



9V-powered meters must never be wired in any configuration that has pin 11 or 12 tied directly to, or at the same potential as, pin 3. Doing so will drive the meter into an overrange condition (display flashes on and off or all digits are blank except for the left-most "1"). This condition is the number one cause of problems with 9V-powered LCD meters. How to solve it — or better still, avoid it — is covered next.

### 5V Regulators

In the real world of DPM's, there are many applications that are battery powered and also have their input signal referenced to, or even below, the negative battery terminal. In these applications, 5V-powered DMS meters must be used in order to avoid the above conditions. To accomplish this, the 9V battery must first be converted to a fairly clean, well regulated 5V. The two primary methods of accomplishing this are through the use of a three-terminal IC regulator or by using a zener diode in conjunction with a series limiting resistor. Figures 2 and 3 illustrate the two approaches.

The total power dissipation of all three components (LM7805, zener diode and series resistor) must be limited in order to prevent device overheating. The DMS-EB data sheet describes limitations to observe when using the LM7805. As a rule, non-backlit LCD meters can use the LM7805 with battery inputs up to 24Vdc.

### Power Supply Considerations

The subject of power sources for DATEL's DMS Series digital panel voltmeters may, at first, appear to be a simple topic that could be covered in two short paragraphs. The first would discuss 5V-powered meters and the second, 9V-powered meters. In most applications, the choice is straightforward. Usually all that is available is either a +5V power source, normally derived from the ac line, or a battery in the 6-12V range. In the former case, when all you have is 5V, you should obviously strive to use a 5V-powered meter (either LED or LCD).

It is economically unwise, although one could do so, to use some type of DC/DC conversion and generate 9V solely for the sake of using a 9V-powered meter. Conversely, there are times when it is necessary to use 5V-powered models when the only available power source is the 6-12V battery mentioned earlier.

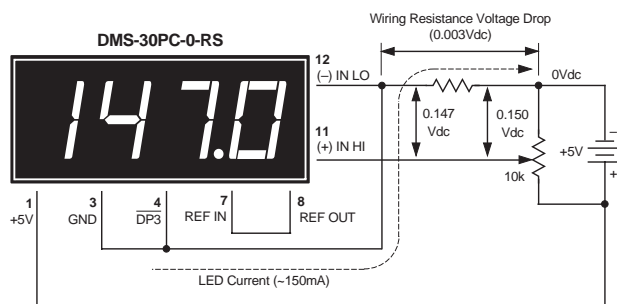


Figure 4. Single Ended Circuit with Ground-Loop Induced Errors.

All DATEL DMS meters require stable, well regulated, dc power supplies in order to achieve their full specified performance. All models have an internal, 1-2 microfarad, filter capacitor connected across pin 1 (+5V SUPPLY/+BATTERY) and pin 3 (5V RETURN/-BATTERY) to attenuate high-frequency noise. In most applications, this eliminates the need and additional expense of external decoupling capacitors. DC power sources with low-frequency (less than 1kHz) ripple and noise in excess of 50mV may induce instabilities in the meter's display and may require additional external power-supply filtering.

### Ground Loops

"Ground loops" are another topic that deserves discussion because they rear their ugly heads all too often, especially when precision 4½ digit meters are used. Ground loops can cause both inaccurate and unstable readings. The display can "jump" up or down ("hunting") by as many as 20 counts. It will almost never read all "0's" with zero Volts applied.

A harmful ground loop can occur any time current which powers the meter's display (current entering or leaving pin 3) becomes intermixed with signal current (the current flowing in or out of pin 12). This usually occurs only with single-ended input signals due to the fact that (-) INPUT LO, pin 12, is normally connected to pin 3 (GROUND).

Figure 4 illustrates a common ground-loop condition and the associated voltages that cause the display inaccuracies. The error voltages are generated because all wiring that has current flowing through it has a voltage drop (referred to as the "IR" drop) between one end of the wiring and the other end.

The solution to the problem is simple: avoid connecting pin 12, (-) INPUT LO, directly to pin 3 in single-ended applications. Use a separate wire or pc-board trace, originating at the power and/or signal ground point, to tie (-) INPUT LO to zero Volts. Figure 5 shows how to correctly wire a single-ended signal.

LCD display meters are not normally sensitive to ground-loop induced errors. The total current drain of these models is usually less than 1mA (compared to 100mA or higher for their LED counterparts). It never hurts, however, to always use the wiring precautions described above, especially if backlit displays, with their significantly higher supply currents, are used.

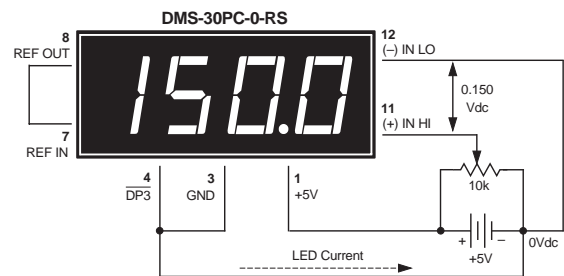


Figure 5. Correct Circuit Connections with No Ground-Loop Errors



DATEL, Inc. 11 Cabot Boulevard, Mansfield, MA 02048-1151  
Tel: (508) 339-3000 (800) 233-2765 Fax: (508) 339-6356  
Internet: www.datel.com Email: sales@datel.com  
Data sheet fax back: (508) 261-2857

DATEL (UK) LTD. Tadley, England Tel: (01256)-880444  
DATEL S.A.R.L. Montigny Le Bretonneux, France Tel: 01-34-60-01-01  
DATEL GmbH München, Germany Tel: 89-544334-0  
DATEL KK Tokyo, Japan Tel: 3-3779-1031, Osaka Tel: 6-354-2025