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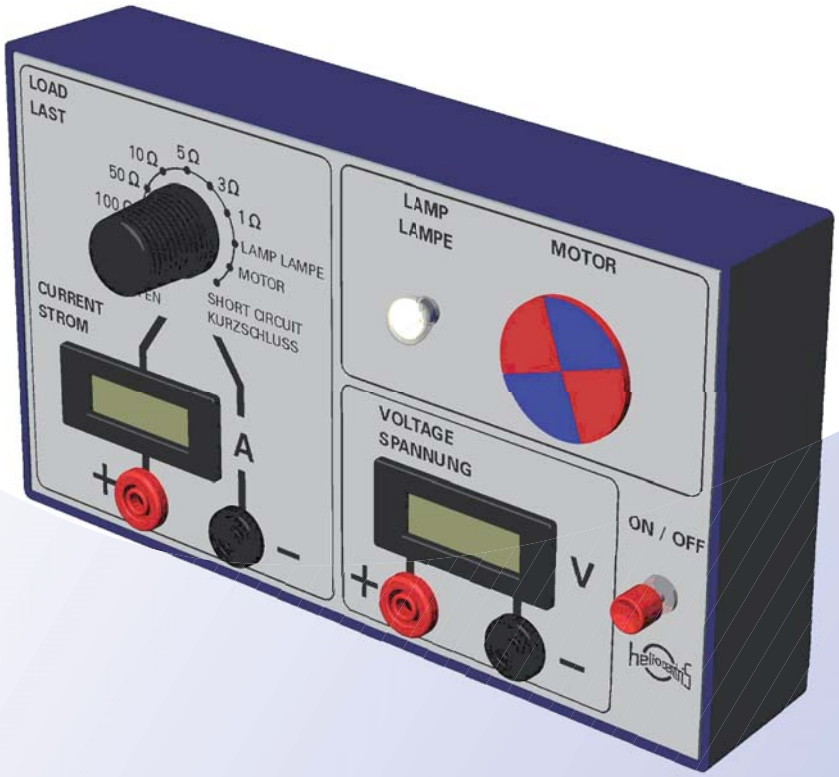
Dr FuelCell™ Load Measurement Box

Instruction Manual



Instruction Manual for Dr FuelCell™ Load Measurement Box

Version 1.0.1

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Content

1 About This Document

This document is intended to help you easily use your Dr FuelCell™ Load Measurement Box in experiments. The experiments are described in detail in the documentation provided with your Dr FuelCell™ product.

1.1 Symbols and Signs

1.1.1 Symbols

In this document following symbols and signs are used:

Symbol	Meaning
➔	Here you have to do something
1.	Here you have to do something and have to pay attention to the order
✓	This is a prerequisite you need to complete before starting the next step or an item you need for the completion of the next step
•, -	Item of a list

Table 1-1 Symbols used in this document

1.1.2 Warning Signs

The warning signs appear as follows:

⚠ **RISK LEVEL**
Type and source of danger are described here! Possible consequences if safety measures are not heeded are described here. ➔ Safety measure to be heeded is given here.

Following risk levels are present when working with the product:

NOTICE	
Dangerous situation! If safety measures are not observed, damage to equipment may occur.	

Useful hints appear as follows:

TIP	
Useful hint.	

1.2 Further Applicable Documents

In addition to the information in this Instruction Manual the documentation for individual Heliocentris products, e. g. the Dr FuelCell™ Model Car Kit, outlines experiments using the load measurement box.

2 General Safety

The load measurement box is constructed according to state of the art. Nevertheless, improper operation or abuse can present danger to:

- The unit itself and other items of property

2.1 For Your Safety

This information on general safety is supplemented by specific warnings throughout this Manual. These warnings explain how to act, in order to protect yourself or other persons or property from injury or damage.

➔ Keep this Manual available at all times.

➔ Read and completely understand this Manual.

➔ Adhere to the local statutory regulations.

➔ Follow safety instructions and warnings.

➔ Give this Manual to subsequent owners of the load measurement box.

2.1.1 Intended Use

The load measurement box is solely constructed for indoor experiments and indoor demonstrations.

2.1.1.1 Prohibited Use

The load measurement box may **not** be used for:

- Measuring voltage and current with other than components of the Dr FuelCell™ series

Components or products delivered by or purchased from Heliocentris may not be used in aviation or space flight (including models).

2.1.2 Operators

The load measurement box is intended only for persons over age 12. Young persons over age 12 should use the kit only under the supervision and guidance of qualified adults. The adults must ensure appropriate handling. They must be aware of the possible dangers.

Students using the equipment must be supervised by experienced teaching staff.

2.2 Location Condition

The load measurement box must be operated on an even and stable, horizontal base, at a recommended height of 75–85 cm (30–34").

Room and equipment must meet the local statutory regulations.

2.3 Shipping and Transport

Prior to shipping or transporting the load measurement box:

➔ Always turn off the load measurement box.

For shipping:

➔ Use only the original storage container.

2.4 Safety Measures

For your own safety:

➔ Only use Dr FuelCell™ components, unless stated otherwise.

➔ Do not connect the Dr FuelCell™ Load Measurement Box to AC power supplies.

2.5 Electromagnetic Compatibility

The load measurement box complies with Electromagnetic Compatibility (EMC) Directive 89/336/EEC.

2.6 Warranty

The warranty period for the Dr FuelCell™ Load Measurement Box is 12 months from the date of delivery. The warranty covers only faults that occur in the context of proper use through no fault of the operator.

The guarantee covers missing components only at the time of delivery. Certain characteristics, such as the life span of the load measurement box, are not guaranteed.

Warranty does not cover faults that occur if:

- The operator caused damage by improper operation
- The equipment was arbitrarily repaired or altered
- Third parties caused damage because the operator neglected his / her duty of supervision

3 The Load Measurement Box

With the load measurement box it is possible to measure characteristic curves and to perform quantitative investigations.

The load measurement box contains an ammeter in series with a selectable load and a voltmeter.

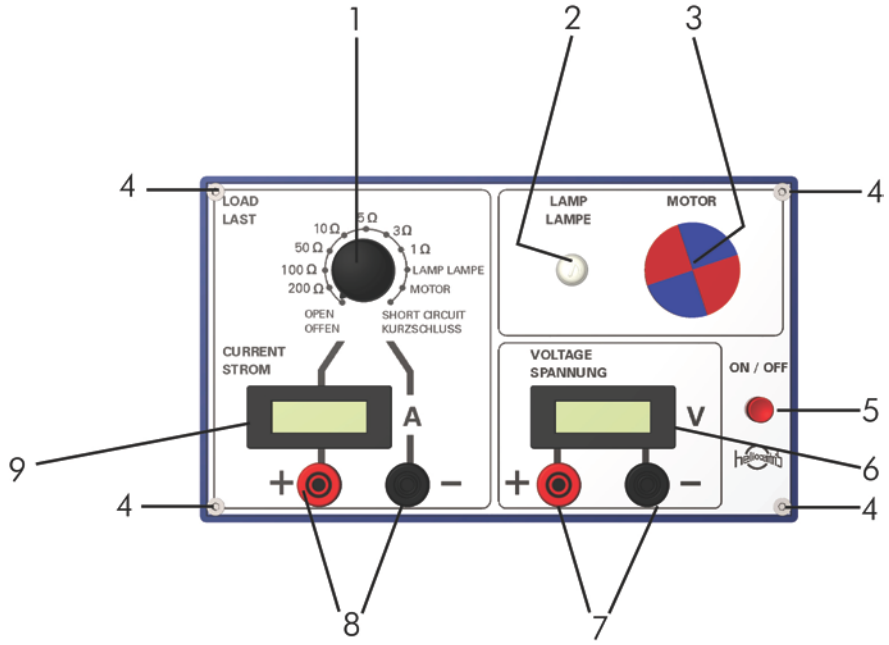

Fig. 3-1 Load measurement box

1	Load knob	6	Voltmeter display
2	Demonstration lamp	7	Banana jack voltmeter terminals
3	Demonstration motor	8	Banana jack ammeter terminals
4	Screws to access battery holders	9	Ammeter display
5	ON / OFF button		

TIP

A wiring diagram of the load measurement box can be found in chapter *TECHNICAL DATA* on page 15.

4 How to Use the Load Measurement Box

The load measurement box can be used with products of the Dr FuelCell™ series. Please also adhere to the original documentation of your Dr FuelCell™ product.

4.1 Preliminaries

4.1.1 Where to Set Up the Load Measurement Box

The base on which to set up the load measurement box should be:

- Even, stable and horizontal

4.1.2 Unpacking

You should have received the package in perfect condition. Nevertheless:

➔ Check for completeness (see *PARTS LIST*on page 15).

➔ Check the contents for visible damage.

In the event of transport damages:

➔ Contact your supplier.

4.2 How to Measure Current and Voltage with the Load Measurement Box

To measure the current of your Dr FuelCell™ device:

1. Set the *LOAD* knob to *OPEN*.
2. Connect the red (positive) terminal of your device to the red (positive) terminal of the ammeter.
3. Repeat step 2 for the black (negative) terminals.

If you wish to add a load, you can set the *LOAD* knob to the desired resistance. You can also set the *LOAD* knob to *LAMP* or *MOTOR* to use the demonstration lamp or the demonstration motor as a load.

4. Push the *ON / OFF* button.
5. Read out the current on the ammeter display.

To measure the voltage of your Dr FuelCell™ device:

6. Connect the red (positive) terminal of your device to the red (positive) terminal of the voltmeter.
7. Repeat step 7 for the black (negative) terminals.
8. Push the *ON / OFF* button.
9. Read out the voltage on the voltmeter display.

Turn the load measurement box *OFF* when you have finished all your measurements:

10. Push the ON / OFF button.

The numbers in the displays disappear.

TIP

The Dr FuelCell™ Load Measurement Box turns itself off when it has not been used for approximately 25 minutes.

4.3 How to Measure Current and Voltage of the Reversible Fuel Cell

This experiment is an example taken from the Instruction Manual for the Dr FuelCell™ Model Car Kit. The load measurement box can also be used with the Dr FuelCell™ Science Kit.

- ✓ 2 red and 2 black patch cords
- ✓ Fuel cell filled with hydrogen
- ✓ Load measurement box

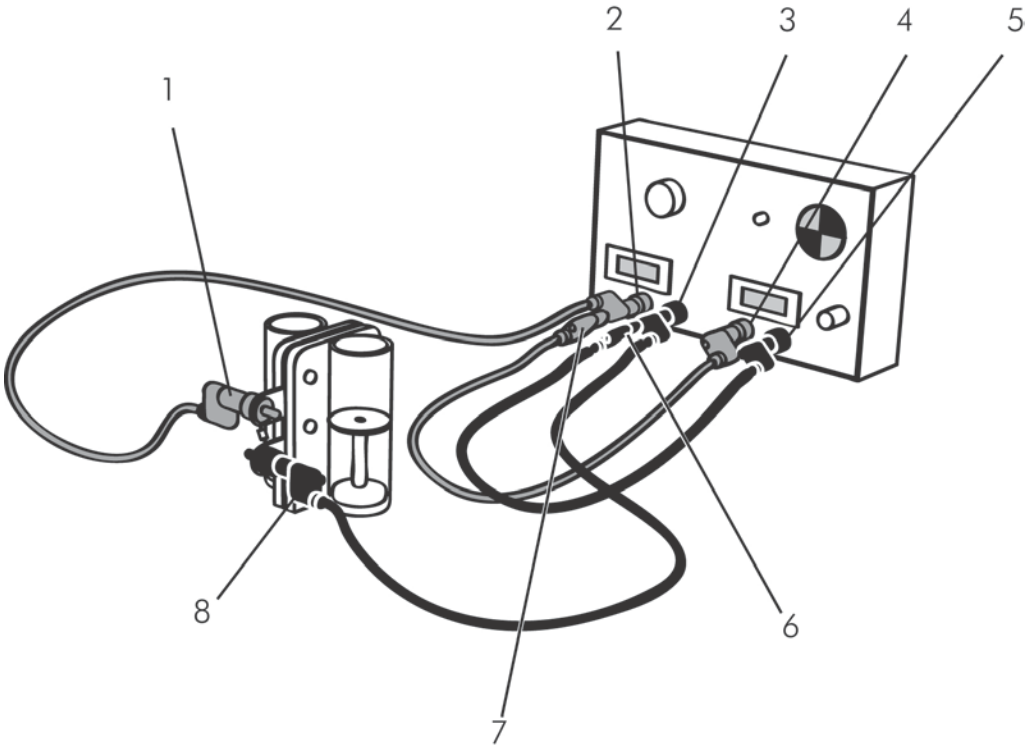

Fig. 4-1 Connecting the reversible fuel cell with the load measurement box

How to connect the reversible fuel cell with the measurement box

To connect the reversible fuel cell to the load measurement box:

1. Set the *LOAD* knob to *OPEN*.
2. Connect the red (positive) terminal of the reversible fuel cell (1) to the red (positive) terminal (2) of the ammeter.
3. Repeat step 2 for the black (negative) terminals (8, 3).
4. Connect the red (positive) terminal of the ammeter (7) with the red (positive) terminal of the voltmeter (4).
5. Repeat step 4 for black (negative) terminals (5, 6).

The reversible fuel cell is ready to be measured.

How to measure current and voltage with the load measurement box

NOTICE

Over current at the reversible fuel cell membrane!

Damage to the reversible fuel cell membrane.

➔ Do not set the load knob to *SHORT CIRCUIT*.

6. Set the *LOAD* knob to the desired resistance.
7. Push the *ON / OFF* button.

8. Read out the current on the ammeter display.
9. Read out the voltage on the voltmeter display.

How to use the demonstration lamp as a load

10. Set the *LOAD* knob to *LAMP*.

The demonstration lamp starts to glow.

11. Read out the current on the ammeter display.
12. Read out the voltage on the voltmeter display.

How to use the demonstration motor as a load

13. Set the *LOAD* knob to *MOTOR*.

The motor starts to run.

14. Read out the current on the ammeter display.
15. Read out the voltage on the voltmeter display.

Turn the load measurement box *OFF* when you have finished all your measurements:

➔ Push the *ON / OFF* button.

The numbers in the displays disappear.

5 How to Shut Down the Dr FuelCell™ Load Measurement Box

5.1 How to Shut Down and Store the Load Measurement Box

1. Switch off the load measurement box.
2. Disconnect all components.
3. Store the load measurement box in the original container.

5.2 Disposal

Dispose of the load measurement box or single parts properly according to your statutory regulations.

6 Technical Data

6.1 Parts List

Designation	Part No.
Load measurement box	E20-0004
Instruction Manual	A13-0058EN

Table 6-1 Parts list

6.2 Specifications

The Load Measurement Box complies with the following regulations:

- EMC 89/366/EEC

Characteristics	Value
Length / width / height	190 mm × 110 mm × 85 mm (7.5" × 4.3" × 3.3")
Ammeter range	0–2 A
Voltmeter range	0–20 V DC
Batteries	9 V ANSI-1604A or IEC-6LR61 (2)
Demonstration motor	
Operating voltage / current	0.2–3 V / 10–15 mA
Demonstration lamp	
Operating voltage / current	0.6–1.55 V / 80 mA
Maximum load voltage	3 V (at 1 Ω , maximum load voltage is 1 V)

Table 6-2 Specifications load measurement box

6.3 Wiring Diagram of the Load Measurement Box

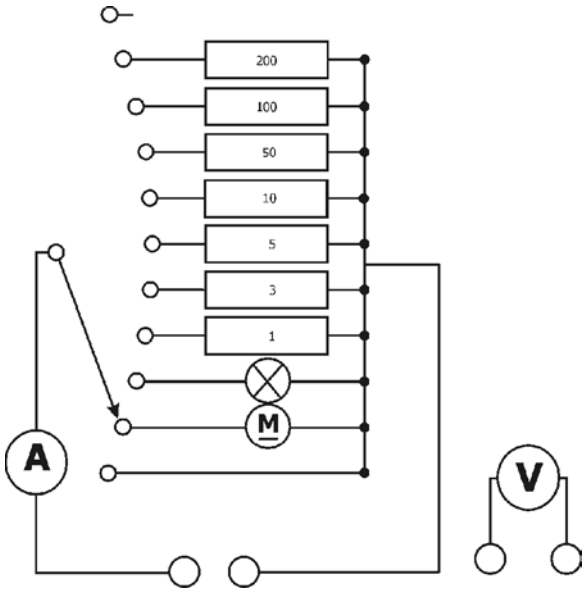

Fig. 6-1 Wiring of the load measurement box

7 Troubleshooting

7.1 Problems and their Remedies

TIP

The problems are examples. For problems that occur with set-ups using other Dr FuelCell™ components, see documentation for your Dr FuelCell™ product.

TIP

The problems are arranged alphabetically.

What's the trouble?	Possible cause?	Remedy!
Ammeter and / or voltmeter do not display as expected when the load measurement box is acting a load for the fuel cell / reversible fuel cell.	Improper connections or *LOAD* setting.	When you measure current and voltage of the reversible fuel cell, the load measurement box provides a load that you select. The ammeter displays the current flowing through this load. Use the *LOAD* knob to select a load, but do **not** select *SHORT CIRCUIT*. The voltmeter section of the load measurement box is not internally connected to anything else; it simply measures the voltage difference between whichever two points you connect to its terminals.

What's the trouble?	Possible cause?	Remedy!
LOAD knob has become misaligned.	Setscrew came loose or knob was forced past its stop.	At full clockwise it should stop at *SHORT CIRCUIT*, and at full counter-clockwise it should stop at *OPEN*. Loosen setscrew and attach knob to the shaft in the correct position.
No output, or low output at load measurement box.	Improper connections to load measurement.	Check that patch cords are routed correctly. Ensure patch cords are secure. If faulty, contact Heliocentris to report the problem; see *SERVICE* on page 20.
No output, or low output at load measurement box.	Load measurement box is adding resistance.	If you are using the load measurement box for measuring the current of an external load set the *LOAD* knob to *SHORT CIRCUIT*.
Numbers on one or both the LCD displays are not visible.	Exhausted batteries.	Because each meter has its own battery, one meter can lose its display although the other works normally; see *HOW TO REPLACE THE LOAD MEASUREMENT BOX BATTERY* on page 19.

Table 7-1 Troubleshooting

8 Maintenance and Service

In general no special maintenance work has to be performed.

8.1 How to Clean the Dr FuelCell™ Load Measurement Box

➔ The plastic surfaces of the load measurement box can be cleaned with distilled water or a mild cleaner.

8.2 How to Replace the Load Measurement Box Battery

If one or both of the meter displays are fading, the batteries must be replaced. Each meter has its own battery.

✓ Small Phillips screw driver at hand

✓ 2 Batteries type ANSI-1604A or IEC-6LR61

1. Remove the four screws in the corners of the load measurement box with a small Phillips screw driver.
2. Carefully lift off the front panel.
3. Remove the two old batteries.
4. Insert the new batteries.
5. Put the panel back in place and tighten the screws.
6. Dispose of the batteries according to your local regulations.

8.3 Service

If you are having problems with the load measurement box and were not able to remedy these problems with the help of the Troubleshooting chapter, contact:

Fuel Cell Store

1902 Pinon Drive, Unit B

College Station, Texas, USA 77845

Phone: 1 (855) 251-0016

e-mail: sales@fuelcellstore.com

A Heliocentris customer service representative will contact you and instruct you how to proceed. If the representative asks you to return the device for repair or replacement, you must ensure proper and safe packaging.

Heliocentris is not responsible for damage caused by improper packing and shipping. Devices for which the warranty has expired are shipped at your cost.

If you wish, you may instead contact the local dealer where you bought your load measurement box to handle your complaint.