

## Minimum-Component Battery Monitors

### Introduction

Many applications require that the system power supply voltage be precisely monitored. This is especially true when the equipment is battery operated, since battery voltage can be used as a measure of remaining battery capacity. Three, simple, energy-efficient ways to monitor a dc voltage source are shown in the figures below.

### Using LCD Display Meters

The following meters can all be used for this application: DMS- 20LCD-1-9, DMS-30LCD-1-9 and DMS-40LCD-0/1-9. All are 7.5 to 14V-powered meters featuring very low current consumption and input ranges of  $\pm 2V$ . In Figure 1, resistors R1, R2 and R3 make up a precision 10:1 voltage divider. Three resistors are required because 9V-powered meters can only make differential measurements. Pin 12 (–) INPUT LO) can never be tied directly to the negative battery terminal (pin 3).

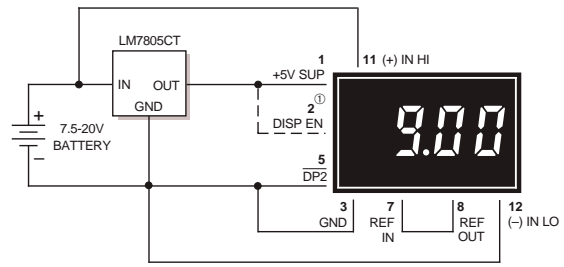
If we assume that the battery voltage in the following figures measures exactly 9.00V, then the differential voltage drop across R2 is 1/10 of 9.0V or 0.90V. DP2 is turned on to make it appear that the meter is measuring 9.00 Volts. Note that selecting a different decimal point does not change the input range of the meter.

### Using LED Display Meters

It is also possible, with some additional circuitry, to use LED display, DMS Series voltmeters as battery monitors. The following LED meters can be used for battery monitoring: DMS-20PC-2-RL, DMS-30PC-2-RL and DMS-40PC-2-RL. These models all have built-in precision 10/1 dividers in their input stage. The primary disadvantage of using an LED display meter is the increased current required for powering the display itself—current that in many applications cannot be ignored. Because of this increased

LED current drain, only red low-power models (-RL suffixes) are recommended for use in power-sensitive configurations. Additionally, a regulated 5V power source must be generated since LED meters are only available as 5V-powered devices. As shown in Figures 2 and 3, the LM7805CT three-terminal regulator, in a TO-220 package, is used to generate the 5V power for the meter.

The battery voltage is applied to the input of the regulator and also to the input of the meter. For prototype purposes, Murata Power Solutions' DMS-EB (for DMS-30PC and DMS-40PC meters) and DMS-EB2 (for DMS-20PC meters) Application Boards contain the required pboard traces to mount the LM7805. If reverse-polarity protection is required, a 1N4001 or similar general-purpose silicon diode can be placed in series with the LM7805 (between the "+" battery terminal and the regulator). However, pin 11 (+) INPUT HI) must still be tied directly to the battery's "+" terminal.



① Pin 2 connected on DMS-20PC-2-RL only.

Figure 2. Connections for the DMS-20PC-2-RL and the DMS-30PC-2-RL

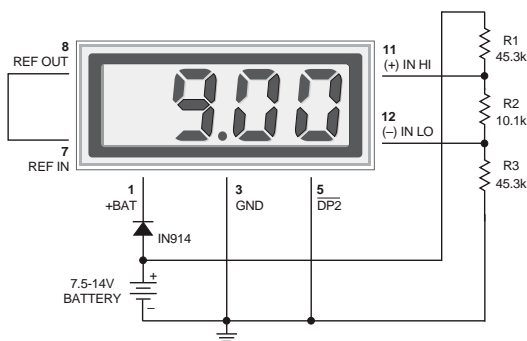


Figure 1. Connections for the DMS-20LCD-1-9 and the DMS-30LCD-1-9

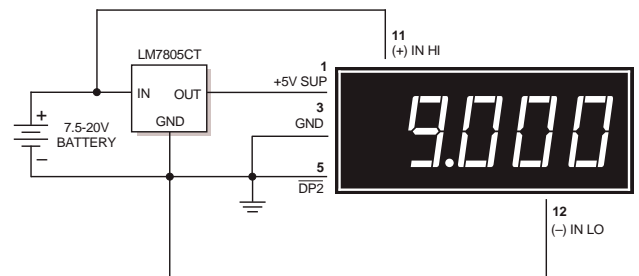


Figure 3. Connections for the DMS-40PC-2-RL