

Figure 6. Printed Circuit Bottom View

4. **Decimal Indication.** Jumper between pin 5 and pins 7, 13 or 15 depending upon which decimal point is to be illuminated. See below. If a decimal is not desired, do not install a jumper.

Decimal Location	+ 1 . 0 . 0 . 0
Pin No.	15 13 7

5. **Connector.** Plug connector onto P/C fingers at rear of RM-351. Orient connector so the keying tab mates with the slot in the P/C board.

6. **Readings.** Apply power and signal. Within 10 seconds the RM-351 will display the correct reading.

NOTE

If it is desired to power the RM-351 from a +5V supply which is not floating with respect to the signal to be measured, the following conditions must be met. The supply must be well regulated, have low impedance, and be noise-free. The negative side of the supply and the low side of the signal must be within 100 mV of each other.

OPERATION (RM-351TB)

1. **Power Supply.** Connect the negative side of your 5V supply to contact 5 of the terminal block and the positive side to contact 6.

2. **Signal.** Connect the signal to be measured to contact 1 of the terminal block. A shielded lead may be needed if the signal has a high source resistance. Connect the low side of the signal to be measured to contacts 2 and 5. It will usually be better to do this with two separate wires rather than a jumper across contacts 2 and 5 at the terminal block. This will eliminate current flow through the signal low connection to pin 2.

3. **Polarity Display.** For instructions on blanking of the polarity display, refer to the paragraph on polarity display under Operation (RM-351).

4. **Decimal Indication.** Jumper between contact 3 and contacts 4, 7, or 8 depending upon which decimal point is to be illuminated. See

below. If a decimal is not desired, do not install a jumper.

DECIMAL LOCATION	+ 1 . 0 . 0 . 0
CONTACT NO.	8 7 4

5. **Readings.** Apply power and signal. Within 10 seconds the RM-351 will display the correct reading.

NOTE

If it is desired to power the RM-351TB from a +5V supply which is not floating with respect to the signal to be measured, the following conditions must be met. The supply must be well regulated, have low impedance, and be noise-free. The negative side of the supply and the low side of the signal must be within 100 mV of each other.

CALIBRATION.

1. Using a knife or thin screwdriver, carefully pry off the red plastic front panel to make the calibration potentiometer available for adjustment.

2. Ensure a 5-minute warm-up period.

3. Verify the +5-volt power supply voltage. If necessary, adjust to +5V (±0.1V).

4. **200 Millivolt Meter.** With a precision DC power supply, apply +190 mVDC. Adjust potentiometer R4 at front of meter until readout displays +190.

NOTE

As in paragraph 3 above, for a 2-volt meter, apply +1.900 VDC; a 20-volt meter, apply +19.00 VDC; a 200-volt meter, apply +190.0 VDC; and a 1000-volt meter, apply 900 VDC.

RANGE MODIFICATION (Except 200 mV unit)

1. Remove two screws fastening mating connector to meter case (RM-351 only).

2. Unplug mating connector (RM-351 only)

3. Remove plastic front panel (see Calibration).

4. Remove two screws and two retaining brackets behind front panel.

5. Slide meter out of case.

6. Observe resistor values for R9 and R10 and compare to figure 7 and Table III.

7. Install resistors specified in Table III to attain desired range. Note that resistors R9 and R10 plug in. No soldering is required.

8. If a decimal indication is required, refer to paragraph 4 under Operation.

9. Reassemble meter.

10. A range modification resistor set covering the four higher ranges of the instrument is available from your distributor. Specify NLS part number 39-356.

Table III. Resistor Values in Range Modification Kit

RANGE	R9	R10
2V	100 kΩ (±5%)	OMIT
20V	909 kΩ (±1%)	100 kΩ (±1%)
200V	10 MΩ (±1%)	100 kΩ (±1%)
1000V	10 MΩ (±1%)	10 kΩ (±1%)

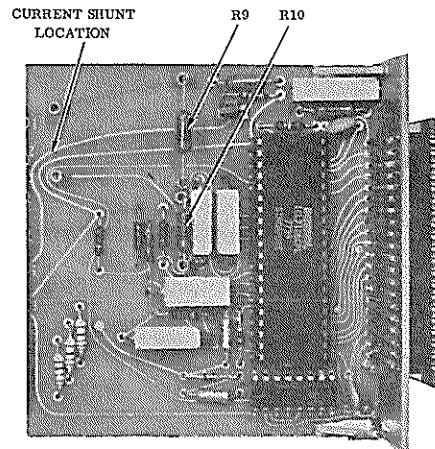


Figure 7. Component Location

CURRENT MEASUREMENT

A shunt resistor may be plugged in to the terminals shown in figure 7 to permit current measurement. Alternatively, an external shunt resistor may be connected between signal high and signal low. For current measurement, the meter should be connected in the 200 mV or the 2 V range, depending on the full scale voltage drop which can be tolerated. Table IV shows the shunt resistor value required. The accuracy of measurement will be determined largely by the accuracy of the shunt resistor.

Table IV. Shunt Resistor Values

Full Scale Current Range	Shunt Resistor for meter in 200 mV Range
2mA	100 OHMS
20mA	10 OHMS
200mA	1 OHM
2A	.1 OHM*
Full Scale Current Range	Shunt Resistor for meter in 2V range
2mA	1000 OHMS
20mA	100 OHMS
200mA	10 OHMS
2A	1 OHM*

* Use external shunt only

MAINTENANCE.

To facilitate maintenance, all three integrated circuits plug into the printed circuit board and can be easily removed without soldering. These include the LCD display, the ICL7016-CPL chip and the CD4049AE chip.

Specifications Subject to Change without Notice



Non-Linear Systems, Inc.
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RM-351 & RM-351TB DIGITAL PANEL METERS

INTRODUCTION.

The RM-351 and the RM-351TB are three and one-half-digit, fixed range instruments with automatic polarity. The RM-351 has a card-edge connector and the RM-351TB has a terminal block connector. The meters are available in any one of five ranges: ± 199.9 millivolts F.S., ± 1.999 volts F.S., ± 19.99 volts F.S., ± 199.9 volts F.S. or ± 1000 volts F.S.

Except for the ± 199 millivolt range, modification from one range to another may be easily accomplished by the substitution, addition or deletion of one or two resistors. Calibration is readily accomplished by the adjustment of one potentiometer, accessible at the front of the instrument. For operation, an external ± 5 vdc ($\pm 5\%$) power supply is required. See figure 1 for a typical power supply circuit.

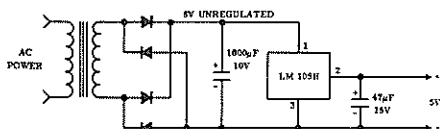


Figure 1. Typical Power Supply Schematic

SPECIFICATIONS.

Range: 0 to ± 199.9 mVDC
 or 0 to ± 1.999 VDC
 or 0 to ± 19.99 VDC
 or 0 to ± 199.9 VDC
 or 0 to ± 1000 VDC

Accuracy: $\pm(0.05\% \text{ Rdg.} + 0.05\% \text{ F.S.})$

Update Rate: 3 readings/second nominal

Display: 0.6" high LCD

Operating Temperature: 0°C to $+50^{\circ}\text{C}$

Power: $+5$ vdc ($\pm 5\%$) @ 6 mA maximum

Size: See figures 3 and 4.

Weight: 5 oz (142 grams)

T/C: $\pm 0.02\% \text{ Rdg./}^{\circ}\text{C}$ on 200 mV & 2V ranges;
 $\pm 0.025\% \text{ Rdg./}^{\circ}\text{C}$ on other ranges

Input Z: 200 mV range, 100 M Ω ; 2V range, 1000 M Ω ; 20V range, 1 M Ω ; 200 V & 1000V ranges, 10 M Ω

Common-Mode

Rejection: 80 db minimum

Common Mode

Compliance: ± 100 mV between SIG LO & neg. terminal of B+ supply

Decimal Location: May be positioned by jumper on connector to any one of three locations; $\pm X.X.X.X$

Input Current: 250pA maximum (room temp.)

Input Voltage

Protection: ± 50 vdc or 50 vrms maximum, 200 mV or 2V ranges; ± 150 vdc or 150 vrms maximum, 20V range; ± 1000 vdc or 700 vrms maximum, 200V and 1000V ranges.

Overload

Indication: Positive overload: ± 1 ; negative overload: -1 is displayed for inputs exceeding full scale.

OPERATING PRINCIPLES (See figure 2.)

Analogue-to-digital conversion is accomplished in a single monolithic integrated circuit. The output of the A/D converter drives an LCD display. Provision is made for blanking the polarity sign. Decimal point selection is accomplished by external jumpers.

MOUNTING DATA

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

92 millimeters $+1, -0$ mm (3.622 inches $+ .040, -0$ in.)

INSTRUCTIONS

43 millimeters $+1, -0$ mm (1.693 inches $+ .040, -0$ in.)

The meters will also fit the DIN/NEMA standard cutout, 92 mm x 45 mm (3.622 in 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 spring retainer from its holes in the sides of the meter at the rear. Insert the meter from the front of the panel cutout. Replace the spring retainer and slide it behind the mounting panel to fasten the meter in place. It does not matter whether the spring retainer swings from above or below the meter.

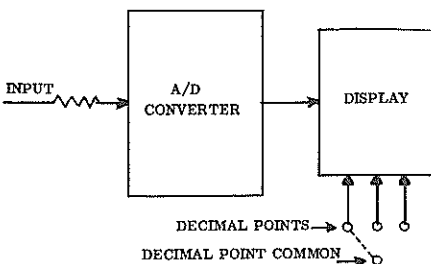


Figure 2. Simplified Block Diagram

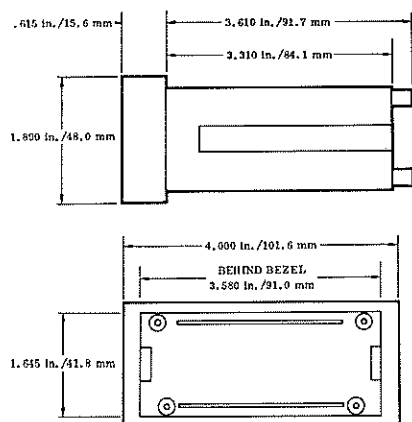


Figure 3. Card-Edge Configuration

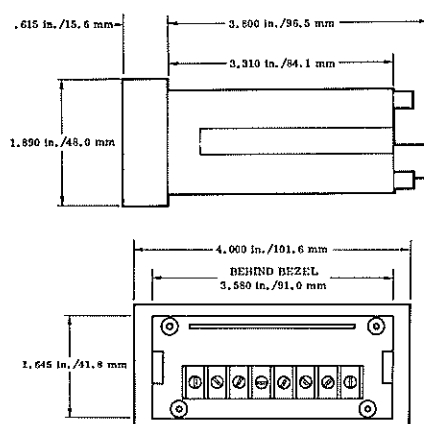
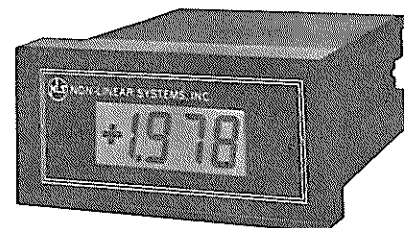


Figure 4. Terminal Block Configuration

MATING CONNECTOR (RM-351)

Any of the following connectors may be used with the RM-351:

Manufacturer	Connector Part Number
Viking	2VH15/1AB5
Stanford Applied Engineering	SAM-15S/1-2
	Polarizing Key Part Number 007900
Masterite Industries	S014GR15-SR-H-X
	Polarizing Key Part Number 60217-1
Microplastics, Inc.	MP-0156-15-SP-1
	Polarizing Key Part Number 04-0001-000



A polarizing key should be installed between contacts 1 and 2. A connector with polarizing key installed is available from NLS. Part number is 46-107-1. The connector is fastened to the case with two screws, 4-40 x 7/16".

Table I. Connector Pin Information for RM-351

Pin No.	Function
1	Signal High
2	N/C
3	Signal Low
4	N/C
5	Decimal Pt. Com.
6	N/C
7	10^0 Decimal
8	N/C
9	Power Gnd
10	N/C
11	+5 Volts
12	N/C
13	10^1 Decimal
14	N/C
15	10^2 Decimal

TABLE III. Terminal Block Contact Information for RM-351TB

Contact No.	Function
1	Signal High
2	Signal Low
3	Decimal Pt. Com.
4	10^0 Decimal
5	Power Ground
6	+5 Volts
7	10^1 Decimal
8	10^2 Decimal

OPERATION (RM-351)

1. **Power Supply.** Connect the negative side of your 5V supply to pin 9 of the connector and the positive side to pin 11.

2. **Signal.** Connect the signal to be measured to pin 1 of the connector. A shielded lead may be needed if the signal has a high source resistance. Connect the low side of the signal to be measured to pins 3 and 9 of the connector. It will usually be better to do this with two separate wires rather than a jumper across 3 and 9 at the connector. This will eliminate current flow through the signal low connection to pin 3.

3. **Polarity Display.** The polarity may be blanked by cutting two PC traces and adding two jumpers on the PC board. Figure 5 shows the location of the two jumpers and one of the traces to be cut. Figure 6 shows the other trace to be cut. The traces to be cut contain two parallel lines about one sixteenth inch long. For instructions on removing the meter from the case, refer to the paragraph on Range Modification.

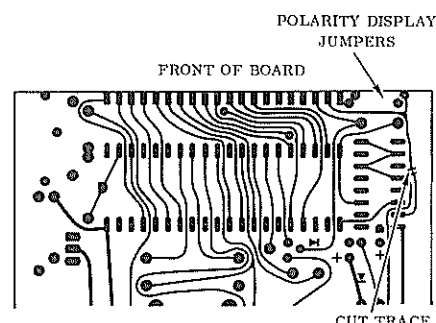


Figure 5. Printed Circuit Top View