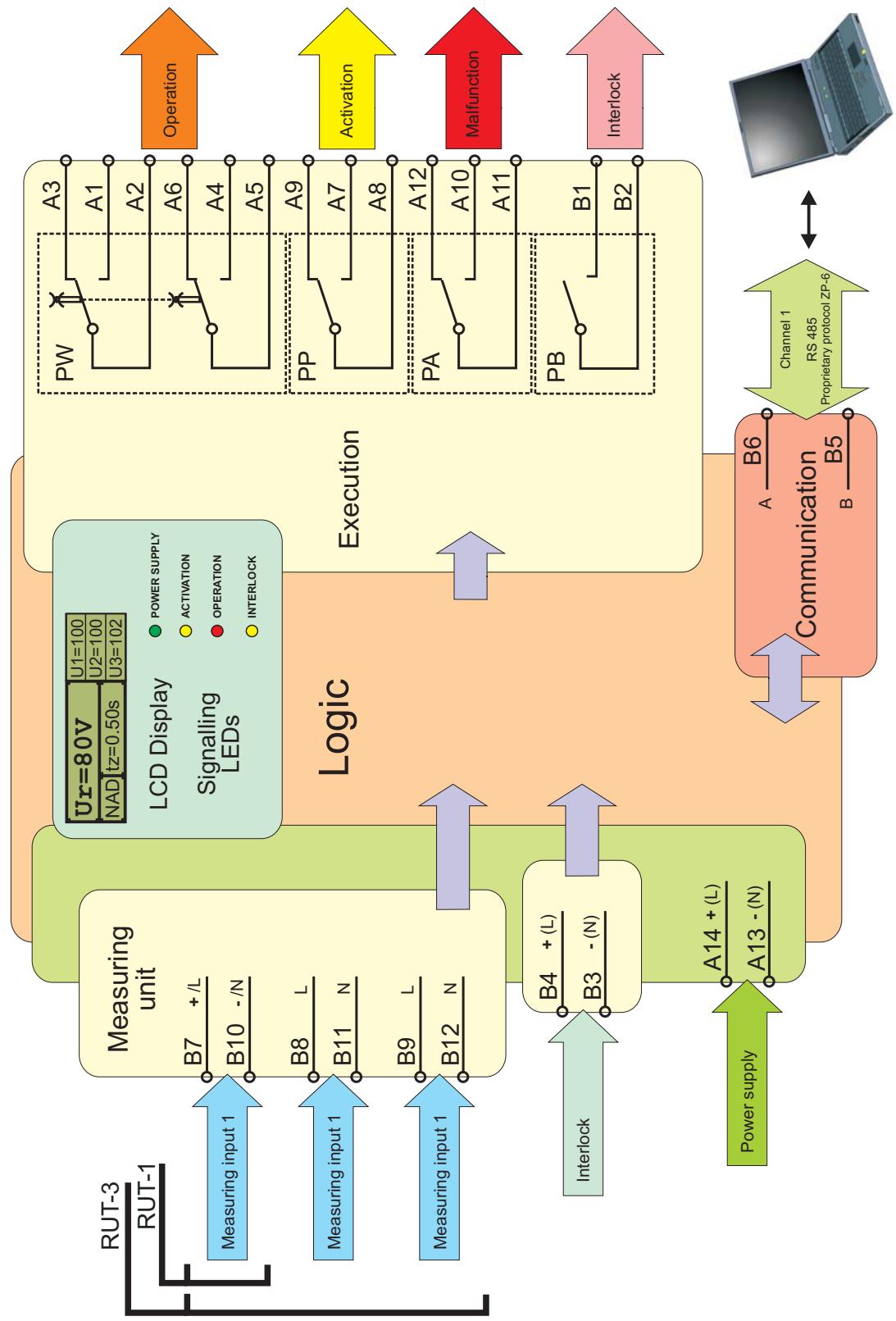




RUT-1, RUT-3

TIME - VOLTAGE

Fig. 1. Structural diagram of RUT-1/RUT-3 relay.



APPLICATION

The RUT-1, RUT-3 relays are meant for use in the automation and protection circuits as voltage monitoring elements with a programmable time delay. The following operating modes are available:

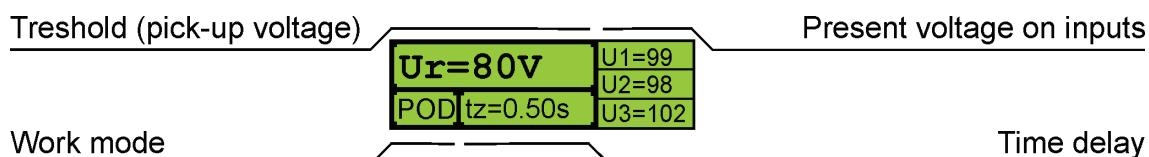
1. POD-NAP – operation after identifying decrease of monitored voltage below set value (Time-delay under-voltage protection)
2. NAD-NAP – operation after identifying increase of monitored voltage over set value (Time-delay over-voltage protection)
3. KPW – operation when monitored voltage is within a set range (Time-delay within-range protection)
4. KPZ – operation when monitored voltage is beyond a set range (Time-delay out of-range protection)

CONSTRUCTION

The RUT-type relay has isolated measuring inputs. RUT-3 monitors up to three independent values of effective 50Hz sinusoidal voltage, RUT-1 monitors one DC voltage. Voltage level detector checks extreme values of effective voltage measured, and the steering system executes programmed functions basing on information from the detector, and state of the input blockade.

The relay has one instantaneous changeover contact of the activation relay (PP), two time-delayed changeover contacts of the operating relay (PW), one make contact of a relay signalling activation of a blockade (PB). The RUT-1/RUT-3 relays are mounted in a housing, sizes $110 \times 100 \times 77$ mm, with 28 terminations in a form of 2 plugs, suitable to be mounted in typical GZ-14 sockets (plate-mounting), GZ-14U (bus-mounting) or GZ14Z – to be mounted in a relay chassis type R8614Z. Dimensions of the relay are presented on Picture 11.

An LCD display, enabling preview of status and configuration, is located on the front panel of the relay.



Communication with the user is ensured with five buttons, enabling:



Settings preview (available in „OPERATE” mode)
Setting up values (available in „PROGRMMING” mode)



Return to one level up (exit)



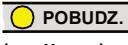
Entering into another level (confirmation)
Confirmation of settings (available in „PROGRMMING” mode)



Reset (confirmation of operation)

Time-voltage relay RUT-1, RUT-3

Four LEDs are located on the front panel, signalling following::

LED	Turned off	Continuous Light	Blinking Light
 (green)	RUT-1/RUT-3 has no power supply	RUT-1/RUT-3 has power supply	-----
 (yellow)	RUT-1/RUT-3 is not activated, and the PP relay is not and has not been operating since the last reset or loss of power supply.	RUT-1/RUT-3 is activated, and the PP relay is operating	RUT-1/RUT-3 is not activated, but the PP relay was operating. The POBUDZ diode is blinking till manual reset or loss of power supply.
 (red)	RUT-1/RUT-3 is not activated, and the PW relay is not and has not been operating since the last reset or loss of power supply.	RUT-1/RUT-3 is or was activated and operating, and the PW relay is operating	RUT-1/RUT-3 is not activated, but the PW relay has been in operation. The D diode is blinking till manual reset or loss of power supply.
 (yellow)	RUT-1/RUT-3 is not locked	RUT-1/RUT-3 has power voltage and is locked	-----

The structural scheme of the RUT-1/RUT-3 is presented on picture 1.

OPERATION

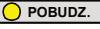
When supply voltage is applied the relay is ready for work accordingly to chosen operating mode. Execution of all four operating modes is ensured by independent set up of working parameters:

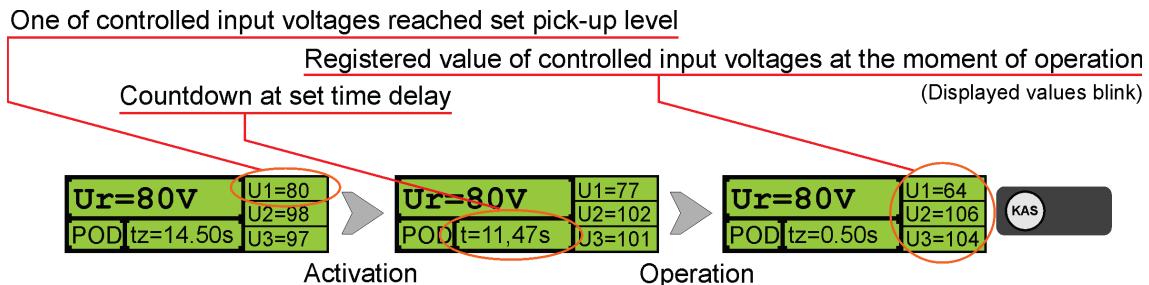
For operating modes POD-NAP (time-delay under-voltage protection), and NAD-NAP (time-delay over-voltage protection) the following parameters can be configured:

- Pick-up voltage Ur (voltage to operate),
- hysteresis Uh (depth of the voltage hysteresis)
- time delay t_z (delay time to operate)
- work mode of PW relay (operation of the PW relay with hold up (ZP), and without hold up ((BP))
- averaging filter (elimination of random interferences)
- activation of inputs (choosing activated measuring inputs – only RUT-3)

For operating modes KPW (time-delay within-range protection), and KPZ (time-delay out of-range protection) the following parameters can be configured:

- top voltage G (top voltage to operate),
- bottom voltage D (bottom voltage to operate)
- hysteresis Uh (depth of the voltage hysteresis)
- time delay t_z (delay time to operate)
- work mode of PW relay (operation of the PW relay with hold up (ZP), and without hold up (BP))
- averaging filter (elimination of random interferences)
- activation of inputs (choosing activated measuring inputs – only RUT-3)

The RUT-3 relay monitors up to 3 values of alternating voltage with a possibility to deactivate each input. RUT-1 monitors one direct voltage. In case of detection of excess voltage on any input the PP relay is activated, and  diode lights up with permanent light signalling its activation. At the same moment countdown of the set time delay begins.



During the countdown the symbol "tz" changes into "t". At the same time effective values of monitored voltages (input voltages) are displayed. At the moment of activation they are saved, and displayed cyclically until button  is pushed.

In each work mode the PP relay is activated for as long, as activating pulse lasts. If during countdown of time "tz" the activation decays the  diode turns into blinking light, and the PP relay releases. If the activation lasts longer than "tz" the PW relay is activated and the  lights up. The PW relay may operate in two programmed operating modes – with or without hold up. In the hold-up mode PW-ZP the PW relay is held up until manually reset with a button marked , in the non-hold up mode PZ-BP the PW relay is activated only for as long as the activating pulse lasts. If the activation decays after operation of the PW relay the diodes marked  and marked  change light into blinking. This state lasts till moment of manual reset. Activation of the relay ends when all monitored voltages return to values not exceeding the set pick-up values. The difference between pick-up voltage and drop-off voltage is called hysteresis (Uh) and is programmable.

Additionally, in any moment of time it is possible to block the PW relay by application of voltage on terminals B3/B4 of the relay. The blocked status is signalled with a continuous light of diode marked .

The RUT-1/ RUT-3 is equipped with an averaging filter with programmable averaging time, which enables elimination of accidental pick-ups resulting from interferences in controlled inputs. Turning on the averaging filter results with longer response time of the relay. The extra time is proportionate to the time constant T of the filter.

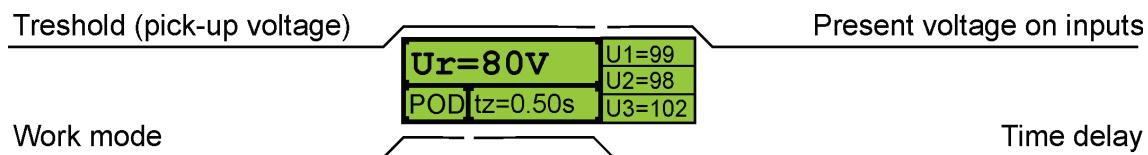
Changing of the operating mode results with changing of all setting to their default values:

- pick-up voltage: Ur = 0.8 UWn
- top voltage: G = 1.1 UWn
- bottom voltage: D = 0.8 UWn
- Hysteresis: Uh = 1 V
- Delay-time: tz = 0.5 s
- Operating mode of the PW relay: PW-BP
- averaging filter: „OFF”
- activation of inputs: U1 - ■ U2 - ■ U3 - ■ (all inputs active)

AVAILABLE OPERATING MODES

POD-NAP – time-delay under-voltage protection

The relay monitors voltage levels on measuring inputs, activates after detecting decrease of monitored voltage on any of the inputs below set value, and operates with a specified time delay. Information on chosen operating mode, pick-up voltage U_r , and time delay t_z as well as present values of effective input voltage are presented on line on a display.



The below diagram presents working algorithm of the relay after detecting decrease of monitored voltage below set value.

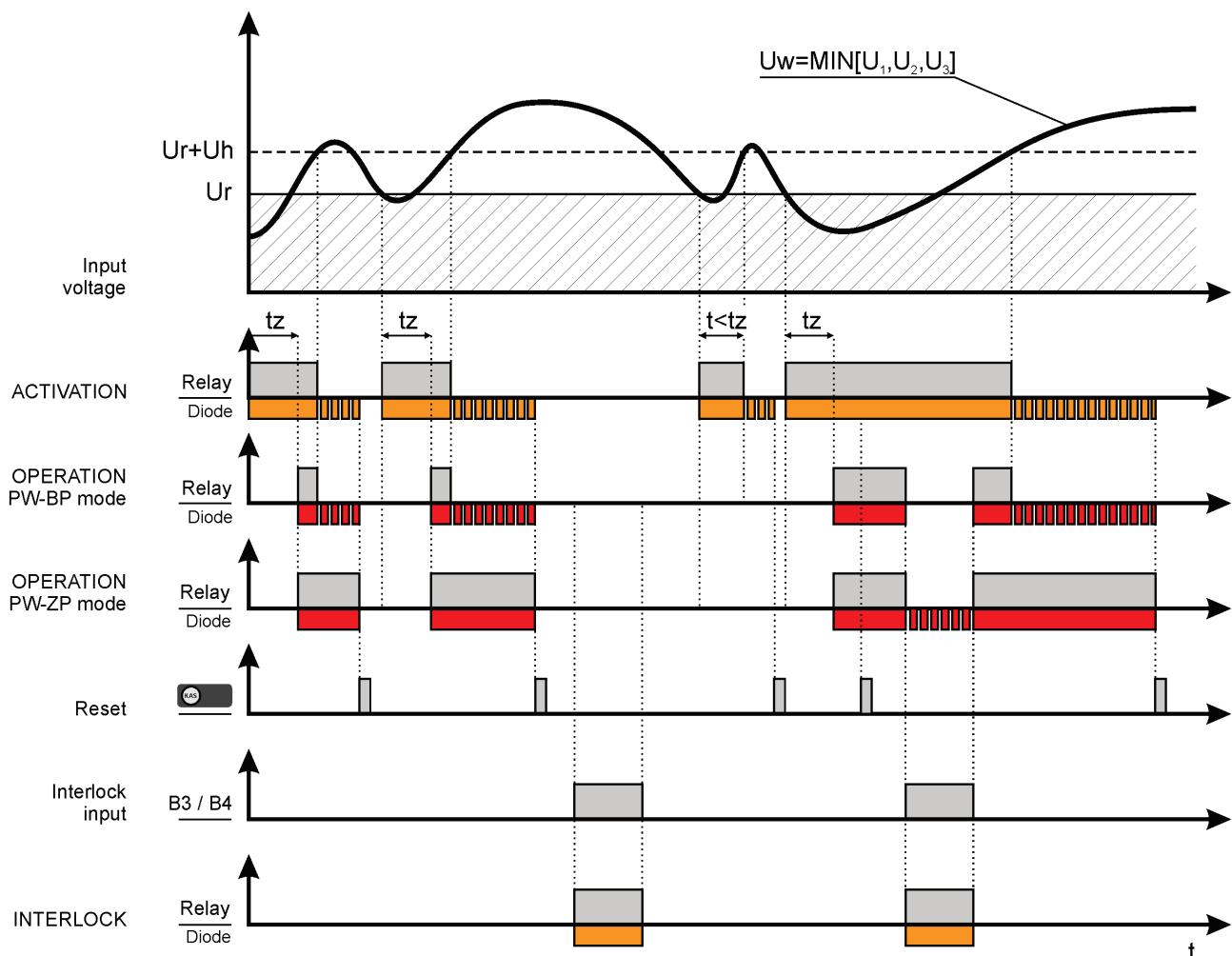
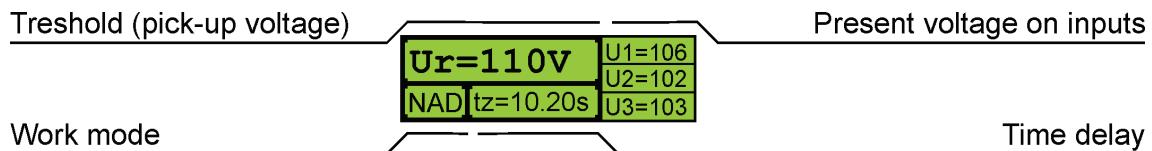


Fig. 2. Operation of the relay for the POD-NAP operating mode

NAD-NAP time-delay over-voltage protection

The relay monitors voltage levels on measuring inputs, activates after detecting increase of monitored voltage on any of the inputs over set value, and operates with a specified time delay. Information on chosen operating mode, pick-up voltage U_r , and time delay t_z as well as present values of effective input voltage are presented on line on a display.



The below diagram presents working algorithm of the relay after detecting increase of monitored voltage over set value.

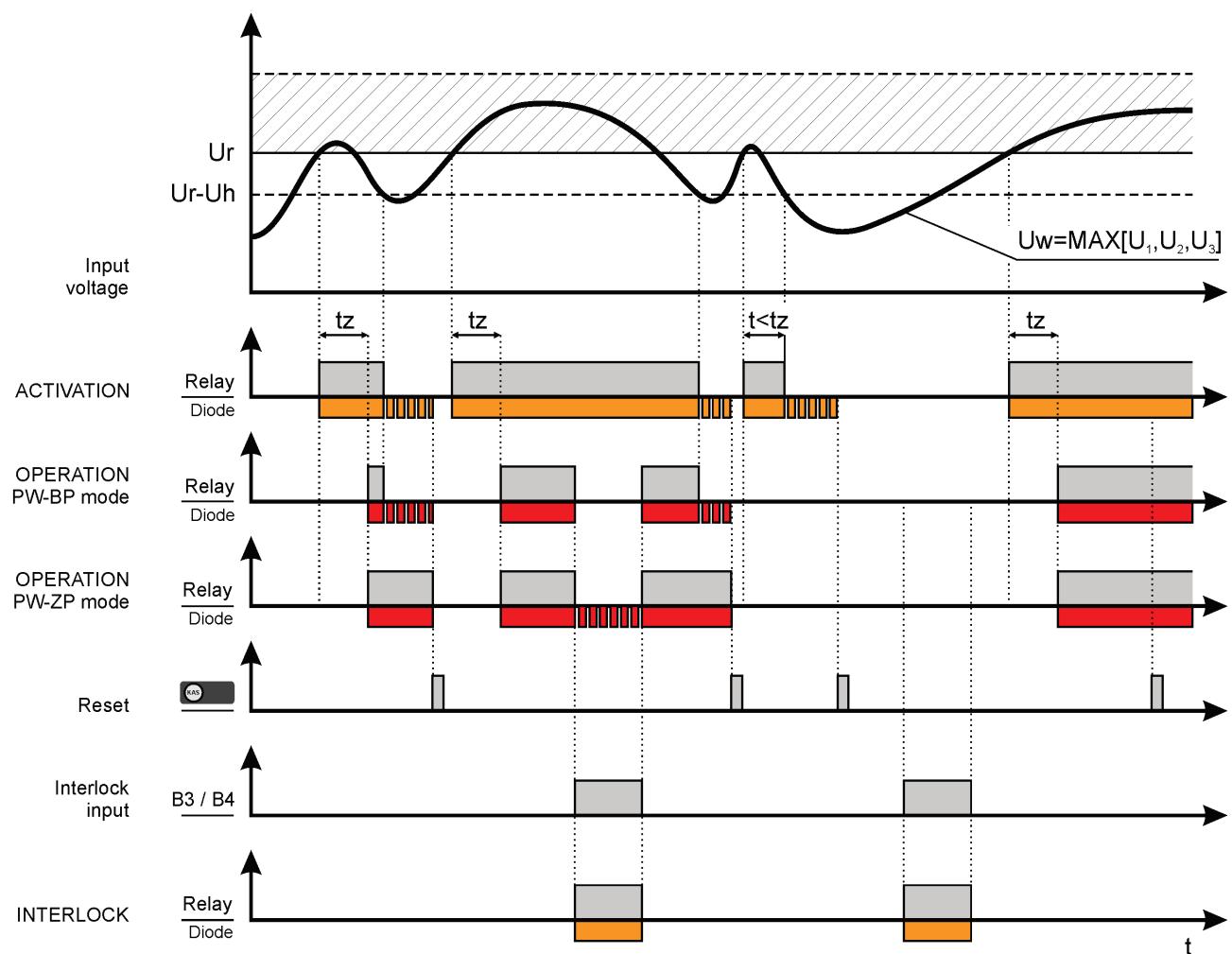
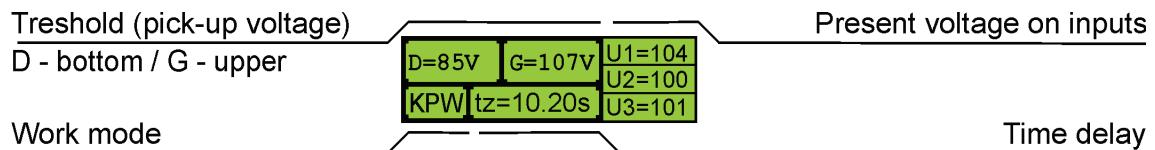


Fig 3. Operation of the relay for the NAD-NAP operating mode

KPW –time-delay within-range protection

The relay monitors voltage levels on measuring inputs, activates when effective values of all input voltages are within a defined range, and operates with a specified time delay. Information on chosen operating mode, set values of pick-up voltage D (bottom pick-up voltage), G (top pick-up voltage), and time delay t_z as well as present values of effective input voltages are presented on line on a display.



The below diagram presents working algorithm of the relay when values of monitored voltages are within a defined range.

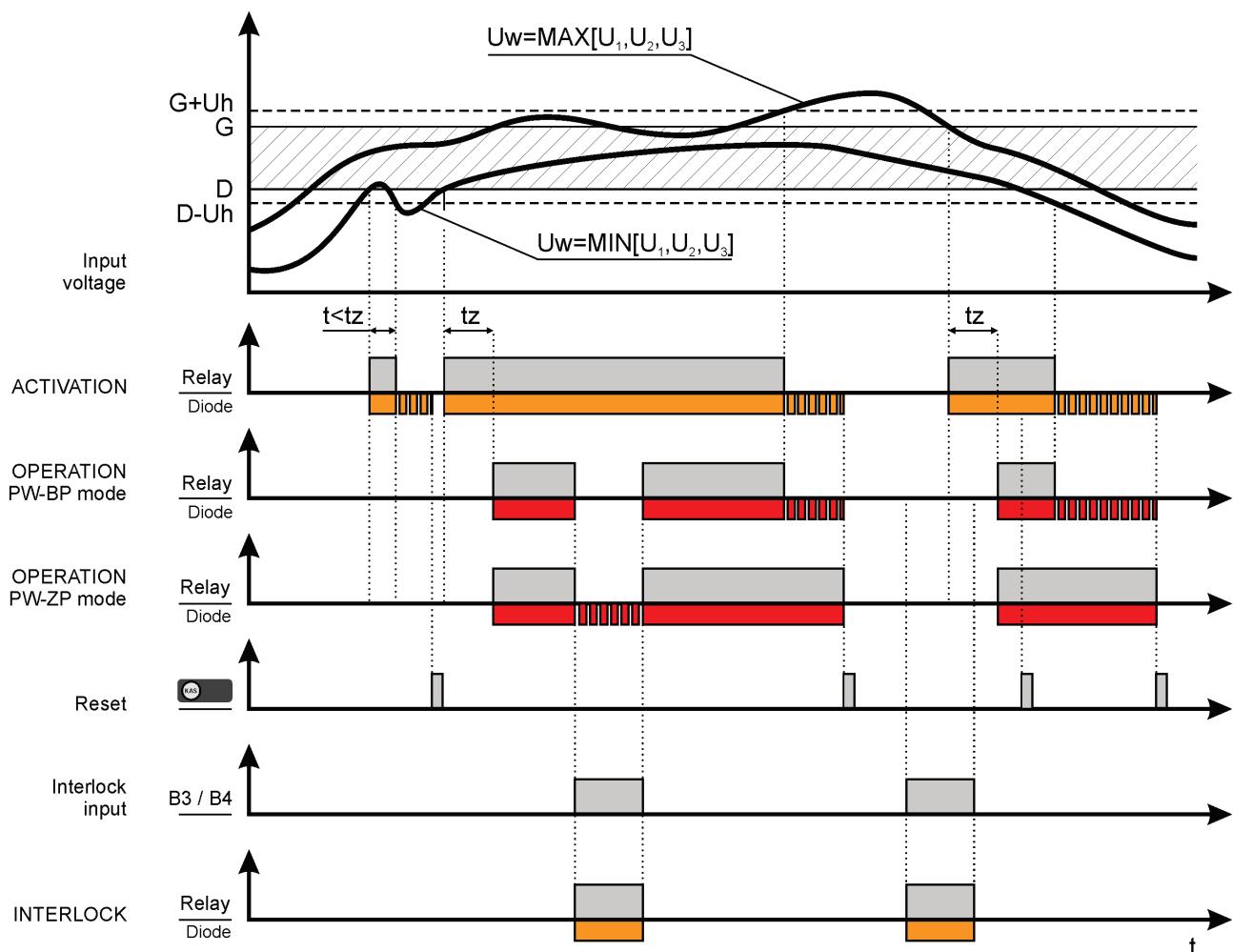
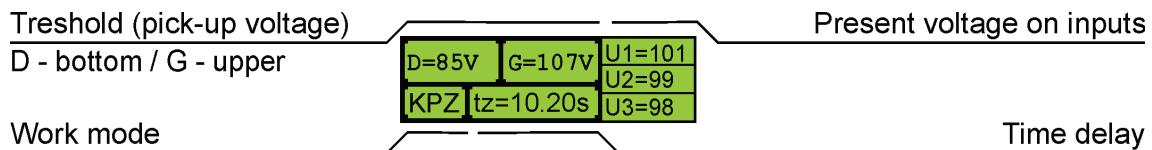


Fig 4. Operation of the relay for the KPW operating mode

KPZ time-delay out-of-range protection

The relay monitors voltage levels on measuring inputs, activates when effective values of all input voltages are outside of a defined range, and operates with a specified time delay. Information on chosen operating mode, values of pick-up voltage D (bottom pick-up voltage), G (top pick-up voltage), and time delay t_z as well as present values of effective input voltages are presented on line on a display.



The below diagram presents working algorithm of the relay when values of monitored voltages are outside a defined range.

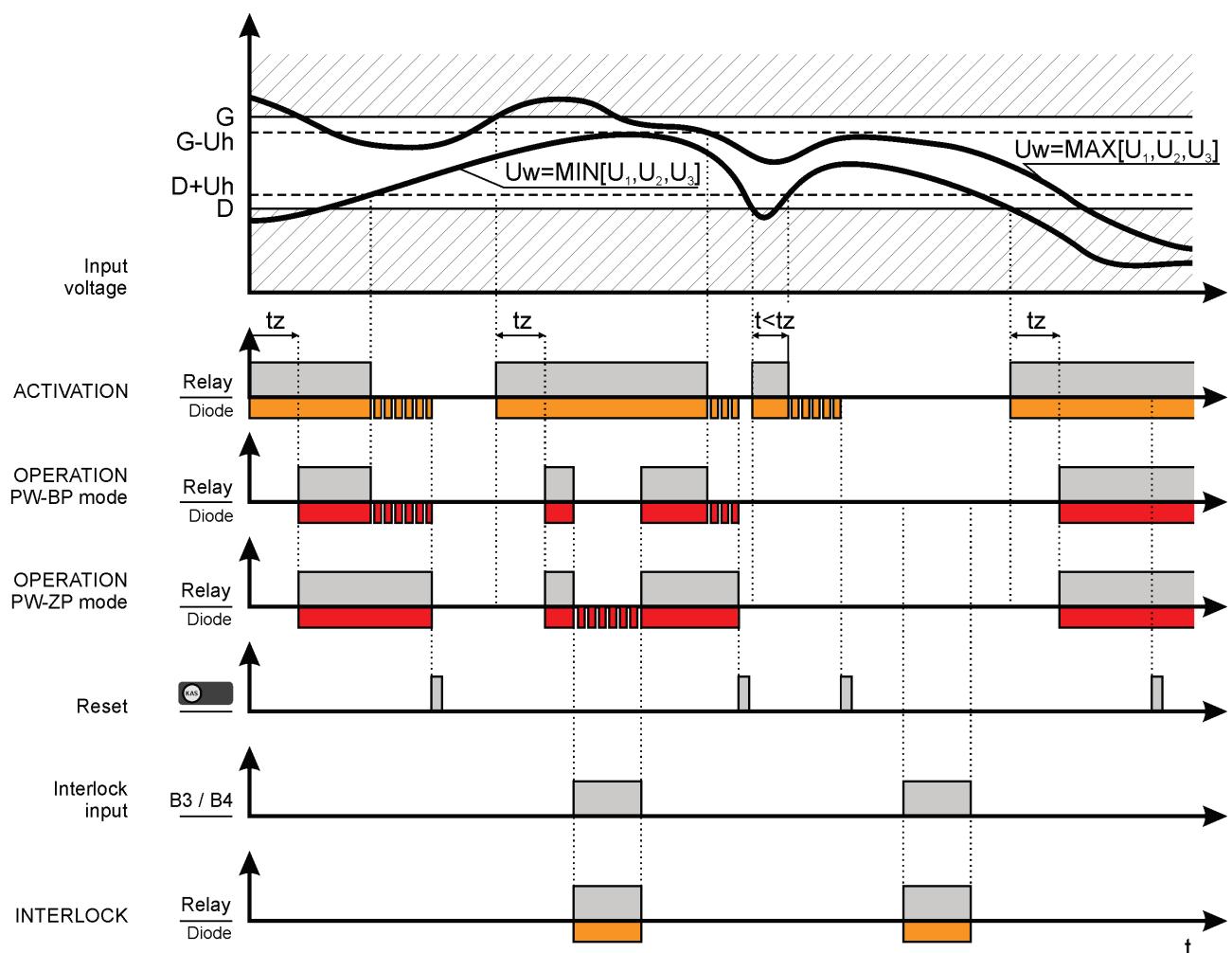


Fig 5. Operation of the relay for the KPZ operating mode

SETTINGS PREVIEW AND PROGRAMMING

SOFTWARE VERSION

When the relay has power supply it is possible to check software version of the device. In order to do so, push buttons simultaneously. The LCD shows information on type of device, software version, producer, and a serial number. To exit to the main menu push the button marked or wait for automatic exit after 25 seconds.



Fig 6. Display - type of device, software version, producer, and a serial number

SETUP PREVIEW

During work of the relay it is possible to preview set parameters. Pushing buttons or results with change of the main view into setting preview accordingly to diagram presented on Figure 7. Exit to the main menu is done by pressing the button marked (or automatically after 25 seconds).

SETUP OF THE PARAMETERS

Pushing buttons marked or changes the main view into the setup preview, as described above. To enter editing of the setup push (enter) on the chosen preview. The parameter displayed on the screen starts blinking. Pushbuttons or enable changing setup of displayed parameter. Pressing the (enter) button confirms changes made to the setup. After confirming new setup the system requires entering password. To choose values of selected input figures push buttons or . Pressing the (enter) button confirms each digit and moves to the next one. After entering correct password the relay saves new setup, and confirms this by presenting "Zapisano ust" on the screen. In case wrong password was given the screen will display „Błędne hasło" communicate, and return to entering the password menu. To exit entering the password menu press (ESC) button or wait 25 seconds.

Attention: Default password is **0 0 0 0**. Changing the password is possible only from the front panel of the relay. In case of losing the new password please contact the producer.

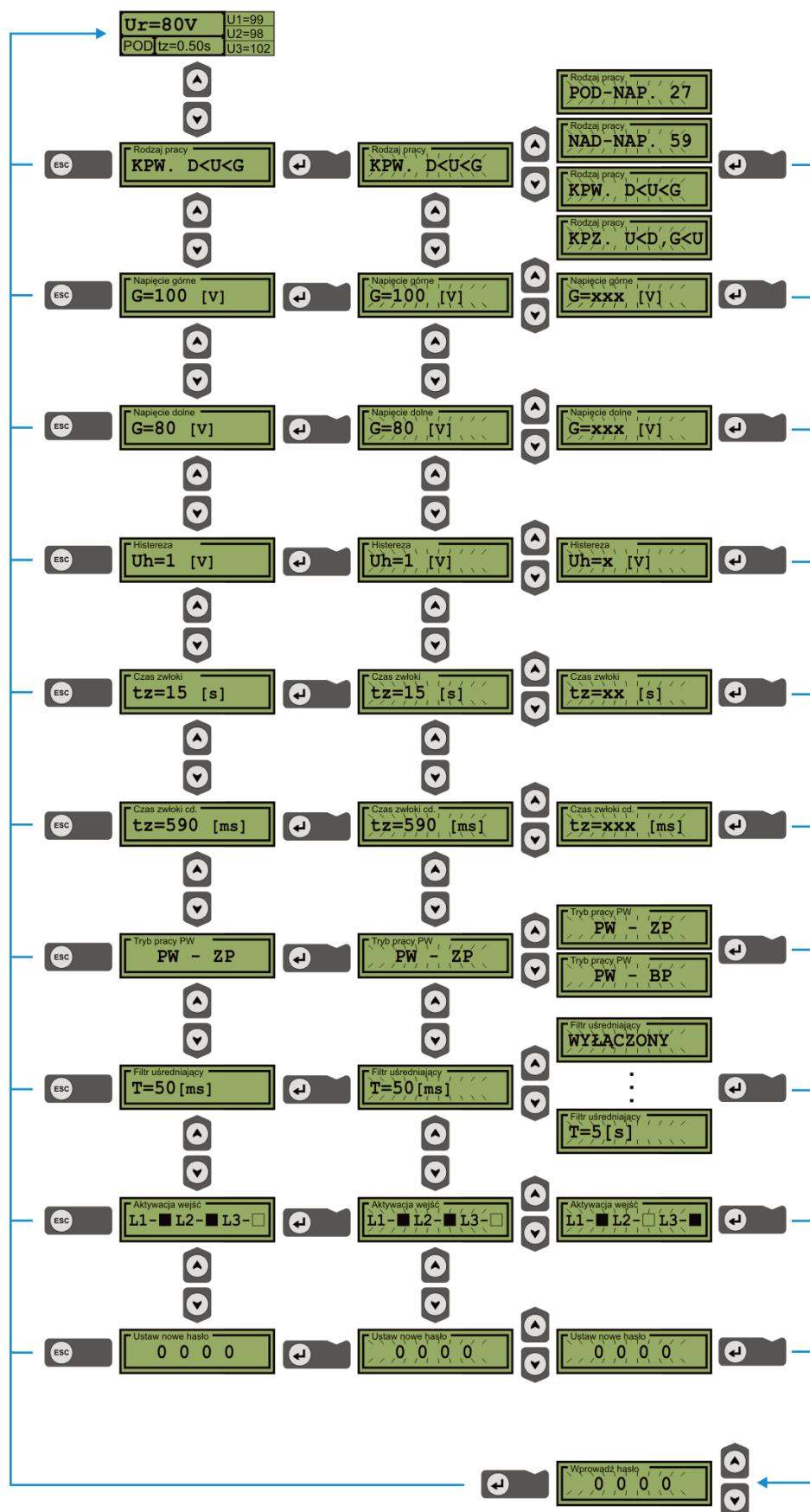


Fig 7. Diagram of preview and editing the setup

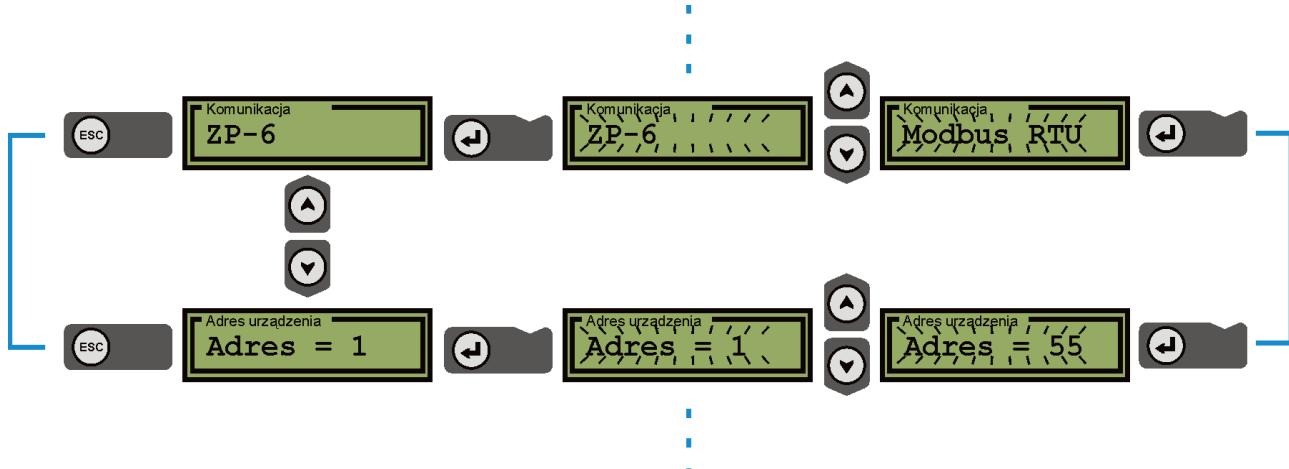


Fig 7b. Diagram of preview and editing the setup – options available in relays version v2.xx and later.

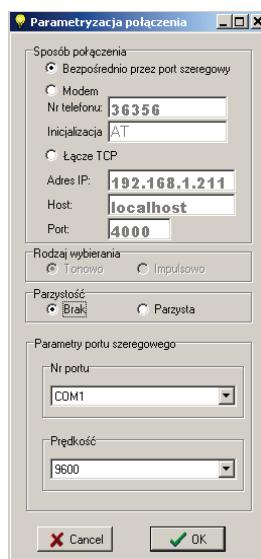
FUNCTIONAL SOFTWARE

Installation and launching the software.

Along with the relay, user receives software enabling its setup and use. The installation pack is delivered on a CD. In order to start the installing process launch SETUP.EXE file, and then follow the instructions displayed by the installing programme. All files required for the programme to operate will be copied to the computer. After installing the software a shortcut to ZPrAE-EDIT will be added in the Programmes menu / ZPrAE Sp. z o.o. folder.

Starting work with ZPrAE-EDIT application.

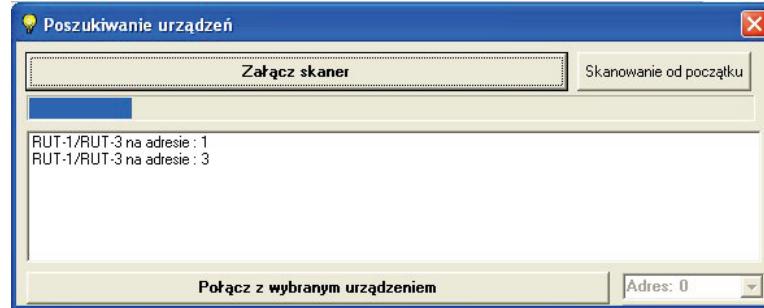
The programme can be launched from the START menu ZPrAE Sp. z o.o. folder ZPrAE-EDIT file, or by launching the execution file ZPrAE-EDIT.exe (located in the installation catalogue). Starting the programme opens the main window, and allows entering further windows enabling preview of the status and setup of the relay. Connect the relay to the computer with a RS-485 link. Initiating work the programme should be proceeded by successful configuration the connection, unless the programme was used before, and the configuration was saved. In order to input changes choose OPCJE/PARAMETRY POŁĄCZENIA from the main menu. A window with choice of port and transmission speed will appear on the screen. For the RUT relay, standard speed is 9600 bps and no parity.



Picture 8. Window of parameterisation of the connection

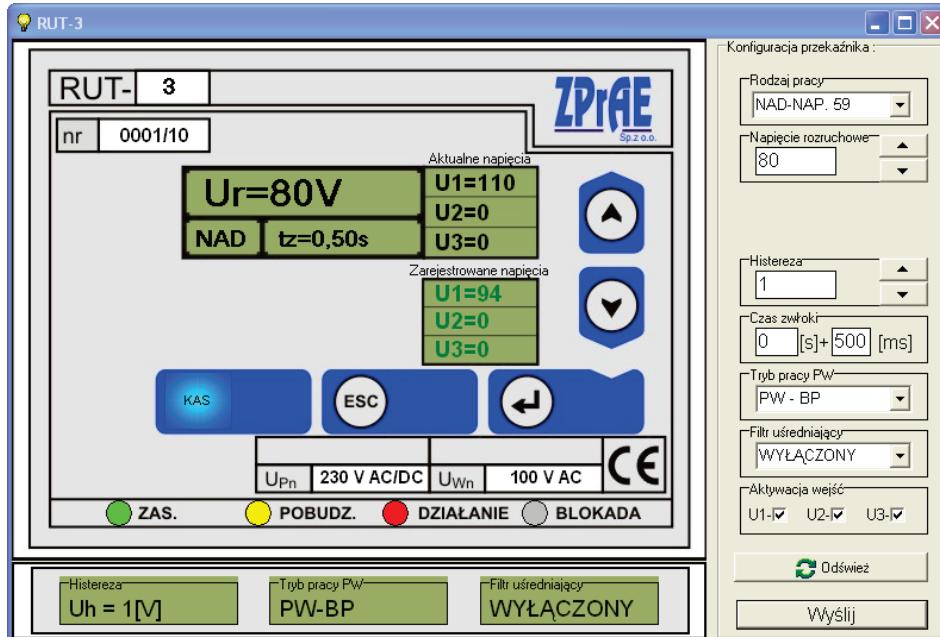
After correct configuration of the connection the START button on the main menu opens window enabling search for connected relays. Search for devices begins after pushing button "Załacz skaner". The scanning result is presented as list of devices, their types and addresses. In order to connect to a relay with chosen address, pick it on the list and push button „Połącz z wybranym urządzeniem”. The RUT-1/RUT-3 relays with software version 1.xx have fixed address being a result of operation: number of the relay modulo 255 ($[Adr] = [Nr] \bmod [255]$). Address of the RUT-1/RUT-3 relay in version 2.xx and later can be set up from the front panel of the relay. While connecting a larger number of relays into one RS485 system it is crucial that addresses of the relays are not repeated.

Time-voltage relay RUT-1, RUT-3



Picture 9. Window of search for connected devices.

The programme enables displaying window showing elevation of the relays housing and its configuration. The view is divided into two parts. The left hand side of the picture represents elevation of the RUT relay, on which the following data is displayed: current settings, state of the relay, values of voltages on measuring inputs, values of voltages registered during the last activation as well as basic information describing the relay like type of the relay, serial number, nominal voltage of measuring inputs, nominal auxiliary voltage. The right hand side of the window represents a panel dedicated for configuration of the relay. The panel contains editable fields enabling setup of new values of specific parameters, and two pushbuttons: "Odśwież" (reading current setup from the relay) and „Wyślij” (enabling saving the new set up after entering correct password). The picture of the elevation of the relay has an active "KAS" button enabling remote resetting the relay after operation.



Picture. 10.Window of the ZPrAE-Edit edit programme for RUT-1/RUT-3

REMOTE COMMUNICATION – RTU MODBUS in version 2.xx and later

Records and functions

The RUT-3 relay in version 2.xx and later has a RTU MODBUS communication protocol implemented. It enables remote setup of alerts, resetting and preview of current voltages. In order to enable remote change of setup a command with actual password shall be sent to the device. Such command activates remote setup for 60s. Address of the device can be set up from the front panel of the relay in range from 1 to 254.

MODBUS functions supported

0x01	Read Coils
0x02	Read Discrete Inputs
0x03	Read Holding Registers
0x04	Read Input Registers
0x05	Write Single Coil
0x06	Write Single Register
0x11	Report Slave ID

Report Slave ID:	
	Functions supported: 0x11 In response for function 0x11 we obtain: Slave ID: 0x04 Run Indicator Status: 0xFF = ON Additional Data: „RUT-3 230 [VAC] P>S> ZPrAE v X.XX” (X.XX – describes software version)

Addressing

Discrete State:	Functions supported: 0x02				
<hr/>					
Address:	Parameter	Data type:	Value:	Range:	Attribute:
1	RUT-1/3 activated	Bit	Off=0, On=1	0-1	read
2	RUT-1/3 operated	Bit	Off=0, On=1	0-1	read
3	RUT-1/3 interlocked	Bit	Off=0, On=1	0-1	read
4	RUT-1/3 was_activated	Bit	Off=0, On=1	0-1	read
5	RUT-1/3 was_operated	Bit	Off=0, On=1	0-1	read
6	RUT-1/3 malfunction	Bit	Off=0, On=1	0-1	read

Coils:	Functions supported: 0x01, 0x05				
<hr/>					
Address:	Parameter	Data type:	Value:	Range:	Attribute:
100	Reset	Bit	Off=0, On=1	0-1	read/write

Holding Register:	Functions supported: 0x03, 0x06				
<hr/>					
Address:	Parameter	Data type:	Value:	Range:	Attribute:
3000	Permission for writing	Unsigned 16	0-9999	0 – 9999	write – act. password
3001	New password setup	Unsigned 16	0-9999	0 – 9999	write
3002	Operation mode	Unsigned 16	0-3 (5)	0-3 (5)	read/write
3003	Upper voltage threshold	Unsigned 16	*1)	1 – 1,2Un	read/write

Time-voltage relay RUT-1, RUT-3

3004	Start-up voltage / Bottom voltage threshold	Unsigned 16	*1)	1 – 1,2Un	read/write
3005	Hysteresis	Unsigned 16	*1)	0Un – 1,2Un	read/write
3006	Operation time of the relay	Unsigned 16	0-30099	0ms – 300,99s	read/write
3007	Operating mode of PW	Unsigned 16	0-1	0= Off / 1= On	read/write
3008	Averaging filter	Unsigned 16	0-5	0-5	read/write
3009	Active inputs (only RUT-3)	Unsigned 16	1-7	1-7	read/write – RUT-3

Input Register:		Functions supported: 0x04			
Address:	Parameter	Data type:	Value:	Range:	Attribute:
4000	Voltage L1	Unsigned 16	*1)	0Un – 1,3Un	Read
4001	Voltage L2/ (Voltage in the moment of operation – only RUT-1)	Unsigned 16	*1)	0Un – 1,3Un	Read
4002	Voltage L3	Unsigned 16	*1)	0Un – 1,3Un	read – RUT-3
4003	L1 Voltage in the moment of operation	Unsigned 16	*1)	0Un – 1,3Un	read – RUT-3
4004	L2 Voltage in the moment of operation	Unsigned 16	*1)	0Un – 1,3Un	read – RUT-3
4005	L3 Voltage in the moment of operation	Unsigned 16	*1)	0Un – 1,3Un	read – RUT-3

*1) – Value depending on rated voltage of the relay

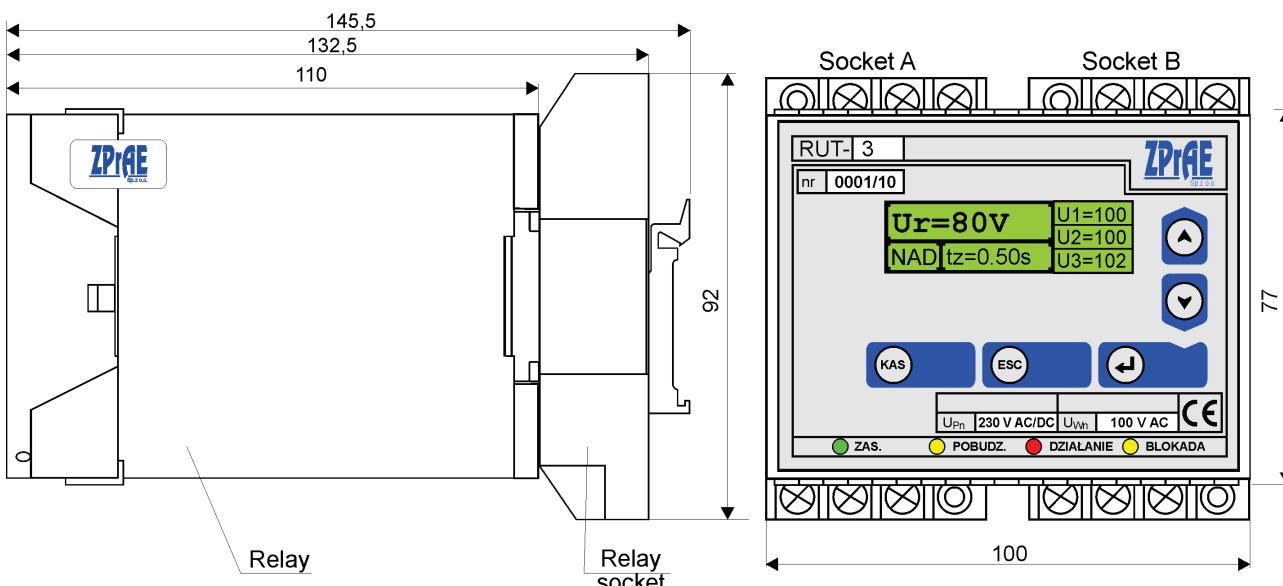
TECHNICAL INFORMATION (for $U_n = 220 \text{ V DC}$)

Auxiliary power supply		
Rated voltage		$U_n = 220 \text{ V}$ or other as ordered
Operate range		$0,8 \dots 1,1 U_n$
Power consumption		$P \leq 2,5 \text{ W}$
Control input		
Number of inputs	RUT-1	1
	RUT-3	3 (galvanically isolated)
Rated Voltage	RUT-1	$U_{Wn} = 110 \text{ V DC}$ or 220 V DC
	RUT-3	$U_{Wn} = 100 \text{ V AC}$; 50Hz or 230 V AC ; 50Hz
Measuring accuracy of the input voltage		AC: $\pm 2,5\%$ U_{Wn} ; DC: $\pm 1\%$ U_{Wn}
Power consumption of the measuring circuit		$\leq 0,5 \text{ W}$
Maximal measured voltage		$1,3 U_{Wn}$
Maximal programmable operation threshold		$1,2 U_{Wn}$
Resolution of setup		1 V
Response time without averaging filter		$\leq 20 \text{ ms}$
Blocking input		
Rated Voltage		$U_n = 220 \text{ V DC}$ (230 V AC) or other as ordered.
Power consumption		$\leq 0,3 \text{ W}$
Available working modes of the relay		
Time-delay under-voltage protection		POD-NAP. 27 (wg. IEEE Standard C37.2-1996)
Time-delay over-voltage protection		NAD-NAP. 59 (wg. IEEE Standard C37.2-1996)
Time-delay within-range voltage protection		KPW. D<U<G
Time-delay outside-range voltage protection		KPZ. U<D,G<U
Hysteresis of the measuring circuits		
Maximal depth of the hysteresis	POD-NAP	$U_h < (1,3 U_{Wn} - U_r)$
	NAD-NAP	$U_h < U_r$
	KPW	$U_h < \min((1,3 U_{Wn} - G))$
	KPZ	$U_h < (G-D)/2$
Resolution of the hysteresis setup		1V
Delay time of the controlling relay		
Setup range		$0 \div 300,99 \text{ s}$
Resolution of the setup		10 ms
Accuracy of the set time		$\pm 10 \text{ ms}$
Averaging filter		
Time constant T (adjustable)		OFF, 50 ms, 100 ms, 500 ms, 1 s, 5 s
Response time with averaging filter		$< 1,5T$
Contacts of the relay		
Maximal breaking capacity DC		$I = 0,2 \text{ A}$ for $U = 220 \text{ V}$; L/R = 40 ms
Maximal continuous current		$I = 5 \text{ A}$
Time to operate of the relay		<10ms

Time-voltage relay RUT-1, RUT-3

Insulation	
Rated insulation voltage	250 V
Overtoltage category	III
Proof voltage between the coil and the contacts	2 kV; 50 Hz; 1 min
Proof voltage of the contact gap	1 kV; 50 Hz; 1 min
Communication	
Type / Protocol / speed	RS-485 / ZP-6/ 9600 bps
Firmware	ZPrAE-Edit
General Data	
Ingress Protection of the housing (IP)	IP40
Ambient temperature	od -5 °C do +40 °C
Ambient protection	RT II
Signalisation of Operation	Green LED „ZAS”
Terminations (socket / plug)	2 x GZ14
Dimensions	77 × 55 × 110 mm (W×S×G)

DESIGN AND DIMENSIONS OF THE RELAY



Picture 11. Dimensions of the RUT-1/RUT-3 relay

Attention:

We have prepared a vast offer of auxiliary equipment in order to support mounting of our relays (cases, sockets, plugs). The auxiliary equipment is designed based on our clients suggestions and many years of our own experience. More information can be found in catalogue: "GZ-14/GZ-14Z, R-8614/R8614Z, ZAS-55, ZAS-70, plugs, sockets and relay-chassis" available at www.zprae.pl

RUT-1

RUT-3



OFFER



RSH-3, RSH-3S - tripping
RS-6, RPD-2, RPP-4, RPP-6 - interposing
RMS-2 - signalling
RCW-3, RCDW-1 - circuit continuity monitoring
RKO-3 - power supply circuit continuity monitoring
RB-1, RBS-1, RBS-2 - bistable
RT-22 - time
RUT-2, RUT-3 - time-voltage
RJT-1, RJT-3 - time-current
RKU-1, RKS-1 - final controlling
LZ-1, LZ-2 - operation counters
RPZ-1 - supply source switching
GPS-1 - time synchronisation
MDD-6, MDS-12 - Diode modules
PH-XX, PS-XX - Modules of switches, pushbuttons and control lamps
Relay racks

Busbar protections and breaker failure protections type TSL-9r, TSL-11

Auxiliary and signalization relays

Reserve Central Signalling System type MSA-9, MSA-12, MSA-24

Protection relays type AZT-9, APP-9

Disturbance recorder RZS-9

Energy measurement system and event recorder ZRZ-28

Load Resistors for measuring transformers

DC and AC auxiliary power supply switchgears

Cubicle-contained sets of control and supervision protections

Modular power supplies, measuring suitcases, measuring and registering system RFQ-8

PROFIL-L cubicles

Periodical and post-failure tests, as well as repairs and overhauls of busbar protections TSL

Servicing, string-up and post assembly tests