

myDAQ DC supply and multimeter

We're going to test the myDAQ multimeter and current limits of myDAQ power supplies. Open the DC Level and the Digital Multimeter from the the NI ELVISmx Instrument Launcher: Start menu -> All programs -> National Instruments -> NI ELVISmx for NI ELVIS & NI myDAQ -> NI ELVISmx Instrument Launcher.

myDAQ multimeter limits and safety information

Voltage limits: DC: 60 V, AC: 20 V (rms), (**Measurement Category I**).

Safety information (from the myDAQ specifications):

Caution Do not use this device for connection to signals or for measurements within Measurement Categories II, III, or IV.

Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as MAINS voltage. MAINS is a hazardous live electrical supply system that powers equipment. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

Measuring resistance

You can measure the resistances of your resistors to identify them.

1. Select the resistance measurement function (5 in the figure below).



2. Connect the measurement leads to myDAQ as indicated in the Banana Jack Connections diagram of the multimeter window.

Mode menu: You can specify the range or use the Auto setting. Measuring with the Auto setting is somewhat slower.

Acquisition mode: Select Run Continuously for continuous measurements. Run Once stops the measurement automatically.

3. Press Run to start the measurement.
4. Connect the measurement leads to the resistor and wait for the reading.

Using the analog output as a DC voltage supply

The analog output can be used as an adjustable DC voltage supply. Connect a 1-k Ω resistor to the breadboard (ends on different rows). Connect wires from these rows to AGND (3. from the left) and to AO 0.

Set the Voltage Level of the DC Level instrument to 1 V. Press Start.

Set the multimeter mode to Specify range and the range to 20 V and press Run.

Connect the multimeter measurement probes to myDAQ as indicated in the multimeter window.

Measure the voltage between the resistor terminals. Is it the same as the Voltage Level?

Keep increasing the Voltage Level until the multimeter reading does not increase. At what Voltage Level does this happen? Calculate the current by using the multimeter reading and the resistor nominal value. Compare it to the maximum given in the specifications, 2 mA.

Stop the DC Level instrument by pressing Stop.

Testing the +5 V digital supply

Measure the voltage between DGND and the 5V connector. Is it +5V?

Connect a 1-k Ω resistor between DGND and 5 V. Measure the voltage between the resistor terminals. Try also larger and smaller resistors.

myDAQ function generator and oscilloscope

Open the function generator and the oscilloscope from the NI ELVISmx Instrument Launcher: Start menu -> All programs -> National Instruments -> NI ELVISmx for NI ELVIS & NI myDAQ -> NI ELVISmx Instrument Launcher.

Connect AGND (3. from the left) to AI 0-.

Connect AO 0 to AI 0+.

Channel 0 of the analog output, AO, is now connected to channel 0 of the analog input (AI).

(When using the analog input, don't exceed the maximum input voltage range, ± 10 V.)

Oscilloscope

Press Run in the Oscilloscope window, and press Run in the Function generator window. The signal should now appear on the screen. To make it stay still, select Trigger Type Edge. Adjust the Horizontal Position, Level and the Slope and see what happens.

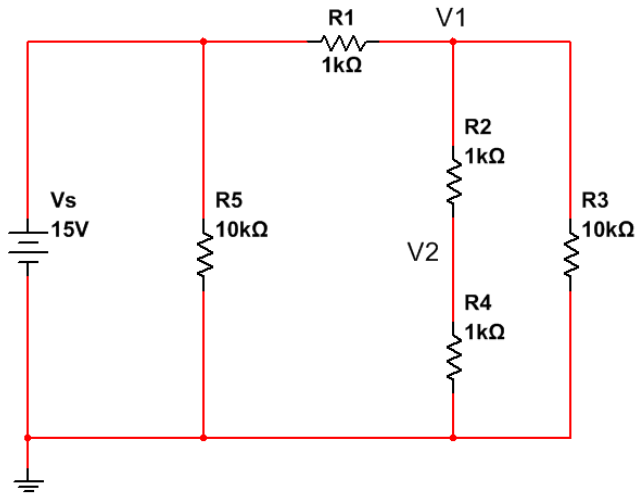
You can also measure signal values by selecting Cursors on and dragging the dashed yellow vertical line from the left edge.

Function generator

Try different settings (amplitude, frequency, DC offset, waveform type) and see how the signal changes.

Solving a resistor network

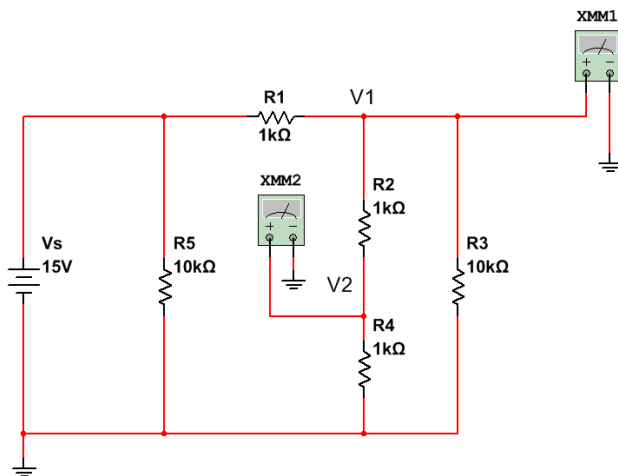
Solve the potentials V_1 and V_2 of the following circuit with paper and pen. Calculate the total current delivered from the power supply and the total power dissipated in the resistor network.



Simulation

Check your solution by simulating the circuit in Multisim. Start Multisim (Start -> All Programs -> National Instruments -> Circuit Design Suite 13.0 -> Multisim 13.0). Note that depending on the version (products are named after the year of their release) you may have 14.0 or 15.0 instead of 13.0.

Build the simulation circuit below:



Place the components by selecting Place -> Component. You can rotate them with Ctrl + R.

Place the **voltage source** by selecting Group: Sources, Family: POWER_SOURCES, Component: DC_POWER. Once the component is placed, change the name and voltage by double-clicking.

Ground symbol: Group: Sources, Family: POWER_SOURCES, Component: GROUND.

1k resistor: Group: Basic, Family: RESISTOR, Component: 1k.

XMM1, XMM2 (multimeters): Simulate menu -> Instruments -> Multimeter. The multimeters can be set to measure current or voltage. The default setting is voltage, so nothing needs to be changed.

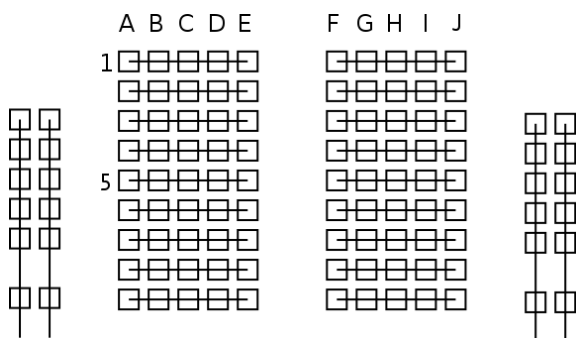
Once the circuit is ready, you can simulate it by using the interactive simulation from Simulate -> Run. Double-click the multimeters to see the voltages.

To simulate the total current drawn by the circuit, you can use a multimeter instrument as previously, or you can do a DC Operating point analysis.

Stop the interactive simulation from Simulate -> Stop. Select Simulate -> Analysis -> DC Operating point. Double-click I(VS) and P(VS) to move them to the list of Selected variables for analysis. Press simulate and you can see the power delivered to the power supply and the current flowing into it (both negative).

Measurements

Build the circuit on the breadboard. Use the myDAQ +15V and the AGND (3. from the left) connectors. Here are the internal connections of the breadboard:



With the circuit connected, measure the **supply voltage and potentials V1 and V2** using the myDAQ multimeter (Start menu -> All programs -> National Instruments -> NI ELVISmx for NI ELVIS & NI myDAQ -> NI ELVISmx Instrument Launcher -> Digital Multimeter).

Measure also the current drawn by the circuit. Select the DC current measurement (A) in the multimeter and connect the probes as indicated in the Banana Jack Connections diagram. Connect the multimeter in series with the circuit.

Calculate the power delivered to the circuit from the measurement results.