

Voltage divider as voltage source

Student Group

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The voltage divider shown in [figure 1](#) is in an unloaded state, as the entire current supplied by the power supply flows through the resistors R_1 and R_2 connected in series. A resistor parallel to R_2 loads the voltage divider. Set the voltage on the power supply to 12 V and measure the exact voltage with a multimeter. Set up the measuring circuit shown in [figure 1](#). For the connected load $R_L = 10\text{ k}\Omega$, the voltage divider represents a voltage source. Like any voltage source, it has a source voltage (also called the original voltage) U_0 and an internal resistance R_i . The internal resistance of a voltage divider considered as a voltage source results from the parallel connection of the divider resistors R_1 and R_2 :

$$R_i = R_1 \parallel R_2 = \frac{R_1 \cdot R_2}{R_1 + R_2}$$

Use the measured values of resistors R_1 and R_2 to calculate the internal resistance R_i of the voltage source:

$$R_i = U_0 =$$

The power P_0 supplied by the power supply can be calculated using the following equation:

$$P_0 = U \cdot I_1$$

The power consumed by the load resistance can be determined using the following formula: $P_L = R_L \cdot I_2^2$

 Fig. 1: Voltage divider

Draw the equivalent voltage source of the voltage divider:

What would be the value of U_2 without R_L ?

$$U_{2, \text{zero}} =$$

Calculate $U_{2,L}$ and I_2 for $R_L = 10\text{ k}\Omega$ using the values of the equivalent voltage source: (Provide formulas!)

$$U_{2L} :$$

$$I_2 :$$

Check the values by measuring:

$$U_{2L, \text{Meas}} :$$

$$I_{2, \text{Meas}} :$$

Check the values using Kirchhoff's rules: (Provide formulas!)

$$U_{2L} :$$

$$I_2 :$$

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