"Chelenergopribor"
Limited Liability Company

Compact portable Microohmmeter

IKS-200A

Operating Manual

PTMR.411212.021 RE

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CONTENTS

Introduction

This operating manual (hereinafter referred to as "OM") is intended to provide information on specifications, design and the principles of operation, as well as the rules of operation of compact portable microohmmeter IKS-200A (hereinafter referred to as IKS-200A).
The OM contains information on the design, operation principles, specifications (features) of IKS-200A, its components and indications necessary for the correct and safe operation of IKS-200A, as well as information on the disposal of the product and its components.

List of used abbreviations:
AB - Accumulator battery
ADC - Analog-to-digital converter;
PSU - Power supply unit;
LCD - Liquid crystal display;
BC – Battery charger;
MC - Microcontroller;
PC - Personal Computer;
SW - Software.

1. Description and operation

1.1. Application

1.1.1. IKS-200A is designed for operational measurement of electric resistance to direct current with applying measuring current of up to 200 A.
IKS-200A allows measuring electric resistance of low-inductive circuits in the range from 0 to 100000 microohm and mostly termination resistance.

1.1.2. Owing to the availability of an extended flow of the measuring current, it is possible to measure resistance to direct current on the circuits with integral current transformer.

1.1.3. The device is designed for operation under the following conditions:

1.1.3.1. *Operating conditions:*

- Ambient temperature, °C ..... -20 … +40;
- Relative air humidity,% …….. 90 at 30°C;
- Atmospheric pressure, kPa ..... 84 ... 106.7;
- Magnetic field strength at 50 Hz up to 400 A/m.

1.1.3.2. *Normal conditions:*

- Ambient temperature, °C ..... 20±5;
- Relative air humidity,% ..... 30 ... 80;
- Atmospheric pressure, kPa ..... 84 … 106.7;

1.1.4. Power supply of IKS-200A is autonomous, from a built-in LiFePo4 battery.

1.1.5. A storage battery of the device has a scheme of charging and over-voltage protection of elements and a scheme of active charge-balancing, providing a long service life of the battery if used properly.

1.1.6. Indication of the measured resistance value is visual, digital, on a graphical monochrome display with backlighting and resolution of 128x64.

1.1.7. To enable connection to external devices, including mobile ones, IKS-200A is equipped with Bluetooth wireless communication interface. Thus, the user can operate the device remotely using special application for OC Android. The application allows changing measurement parameters, starting measurements remotely and saving the results in the memory of a mobile device. The application can be obtained on the website of the device manufacturer.

1.2. Specifications

1.2.1. The range of measured electrical resistance: (1- 100000) mOhм.
1.2.2. The user chooses measuring current value from the ranges: 10, 50, 100 and 200 A.
1.2.3. When current is 10A, resistance in the range of (1 - 100000) mOhм is measured.
1.2.4. When current is 50A, resistance in the range of (1 - 10000) mOhм is measured.
1.2.5. When current is 100A, resistance in the range of (1 - 1000) mOhм is measured.
1.2.6. The limits of permissible basic relative error of a measurement: ±(0.1+0.005(*Rk/Ru*-1)) %, where: *Rk* is a range upper limit, mOhм, *Ru* is a measured value of resistance, mOhм.
1.2.7. The permissible additional relative measurement error at ambient air temperature changing from normal to limit values within the operating temperature ranges is equal to the limits of the permissible basic error for every 20°C.
1.2.8. The permissible additional relative error of measurements in the presence of an external magnetic field at the frequency of 50 Hz with a magnetic field strength of up to 400 A/m is equal to the limit of permissible basic error.
1.2.9. Length of measuring wires, min: ……. 5m
1.2.10. Overall dimensions of the device, max: ……..... 140x100x35 mm
1.2.11. Weight of the measuring unit, max: ……..... 4.2 kg
1.2.12. Time of one short measurement, max: ……. 3 sec.
1.2.13. Time of one "long" measurement, max: ……. 30 sec.
1.2.14. Time of setting the operation mode, max: ……. 5 sec.
1.2.15. Time interval between short measurements, min: ……. 2 sec.
1.2.16. Time interval between "long" measurements, min: ……. 10 sec.
1.2.17. Measured value is shown as 5 digit value.
1.2.18. Communication, performed by using Bluetooth wireless interface, is performed at 2,4 Hz
1.2.19. Wireless communication range: ……. up to 10 m
1.2.20. Output power of the Bluetooth transmitter: ……..... up to 10 mW
1.2.21. Battery charging time, max: ……..……..……..... 4 hours
1.2.22. Input voltage of the built-in charger: …… 18 volt of direct current
1.2.23. Power consumption for battery charging: ……..…….. 4 W
1.2.24. IKS-200A is heat-resistant, cold and moisture-proof and endures transportation in accordance with GOST 22261-94 for measuring instruments of the 4th group.
1.2.25. Class of dust and moisture protection with closed cover: ……...…… IP64
1.2.26. Class of dust and moisture protection with open cover: ……...…... IP40
1.2.27. Average service life of the device, min ……..…… 10 years
1.2.28. Mean time to failure at the probability of non-failure operating time of 0.95, min…… 10000 hours

Note: The characteristic, by which the failure is determined, is the basic error in measuring electrical resistance (clauses 1.2.6).

1.3. IKS-200A components

1.3.1. The device is placed into a shockproof and hermetic case, that's why the front panel of the device is protected from shocks and moisture by the case cover. Sockets for connecting measuring wires and a power supply unit are located on the front panel of the device. There is also an indicator window, with the buttons "Measurement" (Измерение) and "Current range" (Выбор тока), and the LED of the built-in battery charge. The completeness of the device is shown in Table 1.

Table 2. IKS-200A delivery set

Number	Name	Quantity, pcs
1	IKS-200A	1
2	Connecting wire with the probe in the form of "alligator" type clip providing a 4-wire measuring circuit	2
3	Power supply unit 220 V 50 Hz	1
4	Operational manual PTMP 411212.021 OP	1
5	Verification procedure PTMP 4112 212.021 VP	1
6	Passport PTMP 411212.021 PS	1

1.3.2. The device performs the following functions:

- Forms a stable measuring current.
- Amplifies and converts the signal taken from the voltage probes into a digital code.
- Displays a measured value of the resistance.

1.3.3. The battery, providing power supply of the device is installed inside the device case. The batteries of LiFePo4 type, providing necessary measuring current in the wide range of temperatures, are installed into IKS–200A.

1.3.4. The device has a built-in intellectual battery charger, ensuring charging, protection and active balancing of the battery elements.

1.3.5. The power supply unit is designated for charging the built-in battery charger of the device. Having the form of a unit used for connecting to AC supply of 220 V 50 Hz, the power supply unit has DC output of 18 V. The power supply unit is connected to the device measuring block with a connecting cable. On the front panel of IKS-200 A, there is a LED indicator of the battery charge process.

1.4. Design and intended use

1.4.1. A simplified block diagram of IKS-200A is shown in Fig. 1. Face panel is shown in Fig. 2. Fig.2 shows:

1 - 4 mm "banana" type jack for connecting voltage probes;

2 - Jack for connecting current probes;

3 - Socket for connecting built-in charger to the external power unit with DC output of 18 V;

4 – Power switch on / switch off button;

5 - LCD indicator of the device charging process;

6 - Graphic monochrome display with resolution of 128x64;

7 - Buttons “Measurement” (Измерение) and “Current range” (Выбор тока).

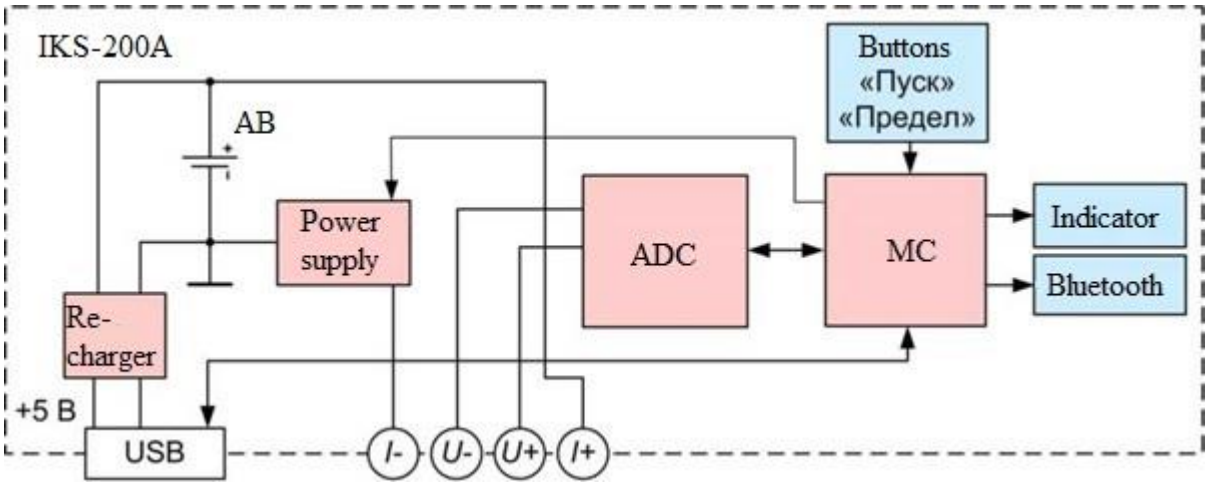

Fig.1. Simplified block diagram of IKS-200A

Fig.2. Front panel of IKS-200 A.

1.4.2. IKS-200A is switched on by pressing the button "Start" (Питание). The indicator backlight turns on, and in less than 5 seconds the device is ready for operation.

1.4.3. By successively pressing the button "Current range" (Выбор тока), the user can select the range of measuring current and the range of the resistance being measured correspondingly. The range, set during the measurement, is saved in the non-volatile memory of the device, and

is restored when the device is switched on.

1.4.4. By pressing the button "Measurement" (Измерения), the user initiates a measurement. Thus, the microcontroller switches on the current source. Measuring current, passing through the current probes (through sockets 2 I + and I-) and the object, creates a voltage drop on it. It is detected by the voltage probes, and through sockets 4U+ and U- goes to the AD converter. Digital data from the AD converter are transmitted to the microcontroller MC, where they are processed and displayed on indicator 6.

1.4.5. Holding the button "Measurement" (Измерение) for 1 second, the user can start a "long" measurement. In this mode, the device switches on measuring current, and keeps it value for 10 seconds, measuring resistance every second. After reading the value of the measured resistance, the user can stop the measurement by pressing the button "Measurement" (Измерение) again. This mode can be used to measure the resistance of inductive circuits, for which a "short" measurement does not give a stable result, for example, the termination resistance of high-voltage power circuit-breakers with built-in current transformer. A “long” measurement ends automatically in 30 minutes. To preserve battery power, it is recommended to stop measuring after the measured resistance is shown on the device indicator.

1.4.6. **During a "long" measurement, it is forbidden to break the current-carrying circuit!**

1.4.7. Indicator 7 shows:

- information about the battery charge in the form of an icon;
- chosen measuring current;
- during measurements – set measuring current;
- during a "long" measurement - time counter from the moment of switching on current;
- after measurements - the obtained value of the resistance or an error message.

1.4.8. IKS-200A switches off automatically in 5 minutes after the last measurement is finished.

1.5. Error messages

1.5.1. In case the measurement failed, IKS-200A displays an error message on the indicator.

1.5.2. Error messages and methods of their remedy are listed in Table 3.

Table 3. Error messages

Message	Possible cause	Methods of remedy
1. Resistance is high or the voltage probes are not attached.	The selected range is lower than the resistance being measured. There is no contact of the voltage probes with the measurement object.	Reduce the measuring current. Connect the voltage probes to the object of measurement again.
2. Setting current error	There is no contact of the voltage probes with the measurement object.	Connect the voltage probes to the object of measurement again.
3. Low battery	The battery is discharged	Charge the battery by connecting it to the power supply unit.
4. Low voltage on one of the battery cells	One of the battery cells is discharged	Charge the battery by connecting it to the power supply unit.

1.6. Battery charging

1.6.1. IKS-200 A is equipped with the built-in charger, which charges the battery from the power supply unit with the voltage of 18 V. The device is supplied with an external power supply unit for charging the battery from AC supply system of 220 V 50 Hz.

1.6.2. After attaching the external power supply unit, battery charging starts automatically. Diagnostic information about charging process is shown on indicator 6, in particular, the information about the voltage on every cell and the rate of charge.

1.6.3. "Charging" (Зарядка) LED is located on the front panel of the device. When IKS-200A is connected to the power supply unit, this LED lights up and remains lit while the battery is being charged. When the battery is fully charged, "Charging" (Зарядка) LED starts blinking.

1.6.4. While the battery is being charged, measurements can’t be conducted.

1.6.5. The battery composed of cells LiFePo4 type is installed into IKS–200A.

1.6.6. **It is prohibited to use batteries of other type!**

1.6.7. To ensure a long battery life, it is recommended to fully charge it at least once every 4 months.

1.6.8. When being charged from the power supply unit, the charger consumes the current of up to 2 A.

1.6.9. The battery is replaced by the manufacturing enterprise.

1.6.10. **The built-in charger provides the measuring current of up to 200 A at a wide range of temperatures and is very powerful. Unauthorized opening and interference with the construction of the battery can cause short-circuit and arcing, as well as damages.**

1.7. Connection to the device through Bluetooth interface

1.7.1. To enable connection to external appliances including mobile ones, IKS–200A is equipped with Bluetooth wireless communication interface.

1.7.2. The user can operate IKS-200A remotely using special application for OC Android.

1.7.3. The application allows changing measurement parameters, starting measurements remotely

and saving the results in the memory of a mobile device.
1.7.4. The application can be obtained on the website of the device manufacturer.

1.8. Safety

While operating and maintaining IKS-200A, the electrical safety requirements should be observed in accordance with GOST 12.3.019-80 and as prescribed in the "Safety rules at operation of consumer's electrical installations".

2. Maintenance

2.1. Preventive works are carried out to ensure normal operation of IKS-200A during its lifetime. The frequency of the device inspections is determined by the environment, the device is located in, and by intensity of its operation.
2.2. Recommended types and timing of preventive maintenance:

- Visual inspection and external cleaning – quarterly;
- State of the battery charge check and recharging – quarterly;
- Full inspection of the device technical condition - annually.

3. Current repairs

Current repair is carried out by the manufacturing enterprise.

4. Verification

Verification of IKS-200A is carried out in accordance with the verification procedure "Method of verification for electrical resistance Microhmmeter IKS-200A", PTMR 4112 212.021 VP.

5. Transportation and storage

5.1. IKS-200A allows for a short-term storage for up to 6 months in the manufacturer's packaging at the ambient air temperature of +5 to +40°C and relative humidity up to 80%. There should be no dust, corrosive gases and other harmful mixtures that cause corrosion in the storage rooms.
During a long-time storage of IKS-200A, it is required to charge the battery fully at least once every 4 months.
5.2. Methods of transportation for IKS-200A should comply with the requirements of GOST 22261-94.
Conditions of transportation for IKS-200A in terms of mechanical and climatic factors impact should not exceed the following values:

1) shock loads:
   - maximum acceleration of 30 m/sec^2;
   - number of shocks per minute from 80 to 120;
   - duration of exposure - 1 hour.
2) increased temperature of + 55°C;
3) reduced temperature of -25°C;
4) relative humidity of 95% at 30°C;
5) atmospheric pressure of 70-106.7 kPa.

5.3. Climatic effects on IKS-200A under utmost conditions of transportation should comply with

the storage conditions 3 or 5 of GOST 15150-69.

6. Disposal

Measures for preparing and sending IKS-200A for disposal are conducted in accordance with the consumer enterprise requirements and instructions. Disposal of the battery is conducted in accordance with the requirements and instructions of the battery manufacturer.