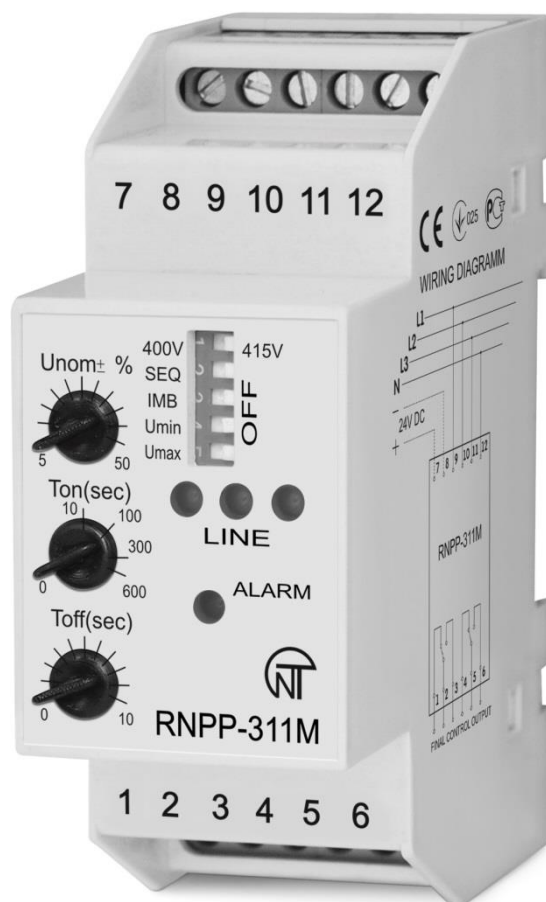


## RNPP-311M

### MULTIFUNCTIONAL THREE PHASE VOLTAGE MONITORING RELAY



## OPERATING MANUAL

*Quality control system on the production complies with requirements ISO 9001:2008*

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 OPERATE THE UNIT WITH THE MECHANICAL DAMAGE TO THE HOUSING.

DO NOT LET WATER INTO THE UNIT.



WARNING! THE UNIT SHOULD BE OPERATED IN THE ELECTRIC MAINS PROTECTED WITH AUTOMATIC CIRCUIT BREAKER WITH THE BREAKING CURRENT OF 6,3 A NOT MORE, B CLASS.

This unit is not designed for power-cut in event of a short circuit.

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

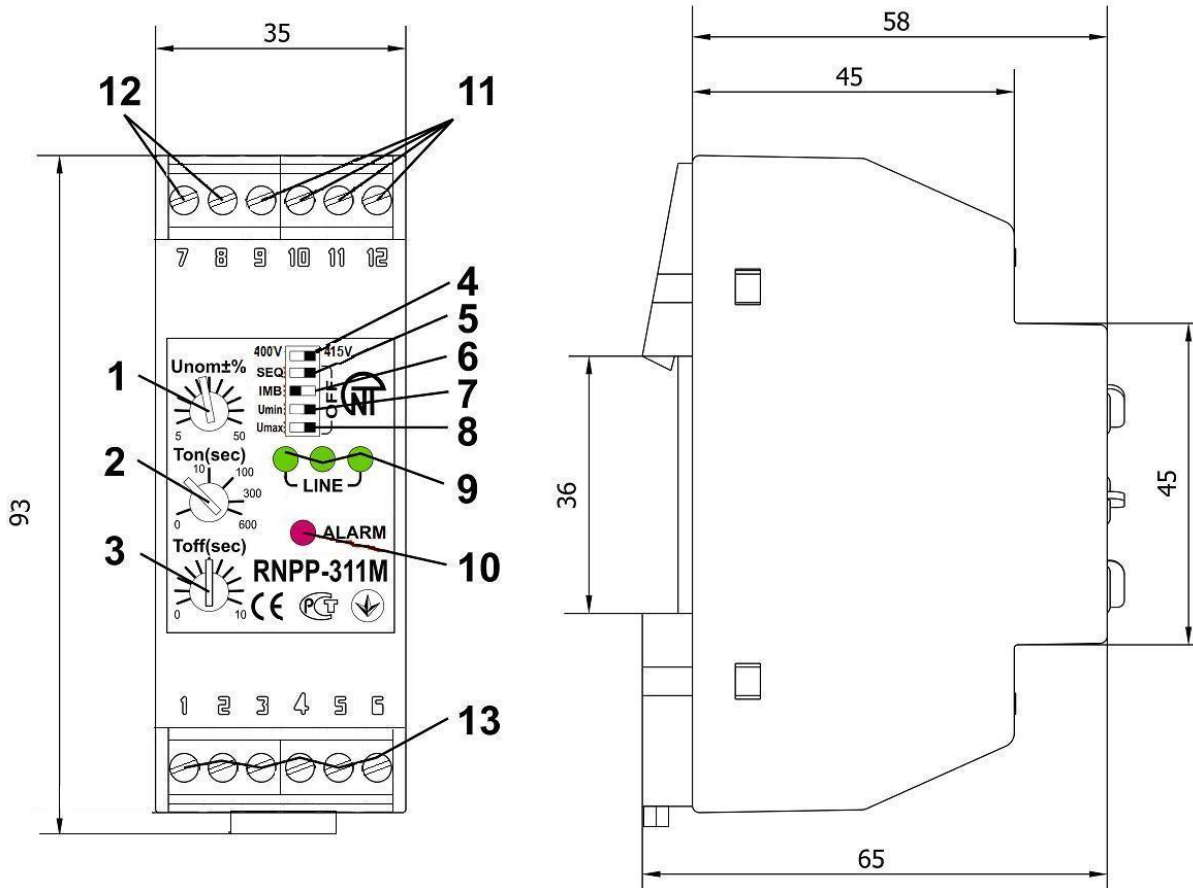
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## 1. APPLICATION

Multifunctional voltage monitoring relay RNPP-311M (hereinafter RNPP-311M) performs the following functions:

- Permissible voltage level control;
  - Control of correct phase sequence, phase loss and phase coincidence;
  - Phase imbalance control (control of full phase power load and phase symmetry);
  - Turning the power load **OFF** by operating with output contacts in case of unallowable mains voltage parameters. User adjusted Tripping time delay is in the range 0-10 sec (**Toff**);
  - Mains voltage monitoring after tripping and automatic turning **ON** the power load when the voltage parameters return back to normal conditions. Autoreclosing time delay is adjusted by (**Ton**) user in the range 0-600 seconds;
  - Alarm indication in case of voltage faults and indication of voltage presence on each phase;
- Using toggle switch (Figure 1; point 4) RNPP-311M user may select the type of the power circuit (400V or 415V) and the set of optionally performed functions (using toggle switches 5-8 shown on Figure 1).



- 1 – Min/Max voltage tripping threshold (**U<sub>max</sub>/U<sub>min</sub>**);
- 2 – Autoreclosing time delay (**T<sub>on</sub>**);
- 3 – Tripping time delay (**T<sub>off</sub>**);
- 4 – Toggle switch: type of power circuit 400V/415V;
- 5 – Toggle switch (ON/OFF): phase sequence control (**SEQ**);
- 6 – Toggle switch (ON/OFF): phase imbalance control (**IMB**);
- 7 – Toggle switch (ON/OFF): Minimal voltage tripping (**U<sub>min</sub>**);
- 8 – Toggle switch (ON/OFF): Maximal voltage tripping (**U<sub>max</sub>**);
- 9 – Green LED indicators of voltage presence on each phase;
- 10 – Red LED “**ALARM**” indicator showing also the open state of the output contacts;
- 11 – Input terminals 400V/415V;
- 12 – Input terminals 24V (available on request);
- 13 – Output terminals.

**Figure 1 - Control descriptions and dimensions diagram**

It is possible to adjust the RNPP-311M to operate in following modes:

- complete voltage parameters monitoring;
- MIN/MAX voltage level monitoring;

- MIN voltage monitoring;
- MAX voltage monitoring;
- correct phase sequence monitoring and phase coincidence control;
- phase imbalance control

Control of voltage presence on each phase is being performed at any position of 4-8 switches.

On special request it is possible to arrange operative input voltage of 24V for the RNPP-311M (is recommended for using in the network lines with a high level of harmonic waves).

**ATTENTION** - the source of operational supply is galvanically connected to zero network.

## 2. TECHNICAL CHARACTERISTICS

Purpose of device - control and distribution equipment.

Typical operation - continued.

Rated line/phase voltage, V	400/230, 415/240
Rated frequency, Hz	45 – 65
Harmonical configuration (nonsinusoidality) of power supply voltage	EN 61000-3-2 (IEC 1000-3-2)
Adjustable range for $U_{max}/U_{min}$ , % of nominal value $U_{nom}$	5 - 50
Adjustable Tripping time delay ( <b>T<sub>off</sub></b> ), sec	0 – 10
Adjustable Autoreclosing time delay ( <b>T<sub>on</sub></b> ), sec	0 – 600
Fixed time delay for tripping in case MIN voltage fault detected (time delay for <b>U<sub>min</sub></b> ), sec	12*
Reaction time in case of phase loss, sec (not more)	0,2
Readiness time on energizing the RNPP-311M, sec (not more)	0,2**
Phase imbalance value, V	60
Voltage hysteresis, V	5 - 6
Phase imbalance hysteresis, V	5 - 6
Accuracy for voltage tripping threshold measurement, V (not more)	3
Accuracy for phase imbalance measurement, % (not more)	2
Protection class against electric shock	II
Permissible contamination level	II
Overvoltage category	II
Nominal voltage of isolation, V	450
Operational voltage range, % of rated voltage	from 50 to 150
Rated impulse withstand voltage, kV	2.5
Power consumption (under power load), VA (not more)	3.0
Maximal current that output contacts may commutate, A	5
Cross-section area of connection terminals, mm <sup>2</sup>	0.5 – 2
Maximum torque of terminal fixing, N*m	0.4
Commutation endurance for the output contacts: - under 5A power load, not less than - under 1A power load, not less than	100000 times 1000000times
Protection degree: - for the device - for the terminals	IP40 IP20
Operational temperature range, °C	from - 35 to +55
Storage temperature conditions, °C	from - 45 to +60
Weight, kg (not more)	0.200
Overall Dimensions, mm	35 x 93 x 68
Standard 35 mm DIN rail mounting	
Mounting position as per requirement (arbitrary)	
<p>*In case of minimal voltage alarm situation (<b>U<sub>min</sub></b> fault) then tripping time delay of 12 seconds will be applied on the following conditions:</p> <p>a) <b>U<sub>max</sub></b> and <b>U<sub>min</sub></b> switches are set to the left position;</p> <p>b) At any other combination of switches of <b>U<sub>max</sub></b> and <b>U<sub>min</sub></b>, of relay will work with the <b>T<sub>off</sub></b> time preset by the user;</p> <p>If within this 12 sec time interval it will happen some other type of voltage interruption (for example <b>U<sub>max</sub></b> fault), then the RNPP-311M will trip the power load with minimal time: with the <b>T<sub>off</sub></b> time preset by the user or the left time of 12 sec interval.</p> <p>**In case of maximal voltage mode – 0.3 seconds.</p>	

### Specification of the Output contacts (1-2-3 and 4-5-6)

Cos φ	Maximal current at ~ 250V	Maximal capacity	Maximal AC Voltage	Maximal current at 30V DC
0,4	5 A	1250 VA	400 V	3 A
1,0	2 A	500 VA		

RNPP-311M complies with requirements IEC 60947-1:2004, IDT, IEC 60947-6-2:1992, IDT, CISPR 11:2004, IDT, IEC 61000-4-2:2001, IDT.

#### Operating conditions

The unit is designed for operation in the following conditions:

- ambient temperature is from minus 35 to +55 °C;
- atmospheric pressure is from 84 to 106.7 kPa;
- relative air humidity (at +25 °C) is 30...80%.

### 3. GENERAL DESCRIPTION

3.1 RNPP-311M is a microprocessor based device. It is self-powered by the power circuit to which it is connected – so that the controlled voltage is also a power supply source. Internal power supply scheme of RNPP-311M is designed such a way that it will keep working if the voltage is present at least at one of the phases (on condition that the neutral is connected).

Alternatively RNPP-311M could be powered by 24 V (AC/DC) external power supply source.

On the upper and lower sides of the front panel there are input and output wiring terminals (kindly see Figure 1):

- 1 – 6 – two groups of independent output changeover contacts: 1-2-3 and 3-4-5;
- 7, 8 – input terminals for 24V power supply “+” and “-” accordingly;
- 9 – 11 – input terminals for L1; L2; L3;
- 12 – neutral.

RNPP-311M should be connected in parallel to the power load by input contacts L1 (9), L2 (10), L3 (11) and the Neutral to terminal 12. If there is no possibility to connect Neutral or the RNPP-311M is installed in the power circuit with isolated Neutral – then the measurement accuracy for the phase imbalance and voltage tripping thresholds increase to 5%.

To terminals **7(+)**, **8(-)** it is possible to connect 24V AC/DC external power supply source.

On the output of the RNPP-311M there are 2 groups of independent changeover contacts (**1-2-3** and **4-5-6**). In “cold” state when the relay is not connected or there is no power - contacts **1-2 (4-5)** are **closed**, while **5-6 (2-3)** are open.

When RNPP-311M is connected in parallel to the power load and input voltage parameters are normal (there is no reason for tripping the power load) – the terminals 1-2 (4-5) are open and the terminals 5-6 (2-3) are closed, except for the maximal voltage mode in which the relay works with the reverse logic of switching on.

*It is recommended to connect the terminals **5-6 (2-3)** in break with a starter coil power.*

When the relay trips, the load is de-energized by the break in the magnetic starter coil power circuit through the terminals **5-6(2-3)**.

**ATTENTION!** – in all modes of operation RNPP-311M trips the power load with the fixed time of 0,2 sec in case of phase loss or if the voltage on any of the phases get lower than 100V.

If RNPP-311M is used as a **maximal voltage** protection relay in this case the break in the magnetic starter coil power must be connected to terminals **1-2 (4-5)**. So if the normal voltage is present and there are no reasons for the tripping - terminals **1-2 (4-5)** are closed and terminals **5-6 (2-3)** are open. This operation logics is made that in a **maximal voltage** mode RNPP-311M has never worked on voltage decreasing. In this mode **Ton** value is not considered only at the first inclusion of the RNPP-311M to main.

#### 3.2. Indication

In table below different combinations of LINE LED indicators are shown:

Green LED indicators LINE	Indication status LINE	Red LED ALARM	Indication status ALARM	Functional state of RNPP-311M
● ● ●	All LEDs are permanently <b>ON</b>	○	Luminescence is absent	Voltage parameters on each phase are normal.
		●	Blinking (reverse reading of the autoreclosing time delay)	
○ ○ ○	Blinking of any (all) LEDs	●	Continuous luminescence	Voltage rise on the corresponding phase is detected
○ ○ ○	Any (all) LEDs are <b>OFF</b>	●	Continuous luminescence	1) Voltage level on any (all) of phases is lower than the user adjusted value; 2) Voltage level on any (all) of phases is lower than 100V or the phase loss is detected;
○ ● ● ● ● ○	Blinking of two LEDs alternately. At first Middle and Right LEDs turn <b>ON</b> and then Middle and Left turn <b>ON</b>	●	Continuous luminescence	Phase imbalance alarm situation.
● ○ ○ ○ ● ○ ○ ○ ●	Left, Middle and then Right LEDs turn <b>ON</b> one by one	●	Continuous luminescence	Wrong phase sequence and phase coincidence alarm situation

**NOTE** - If several alarm situations happen concurrently then they are indicated according the following priority:

- 1 – Phase loss or voltage level on any of phases decrease lower than 100V (the highest precedence);
- 2 – Wrong phase Sequence;
- 3 – **Umin** and **Umax**;
- 4 – Phase imbalance alarm.

If the voltage is present only on one of phases and the external power supply of 24 V is absent then RNPP-311M saves operability when voltage at least 140 V.

### 3.3. Adjustments and settings

**ATTENTION!** Not to break or turn the knobs, please, don't make excessive efforts when performing adjusting operations.

On the front panel of the RNPP-311M there are 3 adjustment knobs to set the desired values and 5 switches to select necessary modes of operation (see Figure 1):

**Unom±%** - combined adjustment for the minimal/maximal voltage tripping thresholds in % of nominal (rated) voltage;

**Toff** – tripping time delay setting (in seconds) for all alarm situations except the phase loss or if the voltage on any of the phases gets lower then 100V. It is recommended to set the **Toff** time not less than 1 sec to escape from undesired frequent trippings caused by fluctuations in power circuits;

**Ton** – time delay (in seconds) for automatic turn **ON** of the power load when the voltage parameters returned back to normal values after the detected voltage interruption (autoreclosing time delay); turn **ON** time delay for after correct voltage is applied to the input terminals;

### 3.4 Toggle switches 4 – 8 (see Figure 1):

Using the switches user may select necessary functions for RNPP-311M to perform:

**400/415V** – to select the desired standard of the power circuit;

**SEQ** – wrong phase sequence or phase coincidence;

**IMB** – phase imbalance;

**Umin** – voltage is lower than the user adjusted value of **Umin**;

**U<sub>max</sub>** – voltage is higher than the user adjusted value of **U<sub>max</sub>**

The switches **SEQ**, **IMB**, **U<sub>min</sub>**, **U<sub>min</sub>** are intended for permission / prohibition of relay operation in case of emergency.

If the switch is set to the Left position – then the corresponding function is turned **ON**;

If the switch is set to the Right position – this function is disabled.

RNPP-311M will operate by any one of **SEQ**, **IMB**, **U<sub>min</sub>**, **U<sub>min</sub>** emergency if this switch is set to the Left position (ON).

#### 4. START UP PROCEDURE AND OPERATION

4.1 RNPP-311M is supplied ready to use and doesn't require any special start up procedures. Due to the use of microprocessor based scheme all the settings and adjustments are set precisely accurately and there is no need to check the accuracy of settings with a help of testing voltmeter.

After long time storage period it is recommended to check the functionality of RNPP-311M. There is no need to perform any routine maintenance if the RNPP-311M is already in use for a long time and being used in accordance to the operation conditions stated in the present documentation.

**ATTENTION!** *All the terminals connections and operation should be strictly performed according to safety regulations. It is recommended to adjust all the knobs and select necessary functions when the RNPP-311M is in the "cold" state (not energized). When testing the device it is allowed to make adjustments and change the settings on the energized RNPP-311M.*

##### 4.2 Start up procedure:

1. Using adjustment knobs set the required values of voltage tripping thresholds **U<sub>nom±%</sub>**; tripping time delay **T<sub>off</sub>** and autoreclosing time delay **T<sub>on</sub>**;

2. Using 5-8 switches on the front panel (Figure 1) at the left or right position.

Left position of the switch - function is enabled;

Right position –function disabled.

3. With the use of the DIP switch 4 ( Figure 1) set the type of the power supply input.

4. Connect RNPP-311M in parallel to the power load - using input terminals **9**, **10**, **11** (see Figure 1) and Neutral to terminal **12**.

If necessary connect external 24V (AC/DC) power supply source to terminals **7 (+)** and **8 (-)**;

5. Connect output terminals (**1-2(4-5)** and **5-6(2-3)**) to the control circuit (operational contacts of the contactor);

6. Give the power supply to input terminals (energize the RNPP-311M)

If on the first start up RNPP-311M doesn't allow to turn **ON** the power load and indicates wrong phase sequence alarm but the user is absolutely sure that the phase sequence is correct – then it is necessary to exchange the wires connected to terminals **10** and **11**.

If RNPP-311M is being used as a **maximal voltage protection relay** then the break in the magnetic starter coil power circuit should be connected to terminals **1-2 (4-5)** (the reverse logic of switching-on).

The switch **U<sub>max</sub>** should be set to ON position (enabled) and the switches **SEQ**, **IMB** and **U<sub>min</sub>** should be set to the OFF position (disabled).

##### 4.3 RNPP-311M usage examples

###### a) Minimal voltage relay

- Switch **U<sub>min</sub>** is set to the left position (function is enabled)

- Switches **U<sub>max</sub>**, **IMB** are set to the right position (function disabled)

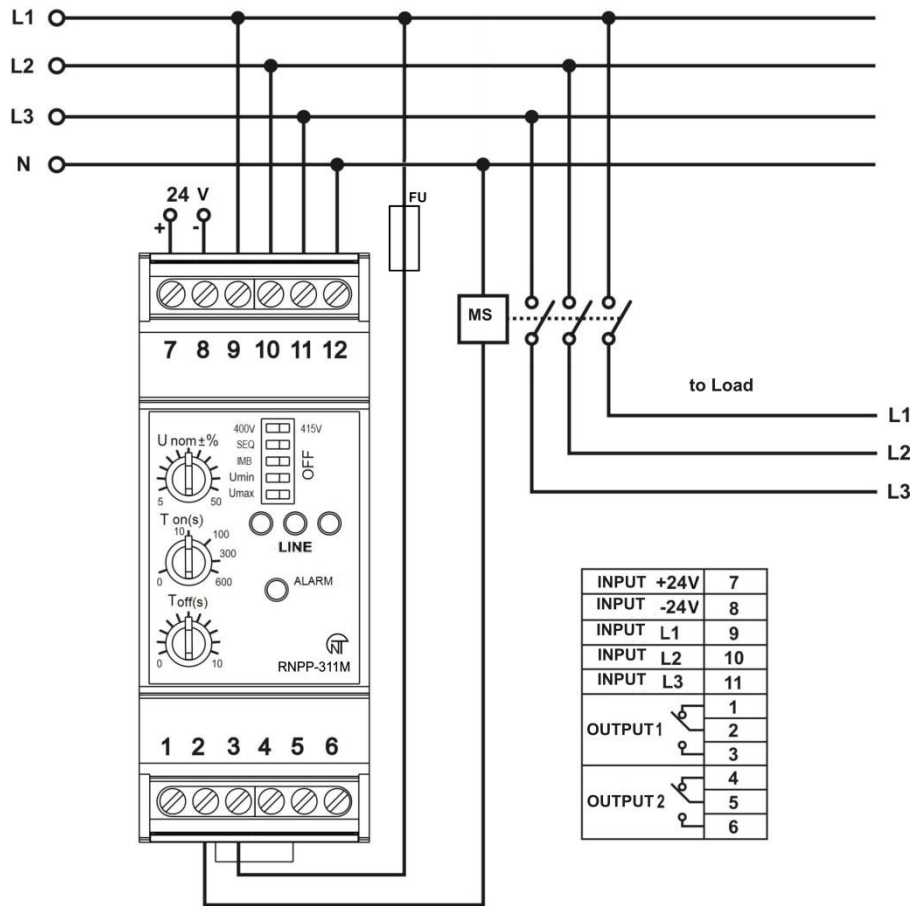
If the voltage level is lower than the user adjusted minimal voltage threshold (**U<sub>nom±%</sub>**) – then RNPP-311M will turn **OFF** the power load with the user preset time delay **T<sub>off</sub>** and red **ALARM** LED indicator will turn ON. Corresponding **LINE** green LED indicator(s) will turn **OFF** indicating on which line the problem occurred. If the voltage on any of the lines is lower than 100V – then RNPP-311M will turn **OFF** the power load within 0,2 sec.

###### b) Voltage level monitoring and phase presence control relay

- Switches **U<sub>min</sub>** and **U<sub>max</sub>** are set to the left position

If voltage level is higher than the user adjusted maximal voltage threshold (**U<sub>nom±%</sub>**) – then RNPP-311M will turn **OFF** the power load with the user preset time delay **T<sub>off</sub>**; in case the minimal voltage problem detected then the power load will be turned **OFF** with the fixed time delay of 12 sec (in order to escape from fault tripping due to startup voltage drops). Red **ALARM** LED indicator will turn **ON**. In case the phase loss detected– then RNPP-311M will turn **OFF** the power load within 0.2 sec.

- 7 -  
**WIRING DIAGRAMM**



**FU** – fuse 6.3 A (circuit breaker)

**Figure 2 - RNPP-311M Connection diagram**

**c) Maximal voltage relay**

- Switch **Umax** is set to the left position (function is enabled)
- Switches **Umin**, **SEQ**, **IMB** are set to the right position
- Red **ALARM** indicator is **OFF**

If high voltage detected RNPP-311M will turn **OFF** the power load with time delay (**Toff** +0,4) sec and the red **ALARM** indicator will turn **ON**.

**d) Turn ON time delay relay.**

- Switches **Umin**, **Umax** are set to the right position

RNPP-311M will turn **OFF** the power load with the user preset time delay **Ton**.

In all operational modes the switching on and switching off of the protection against the wrong phases sequence is carried out by a switch **SEQ** and the switching on and switching off of the protection against the phases distortion is carried out by a switch **IMB**.

In case the phase loss detected or the voltage on any of the lines becomes lower than 100V – then RNPP-311M will turn **OFF** the power load. Corresponding **LINE** green LED indicator(s) will turn **OFF** indicating on which line the problem occurred.

If all switches **Umax**, **Umin**, **SEQ**, **IMB** are set to the left position and the minimal voltage fault detected then the power load will be turned **OFF** with the fixed time delay of 12 sec (in order to escape from fault tripping due to startup voltage drops).

**5. STORAGE AND TRANSPORTATION CONDITIONS**

RNPP-311M should be stored in a factory package in enclosed rooms with ambient temperature from minus 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-311M components. The Buyer must provide the protection of the relay against possible mechanical damages in transit.

## **6. WARRANTY AND CLAIMS CONDITIONS**

6.1 Service life is 10 years. Refer to the manufacturer upon the expire of the service life.

6.2 Guaranteed storage life – is 3 years.

6.3 Warranty period is 36 month upon the day of sale.

The manufacturer shall repair the unit, in the compliance with the operating manual by the user, within the warranty period.

RNPP-311M is not subject to the warranty service in the following cases:

- expiry of the warranty period;
- availability of mechanical damages;
- traces of moisture attack or in the presence of foreign items inside the unit;
- attempts to open and repair;
- damage is caused by electric current or voltage in excess to the permissible values as indicated in the Operating manual.

6.4 Warranty service is provided in the place of purchase

6.5 Post-warranty service shall be provided by the manufacturer.

6.6 The manufacturer's warranty does not cover compensation for direct or indirect losses associated with the unit transportation to the place of purchase or manufacturer's plant.

## **7. ACCEPTANCE CERTIFICATE**

Multifunctional voltage monitoring relay RNPP-311M was produced and accepted in accordance with the requirements of effective technical documentation and was recognized as suitable for operation.