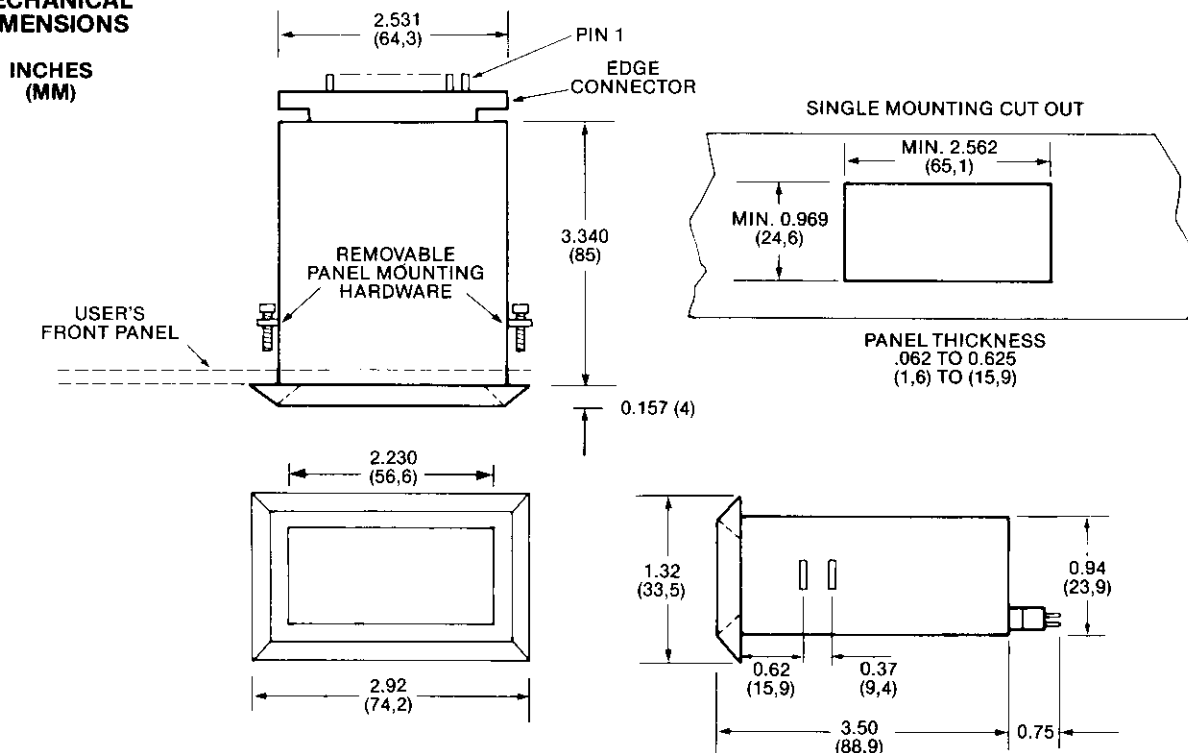
Like the DM-4100N, the DM-4101N offers such high performance features as ultra-high impedance analog signal inputs (1000 MΩ, typically) which require extremely low input bias cur-

rents (5 pA typical). Inputs are bipolar and autozeroed. Built-in circuit pads on the DM-4101N's converter board will accept user-supplied current shunts to extend the full scale input range to currents from ±20 μA to ±2A. Voltage ranges to ±1 kV full scale may also be set with user-supplied components.

Other features include Overrange and Underrange Outputs which can be used in external autoranging circuits; a Hold input which permits display of a given value indefinitely; and a Busy/Done line which goes low at the end of a conversion cycle. The DM-4101N's display may be disabled to reduce power consumption, while keeping the A/D converter cycling. A Reference In/Out line can accept an external reference for use in ratiometric and bridgetype applications.

Power to the meter is +5 Vdc @ 250 mA max. -5V Out @ 15 mA is available to power user circuits.

#### MECHANICAL DIMENSIONS



## SPECIFICATION

(Typical at +25°C, unless noted)

### ANALOG INPUT

<b>Configuration</b> .....	True balanced differential bipolar inputs. Note: The analog input is single-ended as shipped. Open SG5 for differential inputs.
<b>Full Scale Input Range</b> .....	– 1.9999 Vdc to + 1.9999 Vdc
<b>Optional Ranges</b> .....	User-supplied components will extend range to $\pm 1$ kV full scale. User-supplied current shunts extend the full scale input range to currents from $\pm 20 \mu\text{A}$ to $\pm 2\text{A}$ . Note: Optional ranges are available on special order in OEM quantity from Dattel-Intersil.
<b>Input Bias Current</b> .....	5 pA typical, 50 pA maximum
<b>Displayed Accuracy @ +25°C</b> .....	Adjustable to $\pm 0.02\%$ of reading, $\pm 2$ counts
<b>Resolution</b> .....	100 $\mu\text{V}$ in last digit
<b>Temperature Drift of Zero</b> .....	Autozeroed $\pm 1$ count over 0 to +50°C
<b>Temperature Drift of Gain</b> .....	+50 ppm of Reading/ $^{\circ}\text{C}$ typical, $\pm 100$ ppm of Reading/ $^{\circ}\text{C}$ max.
<b>Input Impedance</b> .....	100 Megohms, minimum; 1000 Megohms, typical
<b>Input Overvoltage</b> .....	ANA. LO IN: $\pm 5\text{V}$ max. continuous referred to Power Common ANA. HI IN: $\pm 100$ Vdc max. continuous or $\pm 250$ Vdc (5 sec. Max.) referred to Power Common
<b>Reference</b> .....	Internal, referred to Analog Return. An external, user-supplied reference is optional for ratiometric operation.
<b>External Reference Range</b> .....	+100 mV to +2V, referred to Analog Return
<b>Common Mode Rejection</b> .....	86 dB typical to Analog Return at DC
<b>Common Mode Voltage Range</b> .....	Both inputs must remain within $\pm 4.0$ Vdc of Power Common
<b>DISPLAY</b>	
<b>Number of Digits</b> .....	Four decimal digits and most significant "1" digit (4 1/2 digit)
<b>Display Type</b> .....	Red, light-emitting diode (LED), self-illuminated
<b>Display Height</b> .....	0.3 inches (7,6 mm)
<b>Overscale</b> .....	Inputs exceeding the full scale range cause the display to blink
<b>Autopolarity</b> .....	A minus sign is automatically displayed for negative voltage inputs and may also be blanked.
<b>Sampling Rate</b> .....	Approximately three conversions per second

### INPUT/OUTPUT CONNECTIONS

<b>Decimal Points</b> .....	Right-of-digit selectable decimal points are included for scale multipliers. (Note: This does not change the $\pm 2\text{V}$ input range)
<b>Busy/Done Out (Pin 2)</b> .....	This output is logic "HI" during A/D conversion and logic "LO" when conversion is complete. It may be used in automatic equipment to prevent changing the input voltage during conversion.
<b>Overscale Out (Pin 6)</b> .....	Overscale is "HI" if the previous input exceeds the A/D converter range of $\pm 19999$ counts.
<b>Underscale Out (Pin 7)</b> .....	Underscale is "HI" if the previous input displays $\pm 1800$ counts or less. Underscale and overscale are normally used as up/down ranging gain selection controls for an auto-ranging input section.
<b>Analog HI Input (Pin H)</b> .....	
<b>Analog LO Input (Pin 5)</b> .....	The input is supplied single-ended with Analog LO internally connected by solder gap SG5 to Analog Return (Pin K). The user may open SG5 to achieve differential inputs. The user must supply external circuits to supply bias currents and to not exceed the $\pm 4\text{V}$ common mode voltage range.
<b>Reference In/Out (Pin 4)</b> .....	The instrument is calibrated when a +1.0 Vdc drop exists between Pin 4 and Pin K
<b>Decimal Points (Pins A, B, C, D)</b> .....	Connect selected pin to Decimal Point Common (Pin 1)
<b>Display Enable In (Pin 8)</b> .....	Connect to +5 Vdc power to illuminate display. Disconnect to blank display but keep A/D converter cycling.
<b>Run/Hold In (Pin 3)</b> .....	A TTL "HI" or open pin enables continuous sampling. TTL "LO" or ground will hold and display the last sample for temporary single sample storage or to copy down a reading.
<b>Display Test (Pin J)</b> .....	Ground this input to light all display segments (18888). Otherwise, leave this pin open.
<b>Polarity Enable IN (Pin 10)</b> .....	Ground this input to automatically display a minus (–) sign for negative inputs.
<b>Analog Return (Pin K)</b> .....	Must be externally connected to Pin L.

### POWER REQUIREMENTS

External +5,  $\pm 0.25$  Vdc regulated required at 250 mA typical, 350 mA maximum (65 mA typical with the display and polarity disabled). Logic spikes must not exceed 50 mV. Power current varies rapidly so that unregulated supplies cannot be used. +5V OUT and –5V OUT currents must be added to the +5V IN power requirements.

### PHYSICAL-ENVIRONMENTAL

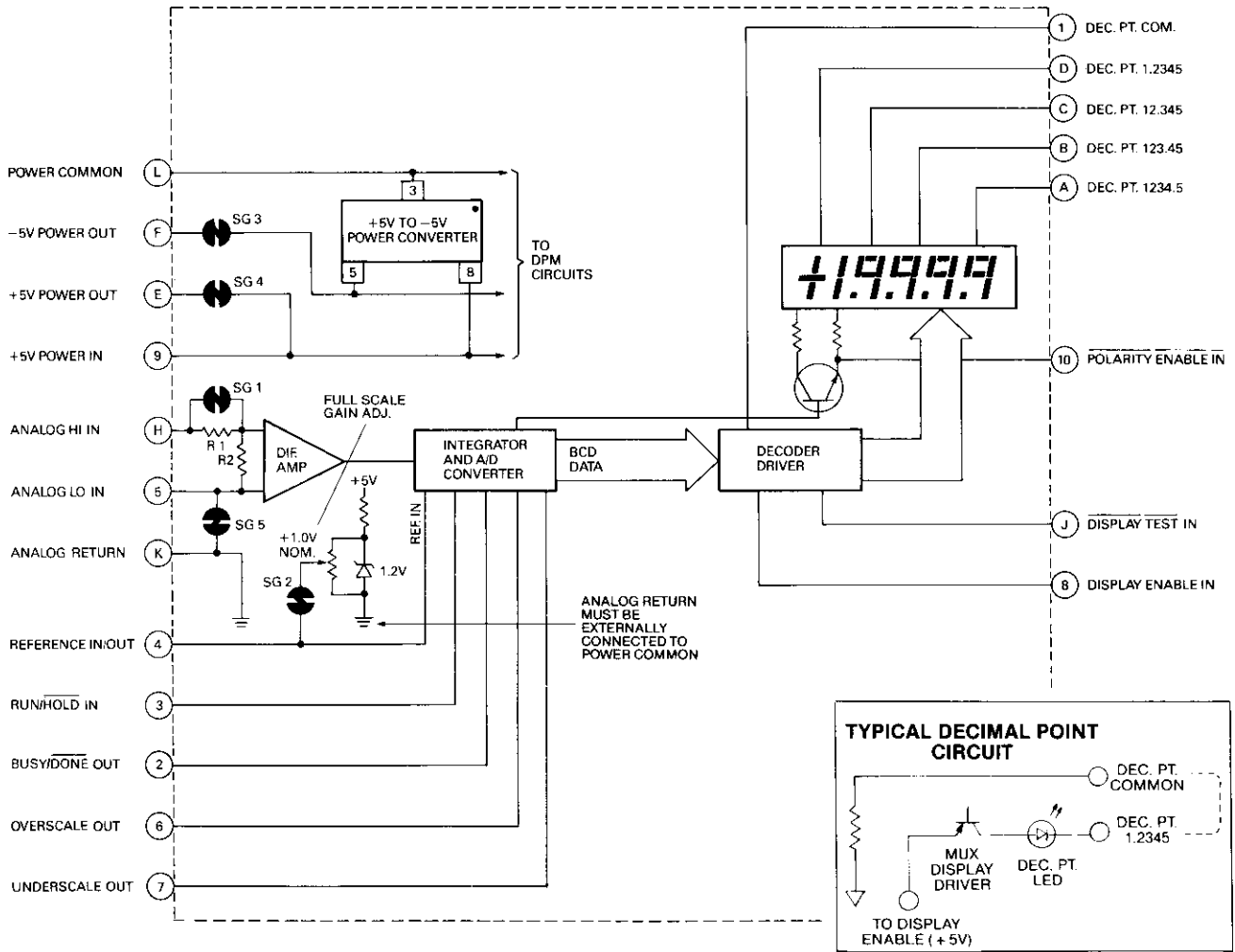
<b>Outline Dimensions</b> .....	2.53"W $\times$ 3.34"D $\times$ 0.94"H (64,3 $\times$ 84,8 $\times$ 23,8 mm)
<b>Cutout Dimensions</b> .....	2.562"W $\times$ 0.97"H min (65,1 $\times$ 24,6 mm)
<b>Mounting Method</b> .....	Through a front panel cutout secured by brackets and two removable side case screws. Panel thickness up to 0.62" (15,9 mm)
<b>Weight</b> .....	Approximately 5 ounces (142g)
<b>Connector</b> .....	Dual 10-pin. 0.156" centers
<b>Mounting Position</b> .....	Any
<b>Operating Temperature Range</b> .....	0 to +50°C

### Ordering Information

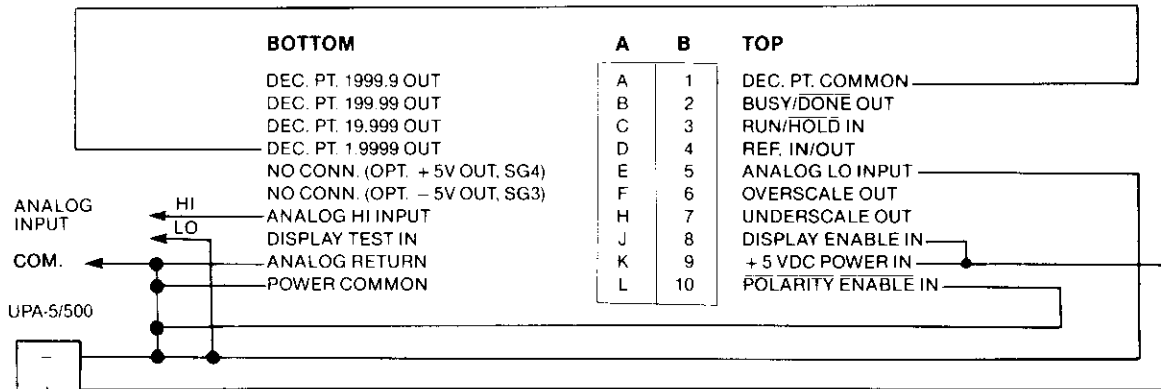
**DM-4101N-1:**  $\pm 2\text{Vdc}$  Input Range (Supplied With Free Connector)

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

SIMPLIFIED BLOCK DIAGRAM



TYPICAL INPUT/OUTPUT CONNECTIONS (DIFFERENTIAL)



NOTES:

- 1.) Open SG2 to input external reference.
- 2.) Datal-Intersil UPA-5/500 is an external, user supplied 115-VAC to 5V/5A regulated, isolated power adapter.
- 3.) Above drawing indicates DPM rear connector, with DPM on its side.
- 4.) Analog return must be externally connected to Power Common.

## INTERNAL MODIFICATIONS

Attenuator and shunt resistor pads are supplied on the bottom DPM printed circuit board to allow the user to program higher current or voltage ranges. Datel will also modify these meters on special order in OEM quantities only.

**CAUTION:**

Such modification should only be attempted by users skilled at miniature electronic assembly. Improper soldering or fabrication procedures can damage the DPM and void the product warranty.

Input attenuator resistors and shunt (R1, R2), solder gaps and jumpers are located by removing the DPM circuit board from its housing.

For the Low Profile miniature models, remove the rear connector and remove the rear cover by inserting a small screwdriver between the cover and the case. Bow the cover backward to release the 2 catches in the side of the case. Slide the circuit board out backwards. After modification, be sure the front filter is in place, then slide the bottom board between the guide rails molded into the case. The rear cover will need to be compressed slightly to fit back into the slots in the case.

Solder Gap 5 (which single-ended-grounds Analog LO In) is located on the bottom (non-component) side of the lower board, in parallel with R1. R1 and R2 are found on the top of the lower board by tracing the Analog HI Input pin etc.

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

**CAUTION:**

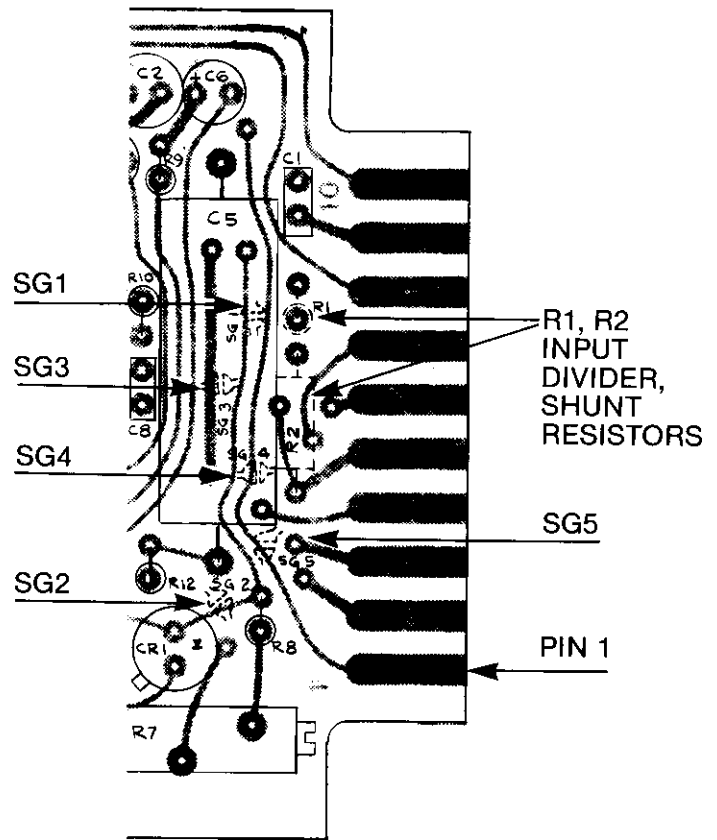
The DM4101N utilizes extremely high impedance, low bias current CMOS differential inputs. Both inputs must remain within the Common Mode Input Voltage Range (CMV) which is within  $\pm 4V$  of Power Common. There is no internal circuitry in the DM-4101 to insure that the CMV range will not be exceeded. To do so would compromise performance in high source resistance applications and with sensitive, high accuracy bridges. The user must provide external circuits to observe the CMV requirement and to supply the tiny but finite input bias currents which would otherwise force unterminated inputs into saturation outside the CMV range. Usually, bridge inputs or external high value input-zeroing load resistors will perform this function. Single-ended input sources under 10 megohms also do this. Call Datel-Intersil's application engineering department at the home office if you need technical assistance.

The inputs are protected from 115/230V AC power line voltage but not from high voltage static discharge. Use ground protection during handling and installation, especially in low humidity environments.

## WARRANTY INFORMATION

NOTE: Datel-Intersil's Digital Panel Meters are warranted to be free from defects in materials and workmanship when operated as described in this brochure for a period of one year from the date of shipment. This information is believed to be sufficient for the user to determine and be responsible for the selection, application and specification of this product for the user's intended usage. This warranty is expressed in lieu of all other warranties, expressed or implied, including the implied warranty of fitness for a particular purpose and of all other obligations or liabilities on the seller's part. The warranty neither assumes nor authorizes any other person to assume for the seller any other liabilities in connection with the sale of the said articles.

## INTERNAL COMPONENT LOCATIONS \*

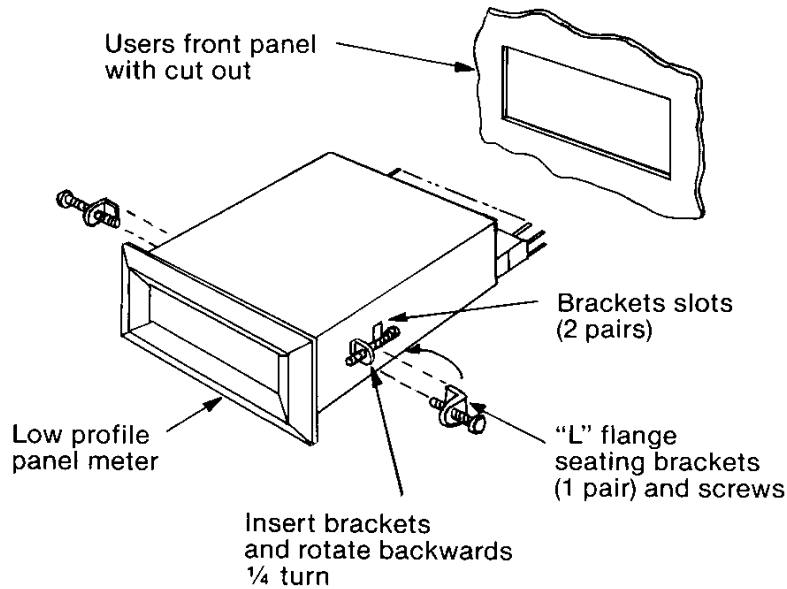


Suggested operating modes such as voltage attenuation or current shunt measurement may include components which are internally installed by the user. Since the selection of these components and the manner of installation is beyond Datel-Intersil's control, the warranty extends only to products which operate as standard, unmodified units. This means that Datel-Intersil will honor warranties on products which have been restored to their original condition (that is, added or modified components will have been removed by the customer before returning the product for repair). Further, the customer must insure that the product was not damaged by the addition and removal of components. Such damage would void the original product warranty.

As a practical matter, users have several alternatives to insure warranty protection. Although this product is 100% functionally tested and inspected, a thorough incoming inspection by the customer should be considered before modification. Those original components of the DPM (displays, IC's, etc.) will be warranted if defective (and, in Datel's opinion, not subject to catastrophic user damage).

Users may also partially remove components (one lead of a shunt resistor, for example) to restore the DPM to original condition while expediting return to the user's modified condition, once Datel has repaired the product.

The intent of this procedure is to allow rapid diagnosis and repair on Datel's test fixtures. Because of the variety of possible DPM modifications, Datel test fixtures can only test unmodified products.



### 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.

### UPA-5/500 + 5V REGULATED POWER ADAPTER FOR DPM'S

#### FEATURES:

- ▶ 115 VAC (± 10%) line power provides + 5 Vdc Out (± 6%) @ 500 mA
- ▶ Line and Load regulated to within 0.3% of rated output
- ▶ Ripple and noise measure less than 8 mV RMS
- ▶ Plugs directly into U.S. power outlets
- ▶ Provides isolated, low voltage operation of meter
- ▶ Designated for U.L. and C.S.A. Listing
- ▶ Low cost \*15.75 (singles)

#### COMPATIBLE WITH

- ▶ DM-3100L, DM-3100N, DM-3100U1, DM-3100X, DM-2115, DM-350, DM-31, DM-LX3, DM-4100L, DM-4100N, DM-4100D.
- ▶ Any DPM which requires + 5 Vdc power at 500 mA or less.

#### SPECIFICATIONS

Input Voltage	115VAC + 10%
Input Frequency	60 HZ
Output Voltage	+ 4.8 to + 5.3Vdc
Output Current	0-500 mA
Regulation (0 to 500mA)	
Line and Load	0.3% typ.
Ripple/Noise	8mV RMS max.
Breakdown Voltage	1500 VAC min.

