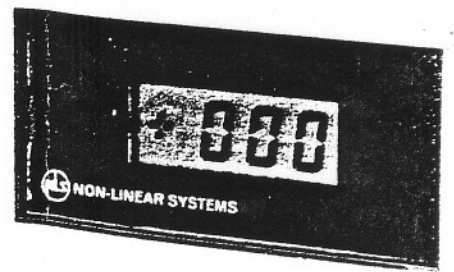




# INSTRUCTIONS

## Model X-37 DIGITAL PANEL METERS



### INTRODUCTION

The X-37 Digital Panel Meter is a bipolar, three and one-half-digit, fixed-range DC voltmeter, available in any one of five ranges from 200 mV full scale to 1000 V full scale. The meter is shipped in the 2-volt range, but modification from any one range to another is easily accomplished by the substitution, addition, or deletion of one to six resistors, available in a kit as an option.

A liquid crystal display with 0.6 high characters allows clear viewing in normal or high ambient light. The low power consumption (0.03 watt) makes it ideal for battery-powered operation.

The X-37 features a depth behind the panel on which it is mounted of less than one-half inch. The meter eliminates zero drift. Full-scale calibration is accomplished by adjusting a single potentiometer accessible from the front of the meter.

A current measurement option is available, permitting measurement of DC current from 200 nanoamperes full scale to 10 amperes full scale.

A mating connector option provides convenient plug-in connections of the external leads.

For operation, an external +5-volt regulated power supply is recommended. A typical configuration for a suitable power supply is shown in figure 1.

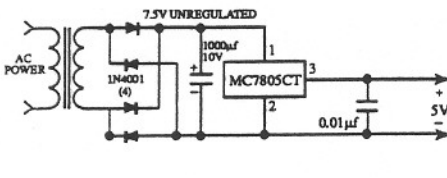


Figure 1. Power Supply Schematic

### SPECIFICATIONS

**RANGES:** 00.0 to 199.9 mV  
 .000 to 1.999 V  
 0.00 to 19.99 V  
 00.0 to 199.9 V  
 000 to 1000 V

**ACCURACY:** +0.1% Full Scale  
**SPEED:** 3 readings/sec, nominal

**POWER:** +5 VDC +5% @ 6 mA  
**SIZE:** See figure 2.  
**WEIGHT:** Approx. 2 oz (56.7 g)  
**DISPLAY:** LCD, 0.6"  
**OPERATING TEMPERATURE:** 0 to +50 C  
**T.C.:** 100 ppm/ C, typical

**INPUT Z:** 200 mV F.S., 100 megohm;  
 2/20/200V F.S., 1 megohm; 1000V  
 F.S., 4 megohms.

**SETTLING TIME:** 1 second for full scale input change.

**NORMAL-MODE REJECTION:** 40 DB min.

**COMMON-MODE REJECTION:** 40 DB min.

**COMMON-MODE COMPLIANCE:** +4V to -1.5V between signal LO and negative terminal of power supply.

**DECIMAL LOCATION:** May be positioned by internal jumper to any of three locations, .X.X.X.X

**RATIO OPERATION:** Reference is brought out to connector for ratio operation.

**INPUT VOLTAGE PROTECTION:** +250 VDC on four lowest ranges; ± 1200 VDC on 1000V range

**MEASUREMENT METHOD:** Integration, input integration time.

**ZERO STABILITY:** Auto-zeroing eliminates zero drift.

**OVERLOAD INDICATION:** +1 for positive inputs; -1 for negative inputs

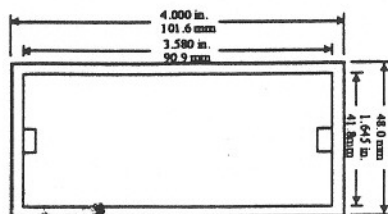
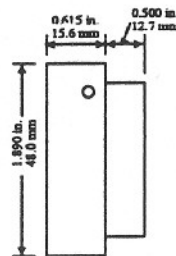


Figure 2. Outline Drawing

### OPERATING PRINCIPLES

**A/D CIRCUIT:** Analog-to-digital conversion is performed by simultaneous integration of analog signals and counting of clock pulses. Input integration time is fixed at 80 milliseconds. Total conversion, including automatic compensation for zero drift, takes approximately 330 milliseconds. All logic signals are handled by a C-MOS integrated circuit.

### INSTALLATION

1. Mount the X-37 as follows:

a. Cut hole in panel 3.62" (92mm) W x 1.69" (43mm) H.

b. Insert meter from the front, through panel cutout.

c. Fit mounting clips (2) into slots located on top and bottom of meter. The foot of the clip should face the rear.

d. Thread the screws (2) into clips and tighten them against the rear surface panel.

2. If you have purchased the mating connector option (53-106), install a keying tab in the connector (Position 2) and attach the hookup wire to the individual connector sockets. Insert the sockets into the connector block making sure the keying tab is in the proper position to latch into the rectangular holes on the block. (Refer to table I.) Positions 3, 4, 5, and 8 do not have sockets.

Table I. Connector Pin Information

1. Signal HI	6. Signal LO
2. Key	7. Ground
3. N/C	8. N/C
4. N/C	9. +5V
5. N/C	10. Ext. Ref.

### OPERATION

1. **Power Supply.** Connect the negative side of your 5V power supply to pin 7 of the connector and the positive side to pin 9.

2. **Signal.** For most applications it is desirable to have SIGNAL LO (pin 6) connected to power ground (pin 7). As shipped, the meter makes this connection with a printed circuit trace labelled "W1". Connect signal to pins 1 (HI) and 6 (LO) respectively of the meter. A shielded cable may be required if the

signal source has a high resistance. If there is any connection between source LO and power ground (other than W1), and if instability is observed in the least significant digits of the display, this instability may be improved by cutting the W1 PC trace.

3. Decimal Location. Jumper between terminal C and terminals L, M or R on the inside of the meter, depending upon which decimal point is to be illuminated. See below.

DECIMAL LOCATION: X . X . X . X  
TERMINAL DESIG: L M R

4. Connector. If the mating connector option has been purchased, after assembling connector, plug onto pins at rear of meter. Orient connector so that the keyway lines up with missing pin in position 2.

#### RATIO OPERATION

For ratio measurement applications, an external reference voltage may be used as follows:

1. Remove jumper W2.
2. Install jumper W3.

3. Connect an external reference voltage of +0.1V 10% to pin 10.

In the ratio mode, the calibration potentiometer, R2 has no effect.

#### VOLTAGE RANGE MODIFICATION.

The X-37 may be range-changed from any one range to another by the installation of various precision resistors.

1. Remove filter in front of display by pressing in on side of bezel and pulling filter out by bowed center. Remove two screws located at either end of display.
2. Carefully remove meter from front of case.

3. Observe resistor values that are in meter and compare to figure 3 and table II. Install resistors of values as specified in table II to attain desired range.

4. If a decimal point is desired, refer to paragraph 3 under

Operation.

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

6. Reassemble meter.

7. Calibrate meter as described under calibration.

8. Matched attenuator resistor sets are available from your distributor, NLS part number 53-107.

Table II. Resistor Values in Range Modification Kit

RANGE	.2V	2V	20V	200V	2000V
R8	--	100K	10K	1K	402
R9	JUMPER	909K	1M	1M	--
R10	--	--	--	--	1M
R11	--	--	--	--	1M
R12	--	--	--	--	1M
R13	--	--	--	--	1M

#### CALIBRATION.

1. Allow 5 minutes for warm up.
2. Set power supply voltage to +5V +/- 2%.
3. With a precision DC power supply, apply voltages as follows:

RANGE OF INSTRUMENT	CALIBRATION VOLTAGE
200mV	190.0 mVDC
2 V	1.900 VDC
20 V	19.00 VDC
200 V	190.0 VDC
1000 V	900 VDC

4. Adjust potentiometer R2 at bottom of meter until readout agrees with input.

5. Disconnect calibration and power supply voltages.

#### OPTIONS.

VOLTAGE RANGE CHANGE KIT. Refer to step 8 under Voltage Range Modification.

CURRENT RANGE KIT. The 53-108 Current Shunt Resistor Kit provides all the resistors required to measure DC currents from 200 nanoamperes F.S. to 10 amperes F.S. The meter must be in the 200 mV range to accomplish this. Refer to figure 4 and table III. Insert the proper resistor as set forth in table III. in position of R14 as shown in figure 4.

MATING CONNECTOR. Refer to step 2 under Installation.

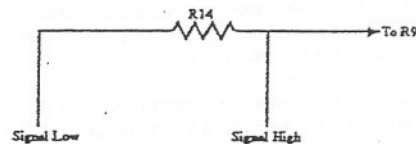
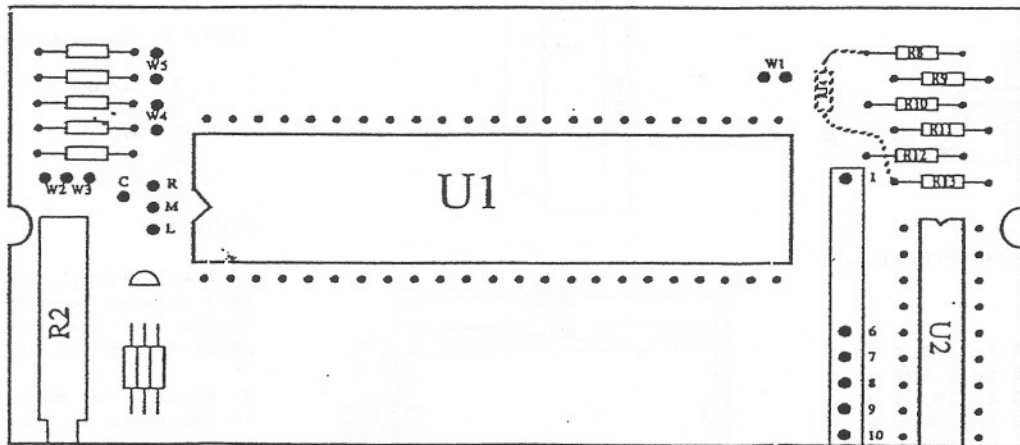


Figure 4. Current shunt Location

Table III. Shunt Resistor Values

FULL SCALE CURRENT RANGE	SHUNT RESISTOR VALUE
200 Nanoamperes	1 Megohm
2 Microamperes	100 Kilohms
20 Microamperes	10 Kilohms
200 Microamperes	1 Kilohm
2 Milliamperes	100 Ohms
20 Milliamperes	10 Ohms
200 Milliamperes	1 Ohm
2 Amperes	0.1 Ohm
10 Amperes	0.01 Ohm



Warning: This meter is frequently used on the high side of the current source to be measured. This arrangement may cause a short between the circuit high side and ground with possible damage to the meter and circuit. To prevent this, an isolated meter power supply is recommended.



## NON-LINEAR SYSTEMS

Originator of the digital voltmeter

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