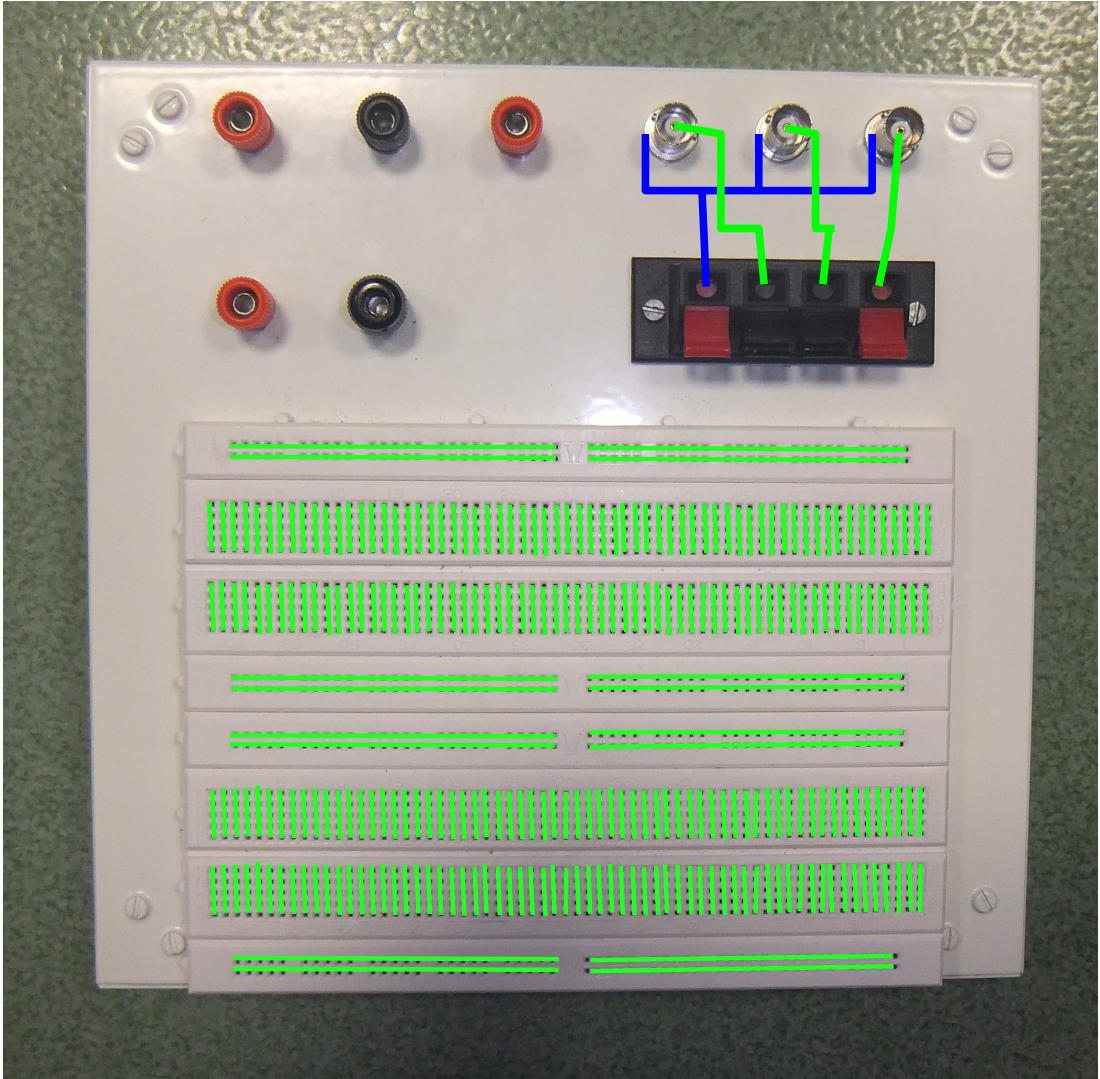


Semiconductor Devices and Analog Circuits

Lab 0

Breadboard connection diagram:



Oscilloscope and function generator

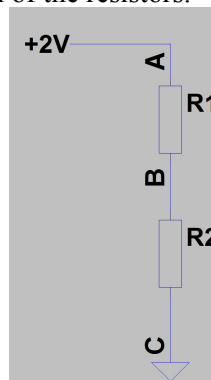
1. Please connect the output of the function generator with the input of the channel 1 of the oscilloscope. Turn the function generator on. The easiest way to set up the oscilloscope to show the signals correctly is to use the “autoset” button. It works correctly most of the times. Sometimes, though, the signal is too complicated and manual adjustments need to be done. Therefore, please try to manually adjust the oscilloscope horizontal and vertical scale in order to be able to see the signal properly when the amplitude and frequency of the signal from generator is changed. Observe the different shapes of signals. You should be able to change the shape, frequency and amplitude of the signal.
2. Oscilloscope trigger level setting.
Please use the trigger level adjust knob to see how does the level of triggering (denoted with an arrow to the right of the trace display area) influence the stability of the signal shown on the screen.
3. Oscilloscope channel coupling setting.
Please make sure, that the oscilloscope coupling mode is set to DC.
Set the output signal of the generator to the following: sinusoidal shape, frequency 1kHz, 0.1V peak-to-peak voltage, 5V offset. Use the autoset button on the oscilloscope to see the signal. Can you see the sinusoidal shape on the screen? For signals with large DC components it is not possible to see the shape of small amplitude, higher frequency signals.
Now, please switch the coupling mode of the oscilloscope channel to AC. Adjust the vertical and horizontal scale settings of the oscilloscope until you are able to see the sinusoidal shape clearly. You will also have to adjust the triggering level.

Multimeter

4. Please take 10 resistors of the same value and measure their resistance using the bench-top multimeter. Please make sure the multimeter is set for resistance measurement and that the probes are connected to the proper terminals. During the measurement, you should not touch any conducting parts of the probes nor any part of the resistor. Also, you have to make sure that the probes are firmly touching the resistor leads. It is best to put the resistor on the table and push the probes firmly to the leads of the resistor. Write down the measurement results and exchange the resistors with the next group. You should have $10 \cdot N$ measured resistance values, where N is the number of laboratory groups present.
Please calculate the following:
 1. mean resistance value
 2. minimal resistance value
 3. maximal resistance valuePlease prepare a histogram of the resistance values. It should range from minimal to maximal value calculated above and have 7 intervals.

Multimeter and power supply

5. Please construct a voltage divider shown below. Use two resistors with the same resistance of at least $1\text{M}\Omega$. Measure the resistance of each of the resistors.



Now switch the multimeter to DC voltage measurement mode and measure the following voltages: U_{AC} , U_{AB} , U_{BC} . Do the U_{AB} and U_{BC} sum up to U_{AC} ? If they do not, the reason is the internal resistance of the voltmeter. When measuring the U_{AB} voltage, the internal resistance of the voltmeter is connected in parallel to the $R1$, effectively changing the voltage divider division ratio. Similarly, when measuring the U_{BC} voltage, the internal resistance of the voltmeter is connected in parallel to the $R2$, effectively changing the voltage divider division ratio. Using the measured $R2$ value, U_{AC} and U_{BC} values, please calculate the internal resistance of the multimeter.