



Selection of Measuring Instruments, Loading Effects and Calibration

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SELECTION OF MEASURING INSTRUMENTS

Main criteria

- given measurement task
- measured quantity
- measured range of the parts
- the dimensions and tolerances
- available time for tests

Minor criteria

- in what form the measured values have to be
- how the values have to be processed
- how the measuring equipment have to be used
- who should operate the measuring equipment

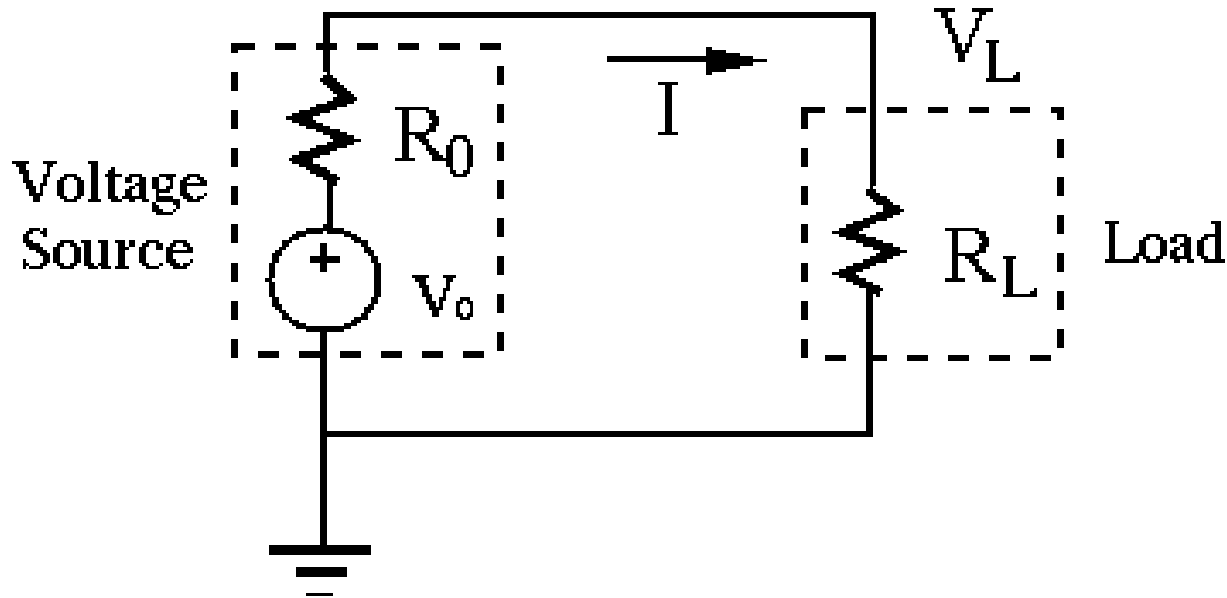
Advanced Minor Criteria

- type / construction
- environmental conditions
- sensors
- control
- software
- consulting and services

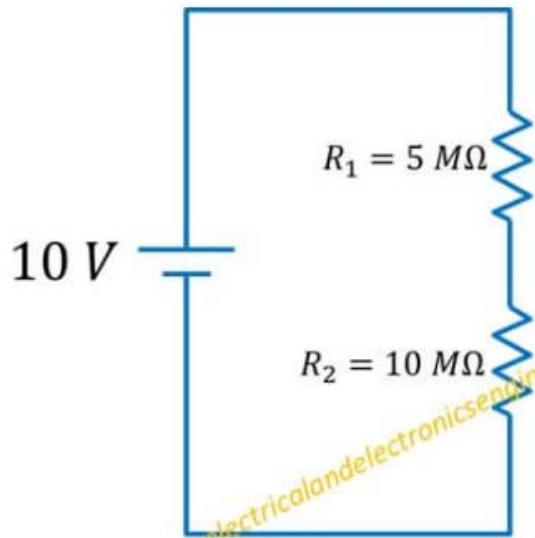


LOADING EFFECT

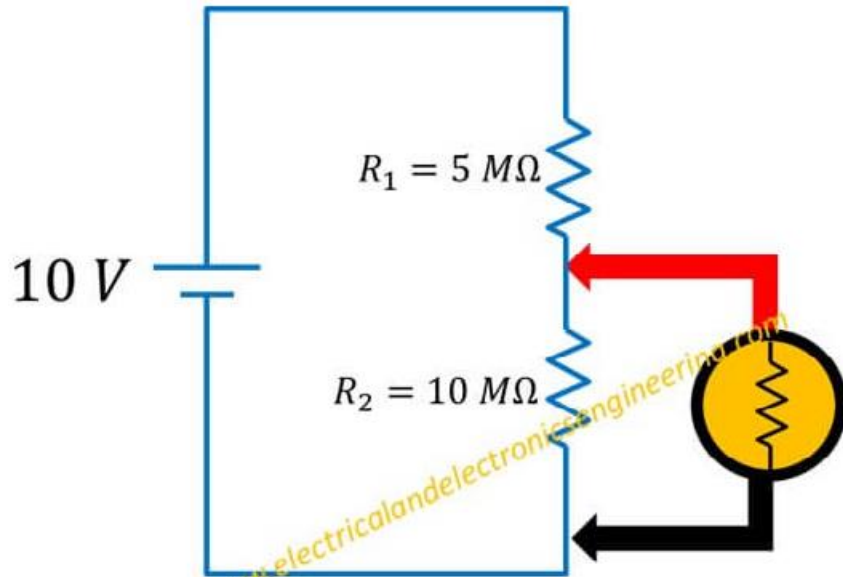
Consider the circuit shown in the figure. Here we want to supply whole of the V_0 to the load resistance R_L . This is possible only when $R_0=0$ and $R_L=\infty$. As both the conditions are not possible to achieve so V_0 can never be equal to V_L . This phenomenon is called loading effect and can be minimized if we maximize the load resistance and minimize the internal resistance



EXAMPLE



$$V_2 = \frac{10\text{ M}\Omega}{5\text{ M}\Omega + 10\text{ M}\Omega} * 10\text{ V} = 6.66\text{ V}$$



$$V_2 = \frac{(10\text{ M}\Omega || 10\text{ M}\Omega)}{5\text{ M}\Omega + (10\text{ M}\Omega || 10\text{ M}\Omega)} * 10\text{ V} = 5\text{ V}$$

$$R_v = 10\text{ M}\Omega$$



CALIBRATION

- Calibration is a comparison between a known measurement (the standard) and the measurement using your instrument. Typically, the accuracy of the standard should be ten times the accuracy of the measuring device being tested. However, accuracy ratio of 3:1 is acceptable by most standards organizations.



WHY CALIBRATION IS IMPORTANT?

- The accuracy of all measuring devices degrade over time. This is typically caused by **normal wear and tear**. However, changes in accuracy can also be caused by **electric or mechanical shock** or a hazardous manufacturing environment (e.x., oils, metal chips etc.). Depending on the type of the instrument and **the environment** in which it is being used, it may degrade very quickly or over a long period of time. The bottom line is that, **calibration improves the accuracy of the measuring device. Accurate measuring devices improve product quality.**



WHEN SHOULD YOU CALIBRATE YOUR MEASURING DEVICE?

A measuring device should be calibrated:

- According to recommendation of the manufacturer.
- After any mechanical or electrical shock.
- Periodically (annually, quarterly, monthly)



Thank You

