

RMO200

MICROOHMMETER

Manual



IBEKO POWER AB
DVpower

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1 Introduction

This manual contains helpful instructions on how to use RMO200 in a safe, proper and efficient way.

Following these instructions can help you to avoid dangerous situations, repair costs and other miss happenings due to incorrect operation. Furthermore it ensures the reliability and life cycle of your RMO200.

RMO200 must be used in observance of all existing safety requirements/ regulations from national/local standards for accident prevention and environmental protection.

Reading the RMO200 manual alone does not release the user from the duty of complying with all national and international safety regulations relevant for working with RMO200.

2 Safety Instructions

Before operating RMO200, please carefully read the following safety instructions.

It is not recommended that the RMO200 will be used (or even turned on) without the understanding of this manual.

RMO200 should only be operated by trained and authorized personnel.

Rules for Use

- RMO200 should only be used when in a technically fit condition. Its use should be in accordance with the safety regulations for the actual working site and application. Always be aware of the dangers of high voltages and currents associated with this equipment and its environment. Pay attention to the information provided in the operations manual.
- RMO200 is intended exclusively for the application areas specified in "Designated Use". The manufacturer and distributors are not liable for damage resulting from unintended usage. The user alone assumes all responsibility and risk.
- The instructions provided in this manual are considered part of the rules governing proper usage.
- Do not open RMO200.

Orderly Practices and Procedures

- The manual should always be available on the site where the RMO200 is used.
- Before using RMO200, all personnel (even personnel who only occasionally, or less frequent, work with RMO200) assigned to RMO200 should read the operations manual.
- Do not undertake any modifications, extensions, or adaptations to the RMO200.

Cleaning

To clean RMO200, use a cloth dampened with isopropanol alcohol or water.

Operator Qualifications

- Testing with RMO200 should only be carried out by authorized and qualified personnel.
- Personnel receiving training, instruction, direction or education on the RMO200 should remain under the constant supervision of an experienced operator while working with the test set and the test object.

Safe Operation Procedures

- Hazardous voltages of up to 400V can occur inside RMO200. Therefore is not permitted to open RMO200.
- Before putting RMO200 into operation, check the test set for visible damages.
- Do not operate RMO200 under wet or moist conditions (condensation)
- Do not operate RMO200 when explosive gas or vapors are present.
- The serial interface of RMO200 should only have external devices connected that meet the requirements for SELV equipment according to EN 60950 or IEC 60950.
- If RMO200 is opened by the customer, all guarantees are invalidated.
- If RMO200 seems to be functioning improperly, please contact the IBEKO POWER AB (refer to section "Manufacturer Contact Information").
- Do not use RMO200 without the extra protective ground (PE) cable set connected.

Power Supply

- Supply RMO200 only from a power outlet that is equipped with protective ground .
- Instead of supplying RMO200 from phase – neutral (L1-N, A-N), it may also be supplied from phase – phase (e.g., L1-L2; A-B). However, the voltage must not exceed 240 V AC, please refer to section Technical Data.

3 Designated Use

The Micro OhmMeter RMO200 is designed for measuring contact resistances of non-inductive test objects used in the electric power industry or similar branches. It is employed for resistance measurement during manufacturing, commissioning and testing of:

- power circuit breakers,
- interrupters,
- bar installation,
- cable splices,
- welded joints,
- grounding.

Any other use of the RMO200 than the ones mentioned above is to be considered improper and will not only invalidate all customer warranty claims but also exempt the manufacturer from its liability for repair or exchange.

4 Functionality

4.1 Single Test

The RMO200 generates a filtered (true) DC current and outputs it in an automatically regulated current ramp. The current increases with a constant slope from zero up to a set maximum value. When the current has reached its maximum, RMO200 measures the resistance of the test object. After test the output current ramps back down to zero with a constant slope. By sloping the current up and down, magnetic transients are virtually eliminated.

4.2 Continuous Test

RMO200 can generate DC current continuously using the **Cont** menu. In this menu the current can be chosen the same way like in the **Sing** menu, but the duration of the test can be preset. The test is started pressing the **Ω** button. During the test, a new result is shown on the display and stored into the PC (RMOWin) approximately each second. Using RMOWin the result can be printed like an Excel table which later can be shown as a diagram and used for a report.

Test is completed when the test time previously set in the menu has elapsed, or when the **STOP** button is pressed.

By pushing **STOP** button test could be performed at any time. In case of test interruption by pushing the **STOP** button, the last measured result will remain saved in the internal memory.

Upon expiry of the selected test lasting time, the last result remains saved at selected memory location.

Note 1: Choose measuring current so that for the expected resistance you have maximum value of it.

Note 2: Using RMOWin enables starting and controlling RMO200 from the PC. The results could be stored to PC.

Using RMOWin after testings enables result transfer from the internal RMO200 memory to PC.

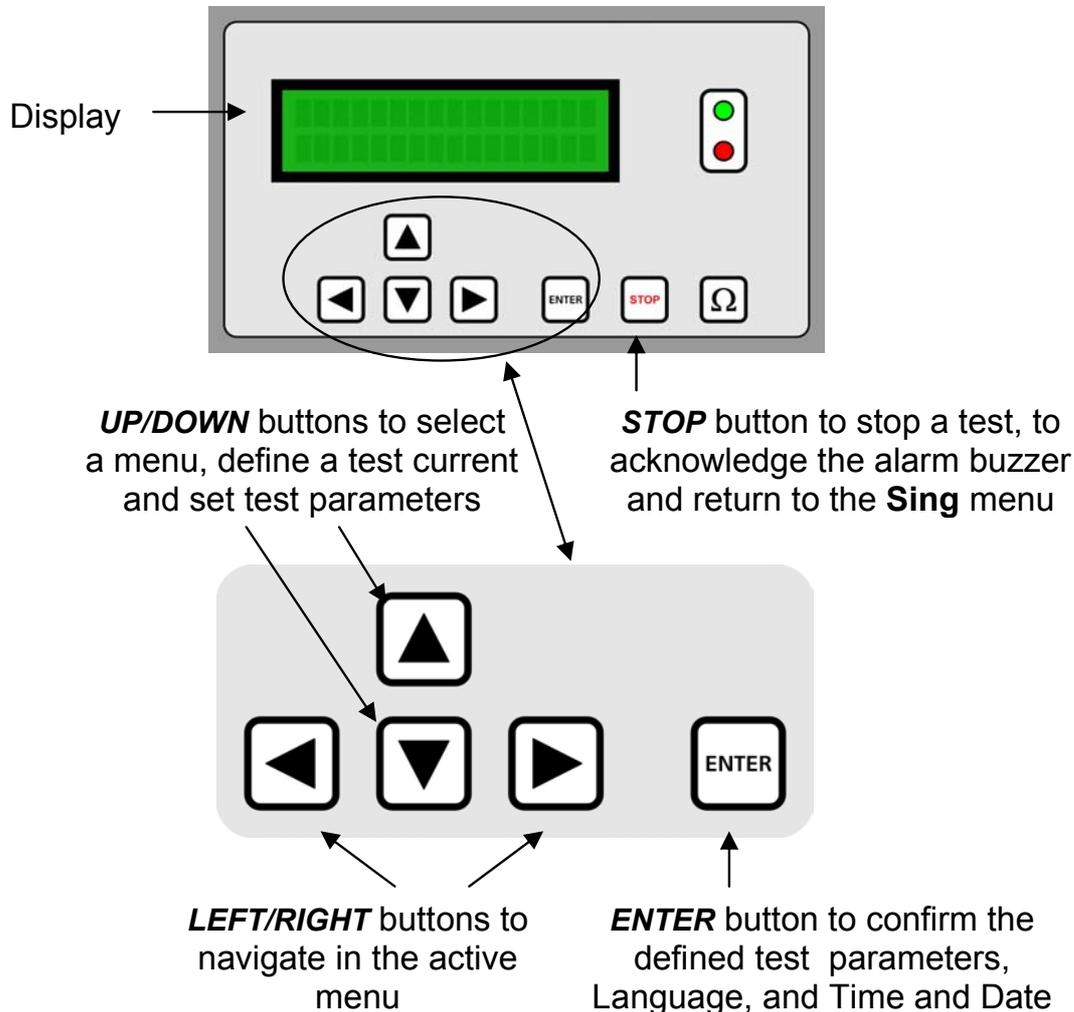
Note 3: At the start of the test (Single and Continuous), a check of cables connection is done. In case of disconnection, or erroneous polarity, an alarm is activated, and the error message is shown on the display.

Voltage sense cables disconnection, occurred during the test, will cause an erroneous result. The display will not show this as an error message.

During tests the high continued DC current will heat up the test set. To prevent RMO200 from overheating, duty cycles apply. The duty cycles depend on the used test current, please refer to section "Duty Cycles".

5 Description

5.1 Front Panel Components



STOP button

Press to stop a test or stop the alarm buzzer.

Ω button

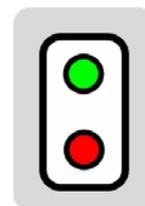
Press to start a test. Test parameters must be selected beforehand.

green LED

- Lights continuously when RMO200 is turned on.
- Flashes when a test can be started.
- Flashes alternately with the red LED during a test.

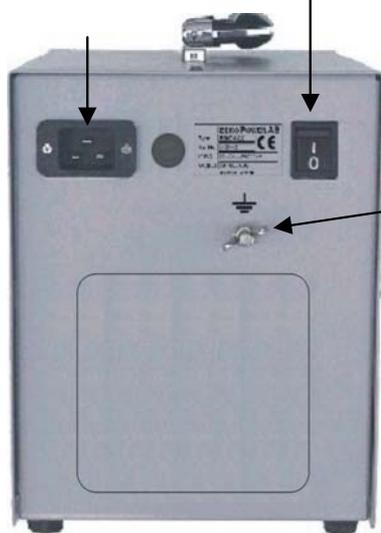
red LED

- Lights continuously in case of operational error.
- Flashes alternately with the green LED during a test.



5.2 Rear Panel Components

Connector for
mains power supply



Power switch

I In this position, RMO200 is connected to the mains power supply.

O In this position, RMO200 is separated from the mains power supply with both poles.

Equipotential connector.

For protection against parasitic currents or voltages, always connect RMO200 equipotential connector to protective ground (PE).

Use only the original cable.

For safety reasons, always establish this connection as the first one before you do any other connections, and separate this connection as the very last one.

5.3 Setting RMO200's Language

To set RMO200's language, use the **LEFT** button, and then **UP/DOWN** buttons to select the **Language** menu.

Figure 5-1:
The **Language**
menu



Move the cursor to the bottom line using the **LEFT/RIGHT** buttons, and select the language of your choice.

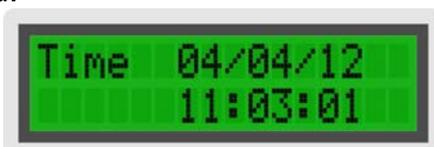
Pressing **ENTER** to confirm, returns you to the **Sing** menu.

Pressing **STOP** to cancel, returns you to the **Sing** menu.

5.4 Setting RMO200's Time and Date

To set RMO200's internal time and date, use the **LEFT** button, and then **UP/DOWN** buttons to select the **Time** menu.

Figure 5-2:
The **Time** menu showing
RMO200's internal time and date



Move the cursor to the position of your choice using the **LEFT/RIGHT** buttons, and change the value with the **UP/DOWN** buttons.

Pressing **ENTER** to confirm, returns you to the **Sing** menu.

Pressing **STOP** to cancel, returns you to the **Sing** menu.

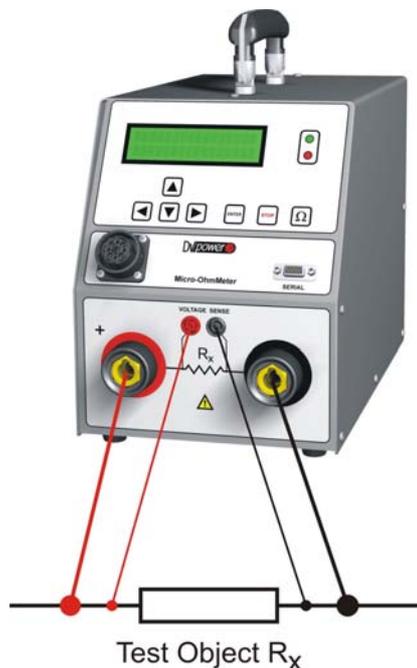
6 Getting Started

6.1 Connecting a Test Object to RMO200

Before you connect a test object to RMO200, make sure that:

- the test object is disconnected or separated from its circuit in accordance with the national safety regulations,
- the test object is properly grounded to protective earth (PE),
- RMO200 itself is properly grounded. To do so, connect the grounding screw on the back of RMO200's to PE using a grounding cable.

Figure 6-1:
Connecting a test
object to RMO200



With RMO200 turned off, connect RMO200 to the test object (R_x) in such a way that the measuring cables from the "Voltage Sense" sockets are attached as close as possible to R_x , and in between the current feeding cables. That way, resistance of both cables and clamps is almost completely excluded from the resistance measurement.

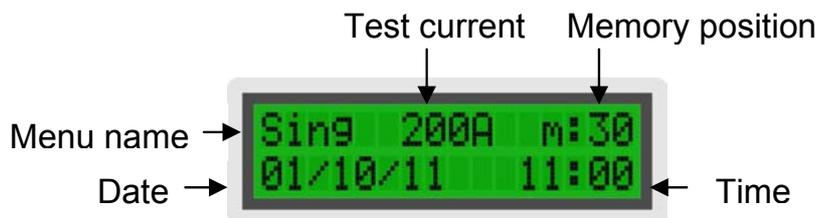
To take care about polarity while connecting measuring cables. Measuring results will be incorrect as a consequence of error.

6.2 Setting the Measurement Parameters

Single Test

Turn on RMO200 with the power switch on the back of the test set. The display shows the **Sing** menu.

Figure 6-2:
The **Sing**
menu



In the **Sing** menu, define a test current for the test. To do so set the value of your choice by means of the **UP/DOWN** buttons.

The memory position (here **m:30**) denotes a position the test data is stored during the test. It can be recalled later by selecting that position's number.

Once a test is finished, the memory position is automatically switched over to the next position.

Continuous Test

Turn on RMO200 with the power switch on the back of the test set. The display shows the **Sing** menu.

Go to **Cont** menu using **LEFT**, and then **UP** button.

Figure 6-3:
The **Cont** menu



In the **Cont** menu, define a test current, memory location and test current duration time.

Using **RIGHT** button move cursor to the position of test current, and using **UP/DOWN** buttons select desired value. Maximum duration of the current depends on its value, please refer to section “Duty Cycles”.

Using **RIGHT** button move cursor to the position of test current duration (here **60 sec**), and using **UP/DOWN** buttons select desired value.

Using button **RIGHT** move cursor to the position of memory location, and using **UP/DOWN** select desired memory position (here **m:40**) to which obtained results will be saved. Upon performed test (either due to time expire or due to push to the **STOP** button) the last measured result will remain registered in RMO200.

Note: In case of PC and RMOWin software use during the test, all performed measurements will be registered. Results will be shown in a table in Excel format with option of additional edit and graphic presentation.

Using RMOWin after testing for transfer of results from selected internal memory location to PC, it is possible to transfer only the result of the last test.

6.3 Measuring with RMO200

Single Test

Before a test can be started, both test current and memory position need to be defined using the **Sing** menu. Once these parameters are defined, press **ENTER** to change to the **Test** menu.

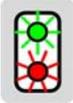
Figure 6-4:
The **Test** menu
before the test



The **Test** menu displays the test current and memory position defined. If one of these values has to be changed, press **STOP** to return to the **Sing** menu.



The flashing green LED indicates that RMO200 is now ready to start the test. Press the **Ω** button to run a test.



During the test, both the green and the red LEDs flash alternately. The display shows a graphical representation of the output current that ramps from 0A to the defined maximum value (here 200A).

Figure 6-5:
The **Test** menu
during the test



Once the current ramp reaches its maximum value, RMO200 measures the current through the test object and the voltage at the test object for 1s, calculates the resistance from these values, and saves the data at the present memory position.



Afterwards, RMO200 ramps down the output current from the max. value to 0A. When 0A is reached, the test is finished and the green LED lights up.

Note: To stop the test prematurely, press the **STOP** button at any time during the test. The current will immediately drop to 0A.

Continuous Test

Before a test could be started, test current, its duration and memory location must be defined using **Cont** menu. Press **ENTER** to change to the **Test** menu.

Figure 6-6:
The **Test** menu
before the test



The **Test** menu displays selected test current (here 100A), its duration (here 60 sec) and memory location of the result (here m:40). If one of these values has to be changed, press **STOP** button to return to the **Sing** menu.



The flashing green LED indicates that RMO200 is now ready to start the test. Press the **Ω** button to run a test.



During the test, both green and red LEDs flash alternately. The display shows current (here 100A) and the current value of the measured resistance (112μΩ). The time passed since the test beginning is also shown on the display (00:35).

Figure 6-7:
The **Test** menu
during the test



Upon completed test (due to expire of selected time or due to push to the **STOP** button) at selected memory location the last measured result will remain registered.

Note: In case of PC and RMOWin software use during the test, all performed measurements will be registered. Results will be shown in a table in Excel format with option of additional edit and graphic presentation.

Using RMOWin after testing for transfer of results from selected internal memory location to PC, it is possible to transfer only the result of the last test.

To stop the test prematurely, press the **STOP** button at any time during the test. The current will immediately drop to 0A.

6.4 Optimizing test

Accuracy given in the table is valid if the maximum possible current is used.

Range	Test Current	Nominal Resestance	Full Range Display	Resolution	Accuracy
1	200 A	100 $\mu\Omega$	99,9 $\mu\Omega$	0,1 $\mu\Omega$	$\pm 0,5\%$ rdg $\pm 0,5\%$ FS
2	200 A	1 m Ω	999 $\mu\Omega$	1 $\mu\Omega$	$\pm 0,25\%$ rdg $\pm 0,25\%$ FS
3	200 A	10 m Ω	9,99 m Ω	10 $\mu\Omega$	$\pm 0,25\%$ rdg $\pm 0,25\%$ FS
4	200 A	20 m Ω	20,0 m Ω	0,1 m Ω	$\pm 0,25\%$ rdg $\pm 0,25\%$ FS
5	100 A	50 m Ω	50,0 m Ω	0,1 m Ω	$\pm 0,25\%$ rdg $\pm 0,25\%$ FS
6	50 A	100 m Ω	99,9 m Ω	0,1 m Ω	$\pm 0,25\%$ rdg $\pm 0,25\%$ FS
7	20 A	250 m Ω	250 m Ω	1 m Ω	$\pm 0,5\%$ rdg $\pm 0,5\%$ FS
8	10 A	500 m Ω	500 m Ω	1 m Ω	$\pm 0,5\%$ rdg $\pm 0,5\%$ FS
9	5 A	1 Ω	999 m Ω	1 m Ω	$\pm 0,5\%$ rdg $\pm 0,5\%$ FS

Note: For resistance value less than 20 $\mu\Omega$ accuracy is $\pm 0,5\%$ rdg $\pm 2 \mu\Omega$.

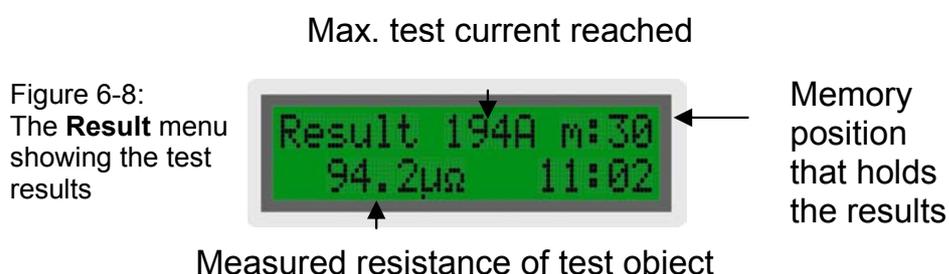
While using RMOWin the result is shown with one more decimal so that the result has ten times better resolution.

6.5 Viewing the Test Results

Once a Single test is finished, RMO200 automatically changes to the **Result** menu to display the test results.

For Continuous Test only the last performed test is shown.

Note: If the defined test current could not be reached, this could be due to a too high contact resistance of the test object and/or of the current cables. The test current value displayed here is the maximum test current reached.



Now there are two choices:

1. Starting a new test with a different current value:
 - press the **STOP** button to change to the **Sing** menu,
 - set a new current value and/or another memory position,
 - confirm your entries by pressing the **ENTER** button,
 - start the test by pressing the **Ω** button.
2. Starting a new test with the same current value:
 - press the **STOP** button to change to the **Sing** menu,
 - press the **ENTER** button to change to the **Test** menu,
 - press the **Ω** button to run a test.
The current value remains the same as in the previous test, the memory position increases by one.

6.6 Viewing Results of Previous Tests

RMO200 stores up to 100 test results. They can be viewed using the **Memory** menu at memory positions 0 ... 99.

Selecting a memory position on the **Memory** menu displays:

- the current fed into the test object,
- the memory position of these results,
- the test object's measured resistance,
- the date or the time, of this particular test.

To view the creation date of the test rather than the time, position the cursor on the latest number of the memory position (here **0**), and use the **RIGHT** button to toggle between date and time.

Figure 6-9:
The **Mem** menu showing the previously saved test results of memory position **30**



6.7 Printing the Test Results

RMO200 stores up to 100 test results. They can be printed using the **Print** menu at memory positions 0 ... 99.

Connect the RS232 port of the RMO200 and the printer with a printer's serial cable. Go to **Print** menu using **LEFT** and then **UP** button. Selecting first and last memory position and press **ENTER** button. The results that are located in the range between this memory locations, including the chosen memory locations, will be printed.

Figure 6-10:
The **Print** menu showing first and last memory position



Setting printer, as well as look of RMO Test Report where given at figures below.

```
[ DIP Sw settings mode ]

Dip SW-1
 1 (OFF) : Input = Serial
 2 (ON ) : Printing Speed = High
 3 (ON ) : Auto Loading = ON
 4 (OFF) : Auto LF = OFF
 5 (ON ) : Setting Command = Enable
 6 (OFF) : Printing
 7 (OFF) : Density
 8 (ON ) : = 114 %

Dip SW-2
 1 (ON ) : Printing Columns = 40
 2 (ON ) : User Font Back-up = ON
 3 (ON ) : Character Select = Normal
 4 (ON ) : Zero = Normal
 5 (ON ) : International
 6 (ON ) : Character
 7 (OFF) : Set
 8 (OFF) : = England

Dip SW-3
 1 (ON ) : Data Length = 8 bits
 2 (OFF) : Parity Setting = Yes
 3 (OFF) : Parity Condition = Even
 4 (OFF) : Busy Control = XON/XOFF
 5 (ON ) : Baud
 6 (OFF) : Rate
 7 (OFF) : Select
 8 (OFF) : = 4800 bps
```

```
RMO TEST REPORT
Date: 2004-07-14

STATION:
.....

OBJECT:
.....

TEST CURRENT 400 A
RESISTANCE 1.00 mΩ
at 09:06 2004-07-14

TEST CURRENT 400 A
RESISTANCE 1.00 mΩ
at 09:07 2004-07-14

TEST CURRENT 400 A
RESISTANCE 1.00 mΩ
at 09:07 2004-07-14

TEST CURRENT 050 A
RESISTANCE 100 μΩ
at 08:32 2004-07-14

TEST CURRENT 050 A
RESISTANCE 100 μΩ
at 08:32 2004-07-14

TEST CURRENT 050 A
RESISTANCE 100 μΩ
at 08:32 2004-07-14

OPERATOR:
```

6.8 Duty Cycles

During tests, RMO200 generates a high DC current that heats up the test set. To prevent RMO200 from overheating, certain duty cycles apply depending on the used test current.

Table 6-11:
Cooling time
between
single
tests

Single Test		
Test current (A)	Cooling time between first 4 tests (sec)	Cooling time after 4 tests (sec)
5, 10, 20	0	0
50, 100		0
150, 200		10

Table 6-12:
Cooling time
between
continuous
tests

Continuous Test		
Test current (A)	Maximal test duration time (sec)	Cooling time between tests (sec)
5,10,20	300	0
50, 100		0
150, 200	150	300

A built-in control prevents these cooling times from being skipped. If you try to start a test within the cooling period, the display shows "Wait" and a timer counting down. After the cooling period has elapsed, start the test using the set test parameters by pressing the Ω button. Cooling of RMO200 is supported by a built-in fan that is automatically activated every time a test is started from the **Test** menu. It continues running 5 minutes after the test is finished.

7 RMO Win Software

RMO Win is a Windows program for working with Micro OhmMeters RMO series. It enables the two-way communication RMO – PC over the serial port RS232.

RMO Win supports the following functions:

- Controlling and starting RMO when the tests are performed from the PC,
- The transfer of the test parameters from the local RMO memory to the PC with the possibility of writing the notes on objects being measured and appropriate comments.

The transferred data from RMO is possible to:

- Display in the form of tables,
- Download as an Excel file.

Every test reading parameters contain:

- The date and the time of the test,
- The real test-current,
- The voltage on the voltage terminals (Voltage Sense),
- The measured resistance value,
- The memory location,
- The name of the object (tested device) and the useful comments.

7.1 The minimum system requirements

Processor	: Recommended > 2 GHz
Memory	: min 32 Mb
Operating system	: 95/98, NT, XP, 2000
The hard disk space	: > 1,5 Mb

7.2 RMOWin installation

To install the RMO Win software do the following:

- Put the RMO Win installation CD in the CD-ROM drive,
 - Click on "Start",
 - Click on "Run",
 - Click on "Browse",
 - Select the CD-ROM drive,
 - Highlight the "RMOWin-V2.EXE",
 - Click on "Open",
 - Click on "OK",
 - Follow the instructions displayed on the screen,
 - When the installation process has been finished - exit the program.
-

7.3 Starting RMOWin

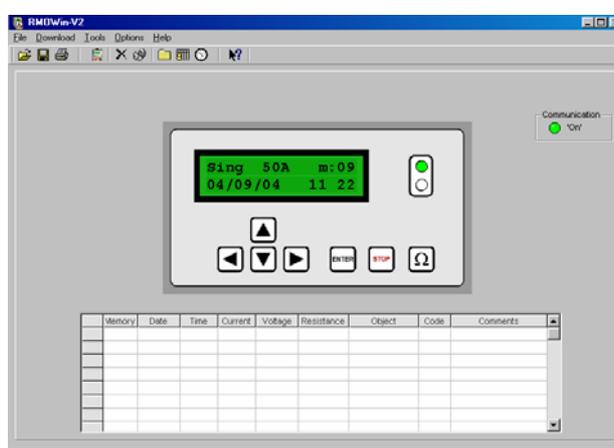
Connect the RS 232 port of the RMO Micro OhmMeter and the PC, with a serial cable.

Turn RMO on.

Start RMOWin:

- Click on "Start",
- Click on "Programs",
- Click on "RMOWin-V2",
- Click on "RMOWin-V2",
or duple click at icon on the desktop.

The look of the RMO Win main menu is shown in the following illustration.



If in the "Communication" field the green led-diode and the sign "ON" are lit, the communication has been established and the program is ready to be used.

You can change port:

- Click on "Tools",
- Click on "Choise of Comm Ports",
- Click on the chosen port wich is not in use,
- Click on "OK".

If in the "Communication" field the green led-diode and the sign "ON" are lit, the communication has been established and the program is ready to be used.

The illustration below depicts the main menu.



File

Open

Opening the file.

Save As

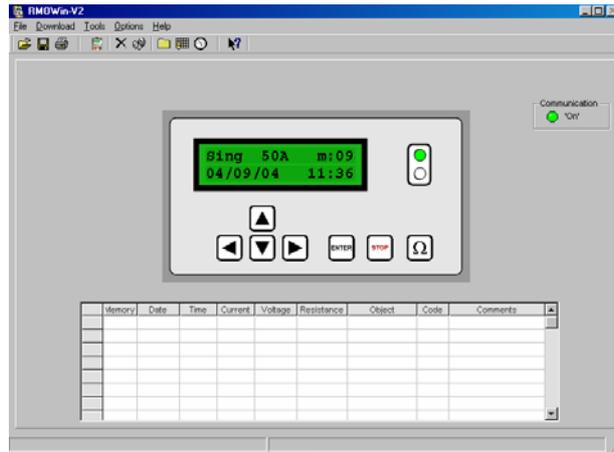
Saving the table in the working directory.

Print

Printing the active table.

Exit

Exiting the program.



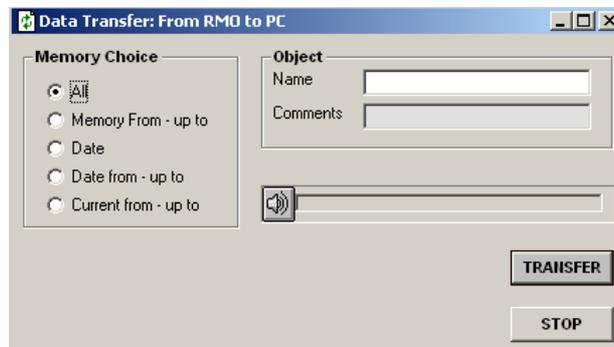
Download

Data From RMO

With this command the results from the internal RMO memory can be transferred to the PC. The transfer is possible only if the serial port RMO is connected, with the appropriate cable, to the PC and the green led diode "Communication" is lit (ON). The results a user wants to transfer from the RMO memory to the PC are possible to choose according to a selected criterion:

All

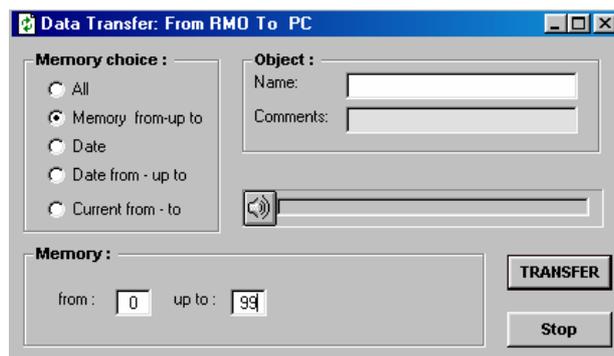
All the test results are being transferred from the internal RMO memory to the PC.



Memory from-up to

It opens a new window that allows a choice of memory locations to be transferred to the PC.

The results that are located in the range between the memory locations, including the chosen memory locations, will be transferred to the PC. The more detailed description on how to use the memory locations can be found in the RMO manual.



Date

The results that are filled in on the chosen date are going to be transferred to the PC.

Data Transfer: From RMO To PC

Memory choice :

- All
- Memory from-up to
- Date
- Date from - up to
- Current from - to

Object :

Name:

Comments:

Date :

7 /25/04

TRANSFER

Stop

Date from – up to

After choosing this option, a new window appears. It provides a choice of selecting a time-interval when the measurement was done. The results received during the time period between the chosen dates, including the chosen dates, are going to be transferred to the PC.

Data Transfer: From RMO To PC

Memory choice :

- All
- Memory from-up to
- Date
- Date from - up to
- Current from - to

Object :

Name:

Comments:

Date :

from: 7 /25/04 up to: 7 /25/04

TRANSFER

Stop

Current from – to

Selecting this option opens a new window, providing a selection of the currents that were used during the test. The choice of the current is made on the drop-down menu.

The range of the values that are between and including the selected values of the current, are going to be transferred to the PC.

Data Transfer: From RMO To PC

Memory choice :

- All
- Memory from-up to
- Date
- Date from - up to
- Current from - to

Object :

Name:

Comments:

Current :

from: 10 A up to: 600 A

TRANSFER

Stop

After choosing the wanted transfer criterion it is recommended to write the name of the object (device) on which the tests took place as well as comments (14 character max) that can be used in the future analysis of the results. These comments will be displayed in the table together with the results.

Transfer

After pressing this key, the selected results are going to be transferred from the internal RMO memory to the PC. Unless the user chooses some other option, all the results from the RMO memory will be transferred (the option All is a default).

After pressing the command transfer, the graphical bar is being displayed showing a status of the transfer.

Stop

A user should press the "Stop" button if for whatever reason he wants to interrupt a transfer. After pressing this key all the choices are being erased and a user will return back to the main menu.

The results table

When the results are transferred to the PC, the table with the layout shown on the illustration below will be displayed:

- Memory : the number of the memory location in the RMO in which the test results are
- Date : the date of the test
- Time : the time of the test
- Current : the test current
- Voltage : the voltage on the Voltage Sense
- Resistance : the measured resistance
- Object : the name of the object
- Code : the code of the tested object
- Comments : comments

Save

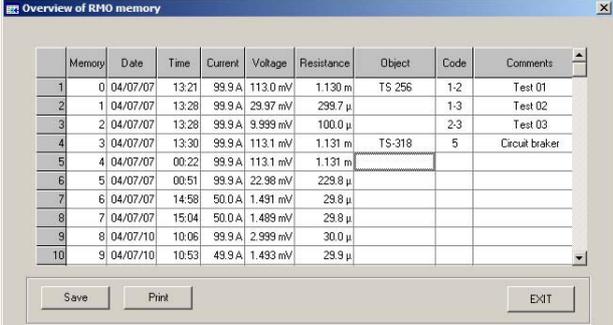
Saving the table as an Excel file. Initially it will be suggested to save in the working directory.

Print

Printing the table

Exit

Returning to the main menu.



Memory	Date	Time	Current	Voltage	Resistance	Object	Code	Comments
1	04/07/07	13:21	99.9A	113.0 mV	1.130 m	TS 256	1-2	Test 01
2	04/07/07	13:28	99.9A	29.97 mV	299.7 µ		1-3	Test 02
3	04/07/07	13:28	99.9A	9.999 mV	100.0 µ		2-3	Test 03
4	04/07/07	13:30	99.9A	113.1 mV	1.131 m	TS-318	5	Circuit breaker
5	04/07/07	00:22	99.9A	113.1 mV	1.131 m			
6	04/07/07	00:51	99.9A	22.98 mV	229.8 µ			
7	04/07/07	14:58	50.0A	1.491 mV	29.8 µ			
8	04/07/07	15:04	50.0A	1.489 mV	29.8 µ			
9	04/07/10	10:06	99.9A	2.999 mV	30.0 µ			
10	04/07/10	10:53	49.9A	1.493 mV	29.9 µ			

Tools

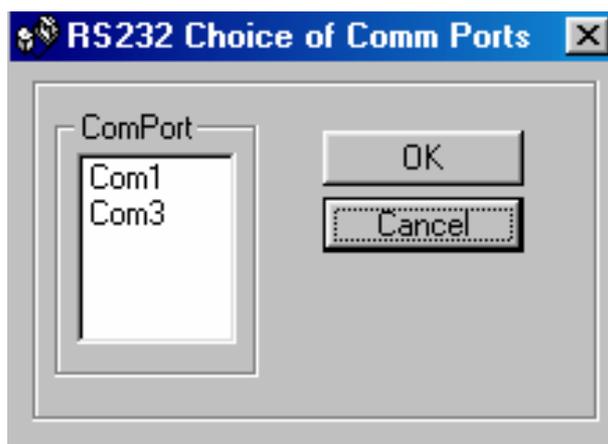
Clearing of table

Erasing all the data from the main menu board.

Choise of Comm Ports

Choosing the otherPC serial port.

This window provides a choice of the other active serial port to be used. After a choice has been made, the green led diode "Communication" is going to be lit and the same text as on the RMO display is going to be shown on the monitor.

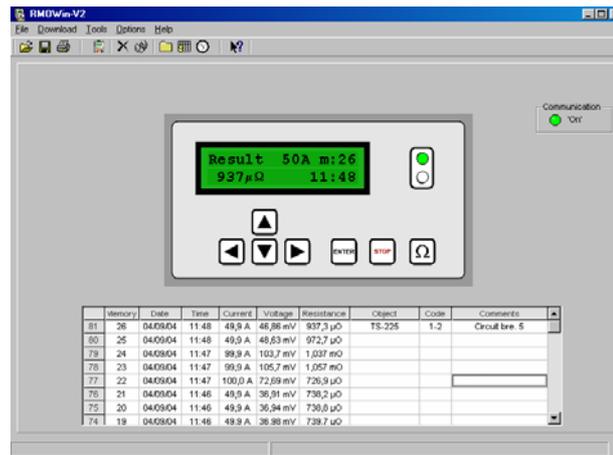


Now the RMO can be controlled from the PC.

Clicking with the mouse on any key of the keyboard has the same effect as pressing the keys on the RMO.

In case that the green led diode is not lit in the "Communication" window, i.e. the red led diode is lit, it is necessary to check the following:

- Is the green led diode on the RMO lit?
- Is the RMO signaling any error?
- Is the serial cable connected tightly?
- Double-check the choice of the serial port.



It is highly recommended to write the information in the columns "Object", "Code" and "Comments" for better systemization of the saved results.

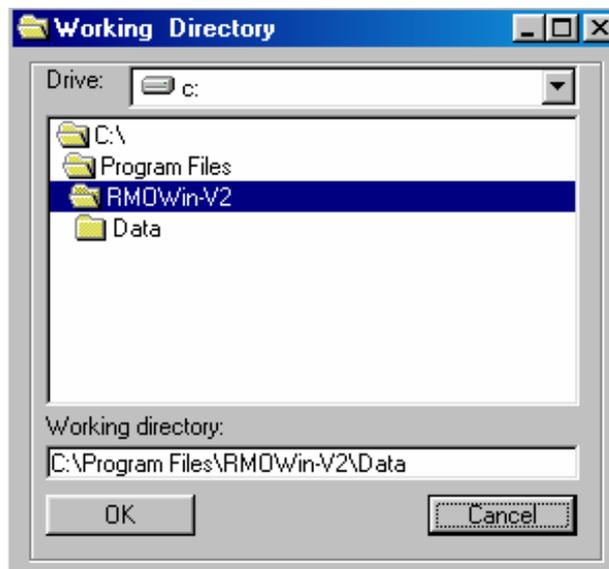
The new test moves the previous test results down so the first line represents the last performed test.

The way of measuring the resistance is described in details in the RMO Manual. If a user wants to analyze these results later, it should be saved on the hard disk. The table is going to be saved as an Excel file, so it can be later used with all Excel functions.

Options

Working directory

The selection of the working directory that is going to be the default one for opening and saving the tables and the files.



Output format

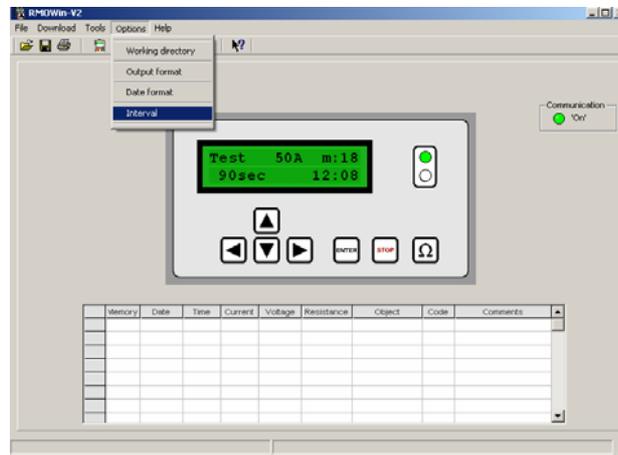
Defines the file format of the saved table.

Data format

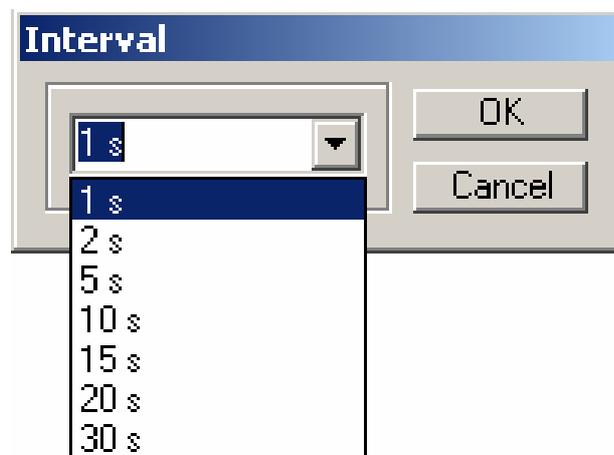
Defines the date format that is going to be shown in the table with the results of the test.

Interval

This function is active only when RMO is in Cont menu. Its purpose is selection of time interval for reading results from RMO to PC. Each time at the expiration of this interval from RMO to PC will be written last measured result.



Go to **Cont** menu and then press function "Interval". The window, as shown bellow, will be opened.



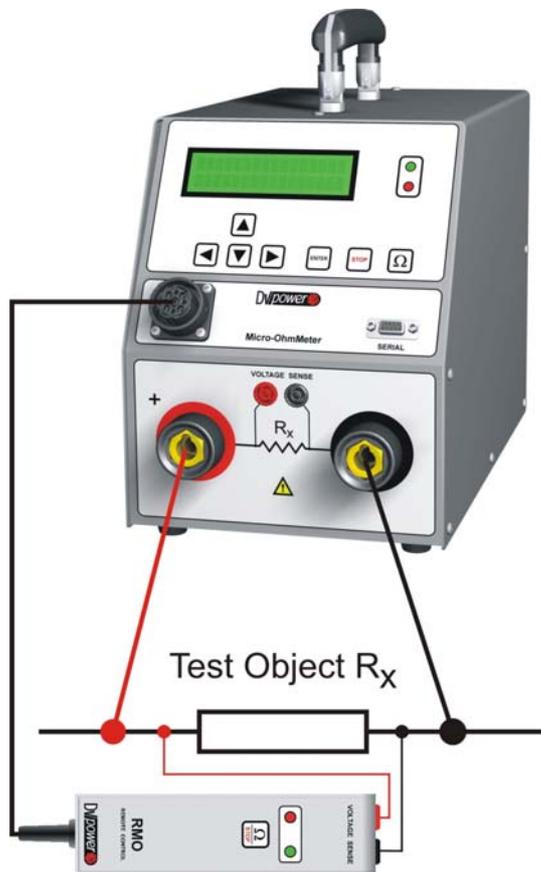
8 Remote Control

The RMO Remote Control Unit is an optional control unit that is used to start and stop the tests from a remote location, away from the actual RMO.

Very often the same test current is fed through the test object for a series of tests. To simplify this and speed up the process, multiple measurements can be carried out with the RMO Remote Control Unit.

Otherwise, the test current setting needs to be changed on the RMO for each new test.

8.1 Connecting the Remote Control Unit to RMO and Test Object



Turn off RMO and plug in the Remote Control Unit to connector on the RMO's front panel.

Connect the Remote Control Unit to the test object (R_X) in such a way that the measuring cables from the "Voltage Sense" sockets are situated as close as possible to R_X , and in between the current feeding cables from RMO. That way, both the cable's and the clamps' typical contact resistance is largely excluded from the resistance measurement.

To take care about polarity while connecting measuring cables. Measuring results will be incorrect as a consequence of error.

Note: Never connect the Remote Control Unit to any other device but RMO.

8.2 Operational Components

Sockets to connect the Remote Control Unit directly to a test object "Voltage Sense +" and "Voltage Sense -"

Depending on the situation, the Ω /STOP button has varying functions:

- When the green LED flashes a new test can be started by pressing this button
- When the green LED lights continuously, pressing this button will prepare RMO for a new test, using the test parameters set on RMO.
- While a test is running (the green and the red LEDs flash alternately), pressing this button stops the test immediately.



The LEDs of the Remote Control Unit function synchronized with the ones of RMO.

-  Green LED
- Flashes when a test can be started.
 - Flashes alternately with the red LED during a test.
 - Lights continuously when a test is done.
-  Red LED
- Flashes alternately with the green LED during a test.
 - Lights continuously in case of operational error.

8.3 Measuring with the Remote Control Unit

Testing with the Remote Control Unit is much like the testing procedure with RMO itself, and is therefore only outlined here:

- Connect the Remote Control Unit to RMO,
- Connect the Remote Control Unit to a test object,
- In the RMO **Sing** menu, define a test parameters for the test, and press **ENTER** to change to the **Test** menu,
- The flashing green LED indicate that RMO is now ready to start the test.
- Press the Ω /STOP button once more to start the test. While the test is running, the green and red LED flash alternately. To stop the test prematurely, press the Ω /STOP button once more.



Once the test is finished, RMO automatically changes to the **Result** menu to display the test results. The green LED lights up continuously.

If an error occurred during the test, the red LED lights up continuously, and the display presents the according error message.

Provided that, for a series of tests, the same test current is fed through the test object, multiple tests can be carried out with the Remote Control Unit.



Simply press the Ω /STOP button again to repeat the procedure.

If different test parameters are required, set them on RMO directly, and start the new test by pressing the Ω /STOP button again.

9 Kelvin Probes

Kelvin Probes provide easy and simple testing.

Current and voltage connections were joined inside single cable having thus no need to use heavy current cables.

Measurement is performed by 10 A (15 m cable) or 20 A (9 m cable) current. In case higher current is given RMO will limit it to value of 15 A or 25 A maximally.

During test it is important to push enough Kelvin Probes to provide proper contact. Otherwise RMO will interrupt test and report error.

It is also important to mind proper placement of contacts to the measured object (sense ones must be inside the loop closed by current ones). Any error will result in wrong test results.

9.1 Connecting the Kelvin Probes to RMO and Test Object



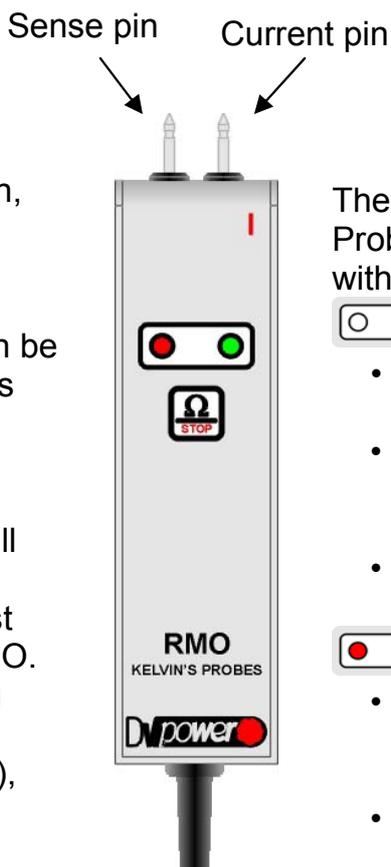
Turn off RMO and plug in the Kelvin Probes to connector on the RMO's front panel.

Connect the Kelvin Probes to the test object in such a way that the sense pins are situated as close as possible to R_x , and in between the current pins. That way, both the cable's and the pins' typical contact resistance is largely excluded from the resistance measurement.

9.2 Operational Components

Depending on the situation, the Ω /STOP button has varying functions:

- When the green LED flashes, a new test can be started by pressing this button.
- When the green LED lights continuously, pressing this button will prepare RMO for a new test, using the test parameters set on RMO.
- While a test is running (the green and the red LEDs flash alternately), pressing this button stops the test immediately.



The LEDs of the Kelvin Probes function synchronized with the ones of RMO.

 Green LED

- Flashes when a test can be started.
- Flashes alternately with the red LED during a test.
- Lights continuously when a test is done.

 Red LED

- Flashes alternately with the green LED during a test.
- Lights continuously in case of operational error.

9.3 Measuring with the Kelvin Probes

Testing with the Kelvin Probes is much like the testing procedure with RMO itself, and with Remote Control:

- Turn off RMO and connect the Kelvin Probes to RMO,
- Turn on RMO and in **Sing** menu, define a test parameters for the test, and press **ENTER** to change to the **Test** menu,
- The flashing green LED indicates that RMO is now ready to start the test,
- Press Kelvin Probes to the surface of the test object by force to provide proper contact,
- Press the Ω /STOP button to start the test. While the test is running, the green and red LED flash alternately. To stop the test prematurely, press the Ω /STOP button once more.
- Once the test is finished, RMO automatically changes to the **Result** menu to display the test results. The green LED lights up continuously.



If an error occurred during the test, the red LED lights up continuously, and the display presents the according error message.

Provided that, for a series of tests, the same test current is fed through the test object, multiple tests can be carried out with the Kelvin Probes. Simply press the Ω /STOP button again to repeat the procedure.

If different test parameters are required, set them on RMO directly, and start the new test by pressing the Ω /STOP button again.



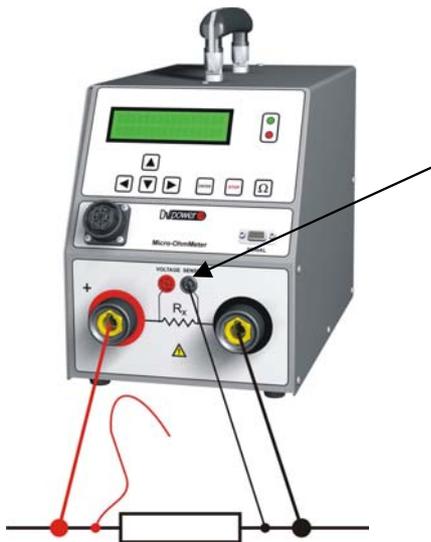
10 Error Messages

Any operational error is indicated by a red LED and accompanied by an alarm. Furthermore, the display indicates an error status message.

To stop the alarm buzzer, remove the status message on the display, and return to the **Sing** menu, press the **STOP** button.

10.1 Error Message "Connection VS"

Figure 10-1:
Disconnection
of a
"Voltage
Sense"
cable and error
message



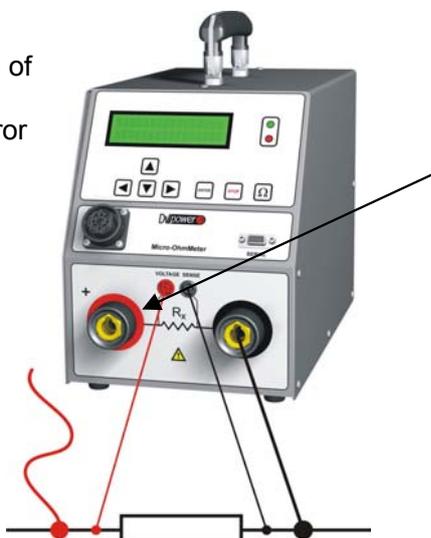
If one of the "Voltage Sense" cables to the test object is disconnected, on either the test set or the test object side at the start of the test, the error message "Connection VS" is displayed.



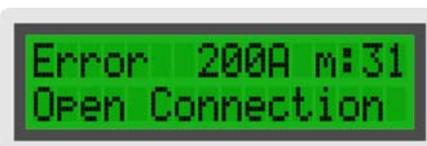
Note: Voltage sense cables disconnection, occurred during the test, will cause an erroneous result. The display will not show this as an error message.

10.2 Error Message "Open Connection"

Figure 10-2:
Disconnection of
the current
cables and error
message



If one of RMO200 current cables ("+" or "-") to the test object is disconnected, on either the test set or the test object side at the start or during the test, the error message "Open Connection" is displayed.



10.3 Error Message "Polarity VS"

This message is displayed if the polarity of measuring cables is incorrect. In this case connect measuring cables correct and repeat the test.

Figure 10-3:
Error message
"Polarity VS"



10.4 Error Message "Change Current"

This message is displayed if the selected test current is too high. In this case reduce the test current and repeat the test.

Figure 10-4:
Error message "Change
Current"



10.5 Error Message "Overheat"

This message is displayed when RMO200's operating temperature rises too high due to a high ambient temperature or, despite the duty cycle time control, too many high current tests were performed in too short of a time.

Figure 10-5:
Error message
"Overheat"



In this case, wait for the test set to cool down and repeat the test.

10.6 Error Message "Malfunction"

If this message is shown on the display, or if RMO200 cannot be operated anymore at all, a serious internal error occurred.

Figure 10-6:
Error message
"Malfunction"



Please do not open RMO200 by yourself. Contact the IBEKO POWER AB (refer to section "Manufacturer Contact Information").

10.6 Error Message "Mains Voltage < 90V"

This message is displayed when RMO200's mains voltage is below 90 V.

Figure 10-6:
Error message
"Mains Voltage < 90V"



In this case to remove the status message you must restart RMO200.

11 Technical Data

11.1 Mains Power Supply

- Connection according to IEC/EN60320-1; UL498, CSA 22.2
- Voltage single phase 110 – 240 VAC, +10% – -15%
- Frequency 50/60 Hz
- Fuse 15 A

11.2 Output data

- Test current 5A – 200A DC
- Typical Accuracy $\pm 0,25\%$ rdg $\pm 0,25\%$ FS

11.3 Environmental conditions

- Operating temperature -10° - $+50^{\circ}$ C / 14° - $+122^{\circ}$ F
- Storage temperature -25° - $+70^{\circ}$ C / -13° - $+158^{\circ}$ F
- Humidity 5 – 95% relative humidity, non condensing

11.4 Mechanical protection - IP54

11.5 Dimensions and Weight

- Dimensions 198 x 255 x 380 mm (WxHxD) without handle
7,8 x 10 x 15 in
- Weight 8 kg / 17,5 lbs

11.6 Safety Standards

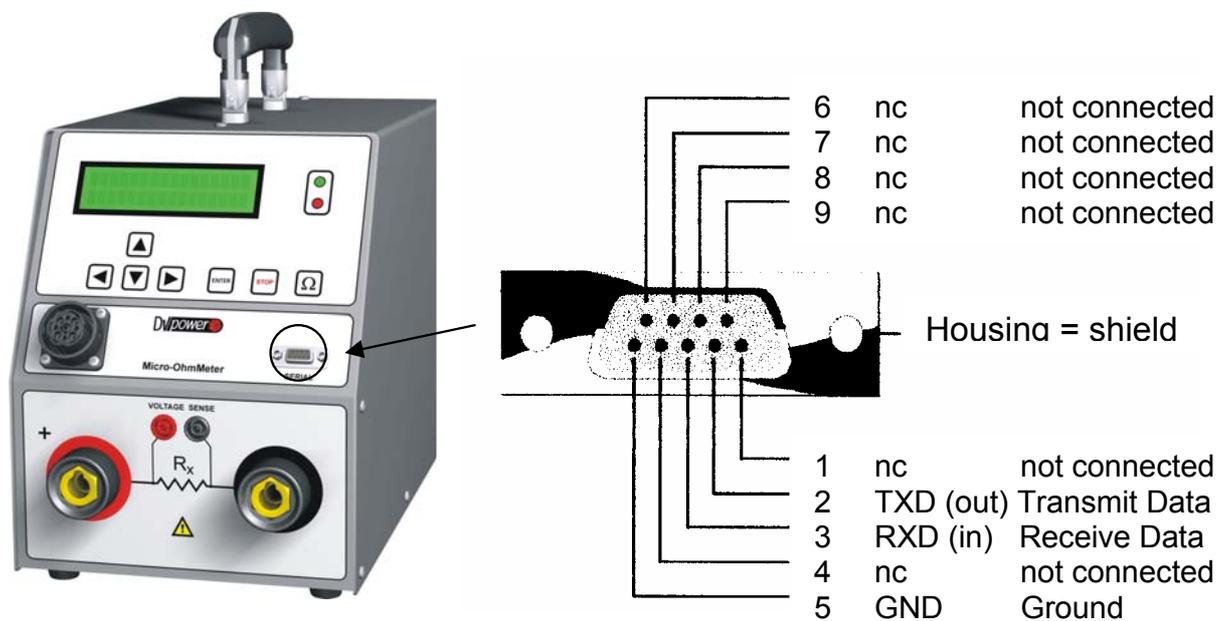
- European standards EN 61010-1
- International standards IEC 61010-1
UL 3111-1
CAN/CSA-C22.2 No 1010.1-92

11.7 Electromagnetic Compatibility (EMC)

- CE conformity EMC standard 89/336/EEC
- Emission EN 50081-2, EN 61000-3-2/3
- Interference Immunity EN 50082-2

11.8 RS232 Interface

RMO200 is equipped with an RS232 serial interface to connect to an external computer.



12 Accessories

Standard	Article No
Current cables 2 x 5m, 25mm ² , 8,4 mΩ with battery clips	
Sense cables 2 x 5m, 2,5mm ² with alligator clips	
RMO-Win PC software including RS232 cable	
Mains power cable	
Ground cable	

Additional	Article No
Remote Control Unit with 9 m cable; Sense cables 3 x 1 m	
Remote Control Unit with 15 m cable; Sense cables 3 x 1 m	
Kelvin Probes, 20 A, with 9 m cable; Max. distance probes 2 m	
Kelvin Probes, 10 A, with 15 m cable; Max. distance probes 2 m	
Transport case	
Transport bags	
Test shunt 100 μΩ (600A/60mV)	
Current cables 2 x 10m, 25mm ² , 16,8 mΩ with battery clips	
Current cables 2 x 15m, 35mm ² , 18 mΩ with battery clips	
Current extension cable 1 x 5m, 25mm ² , 4,2 mΩ	
Current extension cable 1 x 10m, 25mm ² , 8,4 mΩ	
Current extension cable 1 x 10m, 35mm ² , 6 mΩ	
Sense cables, extension 2 x 5m, 2.5mm ²	
Sense cables, extension 2 x 10m, 2.5mm ²	
Sense cables 2 x 10m, 2,5mm ² with alligator clips	
External, battery powered, thermal printer, AC adapter, serial printer cable, paper 112 mm	



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