LCD Meter Single Supply Applications

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LCD panel meters are readily available, inexpensive, and applicable to many projects. There is one "catch" to these devices, however. The source of DC power for the meter unit must be isolated from the circuit being measured. This is because the ground potential of the meter power supply is not the same as the reference potential needed by the analog-to-digital converter IC. A DC-to-DC converter with transformer isolation is an obvious solution. This was discussed in a previous article[1]. In certain situations is quite desirable to operate the LCD meter module from a single supply, in order to keep power loss to a minimum.

This article demonstrates how to do this with two different applications, a single-supply LCD temperature display and a single-supply LCD voltage monitor. These applications should work fine with any LCD module based on the Harris/Intersil 7106 chip.

LCD Temperature Display

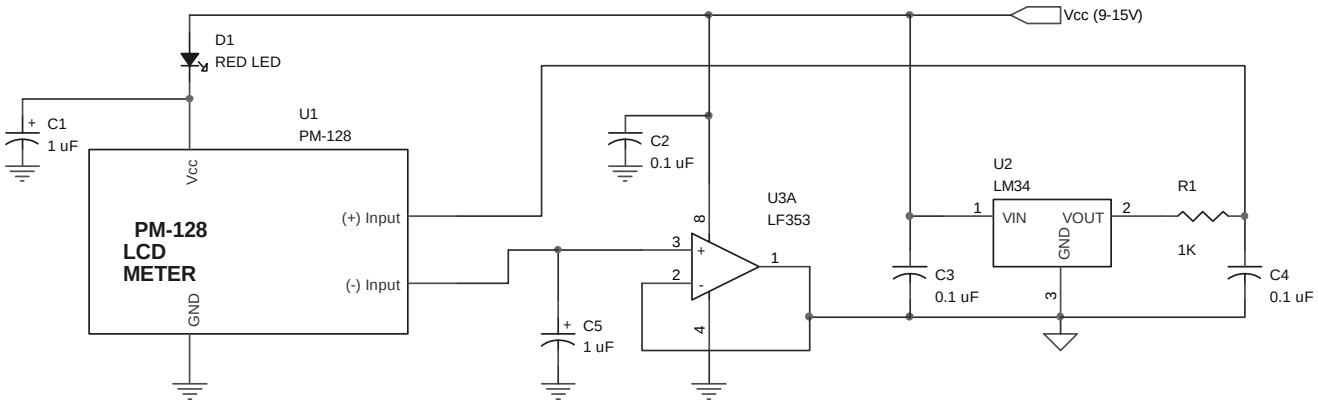

Figure 1: LCD Electronic Thermometer Circuit

The circuit above uses an LM34 as the temperature sensing element. The circuit works by first developing an analog ground signal from the voltage sensed from the negative (-) "input" terminal of the PM-128 LCD meter module. In most LCD meter modules, the negative input is not an input, but actually is biased about 3 volts below the module VCC power supply voltage. U3A buffers this voltage (which is dropped an additional 2 volts below the main VCC by D1, an LED), which allows U2 to use the negative input voltage value as analog ground. The additional voltage drop of D1 helps to ensure adequate supply voltage between pins 1 and 3 of U2, the temperature sensor.

[1] The article "LCD Meter Power Supply", located at http://faculty.kc.devry.edu/twheeler/projects/lcdsupp.pdf, discusses a switching power supply designed to isolate LCD meter modules from a DC source.

Power Supply Self Monitor

Normally an LCD module can't measure its own power supply; but with a little algebraic translation of the main power supply voltage, it is quite easy to do. Figure 2 shows how. Such a circuit could be handy in many applications.

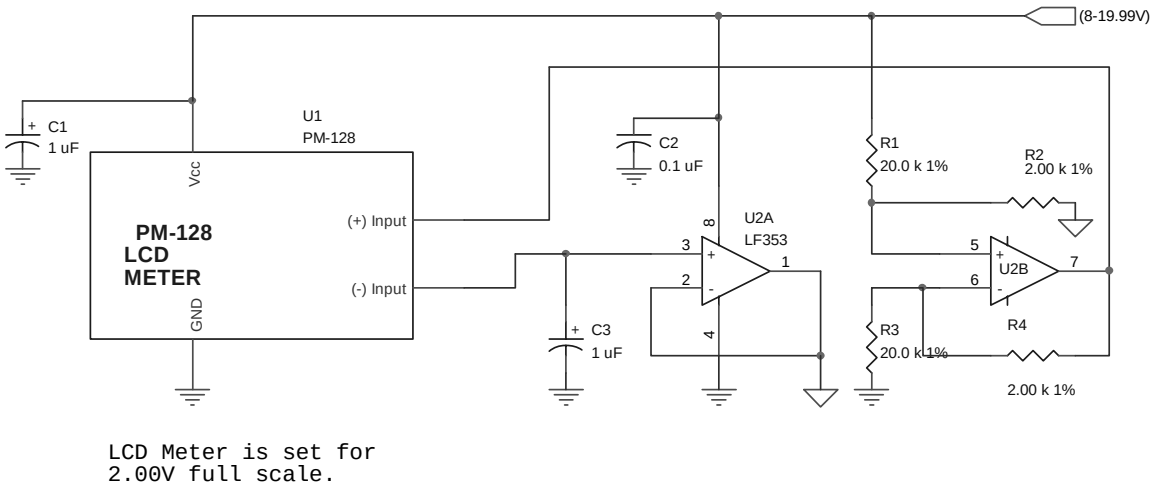

Figure 2: Power Supply Monitor Circuit

Using the principle from the previous circuit, U2A buffers the analog ground reference voltage from the LCD meter module to produce the signal ground. U2B is a differential amplifier that solves the following equation:

$$Vo = \frac{(VCC - GND)}{K} + V_{REF} \quad \text{given} \quad K = \frac{R3}{R4} = \frac{R1}{R2}$$

Where K = 10 (the differential amp has a gain of 1/10), and V_{REF} is the reference voltage derived from the LCD module negative terminal. Choosing K = 10 allows the LCD to monitor up to a 20 volt supply potential when it is set for an actual input full-scale value of 2 volts.

For best accuracy, precision resistors must be used. 1% parts (or better) are recommended; for critical applications, the parts should be hand matched. Using a low-offset operational amplifier can also improve accuracy. The prototype exhibited less than 0.5% accuracy at any reading above 8 VDC. Below 8 VDC, the LCD module is not guaranteed to function correctly.

Higher voltages can be monitored, but be careful; the ICL7106 chip within the meter assembly is rated for an absolute maximum VCC of +15V. For higher voltage applications, the supply the LCD meter module should be regulated to 12V.