RM-452EC
DIGITAL PANEL METER

INSTRUCTIONS

INTRODUCTION.

The Model RM-452EC is a four and one-half-digit, fixed-range, digital panel meter for making DC voltage measurements. DC current can also be measured using internal or external shunt resistors. The instrument is available in any one of four ranges: ±1.9999 volts F.S., ±19.999 volts F.S., ±199.99 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 readily accomplished by the adjustment of one potentiometer accessible at the front of the instrument.

The value of the measured voltage (or current) is displayed in one-half-inch high light-emitting diode numerals. The voltage value is also available in multiplexed binary coded decimal form at the rear of the instrument for convenient interfacing with microprocessors, printers and other system components.

An active filter at the signal input typically provides 60 db of normal-mode rejection at 50-60 Hz.

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

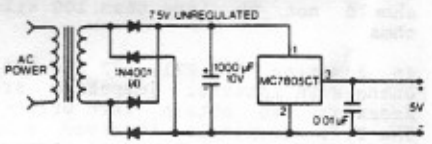


Figure 1. Power Supply Schematic

SPECIFICATIONS.

RANGE: ±.0000 to ±1.9999 VDC
or 0.000 to ±19.999 VDC
or 00.00 to ±199.99 VDC
or 000.0 to ±1000.0 VDC

ACCURACY: ±0.02% Full Scale

SPEED: 3 Rdg/Sec, nominally

OPERATING TEMP: 0°C to +50°C

POWER: +5 VDC ±5% @ 140 mA, max.

DISPLAY: LED, red, 0.5" high

TURN-ON TIME: 10 seconds to 0.05% 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

SIZE: See figure 2

WEIGHT: Approximately 5.6 ounces

MOUNTING DATA.

A rectangular panel cutout is recommended for mounting the meters. The recommended dimensions are:

92 millimeters +1, -0 mm (3.622 inches +0.040, -0 in.)

43 millimeters +1, -0 mm (1.693 inches +0.040, -0 in.)

The meters will also fit the DIN/NEMA standard cutout, 92 mm x 45 mm (3.622 x 1.772 in.) and the widely used 99.7 mm x 42.72 mm (3.925 in. x 1.682 in.) cutout.

Any panel thickness from 1.524 mm (0.060 in.) to 4.57 mm (0.18 in.) may be used.

To mount the meter, remove the retaining spring from its holes in the sides of the meter at the rear. Insert the meter from the front of the panel cutout. Replace the retaining spring and slide it behind the mounting panel to fasten the meter in place. It does not matter whether the retaining spring swings from above or below the meter.

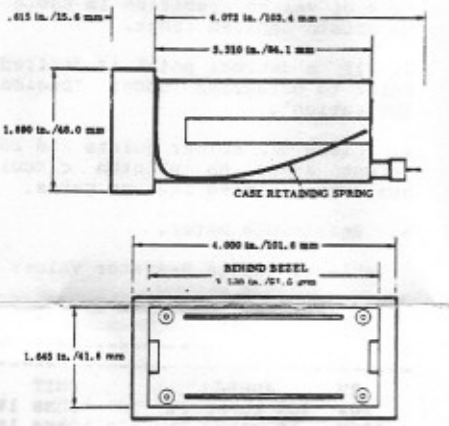


Figure 2. Outline Drawing

MATING CONNECTORS

Any of the following connectors may be used to mate with the RM-452EC:

Manufacturer	Connector Part No.
Viking	2VH15/1AN5 091-0024-000*
Stanford Applied Engineering	SAM-15D/1/2 007900*
Masterite Industries	S014GR15-DR-H-X 60217-21*
Microplastics, Inc.	MP-0156-15-DP-1 04-0001-000*

*Polarizing Key Part No.

A polarizing key should be placed

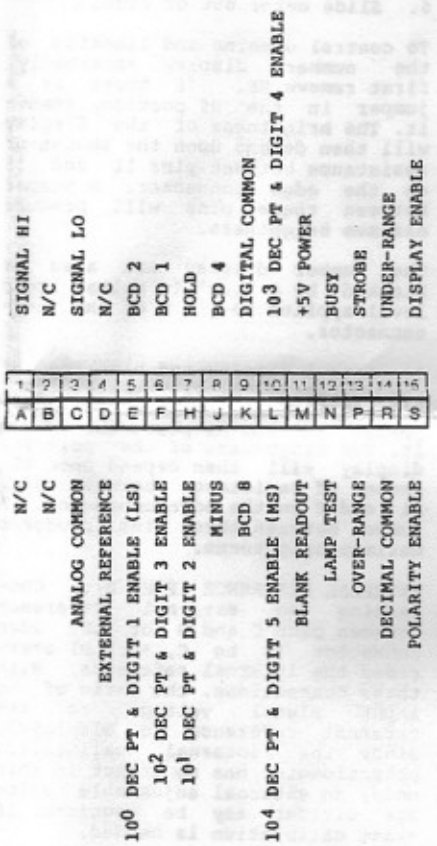


Figure 3. Wiring Connections

5. Connect analog common, pin C, to SIGNAL LO of the source. For maximum accuracy and stability, this connection should be made at the source - not pin 3.

6. 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 3.

DECIMAL POINT INDICATION. To display a decimal point, connect pin R of the edge connector to pin E, H, P, 10 or L, depending upon which decimal point is to be illuminated. See below.

DECIMAL LOCATION	+1	.0	.0	.0	.0 .
CONNECTOR PIN		L	10	F	H E

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

HOLD (PIN 7). Connecting pin 7 of the edge connector to ground (pin 9) will cause the meter to stop making measurements, and to continue to display the result of the measurement in progress when the meter was placed in hold. Removing the connection to ground will permit the meter to continue making measurements.

Logic levels (0 to +5V) may be used

SETTLING TIME: 2 seconds, including polarity change

COMMON-MODE COMPLIANCE: SIGNAL LO may be anywhere in the range from -0.1 volt to +1 volt with respect to power supply common. Note that if the power for the meter is supplied from an isolated power supply, the effective common-mode compliance is the isolation voltage rating of the power supply.

COMMON-MODE REJECTION: 80 db, minimum

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

INPUT CURRENT: 250 picoamperes

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

*Polarizing Key Part NO.

A polarizing key should be placed between pins 1 and 2. A connector with polarizing key installed is available from NLS. Part number is 46-199-1. The connector is fastened to the case with two screws, 4-40 x 7/16".

OPERATION

POWER AND SIGNAL CONNECTIONS.

1. Connect power supply common to pin 9 of the edge connector.

2. Connect +5V power to pin 11.

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

4. Connect SIGNAL HI of the source to pin 1.

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.

Logic levels (0 to +5V) may be used on pin 7 instead of the connection to ground.

DISPLAY DIMMING AND BLANKING. The display can be dimmed or blanked under internal or external control.

Increasing the value of R6 dims the number display. See figure 4 for component location. As shipped from the factory, R6 is a jumper. Removing the jumper blanks the number display.

Increasing the value of R5 dims the polarity display. As shipped from the factory, R5 is a jumper. Removing the jumper blanks the polarity display.

To gain access to the printed circuit board assembly proceed as follows:

1. Remove all sources of power and signal from the meter.

2. Remove the two screws fastening mating connector to meter case.

3. Unplug mating connector.

4. Using a knife or a small screwdriver blade, carefully pry off front panel.

5. Remove the two screws and the two retaining brackets behind front panel.

6. Slide meter out of case.

To control dimming and blanking of the number display externally, first remove R6. If there is a jumper in the R6 postion, remove it. The brightness of the display will then depend upon the amount of resistance between pins 11 and 15 on the edge connector. A jumper between these pins will produce maximum brightness.

The number display can also be blanked by a "low" (0 volts) logic level applied to pin M of the edge connector.

To control dimming and blanking of the polarity display externally, first remove R5. If there is a jumper in the R5 position, remove it. The brightness of the polarity display will then depend upon the amount of resistance between pins 11 and S on the edge connector. A jumper between these pins produces maximum brightness.

EXTERNAL REFERENCE (PIN D). Connecting an external reference between pins C and D of the edge connector (- to C, + to D) overrides the internal reference. With these connections, the ratio of the input signal voltage to the external reference is displayed. Since the internal calibration potentiometer has no effect in this mode, 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.

The input resistance between pins C and D is 59 kilohms, minimum. This resistance may be increased by gaining access to the PC board as described under "Display Dimming and Blanking", and removing R24 and R26. This will increase the reference input resistance to 1000 megohms.

BINARY CODED DECIMAL (BCD) OUTPUTS. The 1, 2, 4, 8 multiplexed BCD outputs are available on connector pins 6, 5, 8 and K, respectively. When digit 5 enable (pin L) goes to a "low" logic level (zero), the 1, 2, 4 and 8 BCD outputs represent digit 5, the most significant digit. When digit 4 enable (pin 10) goes "low", the BCD outputs represent digit 4, and so on, to the least significant digit. For connector pin information refer to figure 3. 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.

(+5V). When the measurement is completed, the "busy" output goes "low" (0V).

OVER-RANGE (PIN P). When the "busy" output goes "low", if the input signal exceeds the full-scale range of the meter, the "over-range" output will go "high" (+5V). It will reset to zero at the beginning of reference integrate in the next measurement cycle.

UNDER-RANGE (PIN 14). When the "busy" output goes "low", if the input signal is 9% of full scale or less, the "under-range" output will go "high" (+5V). It will reset to zero at the beginning of the signal integrate in the next measurement cycle.

POLARITY (PIN J). When the polarity of the input signal is positive, pin J goes "low" (0V). When the polarity of the input signal is negative, pin J goes "high". This output becomes valid at the beginning of the reference integrate and remains correct until it is re-validated 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. Gain access to the printed circuit board assembly as set forth under "Display Dimming and Blanking".

2. Observe resistor values for R17 and R18 and compare to table I and figure 4 below. Install resistors of values specified in table I to obtain desired range.

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

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

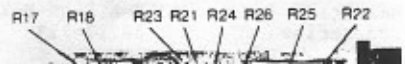
5. Reassemble meter.

Table I. Range Resistor Values

RANGE	R17	R18
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 internally or externally mounted shunt resistor. For internal mounting, replace R18 with the shunt resistor, and replace R17 with a jumper. For external mounting, use meter in the two-volt range and connect shunt resistor between pins 1 and 3 of the edge connector.



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 1.9999 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
19.999 μA	100 kOhms
199.99 μA	10 kOhms
1.9999 mA	1 kOhm
19.999 mA	100 Ohms
199.99 mA	10 Ohms
1.9999 A	1 Ohm*

*External mounting only; resistor dissipates 4 watts at full scale.

SCALING AND ZERO OFFSET.

Provision is made on the PC board assembly to insert additional components required for zero offset. This offset capability together with special scaling greatly increases the versatility of the meter so that virtually any engineering unit may be displayed.

The components required for zero offset are R21, R22 and R23. Unless zero offset is specified, these components are not furnished. However, they may be added at any time, either at the factory or in the field. The values of these components depend upon the amount of zero offset required. However, the total resistance, R21+R22+R23, should not be less than 100 kilohms.

In addition to R21, R22 and R23, changes in internal jumpering are necessary to obtain zero offset. The P.C. terminals involved with zero offset are numbered E1 through E7. Unless the meter has been ordered with specific zero offset, it will be shipped from the factory with no zero offset. E2 will be connected to E4, and E1 will be connected to E5. E3, E6 and E7 will have no connections.

CALIBRATION.

To calibrate the instrument, perform the following steps.

1. Using a knife or a small screwdriver blade, carefully pry off the front panel to gain access to the calibration potentiometer.

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

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

4. Apply DC input signal voltages as follows:

RANGE OF	CALIBRATION

successive digit enables except when the meter goes into overload. For the BCD outputs, "high" = true = +5 volts.

STROBE (PIN 13). 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 5 enable pulse. The second one occurs in the center of the digit 4 enable pulse. This continues through digit 1 (least significant digit) when the fifth and last strobe pulse occurs. The digit enable pulses will continue to scan (unless the previous signal was overload) but no additional strobe pulses will occur until a new measurement is made.

BUSY (PIN 12). When the meter is in the process of making a measurement, the "busy" output is "high"

connector.

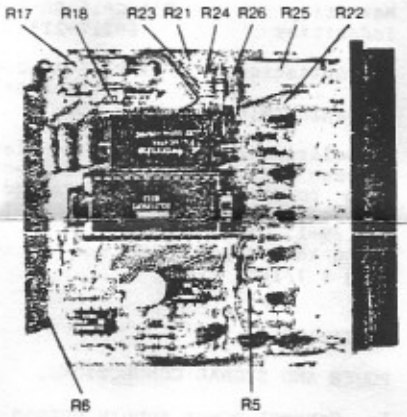


Figure 4. Component Location

If the current being measured enters pin 1 and exits from pin 3, the polarity displayed will be positive.

4. Apply DC input signal voltages as follows:

RANGE OF INSTRUMENT	CALIBRATION VOLTAGE
2 V	+1.9990 V
20 V	+19.990 V
200 V	+199.90 V
1000 V	+999.0 V

5. Adjust R25 at lower right of display panel until display agrees with input.

6. Disconnect calibration voltage and power supply input.

7. Replace front panel.

MAINTENANCE.

The three largest integrated circuits and the five LED display modules all have sockets for ease of replacement.

Specifications Subject to Change without Notice

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