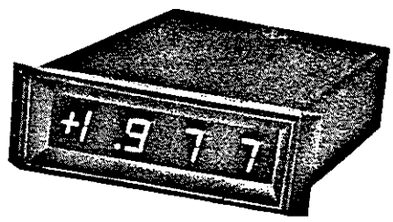
PM-352
DIGITAL PANEL METER

INSTRUCTIONS



INTRODUCTION.

The PM-352 is a three and one-half-digit, fixed-range, miniature digital panel meter with automatic polarity indication for making DC voltage measurements. DC current can also be measured using external shunt resistors. The instrument is available in any one of four ranges: ±1.999 volts F.S., ±19.99 volts F.S., ±199.9 volts F.S. or ±1000 volts F.S.

Modification from any one range to another is easily accomplished by changing one or two resistors. Calibration is accomplished by adjusting a potentiometer accessible at the rear panel.

Systems accomodations include multiplexed BCD outputs, a busy/done output and a hold input.

The PM-352 has a 0.3-inch-high LED numeric readout with LED + and - polarity signs and decimal points for each decade. The polarity display and/or the number display can be blanked or dimmed.

For operation, an external +5 VDC ±5% power supply is required. See figure 1 for a typical power supply circuit.

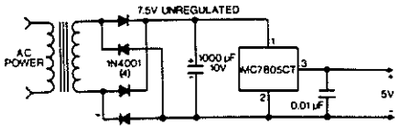


Figure 1. Power Supply Schematic

SPECIFICATIONS.

RANGE:
.000 to 1.999 VDC
or 0.00 to 19.99 VDC
or 00.0 to 199.9 VDC
or 000. to 1000. VDC

ACCURACY: ±0.05% Rdg ±0.05% F.S.

SPEED: 3 Rdg/Sec, nominally

OPERATING TEMP: 0°C to +50°C

POWER: +5 VDC ±5% @ 150 mA, max.

DISPLAY: LED, red, 0.3" high

TURN-ON TIME: 10 seconds to full accuracy

TEMPERATURE COEFFICIENT: ±(0.01% Rdg + 0.001% F.S.)/°C

INPUT Z: 2V range, 1000 megohms; 20V range, 1 megohm; 200V and 1000V ranges, 10 megohms

METHOD OF A TO D CONVERSION: Dual slope

SETTLING TIME: 2 seconds, including polarity change

COMMON-MODE COMPLIANCE: SIGNAL LO may be anywhere in the range from -2 volts to +2 volts with respect to power supply common. Note that if the power for the meter is from an isolated power supply, the effective common-mode compliance is the isolation voltage rating of the power supply.

COMMON-MODE REJECTION: 60 db, minimum

NORMAL-MODE REJECTION: 60 db typical, 40 db minimum @ 50-60 Hz

INPUT CURRENT: 250 pA, maximum on the 2V range.

DECIMAL LOCATION: May be positioned by a jumper to any one of three locations, X.X.X.X

INPUT VOLTAGE PROTECTION: ±100 VDC or peak VAC, 2V range; ±350 VDC or peak VAC, 20V range; ±1000 VDC or peak VAC, 200V and 1000V ranges.

OVERLOAD INDICATION: On all ranges except the 1000V range, an input exceeding full scale is displayed as four flashing zeros.

SIZE: See figure 3

WEIGHT: Approximately 4 ounces

INSTALLATION

1. Mount the PM-352 as follows:

a. Cut hole in panel (figures 2 and 3).

b. Slide trim plate over meter housing, facing beveled edge of trim plate forward.

c. Insert meter through opening in panel from front of panel.

d. Fit mounting clips (2) into slots at sides of instrument. Foot of clip should face forward.

e. Thread screws (2) into clips and tighten screws against rear surface of panel.

2. Install a keying tab in connector to mate with meter between contacts 1 and 2. A connector with keying tab installed is available from your distributor; NLS part number is 39-282. See figure 4 for connector pin information.

OPERATION

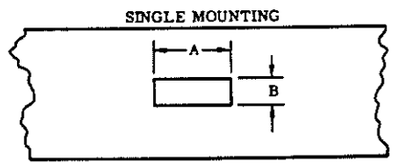
POWER AND SIGNAL CONNECTIONS.

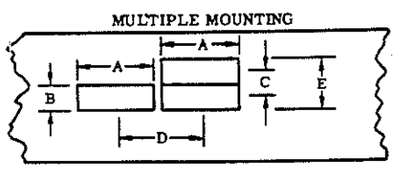
1. Connect power supply common to pin A14 or A15 (these pins are connected internally).

2. Connect +5V power to pins B2 and B14 or B15 (B14 and B15 are connected internally).

3. Connect SIGNAL LO of the source to pin B8.

4. Connect SIGNAL HI of the source to pin B7.





Panel Thickness 1/16" to 1/4"

DIMENSIONS (Inches)

	Panel Cutout With Trim Plate	Center Line Without Trim Plate	Center Line With Trim Plate	Cutout For Multiple Mounting Without Trim Plate
A	2-17/32			
B	31/32			
C		15/16	1-3/16 (Min)	
D		3-1/8 (Min)	3-1/8 (Min)	
E				No. of Units x 15/16

Figure 2. Mounting Data

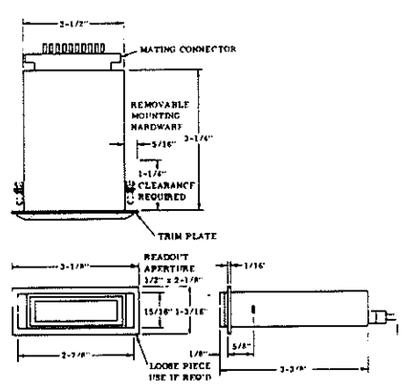


Figure 3. Outline Drawing

NOTE

In an electrically noisy environment it may be desirable to use a shielded lead for this connection. If a shielded lead is used, the shield should be connected to SIGNAL LO of the source.

5. Jumper pins A12 and B12 unless ratio measurements are to be made. For ratio measurements refer to paragraph on External Reference.

6. Connect pin B6, polarity enable, to pin B14 or B15.

7. Connect pin A1, display enable, to pin B14 or B15.

8. Connect analog common, pin B11, to SIGNAL LO of the source. For maximum accuracy and stability, this connection should be made at the source - not pin B8.

9. Connect the negative terminal of the power supply to SIGNAL LO of the source. For maximum accuracy and stability, this connection should be made at the source - not pin B8.

DECIMAL POINT INDICATION. To display a decimal point, connect pin A6 of the edge connector to pin A5, A4 or A3, depending upon which decimal point is to be illuminated. See below.

DECIMAL LOCATION	+1	.0	.0	.0
CONNECTOR PIN		A3	A4	A5

If a decimal point is not desired, omit the jumper.

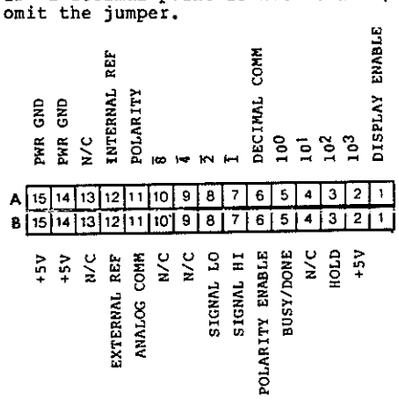


Figure 4. Connector Pin Information

HOLD FUNCTION. Pin B3 is a control input for the reading hold function which can be controlled from either a logic level (0V or +5V) or a contact-closure. A low logic state or contact-closure to ground (pin A14) will cause the meter to cease making measurements and hold the reading of the measurement in progress. A high logic level or open contacts will cause the meter to resume repetitive measurements.

DISPLAY DIMMING AND BLANKING. The display and polarity enable functions are used for dimming and blanking the display by controlling the supply voltage to the readouts. Connecting pin A1, the display enable function, to pin B14 or B15, the +5V supply, illuminates the numerals at full brightness. Connecting pin B6, the polarity enable function, to pin B14 or B15 illuminates the polarity signs at full brightness. Polarity enable is provided separately so that polarity signs can be blanked for measurements having no polarity. The entire readout can be dimmed to any convenient brightness by connecting a resistor or rheostat (variable brightness) between the +5V power (pin B14 or B15) and the enable lines (pins A1 and B6).

EXTERNAL REFERENCE (PIN B12). To make ratio measurements, connect an external reference between pins B11 and B12 of the edge connector (- to B11, + to B12). Pin A12 should have no connection. The ratio of the input signal voltage to the external reference is then displayed. Note that in the ratio mode, the calibration potentiometer has no effect. Therefore an external adjustable voltage divider may be

required if exact calibration is needed.

For best results, the value of the external reference voltage should be between +0.5 and +2.0 volts.

BINARY CODED DECIMAL (BCD) OUTPUTS. The 1, 2, 4, 8 multiplexed BCD outputs are available on connector pins A7, A8, A9 and A10 respectively. When digit 4 enable (pin A2) goes to a "high" logic level (zero), the 1, 2, 4 and 8 BCD outputs represent digit 4, the most significant digit. When digit 3 enable (pin A3) goes "high", the BCD outputs represent digit 3, and so on, to the least significant digit. For connector pin information refer to figure 4. Digits are scanned from most significant to least significant digit. Each digit goes "low" for approximately 1-2/3 milliseconds, and there is no gap between successive digit enables except when the meter goes into overload. For the BCD outputs, "high" = true = +5 volts.

STROBE. If the STROBE output is required, a jumper must be added between pin B4 of the edge connector and pin 26 of ICL7135 (U2). The strobe will then be available on pin B4 of the mating connector. the The strobe output consists of five negative-going pulses which occur once for each measurement cycle, after the end of the full measurement cycle. They are intended for use in transferring the BCD output to external memory devices. The pulses are each approximately four microseconds wide. The first one occurs in the center of the digit 4 (most significant digit) enable pulse. The second one occurs in the center of the digit 3 enable pulse. This continues through digit 1 (least significant digit). The fifth pulse is not needed in PM-352 applications.

BUSY (PIN B5). When the meter is in the process of making a measurement, the "busy" output is "high" (+5V). When the measurement is completed, the "busy" output goes low (0V).

POLARITY OUTPUT (PIN A11). When the polarity of the input signal is positive, pin A11 goes "high" (+5V). When the polarity of the input signal is negative, pin A11 goes "low". This output becomes valid at the beginning of the reference integrate and remains correct until it is revalidated for the next measurement. It is valid when the "busy" output is low.

RANGE MODIFICATION.

The range of the meter can be changed as follows:

1. Insert the blade of a small screwdriver or pen knife between case and rear cover, midway on case above printed circuit connector, and pry gently outward. Remove rear cover.

2. Slide meter assembly from case. Observe that red filter is a loose piece and will be required for reassembly.

3. Observe resistor values for R6 and R8 and compare to table I and figure 5 below. Install resisters of values specified in table I to obtain desired range.

4. If a decimal point is desired, refer to paragraph under "Decimal Point Indication".

5. Clean all solder joints and adjacent areas on printed circuit board to minimize leakage paths.

6. Reassemble meter.

7. A range modification resistor set for PM-352 is available from your distributor, specify NLS part number 39-356.

Table I. Range Resistor Values

RANGE	R6	R8
2V	JUMPER	OMIT
20V	909 kOhms 1%	100 kOhms 1%
200V	10 MOhms 1%	100 kOhms 1%
1000V	10 MOhms 1%	10 kOhms 1%

CURRENT MEASUREMENT.

DC current measurements can be made using an externally mounted shunt resistor. Use meter in the two-volt range and connect shunt resistor between pins B7 and B8 of the edge connector.

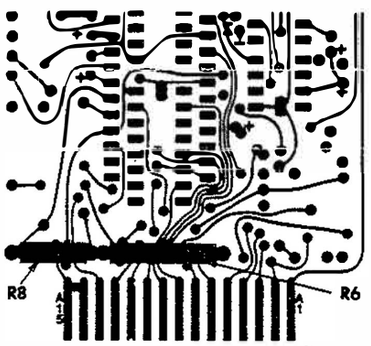


Figure 5. Component Location

If the current being measured enters pin B7 and exits from pin B8, the polarity display will be positive.

The value of the shunt resistor should be chosen as set forth in Table II. Note that at full scale, the voltage drop across the shunt resistor is 1.999 volts. The measuring circuit should be carefully examined to insure that this voltage drop does not introduce excessive error into the measurement.

Table II. Shunt Resistor Values for Current Measurement

FULL SCALE CURRENT	SHUNT RESISTOR
19.99 Microamperes	100 Kilohms
199.9 Microamperes	10 Kilohms
1.999 Milliamperes	1 Kilohm
19.99 Milliamperes	100 Ohms
199.9 Milliamperes	10 Ohms
1.999 Amperes	1 Ohm

CALIBRATION.

To calibrate the instrument, perform the following steps.

1. Allow the meter to warm up for at least five minutes.

2. Set the power supply voltage to +5 volts ±2%.

3. Apply DC input signal voltages as follows:

RANGE OF INSTRUMENT	CALIBRATION VOLTAGE
2 V	+1.990 V
20 V	+19.90 V
200 V	+190.0 V
1000 V	+990. V

4. Adjust potentiometer at rear of meter until display agrees with input.

5. Disconnect calibration voltage and power supply input.

MAINTENANCE.

Due to the solid-state construction and the temperature-cycled burn-in, your PM-352 is an extremely reliable instrument. However in the event of trouble, the LED readouts and the major integrated circuits plug into sockets and can be easily replaced without soldering.

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