

A Voltage Standard for the Hamshack

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Recently, while tuning up a new project, it seemed like the knob on the power supply turned awfully far just to reach 12 volts — then I noticed the "low battery" indicator on the digital multimeter. The voltage was already above 16 volts. Fortunately, that project has an internal regulator so no damage was done. However, it was annoying — this digital multimeter replaced one whose flaky range switch caused similar problems. At times, I've pulled out the old Simpson VOM - the red needle is reliable but not as precise.

A few nights later, I found a bag of parts buried on the workbench — probably purchases from a hamfest last summer. Among the gems was an IC marked AD581L. A quick search at www.analog.com showed it to be a precision voltage reference, laser-trimmed to exactly 10 volts. Just the ticket for untrustworthy digital meters.

The AD581 has only three terminals: an input of 12 volts or higher, an output of 10 volts, and ground. No external components required. I dug up a small ABS plastic box, a couple of pin jacks, and a cord with an Anderson Powerpole connector. Two holes and three solder joints completed the assembly. The photo shows the complex assembly — I added a bypass capacitor, just because. A schematic is hardly necessary.



Time to spark it up — the output was 10.01 volts on the digital multimeter. Pretty good, but the L suffix is specified to be within 5 millivolts, so I tried a lab-grade meter, and read 10.003 volts — really good. The data sheet talks about aging for 200 hours to stabilize, so I ran it for a week and measured again: 10.0031 volts.

Is this accuracy necessary? Probably not, most of the time. I tried several digital multimeters of various age and quality, and obtained the following readings: 10.10, 10.03, 9.96, and 9.98 Volts, a range of 70 millivolts. None is off by more than 0.4%, not bad considering that these were cheap meters rated for 1% accuracy when new, and never calibrated since. 1% accuracy is fine for most measurements, but some things, like battery testing and charging, require finer resolution. We've learned the hard way that good, fully-charged batteries are essential for successful portable operation. Comparison to an accurate standard is a good way to get more accurate results.



This is a handy little gadget that you can build, even if your homebrewing skills aren't quite up to tiny surface-mount microwave components. The AD581 is readily available from www.analog.com, or an equivalent part, the LT1031 from www.linear.com (see application notes AN82 and AN42); both are available from Digikey. In either case, you can pay for as much accuracy as you need. Other voltages are also available. Many are lower noise than normal voltage regulators, so they might be good voltage references for low-noise oscillators.

Some of these parts may be available as surplus — mine apparently was — so let us know if you find a good source.