Murata Power Solutions

DM-3000

Multifunction Digital Panel Meter and Counter Display

OBSOLETE PRODUCT

Contact Factory for Replacement Model

Covered by GSA Contract No. GS-(0S-27959

OBSOLETE PRODUCT

Not available for sale

USE AS:

- 3 digit DPM
- 4-wire slaved display
- 0.1% tachometer, period or frequency meter using optional crystal clock
- DC to 10 MHz general purpose counter with 0 to 999 selectable full count

FEATURES

- 3 red, 0.43" high LED displays
- Dimmable display using external variable duty cycle blanking input
- −5V, 5mA short-circuit proof output for external bipolar or differential op amps
- Built in 2 sample/second variable start clock
- Externally triggerable up to 250 conversions/second
- Selectable leading zero suppression

$99 (1-9)
$79 (100's)

GENERAL DESCRIPTION

The model DM-3000 combines a low-cost unipolar digital panel meter, a DC to 10 MHz 3 digit general-purpose counter or slaved BCD digital display using only 4 lines in a single instrument. By using simple external circuits the DM-3000 3 digit DPM may be converted to a frequency meter, event counter, absolute value bipolar or differential input digital panel meter or 3-digit period measuring instrument.

The DM-3000 has a built-in short circuit proof −5V, 5 mA power supply to operate external input amplifiers or other circuitry, yet the DM-3000 is a complete 3-digit digital panel meter which includes its own internal start clock. Other operating modes include count termination at any arbitrary full scale displayed count. Many suggested circuits are shown in this brochure. A 0.02% crystal clock option may be ordered for precision period and frequency measurement.

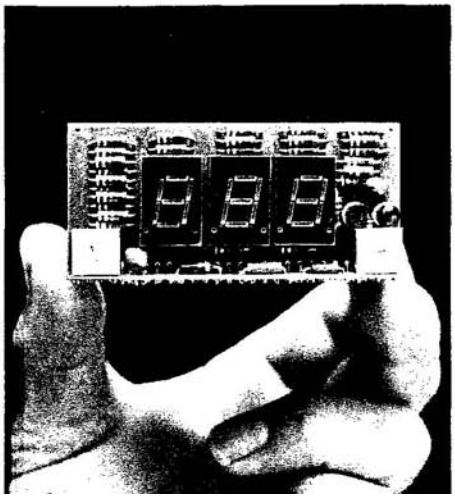
The DM-3000 accepts analog inputs from 0 to +0.999 volts, (10V and 100V ranges optional), uses a single slope conversion and displays the input on three seven-segment LED digits to an accuracy of 0.1% of reading, ±1 digit. The instrument uses conventional +5VDC TTL logic power (such as Datel's model UPM-5/1000B power supply) and consumes 800 mA (320 mA with blanked display).

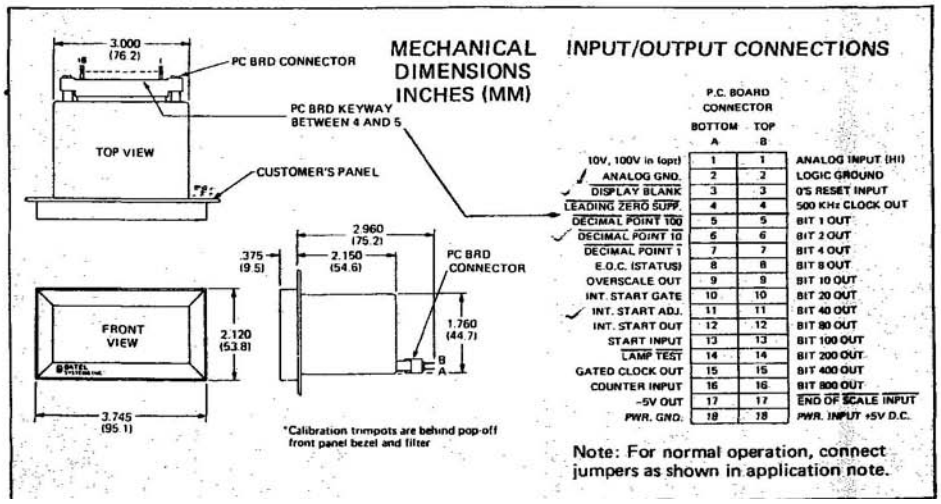
The single-ended input has greater than 100 megohms input impedance and typically 100 nanoamps, bias current. The temperature coefficient is ±100 ppm/°C max. over an operating temperature range of 0 to +50°C. Storage temperature is from −20°C to +85°C. The DM-3000 can accept from 0 to 250 conversions per second from an external start pulse. A built-in start clock operates at 2 conversions/second and may be speeded up using an external resistor.

The red 7-segment LED displays are 0.43" high and each left-of-digit decimal point may be illuminated using contacts on the rear connector. Counter overflow is indicated by a blanked display and a high output on the rear connector contact.

Included in the DTL/TTL compatible logic outputs are full parallel 1-2-4-8 BCD outputs for each digit, an end of conversion (busy) output and overflow. Digital inputs include the external start clock, internal start output, and gate (for hold-to-read) and a segment test input. Leading zero suppression of the 2 most significant digits can be selected as well as display blanking. Clock output and gated clock out are available with counter zero reset, and the end of scale inputs. The large number of control inputs and outputs are provided for extended system use and for custom programming.

The DM-3000 is packaged in a rugged Lexan case with overall dimensions of 3.745" W x 2.960" D x 2.120" H. The case mounts with 4 screws through a 1.812" H x 3.062" W front panel cutout identical to other Datel digital panel meters. A large degree of electrical and pin-out commonality is shared with other Datel DPM's for simple interchangeability.





SPECIFICATIONS (Typical at 25°C unless otherwise stated)

INPUTS

Input Voltage Range (Full Scale)	0 to +999mV, (+9.99V, or +99.9V with atten.)
Input Impedance	100 Megohms min. See pg.3.
Input Bias Current	100nA typ., 250nA max.
Input Configuration	Single-ended unipolar
Max. Continuous Input Overvoltage	±35V
Max. Momentary Input Overvoltage (5 sec. max.)	±125V

PERFORMANCE

Accuracy @ 25°C	Adjustable to ±0.1% of reading ± 1 digit
Resolution	±1mV
Temperature Coefficient	±100ppm/ ° C max. of FS.
Conversion Speed	0-250 conversions/sec.
Internal Trigger Rate	2/sec. adjustable upwards by external resistor. See note.
Operating Temperature Range	0 to +50°C
Storage Temperature Range	−20° to +85°C
Warm Up Time	Essentially zero
Adjustments	Zero, Full Scale (±8mV typ range)
Input Power	+5VDC ±5% @ 800 mA max. (320 mA with display blanked). See note.
Output Power	−5VDC @ 5 mA ±10%. Short circuit proof. For operation of external amplifiers etc.

DISPLAY OUTPUT

Display Type	Seven segment LED, Red 0.43" high full digits (0 to 9) and decimal points.
Overscale	Display blanked
Decimal Points	Selectable at rear connector. Decimal points are displayed left of each digit.
Negative Analog Input	Displays 000

DATA OUTPUTS — All DTL/TTL Compatible

BCD Outputs	12 parallel lines unlatched 8-4-2-1 BCD positive true. Loading 5 TTL loads, Totem-pole.
Overscale	> 1000 counts indicated by high output, 5 TTL loads.
End of Conversion	High during conversion, low conversion complete, 2 TTL loads.
Logic Levels	Inputs +2V ≤ "1" (HI) ≤ +5.0V 0V ≤ "0" (LO) ≤ +0.8V Outputs +2.4V ≤ "1" (HI) ≤ +5.0V 0V ≤ "0" (LO) ≤ +0.4V

INPUT/OUTPUT CONTROL

External Start Input (A13)	Positive pulse 100 nS min. transition from low to high resets register and blanks readout. Negative edge initiates conversion. 10 TTL loads.
Internal Start Gate (A10)	Low input holds last conversion. 3 TTL loads.
Internal Start Adjust (A11)	Resistor to +5V increases trigger rate. See note.
Internal Start Out (A12)	Positive pulse — see application. Has low cuty cycle to avoid display blanking and flicker.

INPUT/OUTPUT CONTROL -Continued

$\overline{\text{Lamp Test Input}}$ (A14)	Low input lights all segments. 3 TTL loads.
$\overline{\text{Leading Zero Suppression}}$ (A4)	Low input provides suppression of zeros on the two most significant digits. 1 TTL load.
$\overline{\text{Display Blanking}}$ (A3)	Low input blanks display. Does not affect conversion. May be used for intensity modulation of display and conserving power. 1 TTL load.
$\overline{\text{Decimal Point Inputs}}$ (A5, 6, 7)	Grounding inputs illuminates corresponding decimal point. Sink 20 mA.
Clock Output (B4)	500 kHz ± 10 kHz 50% duty cycle. 2 TTL loads. 500 kHz ±0.02% crystal optional
Counter Input (A16)	Provides input to counter. Counting occurs on negative transition. 2 TTL loads.
Gated Clock Out (A15)	Provides pulse train of N+1 counts where N is displayed number. 5 TTL loads. Used for slave display or counter.
Zeros Reset (B3)	High input resets counter to zero. 100 nS min. duration. 3 TTL loads.
$\overline{\text{End of Scale Input}}$ (B17)	Activates overflow flip-flop and blanks display on negative input transition. 1 TTL load. Used to short cycle counter.

Note: unused inputs should be grounded or tied to +5V as required to avoid false readings in noisy environments.

PHYSICAL

Case Size	3" W x 1.75" H x 2.25" D
Case Material	Black Lexan Plastic
Weight	6 oz. approx.
Mounting	Through 1.812" x 3.062" cut out. Secured with four 4-40 flathead screws. See mounting diagram.
Price	(1-9) $99.00
Connector	Dual 18-pin PC Brd. Edge Connector Type, 0.1" Centers (not included with DPM)

OPTIONS

1. Quartz crystal timebase 500 kHz . . ±.02%. Operating temp. range drift undetectable on display.
2. 0.1% Precision resistor attenuator kit (RN-DM-3000) 900K, 90K, 10K for 10V and 100V ranges.

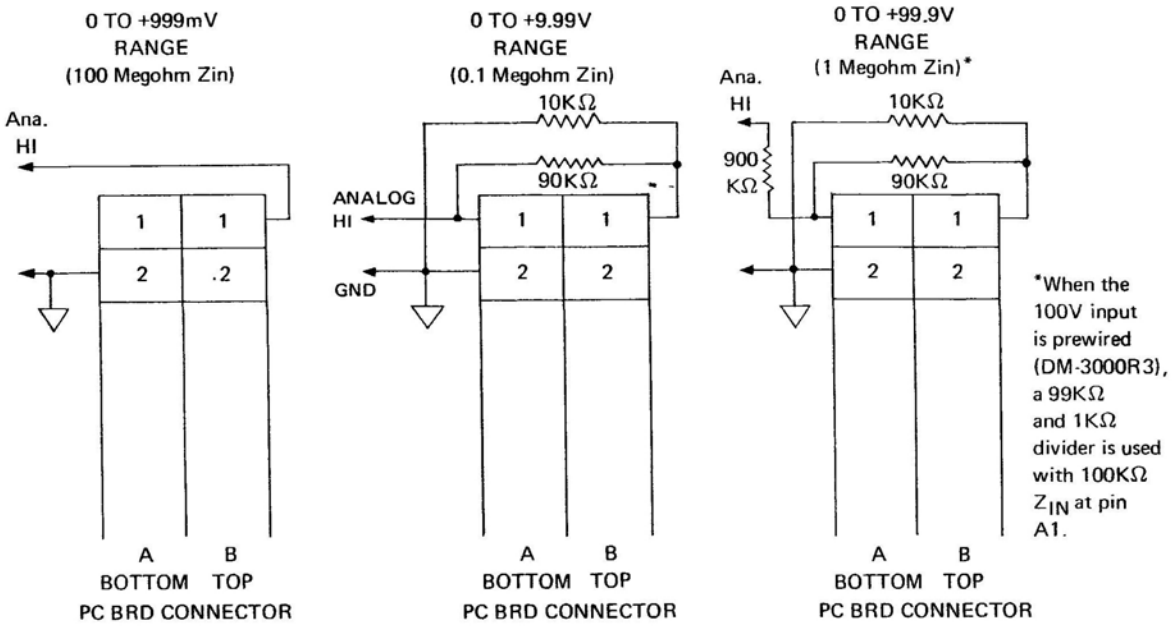
NOTE: BCD outputs are invalid while EOC is HI.

Note: Internal start clock can be speeded up using an external resistor from A11 to +5V. The resistor value is: $R(K\Omega) \simeq \frac{440-Rate}{Rate-2}$ (Rate is in conversions/second) R≥4KΩ

A recommended power supply is Datel's model UPM-5/1000B or equivalent highly regulated type. Avoid spikes entering DPM on +5V power input. Use external filtering or regulation if required. Significant power supply spikes (> 10mV) increase the chance of false readings. DPM current varies rapidly up to 800mA depending on digits displayed and sample rate.

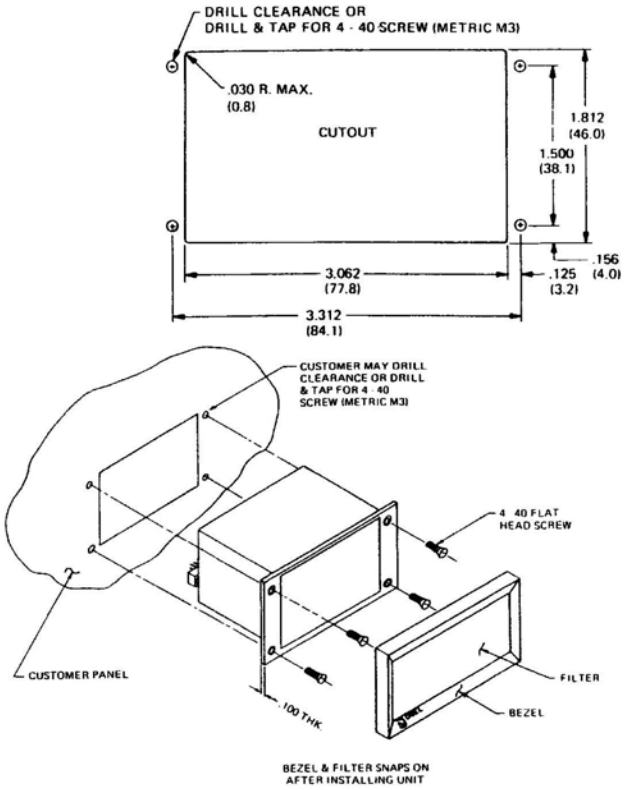
INPUT RANGE SELECTION

To facilitate use of the DM-3000 for +9.99V and +99.9V ranges, a separate kit of matched, low drift input attenuator 0.1% resistors is available (part number RN-DM-3000). These resistors mount directly on the PC board connector and provide 0.1 and 1 Megohm input impedance on the +9.99V and +99.9V ranges. They are ratio matched and will track within ±25ppm/°C over the 0 to +50°C operating range of the DM-3000. They are customer connected as shown below. Input attenuators may be ordered prewired. See ranges 2 and 3 in ordering guide below.



*When the 100V input is prewired (DM-3000R3), a 99KΩ and 1KΩ divider is used with 100KΩ Z_{IN} at pin A1.

MOUNTING DETAILS DIM. IN INCHES (MM)



ORDERING GUIDE

DM-3000

500 KHz CLOCK	
R = CERAMIC RESONATOR (±2%)	
X = QUARTZ CRYSTAL (±.02%)	

Input Range and Impedance

1 = 0 to + 999mV input (pin B1) 100 MΩ
2 = 0 to + 9.99V input (pin A1) 0.1MΩ
3 = 0 to + 99.9V input (pin A1) 0.1MΩ
Options 2 or 3 have installed divider resistors with Z_{IN} shown.

PRICES (1-9)

DM-3000R1 (less connector)	$99
Add for crystal clock	$10
Add for 10V or 100V input	$10
RN-DM-3000 (Attenuator resistors)	$5
Solder Tab Connector, Datel # 2335-1	
Viking 3VH18/1JN-5 or equiv.)	$3.95
Wire Wrap Connector, Datel # 2335-2	
Viking 3VH18/1JND-5 or equiv.)	$3.95

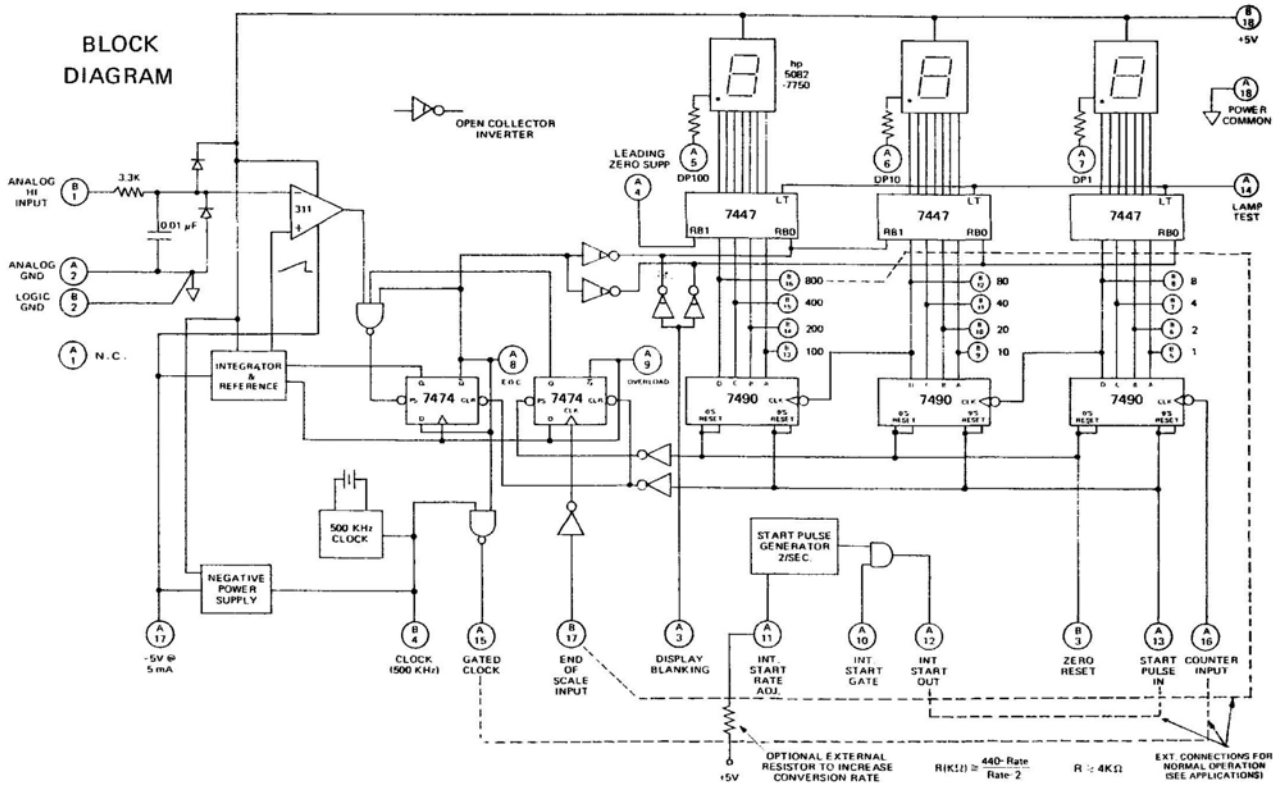
Connectors are not included with DPM. Please order connectors with your DPM.

UPM-5/1000B 5V,1A 115VAC power supply	$49.00
MS-7 Power supply socket	$3.50

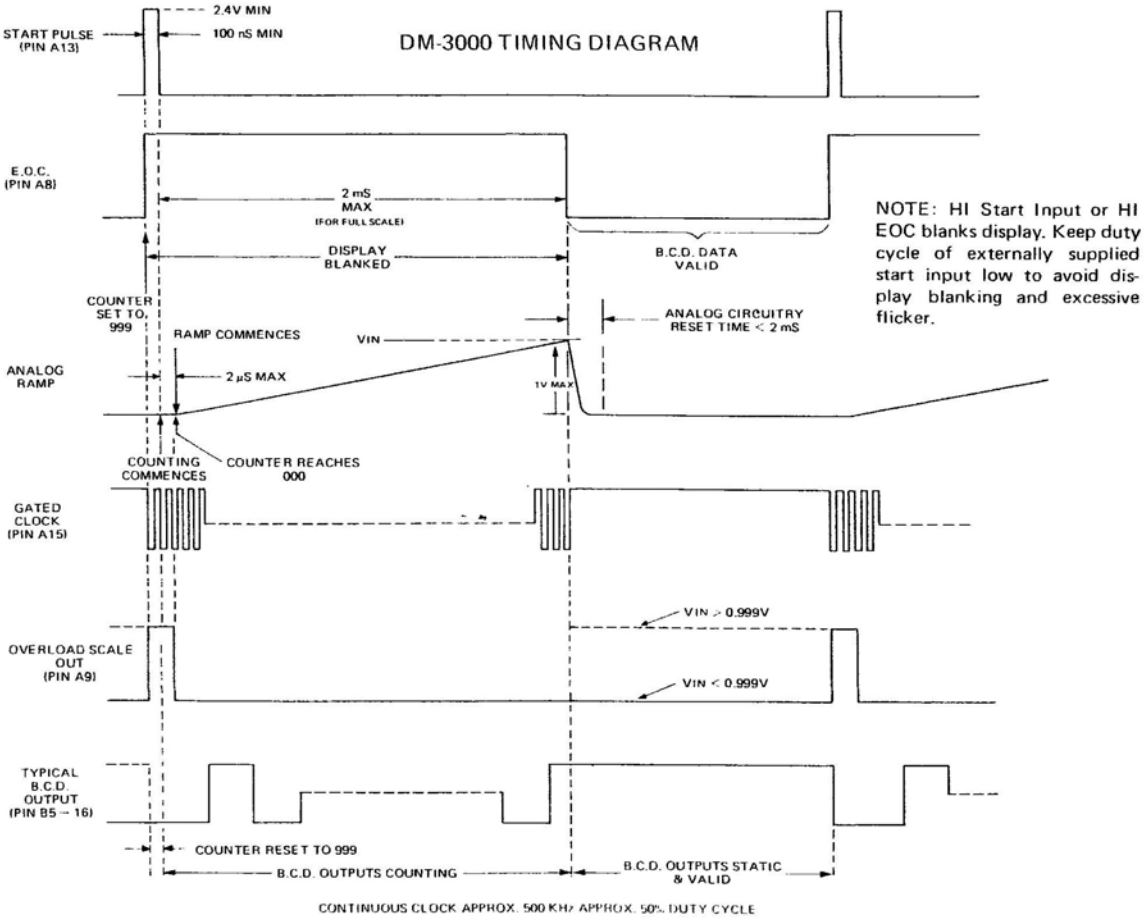
For special functions in OEM quantities, contact factory.

All Datel DPM's are covered by GSA Contract No. GS-00S-27959

BLOCK DIAGRAM



DM-3000 TIMING DIAGRAM



NOTE: HI Start Input or HI EOC blanks display. Keep duty cycle of externally supplied start input low to avoid display blanking and excessive flicker.

ABOUT RELIABILITY

The DM3000 digital panel meter features proven mechanical construction and sound, yet simple, electrical design for a long trouble free service life of repeatable accuracy and performance. Recalibration is suggested every 90 days under variable conditions but the period after initial adjustment can safely be extended in constant environments, e.g., laboratories, offices, etc. without any significant change in performance. In cases where the panel meter is used as a digital counter for frequency, period, events, etc., front panel adjustments do not affect operation and can be ignored.

The DM3000 consists of only 2 printed circuit boards of high grade G10 epoxy-glass laminate (not phenolic) as used in military, aerospace and computer applications. The boards are permanently joined by a soldered interconnect to assure reliability. A gold plated edgeboard connector is used for all input/output connections and can be positively located and secured to the case by integral bosses. A polarizing key prevents mislocation.

The electronic circuitry is composed of high quality digital and linear integrated circuits and a small number of discrete components. Datel's extensive vendor quality assurance and incoming inspection program allows full control of reliability at the component level. Computer automated inspection, selection and grading techniques and a continuously updated vendor quality history file have established a very efficient, reliable supply of components for all Datel's products. Reliability at the component level is extended to reliability at the circuit level by the low parts count and functional simplicity of the DM3000. In addition, this is achieved in a small rugged black Lexan® case that requires a modest 3 inches of panel depth and leaves no doubt about the mechanical integrity of attachment or electrical insulation.

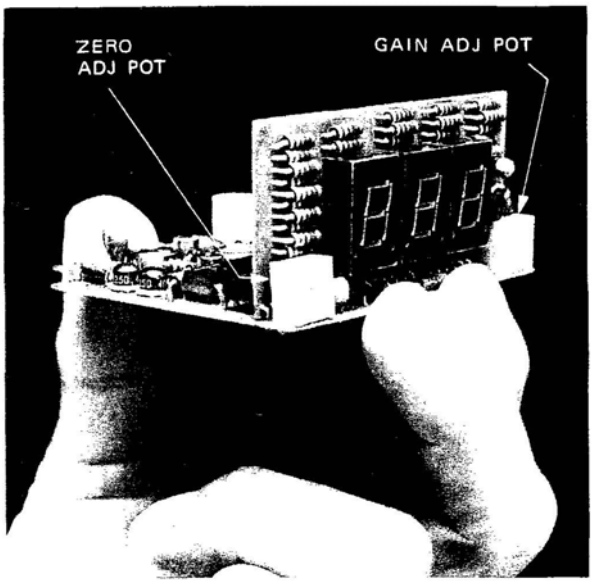
Conventional 7400 series TTL logic is employed, and all parts are commonly available for straightforward repair should it ever prove necessary. Datel maintains a complete stock of replacement parts, assembled circuit boards and repair facilities for fast service. 7400 series logic has been in common use throughout the world in computer and data systems with a proven record of billions of hours of operational experience in every conceivable circuit.

The electrical design is conservative of component ratings and is especially careful with regard to thermal characteristics which is a principal factor affecting reliable operation. Each Datel panel meter receives a 72 hour burn in comprising in excess of 100 power on/off cycles. Experience has shown that the thermal cycling inherent in this type of burn-in is best at locating "infant mortality" failures as components are stressed not only electrically but also mechanically by repeated expansion and contraction. This is many times more effective than a continuous burn in of the same duration which would only apply constant electrical stress. Also, thermal cycling provides a much closer accelerated correspondence to the most frequently encountered operational conditions.

Datel uses rugged solid state 0.43 inch L.E.D. seven segment displays. The displays are located behind a proprietary scratch and solvent resistant red filter with a diffusing surface that minimizes annoying reflections. L.E.D. displays offer exceptionally long life, freedom from lethal voltages, interference, and highly stressed interface circuitry.

As a further assurance of quality, Datel provides a full one year warranty on materials and workmanship for its digital panel meters.

®General Electric Corp.



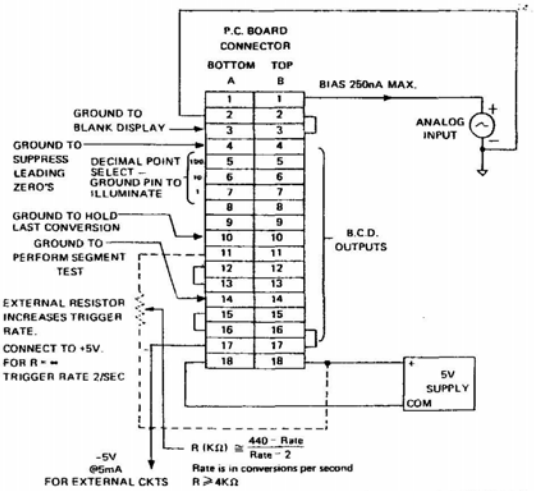
CALIBRATION PROCEDURE

1. Remove front bezel and filter.
2. Set input to DM-3000 from voltage reference source to +0.05% of full scale (+500 microvolts for the 0 to +.999 VFS model).
3. Rotate zero adjust pot until display flickers equally between "000" and "001". (±8mV typ adj. range)
4. Reset voltage reference input source to 99.85% of full scale (+998.5 mV for 0 to +.999 VFS model).
5. Rotate gain adjust until display flickers equally between "998" and "999".
6. Recommended recalibration interval: 3 months.

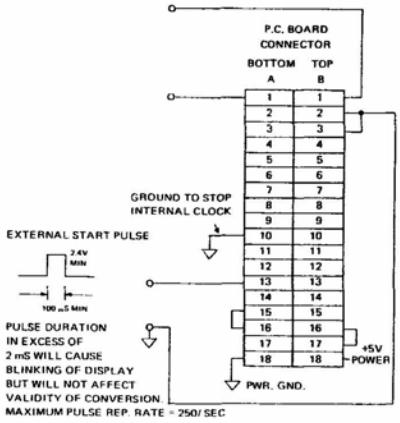
APPLICATIONS SECTION

The applications shown in this section show typical suggested circuits comprised of readily available external components to make your DM-3000 even more useful.
These circuits will tolerate considerable substitution of other manufacturers' components where a particular device number is given. Important circuit details such as trim networks, bypassing and compensation have been omitted for clarity.
Datel cannot warrant the performance of these circuits or their patent status by other manufacturers.
For specific application assistance, contact the Datel home office (617-828-8000).

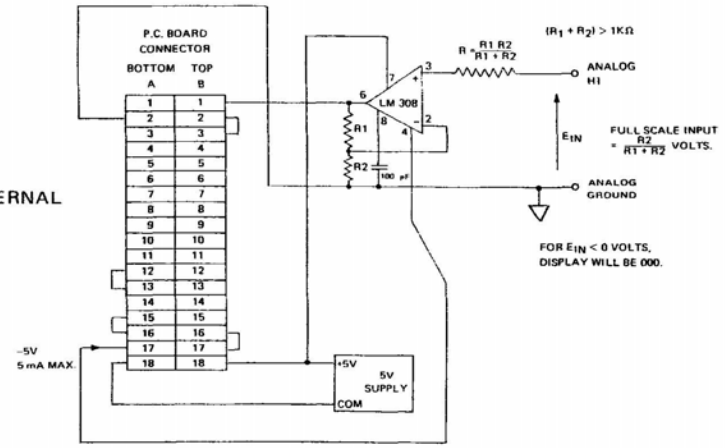
NORMAL CONNECTIONS FOR 0 TO +0.999V SINGLE ENDED INPUT RANGE



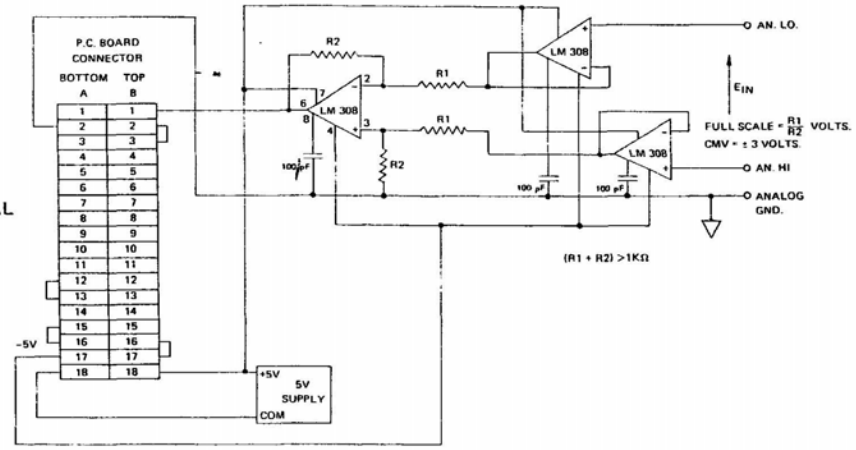
USE OF AN EXTERNAL START PULSE



OPERATION WITH AN EXTERNAL INPUT AMPLIFIER



OPERATION WITH AN EXTERNAL DIFFERENTIAL AMPLIFIER



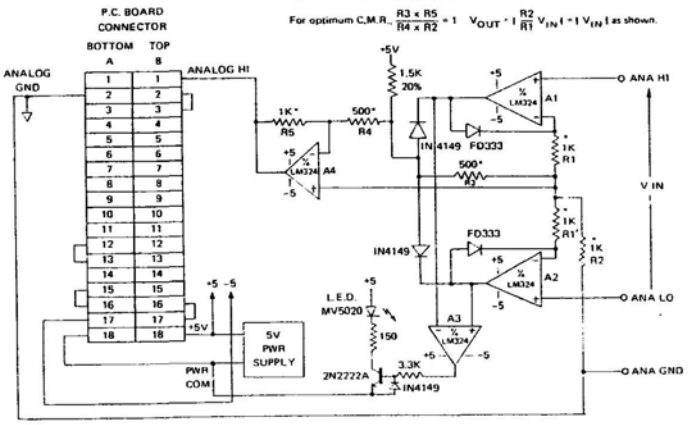
DIFFERENTIAL BIPOLAR INPUT

High impedance, differential absolute value bipolar input circuit using quad op amps.

NOTES:

1. A3 is connected so L.E.D. lights on negative inputs. Swapping inputs of A3 will light L.E.D. on positive input.
2. Common mode range is ±0.5V with ±1V inputs. Quad op amp LM324 is powered by D.P.M.
3. For greater precision, amplifiers A1 and A4 should have offset adjustment.
4. Resistors marked * are precision metal film types 0.1% preferred. 1% types (RN556) can be used, but an adjustment should be included on R4 to optimize common mode rejection.

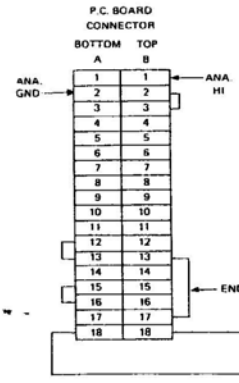
For optimum C.M.R., $\frac{R3 \times R5}{R4 \times R2} = 1$ $V_{OUT} = |\frac{R2}{R1} V_{IN}| = 1 V_{IN}$ | as shown.



CHANGING FULL SCALE TO 199

ANALOG INPUT BECOMES 0.199V

OTHER FULL SCALE COUNTS CAN BE OBTAINED AS DETAILED IN TABLE



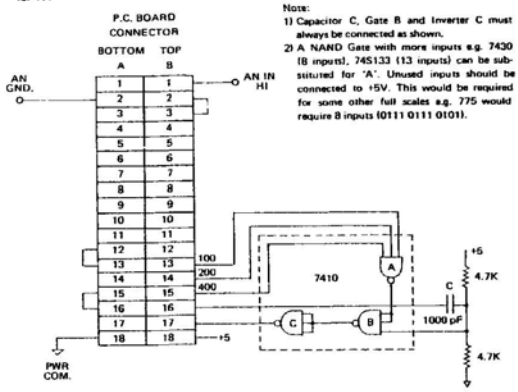
FULL SCALE COUNT	JUMPER B17 TO –
1	B5
9	B8
19	B9
99	B12
199	B13
999	B16

FOR ANY OTHER FULL SCALE COUNT < 999, USE EXTERNAL GATE AS IN NEXT DIAGRAM

CHANGING FULL SCALE TO ANY ARBITRARY COUNT FROM 0 TO 999

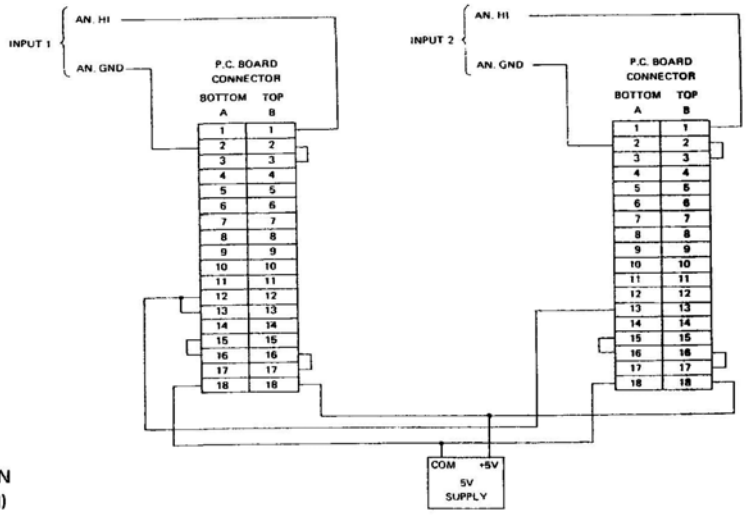
For example, full scale of 699
Connect NAND Gate 'A' to those outputs that would be high on a count of 1 greater than the desired scale.
For example 699 + 1 = 700 corresponds to 0111 0000 0000 in BCD. A three input NAND Gate is required for 'A'.

Note:
1) Capacitor C, Gate B and Inverter C must always be connected as shown.
2) A NAND Gate with more inputs e.g. 7430 (8 inputs), 74S133 (13 inputs) can be substituted for 'A'. Unused inputs should be connected to +5V. This would be required for some other full scales e.g. 775 would require 8 inputs (0111 0111 0101).



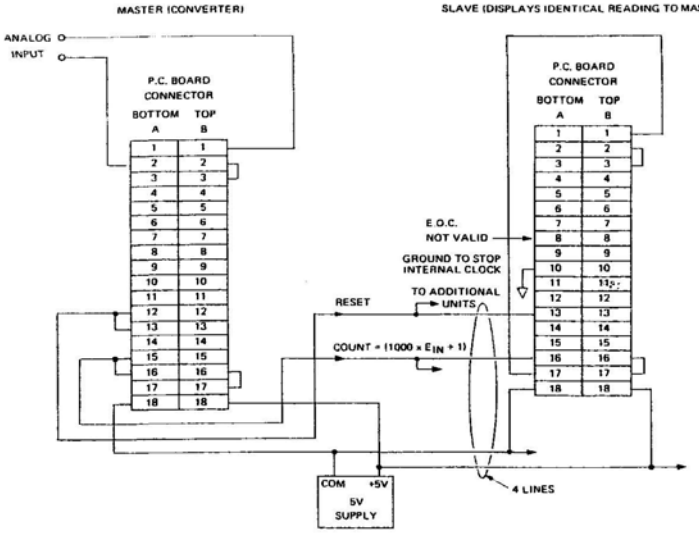
TWO (OR MORE) PANEL METERS CONNECTED FOR SIMULTANEOUS CONVERSION OF TWO ANALOG INPUTS

Differential input recommended to avoid ground loops if operating from common +5V supply.

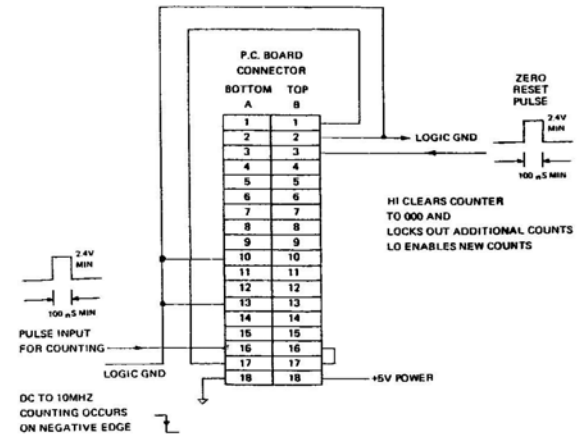


MASTER / SLAVE DISPLAY OPERATION

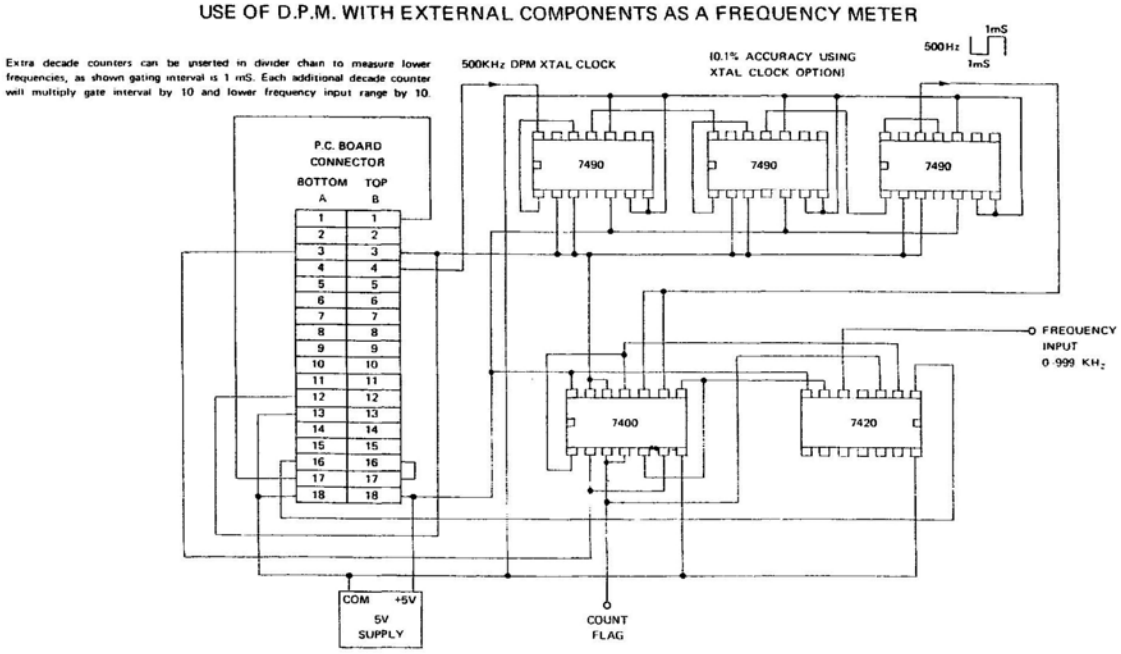
(Can be extended to more units as required)



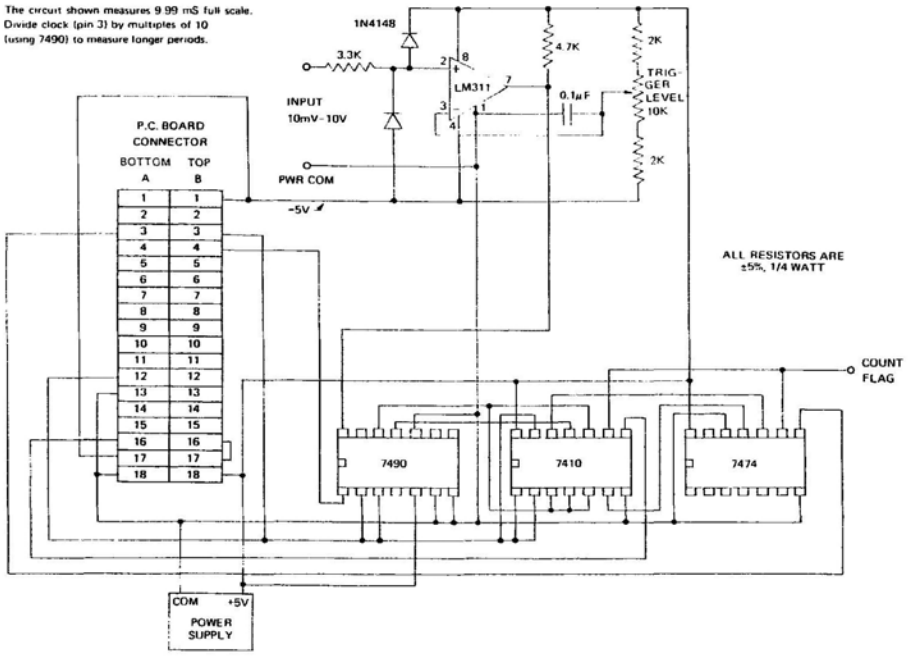
USE OF D.P.M. AS A COUNTER



USE OF D.P.M. WITH EXTERNAL COMPONENTS AS A FREQUENCY METER



USING D.P.M. WITH EXTERNAL COMPONENTS TO MEASURE PERIOD



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01/02/09

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