

## FEATURES

**Discontinued**

- 24-pin, DDIP package
- Single +5V supply
- Laser trimmed to  $\pm 0.05\%$  ( $\pm 1$  digit)
- Models for  $\pm 200$  mV dc,  $\pm 2$  V dc, or  $\pm 20$  V dc input range
- User-selectable decimal point placement
- Fully autozeroing, auto-polarity changeover
- DISPLAY TEST pin
- Red filter, transparent case
- Low power STANDBY mode
- Hermetic version (DMH-30MM) with extended temperature range per MIL-D-87157

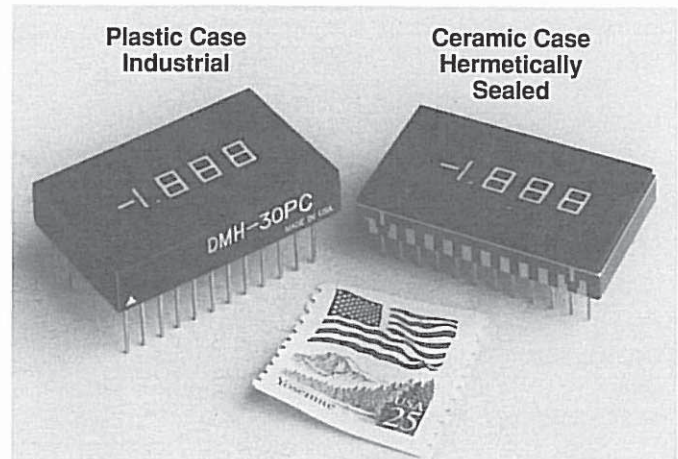
## GENERAL DESCRIPTION

Housed in a standard 24-pin DDIP package, Murata's DMH-30 is the smallest functionally complete 3 1/2 digit, LED display voltmeter available.

It is an ideal component for high performance measurement systems requiring a small display area. Designed for direct PC board mounting, it lends itself to space-critical applications such as avionics instrumentation displays.

The DMH-30 packs many useful features into a small package. In STANDBY mode the display is off, reducing current consumption to 1 mA. This feature is best for battery-powered applications.

Models available include both plastic and hermetically sealed ceramic DDIP versions with input voltage ranges of  $\pm 200$  mV,  $\pm 2$  V, and  $\pm 20$  V. All versions feature laser-trimmed accuracies of  $\pm 0.05\%$  of reading,  $\pm 1$  count typical.



High impedance, differential inputs of 1,000 M $\Omega$  (1 M $\Omega$  for the DMH-30XX-2) minimize circuit loading. A single +5V supply at 200 mA is all that is needed for complete operation. Operation extends over the 0 to +60 °C (DMH-30PC) and -40 to +75 °C (DMH-30MM) temperature ranges.

Other features include an internal reference, full autozeroing, auto-polarity changeover, user-selectable decimal point placement and overrange indication.

## APPLICATIONS

- Board-level diagnostics
- Automatic test equipment
- Lab/test instruments
- Portable monitors
- Weigh scales
- Avionics Displays
- Digital thermometers

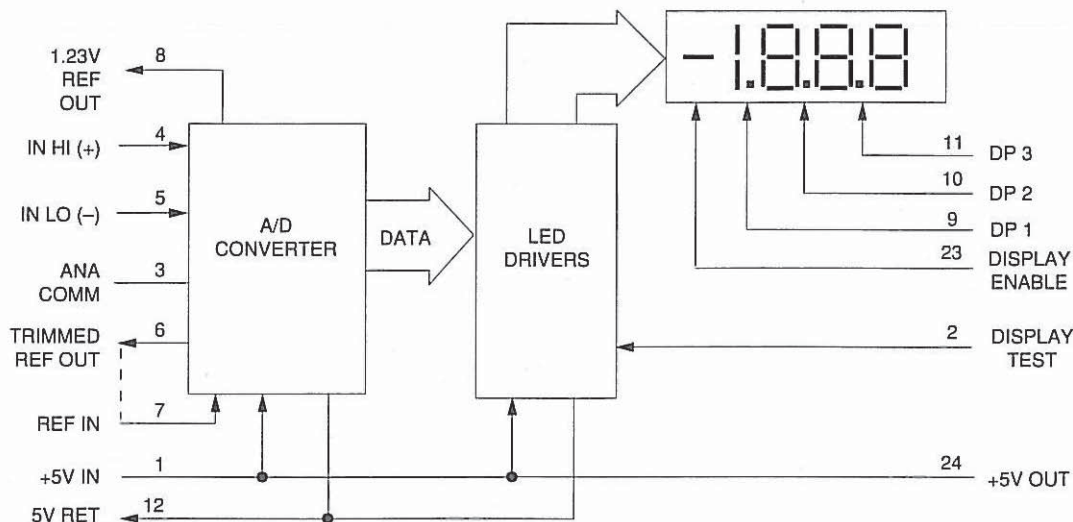


Figure 1. DMH-30 Simplified Block Diagram

### FUNCTIONAL SPECIFICATIONS

Specifications cited are derived from tests at ambient temperature of +25 °C and supply voltage (V<sub>CC</sub>) of +5.0V dc unless otherwise specified. Specifications are for all models unless otherwise noted, using the circuit shown in Figure 4a.

INPUT	MIN	TYP	MAX	UNITS
Full Scale Input				
DMH-30XX-0	—	±200	—	mV dc
DMH-30XX-1	—	±2	—	V dc
DMH-30XX-2	—	±20	—	V dc
Input Impedance				
DMH-30XX-0; -1	100	1000	—	MΩ
DMH-30XX-2	0.8	1.1	—	MΩ
Input Overvoltage	—	—	±250	V dc
Common Mode Volt. Range	—	—	±2.0	V dc
CMR, dc to 60 Hz	—	86	—	dB
Sampling Rate	—	2.5	—	Samp./S
PERFORMANCE				
Accuracy, after 3 minute warm-up time				
DMH-30XX-0 (V <sub>IN</sub> = 0.19000V)	—	±1	±2	Counts
DMH-30XX-1 (V <sub>IN</sub> = 1.9000V)	—	±1	±2	Counts
DMH-30XX-2 (V <sub>IN</sub> = 19.000V)	—	±2	±3	Counts
Zero Reading (V <sub>IN</sub> = 0V)	—	0	±1	Counts
Temperature Drift of Gain				
DMH-30PC-X (0 to +60 °C)	—	±0.15	±0.3	Cnts/ °C
DMH-30MM-X (-40 to +75 °C)	—	±0.15	±0.3	Cnts/ °C
1.23V REF OUT ①	+1.200	+1.230	+1.250	V dc
PHYSICAL				
Display Type and Size	3 1/2 digit red LED, 0.165" high			
Polarity Indication	Autopolarity ("—" for negative V <sub>IN</sub> )			
Overrange Indication	-1... for negative V <sub>IN</sub> 1... for positive V <sub>IN</sub>			
Weight	0.5 oz. (nominal)			
Case Material				
DMH-30PC	Acrylic			
DMH-30MM	Ceramic			
ENVIRONMENTAL				
Operating Temperature				
DMH-30PC	0 to +60 °C			
DMH-30MM	-40 to +75 °C			
Storage Temperature				
DMH-30PC	-40 to +75 °C			
DMH-30MM	-50 to +100 °C			
Humidity	0 to 95% non-condensing			
POWER SUPPLY REQUIREMENTS				
Supply Voltage (pin 1 to 12)	+4.75	+5.00	+5.25	V dc
Supply Current	—	120	200	mA

① 1.23V REF OUT (pin 8) referenced to ANA COMM, (pin 3) at 15 µA maximum.

### TECHNICAL NOTES

1. **Decimal Point Selection** - The decimal point is user-selectable for various application needs. Select the appropriate decimal point by strapping pins 9, 10, or 11 to +5V IN, (pin 1), or DISPLAY ENABLE (pin 23).

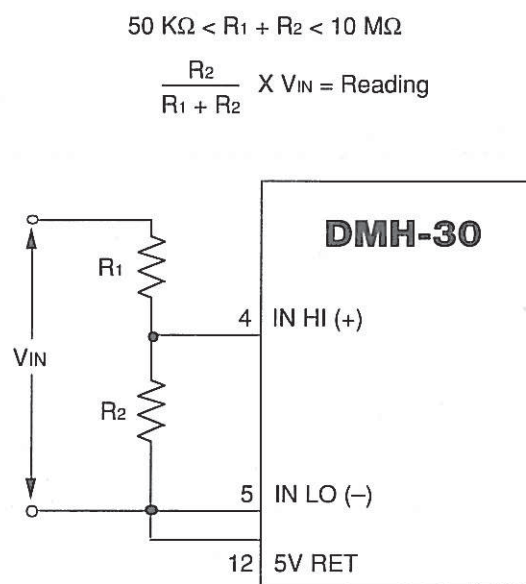
2. **Display Test** - To test the LED display, connect the DISPLAY TEST (pin 2) to +5V IN (pin 1). When enabled, this function replaces the actual input value and creates a display of 1888. DISPLAY TEST will show the minus sign only when a negative value exists on the input. *Do not leave in test mode for more than 10 seconds.*

3. **Enable Display** - Connect the DISPLAY ENABLE (pin 23) to +5V OUT (pin 24) to enable the display. Leaving pin 23 open reduces the overall power consumption to 1 mA. The meter could be operated to provide a display only when needed.

### APPLICATIONS

The DMH-30 is highly versatile and is designed for use in many applications measuring a variety of parameters. The small size, readability and very accurate measurement capabilities of the DMH-30 make it the best alternative for any application.

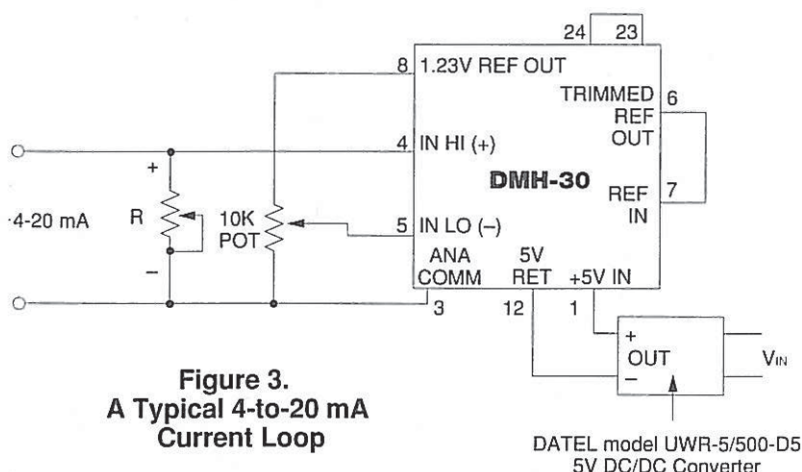
**Engineering Scaling** - the most common parameters measured with the DMH-30 are voltages. In some cases users will have to attenuate the input voltage if it is larger than the rated voltage limit. The simple circuit in Figure 2 can attenuate and/or scale the input variable.



**Figure 2. Simple Attenuation Circuit for Scaling Input Voltages**



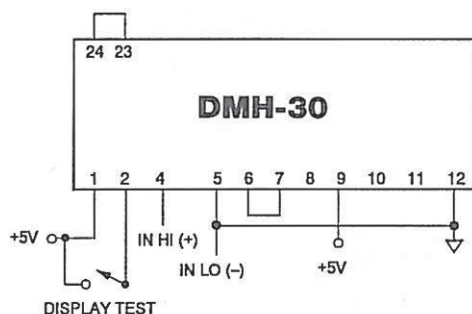
**Process Control Signal Measurement 4-to-20 mA** - In process control applications, a 4-to-20 mA current loop transmits control signals. The DMH-30 uses a shunt resistor across the input. The value of the shunt resistor is dependent upon scaling requirements of the application and can be calculated. A potentiometer tied between the 1.23V REF OUT (pin 8) and ANA COMM (pin 3) provides an offset adjustment.



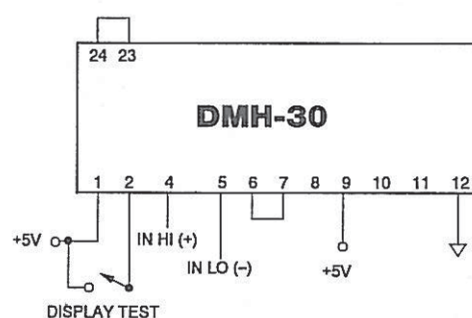
**Figure 3.**  
**A Typical 4-to-20 mA**  
**Current Loop**

## Input Configuration

**Analog Input Connections** - For single ended measurements, tie IN LO (-) (pin 5) to ground as shown in Figure 4a. For differential inputs, use the connections shown in Figure 4b; do not exceed the Common Mode Voltage limit of  $\pm 2V$  dc.



**Figure 4a. Typical Single-Ended Input Connections**



**Figure 4b. Typical Differential Input Connections**

## SHUNT RESISTOR VALUE

Where:  $V_{FSR}$  = Full Scale Voltage Reading  
 $I_{FSR}$  = Full Scale Current

$$R = \frac{V_{FSR}}{I_{FSR}}$$

For 2V full scale:

$$R = \frac{2 - 0}{20 - 4} = \frac{2V}{16 \text{ mA}} = 125 \Omega$$

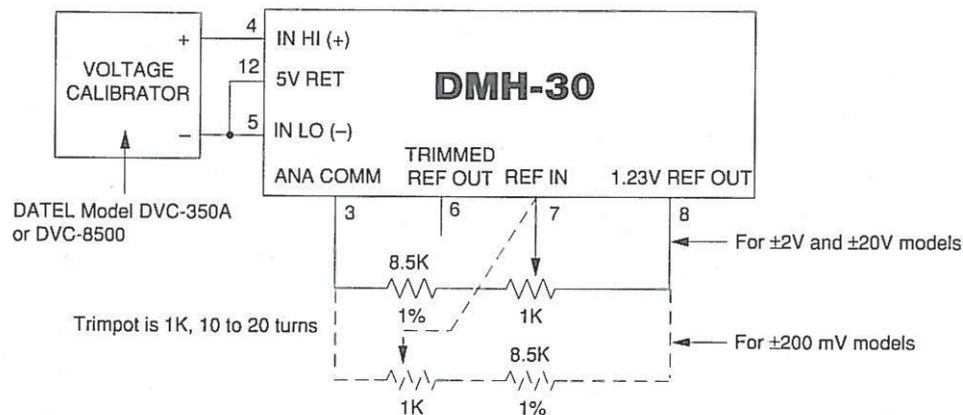
A 200  $\Omega$  potentiometer would work well for this voltage range. Adjust the pot before placing it in the circuit.

Note: the UWR-5/500-D5 provides the required isolation between the +5V supply and the 4-to-20 mA current loop

To calibrate the circuit shown in Figure 3, do the following:

1. With 4 mA applied, adjust the 10K pot to obtain a reading of "0", if desired.
2. With 20 mA applied, adjust R to desired full scale reading.
3. Repeat steps 1 and 2 since both pots interact.

**Full Scale Calibration** - Strap the TRIMMED REF OUT (pin 6) to REF IN (pin 7) for normal, factory calibrated, operation. Use the 1.23V REF OUT (pin 8) for applications needing external gain adjustment. Figure 5 shows the wiring configuration for each model. Calibration is performed with a near full scale input precision voltage.

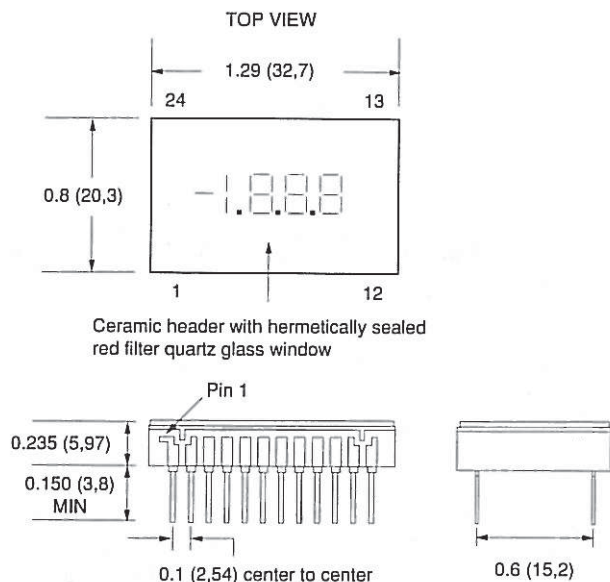


**Figure 5. Using the 1.23V REF OUT to Change the Calibration**

### MECHANICAL DIMENSIONS (ACTUAL SIZE)

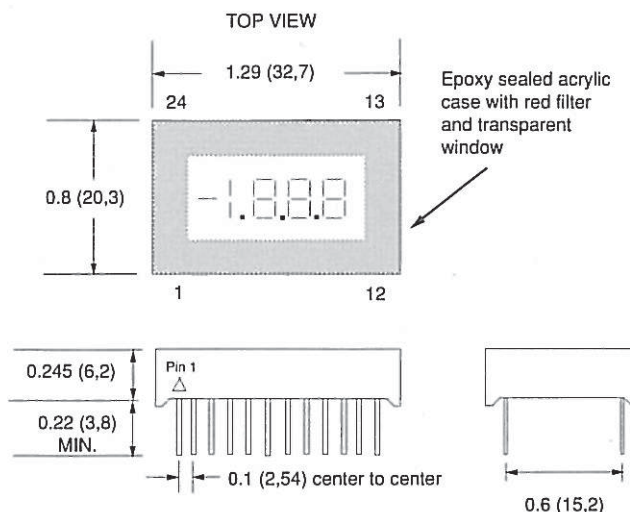
INCHES  
(mm)

#### DMH-30MM-X



**Note:** Pin Dimensions are 0.010 X 0.018 (0,254 X 0,457)  
Pins have a 0.025 (0,635) stand-off from case

#### DMH-30PC-X



**Note:** Pin Dimensions are 0.010 X 0.018 (0,254 X 0,457)  
Case has a 0.030 (0,762) standoff from mounting surface

**Soldering Information:** All models will withstand normal wave soldering with freon fms used in the cleaning step. Other soldering methods should be evaluated carefully as to their effect on the plastic case of the DMH-30PC-X.

### ORDERING INFORMATION

**DMH-30 Series 3 1/2 Digit, Mini Voltage Meters**

#### MODELS

<b>DMH-30PC-0</b>	±200 mV dc, Plastic package
<b>DMH-30PC-1</b>	±2V dc, Plastic package
<b>DMH-30PC-2</b>	±20V dc, Plastic package
<b>DMH-30MM-0</b>	±200 mV dc, Ceramic package
<b>DMH-30MM-1</b>	±2V dc, Ceramic package
<b>DMH-30MM-2</b>	±20V dc, Ceramic package

PIN	FUNCTION	PIN	FUNCTION
1	+5V IN	13	NO CONNECTION
2	DISPLAY TEST	14	NO CONNECTION
3	ANA COMM	15	NO CONNECTION
4	IN HI (+)	16	NO CONNECTION
5	IN LO (-)	17	NO CONNECTION
6	TRIMMED REF OUT	18	NO CONNECTION
7	REF IN	19	NO CONNECTION
8	1.23V REF OUT	20	NO CONNECTION
9	DP1	21	NO CONNECTION
10	DP2	22	NO CONNECTION
11	DP3	23	DISPLAY ENABLE
12	5V RET	24	+5V OUT

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