

## Micromillikilohmmeter MIKO-2.3

### Certificates:

Safety Test Certificate IEC 61010-1:2001 on the MIKO-7  
EMC Compatibility 61326-1:2005 on the MIKO-7

MIKO-2.3 is included in Russian Register of Innovative Products under #239, valid until 12.10.2018

MIKO-2.3 is included in Russian State Register under #51888-12, valid until 30.11.2017

Warranty: 13 months  
Service life: 10 years



### Operates in 4 modes: microohmmeter, milliohmmeter, kilohmmeter and thermometer.

MIKO-2.3 is a portable mini-laboratory allowing performing of all tasks connected with resistance measurement in electrical equipment as this instrument operates in four modes

- All types of electrical equipment (transformers, electrical machines and electrical switching devices) require different means for full-rate diagnostics. However in case of direct-current resistance measurement the multipurpose instrument MIKO-2.3 can be used;
- **"Microohmmeter" mode: contact resistance measuring at the maximum current of 1,000 A in the range within  $1 \mu\text{Ohm} \div 10^5 \mu\text{Ohm}$ .** Moreover, this mode allows considering the availability or absence of current in the measured circuit of transformer;
- **"Milliohmmeter" mode: measuring winding resistance within the range of  $0.1 \text{ mOhm} - 10^6 \text{ mOhm}$ .** Two submodes are used here: measurement of one-phase and three-phase windings. Besides, MIKO-2.3 has a function of automatic recalculation of resistance measurement results for a three-phase winding: calculation of relative deviations of resistance values of moving coils between each other; recalculation of resistance values of moving coils connected according to the triangle scheme into resistance values of phase windings; recalculation of resistance values of moving coils connected according to the star scheme into resistance values of phase windings; recalculation of a winding resistance measured at current temperature T into resistance at base temperature  $\Theta$  with due account for the winding material.
- **"Kilohmmeter" mode: measurement of resistance within the range of  $0.1 \text{ kOhm} - 3 \cdot 10^2 \text{ kOhm}$**
- **"Thermometer" mode: measurement of temperatures of windings, oil and air within the range of  $-20^\circ\text{C}$  to  $+120^\circ\text{C}$ ;**




Switching on each of four modes occurs automatically when appropriate input cable from the instrument set is connected.






- Self-contained power supply, small dimensions and weight. MIKO-2.3 instrument is easy to use and maintain, reliable and resistant to electromagnetic field influence.





## Specifications

Specifications	Value
<b>"Microohmmeter" mode:</b>	
Electric resistance measuring range, $\mu\text{Ohm}$	$1 \div 100,000$
Maximum permissible intrinsic relative error of electric resistance measurement, %	$\pm 0.2$
Measuring current intensity range during electric resistance measurement in "CT (current transformer)-available" and "CT-not available" submodes, A	$10 \div 900$
Measuring current intensity range during electric resistance measurement in "CT-available Tmax" submode, A	$100 \div 400$
Maximum time of one measurement in "CT-not available" submode, sec	2
Maximum time of one measurement in "CT-available" submode, sec	30
Maximum time of one measurement in "CT-available Tmax" submode, sec	20
<b>"Milliohmmeter" mode:</b>	
Electric resistance measuring range, $\text{mOhm}$	$0.1 \div 1,000,000$
Maximum permissible intrinsic relative error of electric resistance measurement, %	$\pm 0.2$
Measuring current intensity range during electric resistance measurement, A	$0.5 \div 5$
One measurement time, sec	$10 \div 900$
<b>"Kiloohmmeter" mode:</b>	
Electric resistance measuring mode, $\text{kOhm}$	$0.1 \div 300$
Maximum permissible intrinsic relative error of electric resistance measurement, %	$\pm 0.5$
Value of induced voltage across the resistor, $\text{kV}$	$\leq 5$
Maximum time of one measurement, sec	3
<b>"Thermometer" mode:</b>	
Temperature measuring range, $^{\circ}\text{C}$	$-20 \div +120$
Maximum permissible intrinsic absolute error of temperature measurement, $^{\circ}\text{C}$	$\pm 1.0$
Maximum accumulator charge time, min	5
Maximum power consumed in the power circuit, W	60
Operation temperature range, $^{\circ}\text{C}$	$-20 \div +40$
IP rating in operating state	IP20
Maximum measuring unit weight, kg	2.7
Dimensions, mm	150x190x75
Interface language	English
User manuals language	English
Calibration period, year	1

## Recommended package of the Instrument

Photo	Item, Index	Application	Recommended complete set (pcs.)
<b>Standard complete set:</b>			
	MIKO-2.3 measuring unit CK5025.01.00.000	The instrument and accompanying documents; K162 microohmmeter cable clamps of "alligator clip + ground clamp" type (length 2.3 m + 1.1m): - <b>of oil high-voltage circuit breakers</b> (U-110; MKP-110; VMT-110 types), - <b>of air high-voltage circuit breakers</b> (BBOA-15 type), - <b>gas-insulated high-voltage circuit breakers</b> (VGU-220; VGV-110; ZAR1DT-145; ZNM428; VGBU-110; VGB-330 types); K233 milliohmmeter cable for power transformer windings with the voltage of 110 kV and less; K322 kiloohmmeter cable for measurement of multiplier, shunt and dividing resistances; Thermometer with K411 cable; Potential spring-loaded contact and pin contact; Mains extension cable; RS-232 interface cable; charging device; Instrument transportation bag and Bag for a cable set.	1
<b>Additional complete set (on order):</b>			
	K161 microohmmeter cable CK5023.02.00.000	Clamps of "alligator clip + ground clamp" type (length 0.9 m + 0.9 m). The maximum current up to 1000A. - <b>of oil high-voltage circuit breakers</b> (all for 6, 10 and 35 kV), - <b>of air high-voltage circuit breakers</b> (VBB-10; VVE-35; VVChP-15 types), - <b>gas-insulated high-voltage circuit breakers</b> (VGT-110; ZAR2F1; VGV-35; VGU-110; ZAR1FE; VGT-110; ZNM427.04980; VGB-35 types).	-
	K163 microohmmeter cable CK5023.02.00.000-02	Clamps of "alligator clip + ground clamp" type (length 4.5 m + 1.0 m). The maximum current up to 500A. - <b>of oil high-voltage circuit breakers</b> (U-220; MKP-220; VMT-220 types in case of work on a hoist), - <b>of air high-voltage circuit breakers</b> (VV-330B; VVBK-110; VVBK-220; VVD-220B; VVS-220B; VVU-110G; VVBM-110B; VVS-110B; VVBK-220 types), - <b>gas-insulated high-voltage circuit breakers</b> (ZAR2F1; VGU-220; VGU-330; VGB-220; ZNM427.07465 types).	-

	K164 microohmmeter cable CKБ023.02.00.000-03	Clamps of "alligator clip + ground clamp" type (length 3.8 m + 1.7 m). The maximum current up to 500A. - <b>of oil high-voltage circuit breakers</b> (U-220; MKP-220; VMT-220 types in case of work without a hoist)	-
	K165 microohmmeter cable CKБ023.02.00.000-04	Clamps of "alligator clip + ground clamp" type (length 10.0 m + 1.0 m). The maximum current up to 500A. - <b>of air high-voltage circuit breakers</b> (VNV-330; VV-500B; VVBK-500; VDN-330Б; VNV-330; VNV-500; VVDM-330B types), - <b>gas-insulated high-voltage circuit breakers</b> (VGU-500; VGB-750; VGB-500; VGB-330).	-
	K154 microohmmeter with contacts CKБ023.05.00.000	length 1.0 m + 1.9 m Cable with two needle contacts – potential contact is spring-loaded. Applied in case of impossibility of connection to the facility using cables with clamps of "alligator clip + ground clamp" type. For pairwork.	1
	K155 microohmmeter cable with contacts CKБ023.13.00.000	length 0.9 m + 2.3 m Cable with one needle contact and one clamp of "alligator clip + ground clamp" type. Applied in case of impossibility of connection to the facility using cables with clamps of "alligator clip + ground clamp" type. Allows working alone.	-
	K121 microohmmeter cable with contacts CKБ023.09.00.000	length 1.8 m + 1.8 m Cable with removable probes and removable small clamps of "alligator clip" type. It is used along with one of K161 ÷ K165 cables for measurement of resistance in any area between connection points of clamps of "alligator clip + ground clamp" type.	-
<b>NEW</b> 	Cable for microohmmeter with quick-operating ground clip	length 0.9 m + 0.9 m Cable for control of high-voltage switches with input pins with diameter of over 80 mm. The cable clamp is equipped with a quick-operating ground clip that ensures instant connection to input pins due to availability of a button at its bottom.	-
	K238 milliohmmeter cable CKБ023.07.00.000-06	length 6.5 m + 6.5 m pin input diameter up to 37 mm Cable for measurement of resistance of direct current of power transformer windings with the voltage of 500 kV and less. In case MIKO-2.3 is placed on the transformer cover.	-

	K236 milliohm meter cable CKБ023.07.00.000-04	length 9 m + 9 m pin input diameter up to 37 mm Cable for measurement of resistance of direct current of power transformer windings with the voltage of 110 kV and less. In case MIKO-2.3 is placed on the ground.	-
	K239 milliohm meter cable CKБ023.25.00.000-06	length 6.5 m + 6.5 m the diameter of an input pin is up to 80 mm. Cable for measurement of resistance of direct current of power transformer windings with the voltage of 500 kV and less. In case MIKO-2.3 is placed on the transformer cover.	1
	K240 extension cable CKБ023.24.00.000	An extension cable for combined operation with K238 and K239 measuring cables. In case MIKO-2.3 is placed on the ground (length 8.5 m).	1
	K235 milliohm meter cable CKБ023.03.00.000	length 3 m Cable for measurement of resistance on direct current of electric motors, electromagnets, current transformers etc.	1
	K321 kiloohm meter cable CKБ023.06.00.000	length 2.1 m + 3.4 m Cable for measurement of multiplier, shunt and dividing resistances in the presence of induced voltage.	-
-	Manipulating rod for equipment of up to 35kV (2.2 m) CKБ010.41.00.000	The rod is designed to ensure convenient connection to contacts of a high-voltage item. The rod is completed with a clamp with current and potential contacts connected by wires with the measurement platform. Test cables are connected to the measurement platform from the ground.	-
	Manipulating rod for equipment of up to 110kV (3.7 m) CKБ010.41.00.000-01		-
	Manipulating rod for equipment of up to 220kV (5.1 m) CKБ010.41.00.000-02		-

### Field of application of micromillikiloohmmeter MIKO-2.3

Measured circuit	Measuring mode MIKO-2.3	Measuring range MIKO-2.3	Standard resistance range of measured circuit
<b>High-voltage circuit breakers (oil, magnetic, air, sulfur-hexafluoride and vacuum)</b>			
Resistance of main contacts of high-voltage circuit breakers	microohmmeter	from 1 to $10^5 \mu\text{Ohm}$	from 8 to 2000 $\mu\text{Ohm}$
Resistance of winding of switching on/off electromagnet	milliohmmeter	from 0.1 to 1000 Ohm	from 1 mOhm to 100 Ohm
Resistance of winding of drive spring engines	milliohmmeter		from 0.5 to 100 Ohm
Resistance of preswitched on resistors	kiloohmmeter	from 0.1 to 300 kOhm	from 100 to 1000 Ohm
Resistance of air circuit breakers engines (Ohmmeter)	kiloohmmeter		from 100 Ohm to 15 kOhm
Resistance of compensating resistors of circuit breakers of MKP-110 type	kiloohmmeter		from 750 to 1000 Ohm
<b>Load-break switches (magnetic, sulfur-hexafluoride and vacuum)</b>			
Resistance of circuit breaker main contacts	microohmmeter	from 1 to $10^5 \mu\text{Ohm}$	from 8 to 2000 $\mu\text{Ohm}$
Resistance of winding of switching on/off electromagnets	milliohmmeter	from 0.1 to 1000 Ohm	from 1 mOhm to 100 Ohm
Resistance of winding of drive spring engines	milliohmmeter	from 0.1 to 1000 Ohm	from 0.5 to 100 Ohm
<b>Disconnecting, isolating and short-circuiting switches</b>			
Resistance of main contacts	microohmmeter	from 1 to $10^5 \mu\text{Ohm}$	from 8 to 2000 $\mu\text{Ohm}$
Resistance of winding of drive spring engines	milliohmmeter	from 0.1 to 1000 Ohm	from 1 mOhm to 100 Ohm
<b>Metal-clad switchgears of internal and external installations</b>			
Resistance of main contacts	microohmmeter	from 1 to $10^5 \mu\text{Ohm}$	from 8 to 2000 $\mu\text{Ohm}$
	milliohmmeter	from 0.1 to 1000 Ohm	
Resistance of winding of switching on/off electromagnets	milliohmmeter	from 0.1 to 1000 Ohm	from 1 mOhm to 100 Ohm
Resistance of winding of drive spring engines	milliohmmeter		from 0.5 to 100 Ohm

<b>Power transformers, autotransformer and oil-immersed reactors</b>			
Measuring of direct-current resistance of transformer winding	milliohmmeter	from 0.1 to 1000 Ohm	from 0.5 mOhm to 10 Ohm
<b>Voltage transformers (electromagnetic and capacitive)</b>			
Measuring of direct-current resistance of winding	milliohmmeter	from 0.1 to 1000 Ohm	from 0.05 to 500 mOhm
	kilohmmeter	from 0.1 to 300 kOhm	from 100 Ohm to 100 kOhm
<b>Current transformers</b>			
Resistance of current and voltage transformer secondary	milliohmmeter	from 0.1 to 1000 Ohm	from 0.050 to 500 mOhm
<b>Collecting and connecting bus-bars</b>			
Testing of cable and bus connections	microohmmeter	from 1 to 10 <sup>5</sup> μOhm	from 1 to 100 μOhm
<b>Power cable lines</b>			
Monitoring of cable lines	milliohmmeter	from 0.1 to 1000 Ohm	from 1 mOhm to 100 Ohm
<b>Cut-outs and fuse-disconnectors for the voltage of more than 1kV</b>			
Measuring of direct-current resistance of conducting part of fuse-disconnector cartridge	milliohmmeter	from 0.1 to 1000 Ohm	from 0.1 to 10 mOhm
<b>Contact connection of wires, protective earth wires, collecting and connecting bus-bars</b>			
Measuring of transient resistance	microohmmeter	from 1 to 10 <sup>5</sup> μOhm	from 1 to 100 μOhm
<b>Electric equipment of excitation systems of generators and synchronous compensators</b>			
Measuring of direct-current resistance of transfer winding and electrical machines in excitation systems	milliohmmeter	from 0.1 to 1000 Ohm	from 0.5 mOhm to 10 Ohm
<b>Electric installations of buildings and structures (automatic circuit breakers)</b>			
Contact testing	microohmmeter	from 1 to 10 <sup>5</sup> μOhm	from 1 to 100 μOhm
<b>Wagons, rails</b>			
Monitoring of rail resistance	microohmmeter	from 1 to 10 <sup>5</sup> μOhm	from 100 μOhm to 100 Ohm
	milliohmmeter	from 0.1 to 1000 Ohm	
Monitoring of wagon wheel pairs resistance	milliohmmeter	from 0.1 to 1000 Ohm	from 1 to 100 mOhm