Murata Power Solutions

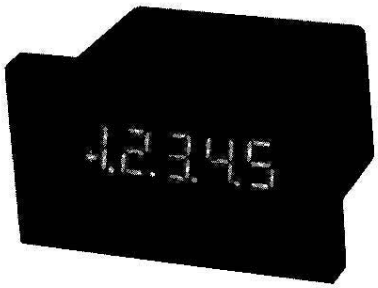
DM-4101L

4½-Digit DPM with BCD Outputs

Discontinued

FEATURES

- **Large .56" digits**
- **Pin-for-pin replacement for the DM-4100L**
- **Improved driver circuit for 20% brighter LED display**
- **±5V dc outputs at 15 mA for user's circuits**
- **Balanced differential inputs with 5 pA bias currents**
- **Internal ratiometric reference for drift correction**
- **Autozeroing with 86dB CMR noise rejection**
- **Short-depth case**
- **BCD Outputs available to drive DM-4103 slave displays**



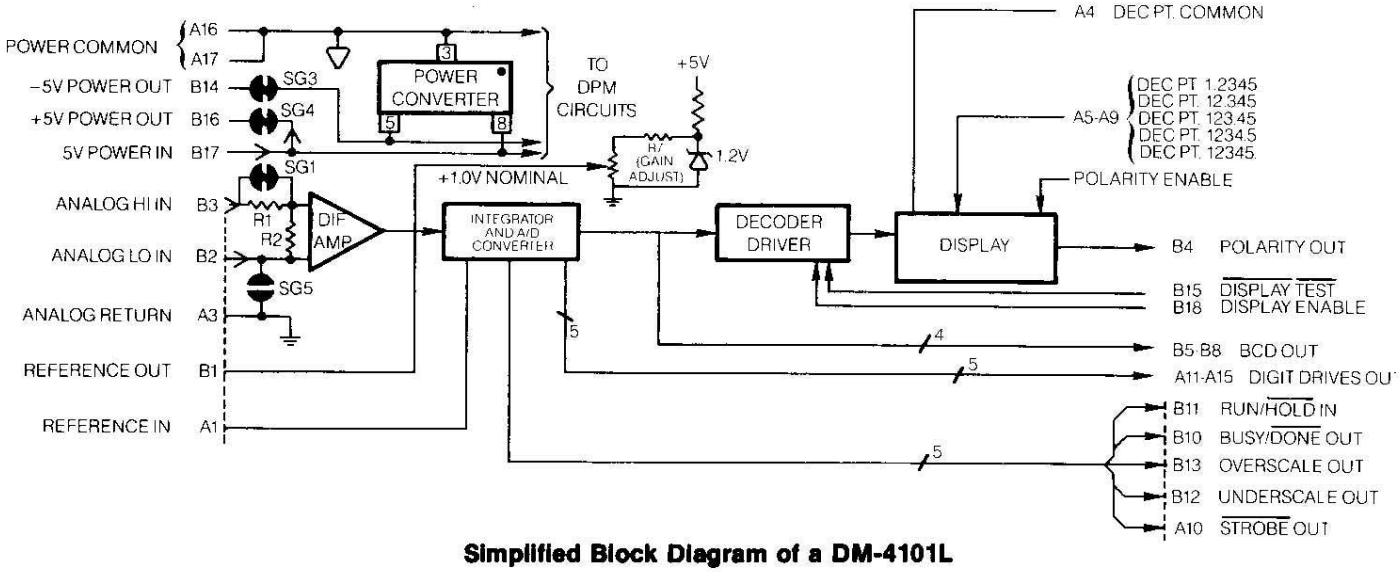
GENERAL DESCRIPTION

The DM-4101L replaces MPS's older DM-4100L DPM, offering higher performance at an even lower price. The improved display driver circuitry gives a 20% brighter output from the .56" high LED's. Besides offering MPS's standard input features, this device provides multiplexed BCD outputs. These outputs can drive a remote display, such as the DM-4103, or be used by an external microprocessor. This DPM is housed in a short-depth case, a feature appreciated by many OEM's.

The quality performance features of the DM-4100L have been retained. CMOS circuitry provides an extremely high input impedance (1000 Megohms), and extremely low input bias current (5 picoamps). The meter's dual slope converter autozeroes the input in each conversion cycle for a true zero reading. And a reference in/out loop permits use of the DM-4101L in ratiometric and bridge-type circuits.

Additional features include a Busy/Done Output which indicates when an A/D conversion is complete. Overscale and Underscale outputs can be used with external circuitry for autoranging. A Run/Hold line permits a reading to be held for several seconds while an operator copies down the reading. And an externally-accessible Display Enable line can blank the display to minimize power consumption, while the A/D converter and BCD outputs are running to drive an external slave display. BCD outputs, used in conjunction with a strobe line from the DM-4101L's A/D converter, can drive a remote slave display (Model DM-4103), or provide A/D data conversion for a microprocessor.

Power to the meter is +5V dc at 350 mA maximum. A dc-to-dc converter in the DM-4101L provides a -5V dc output (at 15 mA maximum) to power user circuitry.



Simplified Block Diagram of a DM-4101L

DM-4101L Specifications (Typical at +25°C, unless noted)

ANALOG INPUT

Configuration
True, balanced differential bipolar inputs (NOTE: Analog input is single-ended as shipped. Open SG2 for differential inputs)

Full Scale Input Range
−1.9999 Vdc to +1.9999 Vdc

Optional Ranges*
Up to ±1000 Vdc

Ammeter Ranges (Optional*)
±199.99 microamps to ±1.9999 Amps

Input Bias Current
5 pA typical, 50 pA maximum

Displayed Accuracy @ +25°C
Adjustable to ±0.02% of reading, ±2 counts

Resolution
100 μV in last digit

Temperature Drift of Zero
Autozeroed ±1 count over 0 to +50°C

Temperature Drift of Gain
± 50 ppm of Reading/°C typ., ± 100 ppm of Reading/°C max.

Input Impedance
100 Megohms, minimum, 1000 Megohms, typ.

Input Overvoltage
± 250 Volts dc., 175 VRMS continuous max.
±300 Volts intermittent max.

Common Mode Rejection
86 dB typical to Analog Return

Common Mode Voltage Range
Both inputs must remain within ± 4V of Power Common.

Reference
Internal, referred to Analog Return. An External, user-supplied reference is optional for ratiometric operation.

External Ref. Range
+100mV to +2V, referred to Analog Return.

Ramp-up Time (Integration Period)
83.3 mS

Sampling Rate
Approximately 3 conversions per second

*Note — The optional ranges require installation of extra components by the user inside the DPM. This is also available on special order in OEM quantities from DATEL.

DISPLAY

Number of Digits
4 decimal digits and most significant "1" digit (4½ digits)

Display Type
Red, light-emitting diode (LED), self-illuminated

Display Height
0.56 inches (14,2 mm)

Overscale
Inputs exceeding the full scale range cause the display to blink

Autopolarity
A minus sign if automatically displayed for negative voltage inputs, and may also be blanked

Sampling Rate
Approximately 3 conversions per second

Decimal Points
Right-of-digit selectable decimal points are included for scale multipliers

Busy/$\overline{\text{Done}}$ Out (Pin B10)
This output is HI during A/D conversion. The falling edge indicates that a new valid data Strobe output will appear in 1.3 milliseconds. The HI Busy level may be used by automatic equipment to prevent changing the input voltage during conversion. See the timing diagram.

$\overline{\text{Strobe}}$ Out (Pin A10)
Consists of 5 and only 5 negative pulses per A/D conversion of approximately 6.7 microseconds width and approximately 1.3 milliseconds apart issued after an A/D conversion. They indicate that valid multiplexed data is available on the BCD data output lines, starting with the Most Significant Digit (MSD). Note that the Polarity output is not part of the BCD data and that the BCD, when taken as 4 multiplexed bits only will be unsigned. A fifth line (Polarity Out, Pin B4), must be polled to determine the sign. Refer to the timing diagram.

Overscale Out (Pin B13)
Should be sampled after the Busy falling edge. Overscale is HI if the previous input exceeds the A/D converter range of ±19999 counts.

Underscale Out (Pin B12)
Should be sampled after the Busy falling edge. Underscale is HI if the previous input displays ±1800 counts or less. Underscale and Overscale are normally used as up/downranging gain selection controls for an auto-ranging input section.

Decimal Point Inputs (Pins A5-A9)
Should be connected to Decimal Point Common (Pin A4) according to the desired display scaling. Note that decimal point selection does not change the ±2V input range.

Display Enable In (Pin B18)
Should be connected to +5V power (Pin B17) to illuminate the display. Leave open to blank the display but keep the A/D converter cycling (use to save power but eliminate turn-on drift).

Run/$\overline{\text{Hold}}$ In (Pin B11)
For normal operation, leave this pin open or tie HI for continuous sampling. Grounding this pin will hold and display the last sample to copy down a reading.

INPUT/OUTPUT CONNECTIONS

Analog HI Input (Pin B3)

Analog LO Input (Pin B2)
The input is supplied single-ended with Analog LO (Pin B2) internally connected by solder gap SG2 to Analog Return (Pin A3). This insures complete compatibility to the single-ended DM-4100L. The user may open SG2 to achieve differential inputs.

Analog Return (Pins A2 and A3)
This analog common bias return is internally connected to Power Common (Pin A16 or A17).

Reference Output (Pin B1)

Reference Input (Pin A1)
Normally Pins A1 and B1 are jumpered together. The instrument is calibrated when a +1.0 Vdc drop exists between Pins A1 (+) and A3 (−). An external reference input to Pin A1 which is biased against Pin A3 may be used by disconnecting Pin B1. Ratiometric drift-correcting action may then be achieved over the reference input range of +0.1 Vdc to +2.0 Vdc (see diagram).

$\overline{\text{Display Test}}$ In (Pin B15)
Ground this pin to display "1888". Otherwise leave this pin open.

$\overline{\text{Polarity Enable}}$ In (Pin A18)
Ground this pin for normal operation. Leave this pin open to blank the +/− sign. May be used to display unsigned (implied positive) numerals with negative inputs. (Reverse sensing)

Polarity Output (Pin B4)
This output should be sampled at the Busy falling edge. HI indicates a positive input; LO indicates a negative input.

Digit Drive Outputs (Pins A11 to A15)
Refer to the timing diagram. Digit drives HI sequentially turn on the five displays with multiplexed BCD data at approximately 150 complete scans per second (1.3 milliseconds per digit). Non-addressed displays (Digit Drive LO) remain dark. Persistence of vision creates a non-blinking image in the eye. Digit Drives may be used for companion remote slave displays.

−5V Power Out (Pin B14)
Up to 15 mA of −5 Vdc power may be taken to power external user-supplied circuits such as signal conditioners. *Caution: Pin B14 is not short circuit protected.* The −5V output is loosely regulated and may require an external user-supplied filter for DC/DC converter ripple depending on the application.

+5V Power Out (Pin B16)
Is connected by solder gap 4 (supplied closed) for an additional +5V power pin.

POWER REQUIREMENTS

External +5V, ±0.25 Vdc regulated required at 350 mA max., 250 mA typical (65 mA typical with display and decimal points disabled). Logic spikes must not exceed 50 mV. Power current varies rapidly so that unregulated supplies cannot be used. (+5V OUT and −5V OUT current must be added to the +5V power requirements)

PHYSICAL-ENVIRONMENTAL

Outline Dimensions
3.00"W × 2.15"D × 1.76"H
(76,2 × 54,6 × 44,7 mm)

Panel Cutout Dimensions
1.812"H × 3.062"W (46,0 × 77,7 mm)

Mounting Method
Through a front panel cutout secured by (4) 4-40 front access screws which are concealed by the bezel

Weight
Approximately 5 ounces (142g)

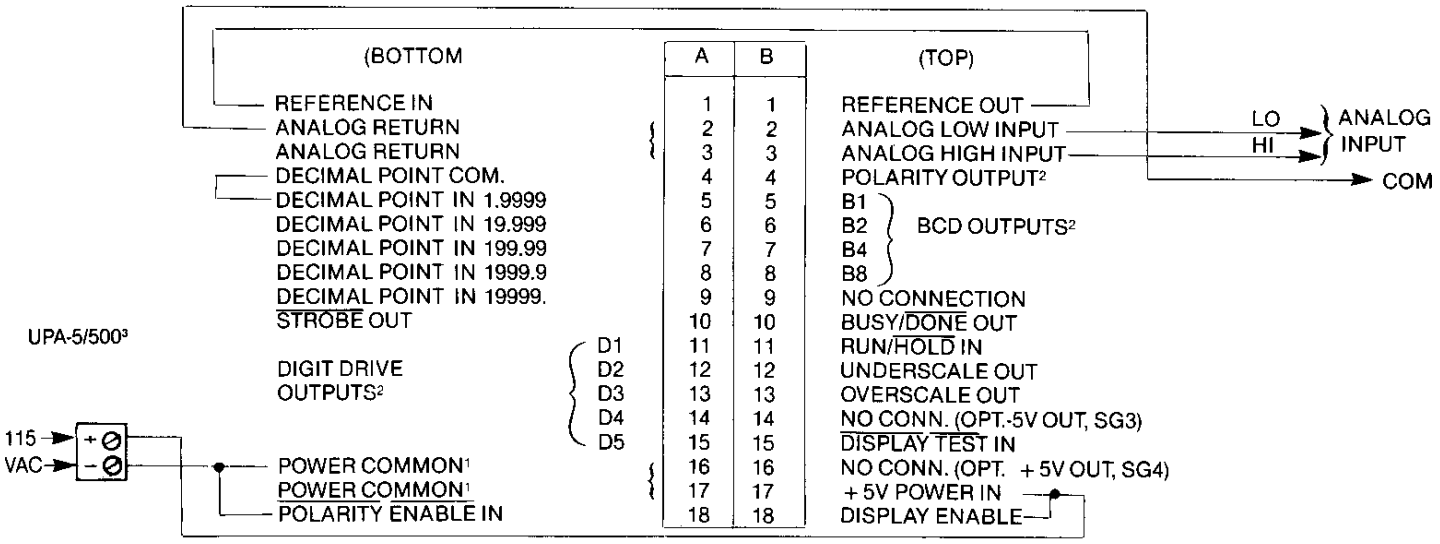
Connector
DM-4101L: Dual 18-pin, 0.100" centers,

Mounting Position
Any

Operating Temperature Range
0 to +50°C

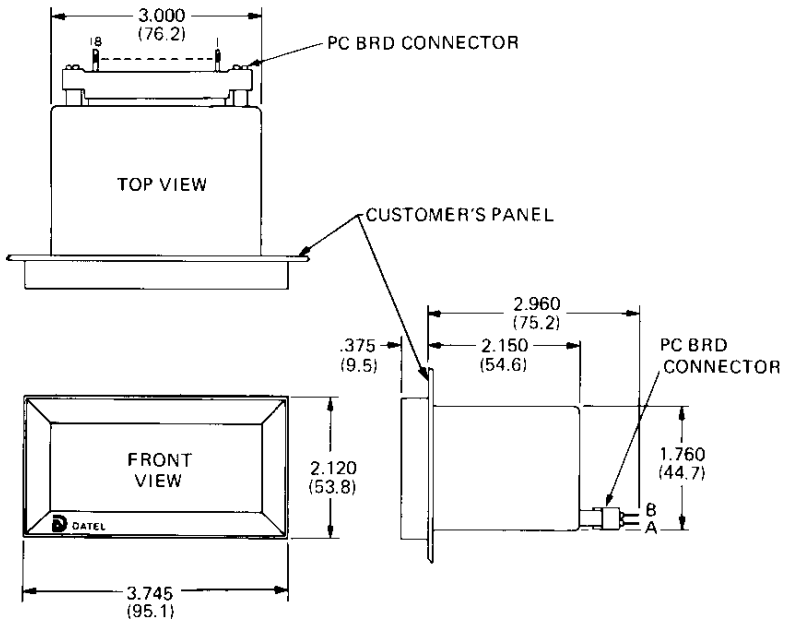
Storage Temp. Range
−25°C to +85°C

TYPICAL INPUT/OUTPUT CONNECTIONS

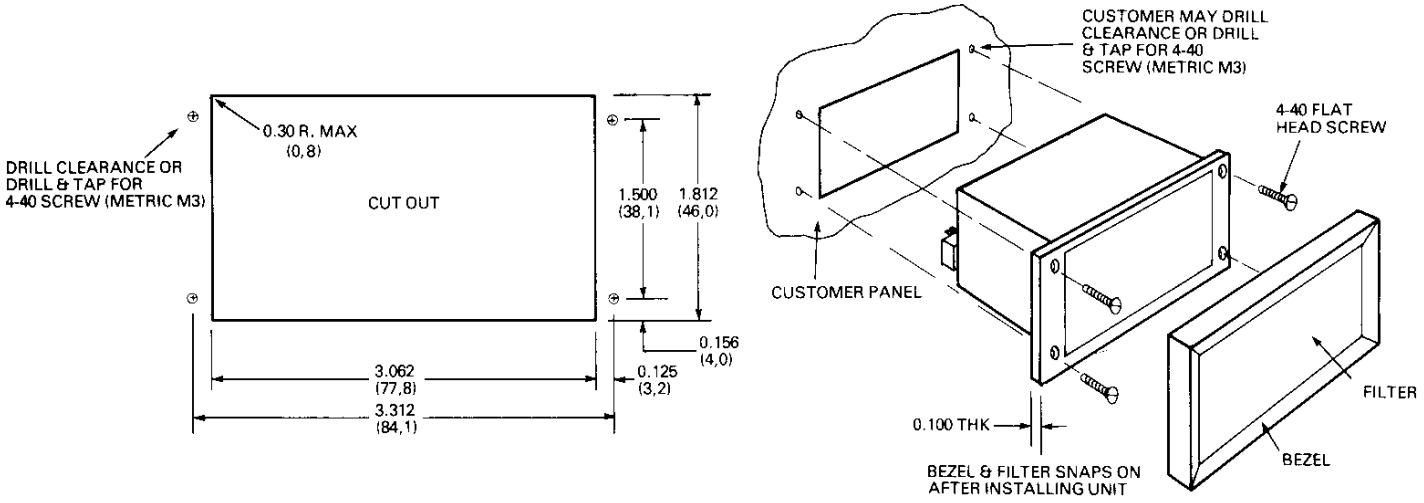


NOTES:
1 The following pins are connected internally: A2 and A3; A16 and A17, A3 and A16.
2 Used in conjunction with DM-4103 slave display.
3 Datel-Intersil UPA-5/500 is an external, user-supplied 115VAC supply.
4 Above drawing indicates DPM rear connector, with DPM on its side.

MECHANICAL DIMENSIONS INCHES (MM)



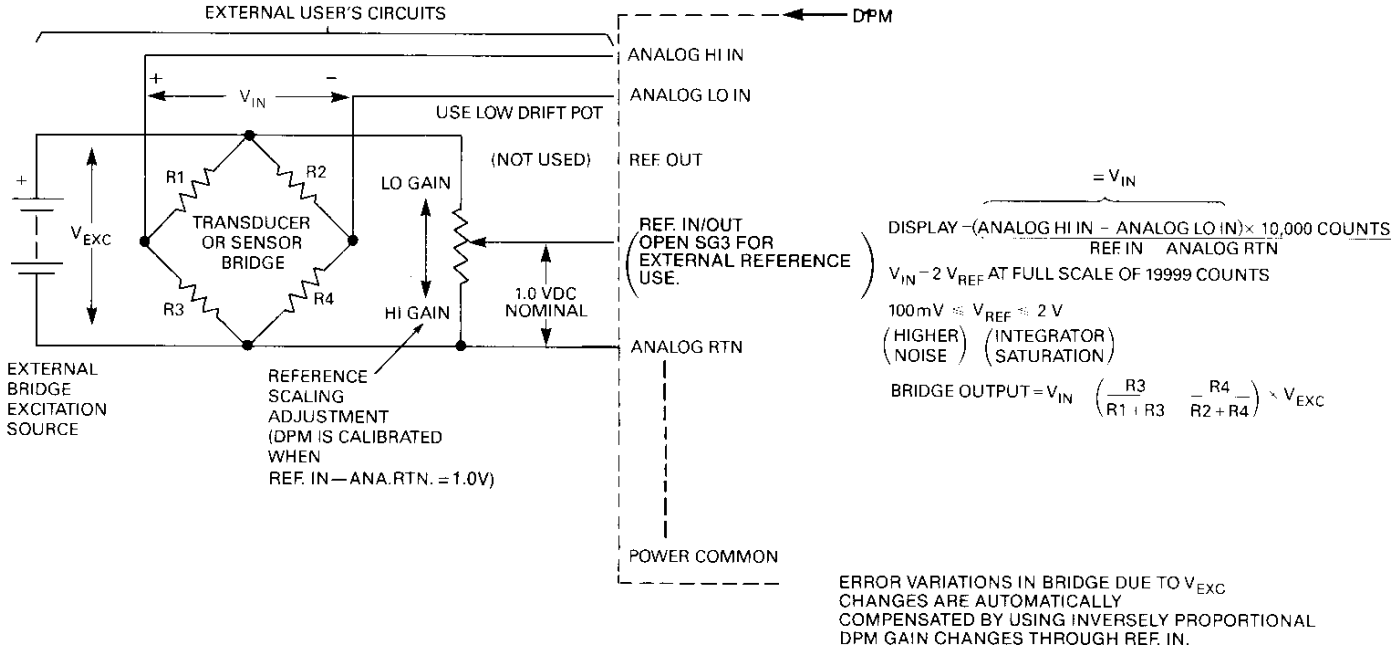
PANEL MOUNTING INCHES (MM)



RATIOMETRIC OPERATION

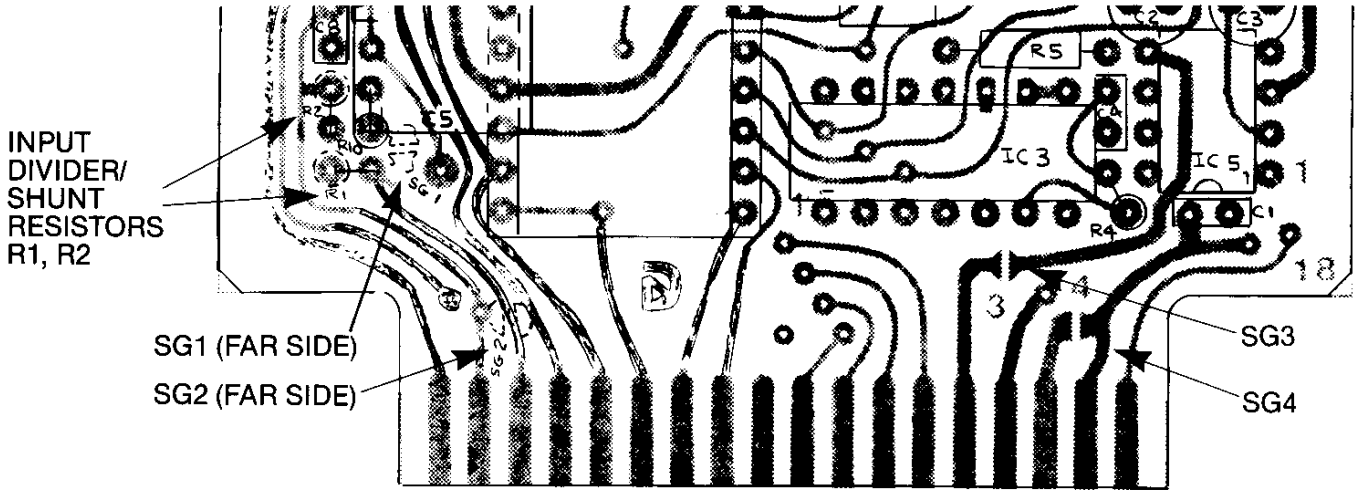
Ratiometric operation is used with bridge-type differential inputs to reduce system errors when two or more reference voltages are otherwise used. By using a single reference to operate the entire measurement circuit, accuracy depends only on the tracking ratio of the resistors rather than the magnitude of the reference voltage.

In the circuit shown here, the DPM's input is the output of a sensor bridge (example: strain gauge or load cell). The bridge requires a source of excitation voltage which varies with the type of application. The DPM also requires a reference voltage. Both bridge excitation and the DPM reference input must be held stable to avoid errors. Bridge output is directly proportional to the bridge excitation. However, the DPM display is *inversely* proportional to the reference input. That is, with a smaller reference input, larger values are displayed. By using a common voltage source to excite the bridge and DPM reference, the DPM will automatically compensate for small bridge output variations. Since the bridge excitation is usually larger than + 1.0 Vdc used to reference the DPM, a precision pot on the voltage source supplies the DPM's reference as a proportion of the voltage source. Over a limited range (+ 0.1 to + 2.0 Vdc), this pot may be used as the DPM's full scale adjustment. Since the DPM's internal reference is not used in this application, the DPM's gain pot will have no effect. The DPM's internal reference may be used for the entire circuit in place of the external voltage source, however an external user-supplied amplifier may be required to get adequate bridge excitation.



INTERNAL COMPONENT LOCATIONS *

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



Internal Modifications

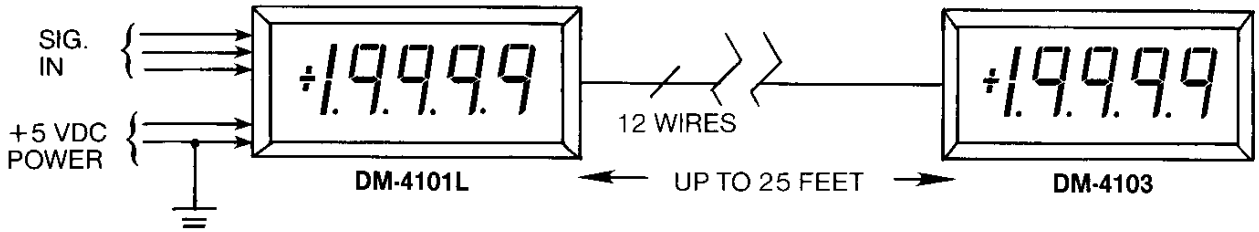
Attenuator and shunt resistor pads are supplied on the bottom DPM printed circuit board to allow the user to program higher current or voltage ranges DATEL will also modify these meters on special order in OEM quantities only.

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 and shunt resistors (R1, R2), solder gaps and jumpers are located by disassembling the DPM circuit board from its housing. *For the short-depth models,* this is done by prying up the front bezel from the bottom and releasing the PC board retaining clip at the rear. The circuit board rear connector should be removed. Slide the PC board assembly out of the front. After modifications, reinstall the board assembly by sliding the bottom board between the guide rails molded into the case.

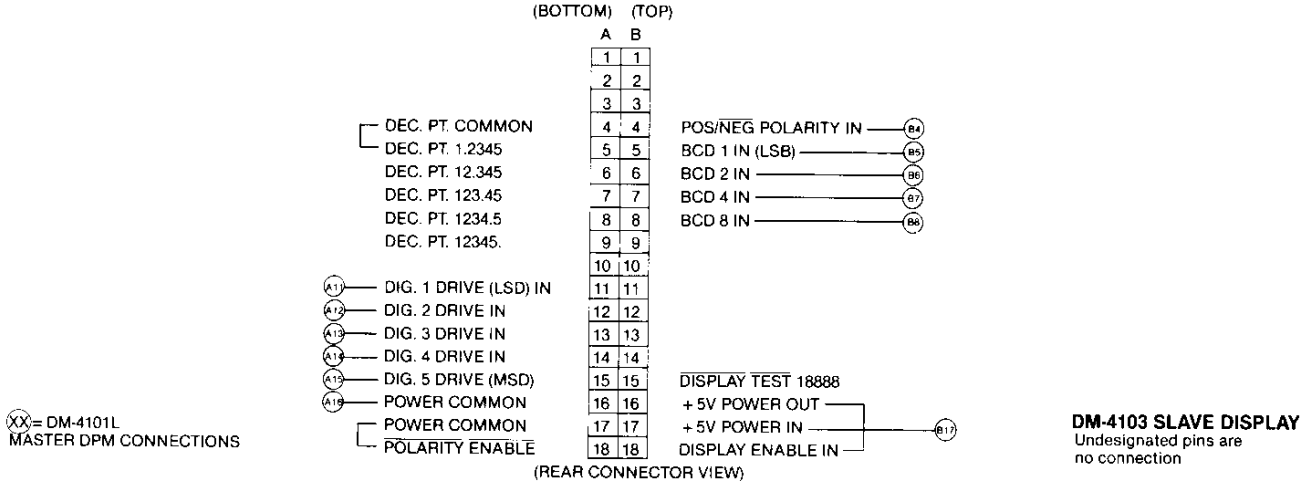
Solder Gap 1 (which single-ended-grounds Analog LO In) is located on the bottom (non-component) side of the lower board, in parallel with R1. R1 and R2 are found on the top of the lower board.

DM-4103 SLAVE DISPLAY WIRING



SLAVE DISPLAY

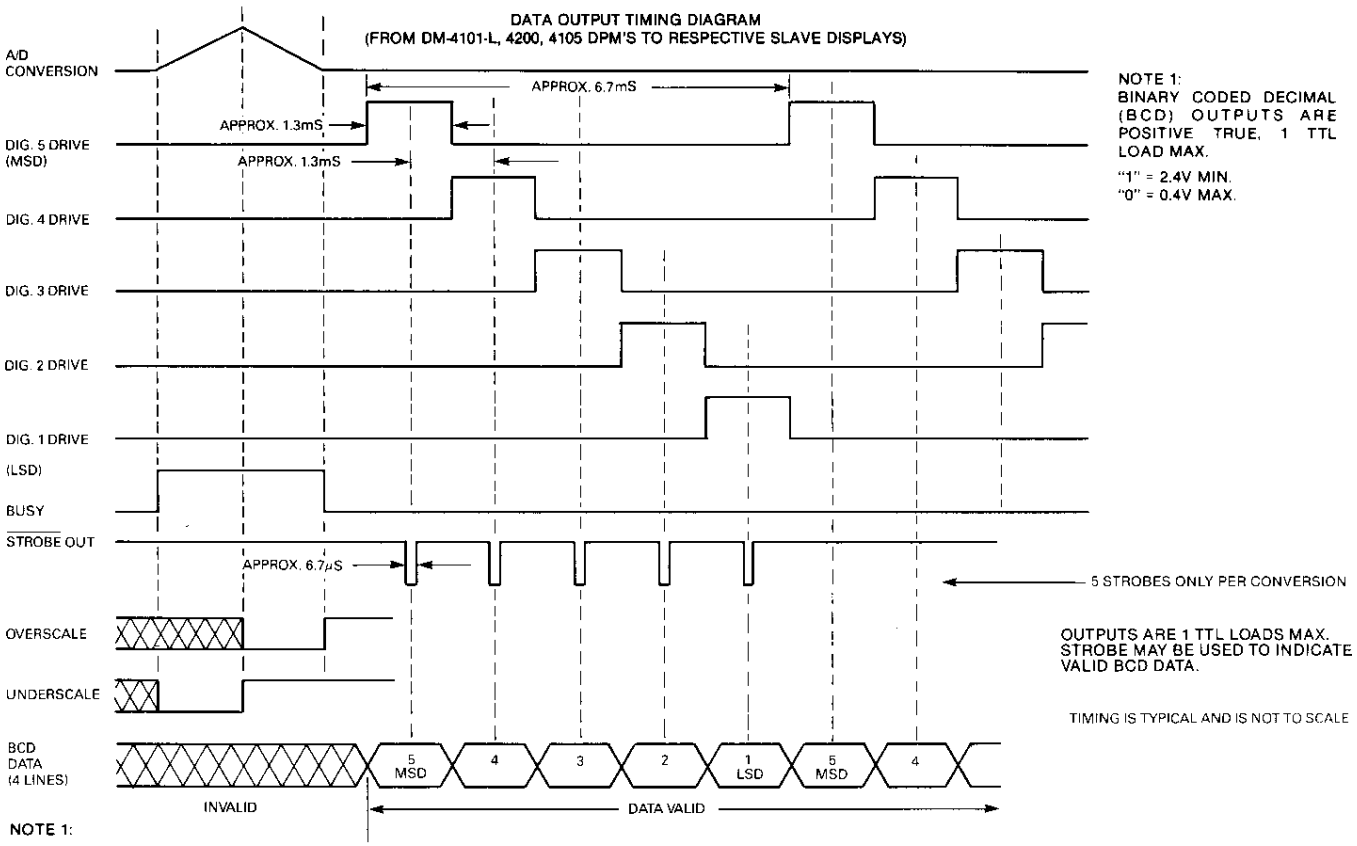
A companion low-cost slave display, Model DM-4103 is offered by DATEL for use with the DM-4101L Master DPM. The DM-4103 can be used as a remote data repeater up to 25 feet away. A simple 12-wire interface, suitable for ribbon cable is shown below. The diagram shows the DM-4103 rear view and the circled connections show pin numbers to be connected on the DM-4101L Master DPM.



DATA OUTPUT TIMING DIAGRAM

To reduce the amount of wiring required to implement a slave display, 4-wire BCD data is multiplexed using 5 digit drive outputs which direct the BCD data to the proper digit. The DPM displays rely on the persistence of vision of the human eye to store an image of the displayed digit. This multiplexing technique is commonly used with DPM's and DVM's. Each digit drive has the effect of sequentially turning on its respective digit when the drive signal is HI. The digit is blanked when the drive is low.

Digits are scanned in this manner in the DM-4101L, 4200, 4105 approximately 150 times per second. The BCD data is updated with every A/D conversion which is approximately 3 times per second. Only 5 strobe pulses are issued with each new conversion. These DPM's may be connected to popular microprocessors by using peripheral interface circuits and a suitable data transfer program. The strobe may be used to generate an interrupt which latches the DPM's output data, then transfers it to memory.



OVERSCALE/UNDERSCALE AUTORANGING CONTROLS

These new 4-1/2 digit differential DPM's include Underscale and Overscale outputs. Overscale trips when the input exceeds 19999 counts. Underscale trips on 1800 counts. If an external circuit consisting of relays or FET switches can change an external *decade* programmable gain amplifier, the Underscale control should be used to decrement a PGA counter which downranges to higher gain. Overscale should increment the PGA counter to cause an uprange to lower gain or less attenuation. Underscale and Overscale are positive-true pulses. They both should be sampled after the Busy falling edge.

The decimal points can also be programmed by the autoranging circuits to indicate what the range is.

Ordering Information

DM-4101L-1: *±2Vdc Input Range (Supplied With Free Connector)*

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

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ISO 9001 and 14001 REGISTERED

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