THREE PHASE MULTIFUNCTIONAL VOLTAGE MONITORING RELAY

RNPP-302M1

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 product after carefully studying the Operating Manual.
Keep the Operating Manual throughout the service life of the product.

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

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

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

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

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

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 product must be performed by qualified personnel having studied this Operating Manual.

In compliance with the requirements of this Operating Manual and regulations the product 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 multifunctional voltage monitoring relay RNPP-302M1 (hereinafter in the text device, RNPP-302M1).

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

Three phase multifunctional voltage monitoring relay RNPP-302M1 is designed for the permanent voltage monitoring, control and protection of the equipment with rated voltage parameters of 220/380V (230/400V or 240/415V) at rated frequency of 50Hz. RNPP-302M1 measures effective values of phase (line) voltages in networks with solidly earthed or insulated neutral and controls the coil of an external magnetic starter (hereinafter referred to as MS), which commutates the load supply circuit. The RNPP-302M1 constantly checks (before and after turning on) the condition of the power contacts of magnetic contactor and detects the stuck together and burned contacts. RNPP-302M1 performs automatic reclosing (hereinafter in the text AR) after the interruption or when the reason of the tripping is eliminated, set previously by the user.

RNPP-302M1 may work in four independent modes:

- phase loss monitoring mode without voltage level control (parameter tPr=0);
- minimum voltage monitoring mode (parameter tPr=1);
- maximum voltage monitoring mode (parameter tPr=2);
- voltage relay (parameter tPr=3).

RNPP-302M1 indicates acting value (true RMS) of the phase voltage or alternatively line voltage depending on mode of operation, voltage fault in mains power supply and the type of the interruption and load relay status (ON/OFF).

***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%.

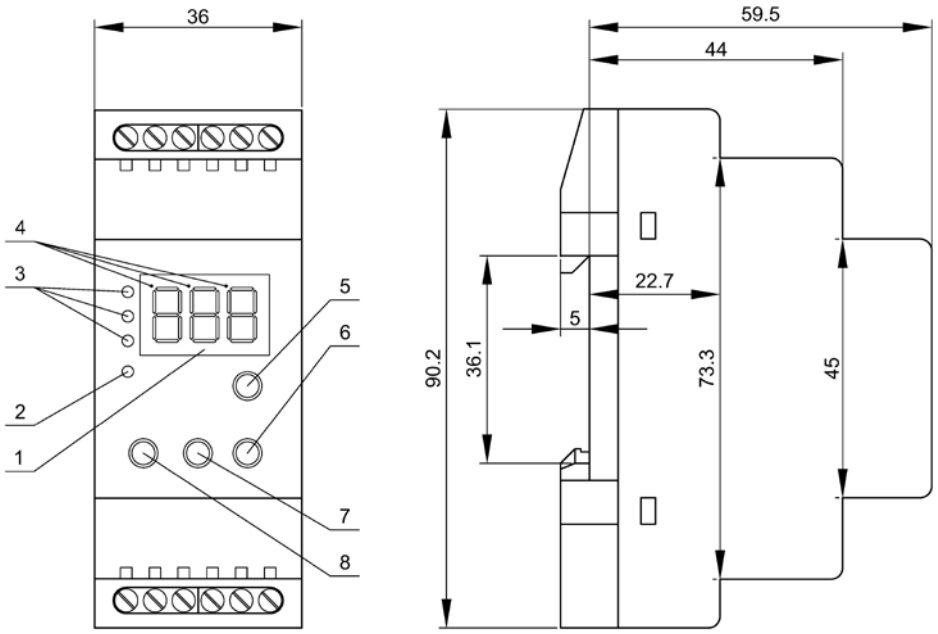
If the temperature of the product after transportation or storage differs from the environment temperature at which it is expected to operate, then before connection to electric mains keep the product under the operating conditions within two hours (because the product elements may have moisture condensation).

ATTENTION! The product 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-302M1

Controls, overall and mounting dimensions of RNPP-302M1 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-302M1

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 phase / line supply voltage	400/230 V, 415/240 V
Mains frequency	45 – 65 Hz
Measurement accuracy for tripping thresholds	≤ 1.5 %
Rated power consumption	≤ 5.0 W
Maximal current that output contacts may commutate	12 A
Harmonical configuration (nonsinusoidality) of power supply voltage	EN 50160
Commutation endurance for the output contacts: - under 5A power load (cos φ = 1.0) - under 1A power load (cos φ = 1.0)	 ≥ 100 000 times ≥ 1 000 000 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), H*B*L	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 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.

3.2 Device connection

ATTENTION! ALL CONNECTIONS MUST BE PERFORMED WHEN THE PRODUCT 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 product 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.

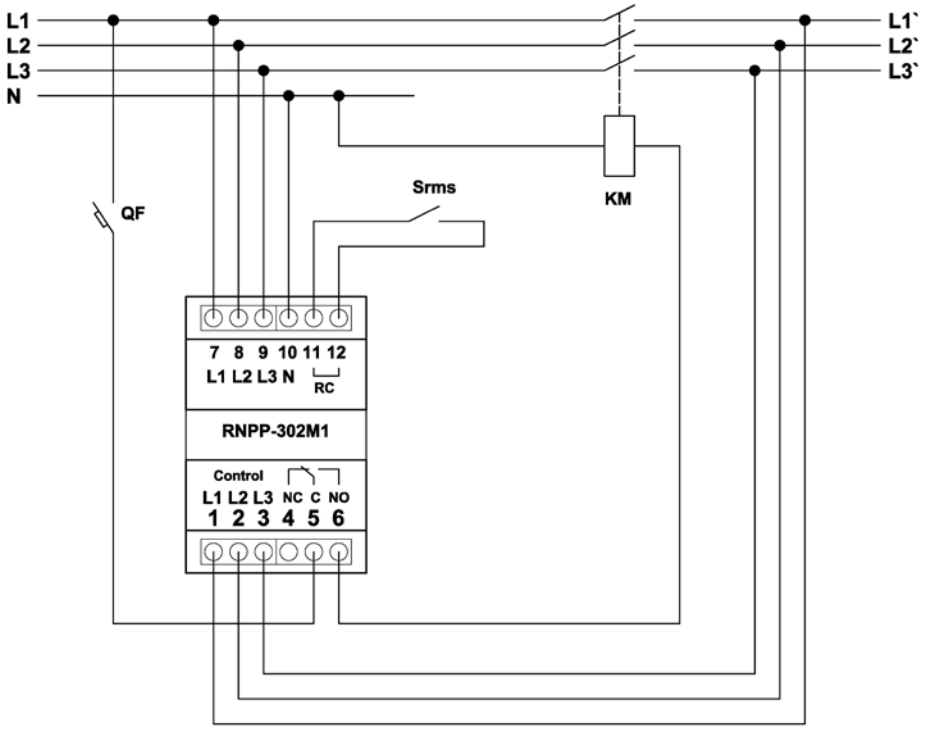
Wires fastening should exclude mechanical damage, twisting and abrasion of the wire insulation.

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 unit 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-302M1.



QF – circuit breaker 10 A.

Note: when using RNPP-302M1 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 UOI = 3 (4,5)).

Figure 2 – Wiring diagram of the RNPP-302M1

3.2.1 Connect the contactor (MS) to the RNPP-302M1 and remote switch contacts as shown on Figure 2.

3.2.2 Connect mains power supply to the input terminals of RNPP-302M1.

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 magnetic starter.*

4 RNPP-302M1 CONTROLS

4.1 At the initial state on the display of RNPP-302M1 is shown:

- depending the operation mode phase voltage on each phase (L1, L2, L3) if parameter UOI=0 (1, 2) or line voltage (L1L2, L2L3, L3L1), if parameter UOI=3 (4, 5);
- phase Indicator (indicator of the currently measured phase);
- load relay status (ON/OFF).

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

If none of the buttons are pressed within 15 seconds the RNPP-302M1 returns to initial state. To exit the menu early, press the button **WR.**

4.3 To restore default factory settings quickly it is necessary to press simultaneously **SET**, **DOWN** and **UP** buttons and energize the RNPP-302M1 while keeping these buttons pressed. Then the display should indicate "nAU". Then Turn OFF the device. Factory settings are restored.

4.4 ***To remotely control the load relay contacts, the corresponding parameters must be configured*** *(Table 3 – RNPP-302M1 Operating modes).*

cCI parameter is the operating mode of the digital input setting. tCc parameter - digital input response time. The control is performed by closing / opening the Srms contact Fig.2. When the load is switched off during digital input control, the measured voltage and the code A_I will be displayed alternately.

5 RNPP-302M1 OPERATION

5.1 Modes of RNPP-302M1 operation

Depending on the tPr parameter value the RNPP-302M1 can work in following modes:

1) Phase loss relay (the relay monitors only the presence of voltage (not the voltage level) on every phase) → tPr =0;
2) Minimal voltage monitoring relay → tPr =1;
3) Maximal voltage monitoring relay → tPr =2;
4) Over/Under voltage monitoring (min/max) mode → tPr =3;

Modes of operation, adjustable parameters, time delays and other controls are shown in Table3.

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.

5.3.2 *Minimal 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 of 5 to 6 V, the load relay is on.

5.3.3 *Maximal voltage monitoring mode*

In this mode power load should necessarily be connected to ***c***ontacts ***4, 5.***

When giving correct power supply to the input of the RNPP-302M1 the position of the load relay contacts does not change contacts 4, 5 are closed and contacts 6 and 5 are open.

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 open and contacts 6 and 5 are closed.

After the end of the reclosing time and when the input voltage drops below the maximum voltage level by a hysteresis value of 5 to 6 V, the load relay goes back into the initial state: contacts 4, 5 are closed and contacts 6 and 5 are open.

5.3.4 *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 of 5 to 6 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 value of 5 to 6 V, the load relay is on.

5.4 Control of the additional voltage parameters

In all above stated modes of operation, the RNPP-302M1 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-302M1 will turn ON the power load after the tPP time.

RNPP-302M1:

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 C1 1 =1 monitors the correct phase sequence and the absence of the phase combination;

3) If the parameter C JL=1:

- when the load relay is switched on, it checks the voltage at the output terminals of the magnetic starter and, if there is no voltage at least at one terminal, switches off the load relay;
- if with switched off load relay RNPP-302M1 detects voltage on the magnetic starter output terminals (sticking of MS contacts), then by switching on the load relay again for 2 seconds and switching off RNPP-302M1 tries to open the contacts. Regardless of the result further operation of the load relay is blocked.

To restart the operation of the RNPP-302M1 again after the detection of wrong phase sequence or the absence of voltage on the contactor output terminals it will be necessary to eliminate the reason of the power interruption, then only by switching off and reconnect the RNPP-302M1.

4) If the parameter C JL=2 RNPP-302M1 works the same as at C JL=1, but does not consider an accident the simultaneous breaking of all contacts MS (full-phase disconnection is permitted) and the alarm situation is detected only in case one or two contacts of the contactor are closed. This function is essential when the ability to turn off the MS through technological contact (external switch, intermediate relay contacts, etc.).

5) Control of the external signals coming to the digital input. It is defined by parameters cC 1=1 (cC 1=2).

RNPP-302M1 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-302M1 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-302M1 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 50 V) is maintained in all modes of operation.

5.5 Indication

In the absence of failure, the RNPP-302M1 indicator displays the effective value of the voltage of the selected phase with the lighting point at the top of the indicator, which indicates the selected phase (L1, L2, L3 in Fig. 1). The ▬ LED is on when the load relay is on.

In the case of faults with minimum voltage, maximum voltage, phase failure and voltage unbalance, the fault LED of the phase in which the alarm occurred is on. If the order of the phase sequence is violated, the alarm LEDs light up alternately (running lights). 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 1. 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	U JL	The absence of voltage on the contactor output terminals or in case of not full phase switching of the contactor
U<<	Minimal voltage	U1 1	Wrong phase sequence
U>>	Maximal voltage	U o	Phase loss
UrP	Phase imbalance		

Table 3 – RNPP-302M1 operation modes

Adjustable and measures parameters	**Parameter codes**	**Min. Value**	**Max. Value**	**Factory settings**	**Description**
Basic parameters					
Voltage measurement indication	1 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** – on closing of the digital input contact the RNPP-302M1 through time tCc turns OFF the load relay; **2** – on opening of the digital input contact the RNPP-302M1 through time tCc turns OFF the load relay

Mode of RNPP-302M1 operation	tPr	0	3	3	**0** – phase loss relay (minimal and maximal voltage are not controlled, alarm – if voltage disappear on 1 or 2 phases); **1** – minimal voltage relay (alarm – if the voltage gets lower than preset U-- value); **2** – maximal voltage relay (alarm – if the voltage gets higher than preset U-- value); **3** – voltage relay (alarm – if the voltage gets lower than U-- value or higher than U-- value)
Method to set Voltage deviation	SUr	0	1	0	**0** – voltage values are set up in absolute values; **1** – voltage values are set up in % of rated power parameters
Phase imbalance control	CrP	0	1	1	**0** – not enabled; **1** – enabled
Phase sequence control	C.1.	0	1	1	**0** – not enabled; **1** – enabled
Control of the voltage presence on the out-put contacts of the contactor	CoC	0	2	0	**0** – not enabled; **1** – enabled; **2** – enabled, and full-phase TURN OFF or TURN ON of the contactor is allowed – there is not alarm
Voltage setting					
Voltage measurement	U0 1	0	5	0	0 – phase voltage 220 V; 3 – line voltage 380 V; 1 – phase voltage 230 V; 4 – line voltage 400 V; 2 – phase voltage 240 V; 5 – line voltage 415 V
Minimal voltage setting, V In % values	U--	85 147 -60	230 398 +10	180 311 -30	If SUr =0 and U0 1=0, U0 1=1; U0 1=2; If SUr =0 and U0 1=3, U0 1=4, U0 1=5; If SUr =1 and any values of U0 1 parameter
Maximal voltage setting, V In % values	U--	235 407 -10	295 510 +20	245 424 10	If SUr =0 and U0 1=0, U0 1=1, U0 1=2; If SUr =0 and U0 1=3, U0 1=4, U0 1=5; If SUr =1 and any values of U0 1 parameter
Phase imbalance, V In % values	UrP	10 17 5	80 138 35	15 25 5	If SUr=0 and U0 1=0, U0 1=1, U0 1=2; If SUr =0 and U0 1=3, U0 1=4, U0 1=5; If Ur =1 and any values of U0 1 parameter
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 imba-lance is detected, s	trP	0.1	30	3.0	
Time delay to TURN OFF the power load in case the phase loss is detected, s	to	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
Device version	rEL			15	The device version may be changed by the manufacturer

4 MAINTENANCE

4.1 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.

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

4.3 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.

5 SERVICE LIFE AND MANUFACTURER WARRANTY

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

5.2 Shelf life is 3 years.

5.3 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.

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

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

5.6 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.

6 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 %.

7 ACCEPTANCE CERTIFICATE

RNPP-302M1 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

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_____

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

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For all questions, please contact the manufacturer:

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Date of sale: _____

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