

Interesting circuit doesn't work

I had occasion to build an expanded scale voltmeter recently. I remembered you had already published a very clever version of this, in November 2006, on page 7. This was a reprint from the "Circuit Notebook" June 1995, which I didn't have.

I built it in about 10 minutes and it didn't work! I took some measurements and pondered for a while; it's a bit of a brain-teaser. The problem is that the 7805/7905 devices are designed to source current to the load, and in this case the current is flowing the other way back into both the regulators. This causes the regulation to fail and the output terminal voltage to rise

(with respect to its GND pin).

The 7905 was much worse than the 7805. With only 1mA flowing backwards into its output pin, the voltage rises to over 6V. I tried a number of regulators from different manufacturers but they were all the same.

To explain the problem, if we assume 12V is applied to the input, the

output pin of the 7905 will be sitting at +7V (ie 12V-5V) with respect to the input minus. This +7V has a current path via the meter to the 5V output of the 7805, thus tending to pull the 7805 to a voltage above 5V. The same happens to the other regulator.

In order to fix it, you need to ensure current is always flowing out of each

regulator. This requires a load resistor from each output pin to the respective GND pin. I would suggest that, to keep it stable, about five times the current should flow via this resistor, ie, 5mA through the resistor and 1mA through the meter.

I am surprised that Wal Douglas claims to have used it successfully for years.

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Comment: well you have uncovered a mess. We did not spot the problem in 1995 and we didn't spot it again in 2006!