RMO-A

MICRO OHMMETERS

Manual

DVpower

Contents

Manual Version: **M-RX00AN-200-EN**
This Manual refers to the firmware version 10.08,

Refers to:
RMO100A, RMO200A, RMO300A, RMO400A, RMO500A and RMO600A models.

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1 Introduction

This Manual provides instructions on how to use the RMO-A instruments safely, properly and efficiently.

The following instructions will help the user avoid unsafe situations, reduce maintenance costs and will ensure the reliability and durability of the RMO-A instruments.

The RMO-A must be used in accordance with all existing safety requirements and regulations based on national/local standards for accident prevention and environmental protection. In addition, the relevant international standards are listed in the paragraph 5.6 of the “Technical Data” section of this document.

1.1 Safety Instructions

Safety is the responsibility of the user. Before operating the RMO-A, please read the following safety instructions carefully.

It is not recommended the RMO-A being used (or even turned on) without careful observation of the instructions listed in this Manual. The RMO-A should only be operated by trained and authorized personnel.

1.1.1 Safety Terms and Symbols

Terms in this Manual

These terms may appear in the Manual:

WARNING: Warning statements identify conditions or practices that could result in an injury or a loss of life.

CAUTION: Caution statements identify conditions or practices that could result in a damage to this product or to the other property.

Terms on the Device

The following warning terms used in this document may appear on the device:

WARNING: indicates that a potential hazard may occur.

CAUTION: indicates that a potential damage may occur to the instrument or to the test object connected to the instrument.

Symbols on the Device

The following symbols may appear on the device:

Refer to Manual

Protective Earth Terminal

1.1.2 Terms of Use

- The RMO-A shall be used only if it is in a good technical condition. Its use shall be in accordance with local safety and industrial regulations. Adequate precautions must be taken to avoid any risks related to high voltages associated with this equipment and nearby objects.
- The RMO-A shall be used only for the application purposes described in the ”Intended Use” section. The manufacturer and distributors are not liable for a damage resulting from the wrong usage. The user bears responsibility for not following the instructions defined in this document.
- Do not remove the protective casing of the RMO-A.
- All service and maintenance work must be performed by qualified personnel only.

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1.1.3 Orderly Practices and Procedures

- The Manual shall always be available on the site where the RMO-A is used.
- Before using the RMO-A, all personnel (even personnel who only occasionally, or less frequently, work with the RMO-A) assigned to operate the RMO-A should read the operations Manual.
- Do not make any modifications, extensions, or adaptations to the RMO-A.
- Use the RMO-A only with the original accessories provided by the manufacturer.
- Use the RMO-A and its original accessories for the device's intended use only.

1.1.4 Device maintenance

Device should be kept in a clean condition to prevent excessive dust or other contaminants affecting its operation. It should be cleaned with water/isopropyl alcohol after noticing any dirt/contaminants on its surfaces.

1.1.5 Operator Qualifications

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

1.1.6 Safe Operating Procedures

- Hazardous voltages of up to 400 V can occur inside the RMO-A. Therefore, it is not permitted to remove the protective casing of the RMO-A.
- Before putting the RMO-A into operation, check the test set for any visible damage.
- Do not operate the RMO-A under wet or moist conditions (condensation).
- Do not operate the RMO-A if explosive gas or vapors are present.
- Only the external devices which meet the requirements for SELV equipment according to EN 60950 or IEC 60950 should be connected to the RMO-A through the serial interface.
- Removing the RMO-A protective casing will void the warranty. Any work inside the instrument without prior authorization from DV Power will also void the warranty.
- If the RMO-A seems to be malfunctioning, please contact the DV Power Support Team (refer to the "Manufacturer Contact Information" section) after previously checking the "Error Messages" section.
- Do not use the RMO-A without the extra protective ground cables supplied with the RMO-A. It must never be operated in a non-grounded configuration as this may result in an electrical shock to the user or damage the RMO-A. Always establish this connection first before establishing any other connections and remove this connection as the very last one.
- Cables between the RMO-A and any other equipment should be connected and disconnected from the RMO-A only while the instrument is switched off.

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1.2 Power Supply

- Supply the RMO-A only from a power outlet which is equipped with the protective ground.
- Besides being supplied from phase – neutral (L1-N, A-N), it may also be supplied from phase to phase (e.g., L1-L2; A-B). However, the voltage must not exceed 264 V AC. Please refer to the section “Technical Data”.
- The RMO-A should be positioned in such a way that it is possible to safely disconnect it from the power supply at any moment.

WARNING / AVERTISSEMENT
This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.
Il s'agit d'un produit de classe A. Dans un environnement domestique, ce produit peut provoquer des interférences radio, auquel cas l'utilisateur peut être amené à prendre des mesures adéquates.

1.3 Measurement Category

RMO-A is intended to be used for measurements in Measurement Category I (CAT I) for voltages to 20 V. Device is also designed to withstand occasional transient overvoltage up to 1000 Vpk.

WARNING / AVERTISSEMENT
This equipment is classified as measurement category I, and must not be used within measurement category II, III and IV.
Cet équipement est classée dans la catégorie de mesure I, et ne doit pas être utilisé dans les catégories de mesure II ,III et IV.

1.4 Intended Use

The Micro Ohmmeters RMO-A 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 use of the RMO-A other than mentioned above is being considered improper and will void the warranty and exempt the manufacturer from its liability for repair or exchange.

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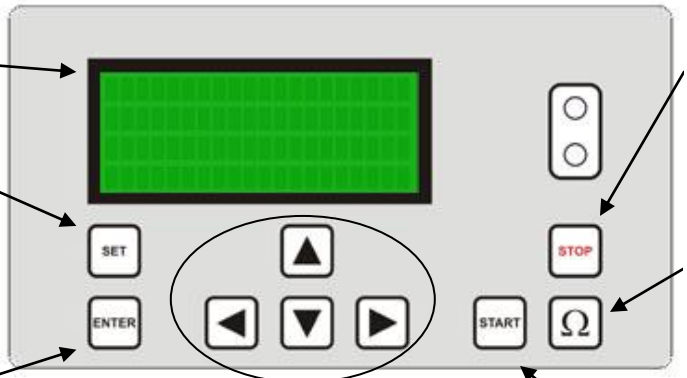
2 Description

2.1 Front Panel Components



Display

SET button to scroll between the menus

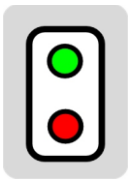
STOP button to stop a test, to acknowledge the alarm buzzer and return to the current menu

Ω button to save the current resistance value in **Contin** menu

ENTER button to confirm the defined test parameters, Language, and Date and Time

UP/DOWN/LEFT/RIGHT buttons to select a menu, define a test current and set test parameters

START button to start the test current



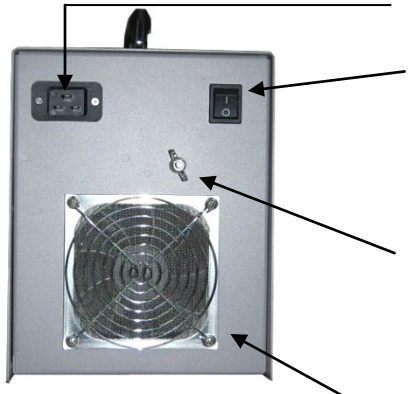
Green LED

- Lights continuously when RMO-A 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.
- Lights when assigned maximum value in **Rmax** menu is exceeded (or reached)

2.2 Mains power and ground connectors



Connector to the mains power supply

Power switch

0 In this position, the RMO-A is separated from the mains power supply with both poles.

I In this position, the RMO-A is connected to the mains power supply.

Earth/ground connector

For protection against parasitic currents or voltages, always connect RMO-A earth/ground connector to protective ground (PE). Use only the originally supplied cable.

Cooling fan

For safety reasons, always establish earth/ground connection as the first step before establishing any other connections, and disconnect it as the very last one.

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3 Getting Started

3.1 Connecting a Test Object to RMO-A

Before connecting the RMO-A to a circuit breaker, make sure that:

- the breaker is disconnected or separated from its circuit on both sides of the breaker in accordance with the national safety regulations; **always comply with local safety regulations when using the RMO-A,**
- the breaker is properly grounded to a protective ground (PE),
- the RMO-A itself is properly grounded. To do so, connect the grounding screw of the RMO-A to a PE using only original grounding cable.

With the RMO-A turned off, connect it to the circuit breaker with its appropriate cables.

Note: ***Cables between the RMO-A and other equipment should be connected and removed ONLY when the RMO-A is switched off.***

Always connect the measuring cables to the RMO-A first and then to the test object; and when disconnecting always disconnect the cables from the test object first and after that from the RMO-A. The grounding wire PE should be disconnected last. Failure to do this may result in a serious injury or even a loss of life.

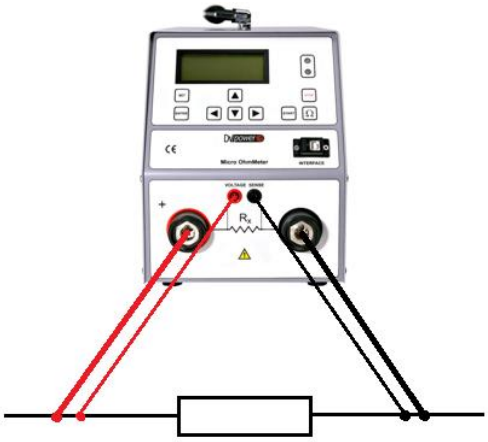

Figure 3-1: Connecting test object to RMO-A

With RMO-A turned off, connect RMO-A to the test object (R_X) in such a way that the measuring cables from the "Voltage Sense" input sockets are attached as close as possible to the test object R_X, and closer to Rx than the connection points of the current feeding cables. That way, resistance of both, cables and clamps is almost completely excluded from the resistance measurement.

Please pay attention to the polarity while connecting the measuring cables otherwise the measurement results will be incorrect.

To maximize accuracy and measurement repeatability make sure that all clamps have a good connection to the test object and avoid any connection between Sense and Current clamps.

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3.2 Settings

To set RMO-A's language, date and time and **Rmax** press and hold ***SET*** button for 3 seconds to select **Settings** menu.

Figure 3-2:
Settings menu

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

Setting RMO-A's Language

To set RMO-A's language, please use the ***RIGHT*** button, and then ***ENTER*** button to select the **Set Language** menu.

Figure 3-3:
The **Language** menu

Move the cursor using the ***RIGHT*** button and select the language of your choice.

Pressing ***ENTER*** to confirm, returns you to the **Settings** menu.
Pressing ***STOP*** to cancel, returns you to the **Settings** menu.

Setting RMO-A's Date and Time

To set RMO-A's date and time, please use the ***RIGHT*** button, and then ***ENTER*** button to select the **Set date and time** menu.

Figure 3-4:
Date and Time menu showing RMO-A's internal date and time

Move the cursor to the position of your choice using the ***RIGHT*** button, and change the value with the ***UP/DOWN*** buttons.
One of three different date formats can be selected:

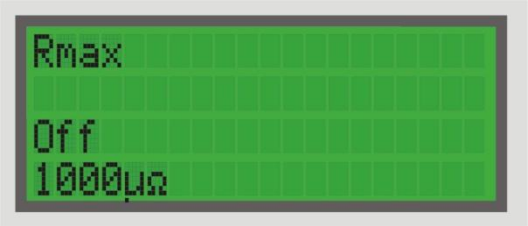
1. YYYY-MM-DD
2. DD-MM-YYYY
3. MM-DD-YYYY

Pressing ***ENTER*** to confirm, returns you to the **Settings** menu.
Pressing ***STOP*** to cancel, returns you to the **Settings** menu.

Setting Rmax

To set RMO-A's Rmax value, please use the ***RIGHT*** button, and then ***ENTER*** button to select the **Set Rmax** menu.

Figure 3-5:
Rmax menu



In the **Rmax** menu, define the status of **Rmax** (**On** or **Off**) and assigned value of resistance.

Using the ***RIGHT*** button move the cursor to the position of **Rmax** menu status, and using ***UP/DOWN*** buttons select **Off** (Figure 3-5) or **On** option.

Using the ***RIGHT*** button move the cursor to the position of assigned value of resistance, and using ***UP/DOWN*** buttons select desired value between 1 µΩ and 9999 µΩ. The default value is 1000 µΩ (figure 3-5). When device is turned off and then turned on, RMO-A remembers the last saved setting of Rmax value and a status.

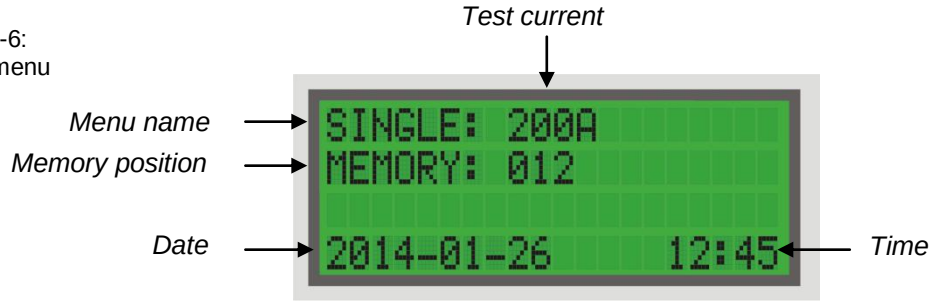
Once these parameters are defined, press ***ENTER*** to change to the **Settings** menu.

3.3 Setting the Measurement Parameters

3.3.1 Single Test

Turn the RMO-A power switch **ON**. The RMO-A will display the **Single** menu and the green LED is **ON**.

Figure 3-6:
Single menu



Before a test can be started, the following parameters need to be defined in the **Single** menu:

- Test current; the following values can be selected:
  5 A, 10 A, 20 A, 50 A, 100 A, *200 A, *300 A, *400 A, *500 A and *600 A.
  *maximal test current is related to the model name.
  e.g. for RMO100A maximal test current is 100 A, for RMO200A is 200 A, …, for RMO600A is 600 A.
- Memory position, 000-499

In the **Single** menu, define a test current for the test (here **200A**). To do so please set the desired value by using the ***UP/DOWN*** buttons.

Using the ***RIGHT*** button move the cursor to the memory location position and using the ***UP/DOWN*** buttons select a desired memory position to which the obtained results will be saved. Once the test is completed the last measured result will remain registered in RMO-A, and the memory position is automatically switched over to the next memory position. The result can be recalled later by selecting that particular memory position number.

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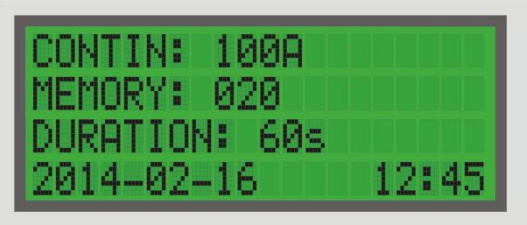
3.3.2 Continuous Test

Turn the RMO-A power switch ON. The RMO-A will display the **Single** menu. Press ***SET*** button to go to the **Contin** menu. Other option to go to the **Contin** menu is to press ***RIGHT*** button four times consecutively and then to press UP button. Press ***STOP*** to return to the **Single** menu.

Figure 3-7:
Contin menu



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

Using ***RIGHT*** button to move the cursor to the position of a test current, and using the ***UP/DOWN*** buttons select a desired value.

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

Use the ***RIGHT*** button to move the cursor to the position of a memory location. Use the ***UP/DOWN*** buttons to select a desired memory position (here **Memory: 020**) to which obtained results will be saved. Upon the test completion (either due to time expiration or because the test is interrupted by pressing the ***STOP*** button) the last measured result will remain registered in the RMO-A memory.

Note: If DV-Win software is used during the test, all measurements will be registered in the Excel table format, allowing additional editing and graphic presentation options.

When using DV-Win software it is possible to download only the last stored test results from the selected internal memory location.

3.4 Measuring with RMO-A

3.4.1 Single Test

Before a test can start, both a test current and a memory position need to be defined using the **Single** menu. Once these parameters are defined, please press ***ENTER*** to change to the **Ready** state.

Figure 3-8:
Ready state

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

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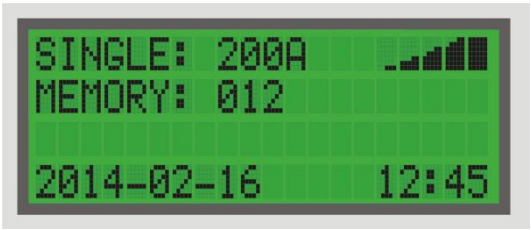
The flashing green LED indicates RMO-A is now ready to start the test. Press the ***START*** button to run a test. At the start of the test, the internal cable connection safety check is done automatically by the device itself. In case of e.g. a disconnection, an alarm is activated and the error message is shown on the display.

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 0 A to the defined maximum value (here 200A).

Figure 3-9:
Single menu during the test



Once the current ramp reaches its maximum value, RMO-A 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 predefined memory location.

Afterwards, RMO-A ramps down the output current from the predefined value to 0 A.
After 0 A is reached, the test is finished and the green LED is ON.

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

3.4.2 Continuous Test

Before the test could be started, a test current, duration of the test and memory location must be defined using **Contin** menu. Press ***ENTER*** to change to the **Ready** state.

Figure 3-10:
Ready state

The **Ready** state displays the selected test current (here **100A**), duration of the test (here **60** sec) and memory location of the result (here **Memory: 020**). If one of these values has to be changed, press ***STOP*** button to return to the **Contin** menu.

The flashing green LED indicates RMO-A is now ready to start the test. Press the ***START*** button to run a test.

During the test, both green and red LEDs flash alternately. The display shows test current (here **100A**) and the current value of the measured resistance (here **94,2µΩ**). The time passed since the beginning of the test is also shown on the display (here **00:35 s)**

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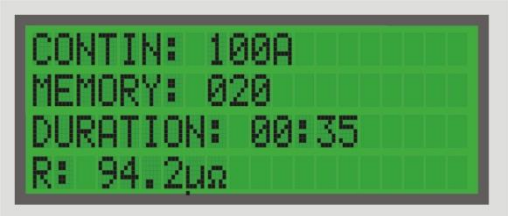
Note: To stop the test at will, please press the *STOP* button at any time during the test. The current will immediately drop to 0 A.

Figure 3-11: **Contin** menu during the test



Upon completion of the test (either due to expiration of selected time or using the ***STOP*** button) the last measured result will remain registered at the previously selected memory location. By pushing the ***Ω*** button the recent test result is stored in the internal device memory.

Note: If DV-Win software is used during the test, all measurements will be registered in the Excel table format, allowing additional editing and graphic presentation options.

When using DV-Win software it is possible to download only the last stored test results from the selected internal memory location.

3.4 Measurement parameters

The table below provides RMO-A device accuracy parameters under the maximal test current per the range being used.

Table 3-1 Measurement parameters for RMO-A series

Range	Recommended Test Current	Nominal Resistance	Full Range Display	Resolution	Typical accuracy
1	100 A - *I_{max}	1 mΩ	999,9 µΩ	0,1 µΩ	± 0,1 % rdg ± 0,1 % FS
2	100 A - 200 A	10 mΩ	9999 µΩ	1 µΩ	± 0,1 % rdg ± 0,1 % FS
3	50 A - 100 A	20 mΩ	20,00 mΩ	10 µΩ	± 0,1 % rdg ± 0,1 % FS
4	20 A - 50 A	50 mΩ	50,00 mΩ	10 µΩ	± 0,1 % rdg ± 0,1 % FS
5	10 A - 20 A	100 mΩ	99,99 mΩ	10 µΩ	± 0,1 % rdg ± 0,1 % FS
6	10 A	500 mΩ	500,0 mΩ	0,1 mΩ	± 0,1 % rdg ± 0,1 % FS
7	5 A	1 Ω	999,9 mΩ	0,1 mΩ	± 0,1 % rdg ± 0,1 % FS

**** I_{max} – maximal test current for appropriate model (e.g. 600 A for RMO600A model)***

3.5 Duty Cycles

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

Table 3-2: Cooling time between single tests

Single Test		
Test current (A)	**Cooling time between first 3 tests (sec)**	**Cooling time after 4 tests (sec)**
5, 10, 20, 50, 100	0	0
200	0	10
300	0	20
400	5	30
500	10	40
600	10	50
Continuous Test		
Test current (A)	**Maximal test duration time (sec)**	**Cooling time (sec)**
5, 10, 20, 50, 100	300	0
200	150	1 x test duration
300	90	2 x test duration
400	50	3 x test duration
500	30	4 x test duration
600	20	6 x test duration

A built-in control prevents these cooling times from being skipped. If a start of the next test attempted within the cooling period, the display shows "Wait" message and a timer displays remaining time till the end of a prescribed cooling period. After a cooling period has elapsed, start the test using the set test parameters by pressing the ***START*** button. Cooling of RMO-A is supported by a built-in fan that is automatically activated every time a test is started from the **Ready** state. It continues running 5 minutes after the test is finished.

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3.6 Test Results

Once a Single test is finished, the RMO-A 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 resistance of the test object and/or the current cables.

The test current value displayed on the device screen is the maximal test current reached.

The **Result** menu is displayed for 12 seconds and the display automatically goes back to the start menu.

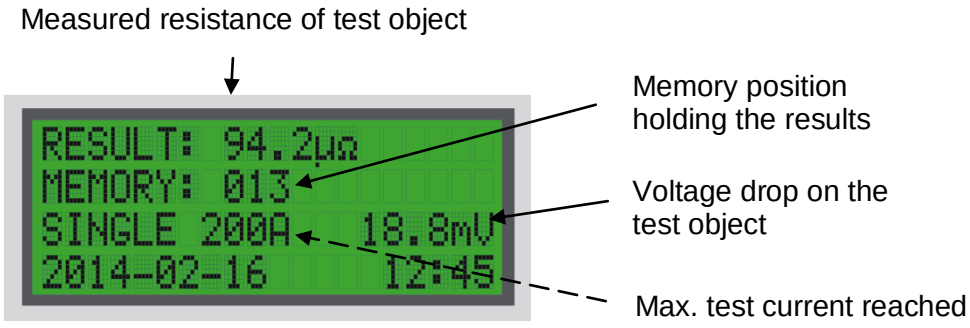

Figure 3-10: **Result** menu showing the test results obtained in Single test

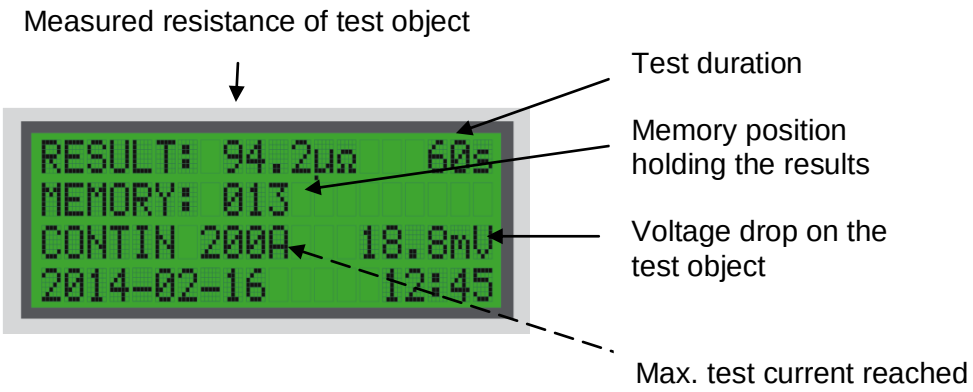

Figure 3-11: **Result** menu showing the test results obtained in Continuous test

The user has two choices:

Starting a new test with the same current value:

- press the ***ENTER*** button to change to the **Ready** state with same test conditions,
- press the ***START*** button to run the test.
  The current value remains the same as in the previous test. The memory position increases by one.

Starting a new test with a different current value:

- press the ***STOP*** button to change to the starting menu (**Single** or **Contin**),
  set a new current value and/or another memory position,
- confirm entries by pressing the ***ENTER*** button,
- start the test by pressing the ***START*** button.

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4 Error Messages

Any operational error is indicated by a red LED and an audio 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 **Single** menu, press the ***STOP*** button.

4.1 Error Message "Connection VS"

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

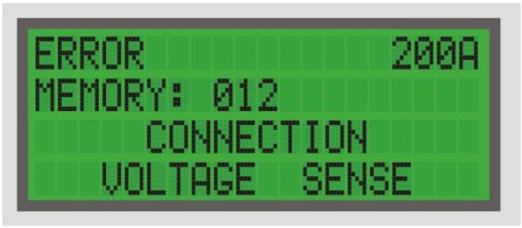


Figure 4-1: Disconnection of a "**Voltage Sense**" cable and corresponding error message

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

4.2 Error Message "Open Connection"

If one of RMO-A current cables ("+" or "-") is disconnected, from the test set or from the test object at the start or during the test, the error message "Open Connection" is displayed.

Figure 4-2: Disconnection of the current cables and corresponding error message

4.3 Error Message "Polarity"

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

Figure 4-3: Error message "Polarity"

4.4 Error Message "Change Current"

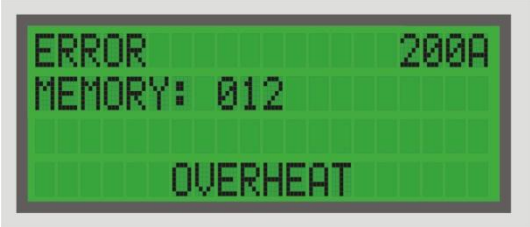
This message is displayed if during the test the voltage at the test object exceeds 5 V. In this case reduce the test current and repeat the test.

Figure 4-4:
Error message
"Change Current"

4.5 Error Message "Overheat"

The message is displayed when RMO-A device'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 4-5:
Error message
"Overheat"



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

4.6 Error Message "Malfunction"

If this message is shown on the display, or if RMO-A cannot operate anymore at all, a serious internal error occurred.

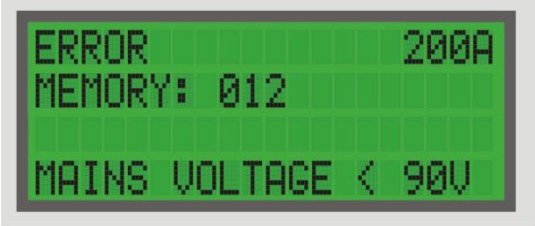
Figure 4-6:
Error message
"Malfunction"

Please do not open RMO-A without permission and instructions given by IBEKO Power AB. Contact the IBEKO Power AB (refer to the Section "Manufacturer Contact Information").

4.7 Error Message "Mains Voltage < 90V"

This message is displayed when RMO-A's mains voltage is below 90 V.

Figure 4-7:
Error message
"Mains Voltage < 90V"



To remove it please restart RMO-A.

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5 Troubleshooting

If it is suspected the device is presenting inaccurate results, the following tests should be performed:

5.1 Maximum current test

If the device is unable to reach the set test current on the test object the following procedure should be performed:

5.1.1 Testing with test shunts

This test can be done in the office or in the field.

1. Connect two test shunts R_1 (100 µΩ) and R_2 (1 mΩ) in series with Micro Ohmmeter as shown in the Figure 5.1. *Please make sure to use only the original set of cables intended for that device.*
2. Set the maximum test current on the RMO device and start the test (**Single** test).
3. If the selected current is reached the device is working correctly.
4. If the selected current cannot be reached, please contact the DV Power Support Team.

5.1.2 Testing with the test object (in the field)

This test is performed in the field, using the test object. Purpose of the test is to measure the total resistance: the resistance of the test object, as well as the resistance of the connections.

1. Connect the RMO device to the test object as shown in the Figure 5.1: Connect the voltage sense clamps to the screws on the current cables clamps. Position the sense conductors outside the loop made by the current cable conductors' leads. *Please make sure to only use the original set of cables intended for that device.*

NOTE: *This connection method is used ONLY for this test. When performing a regular resistance measurement of the test object, it is necessary to make sure that the Kelvin (4-wire) measuring method is applied – the voltage sense connections must be connected directly to the test object, as shown in the Figure 5.1.*

2. Set the maximum current on the RMO device and start the test (Single test).
3. Read the resistance obtained from the RMO device. Please note that in this case the resistance of the test object is increased by the resistance of contacts between Current cables and a test object.
4. If the measured resistance exceeds several hundred micro ohms (~500µΩ) the resistance of the contacts is too high. Please perform the necessary actions to lower the resistance of these contacts.
5. If the measured resistance is low, and the device still cannot reach some test currents, please contact the DV Power Support Team.

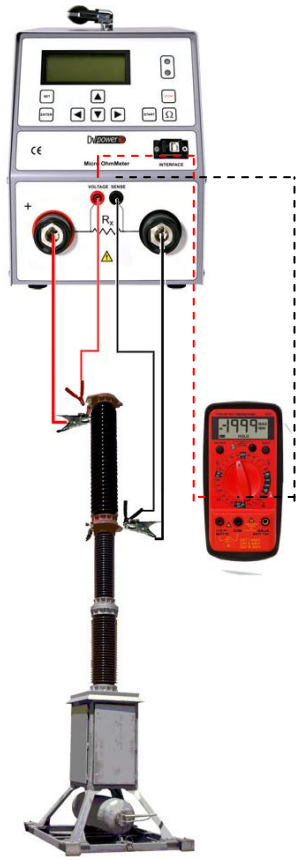

Figure 5.1 – *Test connection scheme*

NOTE: *If a voltmeter is available in the test field, connect the voltmeter to the Voltage Sense inputs of the device. Total resistance of the test object can be calculated by dividing the voltage obtained from the voltmeter by the current generated from the device (shown on the display):*

$$R = \frac{Uv}{Id}$$

5.2 Measurement accuracy check

If suspected the device is presenting inaccurate results, the accuracy check described bellow should be performed:

5.2.1 Accuracy check

1. Connect two test shunts R_1 (100 μΩ) and R_2 (1 mΩ) and Voltage Sense cables as shown in the Figure 5.1.
2. Set Single test on the device, set the first test current from the list and start the test. Read the resistance value measured by the Micro Ohmmeter and compare it to the expected values written in the Table 5.1. Repeat this step for all test currents written in the Table 5.1.
3. Connect the Voltage Sense cables in parallel to the R_2 test shunt and repeat tests described in the previous step.
4. If the measured results differ from the expected values please proceed to the next step (Section 5.2.2) – looking for the root cause of inaccurate measurements.

5.2.2 Test currents check

1. Short circuit the Voltage Sense input of the device and connect a digital voltmeter in parallel to the R_2 test shunt as shown in the Figure 5.2.
2. Set **Contin** test (10s) on the device, set the first test current from the list and start the test. Note the voltage V_2 measured by the voltmeter and compare it to the expected one: $V_2 = I \cdot R_2$.
3. Repeat the test for all test currents specified in the Table 5.2. If the measured voltages do not differ significantly from expected ones, the device is generating current correctly. Please proceed to the next step.

5.2.3 Voltage measurement check

1. Connect the Voltage Sense cables in parallel to the R_1 test shunt and digital Voltmeter in VS input of the device, as shown in the Figure 5.3.
2. Set **Conti** test (10s) on the device, set the first test current from the list and start the test. Note the resistance measured with the RMO device (R_{1meas}), the voltage V_1 measured with the voltmeter, and calculate the resistance:

$$R_{1cal} = \frac{V_1}{I}$$

3. Repeat the test for all the test currents specified in the Table 5.3. If the calculated resistances does not differ significantly from the resistances measured with the RMO device, the device is measuring correctly.

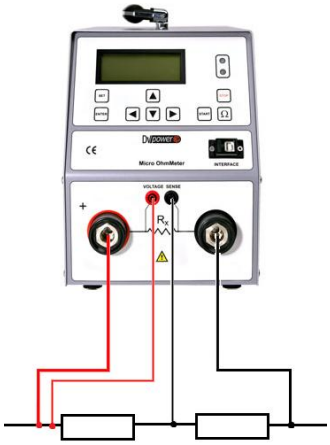

Figure 5.2 – *Connection diagram*

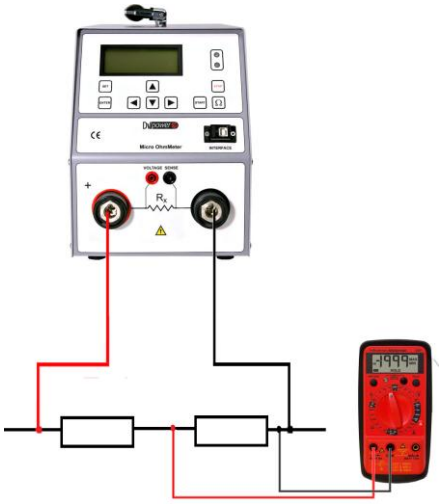

Figure 5.3 –*Connection diagram*

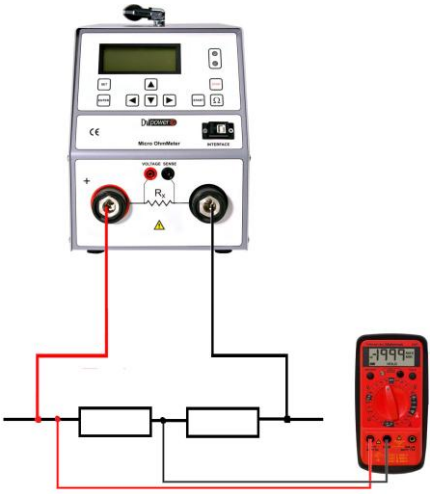

Figure 5.4 – *Connection diagram*

I [A]	R_1 [μΩ]	R_2 [mΩ]
50	*98,9 – 101,1*	*0.989 – 1,011*
100	*98,9 – 101,1*	*0.989 – 1,011*
200	*98,9 – 101,1*	*0.989 – 1,011*
300	*98,9 – 101,1*	*0.989 – 1,011*

Table 5.1 – *Expected results*

I [A]	V_2 [mV]
50	*49,45 – 50,55*
100	*98,9 – 101,1*
200	*197,8 – 202,2*
300	*296,7 – 303,3*

Table 5.2 – *Expected results*

I [A]	R_1 [μΩ]	V_1 [mV]
50	*98,9 – 101,1*	*4,945 – 5,055*
100	*98,9 – 101,1*	*9,89 – 10,11*
200	*98,9 – 101,1*	*19,78 – 20,22*
300	*98,9 – 101,1*	*29,67 – 30,33*

Table 5.3 – *Expected results*

5.3 TestCom application

In case TestCom application is not provided, please contact the DV Power Support Team to request the latest version.

1. Connect the device to a computer and turn it ON.
2. Run the TestCom.exe.
3. Click "Connect" to establish a communication between the device and the computer.
4. Click "Start" and a log file will be generated in the same folder where TestCom.exe is located.
5. Send the log file to DV Power Support Team for analysis.

NOTE: If experiencing problems with running TestCom.exe, please install the Patch.exe, which is included in the TestCom archive. After the installation, it should be possible to run TestCom.exe.

6 Customer Service

Before calling or sending an e-mail to Customer Service for assistance, please perform the following steps:

1. Check all cable connections.
2. Try the test on another instrument, if available.
3. Perform the troubleshoot procedure.
4. Have the following information available:
   - Instrument serial numbers, hardware configuration, and software revision
   - Exact description of the problem, including the test object information, error messages and the sequence of events before it appeared
   - List of solutions that have been tried

The Customer Support Department can be reached at:

Local support (Sweden): +46 8 731 78 24
International support: +46 70 0925 000
E-mail: support@dv-power.com

Note: Email communication is preferred for support issues, since the case is then documented and traceable. Also, the time zone problems and issues with occupied telephones do not occur.

7 Packing the Instrument for Shipment

If you need to send the instrument to DV Power for servicing, please contact the DV Power Customer Service for return instructions at:

Local support (Sweden): +46 8 731 78 24
International support: +46 70 0925 000
E-mail: support@dv-power.com

Note: DV Power is not responsible for shipping damage. Please protect each instrument from shipping and handling hazards carefully. Please ensure protective covers are securely in place. Instruments should be sent to DV Power freight pre-paid, unless other arrangements have been authorized in advance by DV Power Customer Service.

To prepare an instrument for shipment, please follow these instructions:

1. Disconnect and remove all external cables. Do not include manuals and cables, unless recommended by DV Power Customer Service.

2. Reuse the original packing material if it is available. If it is not, pack the instrument for shipment according to the instructions for fragile electronic equipment. It is recommended use two-wall minimum corrugated cardboard box with a minimum 5 cm (2 inch) thick poly foam padding, or a wooden crate with minimum of 5 cm (2 inch) thick poly foam padding all around.

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8 Technical Data

8.1 Mains Power Supply

- Connection — according to IEC/EN60320-1; C320
- Voltage — 90 V – 264 V AC, 50 / 60 Hz, single-phase
- Power consumption

@ **230 V AC**

RMO100A	RMO200A	RMO300A	RMO400A	RMO500A	RMO600A
1210 VA	1890 VA	2360 VA	3520 VA	3930 VA	4560 VA

@ **115 V AC**

RMO100A	RMO200A	RMO300A	RMO400A	RMO500A	RMO600A
1150 VA	1880 VA	2170 VA	2650 VA	3850 VA	4040 VA

- Fuse

RMO100A & RMO200A	12 A / 230 V, type F
RMO300A & RMO400A	15 A / 230 V, type F
RMO500A & RMO600A	20 A / 250 V, type F

8.2 Output data

- Test current

RMO100A	RMO200A	RMO300A	RMO400A	RMO500A	RMO600A
5 – 100 A	5 – 200 A	5 – 300 A	5 – 400 A	5 – 500 A	5 – 600 A

- Max load interval @ I max

RMO100A	RMO200A	RMO300A	RMO400A	RMO500A	RMO600A
300 s	150 s	60 s	60 s @300 A	30 s	20 s

- Full Load Voltage*

@ **230 V of supply voltage**

RMO100A	RMO200A	RMO300A	RMO400A	RMO500A	RMO600A
7.25 V	7.10 V	5.90 V	6.60 V	5.90 V	5.70 V

@ **115 V of supply voltage**

RMO100A	RMO200A	RMO300A	RMO400A	RMO500A	RMO600A
6.90 V	6.10 V	4.70 V	4.30 V	5.00 V	3.70 V

maximal output voltage at maximal test current

8.3 Measurement data

- Resistance range — 0.1 µΩ – 999.9 mΩ
- Resolution

0.1 µΩ – 999.9 µΩ	0.1 µΩ
1.000 mΩ – 9.999 mΩ	1 µΩ
10.00 mΩ – 99.99 mΩ	10 µΩ
100.0 mΩ – 999.9 mΩ	0.1 mΩ

- Typical accuracy — ± (0.1 % rdg + 0.1 % FS)

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8.4 Environmental conditions

- Operating temperature: -10 ºC - +55 ºC / +14 ºF - +131 ºF
- Storage & transportation: -40 ºC - +70ºC / -40 ºF - +158 ºF
- Humidity 5 % - 95 % relative humidity, non condensing
- Installation/overvoltage category II
- Pollution degree 2

8.5 Dimensions and Weight

- Dimensions: (W x H x D) 198 mm x 255 mm x 380 mm / 7.8 in x 10 in x 15 in

- Weight:

RMO100A	RMO200A	RMO300A	RMO400A	RMO500A	RMO600A
7 kg / 15.4 lbs	7 kg / 15.4 lbs	7.5 kg / 16.5 lbs	7.5 kg / 16.5 lbs	8 kg / 17.5 lbs	8 kg / 17.5 lbs

8.6 Data storage and transfer

- Internal memory locations 500 result sets
- Connection Interface USB serial interface to connect to an external computer
  RS232 interface (optional)

8.7 Printer (optional)

- Thermal printer Paper width 80 mm

8.8 Safety Standards

- European standards EN 61010-1
  LVD 2006/95/EC
- International standards IEC 61010-1
  UL 61010-1
  CAN/CSA-C22.2 No. 61010-1, 2nd edition, including Amendment 1

8.9 Electromagnetic Compatibility (EMC)

- CE conformity EMC standard 89/336/EEC
  EMC directive 2004/108/EC
- Emission EN 61326-1
- Interference Immunity EN 61326-1

8.10 Mechanical Protection

- Ingress Protection Rating IP43

9 Instrument & Accessories

Instrument with included accessories	Article No
Micro Ohmmeters RMO-A - DV-Win PC software including USB cable - Mains power cable - Ground (PE) cable	RMO**X**00A-N-00

Recommended accessories	Article No
Current cables 2 x 5 m, ***XX** mm^2 with battery clips	C2-05-**XXY**MB**Y**
Sense cables 2 x 5 m with alligator clips	S2-05-02BPA1
Cable bag	CABLE-BAG-00
Device bag	DEVIC-BAG-00

Optional accessories	Article No
Transport case	HARD-CASE-RA
Test shunt 100 µΩ (600 A/60 mV)	SHUNT-600-MK
Current cables 2 x 10 m, ***XX** mm^2 with battery clips	C2-10-**XXY**MB**Y**
Current cables 2 x 15 m, ***XX** mm^2 with battery clips	C2-15-**XXY**MB**Y**
Current extension cable 2 x 10 m, ***XX** mm^2	E2-10-**XXY**M**Y**F
Sense cables, extension 2 x 10 m	E2-10-02BPBP
Sense cables 2 x 10 m with alligator clips	S2-10-02BPA1
Sense cables 2 x 15 m with alligator clips	S2-15-02BPA1
Built-in thermal printer	PRINT-080-00

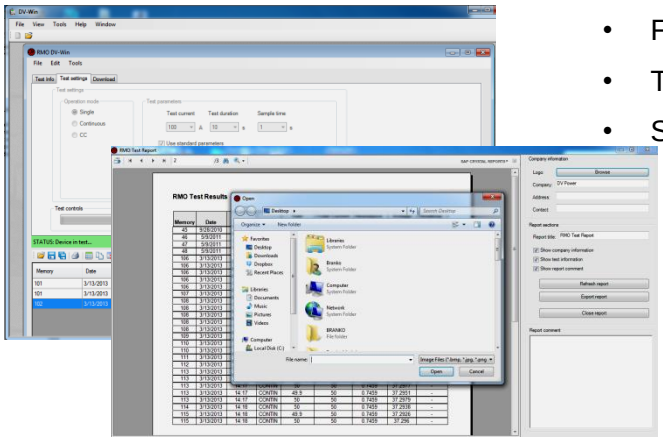
***XX - Cross-section of current cables varies, depending on the ouput power of the model.**
****Y**MB**Y – For RMO100A and RMO200A: Y**MB**Y=L**MB**1; For other models: Y**MB**Y=V**MB**3**

Recommended cross-sections of the current cables for RMO-A models:

CROSS SECTION/ LENGHT	16 mm^2	25 mm^2	35 mm^2	50 mm^2	70 mm^2
5 m	RMO100A	RMO200A	RMO300A & RMO400A	RMO500A & RMO600A	-
10 m	RMO100A	RMO200A	RMO300A & RMO400A	RMO500A & RMO600A	-
15 m	-	RMO100A	RMO200A	RMO300A & RMO400A	RMO500A & RMO600A

DV-Win software

***included in the purchase price**



- Full control of the device in test
- Test reports available in several formats
- Several filters for results download to a PC
- Test plans
- Sampling time feature for CONTIN mode
- Detailed Help menu

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