

## VOLTAGE RELAY PH-101M1



## OPERATING MANUAL

*Quality control system on the development and production complies with requirements  
ISO 9001:2015*

Read the Instruction Manual carefully before using the device.

Before connecting the device to the mains, keep it under operating conditions for two hours.

Do not use abrasive materials or organic compounds (alcohol, gasoline, thinners, etc.) to clean the device.



**DO NOT OPEN AND REPAIR THE DEVICE BY YOURSELF.**

The components of the device may under voltage from the mains.



**DO NOT OPEN OR REPAIR THE PROTECTED EQUIPMENT WHEN IT IS CONNECTED TO THE SOCKET OF THE DEVICE.**

Even when the device de-energized, the electrical contact between the plug and the socket may remain.



**DO NOT OPERATE THE DEVICE WITH MECHANICAL DAMAGE TO THE CASE.**

**DO NOT USE THE DEVICE IN HIGH HUMIDITY.**

**DO NOT ALLOW WATER TO PENETRATE INTO THE DEVICE.**

**ATTENTION!** THE DEVICE SHOULD BE USED IN THE NETWORK PROTECTED WITH A CIRCUIT BREAKER OF CLASS "B", AT CUTOFF CURRENT OF NO MORE THAN 25 V.

The device is not intended for load disconnection in case of short circuits.

In compliance with the requirements of this Operating Manual and regulations the device is safe for use.



The device is safe to use if the operating rules are followed.

This Operation Manual is intended to let you know about the device, safety requirements, procedure for operation and maintenance of voltage-response PH-101M1 (hereinafter referred to as the device, PH-101M1).

**Terms and abbreviations:**

AR– delay of automatic re-closure which is counted after the first switching-on or after the load disconnection due to a voltage failure (Fig. 1);

Display - a three-digit seven-segment indicator;

QF - circuit breaker.

**1 PURPOSE**

Relay PH-101M1 is designed to protect household and industrial electrical equipment (refrigerators, air conditioners, washing machines, TV, video and audio equipment, etc.) from unacceptable voltage fluctuations in the network and the consequences of a neutral (zero) wire break.

Relay PH-101M1 indicates the effective value of the voltage in the network and the state of the output contacts (load state).

Relay PH-101M1 measures and displays the current consumed by the load, active power and disconnects the load when the specified current threshold is exceeded.

Relay PH-101M1 may be used as:

- a voltage relay;
- a digital multimeter (indication of the mains voltage, active power and current consumption).

Relay PH-101M1 gets power supply from the circuit that supplies the load.

The ranges of parameters to be measured and monitored are shown in Table 1.

**2 TECHNICAL SPECIFICATIONS**

**2.1 General**

The general data are shown in Table 1.

**The device meets the requirements of the following:**

- EN 60947-1;
- EN 60947-6-2;
- EN 55011;
- EN 61000-4-2.

*Harmful substances, in more than allowed concentration, are not available.*

**Table 1** – Ranges of parameters to be measured and monitored

Name	Range to be measured	Range to be monitored
Active power, kW	-	0 – 4.0
Load current, A	1 – 16*	0.5 – 20
Input voltage, V	160 – 280	120 – 350
*Note – factory setting – 16 A		

**2.2 Operation conditions**

The device is designed for operation in the following conditions:

- Ambient temperature: from minus 35 to +55°C;
- Atmospheric pressure: from 84 to 106.7 kPa;
- Relative air humidity (at temperature of +25°C): 30 ... 80%.

*If the temperature of a device after transportation or storage differs from the environment temperature at which it is expected to operate, then before connection to electric mains keep the device under the operating conditions within two hours (because the device elements may have moisture condensation).*

**ATTENTION! The device is not intended for operation in the following conditions:**

- Significant vibration and shocks;
- High humidity;
- Aggressive environment with content in the air of acids, alkalis, etc., as well as severe contaminations (grease, oil, dust, etc.).

**2.3 Controls of relay PH-101M1**

Controls and overall dimensions are shown in Figure 1.



- 1 – display;
- 2 – indicator V is on when the display shows the value of the mains voltage;
- 3 – indicator A is on when the display shows the value of the load current;
- 4 – indicator kW is on when the display shows the active power value;
- 5 – button for changing the type of the parameter to be displayed;
- 6 – knob for setting the AR time (t);
- 7 – knob for setting the minimum voltage relay operation (Umin);
- 8 – knob for setting the maximum voltage relay operation (Umax);
- 9 – socket for connecting the protected equipment.

**Fig. 1** – Controls of relay PH-101M1

## 2.4 Specifications

The main technical specifications of the device are shown in Table 2.

The characteristics of the PH-101M1 output contacts are shown in Table 3.

The set parameters are shown in Table 4.

**Table 2** - The main technical specifications

Description	Value
Rated alternating single-phase supply voltage, V	230
Mains frequency, Hz	47 – 65
Harmonic composition (non-sinusoidality) of the supply voltage	EN 50160
Rated insulation voltage, V	450
Rated impulse withstand voltage, kV	2.5
Accuracy of active power measurement, %, not worse	5
Accuracy of current measurement, %, not worse	2,5
Voltage measurement accuracy within the range 120 - 350 V, %, not worse	2
Ready time, s, no more	0.8
Maximum switched current at active load, A	16
Power consumption at unconnected load, W, no more	2
Maximum voltage at which performance is maintained (effective value), V	450
Minimum voltage at which operability is maintained (effective value), V	100
Protection operation time according to Umax, s	1
Turn-off delay when the voltage rises above 420 V - 430 V and the pulse duration is more than 1.5 ms, s, no more	0.05
Delay of shutdown when the voltage rises above 30 V from the Umax setting, s	0.12
Protection operation time according to Umin, s	7
Shutdown delay when voltage drops below 145 V, s	0.24
Voltage hysteresis, V	4
Protection response time when the specified current threshold is exceeded, s	1
Rated operating mode	Continuous
Protection class of the device	IP30
Electric shock protection class	I
Climatic version	NF 3.1
Permissible degree of contamination	II
Overvoltage category	II
Weight, no more, kg	0,2
Overall dimensions, HxBxL, mm	122x61x76
The device retains its operability in any position in the space	

Material of the body frame - self-extinguishing plastic
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<i>If the mains voltage is below 120 V and above 350 V, the voltage value measured by the device is not correct.</i>

**Table 3** – Specifications of PH-101M1 output contacts

Name	Value
Maximum current at active load ( $\cos \varphi = 1$ ) and voltage ~ 230 V, A	16
Maximum power with closed contacts, kVA	4
Maximum switching power at active-inductive load ( $\cos \varphi = 0.4$ ), kVA	0,45
Maximum permissible AC voltage, V	275
Life time: mechanical, times, not less electric, times, not less	500 000 10 000

**Table 4** - Configurable parameters

Name	Minimum value	Maximum value
Automatic voltage reclosing time, s	5	900
Umin actuation threshold, V	160	230
Umax, V	240	290
Actuation threshold for current *, A	1	16
* Notes: 1 - Factory setting - 16 A; 2 - Installation step - 1 A.		

### 3 THE INTENDED USE

#### 3.1 Preparation for operation

##### 3.1.1 Preparation for connection:

- unpack and check the device for damage absence after transportation; in case of such damages detection, contact the supplier or the manufacturer;
- carefully study the Operation Manual;
- If you have any questions regarding the installation of the device, please contact the manufacturer by telephone number indicated at the end of this Operating Manual.

**3.2** Using the knobs located on the front panel, set the values of the maximum (Umax) and minimum (Umin) voltages at which the relay PH-101M1 should operate, as well as the AR time (t). It is recommended to set the AR time for air conditioners, refrigerators and other compressor devices at least 3-4 minutes, for other equipment - according to their operating instructions.

**Do not use excessive force when performing installation operations.**

**3.3** Connect relay PH-101M1 into a power outlet. The display will briefly show “StA”, and then the AR time countdown. During the countdown of the automatic re-closure time, the dot in the least significant digit of the display is lighting and the indicator of the measured parameter is flashing.

After the end of the AR time, if the value of the mains voltage is within the limits set by the User, voltage will appear on the output contacts of the socket. The display will show the parameter measured (the one that was before disconnecting the PH-101M1 from the mains), and the corresponding indicator will be lighting constantly (pos. 2 - 4, Fig. 1).

To change the type of the parameter measured, briefly press the button.

A flashing voltage reading means that the voltage in the network is higher (or lower) than the values set by the User.

**3.4** If necessary, set the adjusted values of the activating thresholds for maximum (“Umax”) and minimum (“Umin”) voltages, as well as the AR time. When turning the knobs, the display shows the value of the corresponding parameter simultaneously with dot flashing.

**3.5.** If necessary, set the required value of the current protection operating threshold (factory setting 16 A). For this:

- press the button for more than six seconds until the flashing inscription “= XX” appears on the display (XX is the set current protection threshold in amperes from 1 to 16) and that one of blacking out the parameter

type indicator, then release the button;

- by shortly pressing the button, set the required value of the response threshold;
- if the button is not pressed for 6 seconds, the relay PH-101M1 will exit the threshold setting state and the set threshold value will be saved.

**3.6.** Connect the protected equipment to the PH-101M1 socket.

#### **4 OPERATION OF RELAY PH-101M1**

**4.1** The PH-101M1 can be in the following states:

- normal work;
- setting the threshold for current protection;
- voltage failure;
- current failure;
- indication of AR time

**4.2** The PH-101M1 relay is in a state of normal operation if the mains voltage is within the limits set by the User and the AR time has expired.

In this state, the protected equipment is connected to the network, the display shows the value of the selected parameter and the corresponding indicator of the parameter is constantly on.

**4.3** If the mains voltage goes beyond the limits set by the User, for a time longer than indicated in the technical specifications (see Table 2), then the PH-101M1 goes into a voltage failure state. From the moment of the trouble occurrence, the countdown of the automatic re-closure time begins.

In this state, the protected equipment is disconnected from the network, and the value of the monitored voltage is displayed in the flashing mode, and the "V" indicator is flashing

After restoring the voltage parameters, if the AR time has not expired, the PH-101M1 will switch over to the state of the AR time indication. In this state, the display shows the time in seconds remained before the PH-101M1 change to the normal operation state, and the dot in the least significant digit of the display is lighting. After the end of the AR time, the PH-101M1 switches over to the normal operation state.

**4.4** If the load current exceeds the preset threshold (para. 3.5) for more than one second, the PH-101M1 will go into a current failure state.

In this state, the protected equipment is disconnected from the network, the "A" indicator flashes, and the code "= XX" is displayed in the flashing mode, where XX is the preset current limit threshold.

In the event of a current failure, it is necessary to eliminate the cause of the failure and briefly press the button on the front panel of the PH-101M1.

#### **5 TRANSPORTATION AND STORAGE**

The device in the original package is permitted to be transported and stored at the temperature from minus 45 to +60 °C and relative humidity of no more than 80 %.

#### **6 SERVICE LIFE AND MANUFACTURER WARRANTY**

**6.1** The lifetime of the device is 10 years. Upon expiration of the service life, contact the manufacturer.

**6.2** Shelf life is 3 years.

**6.3** Warranty period of the device operation is 5 years from the date of sale. During the warranty period of operation (in the case of failure of the device) the manufacturer is responsible for free repair of the device.

**ATTENTION! IF THE DEVICE HAS BEEN OPERATED WITH THE VIOLATION OF THE REQUIREMENTS OF THIS USER MANUAL, THE USER WILL LOSE THE RIGHT TO WARRANTY MAINTENANCE.**

**6.4** Warranty service is performed at the place of purchase or by the manufacturer of the device.

**6.5** Post-warranty service of the device is performed by the manufacturer at current rates.

**6.6** Before sending for repair, the device should be packed in the original or other packing excluding mechanical damage.

*You are kindly requested, in case of the device return and transfer it to the warranty (post-warranty) service please indicate detailed reason for the return in the field of the claims data.*

#### **7 ACCEPTANCE CERTIFICATE**

The device has been manufactured and accepted in accordance with the requirements of valid technical documentation and classified as fit for operation.



