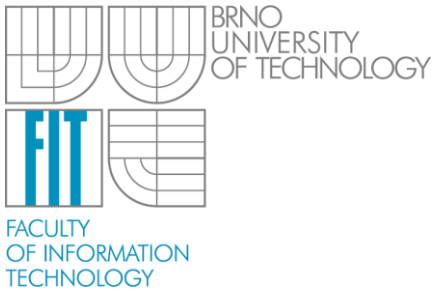
Prvky počítačů (IPRe)

First lab



Vysoké učení technické v Brně, Fakulta informačních technologií v Brně
Božetěchova 2, 612 66 Brno

Lector: Petr Veigend (iveigend@fit.vutbr.cz)

Gabriela Nečasová
Petr Veigend

2014/2015

Contents of todays lab

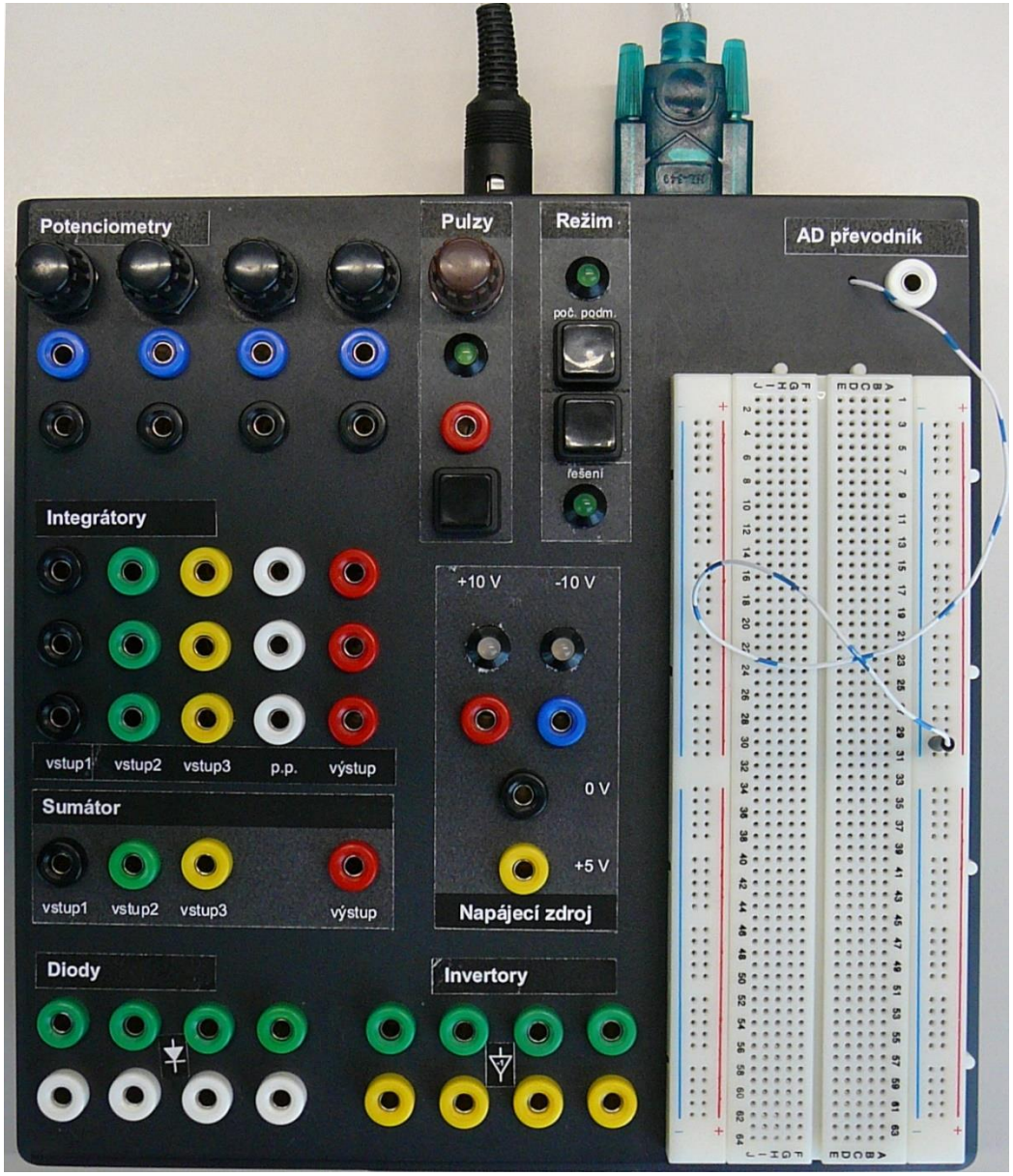
- Basic information, safety briefing
- Introduction to the lab kit, IPR metr software
- Simple measurements
- Solderless field circuits

Basic information, safety briefing

- Hi, my name is Petr
- You don’t have to work alone, you can cooperate
  - **The important thing is to learn something new, understand something, etc.**

- Basically don’t eat, drink, behave responsibly
- We are going to work with electricity and you all know that it can kill you

Introduction to the lab kit



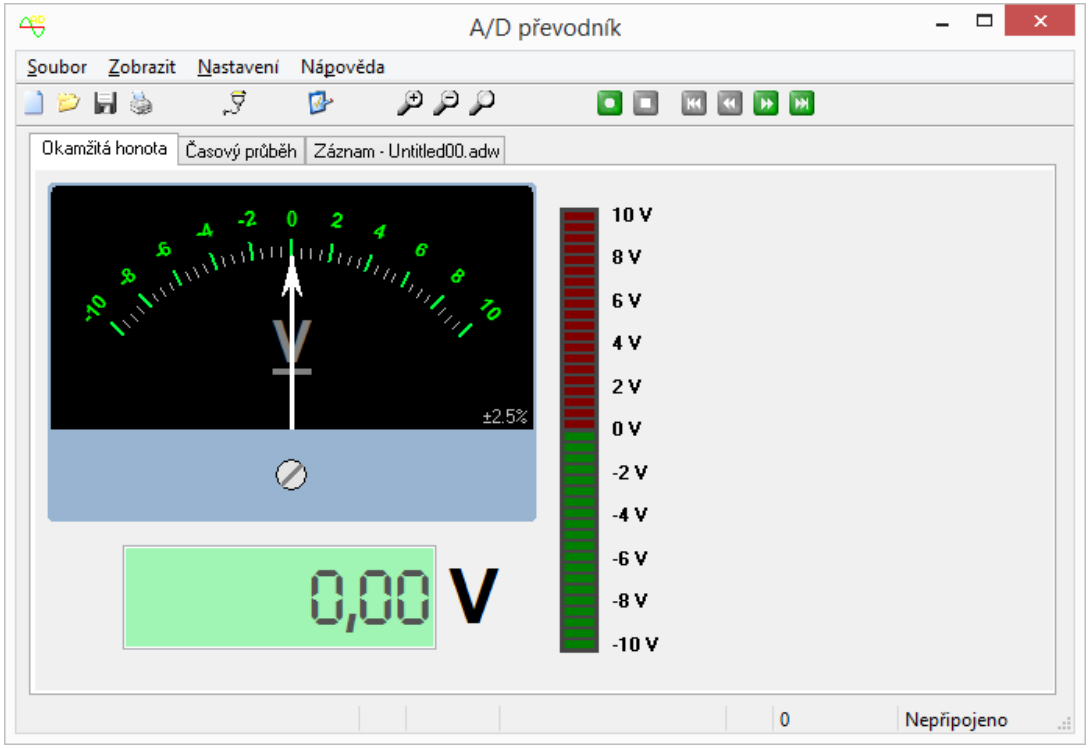
Notice:

- The button that changes the mode of the operation of the kit (Režim)
- AD converter (převodník) input
- Voltage sources +10 V, 0 V, -10 V, +5 V (napájecí zdroj)
- Resistors with variable resistances (potentiometers)
- Integrators
- Adders (sumátor)
- Invertors
- Diodes

- **Solderless board**

IPR Metr application

- Displays the voltage on the input of AD converter



- Okamžitá hodnota – current value
- Časový průběh – value in time

IPR Metr application

- Download IPR Metr from
  - http://www.fit.vutbr.cz/~strnadel/ipr/ipr_downloads.htm
- Save it on your P drive and run it
  - Check, if it says **Připojeno** (**Connected** in English) in the lower hand corner
  - If it doesn't, check the connection settings
    - Nastavení → Vlastnosti → Nastavení portu
    - Port=COM3, BaudRate=9600, StopBits=1, DataBits=8, Parity=None, FlowControl=None

- **Note:** Switch your kit to the **Řešení** operation mode

Simple measurements – voltage sources

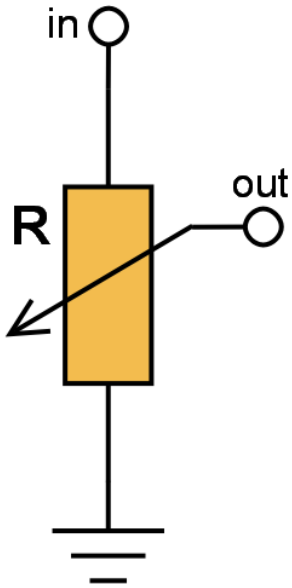
- Using the IPR Metr check that the voltage source supplies the correct voltage.

Simple measurements – voltage sources

- Using the IPR Metr check that the voltage source supplies the correct voltage.
- **Solution**
  - Voltage source (+10V, -10V, +5V) – AD converter

Simple measurements – potentiometer

- Choose one of the potentiometers
- Using the IPR metr check that you can control the value of the voltage in between 0 % to 100 % of the **input voltage** (by turning the knobs)

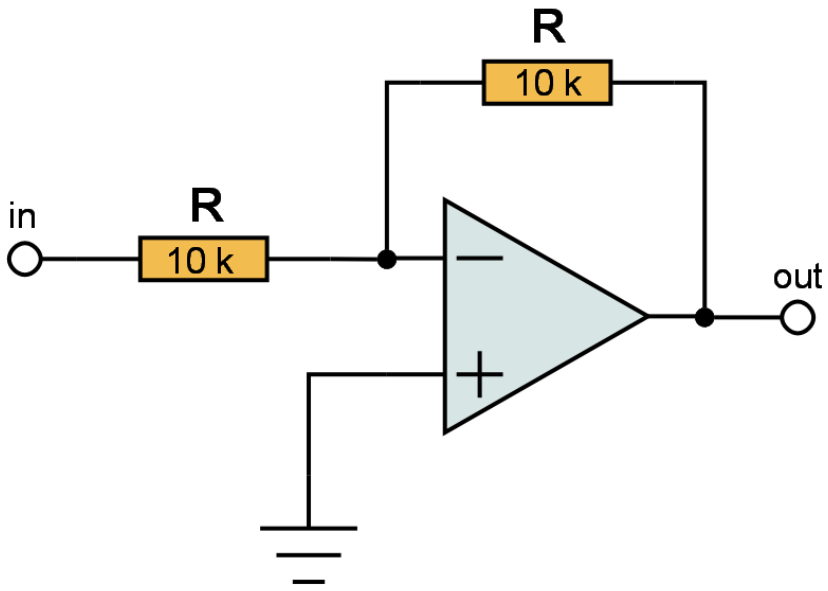


Simple measurements – potentiometer

- Choose one of the potentiometers
- Using the IPR metr check that you can control the value of the voltage in between 0 % to 100 % of the **input voltage** (by turning the knobs)
- **Solution**
  - **Input of the potentiometer** – voltage source
  - **Output of the potentiometer** – AD převodník

Simple measurements – invertor

- Check that the invertor can flip the polarity of the **input** voltage.



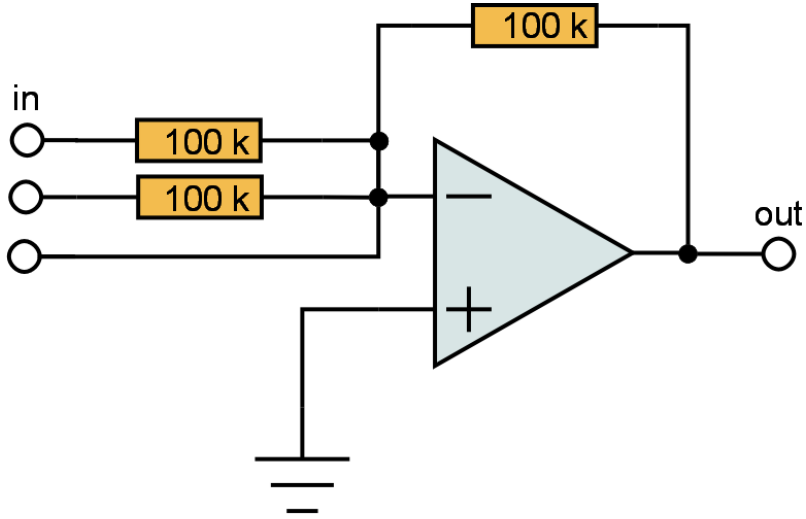
Simple measurements – invertor

- Check that the invertor can flip the polarity of the **input** voltage.

- **Solution**
  - **Input** – voltage source
  - **Output** – AD convertor

Simple measurements – adder (sumátor)

- Check that the adder can add the voltages together
  - 3 inputs (**black**, **green**, **yellow**), invert polarity
  - **1 output**
- Note that one of the inputs is multiplied by infinity. Figure out which one and don't use it.



Simple measurements – adder (sumátor)

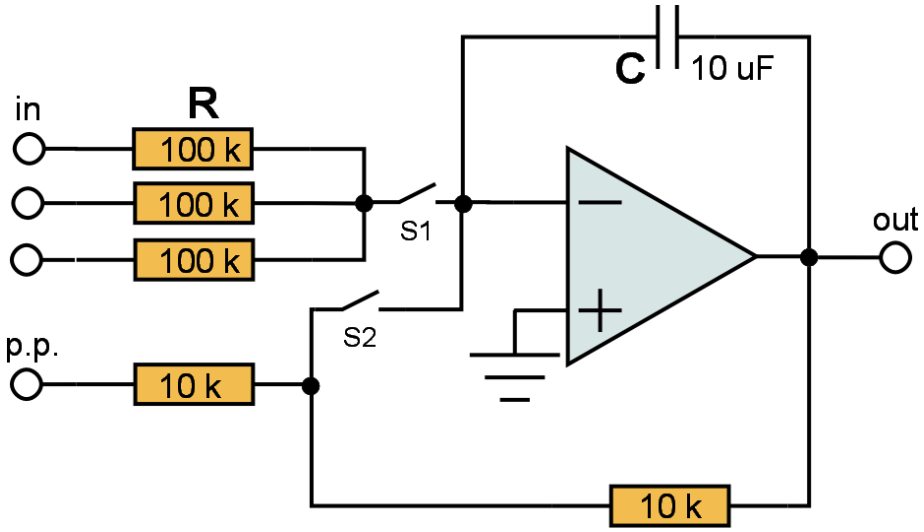
- Check that the adder can add the voltages together
  - 3 inputs (**black**, **green**, **yellow**), invert polarity
  - **1 output**
- Note that one of the inputs is multiplied by infinity. Figure out which one and don't use it.
- **Solution**
  - 1. input: -10V
  - 2. input: +5V
  - Output: AD convertor (you should get +5 V)

Simple measurements – integrator

- Check the integrator
  - 3 inputs (**black**, **green**, **yellow**)
  - 1 initial condition (white)
  - **1 output**

Modes

- Initial condition (poč. podm.)
- Solution (řešení)



Jednoduchá měření – integrátor

- Check the integrator
  - 3 inputs (**black**, **green**, **yellow**)
  - 1 initial condition (white)
  - **1 output**

- **Solution**
  - Input: -10V,
  - Initial condition (white socket): +5V,
  - Change mode to **poč. podm.**
  - Output: AD convertor
  - Switch to mode **řešení**
- Note that integral should calculate the area under the curve

Solderless field

- In this part the lab, we are going to work with the solderless field and multimeter to measure parameters of electrical circuits

Multimeter

Change the settings before plugging in!!!!!!

DCV
direct current
voltage

Ω resistance

DCA
direct current
amperes

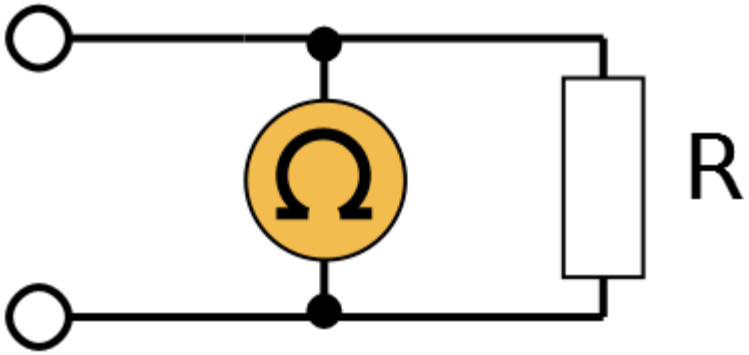
Measurements (U, I, R)
Ground (GND, -)

Circuit 1

1) Prepare a resistor and measure its **resistance (R)**
2) Then connect the provided circuit including the voltage
3) Measure **the current (I)** that is passing through the resistor
4) Measure the **voltage (U)** on the resistor

1) Measure the resistance

- Connect the resistor to the solderless board and measure its resistance

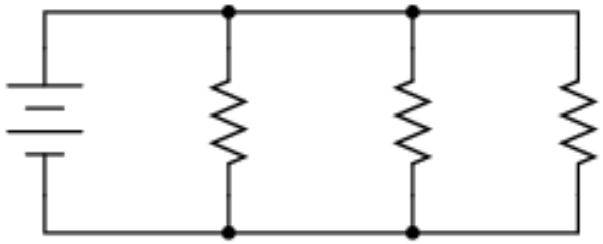


- **How to**
  - Just connect the resistor to the different columns of the solderless field and connect multimeter in parallel (**same columns as the resistor**)
  - Don’t connect input voltage
  - **Multimeter**: set **Ω**, **20k**

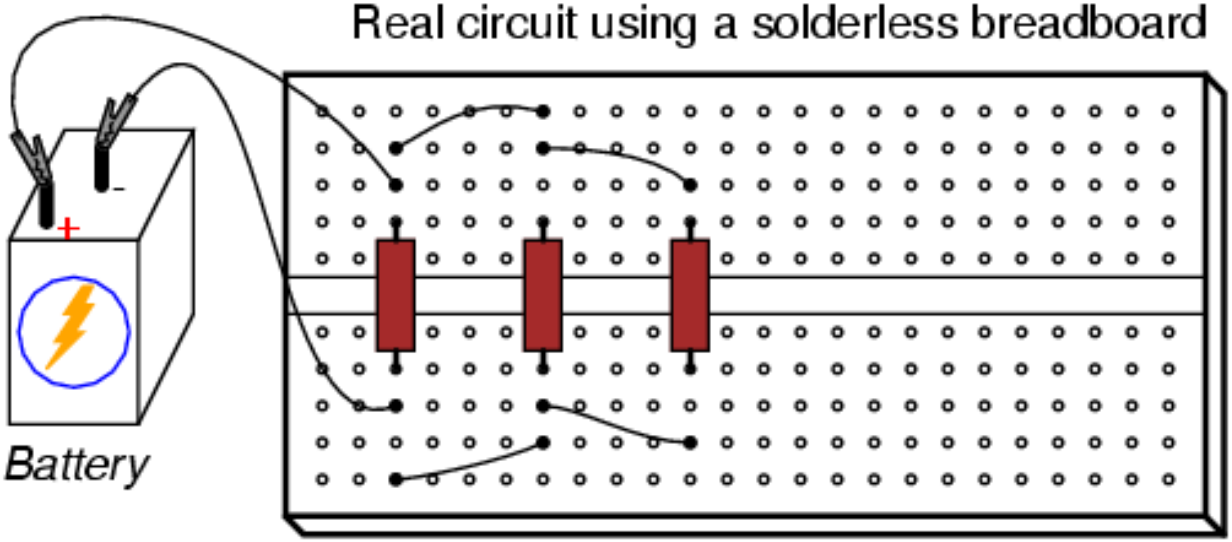
1) Measure the resistance

- Example of the parallel connection

Schematic diagram

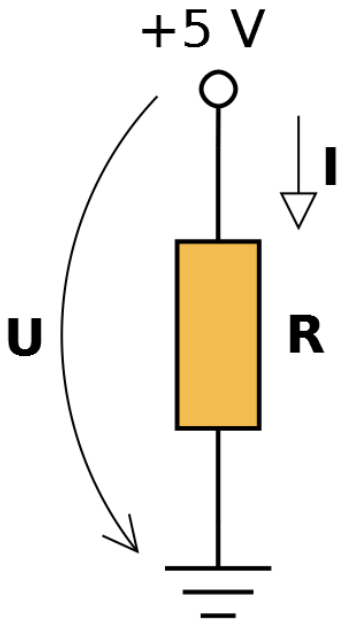


Real circuit using a solderless breadboard



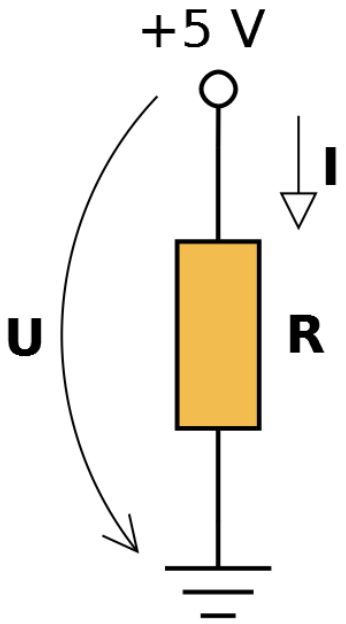
2) Connect this circuit

- Connect this circuit in the solderless field



2) Connect this circuit

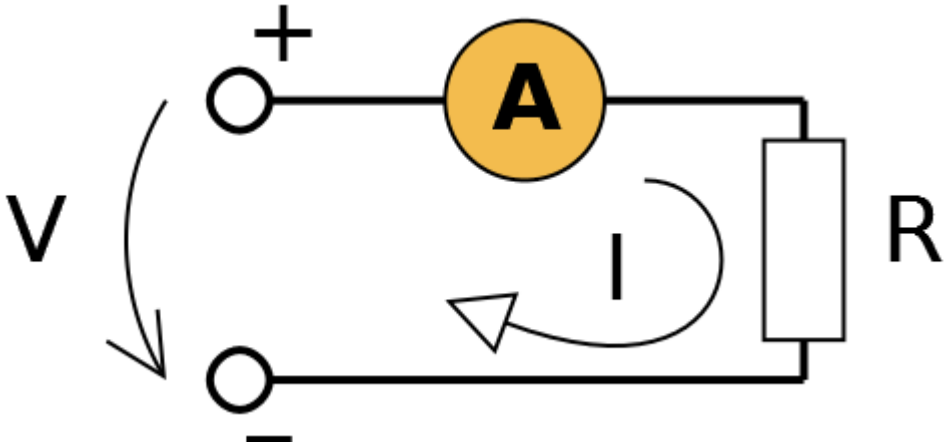
- Connect this circuit in the solderless field



- **How to**
  - On the one terminal of R connect voltage of 5V (**red column**)
  - On the second terminal of R connect 0V (**GND**)

3) Measure the current passing through R

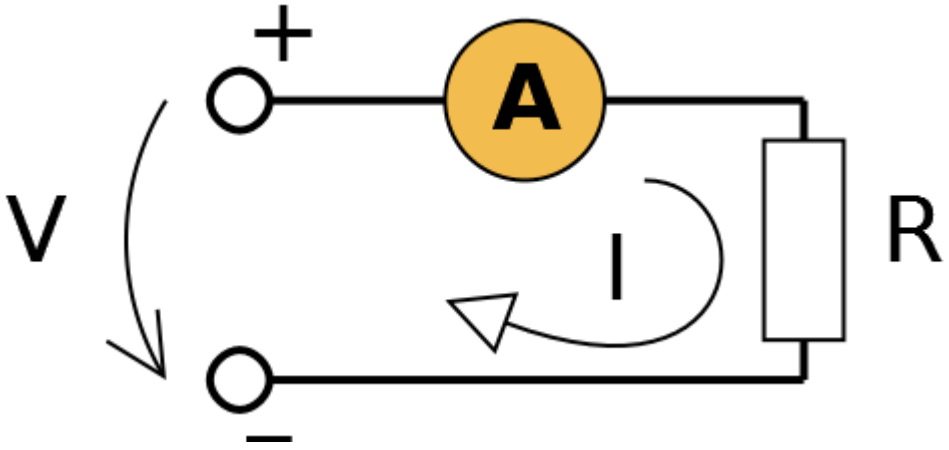
- Current has to be measured **in series**



- **How to**
  - **Multimeter**: **DCA**, **200mA**, before plugging in

3) Measure the current passing through R

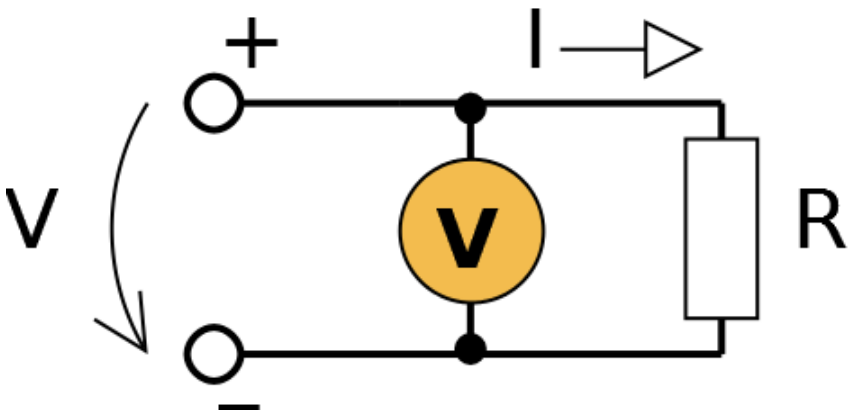
- Current has to be measured **in series**



- **How to**
  - **Multimeter**: **DCA**, **200mA**, before plugging in
  - On one terminal of R connect voltage of 5V (same column)
  - On the other terminal of R (same column) connect the current meter (multimeter, measurements cable), connect the GND cable to the 0V (**GND**)

4) Measure the voltage on the resistor

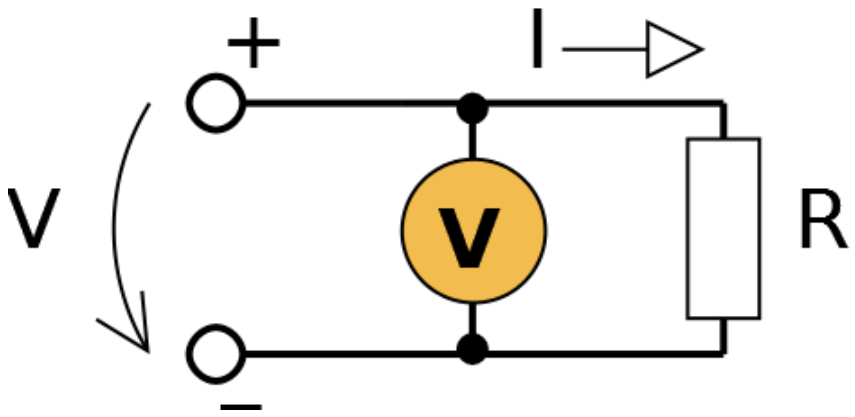
- Voltage has to be measured **in parallel**



- **How to**
  - **Multimeter**: **DCV**, **20V**, before plugging in

4) Measure the voltage on the resistor

- Voltage has to be measured **in parallel**



- **How to**
  - **Multimeter**: **DCV**, **20V**, before plugging in
  - On the one terminal of R connect 5V
  - On the second terminal, connect 0V
  - Connect the measurement cable of the multimeter to the same column as the 5V
  - Connect the GND cable of the multimeter to the column with the GND

Circuit 2

- Connect the following circuit (one terminal is connected to 5V, other is disconnected)

- What is the voltage on the resistor?

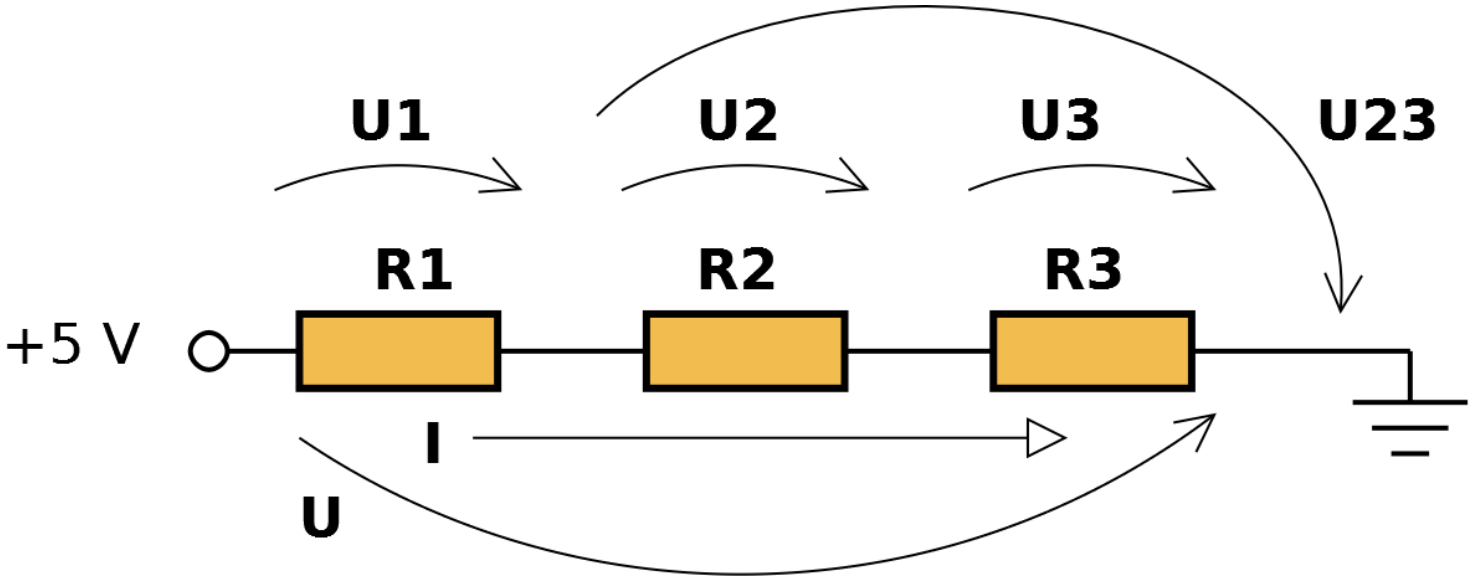
Circuit 2

- Connect the following circuit (one terminal is connected to 5V, other is disconnected)

- What is the voltage on the resistor?
- **Result**
  - There is no voltage drop on the resistor, so there is nothing to measure

Circuit 3

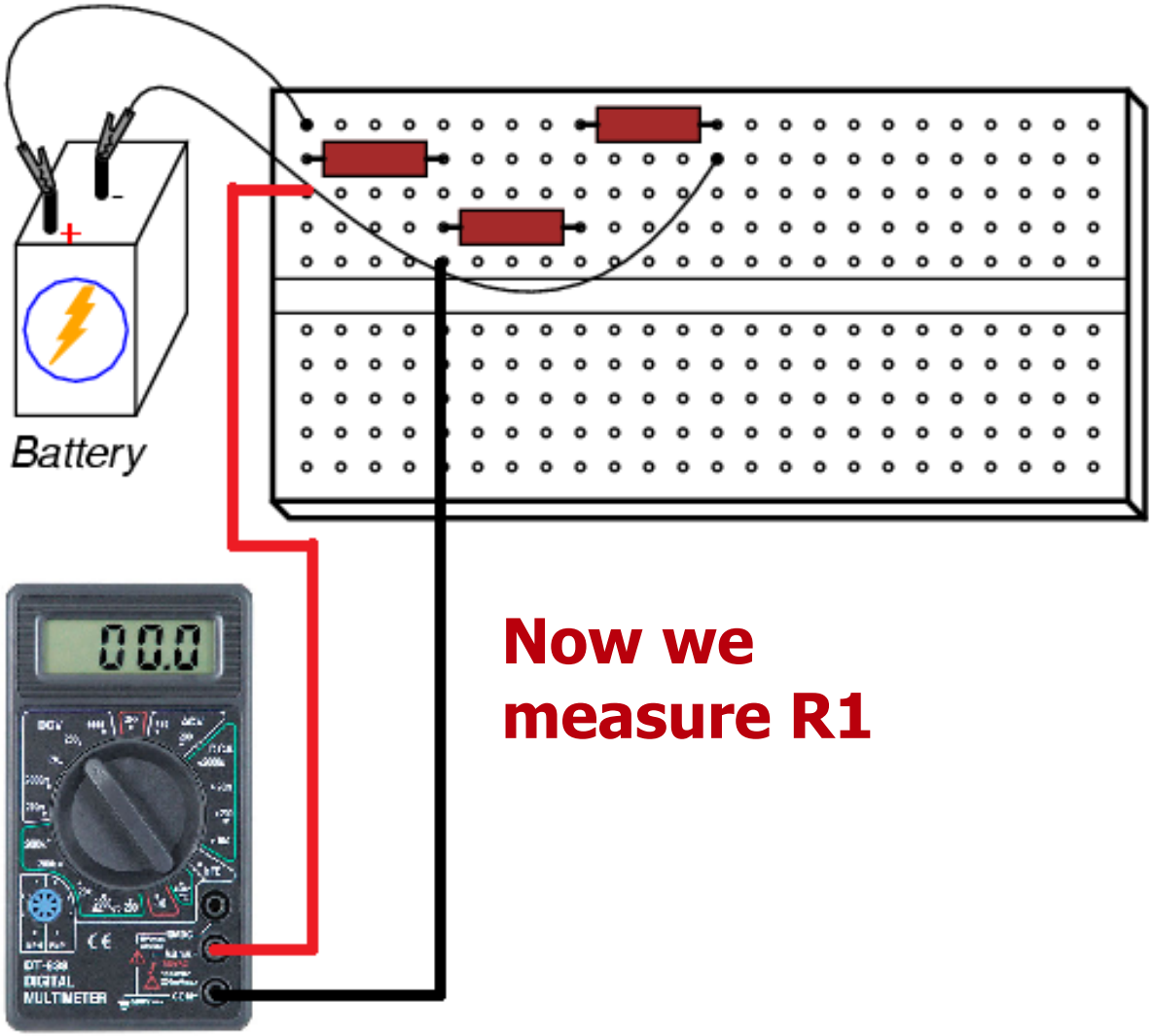
- Connect the following circuit



- Check the Ohm’s Law, Kirchhoff's Law

Example of the series connection

- Check how you set your multimeters



Thank you for your attention!