

# Operating Instructions



**A129** - Measurement Set

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## **Your duty to supervise**

These operating instructions are intended for the supervisor in charge.

- The operating instructions must be read and observed before use.
- These operating instructions must be available to refer to and must be stored in a safe place.
- All the safety instructions must be observed.
- This product may only be activated and operated under the direction of the supervisor in charge.

## **General safety precautions**

The general safety precautions are separately included with this product, and must be read and used before using the product.

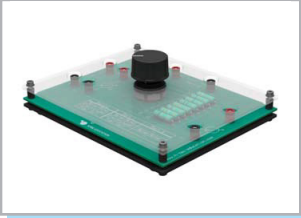
## **Function and intended use**

The Measurement Set is exclusively for the purpose of determination of measured data of H-TEC Education products within the scope of training or demonstration activities.

Any other use is impermissible!

Please refer to the relevant operating instructions for information on the operation of the components to be measured, such as fuel cells, electrolyzers or solar modules.

## Contents



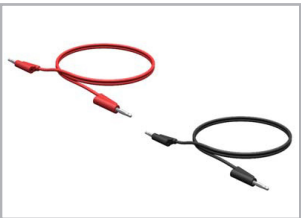
1x Measurement Board



2x Multimeter w/ operating instructions



1x Stopwatch w/ operating instructions



1x Cable Set

4x connecting cable, 2mm, length 50 cm, red

4x connecting cable, 2mm, length 50 cm, black

### **Also necessary (not included)**



2x 9V Battery for multimeters

### **Initial start-up**

#### **Initial start-up of multimeters**

Insert batteries, and read the operating instructions for the multimeters activating them as described there.

#### **Initial start-up of stopwatch**

Read the operating instructions for the stopwatch activating it as described there.

## Use of the Measurement Set

The connections and use of the decade resistor are explained below.

Please refer to the relevant operating instructions and experimental templates for implementation of experiments, as well as the set-up and operation of the components to be measured.

### Overview of the decade resistor:

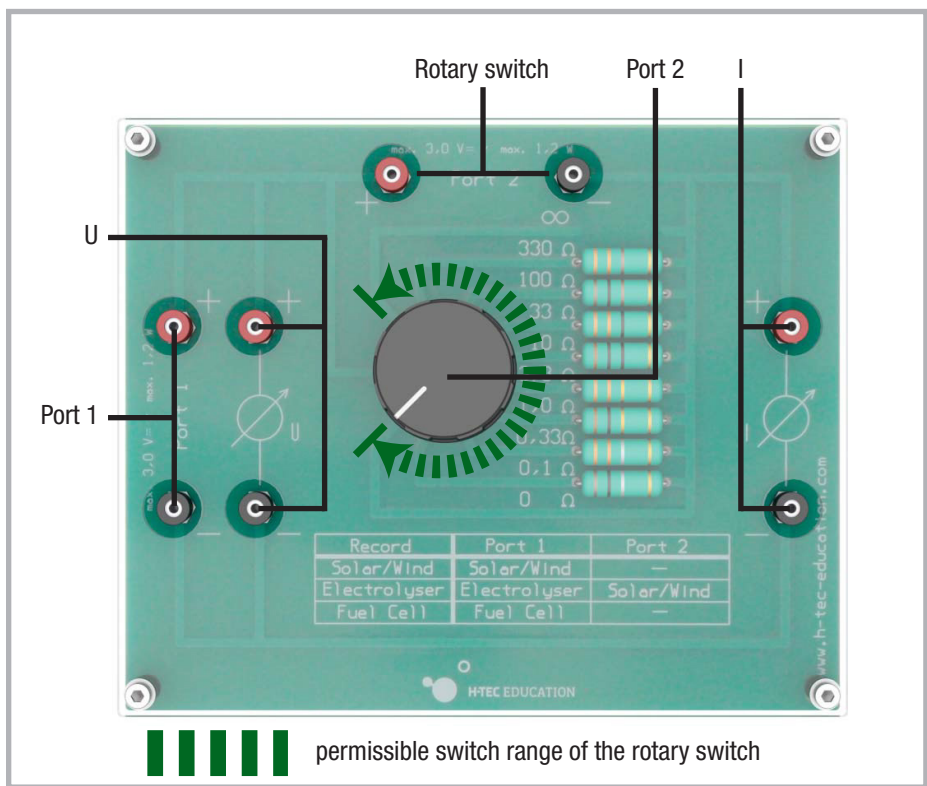


Fig. 1: Decade resistor, top view

## General Warning Notices

### CAUTION

#### **Risk of damage to the equipment by applying any type of voltage!**

Applying any type of voltage to the “U” and “I” connections, may damage set-up components beyond repair. Never apply any voltage to the “U” or “I” connections!

### CAUTION

#### **Risk of damage to the equipment due to electrical overload!**

Connecting components with too high an output voltage or power to the “Port 1” or “Port 2” connections may damage the decade resistor beyond repair. Never connect components to the “Port 1” or “Port 2” connections if their electrical output values exceed the maximum permissible input values at the connections.

### CAUTION

#### **Risk of damage to the equipment through improper handling!**

Using force to turn the rotary switch beyond the permissible switching range will damage the rotary switch beyond repair. Never use force to activate the rotary switch and only activate it within the permissible switching range.

## Setting up the Decade Resistor for Experiments

### 1.) Setting up for experiments with solar modules or wind turbines:

The components are connected as follows:

Port 1	Port 2	U	I
Solar module or wind turbine	-Empty-	Multimeter Voltage measurement	Multimeter Current measurement

Ensure the correct polarity (red = “+”, black = “-”)!

Ten different resistance values can be set using the rotary switch. Every rotary switch position produces another operating point.

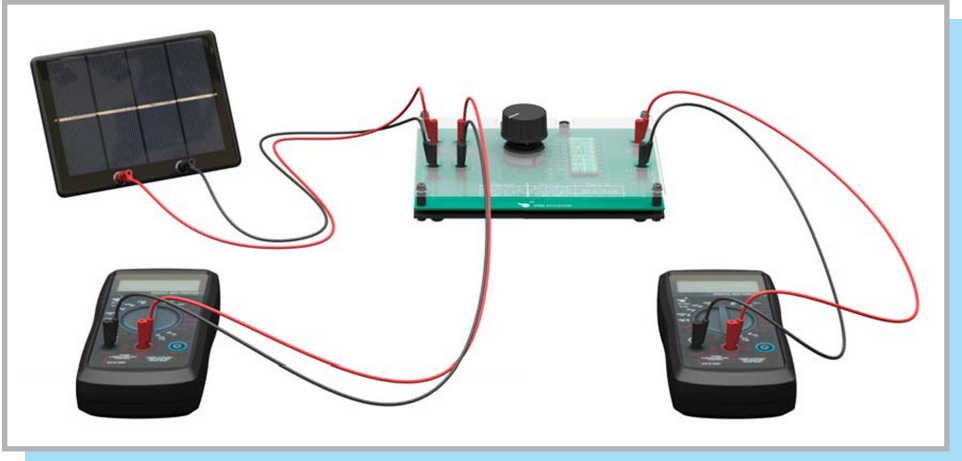


Fig. 2: Set-up example with Solar Module

### 2.) Setting up for experiments with electrolyzers:

The components are connected as follows:

Port 1	Port 2	U	I
Electrolyzer	Solar module or wind turbine	Multimeter Voltage measurement	Multimeter Current measurement

Ensure the correct polarity (red = "+", black = "-")!

Ten different resistance values can be set using the rotary switch. Every rotary switch position produces another operating point.

### 3.) Setting up for experiments with fuel cells:

The components are connected as follows:

Port 1	Port 2	U	I
Fuel Cell	- Empty-	Multimeter Voltage measurement	Multimeter Current measurement

Ensure the correct polarity (red = "+", black = "-")!

Ten different resistance values can be set using the rotary switch. Every rotary switch position produces another operating point.



## Technical Data

Please refer to the relevant operating instructions for the technical data of the multimeters and the stopwatch.

### Decade resistor:

H x W x D:.....50 x 160 x 132 mm

Connections:.....female connectors for 2 mm multilam plugs

$U_{\max}$  Port 1 & Port 2:.....3.0 VDC

$P_{\max}$  Port 1 & Port 2:.....1.20 W

## Troubleshooting

The measured values are not working.

Possible Cause:

- The components to be measured are not working properly.

Solution:

- Make sure the components to be measured are working properly. For instructions on troubleshooting with regard to the individual components to be measured, see the relevant operating instructions.

Possible Cause:

- The components are not connected properly.

Solution:

- Make sure that all the components are connected as described in the “Use of the Measurement Set” chapter.

Possible Cause:

- The decade resistor is damaged.

Solution:

- Contact H-TEC Education

The measured values are determined to be too low.

Possible Cause:

- Higher currents can magnify contact resistance.

Solution:

- Check all connections for secure, tight connection. However, the values measured are accurate in a qualitative sense.

**Should the above-mentioned solutions not remedy the cause of error, please contact H-TEC Education.**

## Shutting Down

Before putting the product into storage, the following point must be observed:

- Remove all batteries from devices.

## Maintenance

The product's components do not need maintenance. The following points should, however, be observed:

- Only use dry, lint-free cloths to clean the products.
- Ensure that the batteries in the multimeters and stopwatch are replaced before they are completely depleted.

## Transport and Storage

With regard to transport and storage of the product, the following point should be observed to ensure a long service life. Transport and store only:

- In the original package
- Dry and dust-free
- At temperatures of 40° - 120° F (4° - 50° C)
- Protected from vibrations

## Disposal

According to European regulations, used electric and electronic devices may no longer be disposed of as unsorted household waste. The symbol of the crossed-out wheellie bin indicates the necessity of separate collection. Your local waste management company can provide you with additional information about disposal options.



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