

## RNPP-302M

### **MULTIFUNCTIONAL THREE PHASE VOLTAGE MONITORING RELAY**





## OPERATING MANUAL



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

Review the Operating manual before using the unit.

Store the unit in the operating environment for 2 hours before switching to the mains.

-  Do not use abrasives or organic compounds for cleaning (spirit, gasoline, solvents, etc.).  
**NEVER ATTEMPT TO REMOVE AND REPAIR THE UNIT.**  
Some of the unit components may be live.
-  **NEVER ATTEMPT TO OPEN AND REPAIR THE PROTECTED EQUIPMENT, IF SWITCHED TO THE UNIT SOCKET.**  
**NEVER ATTEMPT TO OPERATE THE UNIT UNDER CONDITIONS OF HIGH HUMIDITY.**

Do not allow any water on the contacts of the connecting blocks or inner elements of the unit.  
Do not use the unit in corrosive environments with the air containing acids, alkalis, oils, etc.

**THE UNIT IS NOT DESIGNED FOR LOAD COMMUTATION IN CASE OF SHORT CIRCUITS.  
THEREFORE, THE LOAD POWER SUPPLY CIRCUIT SHOULD BE EQUIPPED WITH THE  
CIRCUIT BREAKER FOR CURRENT OF 10 A MAXIMUM.**

This unit is safe for use in case of compliance with operating rules.

## 1. APPLICATION

Universal Three phase voltage monitoring relay RNPP-302M (hereinafter **RNPP-302M**) is designed for the permanent voltage monitoring, control and protection of the equipment with rated voltage parameters of 220/380V and 230/400V or 240/415V at rated frequency of 50Hz. RNPP-302M protects the power load from the following alarm situations and power faults:

- over/under voltage, voltage surges and fluctuations,
- phase loss,
- phase coincidence,
- wrong phase sequence,
- phase imbalance in the AC power circuits
- control over the full phase switching of the contactor
- remote control input signal to operate with the power load as per requirement

The RNPP-302M operates with the magnetic coil of the external contactor which in its turn operates with the power load. The RNPP-302M constantly checks (before and after turning on) the condition of the power contacts of magnetic contactor and detects the stuck together and burned contacts. When the power parameters return back to normal after the interruption or when the reason of the tripping is eliminated the RNPP-302M performs automatic reclosing/reset and thus restart the equipment. It does so following a time delay (0-600 sec), set previously by the user.

RNPP-302M relay may work in four independent modes:

1. phase loss monitoring mode without voltage level control (parameter  $tPr = 0$ );
2. minimum voltage monitoring mode (parameter  $tPr = 1$ );
3. maximum voltage monitoring mode (parameter  $tPr = 2$ );
4. symmetrical min/max voltage monitoring mode (parameter  $tPr = 3$ )

The LED display of the RNPP-302M indicates:

- acting value (true RMS) of the phase voltage or alternatively line voltage depending on mode of operation;
- voltage fault in mains power supply and the type of the interruption;
- load relay status (ON/OFF).

**NOTICE** - The term "rated voltage" used in this device manual means that the input voltage corresponds all settings and parameters adjusted by user (see Table 2).

## 2. MAIN FEATURES

Digital input to turn ON/OFF the RNPP-302M remotely.

Changeover relay output (8A 250V at  $\cos \varphi=1$ ) for the operation by the magnetic contactor to commute any desired power load.

Changeover relay output (8A 250V at  $\cos \varphi=1$ ) for the signalization.

Harmonical configuration (non-sinusoidality) of power supply voltage: EN 50160.

Measurement accuracy for tripping thresholds: not exceed 1.5%.

Rated phase/line voltage 220/380V (230/400V or 240/415V).

The adjustable ranges for minimal voltage; maximal voltage tripping; phase imbalance; time delays for the protection tripping; automatic restart (autoreclosing) time and other adjustable parameters are shown in the Table 2.

Rated power consumption: not exceed 3 W.

Protection degree of the enclosure case: IP40.

Protection degree of terminal block: IP20.

Cross-section of connection terminal wires: 0.25 – 2.5 mm<sup>2</sup>

Screw torque of terminal clamps: 0.4 N\*m.

Operational temperature ranges from - 35 to +55 °C and exposed to not more than 90% of relative humidity.

Weight not more than 0,3 kg.

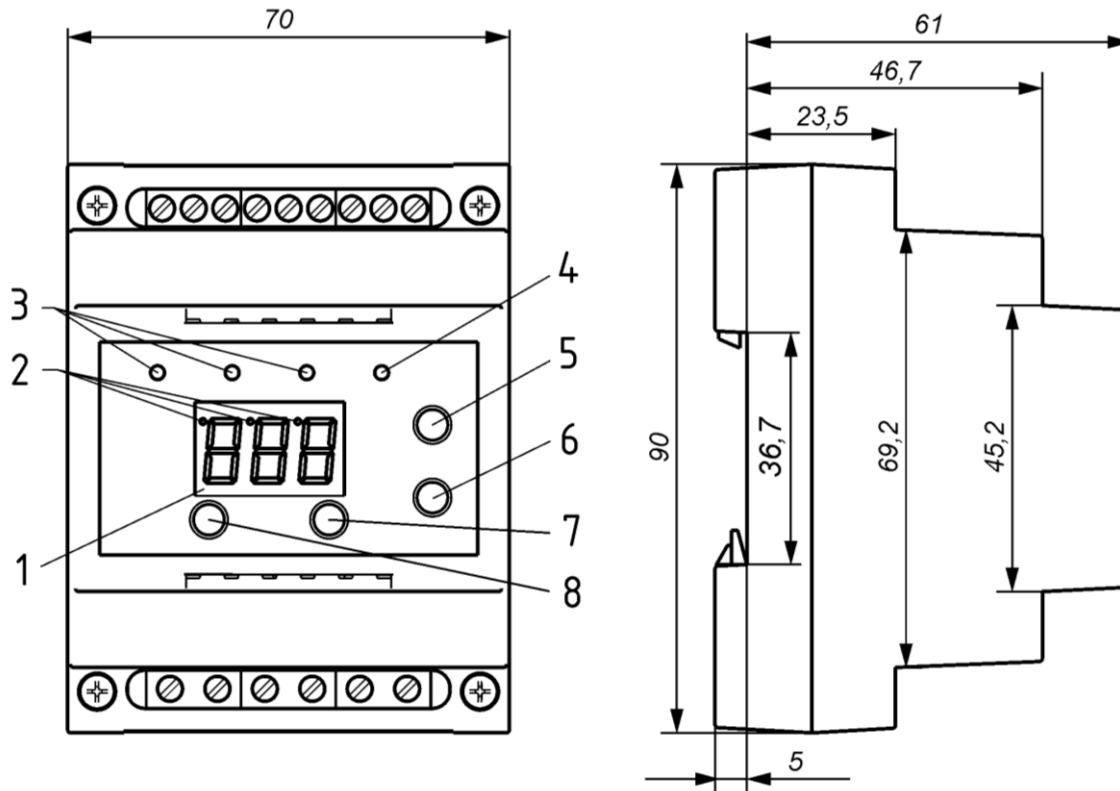
Mounting: fit the standard 35 mm DIN-rail.

Mounting position: arbitrary - as per requirement

Dimensions and control buttons are shown on Figure 1.

RNPP-302M complies with requirements:

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



- 1 - display
- 2 - phase indicator
- 3 - Red LED “L1” – lights up in case of the alarm on phase L1  
Red LED “L2” – lights up in case of the alarm on phase L2  
Red LED “L3” – lights up in case of the alarm on phase L3
- 4 - Green LED “REL” – lights up when the output relay is closed
- 5,6 - “ $\wedge$  and  $\vee$ ” Buttons - to scroll and adjust the parameters value in the menu
- 7 - “WR” – to write and save the parameter
- 8 - “SET” button – to set the parameter value

**Notes:**  $\wedge$  button hereinafter in text – “UP”,  $\vee$  button – “DOWN”

**Figure 1.** Front panel, controls and size dimensions of the **RNPP-302M**

### 3. START UP PROCEDURE

Connect the contactor (magnetic starter) to the **RNPP-302M** and make all other necessary connections as shown on Figure 2.

Connect mains power supply to the input terminals of RNPP-302M

Turn ON the power and adjust all required settings according to Table 2.

**NOTE.** All wiring connections must be performed on the dead device.

### 4. RNPP-302M CONTROLS

**4.1.** At the initial state on the front panel the following information is shown:

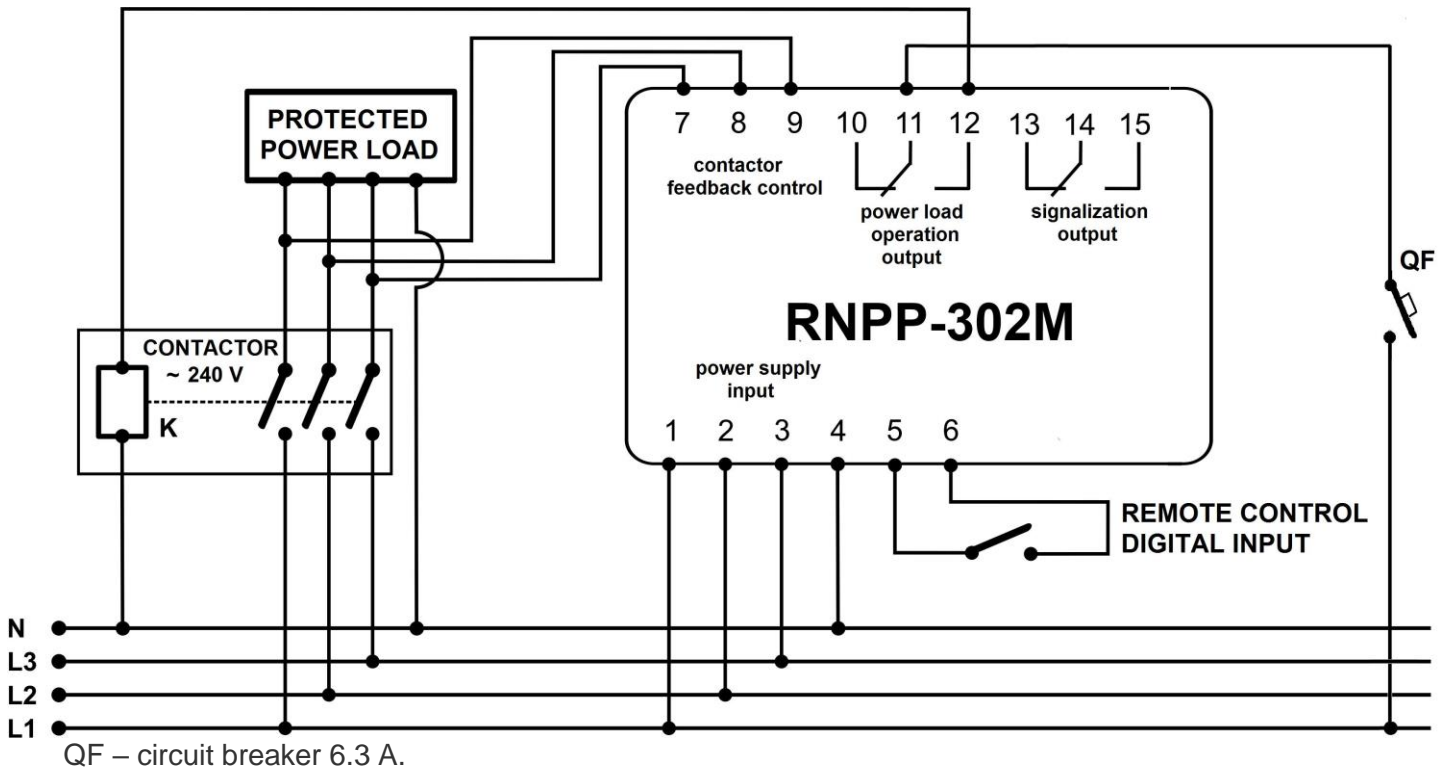
- depending the operation mode phase-to-neutral voltage on each phase (L1, L2, L3) if the parameter  $U_0$   $l=0$  (1, 2) or alternatively phase-to-phase voltage (L1-L2; L2-L3; L3-L1) if parameter  $U_0$   $l=3$  (4, 5);
- phase Indicator (indicator of the currently measured phase);
- load relay status (ON/OFF)

To select the phase manually ( $U_0$   $l=0$ ) use **DOWN** and **UP** buttons, alternatively if parameter  $U_0$   $l=1$  the measurement values on phases are displayed in turns automatically every 5 seconds

**4.2.** To view and change the parameters it is necessary press **SET** button and all phase indicators will light up. To scroll between the parameters, use **DOWN** and **UP** buttons. To enter the parameter and change value press **SET** button. Then using **DOWN** and **UP** buttons set the desired values. To save the parameter and exit

the current menu press **WR** button. To exit the menu without saving press **SET** button. If none of the buttons are pressed within 15 seconds the RNPP-302M returns to initial state.

**4.3.** To restore default factory settings quickly it is necessary to press simultaneously **SET**, **DOWN** and **UP** buttons and energize the RNPP-302M while keeping these buttons pressed. Then the display should indicate “**nRU**”. Then Turn OFF the device. Factory settings are restored.



**Note:** when using RNPP-302M in three-phase mains without a neutral wire, the terminal zero-N (terminal 4) remains free. In this case, the control must be performed by linear voltages (parameter  $U0 I = 3 (4,5)$ ).

**Figure 2.** Wiring diagram of the **RNPP-302M** to the 4 wires power circuits (with neutral phase present).

## 5. RNPP-302M OPERATION

### 5.1. Modes of RNPP-302M operation

Depending on the  $tPr$  parameter value the RNPP-302M can work in following modes:

1) Phase loss relay (the relay monitors only the presence of voltage (not the voltage level) on every phase)  $\rightarrow tPr = 0$ ;

2) Minimal voltage monitoring relay  $\rightarrow tPr = 1$ ;

3) Maximal voltage monitoring relay  $\rightarrow tPr = 2$ ;

4) Over/Under voltage monitoring (min/max) mode  $\rightarrow tPr = 3$  ;

Modes of operation, adjustable parameters, time delays and other controls are shown in Table 2.

### 5.2. Time of start of countdown

Time of start of AR countdown depends on the value of the parameter  $rAP$ .

When  $rAP = 0$ , the AR time starts counting from the moment of the occurrence of the fault ( relay trip).

When  $rAP = 1$ , the AR time starts counting from the moment when the normal voltage is restored.

At normal voltage, the **REL** LED flashes during the auto reclosing time countdown.

### 5.3. Voltage monitoring modes

#### 5.3.1 First start up instructions

The features of the first switch-on for the Maximum Voltage Relay mode are described in it.5.3.3. In other modes, when the normal voltage is supplied to the input, the time for operation preparation (0.3 - 0.4 s) is added to the restart time (parameter  $tPP$ ). After the automatic reclosing time is counted, the load relay is switched on: the **REL** LED is on, contacts 10, 11 and 13, 14 are open, and contacts 11, 12 and 14, 15 are closed.

### 5.3.2. Minimal voltage monitoring mode ( $tPr = 1$ )

When the input voltage drops below the minimum voltage level (parameter  $U_{\min}$ ) and after the end of the delay time (parameter  $t_{\min}$ ), the relay is off: contacts 10, 11 and 13, 14 will close, and contacts 11, 12 and 14, 15 will open.

After the end of the reclosing time and when the level of the monitored voltage rises above the level of the minimum voltage by a hysteresis value of 5 to 6 V, the relay is on.

### 5.3.3. Maximal voltage monitoring mode ( $tPr = 2$ )

**In this mode power load should necessarily be connected to terminals 10, 11 or 13,14.**

When giving correct power supply to the input of the RNPP-302M the position of the relay contacts does not change: contacts 10, 11 and 13, 14 are closed, and contacts 11, 12 and 14, 15 are open.

If the increase in input voltage is more than the maximal tripping threshold (parameter  $U_{\max}$ ) within after the end of the delay time (parameter  $t_{\max}$ ) the relay is off: contacts 10, 11 and 13, 14 will open, and contacts 11, 12 and 14, 15 will close.

After the end of the reclosing time and when the input voltage drops below the maximum voltage level by a hysteresis value of 5 to 6 V, the relay goes back into the initial state: contacts 10, 11 and 13, 14 will close, and contacts 11, 12 and 14, 15 will open.

### 5.3.4. Over/Under voltage monitoring (min/max) mode ( $tPr = 3$ )

When the input voltage drops below the minimum voltage level (parameter  $U_{\min}$ ) and after the end of the delay time (parameter  $t_{\min}$ ), the relay is off: the relay is off: contacts 10, 11 and 13, 14 will close, and contacts 11, 12 and 14, 15 will open.

After the end of the reclosing time and when the level of the monitored voltage rises above the level of the minimum voltage by a hysteresis value of 5 to 6 V, the load relay is on.

If the increase in input voltage is more than the maximal tripping threshold (parameter  $U_{\max}$ ) within after the end of the delay time (parameter  $t_{\max}$ ) the relay is off.

After the end of the reclosing time and when the input voltage drops below the maximum voltage level by a hysteresis value of 5 to 6 V, the load relay is on.

## 5.4. Control of the additional voltage parameters

In all above stated modes of operation, the RNPP-302M performs permanent control over additional voltage parameters and in case of deviation from the preset values it turns OFF the power load and turns ON the alarm relay. On the recovery of voltage level and cancel of the alarm situation RNPP-302M will turn ON the power load after the  $tPP$  time and turn OFF the alarm relay.

RNPP-302M performs the control over following parameters:

1) Phase imbalance. If the parameter  $C_{PI} = 1$  the RNPP-302M performs the control over phase imbalance and the tripping threshold for the phase imbalance is defined by parameter  $U_{PI}$ .

2) Wrong phase sequence and phase combination. If the parameter  $C_{PSC} = 1$  RNPP-302M monitors the correct phase sequence and the absence of the phase combination.

3) Feedback control of the voltage presence on the contactor (magnetic starter) terminals. If the contactor has burned or stuck contacts – RNPP-302M will cut the output relay and turn ON the alarm relay. This function is of a great importance as the equipment could be damaged due to bad or damaged contactor whereas all input voltage parameters are fine and correct.

If the parameter  $C_{VLC} = 1$  the RNPP-302M detects the presence of the voltage on the output terminals of the contactor and in case the stuck contacts it turns OFF the power load and turns ON the alarm relay.

4) If the parameter  $C_{VLC} = 2$  the RNPP-302M checks the voltage presence on the output contactor contacts and allows all contacts to be opened (full-phase disconnection is permitted). The alarm situation is detected only in case one or two contacts of the contactor are opened. So it may be the situation when only one or two phases will come to the equipment because of a damaged or not properly working contactor and this may result to the damage of the equipment or installation. This function is essential when the ability to turn off the MS through technological contact (external switch, intermediate relay contacts, etc.).

**To restart the operation of the RNPP-302M again after the detection of wrong phase sequence or the absence of voltage on the contactor output terminals it will be necessary to eliminate the reason of the power interruption, then only by switching off and reconnect the RNPP-302M.**

5) Control of the external signals coming to the digital input. It is defined by parameters  $C_{DI} = 1$  ( $C_{DI} = 2$ ).

RNPP-302M has the digital input that may be used to detect the external alarm situation (for example the signal from thermostat built into the AC motor coil). On getting the signal the RNPP-302M immediately disconnect the power load and displays the “A I” alarm code. When the alarm situation is eliminated (there is no signal from the external source) the RNPP-302M will automatically turn on the power load with the delay time defined by  $t_{PP}$  parameter.

Monitoring of the absence of phase failure (voltage drop for any of the phases below 50 V) is maintained in all modes of operation.

### 5.5. Indication

In the absence of failure, the RNPP-302M indicator displays the effective value of the voltage of the selected phase with the lighting point at the top of the indicator, which indicates the selected phase (L1, L2, L3 in Fig. 1). The REL LED is on when the load relay is on.

In the case of faults with minimum voltage, maximum voltage, phase failure and voltage unbalance, the fault LED of the phase in which the alarm occurred is on. If the order of the phase sequence is violated, the alarm LEDs light up alternately (running lights). For all other types of failures, all alarm LEDs are on.

All alarm signal codes are output to the digital indicator in accordance with Table 1. The REL LED flashes during the reclosing time countdown at the normal voltage.

### 5.6. Alarm

Any of the two groups of contacts 10,11,12 or 13,14,15 can be used for alarm.

**Table 1 - ALARM CODES**

Signalization codes shown on display			
$A I$	Digital input turn OFF remote control	$U_{JL}$	The absence of voltage on the contactor output terminals or in case of not full phase switching of the contactor
$U_{\leq}$	Minimal voltage	$U_{i'}$	Wrong phase sequence
$U_{\geq}$	Maximal voltage	$U_{\square}$	Phase loss
$U_{PP}$	Phase imbalance		

**Table 2 - RNPP-302M OPEATION MODES**

Adjustable and measures parameters	Parameter codes	Minimal value	Maximal Value	Factory setting	Description
<b>Basic parameters and SETTINGS</b>					
Voltage measurement indication	$iU$	0	1	1	0 - Manual phase selection. It is displayed the voltage on the phase which is marked by Phase Indicator. 1 - Automatic Phase Selection. Voltage measurements on each phase are shown in turns every 5 sec
Digital input signal to turn OFF of the load relay remotely	$cI$	0	2	0	0 - not enabled 1 - on closing of the digital input contact the RNPP-302M through time $t_{Cc}$ turns OFF the load relay 2 - on opening of the digital input contact the RNPP-302M through time $t_{Cc}$ turns OFF the load relay
Mode of RNPP-302M operation	$tPr$	0	3	3	0 - PHASE LOSS RELAY (minimal and maximal voltage are not controlled), RNPP-302M turns OFF the power load only if voltage disappear on 1 or 2 phases 1 - MINIMAL VOLTAGE RELAY, RNPP-302M turns OFF the power load if the voltage gets lower than preset $U_{\leq}$ value; 2 - MAXIMAL VOLTAGE RELAY, RNPP-302M turns OFF the power load if the voltage gets higher than preset $U_{\geq}$ value; 3 - MINIMAL/MAXIMAL VOLTAGE RELAY, RNPP-302M turns OFF the power load if the voltage gets lower than $U_{\leq}$ value or higher than $U_{\geq}$ value

Adjustable and measures parameters	Parameter codes	Minimal value	Maximal Value	Factory setting	Description
Method to set Voltage deviation	5UR	0	1	0	0 - voltage values are set up in absolute values 1 - voltage values are set up in % of rated power parameters
Phase imbalance control	[PP	0	1	1	0 - not enabled 1 - enabled
Phase sequence control	[1,1	0	1	1	0 - not enabled 1 - enabled
Control of the voltage presence on the output contacts of the contactor	[UL	0	2	0	0 - not enabled 1 - enabled 2 - enabled, and full-phase TURN OFF or TURN ON of the contactor is allowed (for example for the cases where manual stop/start function is required)
<b>Voltage setting</b>					
Voltage measurement	UD I	0	5	0	0 - phase voltage (phase-to-neutral) 220V 1 - phase voltage (phase-to-neutral) 230V 2 - phase voltage (phase-to-neutral) 240V 3 - line voltage (phase-to-phase) 380V 4 - line voltage (phase-to-phase) 400V 5 - line voltage (phase-to-phase) 415V
Minimal voltage setting, V: In % values	U==	85 147 -60	230 398 +10	180 311 -30	If 5UR =0 and UD I=0, UD I=1, UD I=2; If 5UR =0 and UD I=3, UD I=4, UD I=5; If 5UR =1 and any values of UD I parameter.
Maximal voltage setting, V: In % values	U==	235 407 -10	295 510 +20	245 424 10	If 5UR =0 and UD I=0, UD I=1, UD I=2; If 5UR =0 and UD I=3, UD I=4, UD I=5; If 5UR =1 and any values of UD I parameter.
Phase imbalance, V: In % values	UPP	10 17 5	80 138 35	15 25 5	If 5UR=0 and UD I=0, UD I=1, UD I=2; If 5UR =0 and UD I=3, UD I=4, UD I=5; If 5UR =1 and any values of UD I parameter.
<b>Time setting</b>					
Autoreclosing time delay, sec	tPP	0.5	600	10	<b>Attention! The minimum reclosing time for a phase failure is 3 seconds, regardless of the value of the parameter tPP</b>
Time delay to TURN OFF the power load in case of <b>minimal voltage</b> interruption detected, sec	t==	0.1	30	10	
Time delay to TURN OFF the power load in case of <b>maximal voltage</b> interruption detected, sec	t==	0.1	30	1	
Time delay to TURN OFF the power load in case the phase imbalance is detected, s	tPP	0.1	30	3.0	
Time delay to TURN OFF the power load in case the phase loss is detected, s	tO	0.1	30	0.5	
Time delay to TURN OFF the power load in case the alarm signal comes from the digital input, s	t[C	0.1	600	10	

Adjustable and measures parameters	Parameter codes	Minimal value	Maximal Value	Factory setting	Description
Starting of the reclosing time AR	rAP	0	1	0	0 - the reclosing time AR begins when the alarm signal comes 1 - the reclosing time AR begins when restoration of the mains voltage parameters
Device version	rEL			14	

### 6. STORAGE AND SHIPPING CONDITIONS

The **RNPP-302M** in manufacturers package should be stored in enclosed rooms with ambient temperature from -45° to +60° C and exposed to not more than 80% of relative humidity. It should be no fumes in the air that may exert a deleterious effect on package and the RNPP-302M components.

### 7. WARRANTY AND CLAIMS CONDITIONS

**7.1** The unit service life is 10 years. Upon expiration of the service life, you should contact the Manufacturer.

**7.2** Shelf life is 5 years.

**7.3** Warranty period of the unit operation is 5 years from the date of sale.

During the warranty period the Manufacturer is responsible for free repair of the unit, if the Consumer has complied with the requirements of this Operating Manual.

**ATTENTION! IF THE UNIT HAS BEEN OPERATED WITH VIOLATION OF THE REQUIREMENTS OF THIS OPERATION MANUAL, SELLER WILL FORFEIT THE RIGHT TO WARRANTY SERVICE.**

**7.4** Warranty service is performed at the place of purchase or by the Manufacturer of the product.

**7.5** post-warranty, service is performed by the Manufacturer at current rates.

**7.6** Before sending for repair, the unit should be packed in the original or other packaging excluding mechanical damage.

### 8. ACCEPTANCE CERTIFICATE

Three phase voltage monitoring relay RNPP-302M has been manufactured and accepted in accordance with the requirements of current technical documentation and is fit for service.

Stamp \_\_\_\_\_ Quality control department seal \_\_\_\_\_ Production date \_\_\_\_\_

Sale date \_\_\_\_\_

### 9. NOTICES OF CLAIMS

*Earnest request: when returning the unit or transfer for warranty or post-warranty service, in the fields for claims please indicate in details the reason for return.*

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*Manufacturer is grateful to you for the information about the product quality as well as comments and proposals concerning the unit operation.*



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