



RM-351/AC & RM-351TB/AC DIGITAL PANEL METERS

INTRODUCTION.

The RM-351/AC and RM-351TB/AC are three and one-half-digit, fixed-range digital panel meters for making AC voltage measurements. AC current can also be measured by externally connecting a shunt resistor across the AC signal input terminals. The display consists of 0.6-inch high LCD numerals and a decimal point. Connections to the RM-351/AC are made via two card-edge connectors. Connections to the RM-351TB/AC are made via two terminal blocks. The meters are available in any one of four ranges: 1.999V F.S.; 19.99V F.S.; 199.9V F.S. or 1000V F.S.

Modification from one range to another may be easily accomplished by the substitution, addition or deletion of one to three resistors and one capacitor. Calibration is readily accomplished by 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.

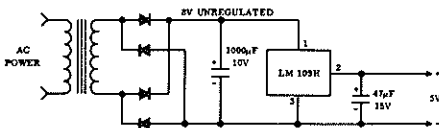


Figure 1. Typical Power Supply Schematic

SPECIFICATIONS.

RANGE	RESOLUTION	INPUT IMPEDANCE	MAXIMUM INPUT VOLTAGE
1.999 VAC	1 mV	1 M Ω , 20 pF	100 VAC
19.99 VAC	10 mV	1 M Ω , 20 pF	400 VAC
199.9 VAC	100 mV	10 M Ω , 20 pF	1000 VAC
1000 VAC	1 V	10 M Ω , 20 pF	1000 VAC

Accuracy: $\pm 0.7\%$ Reading (± 2 digits)

Frequency Range: 50 to 400 Hz

Display: 0.6" high, LCD

Operating Temperature: 0° to +50°C

Power: +5 VDC ($\pm 5\%$) @ 50 mA maximum

Size: See figures 2 and 3

Weight: 8 ounces (227 g)

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

Overload Indication: Left-most digit is the numeral 1; remaining digits are blank.

AC Converter Response: Average responding, calibrated to display RMS value of sine wave.

CONSTRUCTION.

The RM Series AC reading, DC powered panel meters each contain two printed circuit board assemblies, mounted one above the other. The lower assembly is the display/main board

INSTRUCTIONS

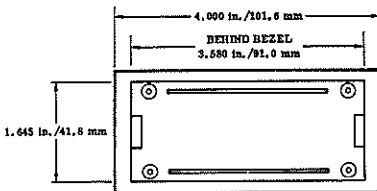
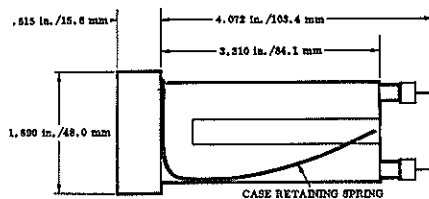
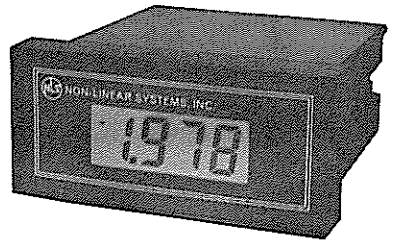


Figure 2. Card-Edge Configuration

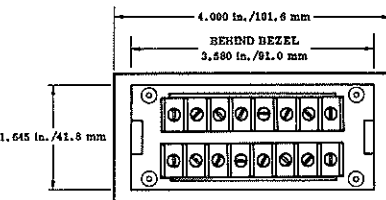
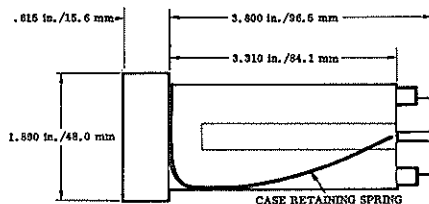


Figure 3. Terminal Block Configuration

assembly and the upper assembly is the AC/DC converter assembly. For the RM-351/AC, all interconnections between the upper and lower assemblies are made via the mating connectors at the rear of the meter. For the RM-351TB/AC, all interconnections between the upper and lower assemblies are made via the terminal blocks.

MOUNTING DATA.

A rectangular panel cutout is recommended for mounting the instruments. 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 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 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.

MATING CONNECTOR (RM-351/AC).

1. Sources. Any of the following connectors may be used to mate with the RM-351/AC.

Manufacturer	Connector Part Number
Viking	2VH15/1AB5
	Polarizing Key Part Number 091-0024-000
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

The mating connector for the display/main board assembly (the lower assembly) should have a polarizing key installed between contacts 1 and 2. This connector with polarizing key installed is available from NLS; part number is 46-107-1.

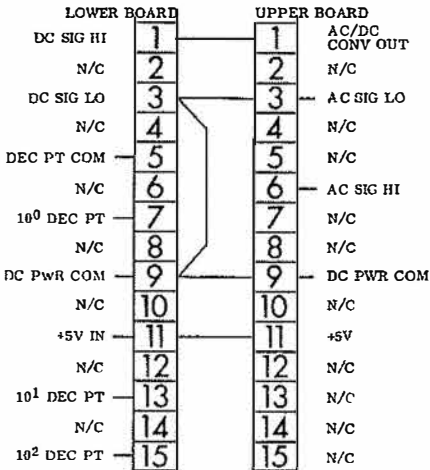
The mating connector for the AC/DC Converter Assembly (upper assembly) should have a polarizing key installed between contacts 2 and 3. The NLS part number for this connector with key installed is 46-107-2. One each of these connectors is furnished with the instrument.

2. Mounting. Before mounting the connectors, check to see that one of them has a polarizing key between contacts 1 and 2 and the other has a polarizing key between contacts 2 and 3. The first connector mounts between the lower bosses and the second between the upper bosses. The locations of the polarizing keys should correspond to slots in the printed circuit boards. Use the screws provided (4-40 x 7/16" RDH PHH) to fasten the connectors to the case.

3. Wiring. Figure 4 provides wiring information for the connectors. Connect contacts 1, 3, 9 and 11 of the upper connector to the corresponding contacts on the lower connector. Connect AC signal HI to contact 6 of the upper connector. A shielded lead may be needed if the signal has a high source resistance. Connect AC signal LO to contacts 3 and 9 of the lower connector. Rather than installing a jumper, improved stability and accuracy may be obtained by connecting two separate wires from contacts 3 and 9 to the low terminal of the source being measured. This will eliminate current flow to contact 3. To display a decimal point, jumper between contact 5 and contact 7, 13 or 15 on the lower connector, depending upon which decimal point is to be displayed. See following decimal location/contact number information.

DECIMAL LOCATION 1 . 0 . 0 . 0
CONTACT NUMBER 15 13 7

Connect the DC power to contacts 9 and 11 on the lower connector; the negative side to contact 9 and the positive side to contact 11.



CONTACT NUMBERS 1 THRU 15 READ FROM LEFT TO RIGHT WHEN FACING REAR OF METER.

Figure 4. Connector Pin Information for RM-351/AC

TERMINAL BLOCK WIRING (RM-351TB/AC).

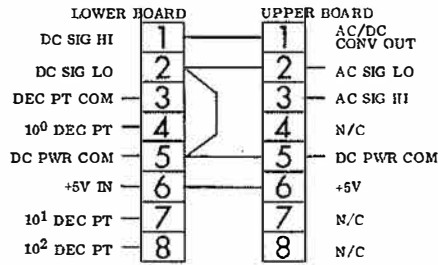
Figure 5 provides wiring information for the terminal blocks. Connect contacts 1, 2, 5 and 6 of the upper terminal block to the corresponding contacts on the lower terminal block. Connect AC signal HI to contact 3 of the upper terminal block. A shielded lead may be needed if the signal has a high source resistance. Connect AC signal LO to contacts 2 and 5 of the lower terminal block. Rather than installing a jumper, improved stability and accuracy may be obtained by connecting two separate wires from contacts 2 and 5 to the low terminal of the source being measured. This will eliminate current flow to contact 2. To display a decimal point, jumper between contact 3 and contact 4, 7 or 8 on the lower terminal block, depending upon which decimal point is to be displayed. See below.

DECIMAL LOCATION 1 . 0 . 0 . 0
CONTACT NUMBER 8 7 4

Connect the DC power to contacts 5 and 6 of the lower terminal block; the negative side to contact 5 and the positive side to contact 6.

CALIBRATION.

- Using a knife or a small screwdriver blade, carefully pry off the red plastic front panel to gain access to the calibration potentiometer.
- Verify the +5-volt power supply voltage. If necessary, adjust to +5V ($\pm 0.1V$).



CONTACT NUMBERS 1 THRU 8 READ FROM LEFT TO RIGHT WHEN FACING REAR OF METER.

Figure 5. Terminal Block Contact Information for RM-351TB/AC

- Allow for a five-minute warm-up period.
- Apply AC input signal voltages as follows:

Range of Instrument	Calibration Voltage
2 VAC	1.900 VAC
20 VAC	19.00 VAC
200 VAC	190.0 VAC
1000 VAC	900.0 VAC

- Adjust potentiometer at lower right of display panel until display agrees with input.
- Disconnect calibration voltage and the +5-volt power supply input.
- Replace front panel.

RANGE MODIFICATION.

A range modification kit containing the components needed to modify the instrument to any of its four ranges is available from your distributor. Specify NLS part number 46-130. The procedure for changing ranges is as follows:

- Remove all sources of power and signal voltage from the meter.
- (RM-351/AC only) Remove the four screws fastening mating connectors to meter case and unplug the two mating connectors.
- Remove plastic front panel (see step 1 under Calibration).
- Remove the two screws and the two retaining brackets behind front panel.
- Slide meter out of case.
- Install resistors and capacitor specified in Table I to attain desired range. See figure 6 for component location. Note that these components should be installed in the upper printed circuit board.
- Reassemble meter.
- Calibrate meter.
- If a decimal indication is required, refer to the applicable paragraphs on wiring (connectors or terminal blocks).

Table I. Component Values for Range Modification

RANGE	R1	R2	R3	C5
2V	Jumper	1 M Ω , 5%	100 k Ω , 5%	0.1 mF, 250V
20V	909 k Ω , 1%	100 k Ω , 1%	Jumper	0.1 mF, 250V
200V	10 M Ω , 1%	100 k Ω , 1%	Jumper	0.1 mF, 250V
1000V	10 M Ω , 1%	10 k Ω , 1%	Jumper	0.01 mF, 1 kV

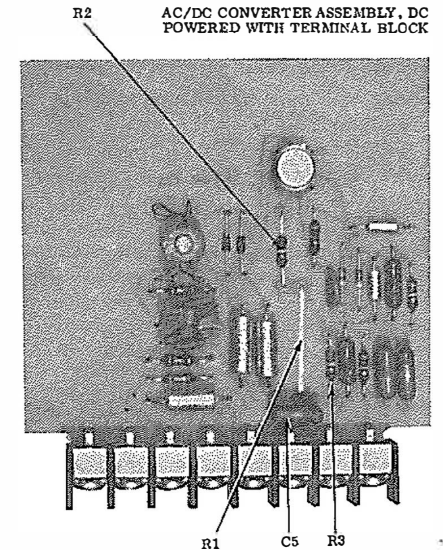


Figure 6. Component Location

CURRENT MEASUREMENT.

A shunt resistor may be connected between AC signal high and AC signal low for current measurement. The meter should be a 2V-range meter or be so modified. Table II shows the shunt resistor value required. The accuracy of measurement will be determined largely by the accuracy of the shunt resistor.

Table II. Shunt Resistor Values

Full Scale Current Range	Shunt Resistor for Meter in 2V Range
2 mA	1000 Ohms
20 mA	100 Ohms
200 mA	10 Ohms
2 A	1 Ohm

MAINTENANCE.

- General.** To facilitate maintenance, all three integrated circuits on the lower board assembly are plug-in components. They can be easily removed and installed without soldering. They include the LCD display, the ICL7106CPL chip and the CD4049AE chip.
- Component Access.** To gain access to the components within the instrument, perform the first five steps under Range Modification.



NON-LINEAR SYSTEMS
Originator of the digital voltmeter

San Diego, CA
Phone: 619-521-2161
sales@nonlinearsystems.com