MRM-100-V2

Digital micro-ohmmeter

User's guide

GF-XXXX

Safety Precautions

- Before to use this instrument the User Guide and Safety warnings must be read and understood.
- Safety procedures and rules for working near high voltage energized systems must be observed during the use of this equipment. The generated voltages and currents may be dangerous.
- Before you begin the measurement verify the mains supply voltage compatibility.
- The micro-ohmmeter must be connected to earth point, through the green terminal or the power cord (both use the same point).
- During a circuit breaker measurement its contacts must be closed and connected to an earth point. The end connected to an earth point must be connected to the "**C-**" terminal.
- Certified the measurement points in which will be connected all the terminals are free of any voltage in relation to earth point and between each other. Take in account that in a substation you will find in disconnected points high potential levels in relation to the earth point. Those potentials are caused by present electromagnetic fields and can be minimized following the indications in the paragraph before.
- Make sure that the current connections are well connected as well as the C-clamp, to avoid undesirable heating.
- Be careful when manipulating the current terminals in the instrument. You may get high temperatures in the current connections.
- Never connect or disconnect the cables during a measurement. If you must modify any connection, it must be made after you have pressed the Stop button.
- The equipment must be kept dry and clean.
- Never use the equipment if you suspect regarding its functionality. The equipment must to be put out of service (contact your distributor service department).

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

Used symbols

	Caution, refer to User Guide.
	Printer.
	USB (Universal Serial Bus).
	30 V max. (to ground): indicates the maximum potential allowed in the terminals during resistance measurements.
	Warning, hot surface. Be careful when handling.
	Equipment complies with current EU Directives.
	Double insulation: symbol indicates that the equipment is classified as Class II (double isolated).
	The rubbish bin with a line through it means that in the European Union, the product must undergo selective disposal for the recycling of electric and electronic material, in compliance with Directive WEEE 2002/96/EC.

Index

1. Description

The **MRM-100-V2** high-current micro-ohmmeter is a portable, digital instrument. It has optimized filters and protections for measurements in electrical substations. Can be used to accurately measure very low contact resistances of high voltage circuit-breakers and switches, busbars, etc., with test currents up to 100A. It employs the 4 terminals-method (U/I measuring principle) to avoid errors caused by test leads and their contact resistances.

Measurement accuracy is guaranteed by a state-of-the-arts signal amplification system, offset-free and of high long-term stability. Resistances readings are shown in the alphanumeric display with up to 4½ digits-resolution. It allows to measure resistances up to 300 mΩ, and the best resolution is 0.1 μΩ.

It has an internal memory for up to 4000 measurements divided into multiple records. The data output (USB) may be connected to a computer to download the stored values.

This equipment incorporates an open ModBus protocol and can be controlled remotely through an Android application or via USB by customized software, labview and PLC

The high-current generation system is based on modern technology that allows to significantly decrease both its weight (approx. 11kg) and size. The cabinet is made of plastic material highly resistant to impacts and to environmental challenges. Internal thermal sensors in all sensitive components avoid any damage caused to the instrument due to overheating.

This is strong but lightweight equipment, and may be easily carried by one person. It is water-resistant and can be used under severe weather conditions (IP54 with closed lid) offering an excellent performance working both in the laboratory and out in the field.

1.1. Operating principle

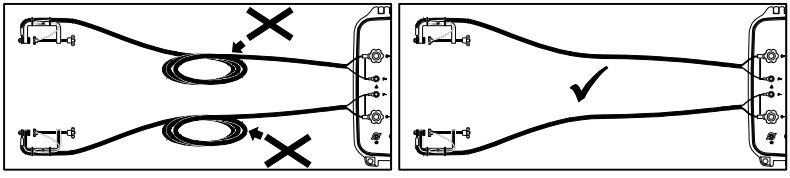
This device uses the Kelvin Bridge architecture, with four terminals, avoiding testing leads resistance to cause error during measurement. The operator may choose test current and the reading is obtained by comparison through internal high-stability standards. The result appears in the alphanumeric display that is very easy to read.

1.2. ⚠ Use of test probes

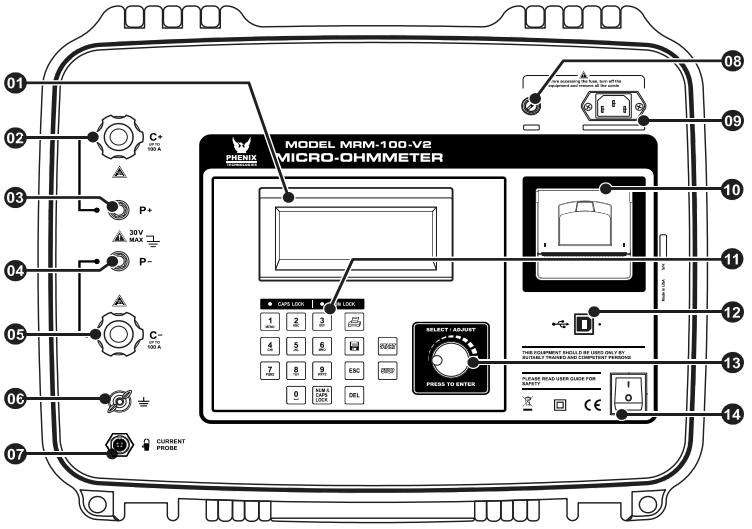
WARNING

Only use the test leads supplied with the equipment, for measurement and calibration procedure.

- Make sure that the current connections are well connected as well as the C-clamps, to avoid undesirable heating.
- Attention when manipulating the current terminals of the instrument. You may get high temperatures in the current connections.
- Make sure that the cables are straight during the measurement to avoid overheating.



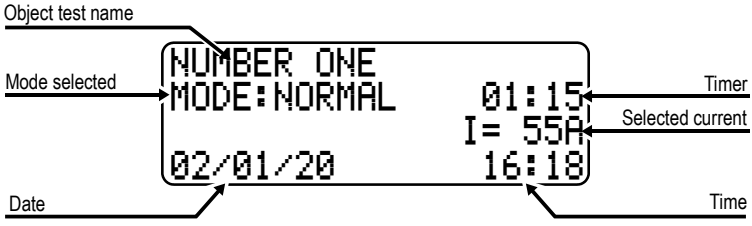
2. Control panel



01 Display.
02 Current terminal (C+).
03 Potential terminal (P+).
04 Potential terminal (P-).
05 Current terminal (C-).
06 Ground.
07 Auxiliary current clamp connector.
08 Fuse.
09 Power cord connector.
10 Printer.
11 Keyboard.
12 USB connector.
13 Test current control.
14 On/Off switch.

3. Display

Alphanumeric LCD display where the measurement result, the corresponding measuring unit, the elapsed time since the measurement started and messages to the operator are displayed.



Built-in chronometer

It features the elapsed time (in minutes and seconds) since test current is applied.

Real time clock

It has a real time clock with date, hours and minutes indication, to make identification of tests recorded in paper or in memory easier.

Test number

Tests are automatically numbered by the equipment to make their identification easier. The test number is printed at the beginning of each test and it is stored in memory.

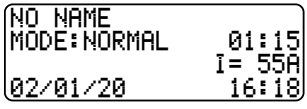
Model and serial number

At the beginning of each test, the equipment model, as well its serial number, are registered, making it possible to relate the obtained results with their respective equipment Calibration Certificate.

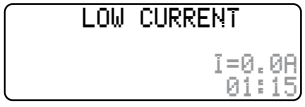
3.1. Display messages

When turning the equipment on using the **On/Off** switch, this introduction message appears for a while.

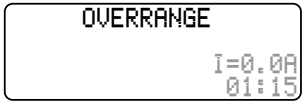
The equipment is carrying out some functional verifications.



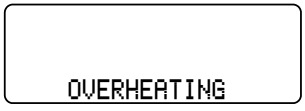
Main screen where a test can be started, or set a new one.



Indicates that the test current is not enough to carry out the reading.



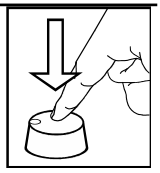
Indicates that the measured resistance is higher than the maximum value readable.



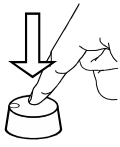
Indicates that some part of the equipment has achieved the critical temperature. Thus the system will cut the high current generation.

4. Settings and Adjustments

This equipment has a MENU for settings and adjustments. To access the MENU, press the **Selector / Adjust** (◯), or press [1 MENU] button.



All navigation is performed through the ◯ and all panel keys are disabled, with the exception of the key [STOP] that has the function to cancel and return to the initial screen.

[1 MENU]	Open MENU
	Short press: Open MENU, open selected sub-menu / confirm settings.
	Change selection / values
[ESC]	Cancel
[STOP]	Cancel and close the MENU

ATTENTION: The configuration MENU can not be accessed during the tests.

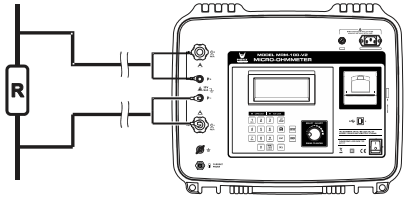
MENU	SUBMENU	DESCRIPTION
SETUP TEST		
	EDIT OBJECT NAME	Allows write the name of the object under test, using the alphanumeric keyboard.
	TEST MODE	Allows to select the test mode: MANUAL or AUTOMATIC.
	TEST CURRENT	Allows to select the test current for Automatic Mode.
	TEST DURATION	Allows to setup the test duration between Unlimited (there is not any pre-selected test duration) and Limited (minimum of 15 seconds and maximum of 2 minutes).
	BOTH SIDE GROUNDED	Turn on and off the BSG test.
LANGUAGE		Allows you to change the interface language between: English and Spanish.
MEMORY		
	USAGE	Displays the percentage of internal memory used.
	DELETE	Deletes all records from memory.
SETTINGS		
	DATE FORMAT	Selecting the date format.
	TIME FORMAT	Selecting the time format.
	SET DATE	Setting the date.
	SET TIME	Setting the time.
	AUTO SAVE	Save the last measured value in the internal memory when the test is finished.
	DISPLAY	Setting the display.
	SYSTEM INFO	Displays the firmware version and serial number.

5. Measurement

- The User Manual and its respective safety precautions must be read and understood before using the micro-ohmmeter.
- The usual safety precautions and safety regulations must be strictly observed.
- It should be checked that the item to be measured is voltage free.
- To ensure safety, use only the accessories supplied by the manufacturer.

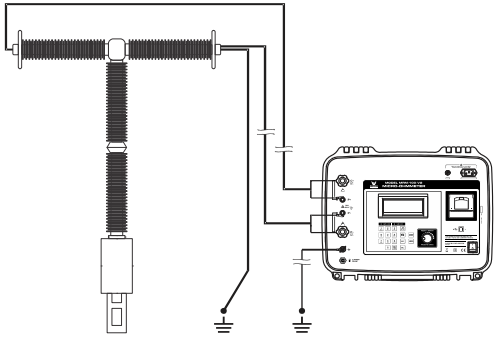
1. Before turning the equipment On, connect the test leads to the item to be measured and to the front panel terminals.

Simple measurement



Measurement with potential risk

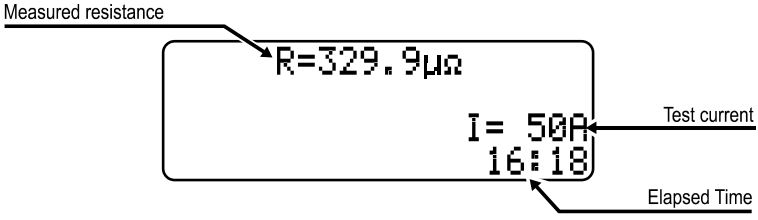
Ex .: High voltage circuit breaker under external influence of electromagnetic fields from nearby energized devices.



⚠ The safety ground terminal must be connected before making the other connections to the equipment.

2. Turn on the device with the **On / Off** key ( ).
3. The **display** of the equipment will show the presentation message **MRM-100-V2**.
4. *The **AUTO VERIFICATION** message will appear next and then **PRESS START**.*
5. *Access the device's MENU using the or 1 MENU button.*
6. Select ***SETUP TEST***.
7. To change the object's name, select EDIT OBJECT NAME and write using the equipment keyboard (press *to confirm)*.
8. Select ***TEST MODE*** *to* chose between MANUAL or AUTO (explained below)
9. When the current value is equal to or greater than 5 A, the display will indicate the measured resistance.

10. Upon completion of this process the **display** will indicate the measured resistance value, the elapsed time, the test current and (on BSG mode) the ground current.



Display on AUTO or MANUAL mode

Display on BSG mode

11. The unit of measured resistance shall be expressed in Ω (ohms), mΩ (mili-ohms) or µΩ (micro-ohms).

12. This information can be saved in the internal memory during and / or after the test simply by pressing the **save key** .

13. To finish the test press the red **stop key** . Do not turn off the product with the **power** switch without pressing the stop button .

14. Finally, after all measurements have been completed, switch the device off using the **on / off** switch .

Caution: *Never connect or disconnect the test leads with the equipment performing tests. If you have to make any changes to the connection, it must be done with the equipment in stand-by (not generating current) or turned off.*

5.1. Manual mode

In **manual mode**, the operator selects and adjusts the current value **during** the test, using the ◯.

1. *Access the device's MENU pressing the ◯ or [1 MENU] button.*
2. *Use the ◯ to select **SETUP TEST**, and pressing the ◯ to confirm.*
3. *Use the ◯ to select **TEST MODE**, and pressing the ◯ to confirm.*
4. *Use the ◯ to select **MANUAL**, and pressing the ◯ to confirm.*
5. *Exit the menu and start the test.*
6. *During the test, select the current using the ◯.*

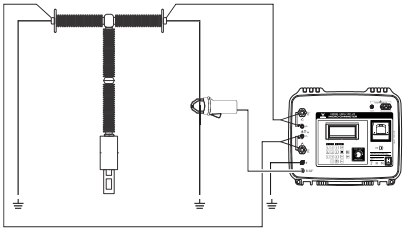
5.2. Auto mode

In **auto mode**, the operator preselects the current value **before** the test (the pre-selected value cannot be changed during the test)

1. *Access the device's MENU using the ◯ or [1 MENU] button.*
2. *Use the ◯ to select **SETUP TEST**, and pressing the ◯ to confirm.*
3. *Use the ◯ to select **TEST MODE**, and pressing the ◯ to confirm.*
4. *Use the ◯ to select **AUTO**, and pressing the ◯ to confirm.*
5. *Choose the test current value, between **50 A** to **100 A** (using the ◯ or the keyboard).*
6. *Exit the menu and start the test.*

5.3. Both Side Ground (BSG)

The BSG (Both Side Grounded) test mode provides to the user and to the equipment a safer way to test objects in a substation since the both sides of a switch, contact or circuit breaker is maintained connected to the ground during the whole test.



ATTENTION: To perform this procedure, place the auxiliary current clamp on the ground of the test object before turning on the equipment

1. *Access the device's MENU using the ◯ or [1 MENU] button.*
2. *Use the ◯ to select **SETUP TEST**, and pressing the ◯ to confirm.*
3. *Use the ◯ to select **BOTH SIDE GROUNDED**, and pressing the ◯ to confirm.*
4. *Use the ◯ to select **ON**, and pressing the ◯ to confirm.*
5. *Exit the menu and start the test.*

6. Protections

The **MRM-100-V2** continuous use time is limited by thermal considerations. Some internal sensors measure the temperature of the sensitive parts and trigger the protection that will cut the current circulation, if any of them exceeds the limit temperature, thus avoiding any damage. The **OVERHEATING** message will appear in the display. Under these conditions, measurements will be inhibited up to the temperature decreases sufficiently.

7. Printer

To print a result, press the [🖶] key during a measurement.

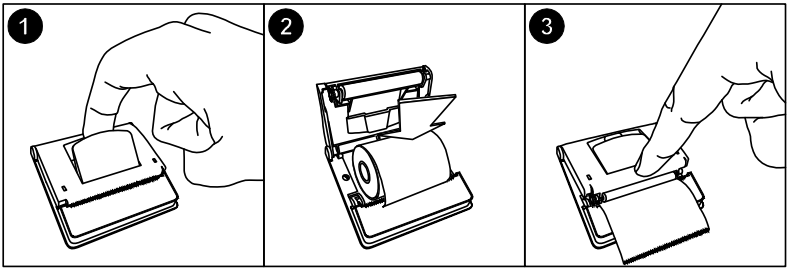
ATTENTION: Don't pull the paper. The printer can be easily damaged.

This printer uses 2.2" (57 mm) -wide thermal paper, which comes in a 1.18" (30 mm)-diameter reel.

Precautions

- Perform the procedures below with the equipment turned off.
- Disconnect the equipment from the mains supply and remove the power cord.
- Disconnect the test leads.

1. Pull the lever located on the lid.
2. Insert the paper reel as shown in the figure.
3. Keep the tip of the paper out of the printer and close the lid.



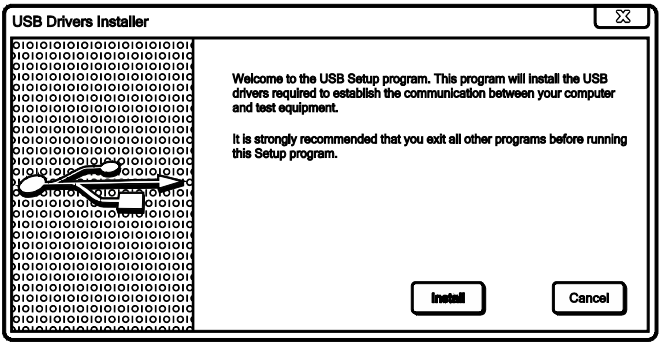
8. Internal memory

This device has internal memory for up to 4,000 measurement values.

9. Software

To install the USB drivers required for the communication between PC and equipment follow the instructions:

- Connect the equipment in the PC using the USB cable.
- If there is an available Internet connection, Windows will silently connect to the Windows Update website and install any suitable driver it finds for the device. If no suitable driver is automatically found then you need to insert the CD-ROM, supplied with the equipment, in the PC, run the executable "**usb-install.exe**" and click in "**Install**".



9.1. PXLogger Software

This software makes communication between the equipment and a computer with Windows operative system easier. It makes it possible to synchronize the date and time of the equipment internal clock with the computer date and clock, to transfer the stored date, to clear the memory, to generate tests reports, etc.

10. Remote control

The Phenix Technologies equipment that have Bluetooth interface can be controlled remotely via an Android device running PHENIX Remote Control application.

Minimum requirements

- Android 4.4 KITKAT System or higher;
- Bluetooth Communication.

Pairing

To perform the pairing between equipment and Android device, follow the procedure:

- To enable the Bluetooth, in screen “Applications”, tap "Settings" > "Bluetooth" and drag the Bluetooth slider to the right.

- To pair your equipment, on screen "Applications", tap "Settings" > "Bluetooth" > "Search". Select the equipment and wait for the end of the pairing (If necessary, accept the automatically generated password to confirm or enter the PIN 1234).

Since the equipment communicates through a highly defunded and open protocol in the industry - Modbus - It is possible for any user to custom their own remote control or automated test system.

All the setup, real-time control, measurement monitoring, as well the test data recording recall may be made using Modbus over USB or Bluetooth. Consult our technical support to get the equipment's memory map and instruction on how to do it.

11. ⚠ Replacement fuse

Precautions

⚠ • Perform the procedures below with the equipment turned off.
• Disconnect the equipment from the mains supply and remove the power cord.
• Disconnect the test leads.

• Disconnect the equipment from the mains, unplugging the power cord.
• With a screwdriver, remove the fuse holder cover, lightly pressing the lid and turning ¼ counter clockwise.
• Remove the blown fuse and insert a new fuse in the fuse holder cover.
• Place the cover in the compartment and with the screwdriver turn ¼ clockwise or until the fuse holder cover properly fits the fuse compartment.

Fuse Schurter, model SPT 5x20 (Time-lag) 10A/250V. High breaking capacity.

⚠ To replace the fuse, use only the fuse type specified in the equipment.

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 Control Panel of this equipment.

⚠ To avoid electrical shock, make sure that the equipment is completely dry before Power it On.

13. Technical specifications

Test currents	: 5 A up to 100 A (True DC). The test current can be set in steps of 0.2 A between 5 A to 20 A and steps from 1 A between 20 A to 100 A.
Resistance ranges	: 0.1 µΩ up to 2 mΩ with 0.1 µΩ resolution. 2 mΩ up to 300 mΩ with 10 µΩ resolution.
Measurement principle	: Four-terminal, Kelvin-type.
Basic accuracy of resistance measurement	: ± 1% of the measured value from 50 µΩ to 300 mΩ.
Auxiliary clamp accuracy	: 1% + 3 digits.
Auxiliary clamp measuring range	: 0.1 ADC to 60 ADC.
Advanced features	: Digital direct reading of very low resistances in the alphanumerical LCD display, with up to 4½ digits. Very fast and accurate measurements.
Built-in printer	: Allows print the measured values.
Built-in memory	: Stores up to 4000 measurements divided into multiple records.
Communication protocol	: ModBus.
Interface	: USB, for configuration, control and download of stored values.
Bluetooth	: For configuration and control.
PXLogger Software	Friendly, easy to use software. Tests are represented in tabular views. With automatic report generator, including the operator's commentaries.
Environmental protection	: IP54 with closed lid.
Safety class	: Meets the requirements of IEC 61010-1

Power supply	**:** 100-240 V~ mains supply.
Operating temperature range	**:** 32°F to 122°F (-0°C to 50°C)
Storage temperature range	**:** 14°F to 158°F (-10°C to 70°C)
Humidity range	**:** 95% RH (non condensing)
Weight	**:** Approx. 24.25 lb (11 kg)
Dimensions	**:** 19.76" x 15.51" x 7.48" (502 x 394 x 190 mm)
Accessories	**:** 2 Combined current and potential leads. 1 Ground cable. 1 Auxiliary current clamp. 1 USB cable. 1 Power cord. 1 PXLogger software license. 1 User guide. 1 Carrying bag. 1 Android App

Subject to technical change without notice.

Notes

Notes