D DATEL

INNOVATION and EXCELLENCE

FEATURES

- **Low Cost, 4½ Digit DPM with LCD Display**
- **Balanced Differential Inputs**
- **.5″ high Liquid Crystal Display (LCD)**
- **1000 Megohm CMOS Input with 5 pA input bias currents**
- **Battery-portable circuitry requires only 15 milliwatts power (5 Vdc @ 3 mA)**
- **Autozeroing with ratiometric reference for drift correction**
- **Digit Serial BCD outputs — can drive DM-4106 remote slave display**
- **+ 5 Vdc Power — provides − 5 Vdc at 15 mA output to power user circuits.**
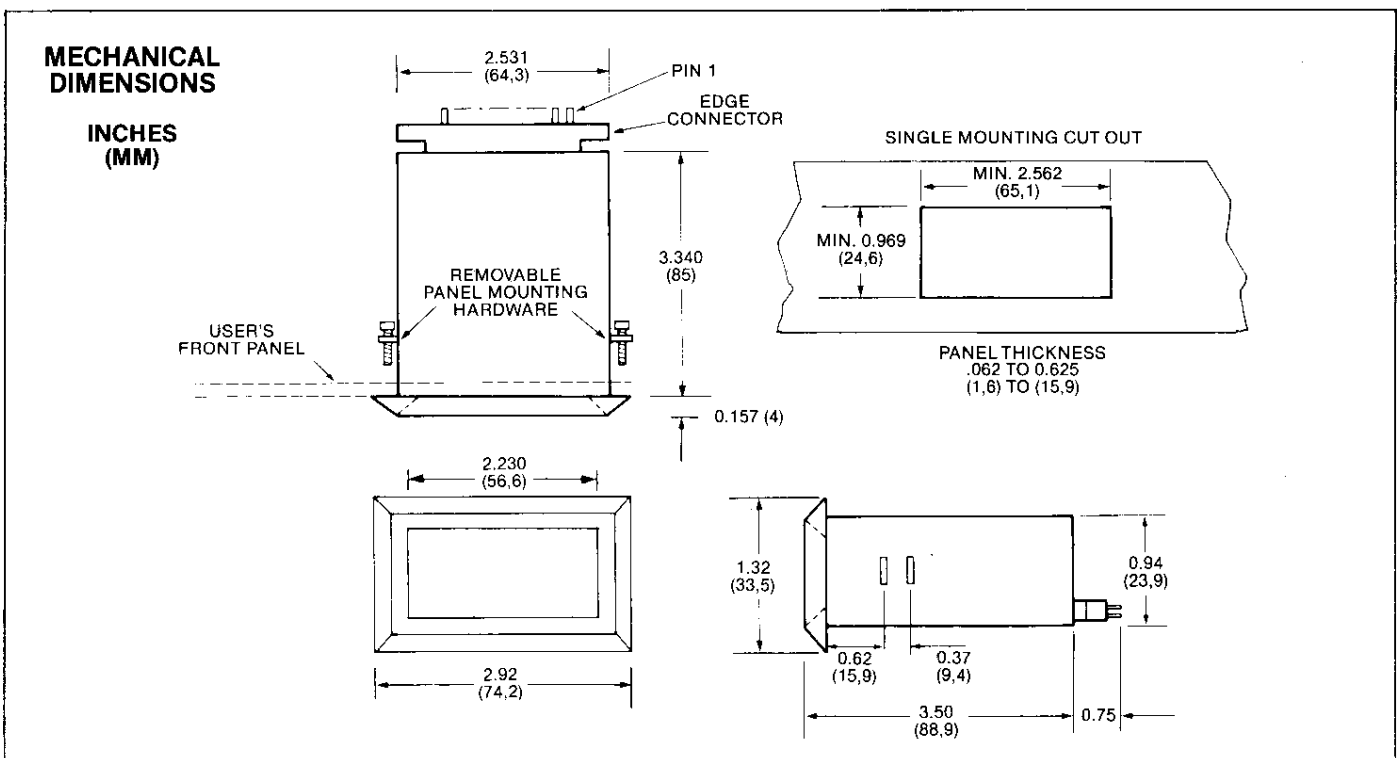- **Right digit programmable as °C or °F for digital thermometer**

DESCRIPTION

The DM-4105 is a 4½-digit DPM (Digital Panel Meter) with balanced differential analog inputs, a .5″ high Liquid Crystal Display (LCD) and low power circuitry which requires only 15 milliwatts of power (+ 5 Vdc at 3 mA, typical). The meter converts analog voltages from − 1.9999V to + 1.9999 Vdc to be displayed as decimal digits. Digit-serial BCD data outputs and digit drives are available on the meter's rear-panel connector where they can be used to drive remote displays, or (in conjunction with an interface demultiplexer) as A/D inputs to a microcomputer, data logger, or printer.

The DM-4105 provides excellent electrical performance in a compact panel-mounting package. Analog inputs have a very high input impedance (1000 Megohm typical) with very low bias currents of 5 pA (typical). Common Mode Rejection Ratio (CMRR) is 86 dB. The meter is autozeroed on each conversion cycle to minimize drift of zero. A Reference In-Out loop can be used to correct drift in externally excited ratiometric circuits.

A variety of designed-in features make it easy to use the DM-4105 in many applications. Blank circuit pads will accept user-supplied current shunts, voltage dividers, and ohmmeter components. Overrange and Underrange outputs can be used to trigger external autoranging circuitry (the DM-4105 display has Overrange and Underrange descriptors which may be set by the user). In 3½ digit thermometer applications, a degree sign can be enabled on the display, while the right Digit (LSD) can be solder-gap-programmed as "C" for Celsius readings or "F" for Fahrenheit readings.

The DM-4105 is powered from + 5 Vdc at 3 mA typical (5 mA max.). It may be powered from 4 "AA" alkaline cells. A − 5V output (at up to 15 mA output) is provided to power external circuits. The meter's Low Profile polycarbonate case is 2.53″W × 3.25″D × 0.94″H (64,3 × 82,5 × 23,8 mm).

MECHANICAL DIMENSIONS

INCHES (MM)

2.531 (64,3)

PIN 1

EDGE CONNECTOR

REMOVABLE PANEL MOUNTING HARDWARE

USER'S FRONT PANEL

3.340 (85)

0.157 (4)

SINGLE MOUNTING CUT OUT

MIN. 2.562 (65,1)

MIN. 0.969 (24,6)

PANEL THICKNESS .062 TO 0.625 (1,6) TO (15,9)

2.230 (56,6)

2.92 (74,2)

1.32 (33,5)

0.62 (15,9)

0.37 (9,4)

0.94 (23,9)

3.50 (88,9)

0.75

SPECIFICATIONS
(typical at +25°C, unless noted)

ANALOG INPUT

Configuration . . . .
True balanced differential bipolar inputs (The user may close SG5 if single-ended inputs are preferred.)

Full Scale Input Range . . . .
−1.9999 Vdc to +1.9999 Vdc

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.

Reference . . . .
Internal, referred to Analog Return. An External, user-supplied referenced biased against pin B3 is optional for ratiometric operation.

External Ref. Range . . . .
+100 mV to +2V, referred to Analog Return (pin B3)

Common Mode Rejection . . . .
86 dB typical to Analog Return

Common Mode Voltage Range . . . .
Both inputs must remain within ±4 Vdc to Power Common. The user must provide external circuitry to keep the inputs within the common mode range (call Datel-Intersil if engineering assistance is needed)

DISPLAY

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

Display Type . . . .
Black-digits-on-white Liquid Crystal Display (LCD); requiring external illumination

Display Height . . . .
0.5 inches (12,7 mm)

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

Autopolarity . . . .
A plus or minus sign is automatically displayed for positive or negative voltage inputs, and may also be blanked. The polarity display may be disabled by opening Solder Gaps 6 and 7. This would be used for unsigned reverse sensing (implied positive) applications with negative inputs.

Sampling Rate . . . .
Approximately 3 conversions per second

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

INPUT/OUTPUT CONNECTIONS

Analog HI Input (Pin A7) . . . .
Analog LO Input (Pin A8) . . . .
Differential input signals are applied to pins A7, A8. The input may be made single-ended to Analog Return (Pin B3) by closing solder gap SG5. Analog HI In is connected to the A/D input through solder gap SG4 (supplied closed). Users may install internal attenuator or current shunt

resistors (see the block diagram) for higher voltage or current ranges. Open SG4 for voltage attenuators; leave SG4 closed for a current shunt installed at R2. Custom voltage or current ranges are available from Datel-Intersil in OEM quantities. A bias current path to Power Common or Analog Return must be provided in the user's external circuits.

Analog Return (Pin B3) . . . .
This analog common bias return must be externally connected to Power Common (Pin A14).

Reference In/Out (Pin B4) . . . .
Normally, pin B4 is not used. The instrument is calibrated when a +1.0 Vdc drop exists between pins B4(+) and B3(−). Internally, this is supplied from a reference diode, the full scale adjustment potentiometer wiper connected through solder gap SG3. An external ratiometric reference may be substituted by opening SG3 and biasing the external source against pin B3. External reference range: +0.1 Vdc to +2.0 Vdc. Refer to the ratiometric diagram.

Digital Connections are MOS and will drive TTL, or LS or CMOS. Outputs will drive 1 TTL load (1.6 mA sink min.).
Outputs: +2.4V ≤ "1" = HI ≤ +5.0V
0V ≤ "0" = LO ≤ +0.4V
Inputs should be driven from open collector TTL outputs (10 KΩ pullup or less) or CMOS buffers (4049, 4050, etc.) or hard wire connection to ground or +5V. Totem pole drivers should use pullups.
Caution: MOS inputs may be damaged by static discharge voltage spikes. Use ground protection when wiring or handling.

Busy/Done Out (Pin A5) . . . .
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.

Strobe Out (Pin A6) . . . .
Strobe consists of 5 negative pulses per 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 mux'd out with the unsigned BCD data. A fifth line (Polarity Out, Pin A3) must be polled to determine the sign. Refer to the timing diagram.

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

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

Backplane Out (Display On, pin B11) . . . .
Backplane Out (Display Off, pin B10) . . . . . .
All decimal points and the degree symbol must be wired to either pin B10 or B11 to blank or display the selected item.

Run/Hold In (Pin A4) . . . .
For normal operation, leave this pin open or tie HI for repetitive sampling. Grounding Pin A4 will hold and display the last sample to copy down a reading.

Polarity Out (Pin A3) . . . .
HI indicates a positive input; LO indicates a negative input. Polarity must be sampled after the Busy falling edge. See timing diagram.

Degree Symbol (°) In (Pin B5) . . . .
The temperature degree symbol may be displayed between the 1's and 10's digit by tying pin B5 to B11. To blank the degree symbol, tie B5 to B10. The 1's digit may be dedicated as an F (Fahrenheit) or ⌐(Celsius) unit abbreviation by modifying internal solder gaps (see table and diagram. Also available preconfigured under special order). This modification provides a 3½ digit (1.9.9.9.°⌐) instrument.
Note: The DM-4105 does not directly measure temperature. External user-supplied probes are required since the DM-4105 remains a ±2 Vdc input instrument.

−5V Power Out (Pin A15) . . . .
Up to 15 mA of −5 Vdc power may be taken to power external user-supplied circuits such as signal conditioners.
Caution: Pin A15 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 B15) . . . .
Pin B15 is connected by solder gap SG1 (supplied closed for an additional +5V power pin).

POWER REQUIREMENTS

External +5 to 6 Vdc regulated required at 3 mA typical, 5 mA max. Logic spikes must not exceed 50 mV. (Note: Any current taken at −5V Out must be added to +5V power to yield total meter power.)

PHYSICAL-ENVIRONMENTAL

Outline Dimensions . . . .
2.53"W × 3.34"D × 0.94"H
(64,3 × 85 × 23,8 mm)

Cutout Dimensions . . . .
2.562"W × 0.97"H min. (65,1 × 24,6 mm)

Mounting Method . . . .
Through a front panel cutout secured by brackets and two removable side case screws. Panel thickness up to 0.62" (15,9 mm)

Weight . . . .
Approximately 5 ounces (142g)

Connector . . . .
Dual 15-pin, 0.100" centers

Mounting Position . . . .
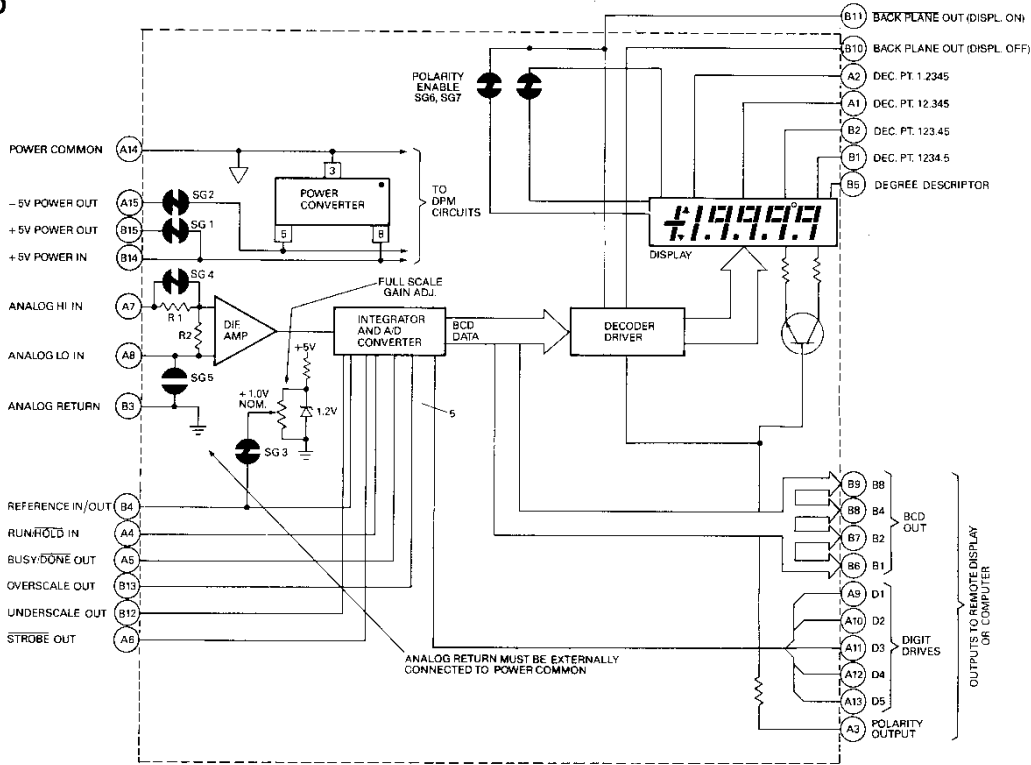Any

Operating and Storage Temperature Range
0 to +50°C (Caution: Avoid long exposure to high temperature, direct sunlight display overheating and high humidity.)
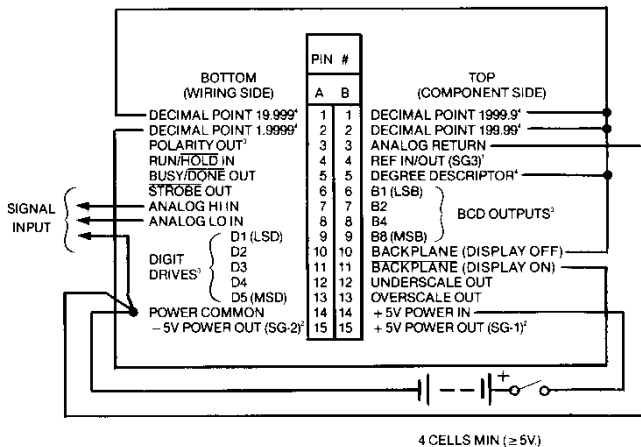
Ordering Information

DM-4105-1: ± 2Vdc Input Range (Supplied With Free Connector)

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

SIMPLIFIED BLOCK DIAGRAM

TYPICAL INPUT/OUTPUT CONNECTIONS

Connector rear view with DPM tilted on its side

NOTES:
1 Close SG3 for REF OUT; open SG3 for REF IN.
2 Close SG2 for −5V OUT; close SG1 for +5V OUT.
3 Used in conjunction with slave display.
4 Tie Decimal Point or Descriptor to BACKPLANE (B11) to enable. Tie all unused Decimal Points and Descriptors to BACKPLANE (B10).
5 Analog Return (pin B3) *must* be externally connected to Power Common (pin A14).

SOLDER GAPS AND JUMPER

SOLDER GAP/ JUMPER	FUNCTION	
	OPEN	CLOSED
SG 1 (N.C.)	No Connection to Pin B15	+5V IN connected to Pin B15
SG 2 (N.C.)	No connection to Pin A15	−5V from DC-DC converter on Pin A15
SG3 (N.C.)	Ref. IN on Pin B4	Ref. IN connected to Ref. OUT, Ref. OUT (1.0 Vdc) on B4
SG4 (N.C.)	R1 in circuit	R1 position shorted
SG 5 (N.O.)	Differential Input	Single-Ended Input (ANA LO connected to ANA RTN)
SG6 (N.C.) } SG7 (N.C.) }	Polarity Sign Disabled	Polarity Sign Enabled
SG8 (N.C.)[3]	Disable LSD Seg. E	Enable LSD Seg. E
SG9 (N.C.)[3]	Disable LSD Seg. D	Enable LSD Seg. D
SG10 (N.C.)[3]	Disable LSD Seg. C	Enable LSD Seg. C
SG11 (N.C.)[3]	Disable LSD Seg. G	Enable LSD Seg. G
SG12 (N.C.)[3]	Disable LSD Seg. F	Enable LSD Seg. F
SG13 (N.C.)[3]	Disable LSD Seg. A	Enable LSD Seg. A
SG14 (N.C.)[3]	Disable LSD Seg. E	Enable LSD Seg. E
SG15 (N.C.)} J1 (N.O.) }	Disable ∇ (Underrange Descriptor)[2]	Enable ∇ (Underrange Descriptor)[2]

NOTES:
1 N.O. = Normally Open
  N.C. = Normally Closed
2 The Underrange Descriptor is displayed whenever input is less than or equal to 9% of input range ($-.18V \le$ input $\le +.18V$ on $\pm 2V$ input range) to track the underrange output (Pin B12).
3 To use LSD (Least Significant Digit) as temperature abbreviation open SG's 8 through 14 to disable LSD. Tie side of Solder Gap connected to display to the following locations to yield "C" or "F". Tie pin B5 to pin B11.

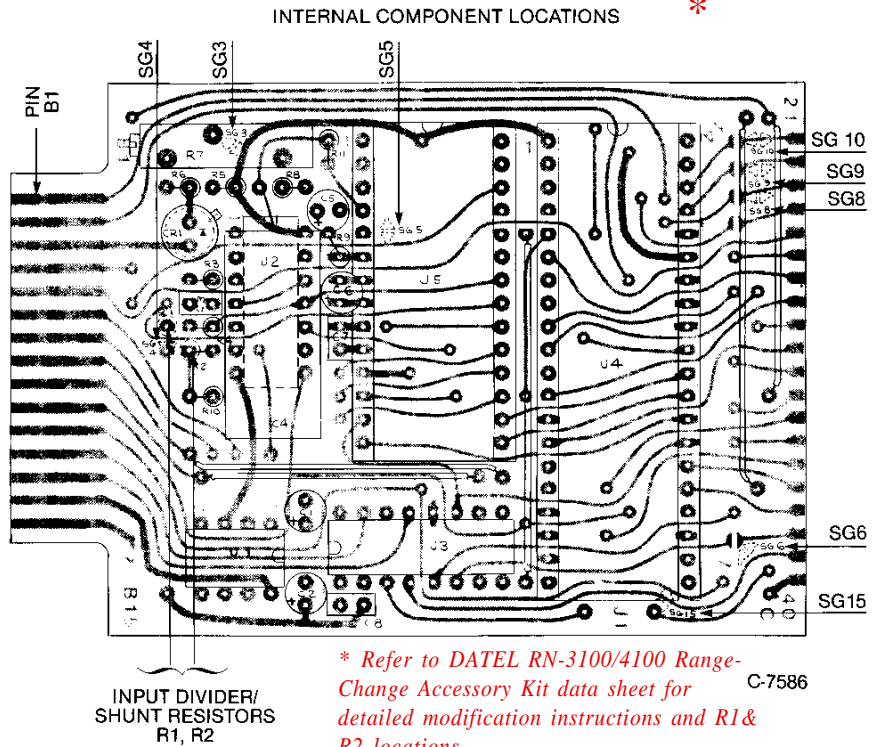| TEMPERATURE ABBREVIATION	TIE TO BACKPLANE (B10)	TIE TO BACKPLANE (B11)
"F" (Fahrenheit)	SG9, SG10, SG14	SG8, SG11, SG12, SG13, Pin B5
"C" (Celsius)	SG10, SG11, SG14	SG8, SG9, SG12, SG13, Pin B5

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 access to internal components, 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 etch.

INTERNAL COMPONENT LOCATIONS

INPUT DIVIDER/
SHUNT RESISTORS
R1, R2

C-7586

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

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*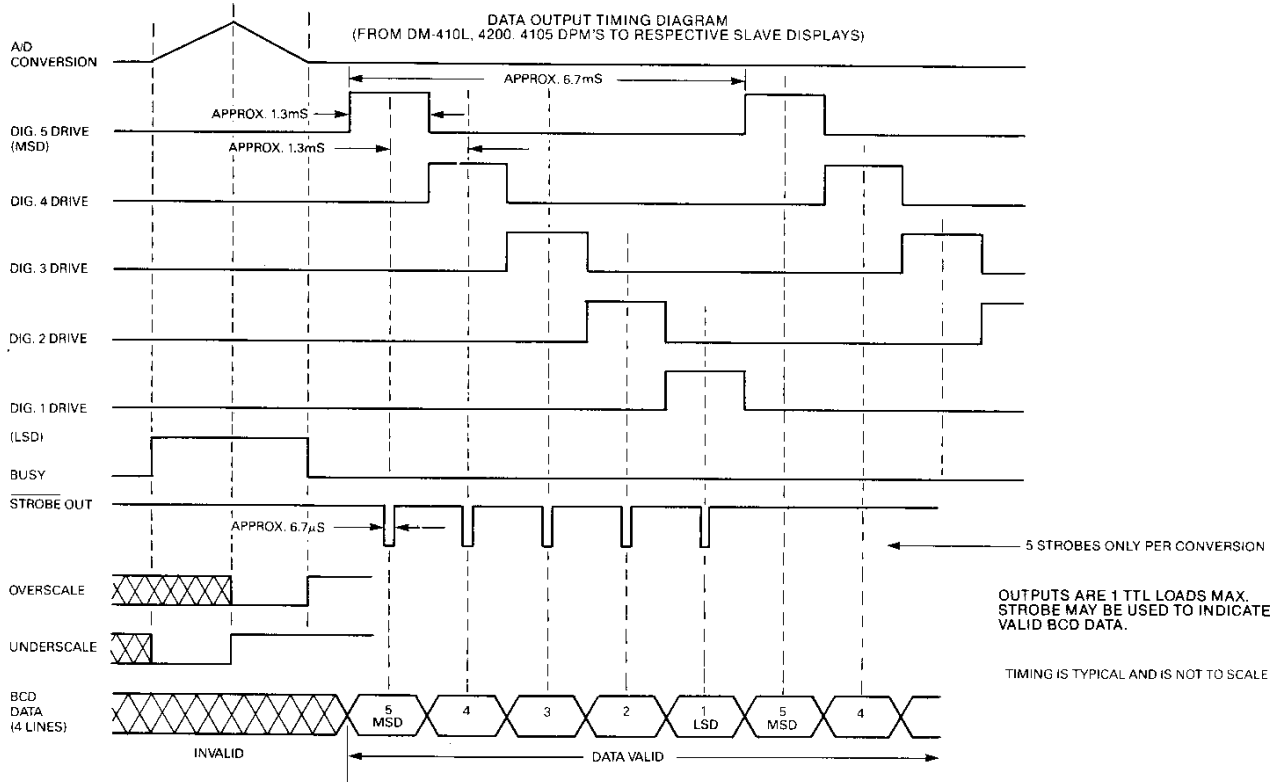 proportional to the reference input. That is, with a smaller reference input, larger values are displayed. By using a common voltage source to excite the bridge and DPM reference, the DPM will automatically compensate for small bridge output variations. Since the bridge excitation is usually larger than + 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.
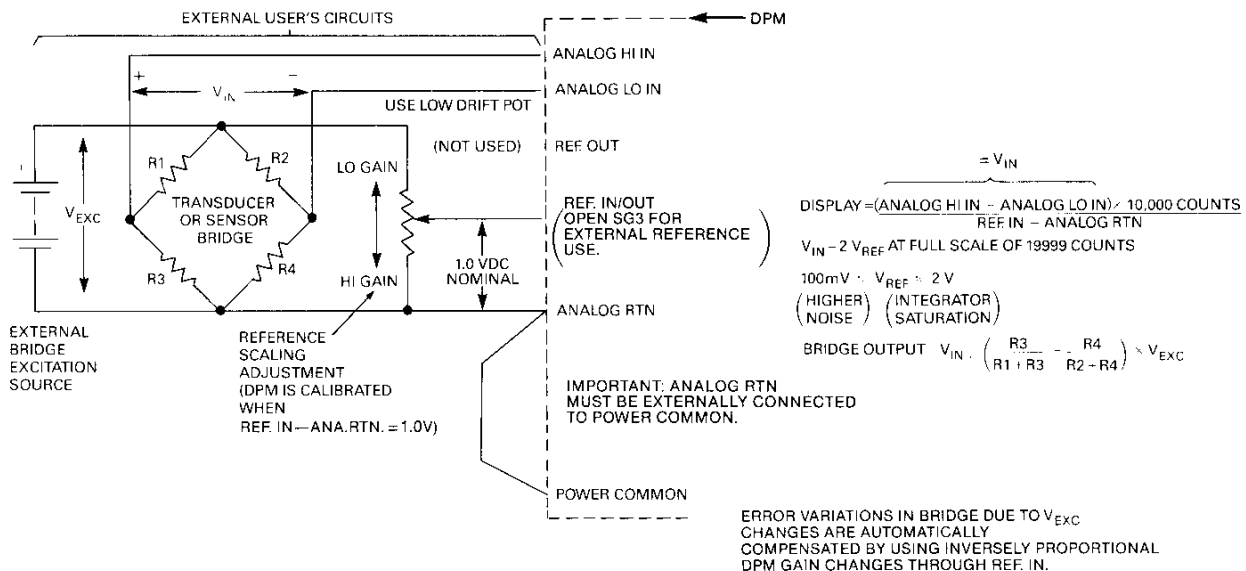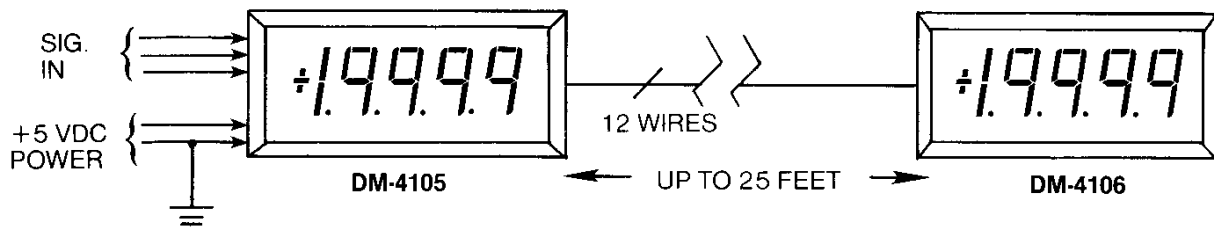
DATA OUTPUT TIMING DIAGRAM

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.

DATA OUTPUT TIMING DIAGRAM
(FROM DM-410L, 4200, 4105 DPM'S TO RESPECTIVE SLAVE DISPLAYS)

5 STROBES ONLY PER CONVERSION

OUTPUTS ARE 1 TTL LOADS MAX. STROBE MAY BE USED TO INDICATE VALID BCD DATA.

TIMING IS TYPICAL AND IS NOT TO SCALE

DM-4106 SLAVE DISPLAY WIRING

SIG. IN

+5 VDC POWER

DM-4105

12 WIRES

UP TO 25 FEET

DM-4106
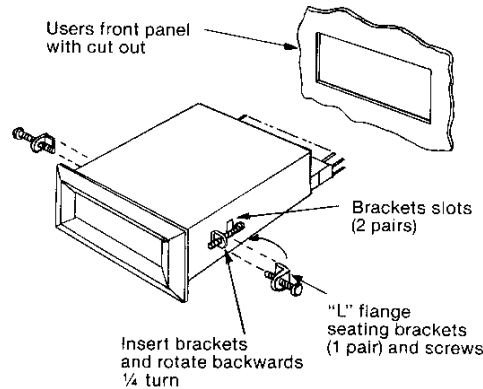
REAR CONNECTOR VIEW

SLAVE DISPLAY

A companion low-cost slave display, Model DM-4106 is offered by Datel for use with the DM-4105 Master DPM. The DM-4106 can be used as a remote data repeater up to 25 feet away. A simple 12-wire interface, suitable for ribbon cable is shown. The diagram shows the DM-4106 rear view and the color connections show pin numbers to be connected on the DM-4105 Master DPM.

WIRING SIDE BOTTOM (A)		COMPONENT SIDE TOP (B)	
DEC PT 19.999	1	DEC PT 1999.9	
DEC PT 1.9999	2	DEC PT 199.99	
A3 — POLARITY INPUT	3	NO CONNECTION	
NO CONNECTION	4	NO CONNECTION	
NO CONNECTION	5	DEGREE SIGN IN — B5	
NO CONNECTION	6	B1 LSB — B6	
NO CONNECTION	7	BCD B2 — B7	
NO CONNECTION	8	INPUTS B4 — B8	
A9 — D1 LSD	9	B8 MSB — B9	
A10 — D2	10	B.P. INPUT/OUTPUT — B10	
A11 — D3	11	B.P. INPUT (DISP COM) — B11	
A12 — D4	12	OVERSCALE INPUT — B13	
A13 — D5 MSD	13	UNDERSCALE INPUT — B12	
A14 — PWR COMMON	14	+5VDC PWR IN — B14	
NO CONNECTION	15	+5VDC PWR OUT	

(A9 D1 LSD, A10 D2, A11 D3, A12 D4, A13 D5 MSD — DIGIT DRIVE INPUTS)

DM-4106 SLAVE DISPLAY

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.

Users front panel with cut out

Brackets slots (2 pairs)

"L" flange seating brackets (1 pair) and screws

Insert brackets and rotate backwards ¼ turn

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.

OVERSCALE/UNDERSCALE AUTORANGING CONTROLS

These new 4½ 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.

CAUTION: The DM-4105 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 ± 4V of Power Common. There is no internal circuitry in the DM-4105 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.

Suggested operating modes such as voltage attentuation 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.

DATEL, Inc. 11 Cabot Boulevard, Mansfield, MA 02048-1151
Tel: (508) 339-3000   (800) 233-2765   Fax: (508) 339-6356
Internet: www.datel.com   Email: sales@datel.com
Data sheet fax back: (508) 261-2857

DATEL (UK) LTD. Tadley, England Tel: (01256)-880444
DATEL S.A.R.L. Montigny Le Bretonneux, France Tel: 01-34-60-01-01
DATEL GmbH München, Germany Tel: 89-544334-0
DATEL KK Tokyo, Japan Tel: 3-3779-1031, Osaka Tel: 6-354-2025