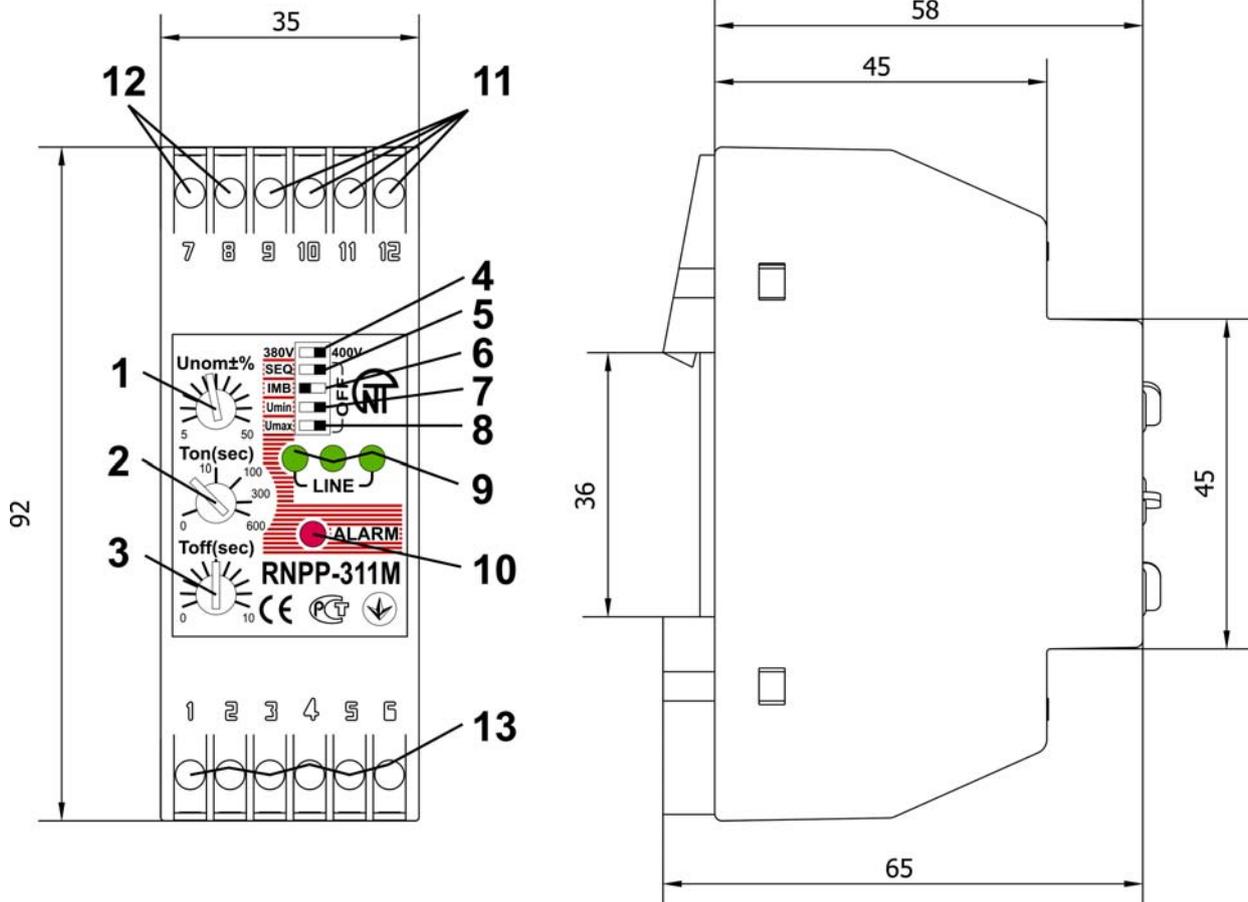


RNPP-311M

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



USERS MANUAL



- 1 – Min/Max voltage tripping threshold (U_{max}/U_{min});
- 2 – Autoreclosing time delay (T_{on});
- 3 – Tripping time delay (T_{off});
- 4 – Toggle switch: type of power circuit 380V/400V;
- 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_{min});
- 8 – Toggle switch (ON/OFF): Maximal voltage tripping (U_{max});
- 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 380V/400V;
- 12 – Input terminals 24V (available on request);
- 13 – Output terminals.

Figure 1 - Control descriptions and dimensions diagram

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 (T_{off});
 - 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 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 (380V or 400V) and the set of optionally performed functions (using toggle switches 5-8 shown on Figure 1).

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 5-8 switches, even if all of them are set to OFF.

On special request it is possible to arrange operative input voltage of 24V for the RHPP-311M.

2. TECHNICAL CHARACTERISTICS

Rated line/phase voltage, V	380/220, 400/232
Rated frequency, Hz	45 – 65
Adjustable range for MIN/MAX voltage tripping threshold (U_{max}/U_{min}), % of rated voltage	± (5 – 50)
Adjustable Tripping time delay (T_{off}), sec	0 – 10
Adjustable Autoreclosing time delay (T_{on}), sec	0 – 600
Fixed time delay for tripping in case MIN voltage fault detected (time delay for U_{min}), 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
Operational voltage range, % of rated voltage	50 - 150
Power consumption (under power load), VA (not more)	3,0
Maximal current that output contacts may commutate, A	5
Commutation endurance for the output contacts: - under 5A power load, - under 1A power load,	not less than 100 000 times not less than 1 000 000 times
Protection degree: - for the device - for the terminals	IP40 IP20
Operational temperature range, °C	From minus 35 up to +55
Storage temperature conditions, °C	From minus 45 op to +70
Weight, kg (not more)	0,200
Overall Dimensions, mm	35 x 92 x 58
Standard 35 mm DIN rail mounting	
Mounting position as per requirement (arbitrary)	
<p>*In case of minimal voltage alarm situation (U_{min} fault) then tripping time delay of 12 seconds will be applied on the following conditions: a) U_{max} and U_{min} switches are set to the left position and the SEQ and IMB are set to the right; b) switches U_{max}; U_{min}; SEQ; IMB are set to the left position; If within this 12 sec time interval it will happen some other type of voltage interruption (for example U_{max} fault), then the RNPP-311M will trip the power load with minimal time: with the T_{off} time preset by the user or the left time of 12 sec interval. ***In case of maximal voltage mode – 0.3 seconds.</p>	

3. GENERAL DESCRIPTION

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. If the device is connected to 24V external power supply – then the tripping time delay (**T_{off}**) will not be affected by the controlled voltage level and presence of voltage on any of the phases.

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** and **4-5** are **closed**, while **5-6** and **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** and **4-5** are closed and the terminals **5-6** and **2-3** are open.

It is strongly recommended to use contactor for the operation with necessary power load so that the output terminals **5-6** and **2-3** would operate with the magnetic coil of the contactor. So when some voltage interruption is detected by RNPP-311M terminals **5-6** and **2-3** will open and it will lead to opening of the power contacts of the contactor and disconnection of the power load.

If RNPP-311M is used as a **maximal voltage** protection relay in this case power load must be connected to terminals **1-2** and **4-5**. So if the normal voltage is present and there are no reasons for the tripping - terminals **1-2** and **4-5** are closed and terminals **5-6** and **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 **T_{on}** value is not considered only at the first inclusion of the RNPP-311M to main.

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 75V.

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

	Maximal current at ~ 250V	Maximal capacity	Maximal AC Voltage	Maximal current at 30V DC
Cos φ = 0,4-1,0	2 A (AC3)	500 VA	400 V	3 A

4. 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 ON	○	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 OFF		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 75V or the phase loss is detected;
	Blinking of two LEDs alternately. At first Middle and Right LEDs turn ON and then Middle and Left turn ON		Continuous luminescence	Phase imbalance alarm situation.
	Left, Middle and then Right LEDs turn ON 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 75V;
- 2 – Wrong phase Sequence;
- 3 – Under/Over voltage (**U_{min}** and **U_{max}**);
- 4 – Phase imbalance alarm.

If the voltage is present only on one of phases and the external power supply of 24 V is not connected to terminals **7,8** then turn **ON** threshold for indication LEDs is in the range 100-140V.

5. ADJUSTMENTS AND SETTINGS

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):

U_{nom}±% - combined adjustment for the minimal/maximal voltage tripping thresholds in % of nominal (rated) voltage;

T_{off} – 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 75V. It is recommended to set the **T_{off}** time not less than 1 sec to escape from undesired frequent trippings caused by fluctuations in power circuits;

T_{on} – 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;

Toggle switches (see Figure 1):

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

380/400V – to select the desired standard of the power circuit;

SEQ – wrong phase sequence or phase coincidence;

IMB – phase imbalance;

U_{min} – voltage is lower than the user adjusted value of **U_{min}**;

U_{max} – voltage is higher than the user adjusted value of **U_{max}**

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.

6. START UP PROCEDURE AND OPERATION

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.

START UP PROCEDURE:

1. Using adjustment knobs set the required values of voltage tripping thresholds **U_{nom±%}**; tripping time delay **T_{off}** and autoreclosing time delay **T_{on}**;
2. Using switches on the front panel (items 5-8 on the Figure 1) select the type of power circuit (380/400V) and the required functions to perform. 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)

NOTE: 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 power load should be connected to terminals **1-2 (4-5)**. And the switch **U_{max}** should be set to Left position (enabled) and the switches **SEQ, IMB** and **U_{min}** should be set to the Right position (disabled).

7. RNPP-311M USAGE EXAMPLES

Minimal voltage relay

- Switch **U_{min}** is set to the left position
- Switches **U_{max}, SEQ, IMB** are set to the right position

If the voltage level is lower than the user adjusted minimal voltage threshold (**U_{nom±%}**) – then RNPP-311M will turn **OFF** the power load with the user preset time delay **T_{off}** 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 75V – then RNPP-311M will turn **OFF** the power load within 0,2 sec.

Voltage level monitoring and phase presence control relay

- Switches **U_{min}** and **U_{max}** are set to the left position
- Switches **SEQ, IMB** are set to the right position

If voltage level is higher than the user adjusted maximal voltage threshold (**U_{nom±%}**) – then RNPP-311M will turn **OFF** the power load with the user preset time delay **T_{off}**; 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 or the voltage on any of the lines becomes lower than 75V – then RNPP-311M will turn **OFF** the power load within 0,2 sec.

Maximal voltage relay

- Switch **U_{max}** is set to the left position
- Switches **U_{min}**, **SEQ**, **IMB** are set to the right position
- Red **ALARM** indicator is **ON**

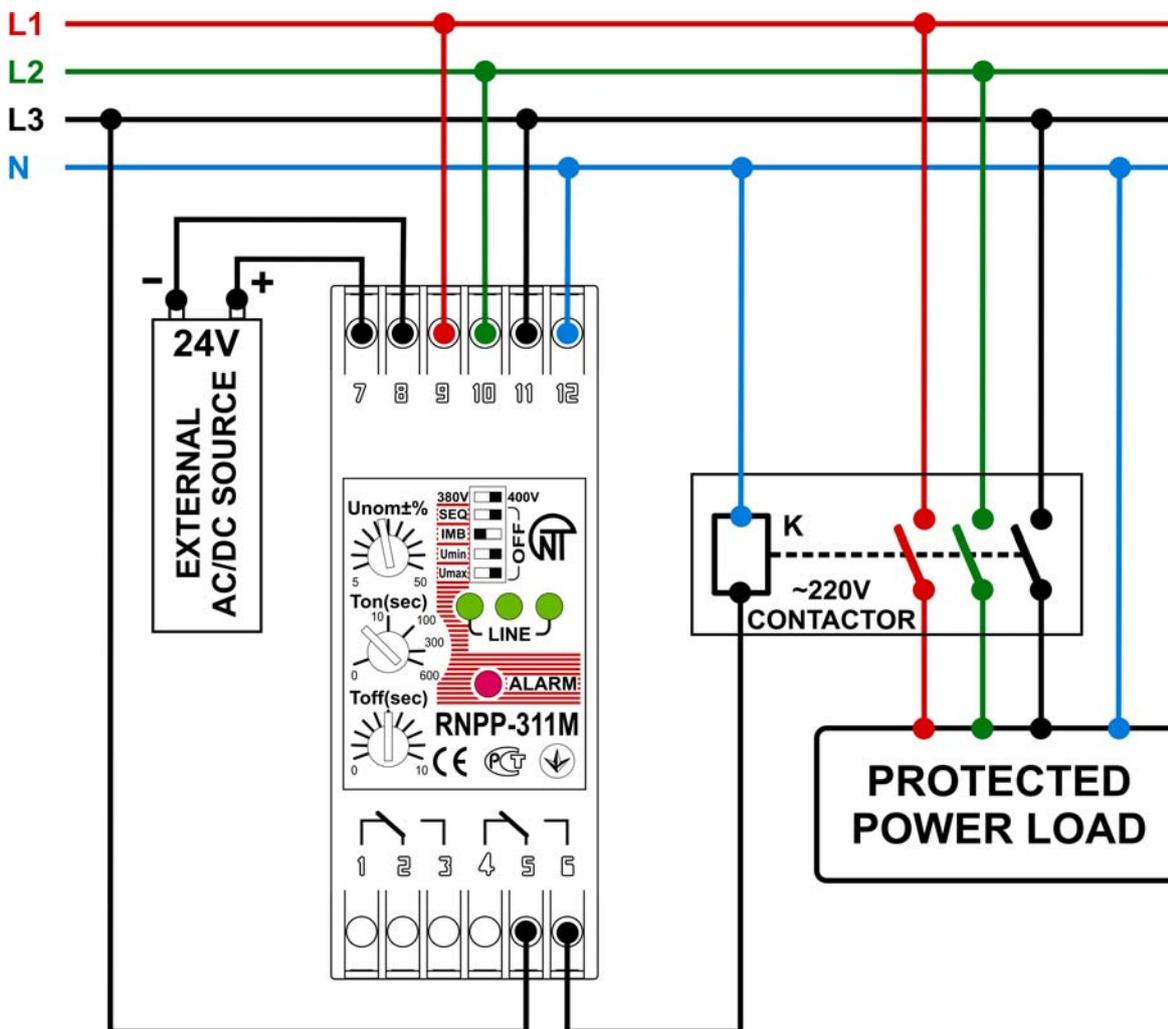
If high voltage detected RNPP-311M will turn **OFF** the power load with time delay

T_{off} +0,4 sec and the red ALARM indicator will turn **OFF**. In case the phase loss detected or the voltage on any of the lines becomes lower than 75V – then RNPP-311M will turn **OFF** the power load within 0,2 sec. Corresponding **LINE** green LED indicator(s) will turn **OFF** indicating on which line the problem occurred.

If all switches **U_{max}**, **U_{min}**, **SEQ**, **IMB** are set to the left position

In this mode of operation RNPP-311M will monitor all voltage parameters and will turn **OFF** the power load and indicate about the problem if the alarm situation detected. If 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).

WIRING DIAGRAMM



8. STORAGE AND TRANSPORTATION CONDITIONS

RNPP-311M should be stored in a factory package in enclosed rooms with ambient temperature from - 45 to +75 °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.

9. WARRANTY AND CLAIMS CONDITIONS

Novatek-Electro Ltd. company warrants a trouble-free operation of the RNPP-311M device within 36 months from the date of sale, on condition that following terms are provided:

- the proper connection;
- the safety of the inspection quality control department seal;
- the integrity of the case, no traces of opening, cracks, spalls etc.