THREE-PHASE UNIVERSAL AC VOLTAGE RELAY

RNPP-3100



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 products.
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 <u>WITHOUT DISCONNECTING THE DEVICE FROM THE MAINS;</u>**
- 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.

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.

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This Operation Manual is intended to let you know about the device, safety requirements, operation and maintenance procedures for the Three-phase Universal AC Voltage Relay RNPP-3100 (hereinafter in the text device, RNPP-3100).

The device meets the requirements of: EN 60947-1; EN 60947-6-2; EN 55011; EN 61000-4-2

No harmful substances amount that exceeds permissible exposure limits.

1. APPLICATION

1.1 Application of device

The RNPP-3100 three-phase universal AC voltage relay is designed for continuous monitoring of permissible voltage levels, phase loss, phase voltage imbalance, incorrect phase sequence, and phase asymmetry in 50 Hz AC voltage circuits. In the event of an emergency, it disconnects the load by opening the control circuit.

The RNPP-3100 measures the RMS values of line (phase) voltages in electrical networks with either solidly grounded or isolated neutrals. After the cause of the fault that triggered the disconnection has been eliminated, the RNPP-3100 automatically restores power (hereinafter in the text AR) after a time delay set by the User.

The RNPP-3100 displays the RMS value of the line (phase) voltage, voltage fault conditions, the load relay status (ON/OFF), and the type of fault.

***Note**: The term "rated voltage" used in this device manual means that the input voltage corresponds all settings and parameters adjusted by user (see Table 3).*

1.2 Operation conditions

The device is designed for operation in the following conditions:

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

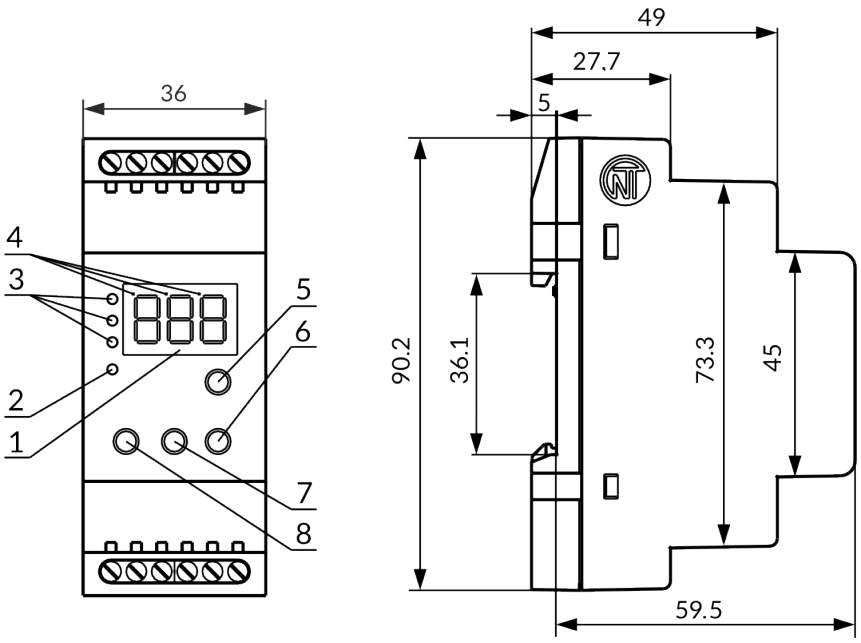
If the temperature of the device after transportation or storage differs from the environment temperature at which it is expected to operate, then before connection to electric mains keep the device under the operating conditions within two hours (because the device elements may have moisture condensation).

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.).

1.3 Controls, overall and mounting dimensions of RNPP-3100

Controls, overall and mounting dimensions of RNPP-3100 are shown in Fig. 1.



1 – display;
2 – Green LED ;
3 – Red LED's **L1, L2, L3**;
4 – phase indicator L1, L2, L3;
5 – ⩓ (**UP**) button;
6 – ⩔ (**DOWN**) button;
7 – **WR** button;
8 – **SET** button.

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.
Green LED – lights up when the load relay is ON.
SET button – to set the parameter value.
WR button – to save the parameter.
⩓, ⩔ buttons – to change the parameter.

Fig. 1 – Controls, overall and mounting dimensions of RNPP-3100

2 TECHNICAL SPECIFICATIONS

The main technical specifications of the device are shown in Table 1. The adjustable ranges for minimal voltage; maximal voltage tripping; phase imbalance; time delays for the protection tripping; automatic restart (AR) time and other adjustable parameters are shown in the Table 3.

Table 1 – The main technical specifications

Description	Value
Rated line voltage	100 V
The line voltage at which the device remains functional	40 – 150 V
Main's frequency	45 – 65 Hz
Voltage Trip Threshold Accuracy	≤ 1.5 %
Power consumption (under load)	≤ 5.0 W
Maximum switching current of the output contacts	12 A
Harmonical configuration (nonsinusoidality) of power supply voltage	EN 50160
Commutation endurance for the output contacts: ▪ *at 230 V AC* - under 5A power load (cos φ = 1.0) - under 1A power load (cos φ = 1.0) ▪ *at a constant voltage of 230 V and a load current of 160 mA*	 ≥ 100 000 times ≥ 1 000 000 times ≥ 10 000 times
Purpose of device	Control and distribution equipment
Typical operation	Continued
Protection degree device	IP 40
Protection degree terminal block	IP 20
Protection class against electric shock	II
Climatic design version	NF 3.1
Permissible contamination level	II
Overvoltage category	III
Rated voltage of insulation	450 V
Rated impulse withstand voltage	4.0 kV
Conductor cross-section for connecting to terminals	0.5 – 2.5 mm^2
Tightening torque of the terminal screws	0.4 N*m
Weight	≤ 0.300 kg
Overall dimensions (fig.1), HxBxL	90.2x36x64.5 mm
Installation (mounting) of the device is on standard 35 mm DIN-rail	
The device remains operational capability in any position in space	
Housing material – self-extinguishing plastic	
Digital input (terminals 11-12) for remote switching on/off the load relay contacts	
Changeover relay output for the operation by the magnetic contactor to commutate any desired power load – 12 A, 250 V, cos φ=1	

3 THE INTENDED USE

3.1 Preparation for operation:

- unpack and check the device for damage absence after transportation; in case of such damage's 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 device, please contact the manufacturer by telephone numbers indicated at the end of this Operating Manual.

3.2 Device connection

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

ATTENTION! THE DEVICE IS NOT INTENDED TO BE USED FOR LOAD COMMUTATION IN CASE OF SHORT CIRCUITS. THEREFORE, OUTPUT CONTACTS OF LOAD RELAY SHOULD BE PROTECTED BY AUTOMATIC CIRCUIT BREAKERS (FUSES) WITH TRIPPING CURRENT NOT EXCEEDING 10 A.

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

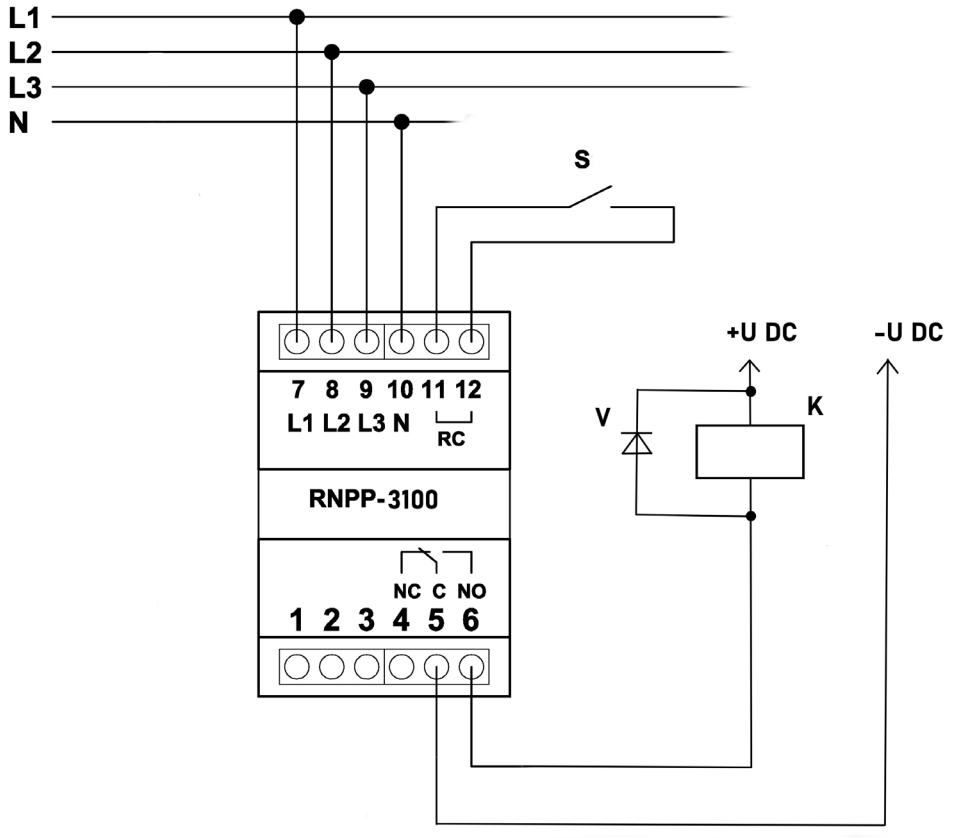
To ensure the reliability of electrical connections you should use flexible (stranded) wires with insulation for voltage of no less than 450 V, the ends of which it is necessary to be striped of insulation for 5±0.5 mm and tightened with bootlaces. Recommended cable cross section for connection is not less 1 mm^2. 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.

To improve operational properties of the device it is recommended to install the fuse (fuse element), or the equivalent for current of 1A in power supply circuit (L1, L2, L3 fig.2) for RNPP-3100.



U DC – DC voltage source up to 230 V;
K – DC Intermediate relay;
V – Installing a diode (e.g., 1N4004) increases the switching lifespan of the RNPP-3100 output relay from 10,000 to 300,000 operations at a DC voltage of 230 V and a current of 160 mA.
S – External remote control contact.

Note: *when using RNPP-3100 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* $U_{LP} = 0$*).*

Figure 2 – Wiring diagram of the RNPP-3100

3.2.1 Connect the device to the intermediate relay (control circuit) and remote activation contacts as shown in Figure 2.

3.2.2 Connect the device to the power supply.

3.2.3 Turn ON the power and adjust all required settings according to Table 3.

Note: *When selecting the value of the minimum voltage (*parameter *U--) take into account the tripping and releasing voltages of the intermediate relay.*

4 RNPP-3100 CONTROLS

4.1 At the initial state on the display of RNPP-3100 is shown:

- the line voltage value during line voltage monitoring, or the phase voltage value during phase voltage monitoring;
- line (phase) voltage indicator;
- load relay status (ON/OFF).

To select the phase manually (ıiU=0) use **DOWN** and **UP** buttons, alternatively if parameter ıiU=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:

- To press **SET** button, The display shows the code of the first parameter (ıiU – voltage display mode), and all phase indicators will light up;
- To scroll between the parameters, use **DOWN** and **UP** buttons;
- To enter the parameter and chance 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.

After pressing the WR button during parameter display, or if no buttons are pressed for 15 seconds, the RNPP-3100 returns to its 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-3100 while keeping these buttons pressed. Then the display should indicate "nAU". Then Turn OFF the device. Factory settings are restored.

4.4 For remote control of the load relay contacts, it is necessary to configure the corresponding parameters in the menu (parameters cC I and tCc Table 3). Then, control the load relay contacts via the digital input by closing/opening contacts 11 – 12. When the remote control is triggered, the display will alternately show the measured voltage and the code A_ I.

5 RNPP-3100 OPERATION

5.1 General Information

The monitored voltage values and load relay response times set by the user are listed in Table 3.

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 (the load relay trip).

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

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

5.3 Voltage monitoring mode

When the input voltage drops below the minimum voltage level (parameter U--) and after the end of the delay time (parameter t--) the load relay is off: contacts 4, 5 are closed and contacts 6 and 5 are 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 3 V, the load relay is on.

If the increase in input voltage is more than the maximal tripping threshold (parameter U--) within after the end of the delay time (parameter t--), the load relay is off: contacts 4, 5 are closed and contacts 6 and 5 are open.

After the end of the reclosing time and when the input voltage drops below the maximum voltage level by a hysteresis maximum voltage (parameter U-H), the load relay is on.

5.4 Control of the additional voltage parameters

In all above stated modes of operation, the RNPP-3100 performs permanent control over additional voltage parameters and in case of deviation from the preset values it turns OFF the power load. On the recovery of voltage level and cancel of the alarm situation RNPP-3100 will turn ON the power load after the tPP time.

RNPP-3100:

1) If the parameter CrP =1 performs the control over phase imbalance and the tripping threshold for the phase imbalance is defined by parameter UrP;

2) If the parameter $C_1{}'_1$ =1 monitors the correct phase sequence and the absence of the phase combination;

Recovery from a fault due to a phase sequence violation is only possible by turning the RNPP-3100 power off and back on.

3) If the parameter $cC\ 1$=1 ($cC\ 1$=2) RNPP-3100 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-3100 immediately disconnect the power load and displays the "$A_\ 1$" alarm code. When the alarm situation is eliminated (there is no signal from the external source) the RNPP-3100 will automatically turn on the power load with the delay time defined by tPP parameter

Monitoring of the absence of phase failure (voltage drop for any of the phases below 30 V) is maintained in all modes of operation.

5.5 Indication

In the absence of a fault, the RNPP-3100 display shows the RMS value of the line voltage during line voltage monitoring (ULP = 0), or the phase voltage during phase voltage monitoring. A lit dot at the top of the display indicates the selected line voltage (L1-L2, L2-L3, L3-L1) or phase voltage (L1, L2, L3) (Fig. 1). The LED is on when the load relay is on.

In the case of faults with minimum voltage, maximum voltage, phase loss faults, the fault indicator of the specific phase where the fault occurred lights up. In case of phase imbalance, the indicators of the phases between which the imbalance occurred light up. If a phase sequence violation occurs, the fault indicators light up sequentially (running lights effect). 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 2. The LED flashes during the reclosing time countdown at the normal voltage.

Table 2 – Alarm codes

Signalization codes shown on display			
$A_\ 1$	Digital input turns OFF remote control	UrP	Phase imbalance
$U<<$	Minimal voltage	$U'_1{}'$	Wrong phase sequence
$U>>$	Maximal voltage	$U\ o$	Phase loss

Table 3 – RNPP-3100 operation modes

Adjustable and measures parameters	Parameter codes	Min. Value	Max. Value	Factory settings	Description
Basic parameters					
Voltage measurement indication	$_1U$	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 (every 5 s)
Digital input signal (terminals 11-12) to turn OFF of the load relay remotely	$cC\ 1$	0	2	0	**0** – not enabled; **1** – load relay tripping after time tCc following the closing of the digital contact; **2** – load relay tripping after time tCc following the opening of the digital contact
Phase imbalance control	CrP	0	1	1	**0** – not enabled; **1** – enabled
Phase sequence control	$C_1{}'_1$	0	1	1	**0** – not enabled; **1** – enabled
Voltage setting					
Nominal line voltage	$U0\ 1$	100	110	100	
Minimal voltage threshold, % of nominal voltage	$U<<$	60	95	80	
Maximal voltage threshold, % of nominal voltage	$U>>$	105	140	110	
Phase imbalance, % of nominal voltage	UrP	5	40	20	

Minimal voltage protection hysteresis, V	U-H	1	10	3	
Maximal voltage protection hysteresis, V	U-H	1	10	3	
Phase imbalance protection hysteresis, V	UrH	1	10	3	
Time setting					
Autoreclosing time delay (AR), s	tPP	0.5	600	10	**Attention! The minimum reclosing time for a phase failure is 3 seconds, regardless of the value of the parameter** tPP
Time delay to TURN OFF the power load in case of minimal voltage interruption detected, s	t--	0.1	30	10	
Time delay to TURN OFF the power load in case of maximal voltage interruption detected, s	t--	0.1	30	1	
Time delay to TURN OFF the power load in case the phase imbalance is detected, s	trr	0.1	30	3.0	
Time delay to TURN OFF the power load in case the phase loss is detected, s	t o	0.1	30	0.5	
Time delay to TURN OFF the power load in case the alarm signal comes from the digital input (terminals 11-12), s	tCc	0.1	600	10	
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
Voltage monitoring	ULP	0	1	0	**0** – line; **1** – phase
Device version	rEL			1	The device version may be changed by the manufacturer

6 MAINTENANCES

6.1 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.

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

6.3 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.

7 SERVICE LIFE AND MANUFACTURER WARRANTY

7.1 The lifetime of the device is 10 years. Upon expiration of the service life, contact the manufacturer.

7.2 Shelf life is 3 years.

7.3 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.

7.4 Warranty service is performed at the place of purchase or by the manufacturer of the device.

7.5 Post-warranty service of the device is performed by the manufacturer at current rates.

7.6 Before sending for repair, the device should be packed in the original or other packing excluding mechanical damage.

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.

8 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 %.

9 ACCEPTANCE CERTIFICATE

RNPP-3100 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

10 CLAIMS DATA

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

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For all questions, please contact the manufacturer:

"Novatek-Electro" Ltd
www.novatek-electro.com
59, Mykhailo Boltenko (Admiral Lazarev) str.,
Odesa, Ukraine, 65007
Tel: +38 (067) 565 37 68;
+38 (050) 359 39 11,
+38 (063) 301 30 40

Date of sale: _____

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