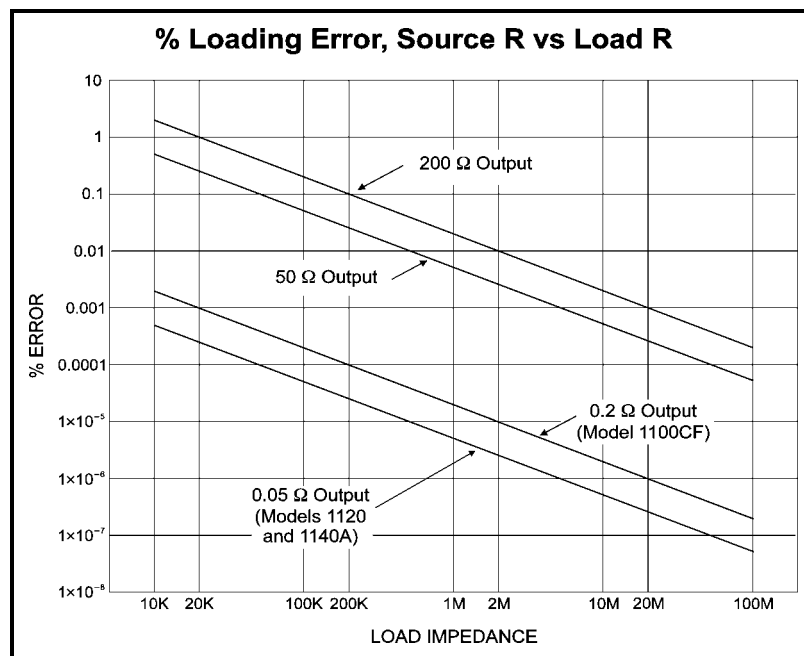


## High Output Resistance in a Dc Calibrator?

Most thermocouple simulators and dc calibrators have an output resistance of 50  $\Omega$  or higher for output voltages under approximately 200 mV. Although 50  $\Omega$  seems small compared to a high-resistance load, it can cause significant errors when high accuracy is required.

With a 1 M $\Omega$  load, an output resistance of 50  $\Omega$  causes an error of 0.005%; with a 50 k $\Omega$  load, 0.1%; and with a 5 k $\Omega$  load, 1%! Therefore, the chance for error is high unless the actual input resistance of the instrument under test is known and the loading effect is calculated *for each test point and each instrument!*

In contrast, the Ectron Model 1100CF has a maximum input resistance of 0.2  $\Omega$ , and the Model 1120 and Model 1140A both have an output resistance of 0.05  $\Omega$ . Thus, when using the Model 1140A, the additional error with a 1 M $\Omega$  load is less than 0.000 005%; with a 50 k $\Omega$  load, less than 0.000 1%; and with a 5 k $\Omega$  load, less than 0.001%.



The graph shows the percent error attributable to calibrator output resistances of 200  $\Omega$  and 50  $\Omega$  of competing units and of the 0.2  $\Omega$ , and 0.05  $\Omega$  output resistances of the Ectron models over a wide range of load resistances.

Older temperature recorders and many cold-junction compensators have resistances of 10 k $\Omega$  or less. Of course, all analog meter temperature indicators have low resistance and should not be calibrated with anything but a calibrator with low output resistance. Loading error is normally not noted on calibrator data sheets, and output resistance is buried in the fine print. When caused by high output impedance, load problems can be a major source of error in the calibration laboratory unless carefully monitored.

To provide a low output resistance at all voltages, Ectron incorporates sophisticated, low-noise output amplifiers in its thermocouple simulator-calibrators rather than just divide the output of the voltage source with resistors. Although these amplifiers add to the cost of the instrument, they greatly simplify its use and are absolutely necessary in thermocouple applications.

**ONE MORE REASON TO CHOOSE ECTRON!**