

**HIGH POTENTIAL DC AND AC CURRENT
MEASUREMENT**

ITW-140R-100

MANUAL

ITW-140R.00.00.00 IO

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The ITV-140R.00.00.00RE operating manual is intended for familiarization with the device, technical data and operation of high-potential DC and AC current meters of the ITW-140R-100 to the extent necessary for operation and maintaining them in constant readiness for operation.



Attention! During operation, part of the product is under high voltage, which is life-threatening. Familiarize yourself with the required safety precautions before use.

Abbreviations used in the manual:

- BV - high-potential block;
- MI - indicator module;
- LCD - liquid crystal indicator

1 DESCRIPTION AND OPERATION

1.1 Purpose of the device

1.1.1 High-potential DC and AC current meters ITV-140R series (hereinafter - "meters") are designed to measure DC and AC sinusoidal current with a frequency of 50-60 Hz and up to 100mA in circuits at potential up to 140 kV.

1.1.2 A feature of the meters is the absence of a galvanic connection between the high-potential measuring and low-potential indicator circuits, which ensures complete operational safety.

The meters are designed for use as part of indoor test facilities in the temperature range from + 5 °C to + 40 °C , relative humidity of the ambient air up to 90% at 25 °C and pressure from 630 to 800 mm Hg. Art.

1.1.3 Shock, vibration, presence of corrosive liquid vapors (acids, alkalis, etc.) in the air are not allowed at the installation site.

1.1.4 The product can be operated by one operator from among the electrical personnel who have permission to work in installations with voltages above 1000 V.

1.2 Basic technical data

1.2.1 The operating range of the measured currents - from 0,10 to 100mA;

NOTE - Meters measure the average (rectified average) value of a direct current and an effective value of an alternating current with a frequency of 50-60 Hz.

1.2.2 AC bandwidth - 0-1000 Hz

1.2.3 Input resistances - 7 Ohm

1.2.4 The limit of the absolute measurement error in the operating range of measured currents and temperatures is determined by the formula:

$$\Delta = 0,01 \cdot I_x + 5 \text{ lsb}, \quad (1)$$

where, I_x is the value of the measured current, mA; lsb - unit of the least significant digit.

1.2.5 Discreteness of counting 0,001mA

1.2.6 Speed - two measurements per second

1.2.7 Frequency range of the radio channel 845-945MHz

1.2.8 Number of frequency channels 16

1.2.9 Transmitter power 1mW

1.2.10 Radio communication range (open space) 5-10m

1.2.11 The meter can withstand an overload by a single current pulse with a duration of no more than 10 ms and an amplitude of no more than 150 A.

1.2.12 BV and MI are powered from built-in AA size Ni-MH batteries with a voltage of 1.2 V and a capacity of 2.1 A h.

1.2.13 Supply voltage - 5V, duration of continuous operation without recharging - at least 8 hours.

1.2.14 Dimensions / weight:

- high-potential unite ITW-140R-BV diameter 170x100 mm/1 kg;
- indicator module ITW3-MI 95x190x40mm/0,5 kg

1.3 Completeness

The composition and scope of delivery of the product is shown in Table 1

Table 1

Designation	Name	Qant.	Note
ITW-140R-BV.00.00.00	High-potential unite ITW-140R-BV	1	
ITW-140R-MI.00.00.00	Indicator module ITW-140R-MI	1	
-	Power supply	2	+12V; 300-500mA
ITW-140R.00.00.00IO	Manual	1	

1.4

Device design and operation of the product

1.4.1 The ITW-140R meter is a DC and AC milliammeter.

Functionally, the meter includes a special measuring device - a high-precision single-range low-frequency "radio voltmeter", structurally divided into two separate modules: measuring and indicator.

The measuring module is located in the ITW-140R-BV high-potential unit, the indicator module is made as a separate ITW-140R-MI module. A precision resistor (shunt) is used as a current-voltage converter in the BV. Communication between the modules is carried out via a digital radio channel.

The measuring module includes a precision voltmeter, a microcontroller that implements the conversion function, and an RF transceiver. The voltmeter measures the voltage from the shunt, and the microcontroller converts it and transmits data to the indicator module in the form of the average DC value, the rms (true RMS) AC value and amplitude values (I_{max} and I_{min}).

The indicator module is made in the form of a hand-held measuring device with LCD, radio frequency transceiver, microcontroller.

Indicator module ITW-140R-MI provides the following functions:

- indication of the measured current;
- wireless communication with BV by radio channel.

1.4.2 The electrical schematic diagram of the ITW-140R-BV high-potential unit is shown in Figure 1, the external view is shown in Figure 2.

As can be seen from the schematic diagram, a current-measuring shunt R3 is connected between the X1 and X2 connectors, the voltage from which is supplied to the measurement module and radio channel A1. The shunt against impulse current overloads (arising, for example, during load breakdown) is protected by powerful voltage limiters (suppressors) VD1 and VD2.

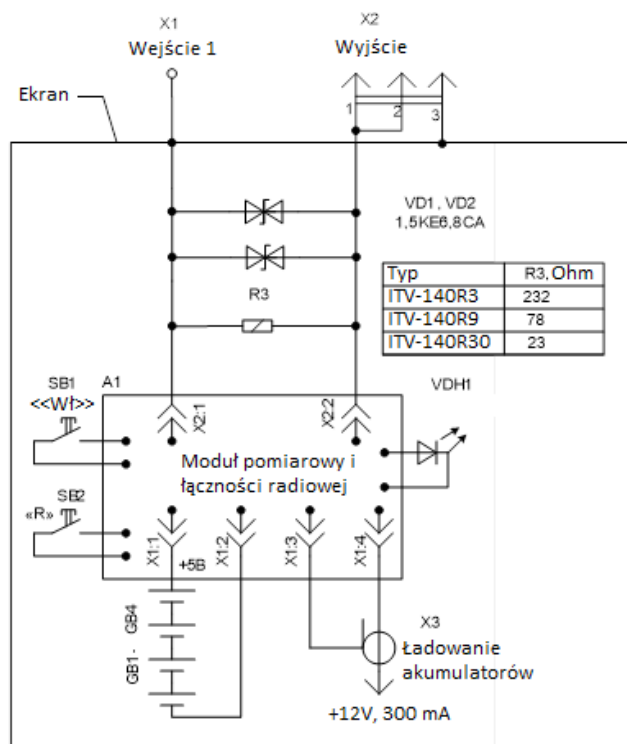


Figure 1. High-potential block ITW-140R-BV.
Electrical schematic diagram.

BV is a metal shielded case, inside of which are placed: a power container with batteries, a shunt and an overload protection unit, a board for the measurement module and a radio channel.

The button of the power switch SB1 "ON", the LED for signaling the supply voltage VDH1, the button SB2 "RESET", the socket for charging the batteries X3 "CHARGE" and the socket X2 "OUTPUT" for connecting the load are brought to the surface. The high-voltage current source is connected to the bracket connected to the case (clamp X1).

High Potential Block Button Functions:

- ON button - power on and off;
- "RESET" button - each press when the power is on leads to a change of the radio channel in a circle from 1 to 16 (in this case, the LED turns off for a short time).

The ITW-140R-BV case is at high potential, and the exit to the test object is made by a coaxial cable, the sheath of which is connected to the case, and insulated at the other end (Figure 2).

Due to this scheme, the leakage current of the high-voltage corona has practically no effect on the accuracy of the output current measurement.

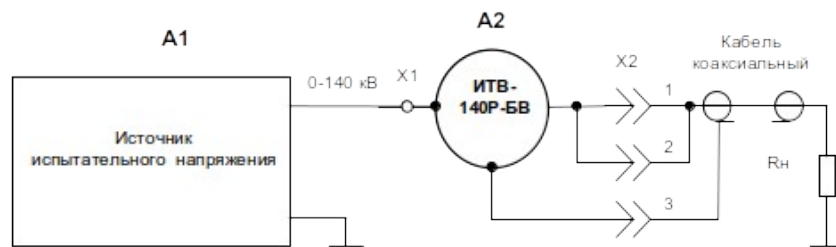
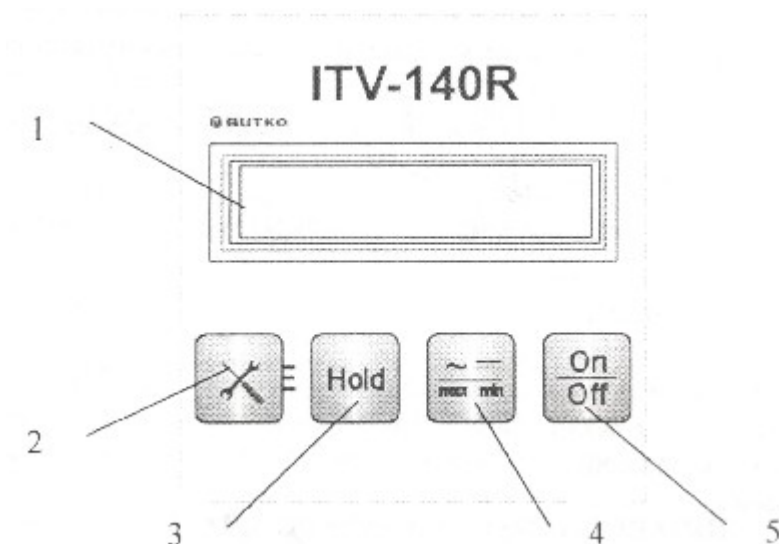



Figure 2. Wiring diagram for high-potential unit ITW-140R-BV

1.4.3 Indicator module ITW-140R-MI


On the front panel of the ITV-140-R-MI there is an alphanumeric LCD screen, a power signaling LED and four control buttons. On the side there is a socket for charging the batteries.

Functions of the buttons of the display unit:



Button 5 «»:

- turning on and off the power of the device

Button 2 «»:

- short press - turn on and off the indicator backlight
- long press (> 1 sec) - setting the contrast of the indicator

Button 4 «»:

- short press - switch mode (DC and AC or peak values);
- long press - search for a radio channel.

Button 4 «HOLD»:


- enabling and disabling the pause mode (fixing the measurement result);

1.4.4 Power supply

Both units are powered by rechargeable batteries (4 pcs. Ni-MH or Ni-Cd rechargeable batteries, size AA, capacity 1800 ÷ 2100 mAh). Each module has built-in battery monitoring and charging circuits. For charging, external power adapters with an output voltage of +12 V DC 0.3 ÷ 0.5 A are used.

1.4.5 Operating the ITW-140R Meter

1.4.5.1 Power on

The BV is switched on by pressing the "ON" button. The MI is switched on by pressing the  (power) button. Blocks can be switched on in any order. Turning on is indicated by LEDs on the front panel of both units.


If, for some reason, one of the units cannot establish radio communication with another unit for 30 minutes (for example, one of the two units is turned off or the units are spaced out of range of radio transmitters), it will automatically turn off to save the battery.

The LED on the front panel displays the power supply status of the units (table 2).


Table 2

Condition	Meaning
Lights up constantly	Power supply is normal or the batteries have finished charging
Flashes quickly (2 times per second)	Batteries are discharged and needs to be charged
Flashes slowly (1 time every 2 sec)	Charger connected, batteries are charging

1.4.5.2 LCD adjustment

The button  (short press) turns on / off the LCD backlight.

Long pressing of this button (more than 1 sec) activates the LCD contrast adjustment. In this case, the MODE button - decreases the contrast, the HOLD button - increases the contrast.

Pressing the button  again - ends the adjustment.

1.4.5.3 Operation

MI displays the result of measuring the DC or AC voltage applied to the BV. All values are calculated continuously and shown on the display averaged over a time of approximately 0.5 s.

Using the "MODE" button, you can select two modes of displaying the measurement results:

~ xx,xxxx mA	- alternating current magnitude (r.m.s. current value), mA
= xx,xxxx mA	- constant current value (average current value), mA

или

↑ xx,xxxx mA	- peak value (maximum), mA
↓ xx,xxxx mA	- peak value (minimum), mA

 **ATTENTION!** *Due to the fact that the ITW-140R is not currently certified for the amplitude measurement mode, it is not recommended to use this mode.*

The meter automatically recognizes the type of current (AC or DC) and displays its value in the required line.

The **HOLD** button is used to stop the indication. The screen readings are "frozen", with the letter "H" (HOLD) displayed in the lower right corner.


Pressing the button again restarts the display.

1.4.5.4 Setting the radio frequency

The measuring and indicator modules of the meter exchange data on one of 16 fixed frequencies (channels) in the range of 845-945 MHz. Tuning to a specific channel is performed by the operator as follows.

Turn on the power supply BV unit and press the "RESET" button on the BV unit control panel (pressing can be done, for example, with a ballpoint pen). Each time you press the button, the BV will cycle through the next channel. Stop on a channel.

With the MI switched on, press and hold the "MODE" button. In this case, the MI will switch to the radio channel search mode ("SEARCH ..." will appear on the screen), then MI will find a working channel (for example, the third one) and the "SAVE. CHANNEL X? YES NO EXIT ". Press the button under the corresponding caption.

 **ATTENTION!** *If there are several meters operating in the range of radio channels, in order to avoid mutual interference leading to incorrect readings, use different channels for all meters.*

2 SAFETY INSTRUCTIONS

2.1 Persons who have information about the product within the scope of this manual and a safety group in installations with voltages above 1000 V are allowed to work with the ITW-140R.

2.2 Working with the ITW-140R must be carried out in accordance with the safety regulations in electrical installations with voltages above 1000V.



ATTENTION! Do not apply high voltage to the high-voltage unit while charging the battery! This will inevitably lead to a breakdown to the network.

3 PREPARATION FOR WORK AND WORK PROCEDURE

3.1 Before taking measurements, you should:

- install the high-potential unit ITW-140R-BV on the insulator near the test object so that there are no metal objects within a radius of 1 m from the block (to exclude high voltage breakdowns);
- connect the test voltage source to the X1 high-voltage terminal (the high-voltage unit case), and the test object to the X2 “OUTPUT” connector with a standard coaxial cable (Figure 3);
- position the ITW-140R-MI at the operator's workplace.

3.2 When taking measurements, you should:

- turn on the power supply of the BV and MI using the power buttons (in this case, the power signaling LEDs should light up);
- turn on the source of the test voltage, and, raising the test voltage to the required value, read off the MI readings in milliamperes;
- record the result and calculate the measurement error;
- turn off the test voltage source.

Note - the measurement error is calculated according to the formula given in Section 1.2, for switching the type of displayed information on the MI, see Section 1.4.

4 INSPECTION AND MAINTENANCE

4.1 Maintenance of the ITW-140R meter is reduced to keeping it clean and periodically charging BV and MI batteries.

4.2 For charging, the plug of the battery charger is connected to the charging socket (stabilized source of constant voltage + 12V, 300-500 mA), and the source itself is connected to the 220V, 50 Hz network. The charge lasts 10-14 hours, no buttons need to be pressed.

5 POSSIBLE FAULTS

Table 3

Malfunction name, external manifestations and additional symptoms	Probable cause	Elimination method
ITW-140R-BV and MI 1 When the power is turned on with the button, the power LED is off. There are no characters on the ITW-140R-MI screen.	Batteries are completely discharged or an open circuit in the power circuit due to poor contact in the battery container	1.1 Charge the batteries using a standard charger. 1.2 Open the power compartment and check the battery voltage with a multimeter (about 5 V). If there is no voltage at the output, try to restore contact by rotating the batteries
2 When you turn on the power of the ITW-140R-MI button, the message "NO SIGNAL" appears on the screen	2.1 The power supply of the ITW-140R-BV unit is not turned on. 2.2 The power supply of the BV unit is on, but the radio signal is absent or too weak. 2.3 BV and MI radio channels are different	2.1 Switch on the power supply of the ITW-140R-BV unit. 2.2 If the distance between devices is more than 10 m, there may be no communication. The distance should be reduced. 2.3 Search for a radio channel in MI (see item 1.4.5.4).

6 STORAGE AND TRANSPORTATION

6.1 The meter should be stored indoors under conditions appropriate to its operating conditions. When stored in high humidity conditions, it should be stored in the manufacturer's shipping container; The batteries should be stored separately from the meter assemblies.

6.2 The storage room must be free of dust and vapors of corrosive liquids.

6.3 The meter can be transported in a shipping container by water, rail, road (on roads with improved surface) and air (in sealed compartments) transport. In this case, measures should be taken to protect the meter from impacts and spontaneous movements.

7 CERTIFICATE OF ACCEPTANCE

High potential AC / DC current meter ITW-140R

head .№ _____ complies with the mandatory requirements of state standards, current technical documentation and is recognized as fit for use.

Date _____

Stamp

8 MANUFACTURER (SUPPLIER) WARRANTIES

8.1 The manufacturer (supplier) guarantees the operability (safety of operational characteristics) of the product for 12 months from the date of transfer to the customer.

8.2 During the warranty period, the manufacturer repairs the product and its accessories that are out of order free of charge, provided that the consumer has not violated the operating rules.

8.3 The warranty does not cover a product with mechanical defects resulting from careless transportation and use.

8.4 After the expiration of the warranty period, the manufacturer provides service under a separate contract.

9 RECLAMATION

In the event of failure of the product to be forwarded to the supplier in full together with the application an application written in any form, but provided that the following data:

- type and manager product number;
- external manifestation of a malfunction;
- the name of the person who filled in the complaint;
- return address and contact telephone number.

The supplier's address is specified in the purchase agreement.