

VOLTAGE, PHASE IMBALANCE AND SEQUENCE RELAY

RNPP-316-500



OPERATING MANUAL



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

Dear customer,

Company NOVATEK-ELECTRO LTD. thanks you for purchasing our devices.
You will be able to use properly the device after carefully studying the Operating Manual.
Keep the Operating Manual throughout the service life of the device.

ATTENTION! ALL REQUIREMENTS OF THIS OPERATING MANUAL ARE COMPULSORY TO BE MET!



WARNING! – DEVICE TERMINALS AND INTERNAL COMPONENTS ARE UNDER POTENTIALLY LETHAL VOLTAGE

TO ENSURE THE DEVICE SAFE OPERATION **IT IS STRICTLY FORBIDDEN THE FOLLOWING:**

- TO CARRY OUT MOUNTING WORKS AND MAINTENANCE **WITHOUT DISCONNECTING THE DEVICE FROM THE MAINS;**
- TO OPEN AND REPAIR THE DEVICE INDEPENDENTLY;
- TO OPERATE THE DEVICE WITH MECHANICAL DAMAGES OF THE CASE.

IT IS NOT ALLOWED WATER PENETRATION ON TERMINALS AND INTERNAL ELEMENTS OF THE DEVICE.

ATTENTION! THE CIRCUIT BREAKER (FUSE) OR ITS ANALOG WITH THE CURRENT OF 6.3 A MAXIMUM OF CLASS B SHOULD BE INSTALLED IN OUTPUT CONTACTS CIRCUIT OF THE DEVICE.

To improve the device performance, it is recommended to install the fuse (fuse-link) in the power supply circuit of RNPP-3165-500 (L1, L2, L3) for current 1 A.

During operation and maintenance the regulatory document requirements must be met, namely:

- Regulations for Operation of Consumer Electrical Installations;
- Safety Rules for Operation of Consumer Electrical Installations;
- Occupational Safety when in Operation of Electrical Installations.

Installation, adjustment and maintenance of the device must be performed by qualified personnel having studied this Operating Manual.

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



This Operation Manual is intended to familiarize you with the design, the requirements for safety, operation and maintenance procedures of the voltage, phase imbalance and sequence relay RNPP-316-500 (hereinafter referred to as the "device", RNPP-316-500).

RNPP-316-500 meets the requirements of:

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

Harmful substances in concentration more than allowed are absent.

Terms and abbreviations:

AR is automatic reclosing;

MS is magnetic starter;

U_{max} – maximal mains voltage response threshold;

U_{min} – minimal mains voltage response threshold;

The term "**Normal voltage**" means that the voltage value does not exceed the threshold limit values set by the User. The phase imbalance and phase sequence are corresponded to technical specifications.

1. DESCRIPTION AND OPERATION

1.1. Application

RNPP-316-500 is designed for measurement of the actual value (TRMS) of the linear voltage in the three-phase network and it performs the following functions:

- load tripping off in case of non-qualitative mains voltage;
- control of the acceptable voltage level;
- control of correct alternation and the absence of phase adhesionx
- control of the full-phase and symmetry of the mains voltage (phase imbalance);
- quality control of the mains voltage after load tripping off and its automatic tripping on after recovery of the mains voltage parameters;
- indication of a failure in case of a faulty situation.

The device provides options for adjusting parameters (voltage response threshold with separate settings for minimum / maximum voltage, automatic re-closure time and protection response delay time).

1.2. Controls, overall and mounting dimensions of RNPP-316-500

Controls, overall and mounting dimensions of RNPP-316-500 are shown in Fig. 1.

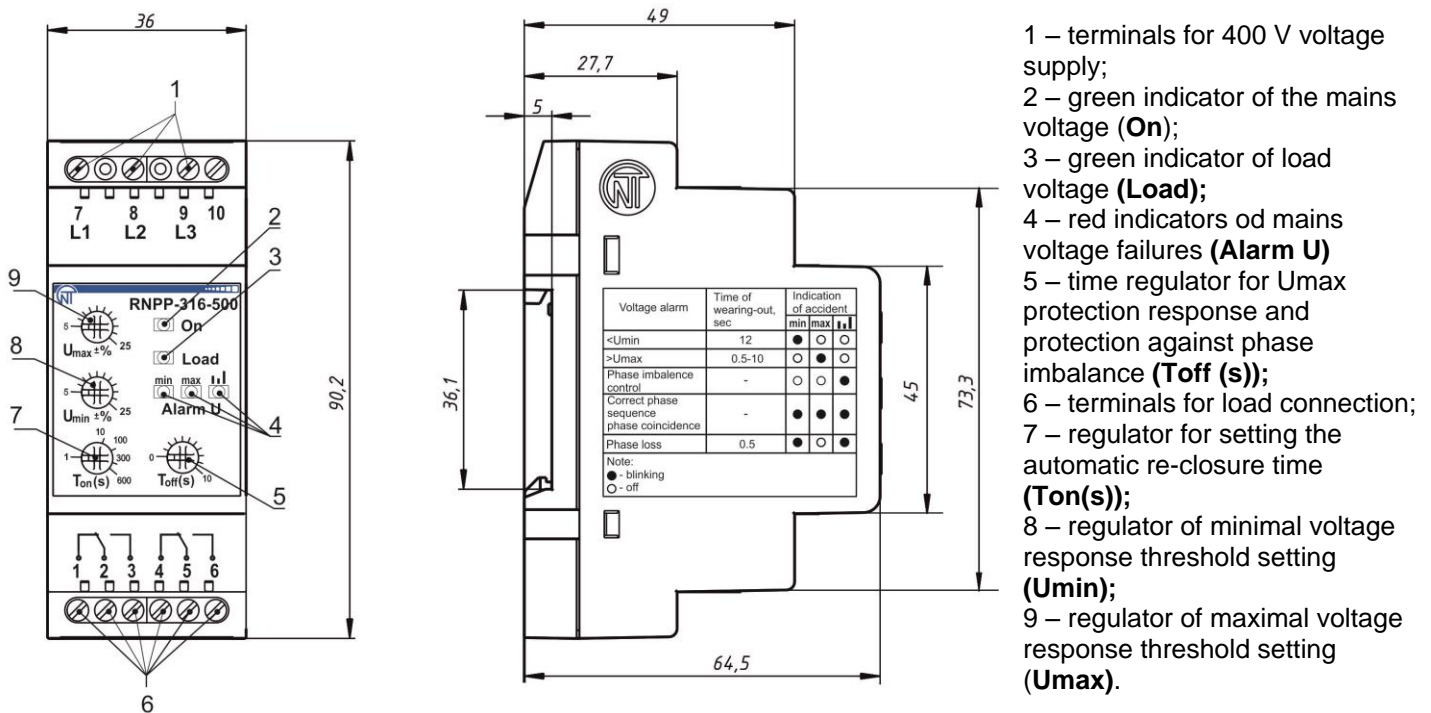


Fig. 1 – Controls, overall and mounting dimensions of RNPP-316-500

1.3. Operation conditions

The device is intended for operation in the following conditions:

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

If the temperature of the device after transportation or storage differs from the ambient temperature at which it is supposed to be operated, then before connecting to the mains keep the device under the operating conditions within two hours (because of condensation may be on the device elements).

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. TECHNICAL SPECIFICATIONS

The basic technical specifications are given in Table 1. The device output contacts specifications are given in Table 2.

Table 1. The basic technical specifications

Description	Value
Rated mains voltage, linear, V	400
Mains frequency, Hz	45 – 65
Harmonic composition (unsinusoidality) of the supply voltage	EN 50160
Range of adjustment of the mains minimum voltage threshold, as a percentage of the rated one	5 – 25
Range of adjustment of the mains maximum voltage threshold, as a percentage of the rated one	5 – 25
Range of regulation of protection response time to U_{max} and phase imbalance, s	0.2 – 10
Range of automatic re-closure time adjustment, s	1 – 600
Fixed response delay at minimum voltage, s	12
Fixed response time when voltage drops more than 50 V from the threshold according to U_{min} , s	0,2
Response time when one of the phases is broken, s, not more	0.5
Value of determination of phase imbalance,%	25
Voltage hysteresis, V	10
Phase imbalance hysteresis, V	8
Accuracy of determining the threshold for voltage, V, not more	5
Accuracy of phase imbalance determination,% ,not more	1.5
Voltage at which operability is maintained (linear), V	130 – 560
Power consumption (at load), W, no more	3.0
Maximum switching current of output contacts, A	5
Switching resource of output contacts: - at the load of 5A ($\cos \varphi = 1,0$), times, at least - at the load of 1 A ($\cos \varphi = 1,0$), times, at least	100 th. 1 mln.
Designation of the device	Control and distribution equipment
Rated mode of operation	Long
Front panel protection	IP40
Terminal block protection	IP20
Class of electrical shock protection	II
Climatic version	NF 3.1
Allowed degree of contamination	II
Overvoltage category	II
Rated insulation voltage, V	580
Rated impulse withstand voltage, kV	4.0
Wire cross section for connecting to terminals, mm ²	0.5 – 1.5
Tightening torque of terminal screws, N·m	0.4
Mass, kg, not more	0.100
Overall dimensions (Fig. 1), H * B * L, mm	90.2x36x64.5
Installation (mounting) - on a standard 35 mm DIN rail	
The device retains its operability in any position in space	
Case material - self-extinguishing plastic	

Table 2. The device output contacts specifications

Mode of operation	Max. current at U ~ 250 V	Max. switching power at U ~ 250 V	Max. continuous allowed AC voltage	Max. current at U _{DC} – 30 V
Cos φ = 0.4	3 A	1200 VA	400 V	3 A
Cos φ = 1.0	5 A			

3. DESCRIPTION OF THE DEVICE

The device constantly controls values of linear voltages in a three-phase network, comparing them with the values set by the regulators of the User on the front panel of the device.

The device trips off the protected equipment if the voltage value exceeds the limits set by the User.

4. THE INTENDED USE

4.1. Preparation for operation

4.1.1. 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 (**pay special attention to the diagram of the device connection to power**).
- If you have any questions regarding the installation of the product, please contact the manufacturer by telephone number indicated at the end of this Operating Manual

4.1.2. Device connection

ATTENTION! ALL CONNECTIONS MUST BE PERFORMED WHEN THE DEVICE IS DE-ENERGIZED.

Error when performing the installation works may damage the device and connected devices.

To ensure the reliability of electrical connections the flexible (stranded) wires with insulation for voltage of at least 600 V should be used, the ends of which it is necessary to be striped of insulation for 5 ± 0.5 mm and tightened with bootlaces. It is recommended to use the wire with cross-section of at least 1 mm². Wires fastening should exclude mechanical damage, twisting and abrasion of the wire insulation.

IT IS NOT ALLOWED TO LEAVE EXPOSED PORTIONS OF WIRE PROTRUDING BEYOND THE TERMINAL BLOCK.

For a reliable contact, tighten the terminal screws with the force indicated in Table 1.

When reducing the tightening torque, the junction point is heated, the terminal block may be melted and wire can burn. If you increase the tightening torque, it is possible to have thread failure of the terminal block screws or the compression of the connected wire.

4.1.2.1. Connect the device according to the diagram shown in Fig. 2.

4.1.2.2. Set voltage thresholds by using **U_{min} ±%** and **U_{max} ±%** regulators.

ATTENTION! Do not use excessive force when performing setting operations.

4.1.2.3 Using the **T_{off} (sec)** control set the protection operation time at the maximum voltage and phase imbalance.

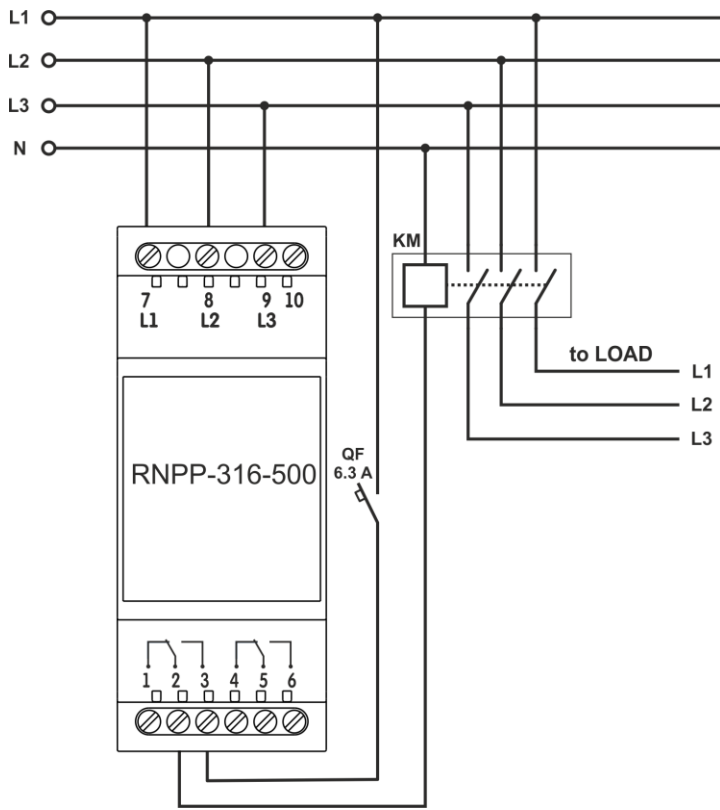
4.1.2.4 Using **T_{on}(sec)** control set the reclosing time AR.

It is recommended to set the reclosing time AR for air conditioners, refrigerators and other compressor equipment at least 180 - 240 seconds.

4.1.2.5 Feed the supply voltage to the terminals of the device.

After power supply to the device terminals, the **On** indicator lights up and the automatic re-closure time counting begins. At the end of the automatic re-closure countdown time, the device connects the protected equipment to the network.

Note - If on the first start up RNPP-316-500 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 **8** and **9**.



QF – circuit breaker 6.3 A;
KM - magnetic starter.

Fig. 2 – Connection Diagram of RNPP-316-500

4.2 Intended use

4.2.1 In the event of a failure, the protected equipment will be disconnected from the network (probable failures and their indication are given in Table 3).

Table 3. Types of failures and versions of **Alarm U** indicator states

Type of failure	Response time, s	Indication of a failure		
		min	max	uI
Voltage below U_{min}	12	●	○	○
Voltage above U_{max}	0.5 - 10	○	●	○
Phase imbalance (linear voltage differ from each other by more than 25%)	0.2 - 10	○	○	●
Phase sequence (alternate flashing of indicators)	RNPP-316-500 is not switched on	●	●	●
Phase adhesion	0.2	●	●	●
Phase breakage	0.5	●	○	●
Note: ● - flashes; ○ - does not light. <i>In case of alarms of several types the corresponding indicators flashes simultaneously.</i>				

After restoring the parameters of the mains voltage, the automatic re-closure time countdown begins.

4.2.2. The device RNPP-316-500 at the output has two groups of independent output switching contacts (1-2-3, 4-5-6). If the supply voltage of the device is off, contacts 1-2 (4-5) are closed, and contacts 2-3 (5-6) are open.

When the RNPP-316-500 responds to the failure, the load will be off by breaking the power supply circuit of the magnetic starter coil through contacts 2-3 (5-6).

5. MAINTENANCE

5.1. Safety precautions



THE TERMINALS AND THE DEVICE INTERNAL ELEMENTS CONTAINS POTENTIALLY LETHAL VOLTAGE. DURING MAINTENANCE IT IS NECESSARY TO DISABLE THE DEVICE AND CONNECTED DEVICES FROM THE MAINS.

5.2. Maintenance of the device must be performed by the skilled professionals.

5.3. Recommended frequency of maintenance is **every six months**.

5.4. Maintenance Procedure:

- 1) Check the connection reliability of the wires, if necessary, clamp with the force specified in Table 1;
- 2) Visually check the integrity of the housing, in case of detection of cracks and damages take the device out of service and send for repair;
- 3) If necessary, wipe the front panel and the housing of the device with cloth.

Do not use abrasives and solvents for cleaning.

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.

7. 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 %.

8. ACCEPTANCE CERTIFICATE

RNPP-316-500 has been manufactured and accepted in accordance with the requirements of valid technical documentation and classified as fit for operation.

Head of QCD

Date of manufacture

Seal

9. CLAIMS DATA

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.

The Company is grateful to you for the information about the quality of the device and suggestions for its operation.



For all questions, please contact the manufacturer:

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Date of sale: _____

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