

DM-LX3

Single Board Differential LCD 3½ Digit Digital Panel Meter

FEATURES

- Ultra-low power — 3.5mA @ 5V in; can be powered from 4 AA alkaline batteries
- Ultra-compact — tiny single board circuit measures only 4.0"W x 2.0"H x .56"D (102 x 51 x 14mm)
- 3½ digits, Liquid Crystal Display (LCD).75" High
- Balanced Differential Inputs, 80 dB CMR Noise Rejection
- 1000 MΩ input impedance, 5 pA input bias current
- Autozeroed, Ratiometric Reference for Drift Correction

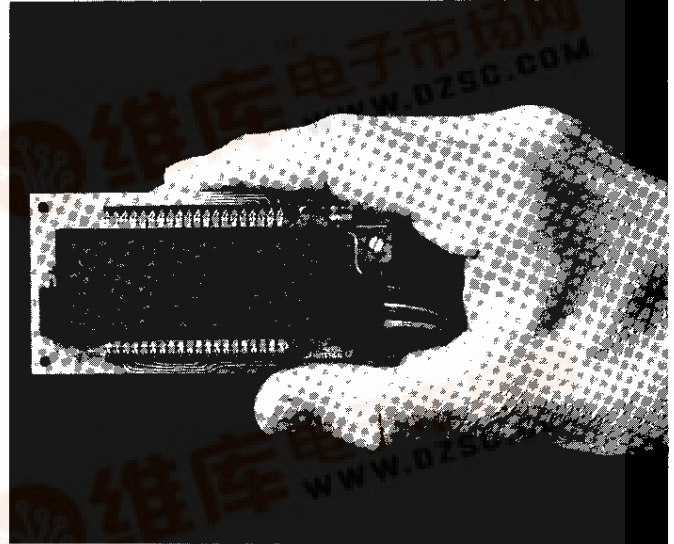
APPLICATIONS

- Voltmeter — Accepts user-supplied attenuators for ±2V to ±300 Vdc Full Scale Ranges
- Ammeter — Accepts user-supplied shunts for ±20 μA to ±2A Full Scale Ranges
- Ohmmeter — 2KΩ to 10MΩ Full Scale Range
- Digital Thermometer — requires a few user-supplied components

GENERAL DESCRIPTION

The DM-LX3 is a high performance, compact Digital Panel Meter (DPM) which displays analog input voltages from -1.999 to +1.999 Vdc on .75" high numerals. Its single board construction results in a very thin assembly (.56" or 14 mm deep) which is only slightly larger than its display — the DM-LX3 can fit into many test instruments, data acquisition systems, and process control panels which could previously accommodate only analog meters. The meter's Liquid Crystal Display (LCD — not self-illuminated) draws only 3.5 mA at +5 Vdc — it can operate from 4 "AA" alkaline batteries, or can optionally be powered from a computer's +5V power bus, or an inexpensive AC power adapter, (DateI-Intersil's UPA-5/500). Pin-selectable decimal points, for factor-of-ten scaling of the display, combined with user-installed range change components permit the meter to display full scale ranges to ±300 Vdc. User-supplied current shunts (from 20 mA to 2A full scale) and digital ohmmeter components (from 200Ω to 10 MΩ full scale) are also easily installed.

Despite its small size and low cost, the DM-LX3 offers very high instrument performance. CMOS circuitry provides 1000 Megohm input

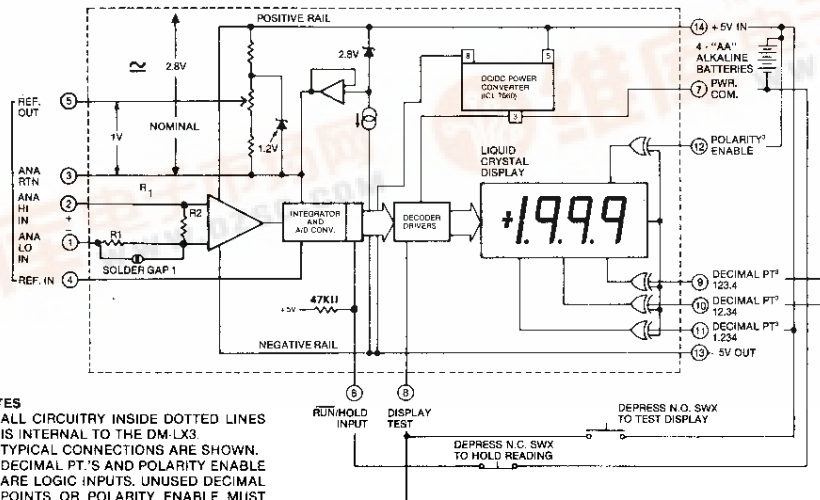


impedance and 5 picoamp input bias current; the meter will not "load down" sensitive input signals. Analog inputs to the meter are balanced differential, and offer 80 dB Common Mode Rejection. Over-voltages to ±250 Vdc (175 VRMS) are handled without damage.

A significant feature is an externally-accessible Reference In-Out loop which sets the meter's gain. This permits the DM-LX3 to be used in ratiometric applications such as a digital ohmmeter — an external reference voltage, derived from a bridge-type input circuit, causes the meter's gain to compensate for voltage drift in the bridge excitation source.

Other circuit features include autopolarity, a Display Hold circuit, and a selectable Display Test. Autozeroing holds the meter's zero drift to ±1 count maximum over the 0° C to +50° C operating range. Temperature drift of gain is typically within ±50 ppm of reading/° C. The meter's on-board DC-to-DC converter can also be used to supply -5V out at 20 mA maximum, to power user-supplied signal conditioning components. (Note that current taken out at -5V OUT must be added to current required to power the meter at +5V IN).

DM-LX3 Simplified Block Diagram



- NOTES**
- ALL CIRCUITRY INSIDE DOTTED LINES IS INTERNAL TO THE DM-LX3
 - TYPICAL CONNECTIONS ARE SHOWN.
 - DECIMAL PT.'S AND POLARITY ENABLE ARE LOGIC INPUTS. UNUSED DECIMAL POINTS OR POLARITY ENABLE MUST BE TIED TO PIN 8.
 - WARNING: DO NOT CONNECT ANA RTN to +5V IN. THIS WILL DESTROY DPM.



PRELIMINARY SPECIFICATIONS (Typical @ +25° unless noted)

ANALOG INPUT

Configuration

True, balanced differential bipolar inputs

Full Scale Input Range

-1.999 Vdc to +1.999 Vdc

Optional Ranges

Up to ± 300 Vdc or $\pm 19.99\mu\text{A}$ to ± 1.999 Amps or 0 to 1.999 k Ω up to 0 to 19.99 Megohms. These optional ranges require connection of additional components supplied by the user.

Input Bias Current

5pA typical, 50pA maximum

Displayed Accuracy @ +25° C, 5V +/- 10%

Adjustable to $\pm 0.2\%$ FSR, ± 1 count

Resolution

1 mV in Least Significant Digit

Temperature Drift of Gain

Within ± 50 ppm of FSR/° C typical, within ± 100 ppm of FSR/° C max.

Temperature Drift of Zero

Autozeroed ± 1 count over 0° to +50° C

Input Impedance

100 Megohms minimum 1000 Megohms typical to Analog Return or Power Common

Input Overvoltage

± 250 Vdc, 175 VRMS continuous maximum ± 300 V dc intermittent maximum

Common Mode Rejection

80 dB to Analog Return, DC to 60Hz, 1 kilohm unbalance

Common Mode Voltage Range

Both inputs must remain within +4V and -4V of Power Common

Warm-Up Time

1 minute to rated accuracy

Reference

Internal, referred to Analog Return. External user-supplied reference optional for ratiometric operation

External Reference Range

Pin 4 +5V to +2V (relative to Pin 3)

Ramp-Up Time (Integration Period)

83.3mS

DISPLAY

Number of Digits

3 decimal digits and most significant "1" digit (3½ digits)

Decimal Points

3 selectable decimal points are included for scale multipliers

Display Type

Liquid crystal display (LCD), requires external room light for viewing.

Display Height

.75" (19mm)

Overscale

If input exceeds + Full Scale, display shows "+1" MSD with zeros blanked

Underscale

If input goes below Full Scale, display shows "-1" MSD with zeros blanked.

Autopolarity

A "+" is displayed for positive inputs, a "-" for negative inputs. It is also possible to disable all polarity signs

Sampling Rate

3 samples per second

CAUTION: Observe CMV range limits on single-supply applications referred to pin 13. Differential mode or battery power is preferred. Contact Datel for assistance.

INPUT/OUTPUT CONNECTIONS

Analog HI Input (pin 2)

Analog LO Input (pin 1)

Differential input voltages are connected between these inputs. A bias current path to ANALOG RETURN from both these inputs must be externally provided. External circuits must constrain these inputs to be within the common mode voltage range.

Analog Return Input (pin 3)

This pin may be used as a low-noise bias current return for some floating inputs. Analog Return is approximately 2.8V below +V_s (+V_s - 2.8V).

Reference In (pin 4)

Reference Out (pin 5)

Normally REFERENCE IN and REFERENCE OUT should be jumpered together. An external high quality reference, referenced to ANALOG RETURN, may be connected to REFERENCE IN or used for ratiometric applications.

Run/Hold Input (pin 6)

Ground this Pin for normal use. Open this pin to latch the last A/D conversion and stop the display from changing. May be used by an operator to copy down the last reading.

+5V Input (pin 14) and Power Common (pin 7)

Power input connections for the meter; requires +5 Vdc @ 3.5mA to power meter alone. (May require up to 23.5 mA, if user powers external circuitry from -5V OUT).

-5V Output (pin 13)

A voltage output may be used from the internal DC-to-DC converter to power user-supplied external circuitry (as a C.A.Z. amplifier to provide gain). Maximum current out is 20mA, all current out must be added to 3.5 mA current in (Pin 14, +5VIN) to determine total current draw of meter.

Polarity Enable Input (pin 12)

A CMOS logic input which enables or disables the polarity symbols on the display. A +5V in voltage causes a "+" to be displayed with positive inputs and a "-" to be displayed with negative inputs. Connect Pin 12 to DISPLAY TEST (Pin 8) to disable polarity.

WARNING: POLARITY ENABLE INPUT SHOULD NOT BE LEFT OPEN.

Decimal Point Inputs (pins 9, 10, and 11)

These are CMOS logic inputs to enable in disable decimal points. Connect to the +5 Vdc to light the desired decimal point. Connect all others to DISPLAY TEST.

WARNING: DECIMAL POINT INPUTS SHOULD NOT BE LEFT OPEN

NOTE: The top of the DM-LX3 display is made of a plastic material which can be scratched easily. It is recommended that a clear plexiglas filter be installed with the meter. Care should also be taken in cleaning the display. Freon may be used, but the surface and edges of the display should be dried carefully. Also, keep the display dry. Water can migrate through the top cover, or seep under the edges and ruin the display.

Display Test Input (pin 8)

Connect this pin to +5V to display 1888 and test all display segments.

CAUTION: TO PREVENT DAMAGE TO THE LIQUID CRYSTAL DISPLAY, HOLD DPM IN "TEST" NO LONGER THAN 1 MINUTE.

POWER CONNECTIONS

D.C. Power In

+5 Vdc (+4V to +7.0 Vdc) at 3.5 mA nominal (up to 23.5mA if current taken from -5V OUT (pin 13)). May be supplied from four "AA" alkaline batteries in series, or a regulated ($\pm 5\%$) power supply (Datel-Intersil UPA-5/500)

D.C. Power Out

-5 Vdc (-4 to -7.0 Vdc, depending on input) @ 20mA max.

Calibration

A multiturn screwdriver pot adjusts the full scale reading (gain). Zero is automatic (auto-zeroing). Suggested recalibration in stable conditions is 90 days.

PHYSICAL-ENVIRONMENTAL

Outline Dimensions

4.0"W x 2.0"H x .56"D (102 x 51 x 14 mm)

Cutout Dimensions

Display requires 2.88" x 1.13" (72 x 29 mm) cutout, also, separate .125" (3.2 mm) diameter hole to access gain adjust pot.

Mounting Method

Front or rear panel mounting possible; for rear mounting, four ½" (12, 7 mm) standoffs required. For front mounting, four .125" (3,2 mm) standoffs required.

Weight

1.8 oz. (52g).

Connector

14-pin DIP plug with cover

Mounting Position

Any

Operating Temperature Range

0° to +50° C
(+32° to +122° F)

Storage Temperature Range *

0° C to +55° C (LCD display is damaged if stored above +60° C)

Altitude

0 to 15,000 feet (4600 M)

Relative Humidity

20% to 80% non-condensing

* WARNING: Avoid long exposure to high temperatures, store at room temperature.

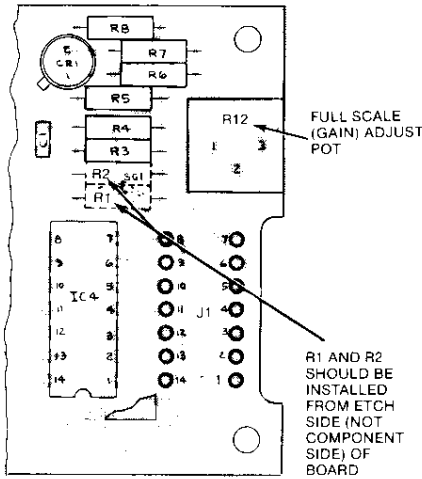
Ordering Information

DM-LX3-1: +/- 2Vdc Input Range
(Supplied With Free Connector)

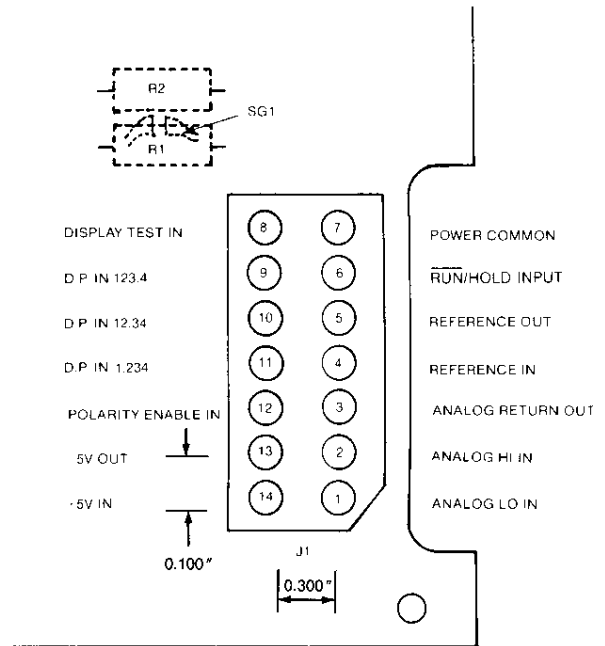
RN-3100/4100: Range-Change
Accessory Kit for DM-Series Meters

DM-LX3 COMPONENT LOCATIONS*

INPUT/OUTPUT CONNECTIONS



- NOTES:
- (1) R1, R2 ARE USER-INSTALLED ATTENUATION OR (R2) SHUNT RESISTORS. BEFORE INSTALLING RESISTORS AT R1, OPEN SOLDER GAP (SG1) ON ETCH SIDE OF BOARD WITH A SOLDERING IRON. NOTE THAT IF R1 IS LATER REMOVED, THE USER MUST CLOSE THE SOLDER GAP.
 - (2) R1 AND R2 FOR VOLTAGE RANGES ARE RN60C EXCEPT *RN70C. CURRENT SHUNTS SHOULD BE 1%, 10 PPM/°C OR BETTER. 1W AND ½W RESISTORS MAY NOT FIT FLUSH TO BOARD.
 - (3) THESE RANGES REQUIRE ADJUSTMENT OF R12 FOR ACCURATE READINGS.
 - (4) IF 10 MΩ IS NOT AVAILABLE, USE R1 = 2 MΩ, R2 = 220 KΩ.
 - (5) THE ±300V RANGE WILL DISPLAY +1999V BUT THE SAFE LIMIT FOR THE BOARD AND CONNECTOR IS ±300V.
 - (6) CONNECT ALL UNUSED DECIMAL POINTS TOGETHER TO DISPLAY TEST (PIN 8).



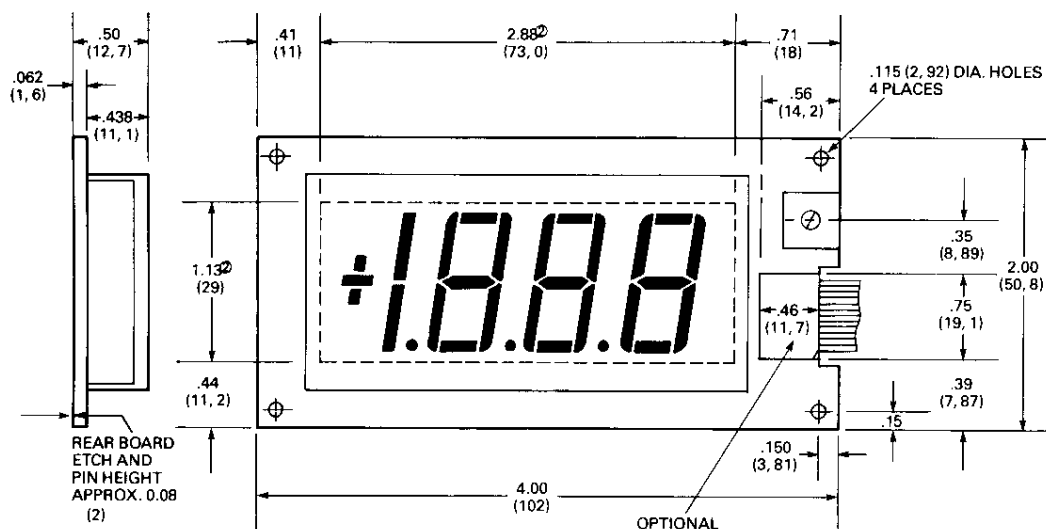
FOR OTHER VOLTAGE AND CURRENT RANGES

F.S. RANGE	R1 ^{1,2}	R2 ^{1,2}	DECIMAL ⁵ POINT
±2V	Short SG1	Omit	pin 11 to 14
±20V ³	10 MΩ ⁴	1.1 MΩ ⁴	pin 10 to 14
	or	or	
±200V ³	9.1MΩ	1 MΩ	pin 10 to 14
±300V ⁵	10 MΩ	100 KΩ	pin 9 to 14
±200 mA	Short SG1	100.1W	pin 9 to 14
±20 mA	Short SG1	100Ω, ½W	pin 10 to 14
+2 mA	Short SG1	1 KΩ	pin 11 to 14
±200 μA	Short SG1	10 KΩ	pin 9 to 14
±20 μA	Short SG1	100 KΩ	pin 10 to 14

* Refer to DATEL RN-3100/4100 Range-Change Accessory Kit data sheet for detailed modification instructions and R1 & R2 locations.

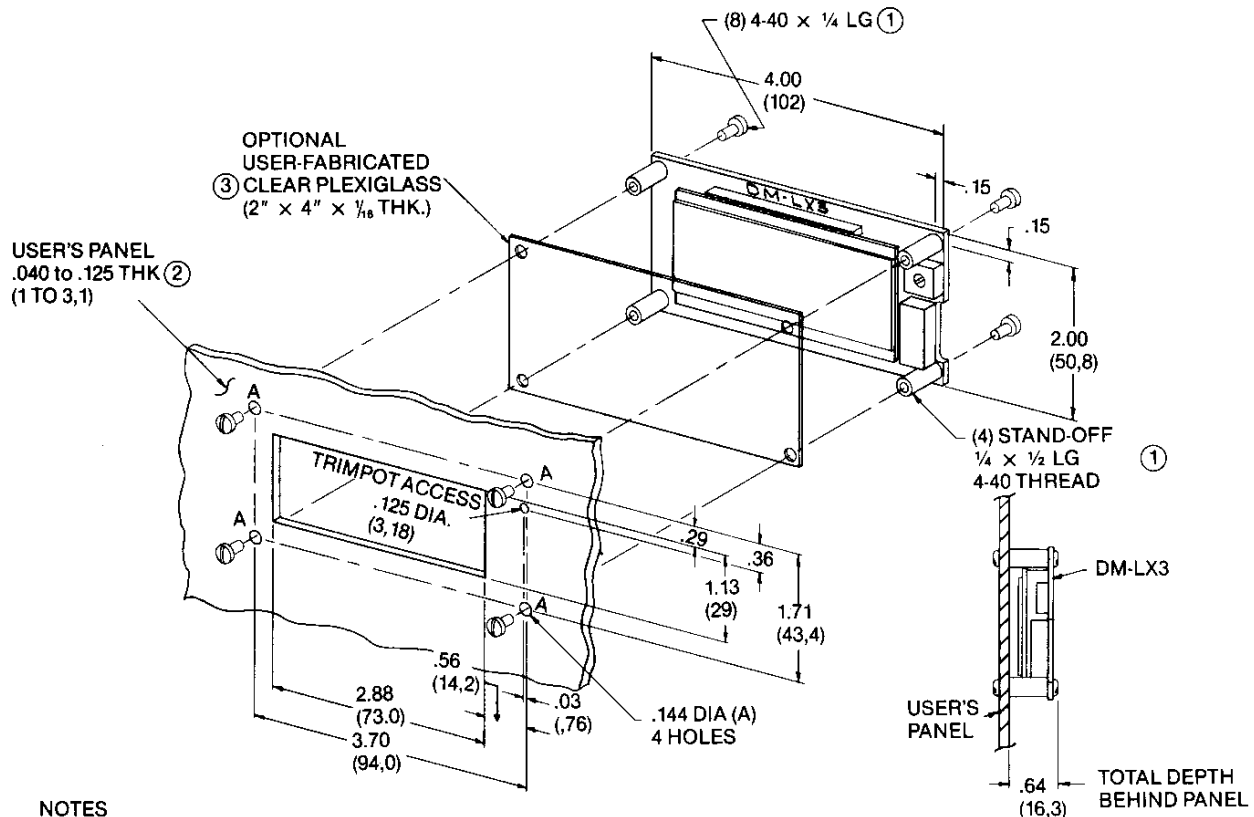
MECHANICAL DIMENSIONS

INCHES (MM)



- NOTES:
1. USE ¼" x ½" LG STAND-OFFS (NOT SUPPLIED WITH METER) TO REAR MOUNT DM-LX3.
 2. THESE ARE NOT OUTLINE DIMENSIONS FOR THE DISPLAY. THEY ARE PANEL CUTOUT DIMENSIONS USED WHEN REAR MOUNTING THE METER.

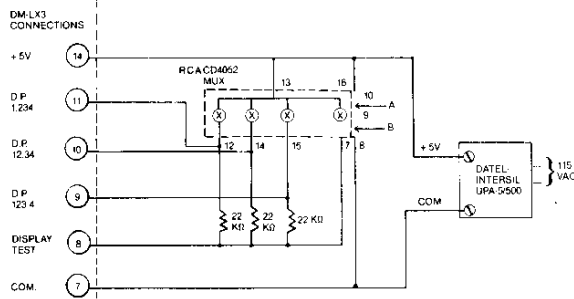
DM-LX3 PANEL MOUNTING
INCHES (MM)



NOTES

- ① STAND-OFFS AND HARDWARE SUPPLIED BY USER.
- ② PANEL THICKNESS OF ABOUT 1/8" MAY REQUIRE 4-40 x 1/8 LG. SCREWS FROM THE FRONT.
- ③ A CLEAR FILTER IS RECOMMENDED TO PROTECT THE DM-LX3 DISPLAY. IF USED, INCREASE LENGTH OF FRONT SCREWS BY 1/8".

OPTIONAL ENCODED DECIMAL POINT CONTROL

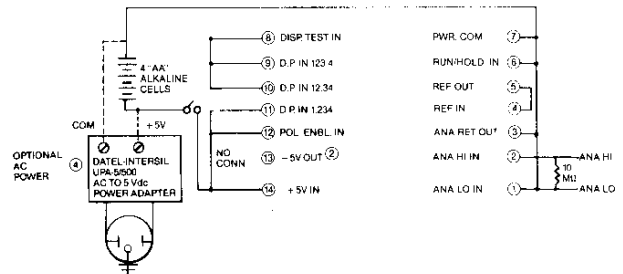


NOTES:

- 1. On CD4052, only X channels 0, 1, and 2 are used.
- 2. Logic levels for A and B inputs are:
LOW: ≤ + 1.5V
HIGH: ≥ + 3.5V
- 3. UPA-5/500 is a Datel-Intersil, user-supplied, user-installed accessory.

INPUT STATES		D.P. SELECTION
A	B	
0	0	1.234
1	0	12.34
0	1	123.4
1	1	NOT USED

SINGLE-ENDED INPUT CONNECTION



NOTES:

- ① Normal connections are shown.
- ② Up to 20 mA may be taken out at -5V OUT. Add current out at -5V OUT to 3.5 mA for total current required at +5V IN.
- ③ **WARNING:** Exposed Liquid Crystal Display may be ruined if edges get wet. Also, top of display is plastic, and can easily be scratched. Clean display top only with Freon.
- ④ The Datel-Intersil UPA-5/500 is a user-installed accessory. Note: Supply either batteries or UPA-5/500 to power DM-LX3.
- ⑤ The optional 10 MΩ resistor ensures open-circuit zeroing.