# NON-LINEAR SYSTEMS
# RM-351TB/XX VDC
## DIGITAL PANEL METERS


## INSTRUCTIONS

The RM-351TB/XX VDC is a 3 ½ digit, fixed-range digital panel meter for making DC voltage measurements. DC current may also be measured by internally or externally connecting a shunt resistor across the DC signal input terminals.

The alphabetical letters "XX", used in the model numbers throughout out these instructions, designate the DC voltage required to operate the instruments. This numerical voltage value is displayed as part of the model number shown on the case of the instrument.

For example, if the model number is RM-351TB/12 VDC, the meter should be operated from +12 volts DC.

A DC-to-DC converter with transformer coupling provides a high degree of isolation between the power supply and the signal measurement circuits. Connections to the RM-351TB/XX VDC are made via two terminal blocks. The meters are available in any one of five ranges: 1.999mV F.S., 1.999V F.S., 19.99V F.S., 199.9V F.S. or 1000V F.S.

Modification among the highest four ranges may be accomplished by the substitution, addition or removal of one or two resistors. Calibration is readily accomplished by adjusting one potentiometer accessible at the front of the meter.

## SPECIFICATIONS

**Ranges:**

| | | |
|---|---|---|
| 0 | to | +/- 199.9 mVDC |
| 0 | to | +/- 1.999 VDC |
| 0 | to | +/- 19.99 VDC |
| 0 | to | +/- 199.9 VDC |
| 0 | to | +/- 1000 VDC |

**Accuracy**: +/-(0.05% Rdg. +/-0.05% F.S)

**Update Rate:** 3 rdg/sec, nominal

**Display:** 0.6" high LCD

**Operating Temp:** 0°c to +50°C

**Power:** DC voltage source, preferably a voltage-regulated power supply. The voltage should be within +/-5% of the voltage shown in the model number on the instrument case. For example, if the model number is RM-351TB/12VDC the power supply should be +12 VDC +/-5%. Power required is less than 3 watts.

**Size:** See figures 1 and 2

**Weight:** Approx. 7 ounces (198 g)

**Common-Mode Rejection:**
80 DB minimum

**Common-Mode Compliance:** +/-100mV between signal low and power common.

**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.

## CONSTRUCTION

The RM-351TB/XX VDC contains 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 power supply assembly. All interconnections between upper and lower assemblies are made via terminal blocks.

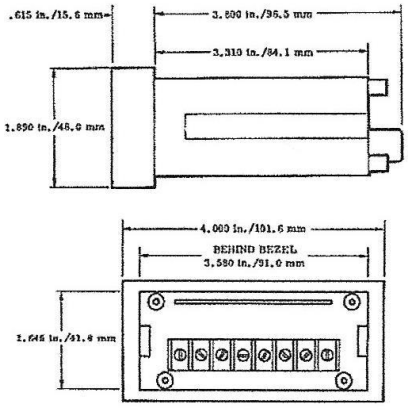


Figure 2

## Mounting Data

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

92 mm +1, -0 mm (3.622 in +0.040, -0 in)
43 mm +1, -0 mm (1.693 in +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, insert the meter from the front of the panel cutout. Insert the retaining spring into the holes in the sides of the meter case at the rear. Slide the spring 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 3 provides wiring information for the terminal blocks, upper terminal block to the corresponding terminals on the lower terminal block.

**Power Ground to Signal Ground:** Jumper terminals 2 and 5 on the lower terminal block.

**Signal:** Connect the DC voltage to be measured to terminals 1 and 2 of the lower terminal block (signal HI to 1 and Signal LO to 2).

**Power Supply:** Connect the DC power to terminals 7 and 8 of the upper terminal block: the negative side to terminal 7 and the positive side to terminal 8.

| | | | | |
|---|---|---|---|---|
| DC SIG HI | 1 | | 1 | N/C |
| DC SIG LO | 2 | \ | 2 | N/C |
| DEC PT COM | 3 | \| | 3 | N/C |
| 10° DECIMAL | 4 | \| | 4 | N/C |
| + 5V COMMON | 5 | /___ | 5 | + 5V COMMON |
| + 5V POWER | 6 | ___ | 6 | + 5V POWER |
| $10^1$ DECIMAL | 7 | | 7 | XX DC PWR COM |
| $10^2$ DECIMAL | 8 | | 8 | XX DC PWR IN |

Figure 3

**Decimal Point:** Jumper between terminal 3 and terminal 4, 7 or 8 on the lower terminal block, depending upon which decimal point is to be displayed.

DECIMAL LOCATION **-x . x . x . x**
TERMINAL NO. **8 7 4**

**Polarity Display:** The polarity may be blanked by cutting two PC traces and adding two jumpers on the PC board. Figure 5 shows the locations 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.

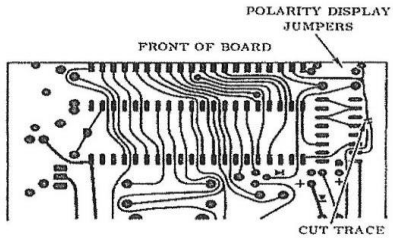

Figure 5. Printed Circuit Top View

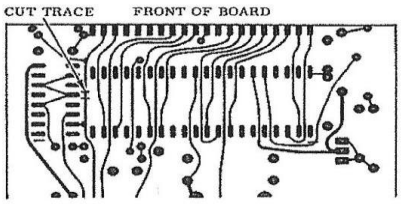

Figure 6. Printed Circuit Bottom View

To gain access to the components within the instrument, perform the first five steps under range modification.

## CALIBRATION

1. Using a knife or a small screwdriver blade, carefully pry off the front panel to gain access to the calibration potentiometer.
2. Adjust power supply voltage to within 2% of its nominal value.
3. Allow a five-minute warm-up period.
4. Apply DC input signal voltages as follows:

| RANGE OF INSTRUMENT | CALIBRATION VOLTAGE |
|---|---|
| 200 mV | 190.0 mV |
| 2 V | 1.900 V |
| 20 V | 19.00 V |
| 200 V | 190.0 V |
| 1000 V | 900.0 V |

5. Adjust potentiometer at lower right of display panel until display agrees with input.
6. Disconnect calibration voltage and power supply input.
7. Replace front panel.

## RANGE MODIFICATION

*(Except 200 mV range)*

A range modification kit containing the components needed to modify the instrument within any of its four highest ranges is available, NLS part number N39-356. The procedure for changing ranges is as follows:

1. Remove all sources of power and signal voltage from the meter.
2. Remove front panel (see step 1 under Calibration).
3. Remove the two screws and the two retaining brackets behind front panel.
4. Slide meter out of case.
5. Install resistors specified in Table 1 to attain desired range. See figure 4 for component location. Note that these components should be placed in the lower board assembly.
6. Reassemble meter.
7. Calibrate meter.

**TABLE 1. Resistor Value 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% | 10KΩ 1% |

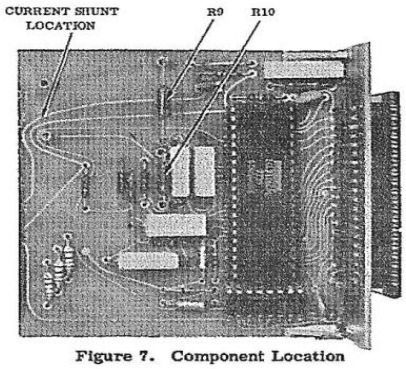

Figure 7. Component Location

## CURRENT MEASUREMENT

A shunt resistor may be plugged into 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 2V range, depending upon the full scale voltage drop which can be tolerated. Table II, shows the shunt resistor value required. The accuracy of the measurement will be determined largely by the accuracy of the shunt resistor.

**Table II. Shunt Resistor Values**

| 200 mV Range Meter | |
|---|---|
| Full Scale Current Range | Shunt Resistor |
| 2 mA | 100 Ω |
| 20 mA | 10 Ω |
| 200 mA | 1 Ω |
| 2 A | 0.1 Ω |

| 2 V Range Meter | |
|---|---|
| Full Scale Current Range | Shunt Resistor |
| 2 mA | 1 KΩ |
| 20 mA | 100 Ω |
| 200 mA | 10 Ω |
| 2 A * | 1 Ω * |

***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 ICL7106CPL, and the CD4049UBE.

*Specifications Subject to Change without Notice*

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