

RNPP-301

THREE PHASE VOLTAGE AND PHASE MONITORING RELAY



OPERATING MANUAL

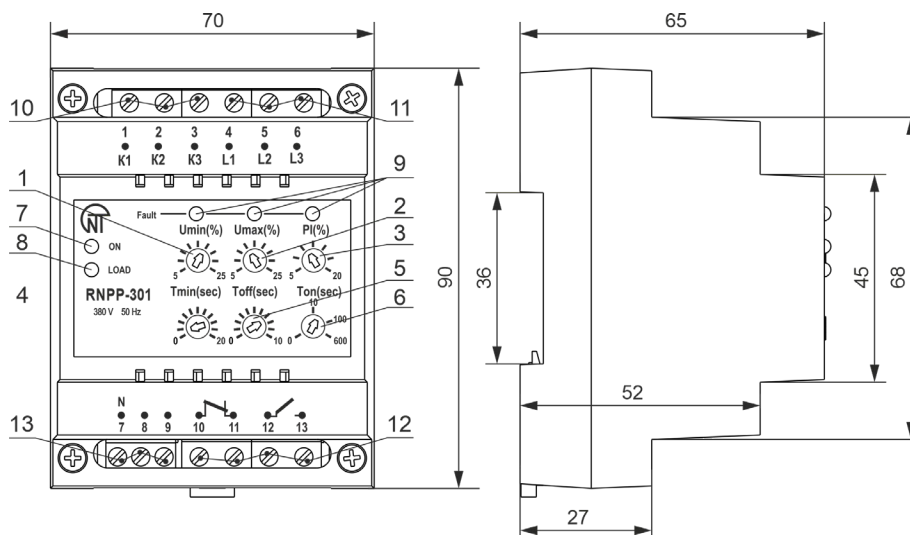


Quality control system on the development and production complies with requirements ISO 9001:2015



Review the Operating manual before using the unit.
NEVER ATTEMPT TO REMOVE AND REPAIR THE UNIT.
DO NOT LET WATER INTO THE UNIT.
Do not use abrasives or organic compounds for cleaning (spirit, gasoline, solvents, etc.).
This unit is safe for use in case of compliance with operating rules.

CONTROLS DESCRIPTION AND DIMENSIONS DIAGRAM



1. control for minimum voltage threshold, U_{min} (%);
2. control for maximum voltage threshold, U_{max} (%);
3. control for peak phase imbalance threshold, PI (%);
4. control of trip delay setting for U_{min} , T_{min} (sec);
5. control of trip delay setting for the mains voltage faults, T_{off} (sec);
6. control for automatic reset delay setting, T_{on} (sec);

7. green LED signal that the mains voltage is present, ON;
8. green LED signal that load is energized, Load;
9. red LEDs signal for the mains voltage fault/ magnetic starter (MS) power contacts monitoring, Fault;
10. MS power contacts monitoring terminals;
11. input contacts;
12. output contacts;
13. terminals for the mode selection: line/phase voltage monitoring.

1 APPLICATIONS

A RNPP-301 voltage control relay is designed for:

1. monitoring of the tolerable **RMS** phase/line voltage level (at the option of user) with independent setting adjustments for the minimum/maximum voltage thresholds;
2. monitoring of the correct phase sequence and phase "non-coincidence" (the phases are supposed to be coinciding when a load is energized not from two different phases but instead from one and the same phase);
3. monitoring of three phase lines for voltage presence and the mains voltage symmetry with adjustable phase imbalance setting;
4. monitoring of the magnetic starter power contacts status at no-load and under load;
5. the load (380V/50Hz) de-energization with user-set trip delay (**Toff**) through the opening the magnetic starter coil power circuit (A.C and D.C. electric circuit switching) when fault conditions occur;
6. the mains voltage quality monitoring after the relay had tripped and did reset automatically with the user-set reset delay (**Ton**) upon the voltage parameters regeneration;
7. all fault conditions (not switching of the magnetic starter power contacts is included) are displayed by special LEDs indicating the specific cause of the occurring voltage fault in the mains.

2 TECHNICAL BRIEF

Rated phase/line voltage, V	230/380
Mains frequency, Hz	45 – 55
Harmonical configuration (nonsinusoidality) of power supply voltage	EN 50160
Adjustable range for Umin, % of nominal value	5 – 25
Adjustable range for Umax, % of nominal value	5 – 25
Adjustable range for phase imbalance, %	5 – 20
Adjustable range for Tmin, sec	0 – 20
Adjustable range for Toff, sec	0 – 10
Adjustable range for Ton, sec	0 – 600
Minimum trip delay when threshold settings are reached, sec	0.1
Reset/energization delay when the relay energizes, sec, not more than	0.2
Voltage hysteresis, V	5 – 6
Accuracy of trip threshold for voltage, V, not more than	3
Phase imbalance accuracy, %, not more than	1.5
Safe operating voltage, % of rated value	50 – 110
Power required (under load), VA, not more than	3.0
Maximum switched current of output contacts, A	5
Output contacts life:	
• under load 5A, no less than, operations	100 000
• under load 1A, no less than, operations	1 mln.
Protection degree of:	
• apparatus	IP 40
• terminal block	IP 20
Permissible contamination level.....	II
Overvoltage category	III
Nominal voltage of isolation, V	450
Rated impulse withstand voltage, kV	4
Cross-section area of connection terminals, mm ²	0.5 – 2
Torque of terminal fixing, N*m	0.4
Operating temperature range, °C	from -35 to +55
Weight, no more than, kg	0.200
Case dimensions 4 modules of S-type	
Mounting 35 mm DIN-rail	
Mounting position as desired	

RNPP-301 complies with requirements: EN 60947-1; EN 60947-6-2; EN 55011; EN 61000-4-2.

3 DESCRIPTION

The RNPP-301 relay (hereafter "the relay") is a digital microprocessor device that provides a high degree of reliability and accuracy. The relay doesn't require any auxiliary power supply because it is self-powered by the three-phase voltage to be monitored. This permits the relay to keep operate capability even when only one phase is present (in the three-phase systems with neutral). Two modes of the mains voltage monitoring can be selected at the user's option:

The phase voltage monitoring mode

To enable phase voltage monitoring mode it's necessary to remove jumper in between terminals 8-9 and connect neutral wire to terminal 7. This mode of operation is recommended for the situations when for the machinery the neutral shift is very critical (within the range of user preset values) and when phase imbalance is a matter of a great concern.

The line voltage monitoring mode

To go into this mode of operation one needs to apply the jumper strap between terminals **8-9**; in this case to connect the neutral is not necessary. This mode of operation is recommended when the neutral drift value and phase voltage imbalance is not important as well as for isolated neutral three-phase systems. The relay will trip when line voltage imbalance between phases occurs.

NOTE: To keep the relay operative and informative when only one phase is present it's advisable to connect the neutral to the terminal **7** not removing the jumper strap between terminals **8-9**. In 3-Phase systems without neutral the relay keeps operational capability when at least two phases are present.

The relay is connected in parallel to load by the **L1, L2, L3** input contacts (the **4, 5, 6** terminals respectively). The neutral connection mode (**N, the 7 terminal**) corresponds to the mains voltage monitoring mode of operation selected by user. The **1, 2, 3** terminals provide the MS power contacts status monitoring and are connected to the output MS power contacts terminals (see the wiring diagram). The relay has two groups of independent output contacts (**10-11, 12-13**). In the "dead status" of the relay (a voltage is not applied to the relay, the relay is not connected) the **12-13** are the **N.O. contacts** and the **10-11** are **N.C. contacts**. After the relay has been connected in parallel to load when voltage is present in the mains and there is no cause for the relay to trip, the **12-13** contacts are being **closed** and the **10-11** contacts are being **opened** with the user-set reset delay Ton.

When the relay tripped, load is de-energized due to the break in the MS coil power circuit by the **N. O. 12-13** contacts.

It is recommended the 12-13 contacts to connect in series with the MS coil power supply.

The 10-11, 12-13 output contacts specification

	Max. current for ~ 250 VAC	Max. power	Max sustained safe voltage~	Max. current for U=30VDC
cos φ = 0.4	3 A	1200 VA	460 V	3 A
cos φ = 1.0	5 A			

MS power contacts transfer monitoring

One of the relay functions is the monitoring of the MS power contacts position before load energization and after load is energized. The monitoring is performed if the **1, 2, 3** terminals are connected to the corresponding phases of the MS output contacts. The monitoring is performed as follows:

1. Before load is energized a test for open position of all three MS power contacts is performed. If at least one contact is closed ("sticks") the relay will be disabled, the load is not energized, all red **"FAULT"** LEDs are **ON**. To enable the relay one needs to remove supply voltage from it. It's recommended to test the MS running order, following safety regulations.

2. When load is energized, the test for closed position of all three MS power contacts is performed. If at least one MS phase contact is open, the relay will trip to de-energize load and will be disabled. All red **"FAULT"** LEDs are **ON**. To enable the relay one needs to remove supply voltage from it. It's recommended to test the MS running order, following safety regulations.

3. When the relay trips for load de-energization, the test for open position of all three MS phase contacts is performed. If at least one contact is closed ("sticks"), the relay will energize and de-energize the magnetic starter one-two times. If the defect is not eliminated, the relay will be disabled, all red **"FAULT"** LEDs will be **ON**. To release the relay one needs to remove supply voltage from it. It's recommended to test the MS running order, following safety regulations.

Indication

- the green LED **«ON»** is always on when at least one phase is under supply voltage;
- the green LED **«Load»** switches on when the load is energized (the **12-13** output terminals are closed);
- each of three LED indicators **«Fault»** flashes according to specific type of fault; all three LEDs flash in turn when there is phase reversal and/or phase "coincidence"; LEDs **«Umin»** and **«PI»** are flashing when there is a phase loss; all three LEDs are on if the relay is disabled for the MS power contacts not-switching.

Controls

The relay has six independent controls for basic parameters. For user's convenience screwdriver slots of adjusting potentiometers are brought out to the relay front panel.

- **Umin** – trip threshold for the minimum allowable voltage, % of rated voltage;
- **Umax** – trip threshold for the maximum allowable voltage, % of rated voltage;
- **PI** – phase/line voltage imbalance threshold (according to selected monitoring mode), difference between RMS phase/line voltages, % of a lesser value;
- **Tmin** – trip delay for the minimum voltage that allows to ignore transient and/or starting voltage drops; it's recommended to set Tmin no less than 10 sec.
- **Toff** – trip delay covering all types of the mains voltage faults, undervoltage excluded. It's recommended to set Toff no less than 1-1.5 sec to prevent the excessive relay trippings due to switching perturbations in the mains;
- **Ton** – automatic reset delay after the relay tripped and the mains voltage parameters have regenerated; this is also the energization time delay after the normal voltage was applied to the relay.

4 PRELIMINARY STARTING PROCEDURE AND SERVICE MANUAL

The relay is ready for service and needs no pre-starting procedure measures. Due to digital technology the relay trip settings are calibrated quite accurate, so to set adjustments one doesn't need to read voltage on the control voltmeter. In order to install the relay at the using activity after extended storage it's recommended to test functionality of the relay. The application of the relay according to specifications above and to the present service manual, continuous work included, allows not to carry out preventive maintenance during service life.

To put the relay in operation one must follow operating instructions given below:

1. To set trip thresholds, trip delays and reset delay by potentiometer's contact arms.
2. To select the mains voltage monitoring mode of operation (to remove/apply a jumping strap between the **8-9** terminals).
3. To connect the relay in parallel to the mains to be monitored (the **4, 5, 6** terminals); to connect, if needed, the neutral (the **7** terminal), to connect the relay output contacts (the **10-11, 12-13** terminals) to the MS coil power circuit (the control circuit).

4. To connect the **1, 2, 3** terminals to the MS output contacts. If there is no need in the MS power contacts position monitoring, the connection is not effected.

5. To apply voltage to the relay.

The relay must be connected according to safety regulations.

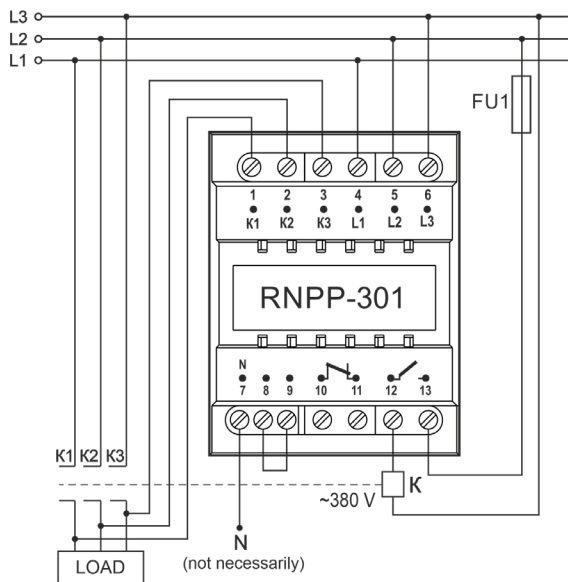
It's recommended to set trip thresholds in the "dead" status of the relay. In testing mode it's permitted to set trip threshold under voltage, following safety regulations.

WIRING DIAGRAM

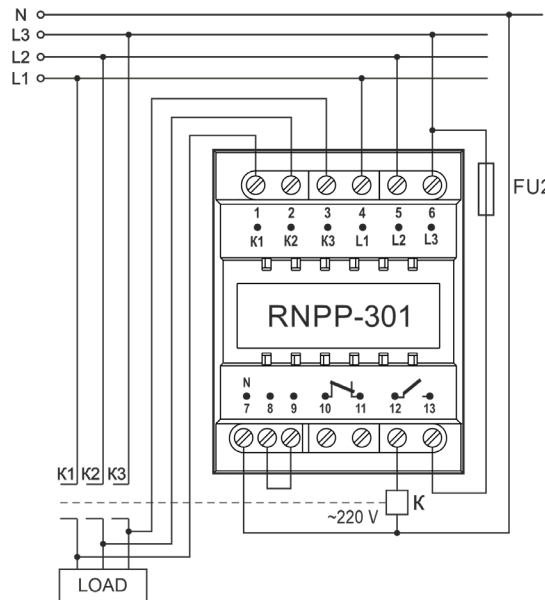
The relay should be connected in parallel to load according to the diagrams shown below.

The RNPP-301 wiring diagram with selectable mode of operation:

SCHEME A. LINE VOLTAGE (PHASE-TO-PHASE) MONITORING MODE



SCHEME B. PHASE VOLTAGE (LINE-TO GROUND) MONITORING MODE



FU1, FU2 – fuse 6.3 A (circuit breaker), **K** – contactor.

5 STORAGE AND SHIPPING CONDITIONS

The relays in manufacturer package should be stored in enclosed rooms at from -45 to $+60$ °C and exposed to no more than 80 % of relative humidity when there are no fumes in the air that exert a deleterious effect on package and the relay material. The Buyer must provide the protection of the relay against mechanical damages in transit.

6 WARRANTY

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

Guaranteed storage life – is 3 years. Warranty period is 5 years upon the day 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, BUYER WILL FORFEIT THE RIGHT TO WARRANTY SERVICE.

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

Post-warranty service is performed by the Manufacturer at current rates.

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

Quality control department seal _____

Production date _____

With questions and comments, please contact manufacturer at the following address:

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Odessa, Ukraine, 65007.

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www.novatek-electro.com

Sale date _____