

THE DC AND AC HIGH VOLTAGE METER

RD-140

OPERATIONS MANUAL

RD140/6.00.00.00-02M

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Operations manual RD-140.00.00.00-02M it is intended for an acquaintance with a device, technical data and principle of work of the high voltage meter RD-140 to the extent necessary to operate and maintain it in constant readiness to work.

Two operators having permit cards for operation with electric installations of voltage above 1000 V are required for working with the device.

Abbreviations used in the manual:

- HVU – high-voltage unit;
- MI – module indicator;
- LCD - liquid crystal display;
- OD - operational documentation.

1 DESCRIPTION AND OPERATION

1.1 Product purpose

1.1.1 Meter of high voltage AC and DC RD-140 (hereinafter - the meter) it intended for measuring AC sinusoidal voltage of 50 Hz frequency from 0 to 100 kV and a DC voltage of 0 to 140 kV.

RD-140 it provides a measurement with high precision:

- rms ac voltage frequency of 50 Hz;
- mean value of DC.

1.1.2 RD-140 can be used in the testing high-voltage laboratories of power electrical engineering profile, and scientific research institutions.

1.1.3 The product complies with GOST (ГОСТ) 17512-82, of climate category UHL (УХЛ) 4.2 by GOST (ГОСТ) 15150-69 and group 2 devices by GOST (ГОСТ) 22261-82.

1.2 Terms of use of the product

1.2.1 RD-140 designed for operation under the following conditions:

- indoors or under cover in the absence of shakes, vibrations, vapors of aggressive liquids;
- the ambient temperature, °C – от 10 до 35 °C;
- The relative humidity of the ambient air, % – until 80;
- the atmosphere pressure, kPa (mm Hg. Art.)- 84 – 106,7 (630-800);
- the coefficient of non-sinusoidal of measurable voltage of alternating current should be no more than 8%;
- the coefficient of pulsation of of measurable voltage of direct current should be no more than 1%;
- the distance from high-voltage unit RD140-HVU for electrically conductive objects, which are grounded or under potential - at least 1 m;

1.3 Basic specifications

The main technical data are given in the Table 1.

Table 1

Name	Rated value	The results of metrological certification
1 The measurement range of DC voltage (average value), kV	from 0 to 140	
2 The measurement range of AC voltage (RMS), kV	of 0 to 100	
3 Frequency range at measurement AC voltage, Hz	of 47,5 to 52,5	
4 Input impedance of high-voltage unit RD140- HVU on DC, MOm	420±10	
5 Input impedance of high-voltage unit RD140- HVU on AC frequency of 50 Hz, MOm, no less	200	
6 Limits of permissible relative error in measuring DC voltage, %	±1	
7 Limits of permissible relative error in measuring AC voltage, %	±1	
8 Discrete measurement definition, kV	0,001	
9 MI and HV units powered by a built-in Ni MH AA size battery voltage of 1.2V and a capacity of 1.5 A · h: <ul style="list-style-type: none"> • supply voltage, V • duration of continuous operation without recharging, h, not less - 	5±0,2 8	
10 The range of the radio channel, m, is not less than	5	
11 Continuous operation of RD-140 at the maximum input voltage, h, not more	1	
12 Continuous operation of RD-140 at the input voltage up to 75 kV, h, not less	8	
13 Operation mode setup time after power on, min.	1	
14 Overall dimensions, mm: <ul style="list-style-type: none"> • RD-140- HVU - • RD-140-MI - 	diameter 280x880 95x190x40	
15 Weight, kg, no more: <ul style="list-style-type: none"> • RD-140- HVU - • RD-140-MI - 	11 0,5	
16 Service life, years, at least	10	

1.4 Components

1.4.1 The composition and the kit of the product is shown in Table 2.

Table 2

Denomination	Name	Qty.	Notation
RD140-HVU.00.00.00-02	High voltage unit RD140-HVU	1	With a set of power (Ni-MH battery, the AA size, 1.2V, 1300-1800 mA / h - 4 pcs.)
RD140-MI.00.00.00	Indicator module RD140- MI	1	With a set of power (Ni-MH battery, the AA size, 1.2V, 1300-1800 mA / h - 4 pcs.)
	Stabilized power supply	1	+12V stab., 0.8-1.5 A with the splitter charger
RD140-PB.00.00.00	Packing box	1	
RD-140/4.00.00.00-02M	Operations manual	1	

1.5 Construction and operation of the device

1.5.1 Functionally, RD-140 includes a transducer (symmetric high-ohmic voltage divider) and its output connected to the so-called "Radiovoltmeter" - high-precision low-voltage microprocessor voltmeter DC and AC voltage, consisting of two separate spaced modules (measuring and indicator), which are connected to each other by radio.

Radiovoltmeter measures the average value of the DC (the DC) voltage, current (rms) value of an alternating (AC) voltage.

Technical data of the radiovoltmeter:

- The range of input voltage measuring module
(the peak value) , V - ± 1
- Frequency range, kHz - 0÷3,5
- Resolution, decimals - 6
- Conversion time, with no more than 0,3
- Radio channel frequency range, MHz 845-945
- The number of frequency channels 20
- Transmitter power, mW 1

- | | |
|---|-----------|
| • Communication range (open space), m, | 5-10 |
| • Continuous operation time, h | 8-16 |
| • Dimensions measuring module board, mm | 65*75*20 |
| • Dimensions display unit, mm | 95*190*40 |

1.5.2 RD-140 is constructively composed of a high-voltage unit RD140-HVU connected to the source of the measured voltage and the indicator module RD140-MI, with which the operator reads the statement. Communication between the units is carried out by radio at a frequency of about 900 MHz, and at a distance of 5 m.

1.5.3 Electrical schematic diagram of the high-voltage unit RD140- HVU is shown in Figure 1, the appearance – in Figure 2.

The high-voltage unit (HVU) is a collinear two oil-filled partially compensated resistive voltage divider, both outputs are connected to the differential input analog-to-digital converter measurement module of the "radiovoltmeter", located in the middle compartment of the unit.

On the surface of the middle compartment withdrawn the power switch button , voltage signal LED of the power socket for charging the battery (Figure 3).

Resistive divider of the unit surrounded by a conductive cylindrical screens, which are electrically connected with the ends conclusions dividers (see. Figures 1 and 2).

This schematic and design of the high-voltage unit allowed:

- reduce the impact on the accuracy of measurement of closely spaced metal objects;
- increased passband;
- reduce of the current corona.

HVU is powered provided by batteries (4 Ni-MH or Ni-Cd AA battery capacity of 1300 ÷ 1800 mA / h). To charge using an external AC adapter (adapter) with the output stabilized voltage DC + 12V DC at a current of (0,8 ÷ 1,0) A.

Calibration is performed at the factory.

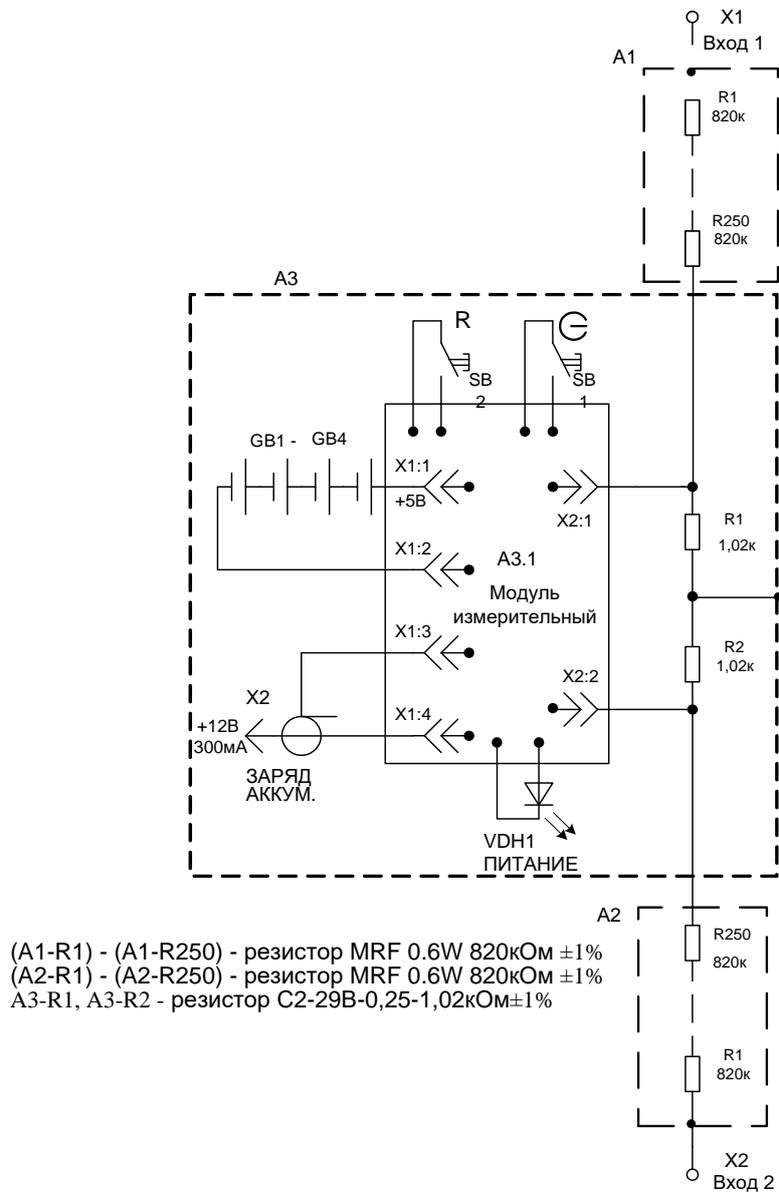


Figure 1. High-voltage unit RD-140-HVU.
 Electrical schematic diagram

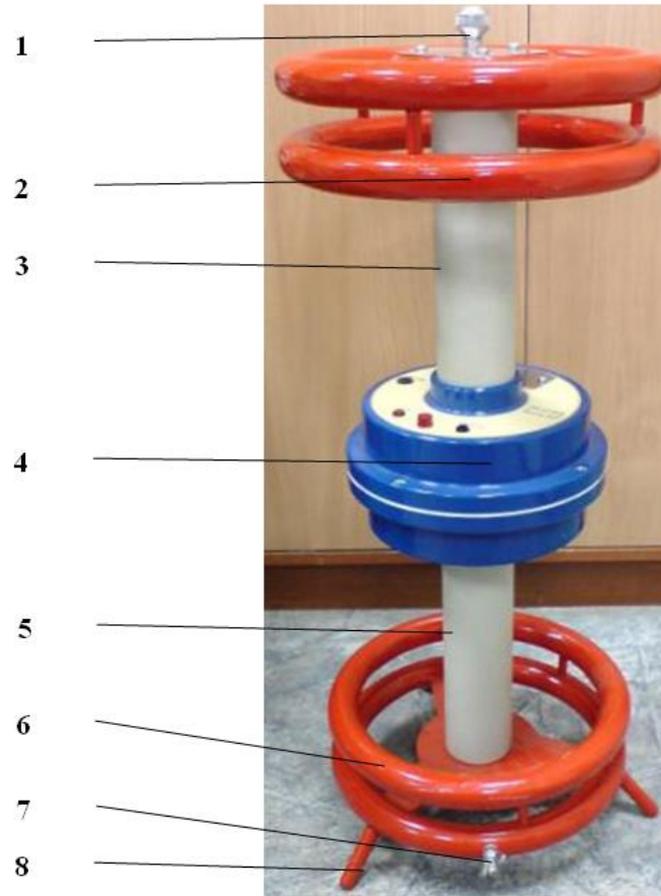


Figure 2. High-voltage unit RD-140-HVU. General view.

1. Clamp X1;
2. Shield of the divider 1;
3. High-voltage resistor A1;
4. Middle compartment A3;
5. High-voltage resistor A2;
6. Shield of the divider 2;
7. The ground clamp of unit, connected to the clamp X2;
8. Leg (3 pcs.)



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Figure 3. Location of controls on the RD-140-HVU

High-voltage power supply button "On" carries on and power-off;

1.5.4 The display module RD140-MI (Figure 4) is designed as a hand-held device with a LCD, an RF transceiver and microcontroller.

The display module provides the following functions:

- indication of the measured voltage;
- wireless communication with BW over the air.



Figure 4. The module indicator RD-140-MI. General view.

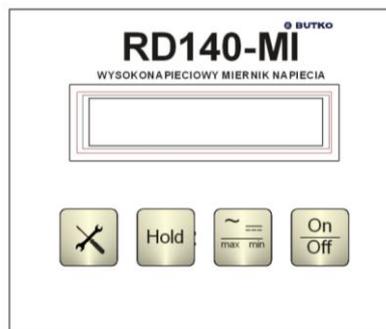


Figure 5. The module indicator RD-14-MI. Front panel.

The front of the RD140-MI (Figure 5), there is screen alphanumeric LCD and four control buttons. Above is the socket for charging the batteries.

MI is powered by batteries MI (four batteries AA Ni-MH type or Ni-Cd). To charge using an external AC adapter (adapter) with a stable output voltage DC 12 V, at least 1A.

1.5.5 Functions of the display module buttons

The function of the display module buttons



- Enable or disable the device power;



- switching the measurement mode and display - RMS and average value of the current or voltage amplitude values;



- Activate or deactivate the pause with fixing the last result, if "Hold mode" has been selected in the settings - the "last edited" or the average for the previous 5 seconds, if you selected the "average of 5 seconds."

Screen indications is "frozen" at the same time displaying on the screen the sign "*".

Pressing the button again resumes the cyclic display of measurement;



- By briefly pressing selected the configuration modes of the meter - "Contrast", "Hold mode", "Find Channel", "Change the channel."

1.5.6 Settings of the meter

Selection of setting is performed by briefly pressing the button , which leads to a cyclic shift to one embodiment of settings - "Contrast", "Hold mode", "Find a channel", "Change the channel"...

1.5.6.1 Adjusting the LCD contrast

To adjust LCD contrast, you must press the button briefly , then press the button briefly



(Located below the word "Settings". To increase or decrease the contrast, press the button below the corresponding arrow (left arrow - increase the contrast, right - decrease) After setting the desired

contrast ratio by pressing the button , exit the settings mode.

Setting of mode



By button  select « Hold mode». Press button , by pressing select "average per 5 sec" or "last edited".

1.5.6.3 Channel search and its number

Turn on the power of the RD-140-HVU.

By button  on RD-140-MI select the mode "Find the channel". Press button , when there is an inscription "Channel Search ..." it scans the dedicated channels (over time, usually no more

than 30 seconds), if it found one of the channels of the RD-140-HVU, it displays the channel number and the serial number of the measuring unit.

If it is impossible to establish a connection between the modules, then on the screen there is the inscription "channel search ...".

1.5.6.4 Change the number of channel

Measuring and indicating module of the meter communicate at one of 6 ÷ 20 fixed frequencies (channels) that are in the range of 845-945 MHz. To a particular channel setting is made by the operator as follows:

Turn the power of the RD-140-HVU.

By button  on RD-140-MI select the mode "Change the channel". Press button , when there is an inscription "settings exit" push the button at the desired setting mode ("settings") or output ("Exit") without changing the channel.

If you select mode setting, select the channel number by pressing the buttons under the signs ◀ or ▶ (increase or decrease the channel number respectively). Button press  It will exit the setup mode with save the changed channel number.

1.5.7 Turning on the power

Turning HVU turned by the power button. MI is turned on by pressing a button . Turning blocks may be performed in an arbitrary sequence. Enabling is indicated by LEDs on the front of both units.

If for any reason one of the blocks can not establish radio communication with another unit for (15-20) minutes (for example, will be switched off one of the two units or the units are spaced beyond the reach of radio transmitter), it automatically switches off to conserve battery.

The LED on the front panel displays the status of power of the HVU (Table 4).

Table 4

Condition	Value
Steady light	Power normal or charge batteries over
Flashes (2 times per second)	Batteries discharged, require recharging
Flashes slowly (1time every 2 seconds)	The charger is connected, the batteries are charged

ATTENTION! If you have several meters, working in the area of reach of radio channels, to avoid mutual interference, resulting in malfunction, you should use different channels of the meters.

2 CONTAINER AND PACKAGING

- 2.1 The meter with operational documentation and packing slip put into the packing box.
Before laying in a box each component of the meter need to wrap with plastic wrap.
Each component part of the meter, put in the box in such a way that the gaps between them and the walls of the box were filled with shock-absorbing means.
- 2.2 Transportation of meter on the long distances is carried out in accordance with GOST (ГОСТ) 2991-85 for container transport.

3 SAFETY PRECAUTIONS

- 3.1 Persons having permit cards for operation with electric installations of voltage above 1000 V are allowed to operate with meter.
- 3.2 Working with the meter must comply with the safety regulations in electrical systems with voltages over 1000V (ДHAОП 0.00-1.21).
- 3.3 ATTENTION! You can not apply a high voltage to the high voltage unit when it is connected to the charger. This will inevitably lead to breakdown of high voltage on the network and damage the meter.**

4 PREPARATION AND OPERATING PROCEDURE

- 4.1 Prior to the measurements of the symmetrical voltage source should be:
- set high voltage unit RD-140 near measured voltage source so that a radius of 1 m from the unit had no metal objects such as grounded, or under potential;
 - connect the ground clamp of RD-140-HVU to the grounding loop by the wire with section not less than 1,5 mm²;
 - connect the source of the measured voltage to the high voltage clamp X1 (second supply output should be grounded). The wire must not sag below the top of the HVU structure and its diameter to prevent corona, should be at least 20-30 mm;
 - MI positioned on the operator's workplace. The distance between MI and HVU should not exceed 5-10 m.
- 4.2 During measurement:
- turn the power of HVU and MI by power buttons (the signal LED power should light up , and MI screen should show zero voltage value);
 - turn on the source of the measured voltage and produce a count readings on MI in kilovolts;

- write the result and calculate the measurement error;
- turn off the source of the measured voltage.

5 TECHNICAL SERVICE

5.1 Maintenance of the meter RD-140 is to maintain the purity and periodic recharging batteries HVU and MI.

5.2 For the charge in the charge socket connected the charging device (stabilized DC power supply + 12V, 300-500 mA), and the source connects to the 220V network, 50 Hz. The charge lasts for 10-15 hours, no need to press any buttons.

Power LED:

- when operating the device and when normal voltage batteries the light is steady;
- when operating the device and when low voltage battery the light flashes rapidly;
- light flashes slowly when charging batteries.

At the end of the charge the LED stops blinking and light is steadily.

5.3 During maintenance is necessary:

- clean the units of the meter from dust by gauze;
- wipe with high-voltage insulation of HVU by cloth moistened with ethyl alcohol rectified technical grade "Extra" GOST (ГОСТ) 18300-87.

8 CERTIFICATE OF ACCEPTANCE

The dc and ac high voltage meter RD-140 s/n №_____ compliance with the essential requirements of state standards and applicable technical documentation and found fit for service.

Release date _____

Stamp

Quality Department _____

9 GUARANTEES OF MANUFACTURER (supplier)

9.1 The manufacturer guarantees the the device requirements of the current technical documentation and standards of the PTB and RB with the conditions of transportation, storage and operation.

9.2 The warranty period of 12 months from the date of shipment to the consumer.

During the warranty period the manufacturer produces free repair of the broken equipment, provided that by the consumer is not have been violated operating rules . The guarantee does not apply to equipment with mechanical defects, obtained as a result of careless handling or use of.

9.3 At the end of the warranty period, the manufacturer carries out service under a separate contract.

10 INFORMATION ABOUT RECLAMATIONS

In the event of equipment failure or malfunction in the work during the period of its warranty, as well as the detection of incompleteness in the primary acceptance, the consumer must be sent to the address of the manufacturer written notice with the following information:

- type and factory number of item;
- the outward manifestation of a fault;
- name of the person who filled in the reclamation;
- return address and contact telephone number.

The reclamation on the device do not make:

- after the expiration of the warranty period;
- in violation by consumer the exploitation, storage, transportation provided by operational documentation.