

**matrix** | RENEWABLES

Advanced Photovoltaic Energy

SAMPLE



**matrix**

CP7526

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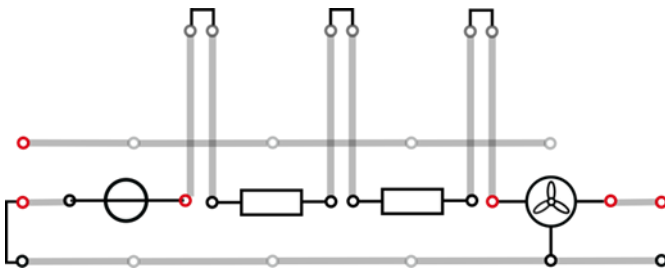
# Electrical Basic Experiments

## Setup of a simple circuit

### Task

Set up a simple electrical circuit.

### Setup



### Required devices

- base unit
- 1 PowerModule (V=5V)
- 1 resistor module, triple
- 2 resistor plug elements (R=100Ω)
- 1 motor module

### Execution

1. Set up the experiment according to the circuit diagram. Plug in every resistor module one resistor.
2. Open and close the electrical circuit by:
  - a) Plug in/plug off a cable.
  - b) Plug in/plug off a current bridge.
  - c) Plug in/plug off a resistor
3. Note your observations.

### Observation

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### Evaluation

1. Formulate reasons for the behaviour of the motor.

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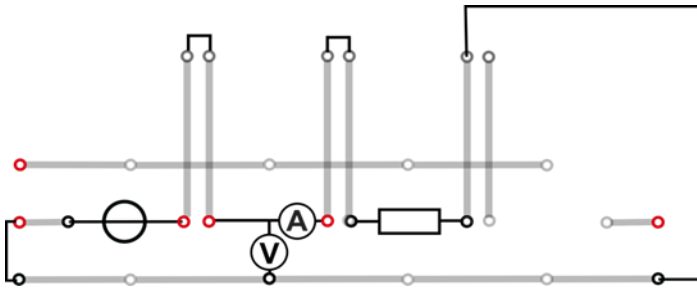
# Electrical basic experiments

## Ohm's Law

### Task

Investigate Ohm's law with several resistors

### Setup



### Required devices

- base unit
- 1 power module
- 1 resistor module, triple
- 3 resistor plug elements (R=100Ω, R=33Ω, R=10Ω)
- 1 AV-Module

### Execution

1. Set up the experiment according to the circuit diagram.
2. Measure voltage and current for various resistances:
  - R=100Ω
  - R=33Ω
  - R=10Ω
3. Note your measured data in the table and calculate each the ratio V/I.

### Measurement

R (Ω)	100	33	10
V (V)			
I (mA)			
V/I (Ω)			

### Evaluation

1. Deduce a connection between resistance R and ratio V/I. Which lawfulness can be derived?

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# Electrical basic experiments

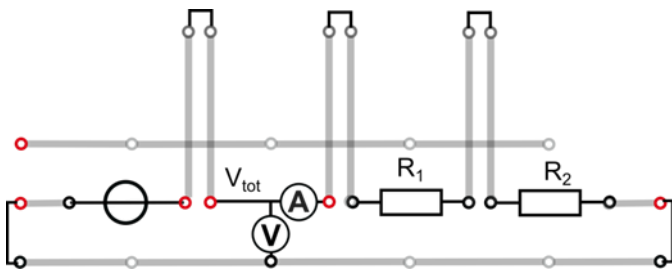
## Series connection of ohmic resistances

### Task

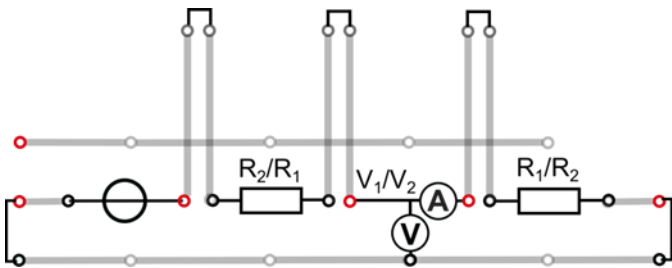
Examine the series connection of ohmic resistances.

### Setup

Setup to measure the total voltage



Setup to measure the single voltage



### Required devices

- base unit
- 1 PowerModule
- 1 resistor module, triple
- 4 resistor plug elements (2x R=100Ω, 2x R=10Ω)
- 1 AV-Module

### Execution

1. Start with a series connection of 2x100Ω. Measure each voltage and current over both resistances ( $V_{tot}$  and the single voltage ( $V_1, V_2$ )) for the following circuits:

- $R_1=100\Omega / R_2=100\Omega$
- $R_1=100\Omega / R_2=10\Omega$
- $R_1=10\Omega / R_2=10\Omega$

2. Set up the experiment according to the voltage measurement. To measure the single voltage over each module, it is necessary to change the position of the resistor modules intermediate.

3. Note your measured data in the table.

### Measurement

	$R_1=100\Omega / R_2=100\Omega$	$R_1=100\Omega / R_2=10\Omega$	$R_1=10\Omega / R_2=10\Omega$
$V_1$ (V)			
$V_2$ (V)			
$V_{tot}$ (V)			
$I$ (mA)			
$R_{tot}=V_{tot}/I$ (Ω)			

# Electrical basic experiments

## Series connection of ohmic resistances

### Evaluation

1. Calculate each the ratio  $R_{tot}=V_{tot}/I$  and note your values in the table above.
2. Calculate each the sum of the single voltages ( $V_1 + V_2$ ) and compare it the voltage over both resistances ( $V_{tot}$ ).
3. What is the influence of the resistance on the current  $I$  and the voltages  $V_1 + V_2$  and  $V_{tot}$ ?
4. What is the connection between the total resistance  $R_{tot}$  and the single resistances?
5. Formulate a law for the calculation of the total resistance in a series connection of resistances.

2.

	$V_1 + V_2$	$V_{tot}$
$R_1=100\Omega / R_2=100\Omega:$		
$R_1=100\Omega / R_2=10\Omega:$		
$R_1=100\Omega / R_2=10\Omega:$		

3.

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4. + 5.

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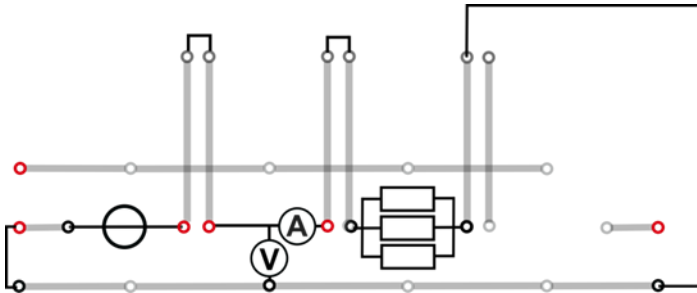


## Parallel connection of ohmic resistances

### Task

Examine the parallel connection of ohmic resistances.

### Setup



### Required devices

- Base unit
- 1 PowerModule
- 1 resistor module, triple
- 6 resistor plug elements (3x R=100Ω, 2x R=10Ω, 1x R33Ω)
- 1 AV-Module

### Execution

1. Set up the experiment according to the circuit diagram. Start with 1 x 100 Ω resistance.
2. Measure each voltage and current for the following circuits:
  - $R_1=100\Omega$
  - $R_1=100\Omega / R_2=100\Omega$
  - $R_1=100\Omega / R_2=100\Omega / R_3=100\Omega$
  - $R_1=10\Omega / R_2=10\Omega / R_3=33\Omega$
3. Note your measured data in the table.

### Measurement

	$R_1=100\Omega$	$R_1=100\Omega / R_2=100\Omega$	$R_1=100\Omega / R_2=100\Omega / R_3=100\Omega$	$R_1=10\Omega / R_2=10\Omega / R_3=33\Omega$
V (V)				
I (mA)				
$R_{tot}=V/I (\Omega)$				

### Evaluation

What is the influence of the resistance on the current I and the voltage V?  
 Formulate a law for the calculation of the total resistance in a parallel connection of resistances.

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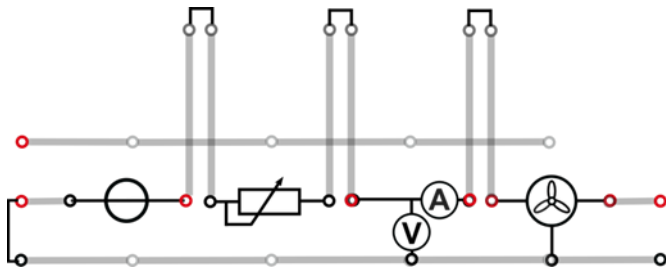
# Electrical basic experiments

## Start-up idling behaviour of a motor

### Task

Examine the Start-up and the idling behaviour of a motor

### Setup



### Required devices

- base unit
- 1 power module
- 1 potentiometer module
- 1 motor module
- 1 AV module

### Execution

1. Set up the experiment according to the circuit diagram.
2. Use the potentiometer to find the operation point where the motor starts. Measure current and voltage at this point and repeat the measurement twice.
3. Then find the operation point, where the motor is just turning before turning into resting position. Measure current and voltage at this point and repeat the measurement twice.

### Measurement

#### 1. Operation point: motor starts turning

	1. measurement	2. measurement	3. measurement
V (V)			
I (mA)			

#### 2. Operation point: motor turns into resting position.

	1. measurement	2. measurement	3. measurement
V (V)			
I (mA)			



# Electrical basic experiments

Start-up idling behaviour of a motor

## Evaluation

1. Determine the required start-up voltage and current.
2. Determine the lowest operation voltage and current.
3. Explain the difference between both.

1.

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2.

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3.

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The full version of this curriculum is available upon purchase of the kit.

Please see contents for a full list of experiments from the full version.