

LOW-VOLTAGE CALIBRATORS

Model 1140A Features as a DC Source

- Resolution of 7 digits
- Output resistance of 0.05Ω
- Output current of 50 mA

A review of the specifications will show the superior features of the Model 1140A as a thermocouple simulator and meter. But this instrument is also a superior dc source and dc digital voltmeter.

First of all, the one-year dc accuracy specification of the Model 1140A is 30 ppm (of the voltage) + $2.5 \mu\text{V}$. If we have the Model 1140A output a 100 mV signal it will be accurate to $5.5 \mu\text{V}$ for one year **without re-zeroing the output (a unique feature)**. Because of its 7-digit resolution we can change the output in $0.1 \mu\text{V}$ increments when producing 100 mV. With these specs alone the Ectron has few competitors in the dc source arena. But the 1140A has two more important features that really set it apart.

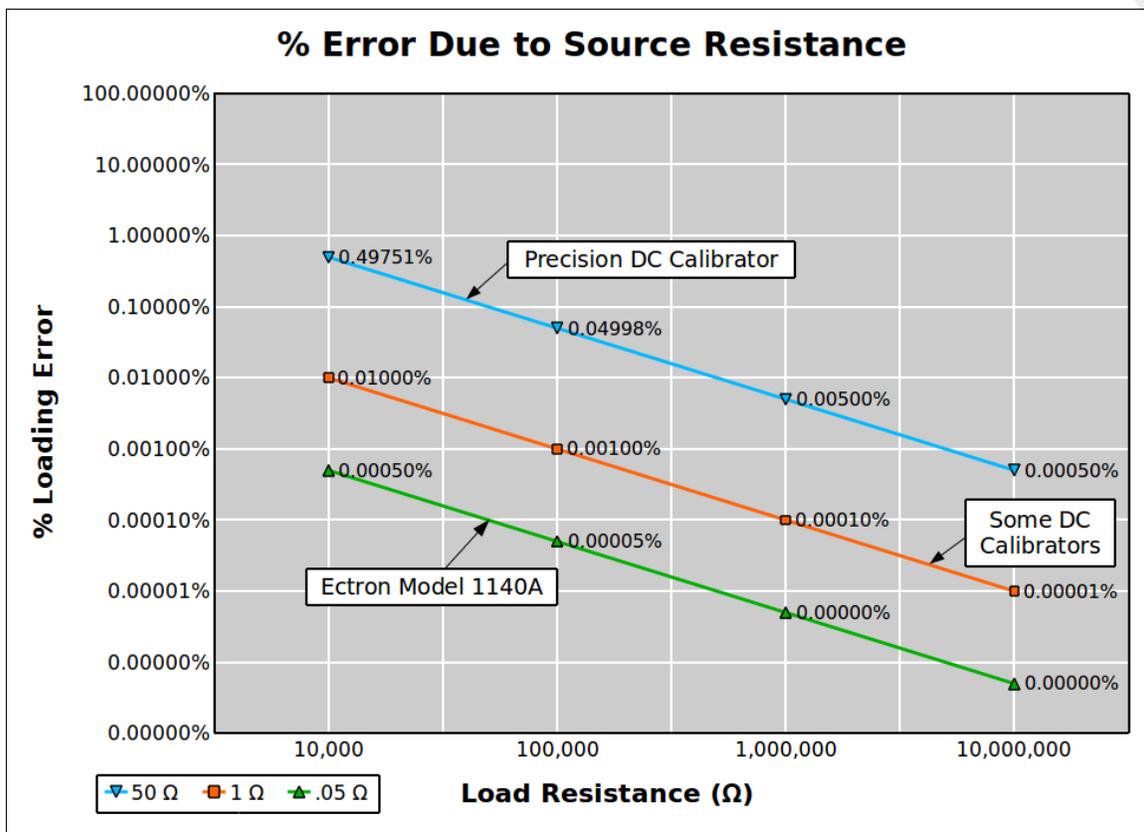
What if you needed to connect a precise 100 mV voltage to a $10,000 \Omega$ load? Try using a big and very expensive (\$40,000) calibrator, a superb do-all model with the best possible accuracy, 9 ppm + $0.5 \mu\text{V}$ (voltages less than 220 mV). You dial up 100 mV and connect to the load, but after a half

day of testing, OOPS, you discover the voltage at the output terminals of the instrument is only 99.52 millivolts! What can be wrong? You check everything and finally, as a last resort you check the manual. Lo and behold, this great instrument has a 50Ω output impedance on the 220 mV range.

What does a 50Ω output impedance do for our test? Well, instead of 100.0000 mV at the output terminals the voltage is almost 0.5% off when coupled to a 10 k Ω load, an error about 1000 times greater than expected. A quick check with Ohm's law confirms the problem. So rather than the quoted accuracy of 9 ppm + $0.5 \mu\text{V}$ for the 220 mV range, we have a gross error. In fact, to equal the quoted accuracy for 100 mV, the load must exceed 5 M Ω and even with this load we double the inaccuracy of the instrument.

Let's now try the 1140A. With an output resistance of only 0.05Ω the voltage is now 99.9995 mV, a loading error of only $0.5 \mu\text{V}$ or 0.0005% of the 100 mV. In other words, when we want to produce a voltage below 220 mV into loads below 1 M Ω we should use the Ectron Model 1140A instead of the more expensive calibrator.





Many other precision dc sources have this same problem. The chart above indicates the amount of error for various load resistances vs. voltage for source resistances of 50 Ω, 1 Ω, and 0.05 Ω. Other advantages of the Ectron for dc operation include a stability of 5.5 μV for one year without re-zeroing (again unlike the mighty 50 lb instrument which requires monthly rezeroing), 7-digit resolution allowing 0.1 μV adjustment on the 0 mv to 999.9999 mV range, and optional IEEE-488.2, Ethernet, and USB interfaces.

There are some dc calibrators with 1 Ω output resistance. These products alleviate the problem by 50:1 but still have problems with many loads requiring calculation to be assured of accurate results.

Again unique among precision dc calibrators, this Ectron instrument has another important feature. Its output current capability is 50 mA even when sourc-

ing microvolt signals. If you want to add multiple paralleled loads or you have very low-resistance loads such as old recorders and meters, they can be accurately driven by the Ectron instrument.

All this means is that when using the Model 1140A, the user can relax knowing that even unusual loads will be accurately calibrated.

ANOTHER REASON TO GO ECTRON



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