

Thévenin's Theorem and Interface Circuit Design

Purpose: Verify Thévenin's Theorem and practice elementary interface circuit design.

Equipment Required

- 1 - Digital Multimeter
- 1 - Triple Power Supply
- 1 - Protoboard
- 1 - $1\text{k}\Omega$ 1/4W Resistor
- 1 - $10\text{k}\Omega$ 1/4W Resistor
- 1 - 100Ω 2W Resistor
- 1 - 150Ω 2W Resistor
- 1 - 200Ω 2W Resistor

Selection of 1/4W resistors available for the design:

100Ω	680Ω	$1\text{k}\Omega$
$3.3\text{k}\Omega$	$5.6\text{k}\Omega$	$8.2\text{k}\Omega$
$10\text{k}\Omega$	$15\text{k}\Omega$	$27\text{k}\Omega$
$100\text{k}\Omega$	$180\text{k}\Omega$	$390\text{k}\Omega$

Prelab

Review the sections of the text on Thévenin's Theorem.

- For the circuit of Fig. 1, find the Thévenin equivalent circuit seen by the 150Ω load resistor, R_3 . In your lab journal draw the circuit schematic for this Thévenin equivalent labeling the values of R_{TH} and V_{TH} . Use the Thévenin equivalent circuit to compute the current through and voltage across the 150Ω load resistor R_3 . Record these values in your lab journal.
- Draw the Norton equivalent for this circuit as seen by R_3 in your journal and as above label R_N and I_N with their values.

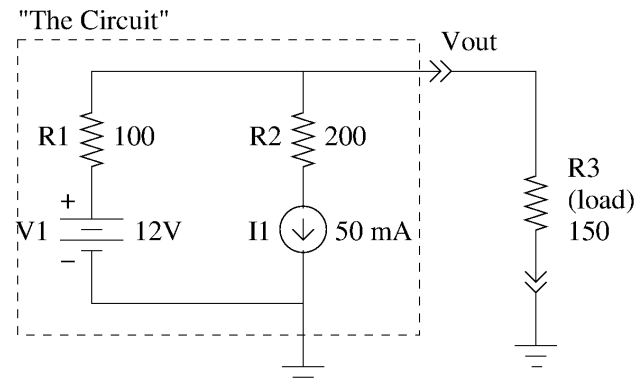


Figure 1. Note that the "load" is external to the circuit.

Procedure**1. Build the Thévenin and Norton equivalent circuits**

- a. Build the circuit of Figure 1. Measure and record both V_{OC} and I_{SC} .
- b. Now construct the Thévenin equivalent circuit and measure and record both V_{OC} and I_{SC} .
- c. Connect the 150Ω load to this circuit and measure and record V_{OUT} .
- d. Build the Norton equivalent for this circuit (now you'll have to configure the source for a constant current equal to I_N) and repeat the measurements requested in parts 1b and 1c.

2. Interface design

This part of the lab will give you some experience thinking about interface circuits.

- a. Design an interface as shown in Fig. 2 using only the resistors listed in the Equipment Required section. The goal of the design is to deliver $100\ \mu\text{A} \pm 10\%$ to the $10\text{k}\Omega$ resistor R_{LOAD} using no more than three additional resistors in the interface.

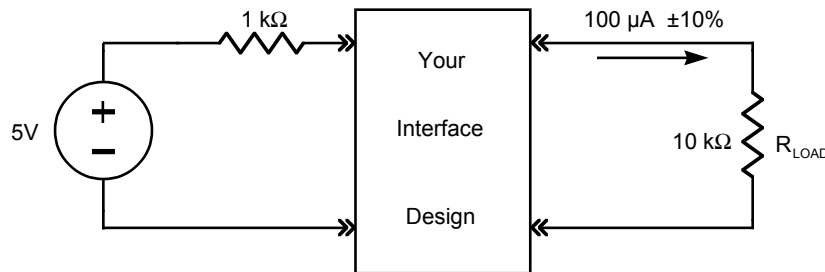
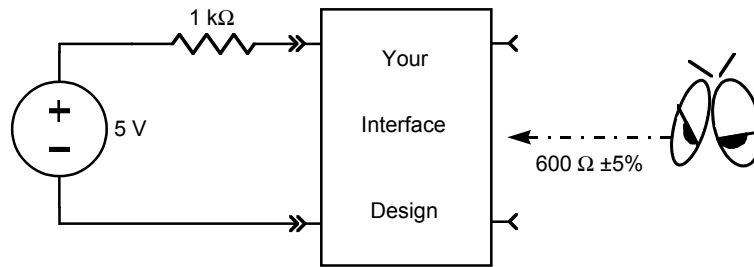


Figure 2

- b. Build your interface circuit and verify its performance. Record all of the results.
- c. For the circuit of Fig. 3, design an interface circuit so that a load connected to it will "see" a Thévenin resistance of $600\Omega \pm 5\%$. You may only use the fixed resistors available but for this exercise you may use four resistors in the interface.

**Figure 3**

- d. Build your circuit and demonstrate the results to your lab instructor. Fully document these results in your lab journal.

Conclusion

For the circuit of Fig. 1, how did the measurements made in the lab compare with the predicted output? How did the Thévenin and Norton equivalents you built compare with the predicted output? Explain any differences.