



MRM-200-V2

200 A digital micro-ohmmeter

User guide



Parts of this manual may differ from your equipment, depending on your country, hardware and / or firmware version and are subject to change without notice.

Safety warnings

- 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.
	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.

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Description

The **MRM-200-V2** 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. It employs the 4 terminals-method (U/I measuring principle) to avoid errors caused by test leads and their contact resistances.

The **MRM-200-V2** has a cooling system that allows making a large number of consecutive tests without activation of thermal protection. Under normal ambient conditions (25 °C) it can perform up to 30 consecutive tests with duration of 1 minute and 1 minute interval, time usually spent for repositioning the cables in another test point.

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.

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 1 Ω, and the best resolution is 0.1 μΩ.

This equipment incorporates the open protocol Modbus and can be remote controlled through an Android app or through 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. 11 kg) and size. Internal thermal sensors in all sensitive components avoid any damage caused to the instrument due to overheating.

This is a 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.

Operating principle

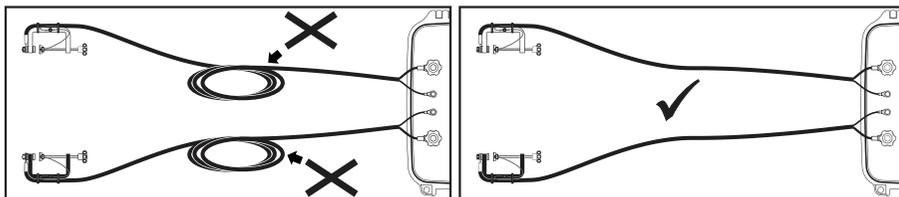
This device uses the Kelvin Bridge architecture, with four terminals, avoiding testing leads resistance to cause error during measurement. The operator may choose test current and the reading is obtained by comparison through internal high-stability standards. The result appears in the alphanumeric display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

■ Use of test probes

WARNING

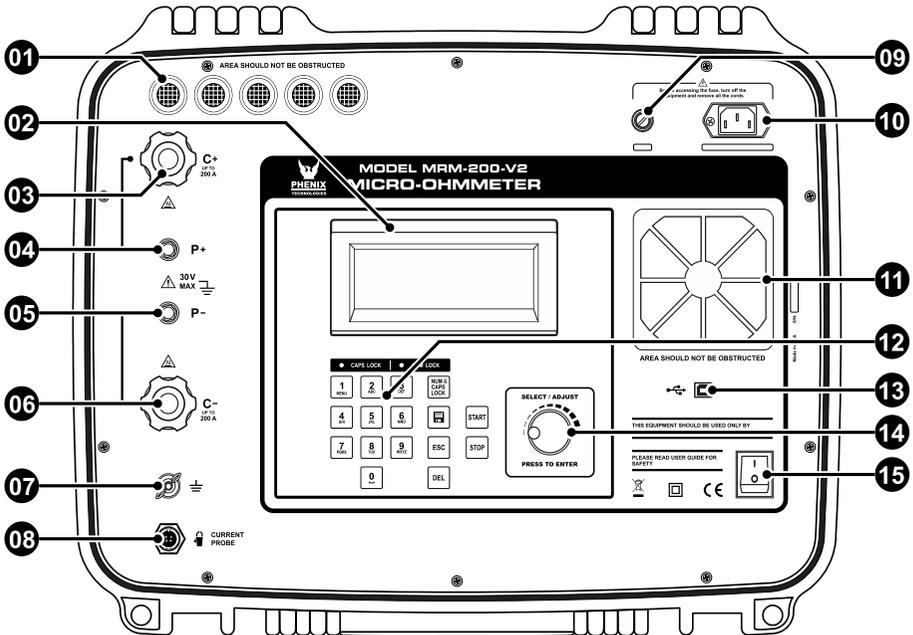
Only use the test leads supplied with the equipment, for measurement and calibration procedure.

- 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



MRM-200-V2

■ Control panel

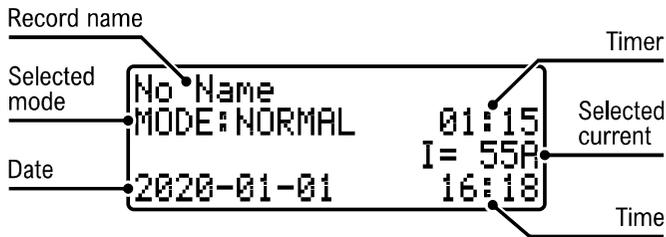


01	Air exit
02	Display
03	Current terminal (C+)
04	Potential terminal (P+)
05	Potential terminal (P-)
06	Current terminal (C-)
07	Ground
08	Auxiliary current clamp connector

09	Fuse
10	Power cord connector
11	Cooling system
12	Keyboard
13	USB connector
14	Test current control
15	On/Off switch

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 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.

■ Display messages

AUTO CHECK

The equipment is carrying out some functional verifications.

No Name
MODE: NORMAL 01:15
 I = 55A
2020-01-01 16:18

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

LOW CURRENT

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

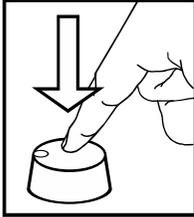
OVERRANGE

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

OVERHEATING

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

Settings and adjustments



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

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

	Open MENU
	Short press: Open MENU, open selected sub-menu / confirm settings
	Change selection / values
	Cancel
	Cancel and close the MENU

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

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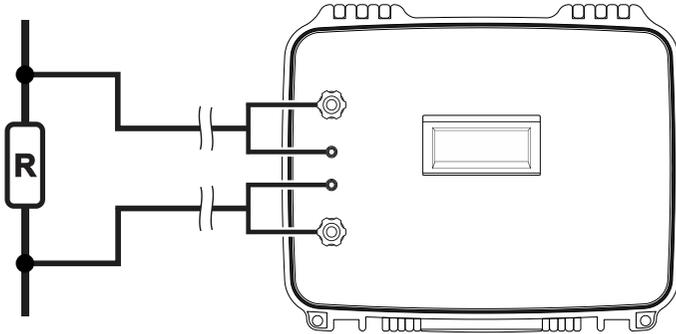
MENU	SUB-MENU	DESCRIPTION
SETUP TEST	EDIT OBJECT NAME	Allows write the name of the object under test, using the alphanumeric keyboard.
	TEST MODE	Allows to select the test mode: MANUAL or AUTOMATIC.
	TEST CURRENT	Allows to select the test current for Automatic Mode.
	TEST DURATION	Allows to setup the test duration between Unlimited (without test duration setting) 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.
MEMORY	USAGE	Displays the percentage of internal memory used.
	DELETE	Deletes all records from memory.
SETTINGS	DATE FORMAT	Selects the date format.
	TIME FORMAT	Selects the time format.
	SET DATE	Sets the date.
	SET TIME	Sets the time.
	AUTO SAVE	Save the last measured value in the internal memory when the test is finished.
	DISPLAY	Display settings.
	SYSTEM INFO	Shows the firmware version and serial number.

Operating the equipment

- The User guide 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.

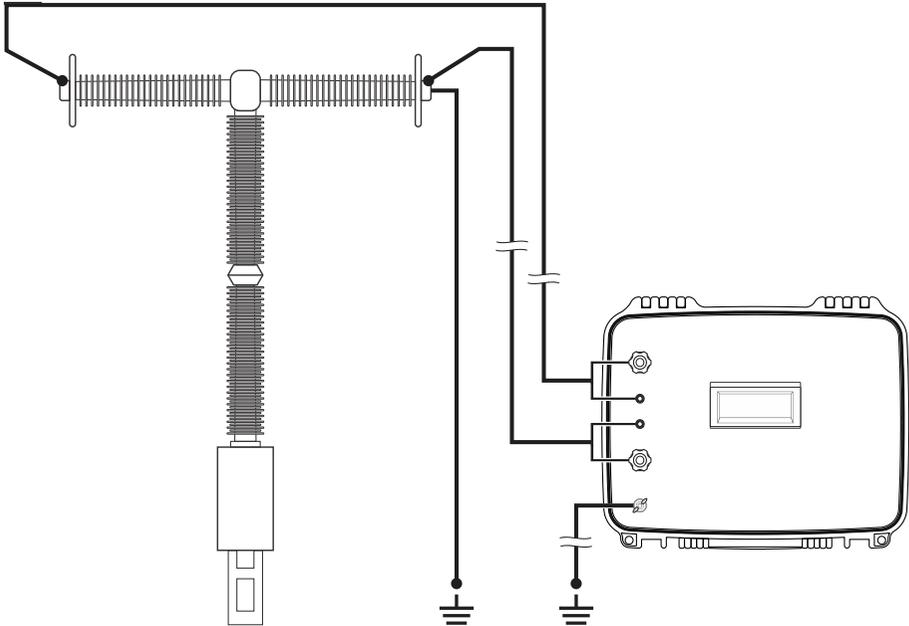
Simple measurement



MRM-200-V2

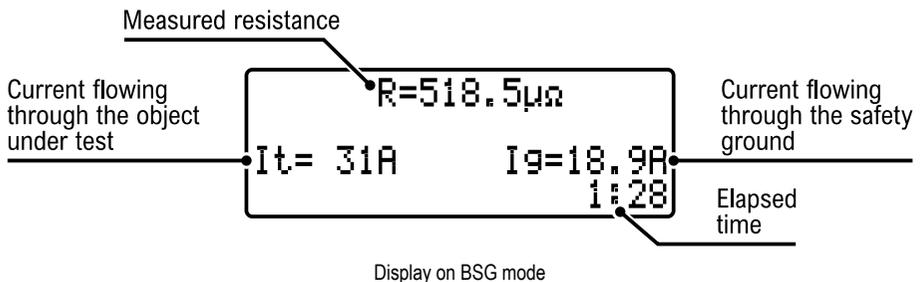
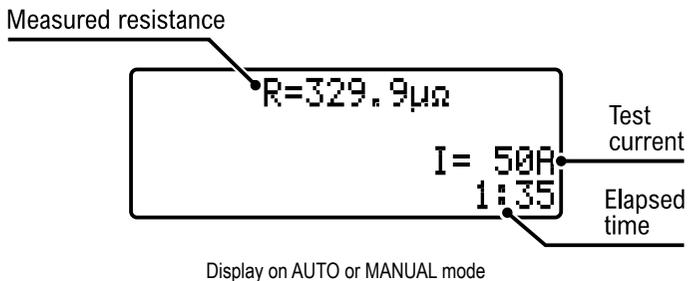
Measurement with potential risk

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-200-V2**.
4. The AUTO CHECK message will appear next and then the main screen.
5. Access the device's MENU using the  or  key.
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.



11. The unit of measured resistance shall be expressed in Ω (ohms), $m\Omega$ (mili-ohms) or $\mu\Omega$ (micro-ohms).
12. This information can be saved in the internal memory during and / or after the test simply by pressing the  key.
13. To finish the test, press the red  key. Do not turn off the equipment with the power switch () without pressing the  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.

■ 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  button.
2. Select SETUP TEST and press  to confirm.
3. Select TEST MODE and press  to confirm.
4. Select MANUAL and press  to confirm.
5. Exit the menu and start the test.
6. During the test, adjust the current using .

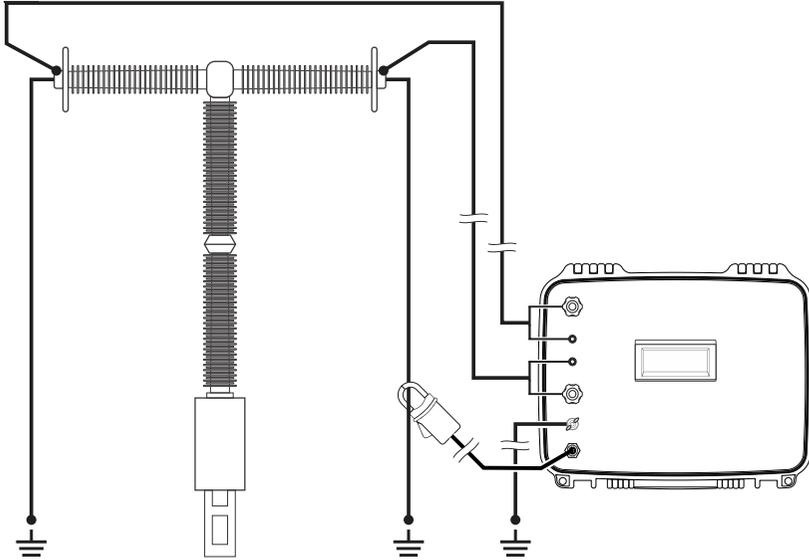
■ Auto mode

In auto mode, the operator preselects the current value before the test (the preselected value cannot be changed during the test).

1. Access the device's MENU pressing the  or  button.
2. Select SETUP TEST and press  to confirm.
3. Select TEST MODE and press  to confirm.
4. Select AUTO and press  to confirm.
5. Choose the test current value using  or the keyboard.
6. Exit the menu and start the test.

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 pressing the  or  button.
2. Select SETUP TEST and press  to confirm.
3. Select BOTH SIDE GROUNDED and press  to confirm.
4. Select the ON option and press  to confirm.
5. Exit the menu and start the test.

Protections

The **MRM-200-V2** continuous using time is limited by thermal considerations. Some internal sensors measures the temperature of the sensitive parts and trigger the protection that will stop the current generation if any of them exceeds the limit temperature, thus avoiding any damage. The OVERHEATING message will appear in the display.

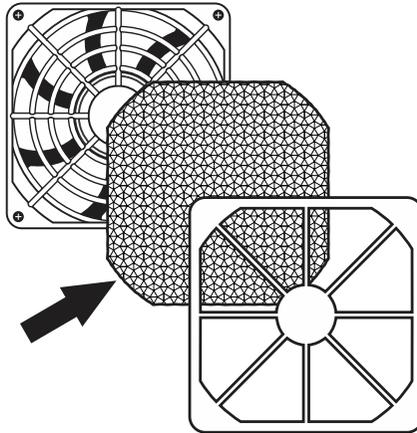


Under these conditions, measurements will be inhibited up to the temperature decreases sufficiently.

Cooling system

The **MRM-200-V2** has a cooling system that allows it to perform a large number of consecutive tests without activating the thermal protection. Under normal environmental conditions you can perform up to 30 consecutive tests with duration of 1 minute and 1 minute interval. This interval is usually used for repositioning the test lead in another test point.

The cooling system filter must be replaced periodically. Changing the filter can be easily performed. Pull the grid up, replace the filter and place the grid again in the panel.



The lack of filter maintenance can decrease the cooling efficiency and thus the amount of consecutive tests. You should use only filters supplied by PHENIX.

Internal memory

The internal memory can store up to 4000 readings, organized by records. Each record works like a folder where all readings saved will be stored in until the operator creates another folder (record). During a measurement, when you want to save a measured value, press the  key.

Desktop software

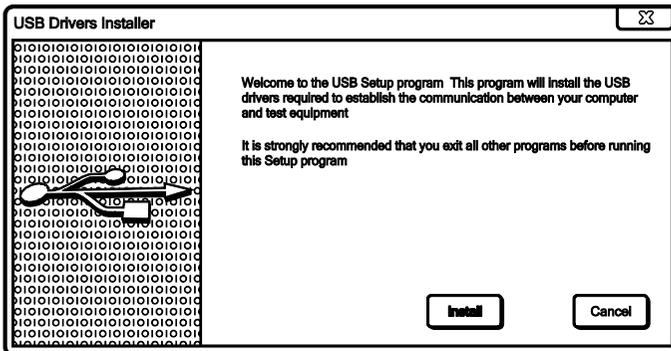
The **PXLogger** software makes communication between the equipment and a computer with Windows operative system easier. It makes possible to:

- Synchronize the date and time of the equipment internal clock with the computer date and clock
- Transfer the stored data
- Clear the internal memory
- Generate tests reports, etc

USB drivers

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”.



Android software

The **PHENIX** equipment that have Bluetooth interface can be controlled remotely via an Android device running **PHENIX Remote Control** app.

■ 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 the open protocol Modbus, it's possible for any user to create 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.

Maintenance

Before each use, check the equipment for visible damage to the enclosure, panel, cables and accessories. If any malfunction or damage is found that could compromise the safety of the equipment, do not use it and contact the Service Center.

■ Cleaning

The panel, terminals and connectors of the equipment must stay dry and clean. Cleaning should be made using a slightly damp cloth in water and a soft detergent or isopropyl alcohol (be sure that the products to be used for cleaning does not affect plastic goods).



Before cleaning the equipment, disconnect the equipment from the mains and disconnect all cables.



After cleaning and before plugging in again, make sure that the equipment is completely dry to avoid risk of electric shock and malfunction of the instrument.

■ Fuse replacement

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

Fuse specifications:

Fuse Schurter
Model SPT 5 x 20 mm, Time-lag T, 10 A / 250 V~
High breaking capacity

1. Disconnect the equipment from the mains, unplugging the power cord.
2. With a screwdriver, remove the fuse holder cover, lightly pressing the lid and turning $\frac{1}{4}$ counter clockwise.
3. Remove the blown fuse and insert a new fuse in the fuse holder cover.
4. Place the cover in the compartment and with the screwdriver turn $\frac{1}{4}$ clockwise or until the fuse holder cover properly fits the fuse compartment.



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

Technical specifications

ELECTRICAL	
Test current	From 5 A up to 200 A (True DC) The test current can be adjusted in: • Steps of 0.2 A from 5 A to 20 A • Steps of 1 A from 20 A to 200 A
Resistance ranges	0.1 $\mu\Omega$ up to 2 m Ω (0.1 $\mu\Omega$ resolution) 2 m Ω up to 200 m Ω (10 $\mu\Omega$ resolution) 200 m Ω up to 1 Ω (1 m Ω resolution)
Basic accuracy	$\pm 1\%$ of reading from 50 $\mu\Omega$ to 1 Ω
AUXILIARY CLAMP (BSG)	
Measurement range	0.1 Adc to 60 Adc
Accuracy	1 % + 3 digits
FEATURES	
Measuring modes	Manual and automatic
BSG function	Allows to test an object with both sides grounded, providing more safety when performing measurements at substations
Timer function	Allows to setup the test duration from 15 seconds up to 120 seconds for current test from 5 A up to 200 A. Allows unlimited test duration for currents equal or lower than 100 A.
Measurement principle	Four-terminal, U/I
Protections	Against overheating, over-current and shortcircuit
Display	Alphanumerical LCD display, 4 lines / 20 characters (Big Number)
Built-in memory	Memory for storing up to 4000 readings organized by records
STANDARDS	
Safety	IEC 61010-1
COMMUNICATION	
Protocol	Modbus
USB	For configuration, control and download the stored values
Bluetooth	For configuration, control and download the stored values

SOFTWARE	
Desktop (PC/Notebook)	PXLogger software: to transfer stored data in the equipment's memory, analyze it and generate test reports
Android (Smartphone/Tablet)	PHENIX Remote Control app: for remote control, allowing to configure, run tests and generate reports
ENVIRONMENTAL	
IP rating	IP54 (with closed lid)
Operating temperature	0 °C to 50 °C
Storage temperature	-10 °C to 70 °C
Humidity	95 % RH (non condensing)
POWER SUPPLY	
Mains	100 - 240 V~
MECHANICAL (EQUIPMENT)	
Weight	Approx. 11 kg
Dimensions	502 x 394 x 190 mm

INCLUDED ACCESSORIES
<ul style="list-style-type: none"> • 2 combined current and potential leads • Auxiliary current clamp • Ground cable • Power cord • USB cable • User guide • PXLogger software • PHENIX Remote Control app • Case for the accessories

All specifications are subject to change without notice.



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TECHNOLOGIES