

MO-2Ke

1 A Digital Milliohmmeter

User's Guide

GU-1254RA

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Safety Precautions

- It should be checked that the item to be measured is voltage free.
- Before starting the measurements, be sure that the battery is well charged and the line voltage is between specified limits.
- Do not connect or disconnect the test leads during the measurement.
- There are no adjustable parts or parts that can be replaced by the user within the equipment. Taking out the panel in order to have an access to the internal parts may be dangerous as there are high voltages inside, capable of causing fatal accidents.
- Cleaning of this instrument should be carried out using a soft cleaning liquid, after verifying that it doesn't attack the plastic parts used in the case and in the panel of this equipment.

This equipment should be used only by a trained and competent person, strictly applying suitable safety rules.

Used symbols

 Equipment complies with current EU Directives.

 Battery

 Ground

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1. Introduction

The **MO-2Ke** low resistance ohmmeter is a portable, microprocessor controlled instrument used to accurately measure resistances of contacts, switches, transformer and motor windings, etc, using test currents from **1 mA** up to **1 A**.

It uses the Kelvin-type (4-terminals) measurement principle, thus eliminating errors caused by the test leads and contact resistances.

Resistance readings are shown in the alphanumeric display with up to a 4 ½ digit-resolution. It allows to measure resistances of up to **2 kΩ**, with resolution of **0.01 mΩ**.

Measurements accuracy is guaranteed by the state-of-the-art system for signal-amplification, offset-free and with long-term stability.

The equipment has a serial output (RS232) that allows collecting measured values in a printer, notebook, palm-top computer or any data logger in order to register the tests performed.

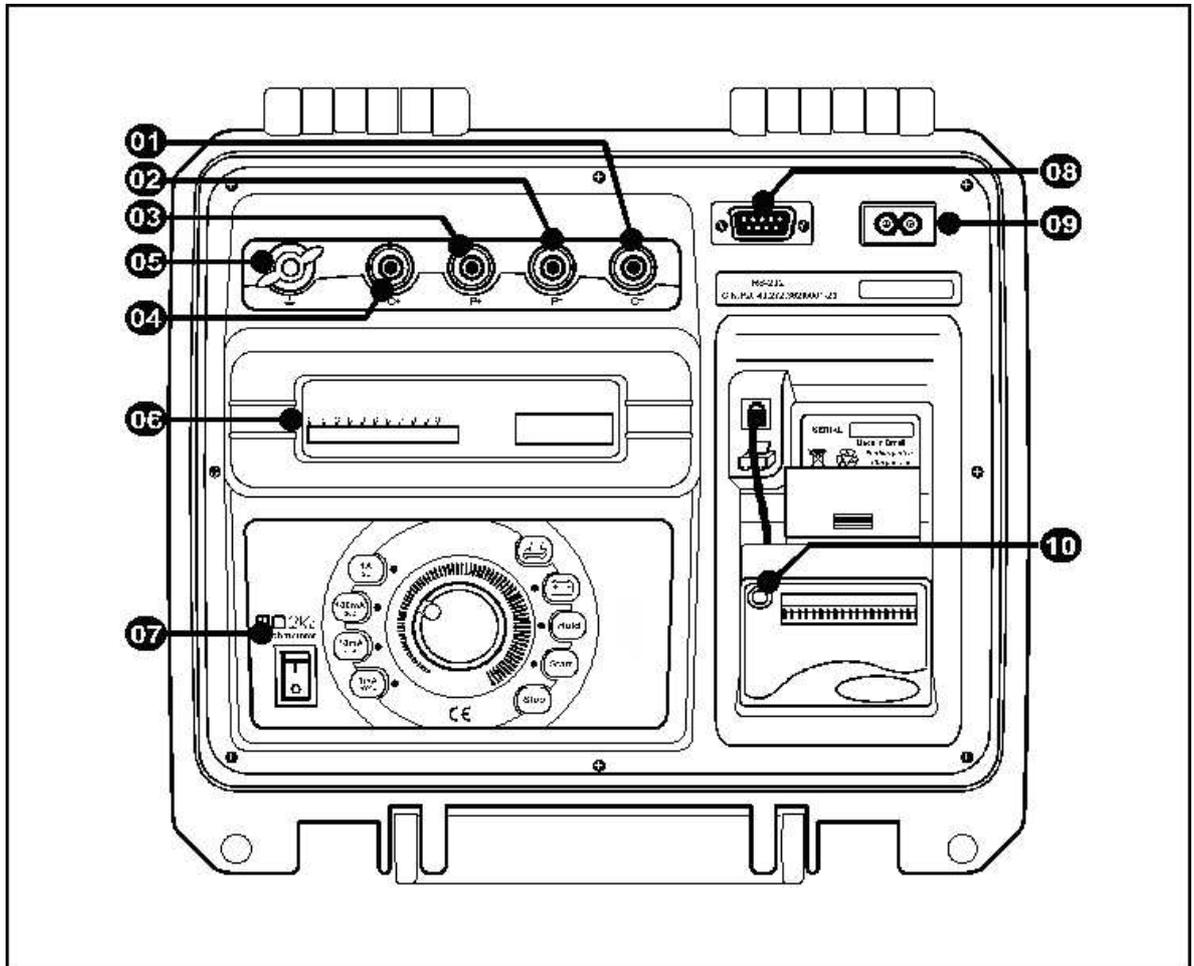
The HOLD function keeps in the display the value measured at a certain time-point.

Test current may be adjusted by the operator in each range and their values are displayed in analogue form (bar-graph), making it easy to measure resistances with a significant inductive component. The open circuit output voltage is up to 10 V, depending on the selected test current, reducing the stabilization time for the test current when highly inductive elements (specially transformers windings) are measured. The measurement circuit has an effective protection against voltage peaks originated by those inductances.

The equipment is housed in a rugged plastic case with a hinged lid and carrying handle. It is a portable, strong, impact resistant and lightweight equipment, suitable to be used in outdoors and under severe weather conditions. It supplies very reliable and accurate measurements both in laboratory and out in the field.

2. Operating instructions

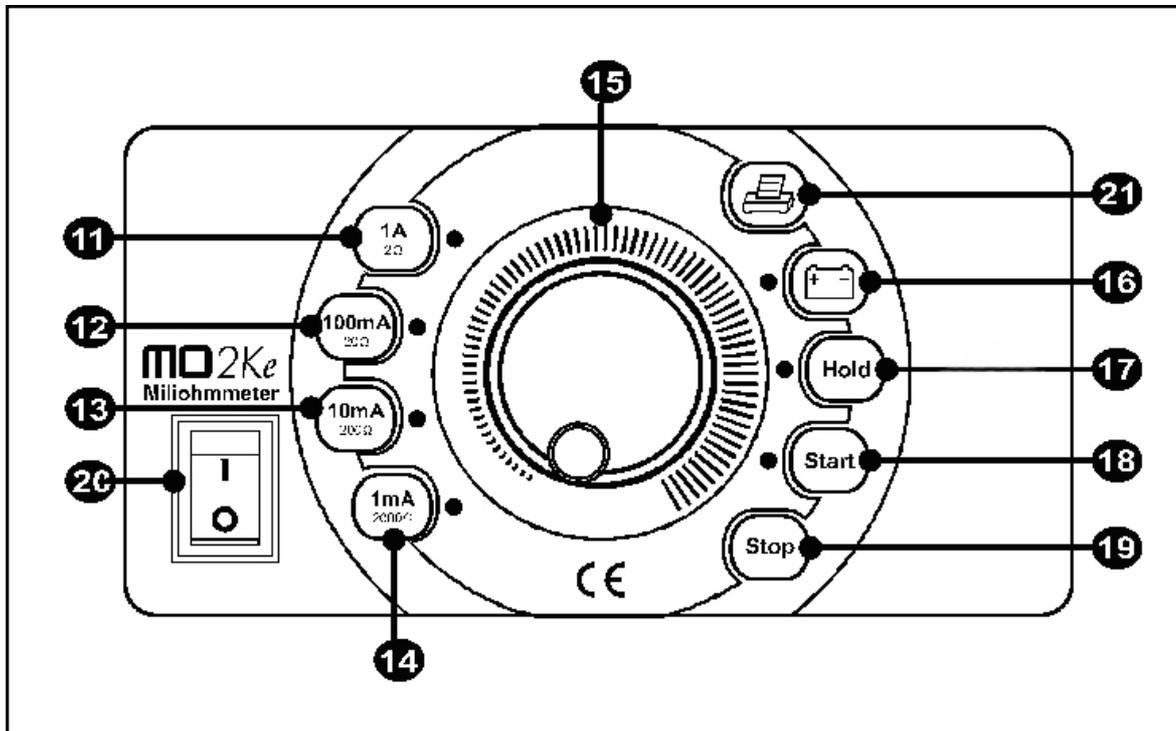
2.1. Panel control functions



- 01 Current terminal (C-)
- 02 Potential terminal (P-)
- 03 Potential terminal (P+)
- 04 Current terminal (C+)
- 05 Ground connection
- 06 Alphanumeric display

- 07 Keyboard
- 08 RS232 data output
- 09 Power supply input
- 10 Paper feed control
(optional printer)

2.2. Keyboard



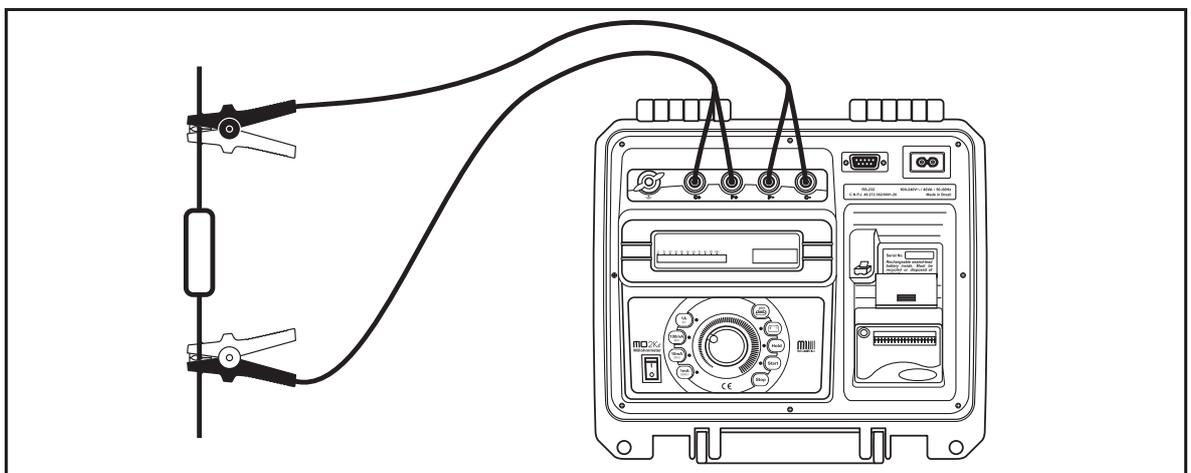
- 11 Selection of 1 A test current.
- 12 Selection of 100 mA test current.
- 13 Selection of 10 mA test current.
- 14 Selection of 1 mA test current.
- 15 Test current control.
- 16 Button to exhibits the battery status on the display and battery charge LED.
- 17 Hold - freeze the last reading on the display.
- 18 Start - start test.
- 19 Stop - end of test.
- 20 On/Off key.
- 21 Prints the measured value shown in the display.

2.3. Utilization of test leads

Select the most adequate test leads, according to the element to be measured. If you want to use other test lead instead of the provided with the equipment, considers the following restrictions about the test lead cable resistance:

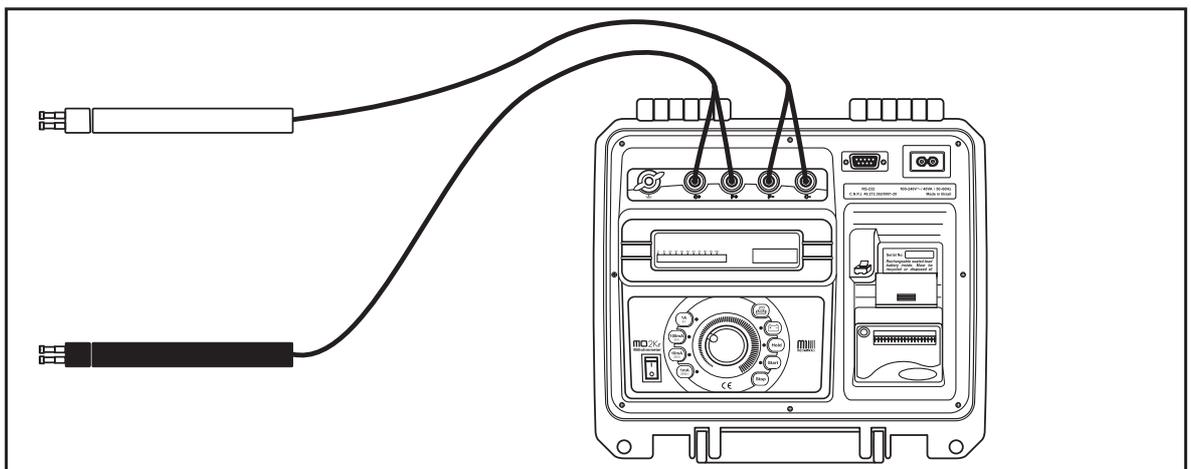
Current cable: Resistance < 200 m Ω

Voltage cable: Resistance < 10 Ω



The test leads in the picture are merely illustrative.

Optionally, retractile test leads can be acquired for measurement of resistance in small elements (small contacts of relays, etc).



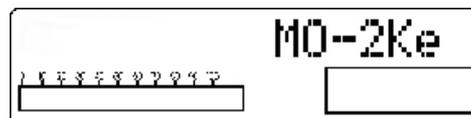
The test leads in the picture are merely illustrative.

3. Measurements

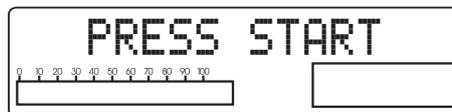
PRECAUTIONS

It should be checked that the item to be measured is voltage free. Before starting with the measurements, be sure that the battery is well charged.

1. Choose the power supply to use. If you are going to use the mains supply, plug the power cord into the connector ⑨.
2. Before turning the equipment ON, connect the test leads to the item to be measured and to the front panel terminals.
3. Switch the equipment ON using the **On/Off** ⑳.
4. The following message will appear on the **display** ⑯:

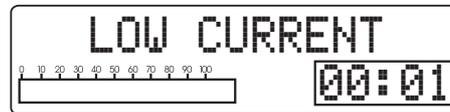


5. And then:



6. Using the buttons **1 A** ⑪, **100 mA** ⑫, **10 mA** ⑬ or **1 mA** ⑭, choose the range and the current to be used.
7. Press the button **Start** ⑬.

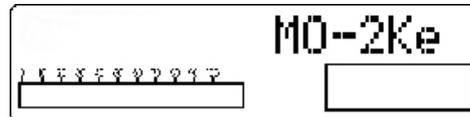
8. Depending on the position of the **test current 15** control (counter-clockwise completely rotated) the following message will turn up:



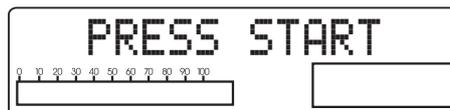
9. Turning the **test current 15** control clockwise increases the current. Adjust this control until obtaining the desired value or until the current indicator (bar-graph) indicates 100%. The bargraph will show the test current value as a percentage of the nominal value selected.
10. The lowest current for measuring is 10% of the range current nominal value. It is important to consider that the measurement errors increase while test current decreases. The error is specified for test currents higher than 80%.
11. The **display 06** will show the resistance value measured.
12. The corresponding unit will be expressed as Ω (ohms) or $m\Omega$ (milli-ohms).
13. The measured value can be retained in the display **06** by pressing the **hold 17** key. Pressing this key again, the value will be updated.
14. Press the key **Stop 19** in order to finish the measurement, and then turn the equipment OFF using the **On/Off 20** switch. (Do not turn off the equipment before pressing the key **Stop 19**).

PRECAUTION: Do not connect or disconnect the test leads during the measurement.

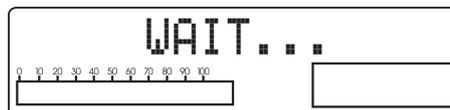
4. Display messages



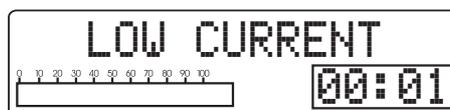
Introductory message that appears when turn the equipment ON.



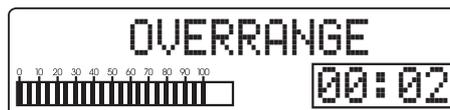
The equipment is ready to start a measurement, thus the operator has to press the **Start** **18** button.



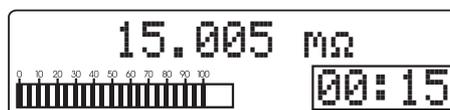
The equipment is adjusting the parameters to optimize the readings.



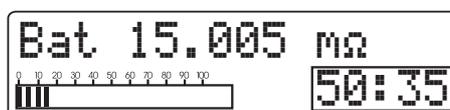
It shows that the test current is not enough to carry out the reading. The operator needs to rotate the **test current** **15** control clockwise.



It indicates that the measured resistance is higher than the maximum value readable in the selected range.



It indicates that the value is the one retained in the display when pressing the **hold** **17** button.



It shows that the battery is quite discharged. Recharge the battery.

5. Printer

Pressing the **printer** **21** key will print the measured value shown in the display.

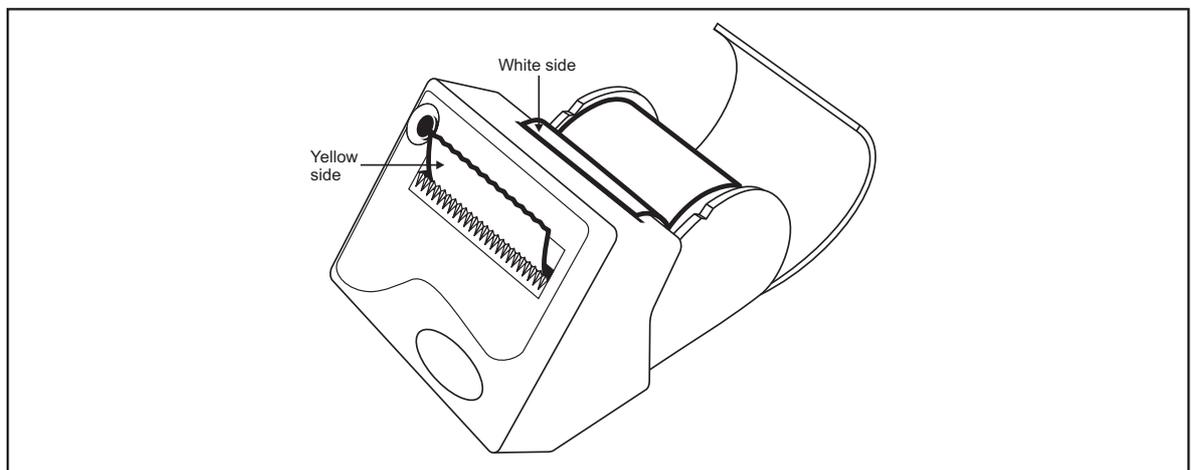
5.1. Paper feed

The **10** switch, which is a blue key located in the left upper part of the printer body, is the Paper feed control. Press this key 3 times after the test is finished and before cutting the paper, in order to visualize the last lines.

ATTENTION: Do not pull the paper. Never try to put the paper back into the printer. In any of these cases, the printer may be easily damaged.

5.2. Paper

This printer uses 37 mm - wide thermal paper, which comes in a 33 mm-diameter reel. The figure shown below indicates how to put the paper.



Press the **10** key, (until the paper appears). To remove the old paper reel, cut the paper next to it and press the **10** key. The removal used-reel operation must be carried out in this way due to the fact that the paper movement is in one-way only, that is, the paper can be moved in one direction only.

6. Auto power-off

The Auto-Power-off function turns OFF the equipment consumption in two situations:

- **During the measurement** - after 15 minutes of operation, without allowing that the battery status checking function is carried out during that period.
- **Idle equipment** - after 15 minutes of inactivity.

The equipment has a protection system that automatic turn OFF the **MO-2Ke** when the battery charge reaches the minimum level.

7. Some notes about accuracy

In order to obtain the specified accuracy, the operator has to adjust the test current to a value higher than the 80% of the nominal value. If it were necessary, it is possible to use a lower current, but by doing this the accuracy will be affected.

MO-2Ke has an auto-compensation system that automatically eliminates the error produced by internal offset. Thus, it is not necessary to carry out measurements by reversing the polarity in order to compute the average value. Nevertheless, if the operator suspect that there is a difference of temperature between the contact points that would generate thermoelectric voltages, it is necessary to carry out two measurements by reversing the current cables and so, the circulation sense of the current through the resistance under measurement. The resistance value to be measured will be the average between the values in one sense and in the contrary (direct and inverse current).

8. Battery and Charger

8.1. Battery description

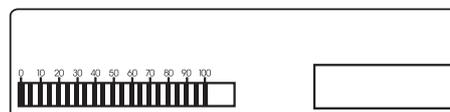
The **MO-2Ke** uses a rechargeable battery for power supply. At the end of the useful life, that battery has to be recycled or disposed of properly in order to take care of the environment.

Voltage: 12 V

Capacity: 3000 mA/h

8.2. Checking the battery status

The charge condition of the battery can be verified before or during the resistance measurement. In order to achieve that, the operator has to press the **battery** key **16** while the equipment is turned ON. The bar-graph shows remaining charge as a percentile value. If during a measurement the battery charge achieves a low level, the **display 06** will show the **BAT** message.



8.3. Battery charger

This equipment has an internal battery charger with a smart, microprocessor-controlled circuit, which adjusts the battery charge to the optimized parameters to ensure the maximum service life. It is supplied by mains of 220 - 240 V~.

- Check that the **On/Off** key ⑳ is in OFF.
- Connect the equipment to the mains supply.
- The **battery** key led ⑯ will keep on lightning with a red light up to completing the charge. At that point, it will change to a green light, being like this up to the equipment disconnection from the mains supply. If, during the battery charge, the equipment is turned ON, the charge will be momentarily interrupted, returning to the charge process once the equipment is turned OFF.

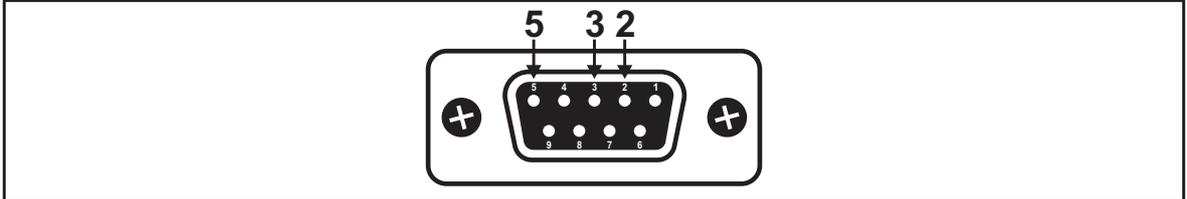
ATTENTION: MO-2Ke has internal filter optimized for mains of **220 - 240 V~ 50 Hz 40 VA**

WARNING



Before starting with the measurements, be sure that the battery is well charged. If during a measurement the battery charge achieves a critical level, the equipment will automatic turn OFF.

9. RS232 data output



The equipment has an **RS232**  output in the panel that can be used to register measurements in a serial printer or data collector.

The outputs are the following ones: Pin 2: Rx ; Pin 3: Tx ; Pin 5: Gnd;

Rate: 4800 bps

8 bits - no parity - 1 stop bit (8,n,1)

Note: In order to assure the compatibility with most printers available in the market, the resistance units are shown with the following symbols:

uR = micro-ohm

mR = milli-ohm

R = ohm

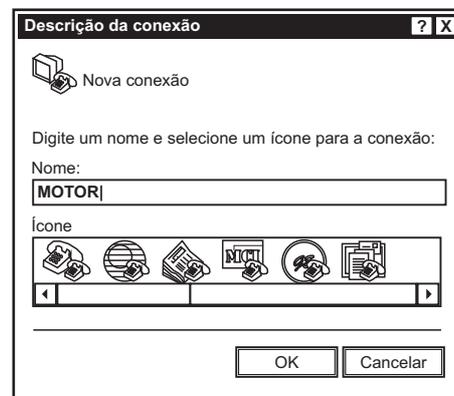
10. Data collection in the computer

To real time transfer data from the **MO-2Ke** to a PC-type computer, use the cable provided with the accessories. Connect it to the equipment RS232 port, and the opposite end in your PC RS232 port.

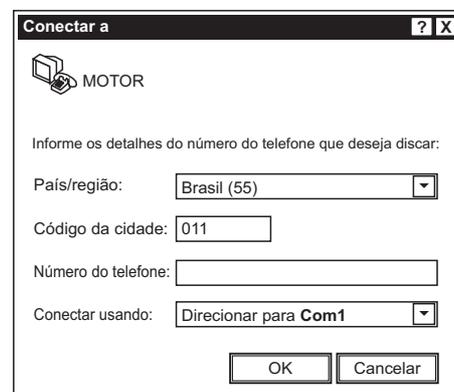
10.1. Hyper Terminal

Open Windows "Start Menu", then go to "Programs", "Accessories", "Communications", until you get to "Hyper Terminal".

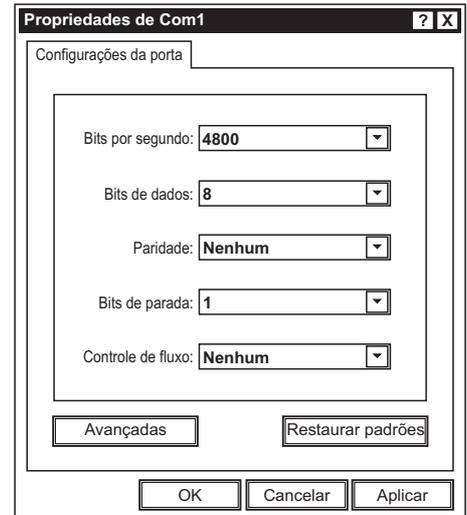
To set up a new connection, enter a name and then select an icon. In this example, the name chosen was "MOTOR". Click OK.



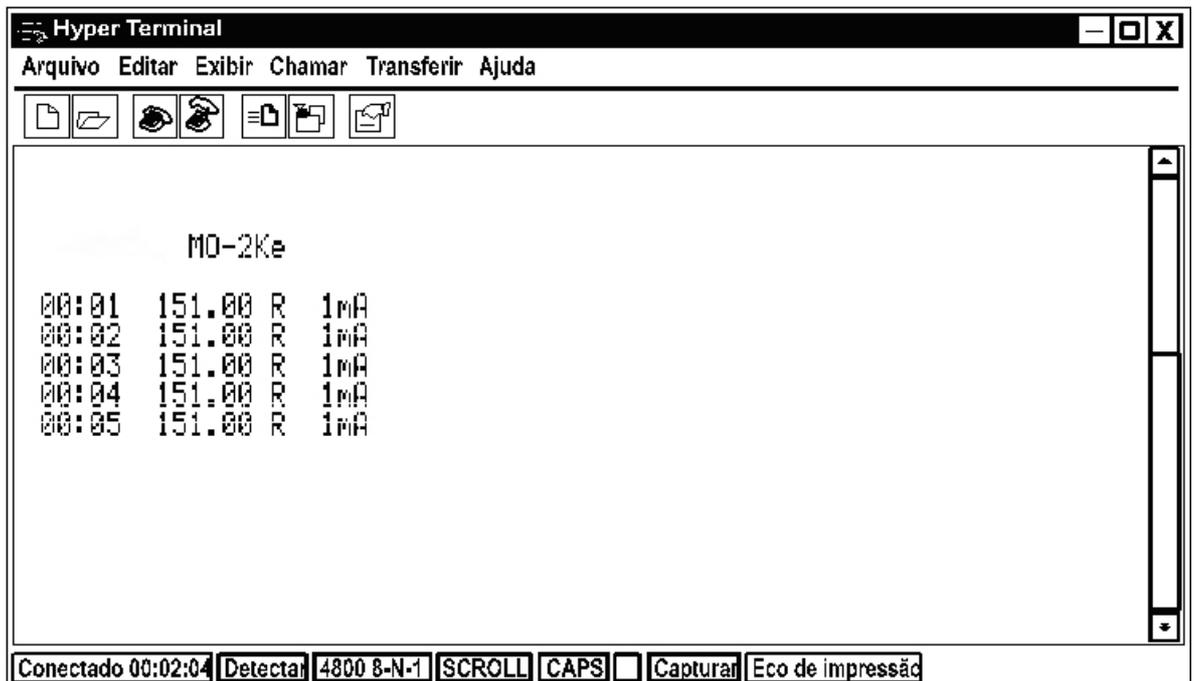
Then check if there is an accessible communications port, for instance Com 1 or Com 2. Choose the correct port in the next window. In this example, the port would be Com 1.



After clicking on OK, go to the next window to fill out the relevant data:
4800, 8, none, 1, none



Now the PC is ready to collect the information obtained from measurements. If **Start** (Ⓜ) is pressed, the **MO-2Ke** will start sending data to the computer. A typical line can feature the following format:



Most Laptops currently in the market do not have RS232 Port. In this case, a **USB → RS232** converter must be acquired, installing the corresponding driver in the Laptop simulating a COM Port.

11. Maintenance

There are no adjustable parts or parts that can be replaced by the user within the equipment. Taking out the panel in order to have an access to the internal parts may be dangerous as there are high voltages inside, capable of causing fatal accidents.

12. Cleaning

Cleaning of this instrument should be carried out using a soft cleaning liquid, after verifying that it doesn't affect the plastic parts used in the case and in the panel of this equipment.

13. Technical support

Technical support / repair for your equipment can be obtained by contacting SOURCETRONIC:

Customer Service

e-mail: info@sourcetric.com

www.sourcetric.com

14. Technical specifications

Test currents	: 1 mA, 10 mA, 100 mA, 1 A - Each current may be continuously adjustable from 0 to 100%
Resistance ranges	: 0-2 Ω @ 1 A 0-20 Ω @ 100 mA 0-200 Ω @ 10 mA 0-2000 Ω @ 1 mA
Resolution	: 0.01 m Ω @ 1 A
Output voltage	: Up to 10 Vdc (open circuit) @ 1 A
Measurement principle	: 4-terminal, Kelvin-type.
Basic accuracy	: ± 0.2 % of reading ± 2 digits
Advanced features	: Digital direct reading of low resistances in the alphanumeric display, with up to 4½ digits Very fast and accurate measurements.
Serial data output	: RS232 @ 4800 bps. Suitable for data collection in an external serial printer, computer or data-logger.
Environmental protection	: IP54 with closed lid.
Safety class	: Meets the requirements of IEC 61010-1/1990, IEC 61010 1/1992 amendment 2
Overvoltage category	: EN 61010-1 to 600 V CAT. III
Power supply	: Internal rechargeable 12 V - 3000 mAh battery or 220 - 240 V~ 50 Hz 40 VA mains
Built-in battery charger	: For 220 - 240 V~ 50 Hz 40 VA mains
Operating temperature range	: -5 $^{\circ}\text{C}$ to +50 $^{\circ}\text{C}$
Storage temperature range	: -25 $^{\circ}\text{C}$ to +65 $^{\circ}\text{C}$
Humidity range	: 95% RH (non condensing)

Weight	: Approx. 3 kg
Dimensions	: 274 x 250 x 124 mm
Included accessories	: 2 Combined current and potential test leads 1 Synthetic bag, for cables and instrument 1 Power cord 1 RS232 cable 1 User guide
Optional accessories	: Thermal printer Retractable test lead

15. Warranty

SOURCETRONIC warrants to the original purchaser that each instrument it manufactures will be free from defects in material and workmanship under normal use and service. The warranty period is valid for 12 months, except the built-in rechargeable battery that has 6 months, and begins on the date of shipment. The manufacturer's warranty does not apply to any product or accessories which, in the manufacturer's opinion, have been misused, altered, neglected, or damaged by accident or abnormal conditions of operation and handling.

To obtain warranty service, send the equipment, with a description of the difficult, shipping and insurance prepaid, to SOURCETRONIC. The manufacturer assumes no risk for damage in transit. SOURCETRONIC will, at its option, repair or replace the defective equipment free of charge or refund your purchase price. However, if SOURCETRONIC determines that the failure was caused by misuse, alteration, accident or abnormal condition or handling, you will be charged for the repair and the repaired equipment will be returned to you transportation prepaid.

This warranty is exclusive and is instead of all other warranties, express or implied, including but not limited to any implied warranty or merchantability or fitness for a particular purpose or use. SOURCETRONIC will not be responsible for any special, indirect, incidental, or consequential damages or loss of data, whether in contract, or otherwise.

For application or operation assistance or information on SOURCETRONIC products, contact:

SOURCETRONIC

Georg-Groening-Strasse 47 – 28209 Bremen - Germany

Fax: (+ 49) 421 – 277 9998

email: info@sourcetric.com

Liability limitation

The liability for malfunctioning of the equipment is limited to the application of the warranty pursuant to the aforementioned provisions. The manufacturer does not take any responsibility for any eventual damage due to the use or impossibility to the use of the equipment such as the loss of memory data, accidents in the field, loss of profit, etc.