



RM-351/AC/115 & RM-351TB/AC/115
 RM-351/AC/230 & RM-351TB/AC/230
DIGITAL PANEL METERS

INSTRUCTIONS



INTRODUCTION.

The RM-351/AC/115, RM-351TB/AC/115, RM-351/AC/230 and RM-351TB/AC/230 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 meters are line-powered (the last three digits of the model number indicate the line input voltage) and the display consists of 0.6-inch LCD numerals, decimal point and a polarity sign. The RM-351/AC/115 and RM-351/AC/230 have two card-edge connectors. The RM-351TB/AC/115 and RM-351TB/AC/230 have two terminal blocks. The meters are 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 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.

SPECIFICATIONS.

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

Accuracy: ±0.7% Reading (±2 digits)

Frequency Range: 50 to 400 Hz

Display: 0.6" high LCD

Operating Temperature: 0°C to +50°C

Power:

RM-351/AC/115	} 105 to 125 VAC
RM-351TB/AC/115	
	} 50/60 Hz
RM-351/AC/230	} 210 to 250 VAC
RM-351TB/AC/230	
	} 50/60 Hz

Size: See figures 1 and 2

Weight: 12 ounces (340 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, AC powered panel meters each contain two printed circuit board assemblies, mounted one above the other. The lower assembly is the display/main board assembly and the upper assembly is the AC/

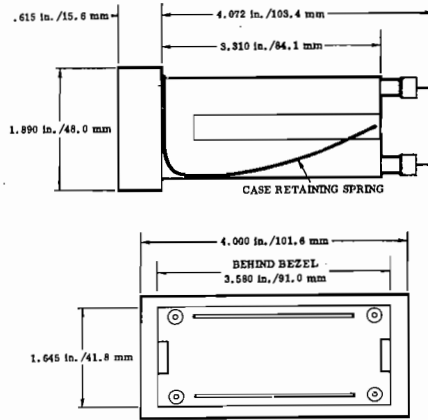


Figure 1. Card-Edge Configuration

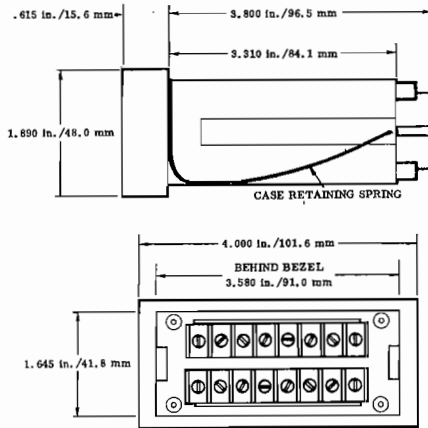


Figure 2. Terminal Block Configuration

DC converter assembly. For the RM-351/AC/115 and the RM-351/AC/230, all interconnections between the upper and lower assemblies are made via the mating connectors at the rear of the meters. For the RM-351TB/AC/115 and the RM-351TB/AC/230, 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 CONNECTORS (RM-351/AC/115 & RM-351/AC/230).

1. Sources. Any of the following connectors may be used to mate with the RM-351/AC/115 and the RM-351/AC/230:

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.

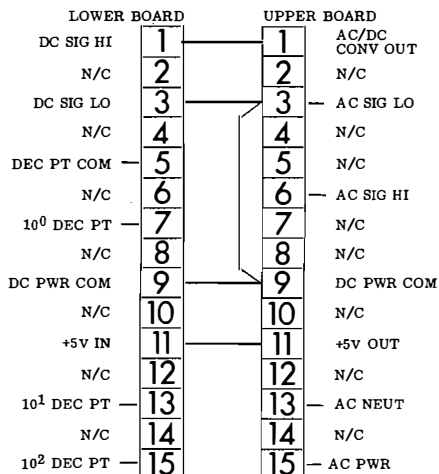
2. Mounting. Before mounting the connectors, check to see that one of them has a polarizing key between contacts 1 and 2 and the other has a polarizing key between contacts 2 and 3. The first connector mounts between the lower bosses and the second between the upper bosses. The locations of the polarizing 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 3 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. Jumper pins 3 and 9 of the upper connector. Connect the AC signal to be measured to contacts 3 and 6 of the upper connector (signal HI to 6 and signal LO to 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 below.

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

Connect the AC power to contacts 13 and 15

on the upper connector. The "hot" side of the AC line should be connected to contact 15 since it is this contact which is connected to the internal fuse.



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

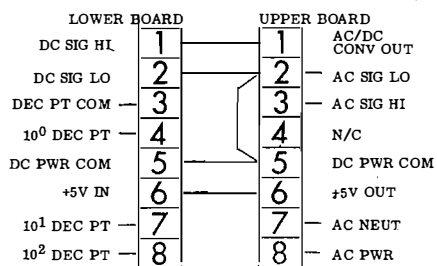
Figure 3. Connector Pin Information for RM-351/AC/115 or /230

TERMINAL BLOCK WIRING (RM-351TB/AC/115 and RM-351TB/AC/230).

Figure 4 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. Jumper contacts 2 and 5 on the upper terminal block. Connect the AC signal to be measured to contacts 2 and 3 of the upper terminal block (signal HI to 3 and signal LO to 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 AC power to contacts 7 and 8 of the upper terminal block. The "hot" side of the AC line should be connected to contact 8 since it is this contact which is connected to the internal fuse.



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

Figure 4. Terminal Block Contact Information for RM-351TB/AC/115 or /230

CALIBRATION.

1. Using a knife or a small screwdriver blade, carefully pry off the red plastic front panel to gain access to the calibration potentiometer.
2. Verify that the line voltage is correct.
3. Allow for a five-minute warm-up period.
4. Apply AC input signal voltages as follows:

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

5. Adjust potentiometer at lower right of display panel until display agrees with input.
6. Disconnect calibration voltages and line power.
7. 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:

1. Remove all sources of power and signal voltage from the meter.
2. (RM-351/AC/115 & RM-351/AC/230 only) Remove the four screws fastening mating connectors to meter case and unplug the two mating connectors.
3. Remove plastic front panel (see step 1 under Calibration).
4. Remove the two screws and the two retaining brackets behind front panel.
5. Slide meter out of case.
6. Install resistors and capacitor specified in Table I to attain desired range. See figure 5 for component location. Note that these components should be installed in the upper printed circuit board.
7. Reassemble meter.
8. Calibrate meter.
9. 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 MΩ, 5%	100 kΩ, 5%	0.1 mF, 250V
20V	909 kΩ, 1%	100 kΩ, 1%	Jumper	0.1 mF, 250V
200V	10 MΩ, 1%	100 kΩ, 1%	Jumper	0.1 mF, 250V
1000V	10 MΩ, 1%	10 kΩ, 1%	Jumper	0.01 mF, 1 kV

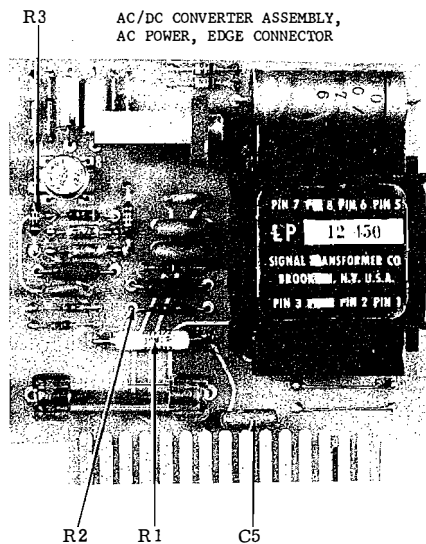


Figure 5. Component Location

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.

1. **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.

2. **Component Access.** To gain access to the components within the instrument, perform the first five steps under Range Modification.

3. **Fuse Replacement.** The RM-351/AC/115 and the RM-351TB/AC/115 meters are protected with a 3AG, 1/8 ampere, "slo-blo" fuse. The RM-351/AC/230 and the RM-351TB/AC/230 meters are protected with a 3AG, 1/16 ampere, "slo-blo" fuse. The fuse is mounted in fuse clips on the upper board assembly. To replace the fuse, gain access as set forth in paragraph 2 above then replace the fuse and reassemble the meter.

