LUMEL

METER OF NETWORK PARAMETERS NR30 TYPE

PROTECTION RELAY
(supplement to the NR30 meter user manual)

Contents

1 ENABLING THE EXTENDED FUNCTION OF THE PROTECTION RELAY

To enable additional functionality in the ND30 meter, enter the appropriate code received from the manufacturer from the meter menu (Information → Service code). The code is assigned to the serial number of the meter and cannot be used in another meter.

However, before the functionality of the Protection relay is purchased, it is possible to check/test its operation in the form of temporary full-functional access for the period of 48 hours (the meter's working time with the power on is taken into account). This is done from the menu level of the meter (Information → Service code) by entering the code "001". This code can be entered only once, and after 48 hours the functionality of the Protection relay is disabled. It is only possible to re-enable the Protection relay after purchasing and entering the appropriate code received from the manufacturer.

2 OPERATING MODES

(supplement to item 7 of the NR30 meter user manual)

		Protection Relay 1	Protection Relay 2
Configuration of alarms		⊙ Off ○ On	⊙ Off ○ On

The menu visible only when the Protection relay is deactivated

		Logical conditions	RLY state if AL on	Holdback alarm off	Disp. alarm event	Default settings
	Settings	⊙ C1 ○ C1 v C2 v C3 ○ C1 ^ C2 ^ C3 ○ (C1 ^ C2) v C3 ○ (C1 v C2) ^ C3	○ Off ⊙ On	⊙ Off ○ On	⊙ Off ○ On	⊙ No ○ Yes

Alarm 1 / Alarm 2 — Condition C1 / Condition C2 / Condition C3

Quantity	Condition type	Lo limit condition [%]	Hi limit condition [%]	Delay condition on [s]
⊙ U1 ○ I1 ○ P1 ○ Q1 . . ○ hh:mm	⊙ n_on ○ noFF ○ on ○ oFF ○ H_on . . ○ 3_oF	+0099.0	+101.0	0000

Delay condition off [s]	Hldbk cond. off->on [s]	Display cond. event		
0000	0000	⊙ Off ○ On		

The menu visible only when the Protection relay is activated

	RLY state if AL on	Active phases count	Alarm type	Latch	Low threshold [%]
Alarm 1 / Alarm 2 (Protection relay)	⊙ Off ○ On	○ 1st phase ○ 2nd phase ○ 3rd phase ○ 1-2 phases ○ 1-3 phases ○ 2-3 phases ⊙ All phases	⊙ Min. voltage ○ Min. current ○ Max. voltage ○ Max. current ○ Window (Voltage) ○ Window (Current) ○ Phase loss ○ Asymmetry (Voltage) ○ Asymmetry (Current) ○ Phase sequence	⊙ Off ○ On	095

High threshold [%]	Assymetry Treshold [%]	ON State Delay [s]	OFF State Delay [s]	Maintaining restart (Latch)
105	03	0000	0000	⊙ No ○ Yes

(Left margin label spanning the matrix: **Alarms**)

Fig.1. Programming matrix (supplement to Fig. 12a user's manual of NR30)
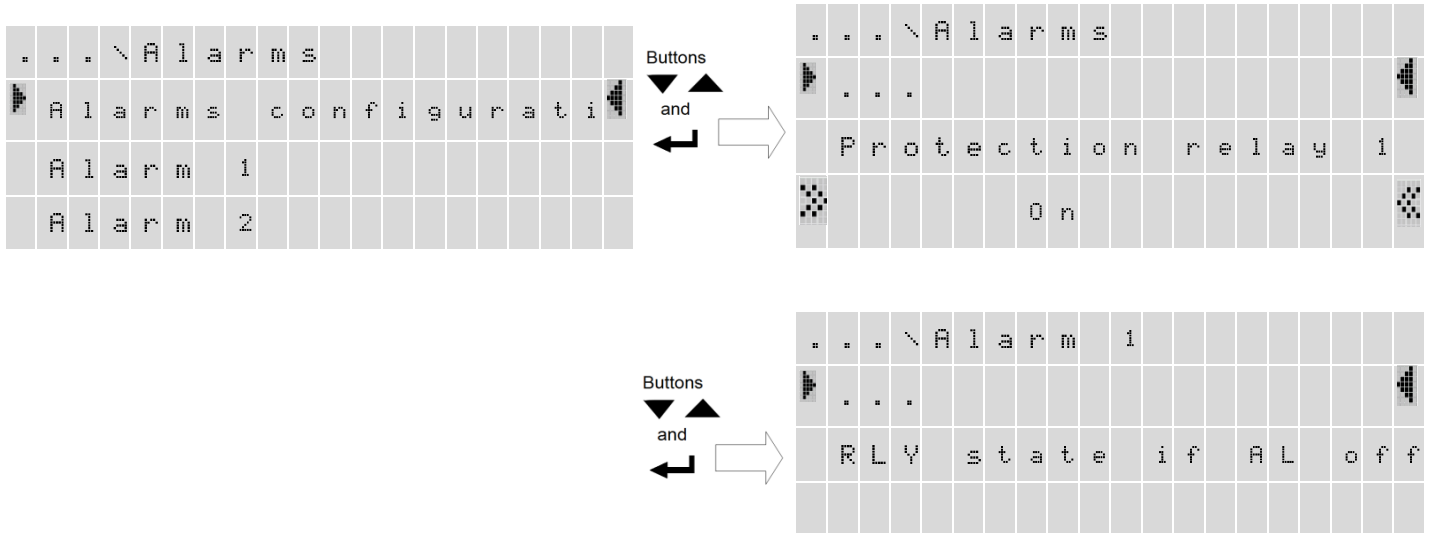
2.1 Protection relay mode

Supplement to item 8.3 of the NR30 meter user manual.

To enable the Protection relay functions, select Alarms → Config. of alarms, set the parameter "Protection relay" as Enabled. The configuration applies to each alarm separately. If it is selected that the Protection

relay 1 is enabled, parameters related to the Protection relay will appear in the Alarm 1 sub-menu instead of the standard alarm parameters (Fig. 1). The same situation applies to Alarm 2. The relay functions can also be programmed from the Modbus RTU and Modbus TCP levels.

Select the **Alarms** mode in options and approve the choice by pressing ⏎ .

When the Protection relay is on:
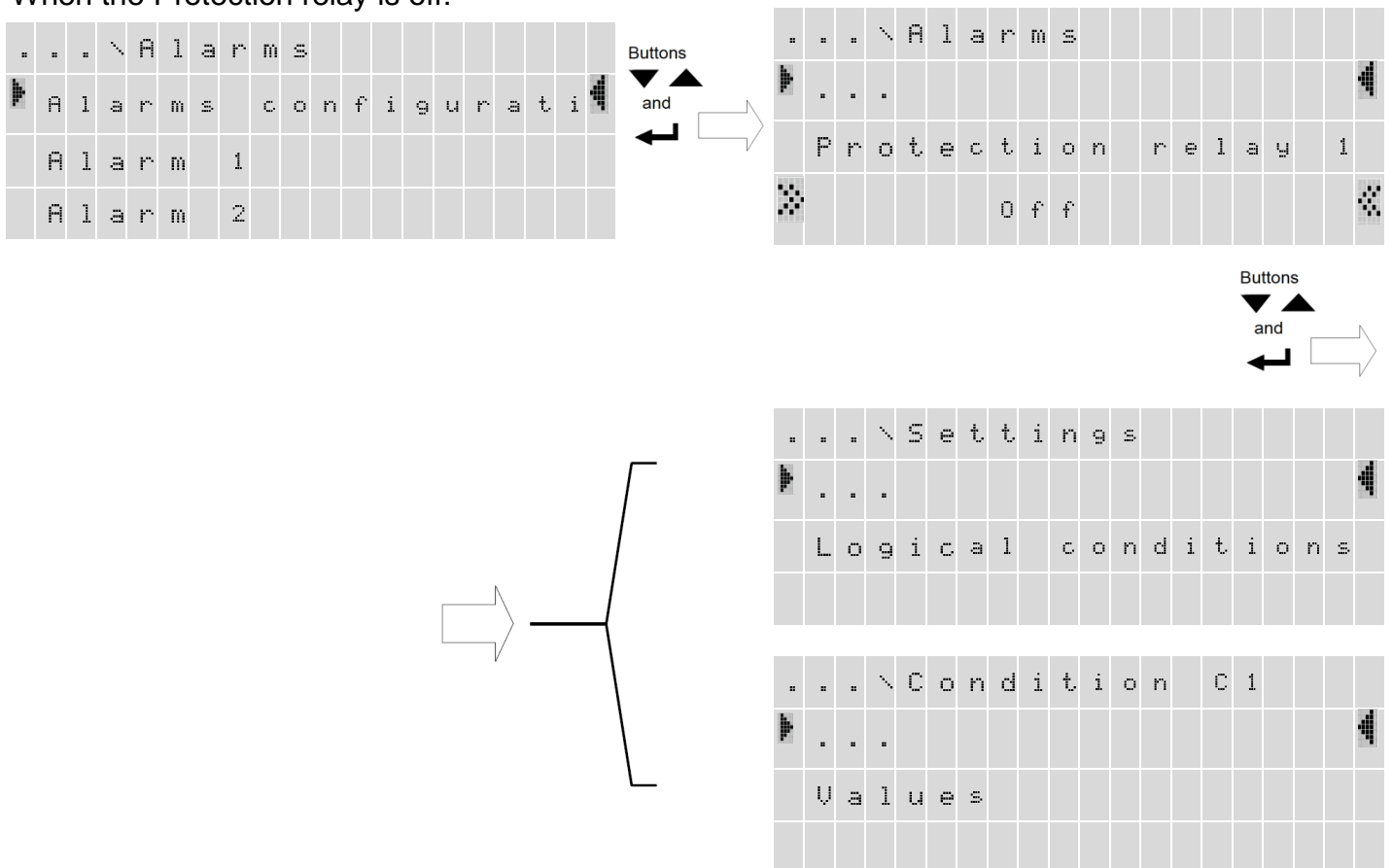

When the Protection relay is off:

Fig.1. Alarm mode screens (supplement to Figure 16

Supplement to Table 2 of user manual of NR30

No.			Parameter name	range	Notes / description	Default value
		Alarms Configuration	Protection Relay1, 2	OFF ON		
1			Logical conditions	C1 C1 v C2 v C3 C1 ∧ C2 ∧ C3 (C1 ∧ C2) v C3 (C1 v C2) ∧ C3		C1
2	Protection relay off	Factory	RLY state if AL on	OFF ON	State of relay with activated alarm Deactivated/Activated	ON
3			Holdback alarm off	OFF ON	Alarm deactivation lock	OFF
4			Disp. alarm event	OFF ON	When the function of alarm signaling is switched on, then after the state of emergency the alarm symbol is not blanked, but it begins to flash. The signaling lasts until simultaneous pressing the Buttons ▲ ▼ The function only applies to the alarm signaling; thus relay contacts will act without maintaining, according to the selected type of alarm.	OFF
			Set AL defaults	No / Yes	Default settings of parameters	No
5	Protection relay off	Condition 1 Condition 2 Condition 3	Values	U1,I1,P1,Q1,…,hh:mm	Value at the alarm output, parameter acc. to table 7	U1
6			Condition type	n_on, noFF, on,oFF, H_on, HoFF, 3non, 3noF, 3_on, 3_oF	acc. to fig. 17	n-on
7			Lo limit condition	-144.0…144.0	Lower value of condition in % of the nominal value of input quantity acc. to table 7	99.0
8			Hi limit condition	-144.0…144.0	Upper value of condition in % of the nominal value of input quantity acc. to table 7	101.0
9			Delay condition on	0 … 3600	Delay of condition act. in seconds	0
10			Delay condition off	0 … 3600	Delay of condition deact. in seconds	0
11			Hldbk cond. off->on	0 … 3600	Locking the condition reactivation in seconds	0
12			Display cond. event	OFF ON	Signaling of condition occurrence When the function of maintaining is switched on, after the state of condition is finished, the condition symbol is not blanked, but it begins to flash. The signaling lasts until simultaneous pressing the Buttons ▲ ▼	OFF

			RLY state if AL on	Deact., Act.		Deact.
13			Active phases count	1st phase, 2nd phase, 3rd phase, 1-2 phases, 1-3 phases, 2-3 phases, All phases		All phases
14	Protection relay on		Alarm type	Undervoltage Undercurrent Overvoltage, Overcurrent, Window (Volt.), Window (Curr.), Phase Failure, Asymmetry (Volt.), Asymmetry (Curr.), Phase sequence		Undervoltage
15			Latch	Off, on		off
16			Low threshold	5...140	in % of the nominal value of input quantity	95
17			High threshold	5...140	in % of the nominal value of input quantity	105
18			Assymetry Threshold	1...30	in % of the nominal value of input quantity	3
19			ON State Delay [s]	0...3600	in seconds	0
20			OFF State Delay [s]	0...3600	in seconds	0
21			Alarm Hold ON Reset	No/Yes		No

Types of alarm: "Undervoltage", "Undercurrent"
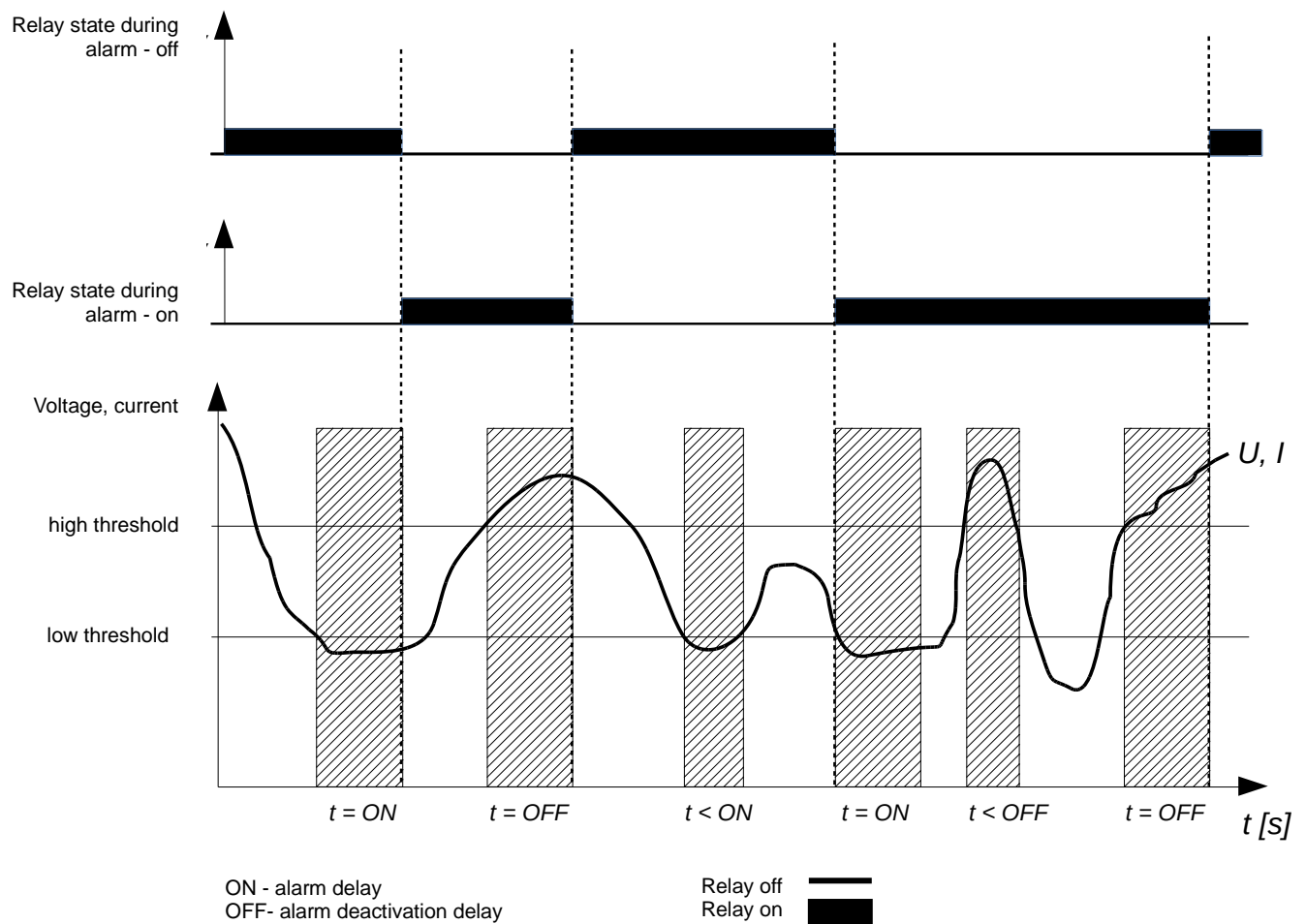
ON - alarm delay
OFF- alarm deactivation delay

Relay off
Relay on

The alarm is triggered when the measured value (RMS value) of the voltage or current (depends on the "Alarm type" parameter) on one of two or one of three phases (depends on the "Number of active phases" parameter) falls below the value defined in the "Low Threshold" parameter. After exceeding the threshold, the timing of the alarm activation delay begins (parameter "Alarm activation delay"). After this time, the alarm is activated and the relay goes into the state defined by the parameter "Relay status when alarm activated". The alarm is switched off when the measured value (RMS value) of voltage or current on one, two or three phases (depends on the "Number of active phases" parameter) increases above the value defined by the "High Threshold" parameter. Then, the timing of the alarm deactivation delay begins (parameter "Alarm deactivation delay"). After this time, the alarm is turned off. In the case when the value of any of the parameters "Alarm activation delay", "Alarm deactivation delay" is equal to zero, then when the alarm is activated/deactivated, the relay will be switched on/off at the same time.

Types of alarm: "Max. Voltage", "Max. Current"
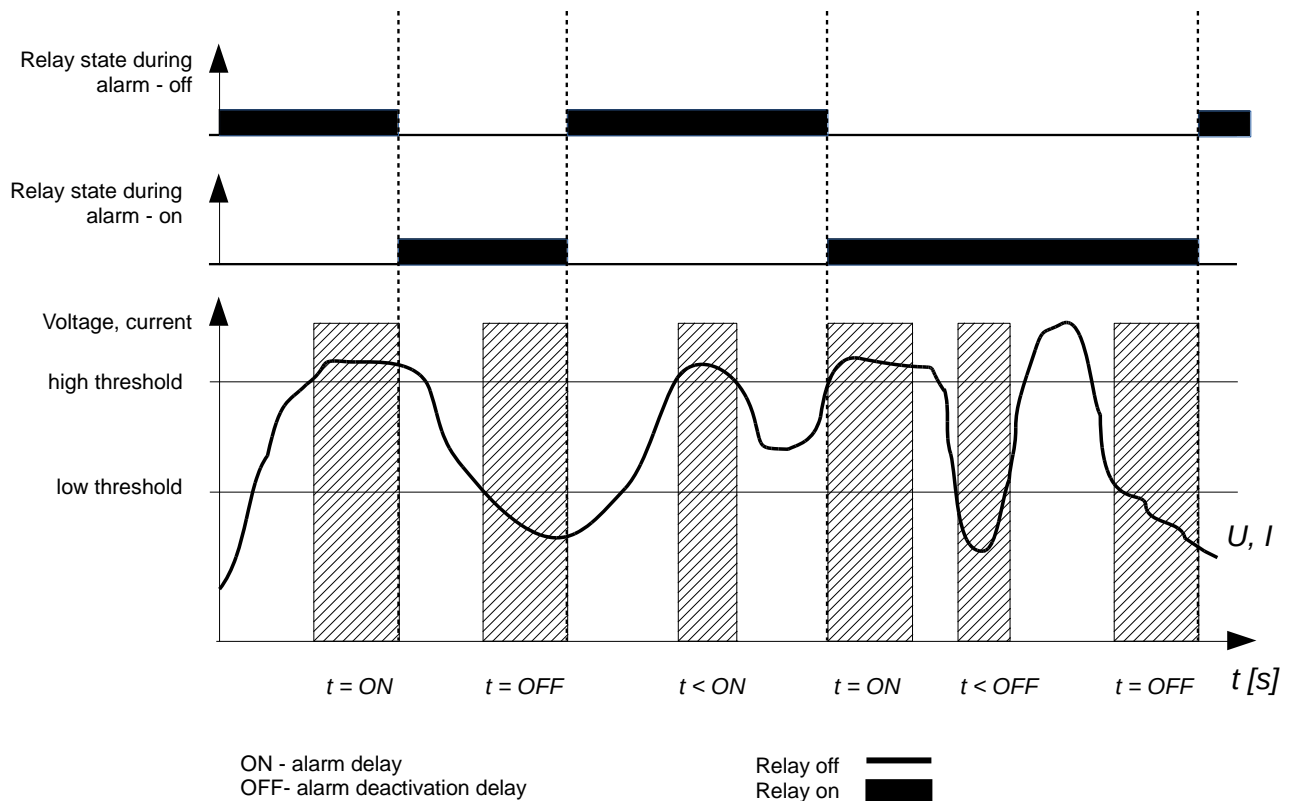
ON - alarm delay
OFF- alarm deactivation delay
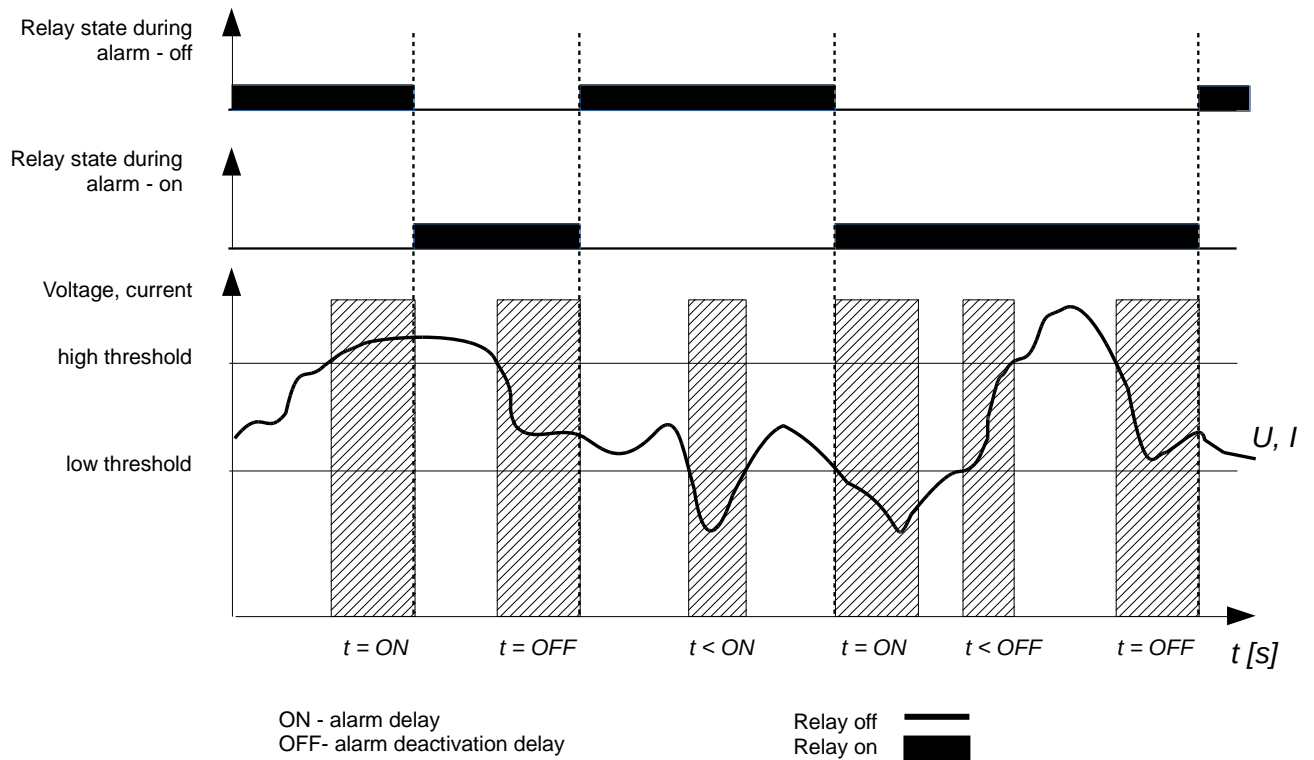
Relay off ——
Relay on ▬

The alarm is triggered when the measured value (RMS value) of the voltage or current (depends on the "Alarm type" parameter) on one of two or one of three phases (depends on the "Number of active phases" parameter) increases above the value defined in the "High Threshold" parameter. After exceeding the threshold, the timing of the alarm activation delay begins (parameter "Alarm activation delay"). After this time, the alarm is activated and the relay goes into the state defined by the parameter "Relay status when alarm activated". The alarm is switched off when the measured value (RMS value) of voltage or current on one, two or three phases (depends on the "Number of active phases" parameter) falls below the value defined by the "Low Threshold" parameter. Then, the timing of the alarm deactivation delay begins (parameter "Alarm deactivation delay"). After this time, the alarm is turned off. In the case when the value of any of the parameters "Alarm activation delay", "Alarm deactivation delay" is equal to zero, then when the alarm is activated/deactivated, the relay will be switched on/off at the same time.

Types of alarm: "Window (of voltage)", "Window (of current)"

Relay state during alarm - off

Relay state during alarm - on

Voltage, current

high threshold

low threshold

U, I

$t = ON$ $t = OFF$ $t < ON$ $t = ON$ $t < OFF$ $t = OFF$ $t\ [s]$

ON - alarm delay
OFF- alarm deactivation delay

Relay off
Relay on

       The alarm is triggered when the measured value (RMS value) of the voltage or current (depends on the "Alarm type" parameter) on one of two or one of three phases (depends on the "Number of active phases" parameter) increases above the value defined by the "High Threshold" parameter or falls below the value specified by the "Low Threshold "parameter. After exceeding the threshold, the timing of the alarm activation delay begins (parameter "Alarm activation delay"). After this time, the alarm is activated and the relay goes into the state defined by the parameter "Relay status when alarm activated". Alarm is deactivated when the measured value (RMS value) of the voltage or current on one, two or three phases (depends on the "Number of active phases" parameter) falls between the values specified by the "Low threshold" and "High threshold" parameters. Then, the timing of the alarm deactivation delay begins (parameter "Alarm deactivation delay"). After this time, the alarm is turned off. In the case when the value of any of the parameters "Alarm activation delay", "Alarm deactivation delay" is equal to zero, then when the alarm is activated/deactivated, the relay will be switched on/off at the same time.

Types of alarm: "Phase loss"

       The principle of the alarm operation is analogous to the principle of the operation of the alarm type: **"Min. voltage", "Min. current"**
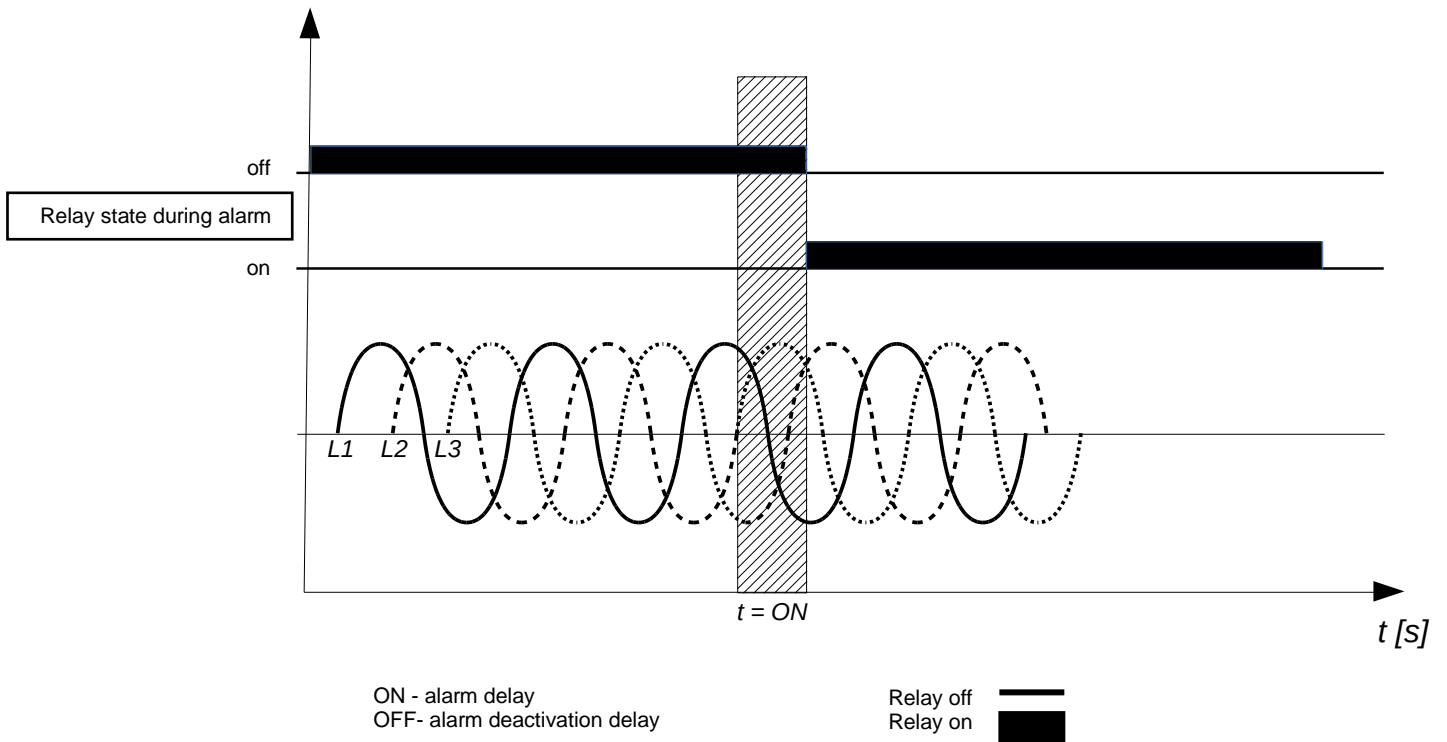
Types of alarm: "Asymmetry (Voltage)", "Asymmetry (Current)"
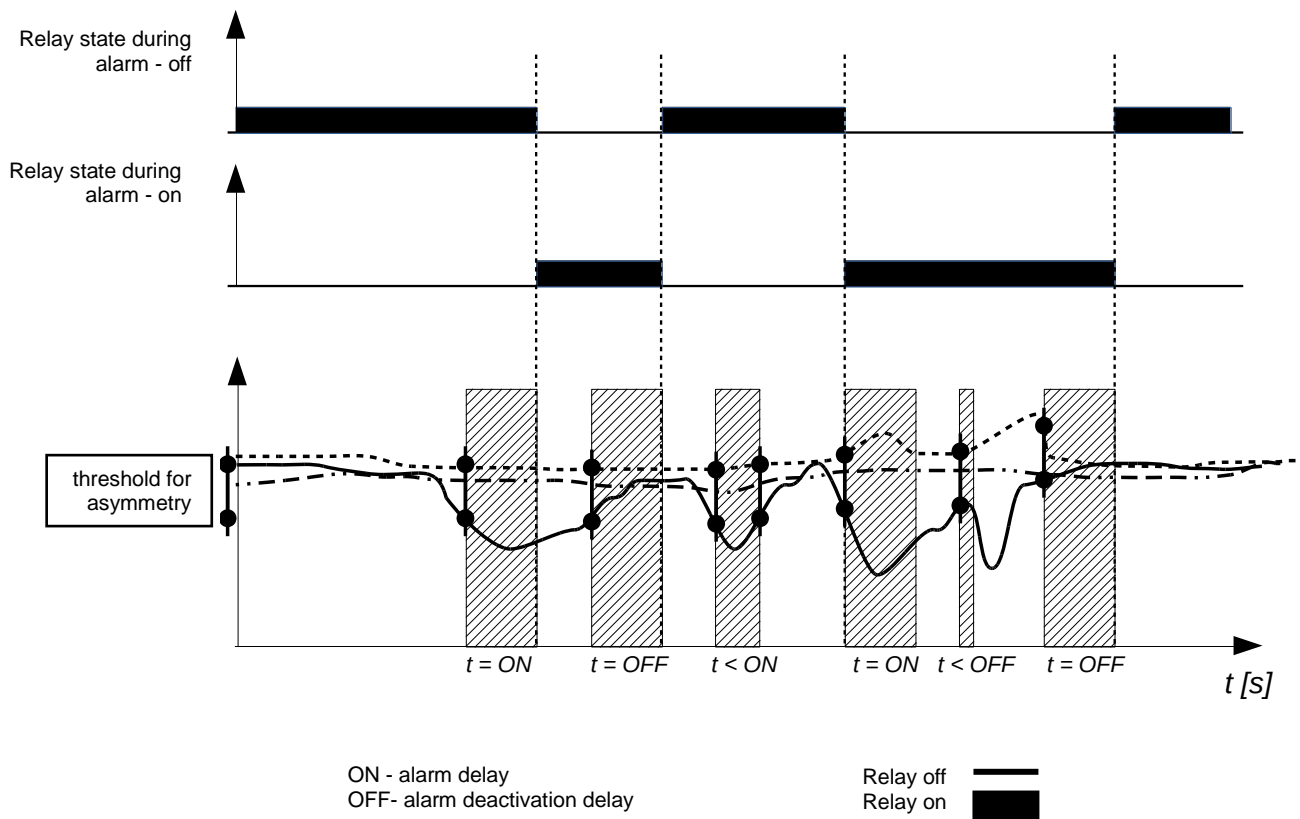
ON - alarm delay
OFF- alarm deactivation delay

Relay off
Relay on

When the asymmetry for measured values (RMS values) of voltages or currents (depends on the "Alarm type" parameter) between two phases (depends on the "Number of active phases" parameter) increases above the value defined by the "Asymmetry threshold" parameter, the timing of the alarm activation delay begins (parameter "Alarm activation delay"). After this time, the alarm is activated and the relay goes into the state defined by the parameter "Relay status when alarm activated". The alarm is switched off when the asymmetry for measured values (RMS values) of voltages or currents (depends on the "Alarm type" parameter) between phases (depends on the "Number of active phases" parameter) falls below the value defined by the "Asymmetry Threshold" parameter Then, the timing of the alarm deactivation delay begins (parameter "Alarm deactivation delay"). After this time, the alarm is turned off. In the case when the value of any of the parameters "Alarm activation delay", "Alarm deactivation delay" is equal to zero, then when the alarm is activated/deactivated, the relay will be switched on/off at the same time.
For this type of alarm, the "Number of active phases" parameter must be set to two or all phases.

Types of alarm: "Phase sequence"

off

| Relay state during alarm |

on

L1   L2   L3

t = ON

t [s]

ON - alarm delay
OFF- alarm deactivation delay

Relay off
Relay on

If a change in the phase sequence is detected, the timing of the alarm activation delay begins (parameter "Alarm activation delay"). After this time, the alarm is activated and the relay goes into the state defined by the parameter "Relay status when alarm activated". The alarm is deactivated when the phase order is correct. Then, the timing of the alarm deactivation delay begins (parameter "Alarm deactivation delay"). After this time, the alarm is turned off. In the case when the value of any of the parameters "Alarm activation delay", "Alarm deactivation delay" is equal to zero, then when the alarm is activated/deactivated, the relay will be switched on/off at the same time.

For this type of alarm, the "Number of active phases" parameter must be set to two or all phases.

3 MAP OF REGISTERS OF NR30 METER

Supplement to item 12 of the NRD30 meter user manual.

In NR30 meter the data is placed in 16- and 32-bit registers. Process variables and parameters of the meter are located in the address space of registers in a manner dependent on the type of the variable. Bits in 16-bit register are numbered from the youngest to the oldest (b0-b15). 32-bit registers contain floating point numbers in IEEE-754 standard. Byte order 3210 – the oldest is sent first.

Supplement to Table 13 of the user manual of NR30

Address range	Value type	Description
4400- 4440	Integer (16 bits)	Value placed in one 16-bit register. Registers of status, energy values, the meter MAC address, configuration data. Description of registers can be found in table 20. Read-only registers.
4600-4610	Integer (16 bits)	Value placed in one 16-bit register. Configuration registers of Protection relay.

Base with the address 4500 (16-bit registers) in NR30 for the Protection relay

Register address	Ope-rations	Range	Description	Default
4600	RW	0 .. 1	The number of the relay for configuration. 0 – relay number one, 1 – relay number two,	0
4601	RW	0 .. 1	Relay function: 0 – standard relay supported by the NR30 alarm functions, 1 – function of the Protection relay,	0
4602	RW	0 .. 1	Relay status at the time of the alarm: 0 – disabled, 1 – enabled.	0
4603	RW	0 .. 6	The quantities to which the alarm is to operate: 0 - first phase, 1 - second phase, 2 - third phase, 3 - first and second phase, 4 - first and third phase, 5 - second and third phase, 6 - all phases,	6
4604	RW	0 .. 9	Alarm type 0 - Minimum voltage, 1 - Minimum current, 2 - Maximum voltage, 3 - Maximum current, 4 - Window (voltage), 5 - Window (current), 6 - Phase loss, 7 - Asymmetry (voltage) - available at supervision of at least 2 phases, 8 - Asymmetry (current) - available at supervision of at least 2 phases, 9 - Phase sequence - available with supervision of 3 voltage phases	0
4605	RW	0 .. 2	Latch 0 - when an alarm occurs, it will not latch, 1 - when an alarm occurs, it will latch, that is, after the alarm condition disappears, it is still active,	0

			2 - resetting the alarm occurrence and returning the relay to the position that occurs when there is no alarm,	
4606	RW	5 .. 140 [%]	Lower threshold of quantity in percentage (relative to nominal current or voltage)	95
4607	RW	5 .. 140 [%]	Upper threshold in percentage (relative to nominal current or voltage) - upper threshold value cannot be lower than the lower threshold	105
4608	RW	1 .. 30 [%]	Value threshold for asymmetry relative to the nominal value (voltage or current)	3
4609	RW	0 .. 3600 [s]	Delay time (in units of 1s) of alarm activation in seconds - time 0 means the shortest possible activation time resulting from hardware limitations	0
4610	RW	0 .. 3600 [s]	Delay time (in units of 1s) of alarm deactivation in seconds - time 0 means the shortest possible deactivation time resulting from hardware limitations	0

Supplement to Table 20 of user manual of NR30

Register address	Ope-rations	Range	Description	Default
4424	R	0...65535	Status register 7– description below	0

Status register 7 (address 4424, R)

Bit 8 – reserved
Bit 7 – reserved
Bit 6 – reserved
Bit 5 – reserved
Bit 4 – reserved
Bit 3 – reserved
Bit 2 – reserved
Bit 1 – "1" – functions of MQTT protocol enabled
Bit 0 – "1" – functions of Protection relay enabled