RELSiS®

R&D Manufacturing Enterprise

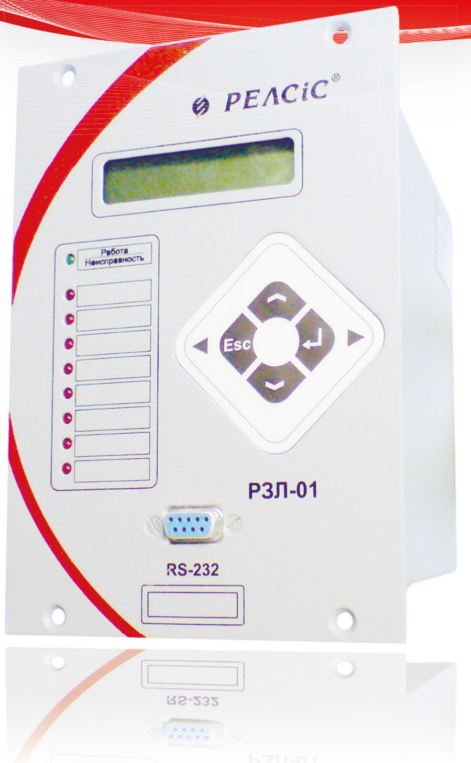
Relay Schemes and Systems

RELAY PROTECTION AND AUTOMATION DEVICES

MANAGEMENT SYSTEM QUALITY
ISO 9001

Contents

RZL-01



RELAY PROTECTION DEVICE for 6 – 35 kV distribution networks

Redundant CT circuits bypass power source

Backup trip via CB current solenoids

Digital oscilloscope Event log

Integration in SCADA-system

Application

The microprocessor relay protection device RZL-01 is designed to perform the functions of relay protection, automation, control, registration and alarms of:

- cable andoverhead 6-35 kV lines;
- backup power transformer protection and others.

The device is designed for installation in relay sections and compartments of switchgears, in control panels and boxes located in the relay halls and on the control desks of power substations 6-35 kV.

The device can be used for protection of distribution networks elements as an independent device, and in combination with other devices of relay protection and control systems.

Features

- Performance of protection functions, automatics and control, complies with regulations requirements;
- User-defined variable internal configuration (binary inputs, outputs and LEDs);
- Configuration setting via human-machine interface and/or software tool included;
- Entering and saving settings of protection and relay control devices;
- Free assignment of LED indicators for displaying status of binary inputs, starts/operation of the overcurrent protection / ground fault protection (OCP/GFP), re-closure failure, OCP acceleration, and other service functions;
- One current-time responsible OCP stage;
- Configurablebinary outputs for protection start/operation functions of OCP/GFP, automatic reclosing, circuit breaker failure backup, busbar lockout protection;
- Free configurable 16 channels of event logging (logic functions and binaryinput/output state);
- Remote control, measuring, alarm signalization, entry and change of settings via communication lines;
- Self-supervision (watchdog) and self-blocking on failure;
- Opto-coupler binary inputs insulation.

Protection functions

- Each OCP stage accelerationon CB closing operations.
- Single-stage non-concentrated GFP protection;
- Busbar instantaneous protection lockout;
- Interconnecting of external protection.

Automation functions

- CB operationon external commands.
- Single/double automatic re-closing after OCP/GFP operation, externalprotection commandon binary input (IN). Reclosing operation on the certainOCP stages.
- CBFP on designated overcurrent stages by "Working GFP" signal, by external signal from designated binary input (IN).

Additional service functions

- Built-in clock and calendar;
- Measurement of phase currents and zero sequence current 3I0, and their primary/secondary value display;
- Digital fault recorder with non-volatilememory;
- Event log;
- Statistics register.
- Multi-lingual LCD interface: English, Ukrainian, Russian.

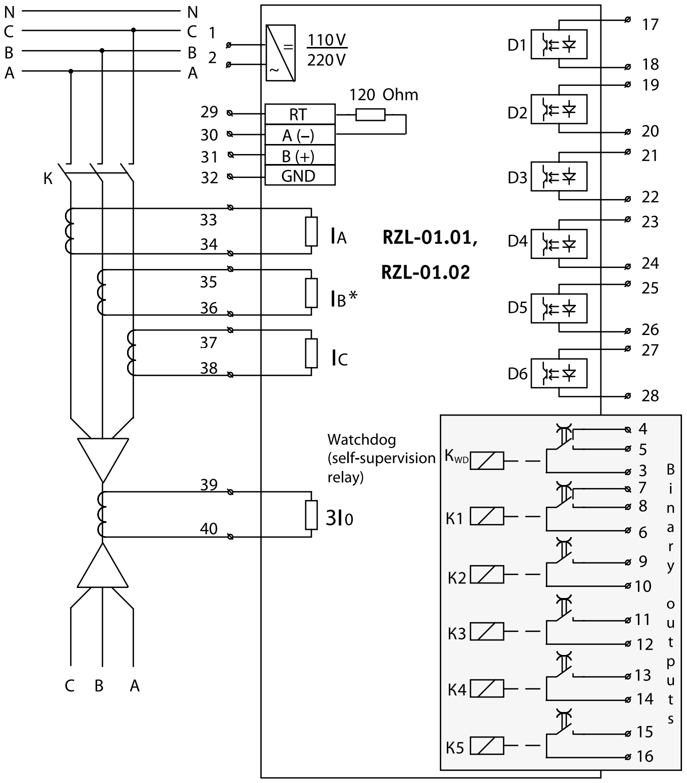
Technical parameters

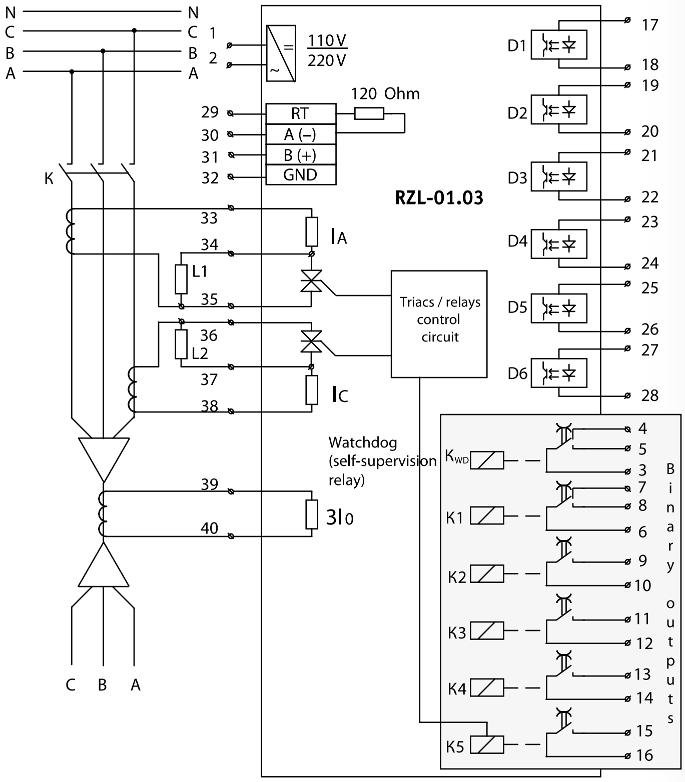
Rated input signals, auxiliary power supply	
Rated input phases current *In* / zero-sequence current 3I0 *In3I0*	5 A or 1 A / 1 A
Voltage range (DC or AC), frequency range	90-250 V AC/DC, 45-55 Hz
Powerconsumption + per each binary output energized	5 V·A + 0,4 V·A
Instantaneous current inrush on energize (10 μs)	10 A
Operating supply interrupt duration	500 ms
Self-test availability time: – Auxiliary voltage supply – Current circuits supply	50 ms 150 ms
Self-test duration	250 ms
Backup supply from current circuits (RZL-01.02, RZL-01.03)	
Minimum / Rated / Continuous current	4 A / 5 A / 20 A (4 In)
Voltage input power	2,5 V·A
Maximum analog input power	12 V·A
Three-stage overcurrent protection /OCP/	
Current setting range	0,1 – 25 In, step 0,1 A
OCP time-delay instance setting range	0 – 32 s, step 0,05 s
OCP acceleration instance setting range / OCP setting time	0 – 5 s / 0 – 5 s, step 0,1 s
Non-directional ground-fault protection /GFP /	
Current instance setting range	0,01 – 1 A , step 0,01 A
Time-delay setting range	0 – 32 s, step 0,05 s
Auto-reclosing / AR /	
1st and 2nd ARC cycles time-delay setting range	0,8 – 600,0 s, step 0,1 s
Next ARC cycle availability time range	0,9 – 600,0 s, step 0,1 s
AR preparation time	30 – 600,0 s, step 0,1 s
Breaker failure back-up	
Current instance setting range	0,1 – 25 In, step 0,1 A
Time-delay setting range	0,1–4,0 s, step 0,1 s
Binary inputs	
RZL-01.01, RZL-01.02, RZL-01.03 voltage activation binary inputs with opto-coupler insulation	6
RZL-01.02 D2, RZL-01.03 D2 voltage activation binary inputs with opto-coupler insulation dry contact binary inputs (galvanically connected with power supply circuits)	4 2 (inputs D5, D6)
RZL-01.02 D3, RZL-01.03 D3 voltage activation binary inputs with opto-coupler insulation dry contact binary inputs (galvanically connected with power supply circuits)	3 3 (inputs D4, D5,D6)
RZL-01.02K1 voltage activation binary inputs with opto-coupler insulation	5
Input-to-output command transfer time-delay setting range (for each input)	0 – 32,0 s
Control voltage DC *Un*	220 B (110 V*) U«1»>0,6Un; U«0»<0,4Un
Control voltage AC 50 Hz *Un*	220 V (110 V*) U«1»>0,8Un; U«0»<0,45Un
Dry contact inputs internal supply module voltage	310 V (154 V*) DC **
Operation threshold deviation	±0,1·Un
Input resistance	50 kOhm
Binary outputs	
Number of programmable outputs - NO+NC contact / - NO contact	1 / 4 (1 / 3 - in RZL-01.02K1)
Internal fail signal output, switch contact	1
Switching ability of relay contacts - Maximum tripping AC voltage/ current / power (cosφ=0,6) - Maximum turn-on DC voltage / current (τ=30 ms) - Maximum DC tripping power - Rated continuous AC/DC current	 220 V, 5 A,1000 VA (cosφ=0,6) 250 V / 0,4 A 30 Wt 8 A
Insulation parameters	
Current inputs insulation to coating and voltage inputs between inputs and input to the ground	AC 2000 V, 50 Hz, 1 min
The rest, galvanically isolated, circuits (except for the closing of the relay contacts)	AC 1500 V, 50 Hz, 1 min
Outputs of NO contacts of electromagnetic relays	AC 500 V, 50 Hz, 1 min
Short-time thermal resistance of current circuits	
RZL-01.01: during 1 sec / 60 sec	80·Iн / 8·Iн
RZL-01.02 and RZL-01.03: during 1 sec / 60 sec	50·Iн / 4·Iн
Device surge, static electricity, disturbance withstand performed by GOST 29280 (EN61000-4-2 – EN61000-4-11)	
Analog inputs withstand: - voltage surges (three positive, three negative)	5 кV, 1,2/50 μs, 3 "+", 3 "-"
- high frequency disturbance (maximum instantaneous value): longitude / transverse	2,5 кV / 1,0 кV
- operating supply interrupt duration	500 ms
Operating ambient temperature range Storage and transportation	UHL4: –20°C ... +55°C, UHL3.1: –40°C ... +70°C
Communication	
Protocol	Modbus RTU
Interfaces / Connection speed	RS485 /9600/19200/38400 bps RS232 /19200 bps

* Also available modification with binary inputs control voltage 110 V (to be specified in order list).

** Binary inputs D4, D5, D6 for modifications RZL-01.xx D2/D3 are supplied from an internal power module and their terminals are galvanically connected with power supply terminals.

Wiring Diagrams



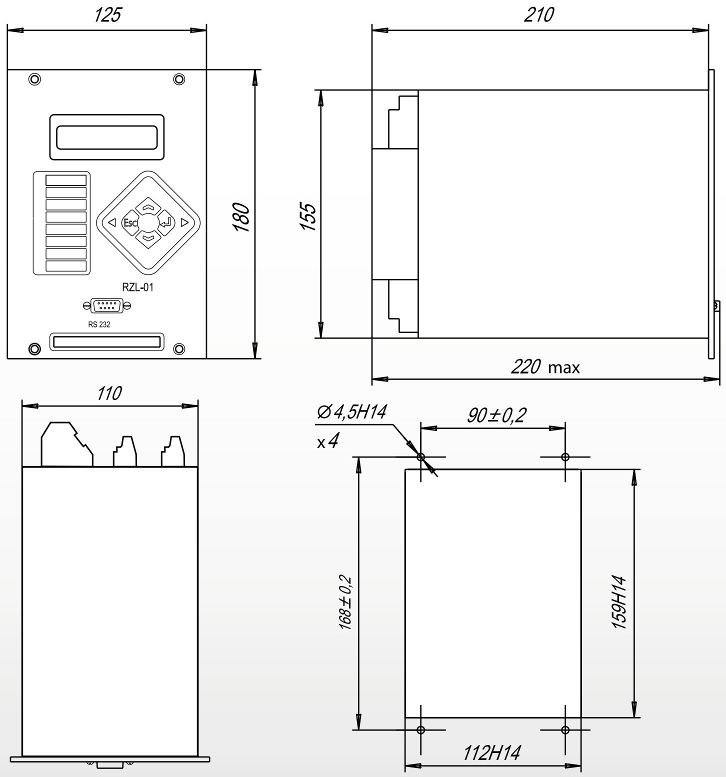


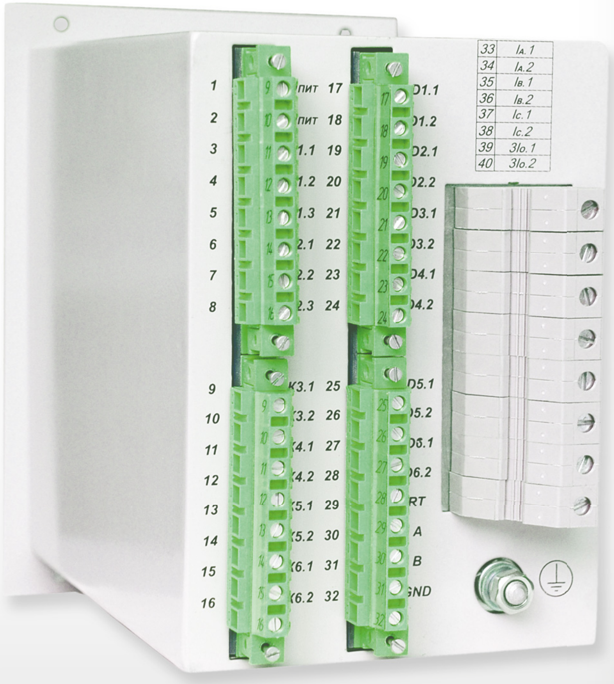
Wiring diagram of external circuits to the devices **RZL-01.01, RZL-01.02**

1. The RT, A, B, GND inputs are used to connect the RS485 bus (RT-B - connect the jumper to enable the internal 120-ohm terminating resistor).
2. The states of all relays shown in "off" position. Self-supervision relay KWD closes the contacts 3-5 after powering (if relay malfunction - closes contacts 3-4).
3. Binary inputs D1-D6 are independent of connection polarity.

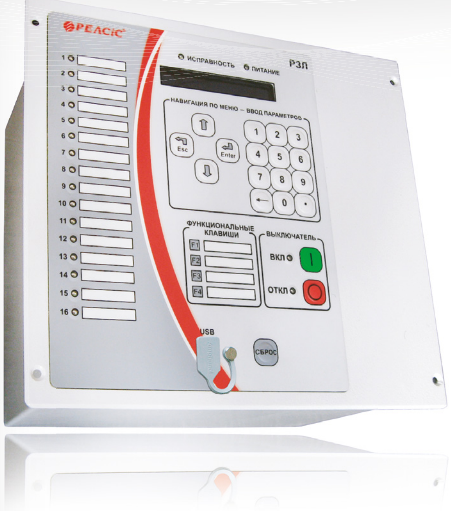
Wiring diagram of external circuits to the device **RZL-01.03**
with backup trip current solenoids circuit
L1, L2 – trip-coils of breaker solenoids.

Dimensions





RZL-05.A



ADVANCED PROTECTION and CONTROL DEVICES with user defined logic for SUBSTATIONS and SWITCHGEARS 1 – 45 kV

A wide range of protection and automation functions

Combined power supply including CT circuits unit

Backup trip via CB current solenoids

Digital oscilloscope
Event log

Integration in SCADA-system

Environment temperature -40°C ... +55°C

User-defined logics

Fast-operating arc fault protection with lens-type photosensor

Application

New modified electronic microprocessor devices of **RZL-05.A** series with user-defined logics inclusion are used for protection, automation, control and monitoring of power distribution network elements. Devices are the most suitable for incoming, outgoing feeders and busbar section coupler bays of 1 –45 kV distribution networks and substations DC, AC or rectified operating current.

This modification has a greater number of discrete inputs and binary outputs in comparison with other devices of the RZL-05 family.

Devices are to be mounted into relay cubicles of switchgears, relay panels.

Features

- Protection, automation and control of an intended network elements.
- Operating parameters settings via built-in HMI and PC software tool: functions activation/deactivation, protection stages values and time delay for each stage e t.c.
- Individual configuration of each photosensor input.
- Flexible configuration settings.
- Three photosensors of arc-fault protection with a current control action to switch-off its own and/or incoming feeder.
- Non-volatile storage of settings, events, fault recordings.
- Total waveform recording duration 600 s.
- A solid number of output relays, incl. one reinforced relay for switching high values instantaneous currents, switching in circuits with high inductance, and one bistable relay, eliminating the need to install additional relays.
- A greater number of inputs, outputs and indicating LEDs in comparison with standart devices.
- RS-485 and Ethernet (RJ-45) interfaces of MODBUS data transfer protocol.
- Remote configuration and data transfer including current parameters and function settings, apparatus state, events, measurements via RS-485 interface by MODBUS RTU protocol or via the Ethernet interface (RJ-45) by MODBUS TCP protocol.
- Remote control of HV devices via MODBUS RTU of MODBUS TCP protocol.
- Wire connection terminals with end-position locking plug.
- Steel casing.
- Front side USB interface.
- Real-time self-supervision.
- Two mutually redundant power supply units.
- Self-blocking on internal failure to prevent false operations.
- Optional current circuits low-burden redundant power supply.
- Universal AC/DC power supply source.
- Supply input and all signal circuits are galvanically isolated.
- Solid overvoltage withstand.
- Interredundant hardware circuits and software sub-systems to improve the reliability of protection, automation functions and data transfering.
- Optocoupler-insulated binary inputs.
- Presence of digital inputs, controlled by "dry contact", and which saves execution of their functions when switching-off operational power supply.
- Solid ambient conditions withstand (-40...+55 °C).
- Multi-lingual LCD interface: English, Ukrainian, Russian.

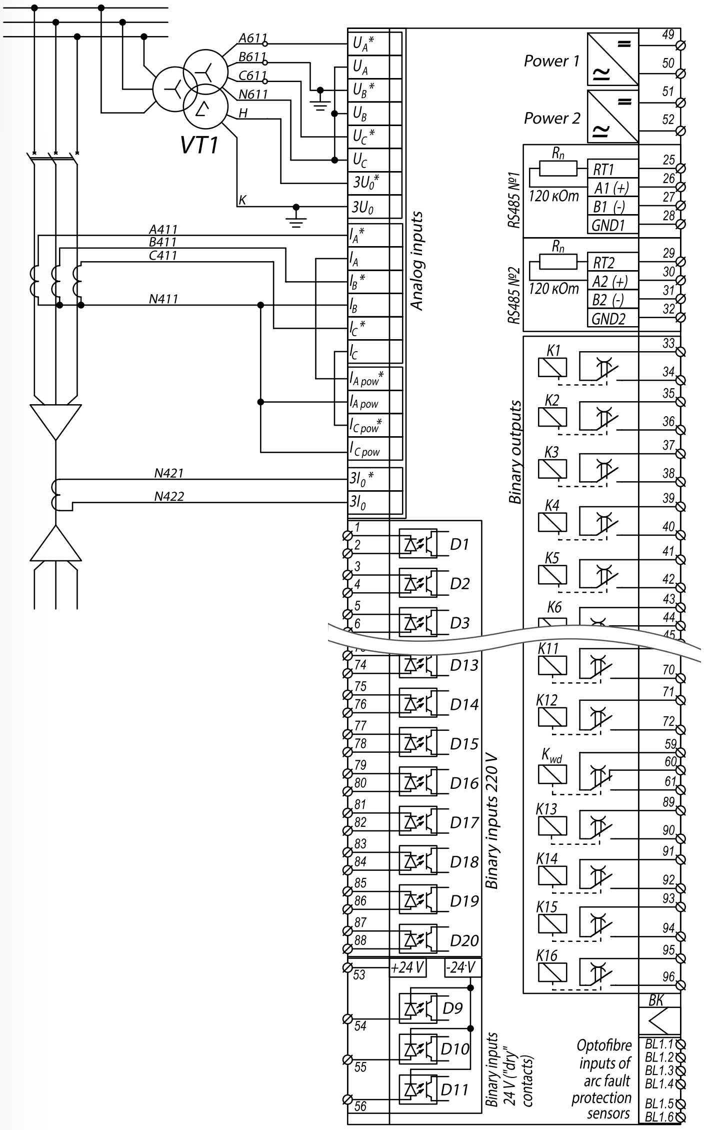
Technical parameters

Power supply units parameters	
Operating voltage range, DC or AC	90 – 254 V
Power-on availability time	0,3 s
Operating supply interruption	0,5 s
Independent supply channels (auxiliary voltage circuits)	2
Device burden	2x10 Wt
Supply from current transformer circuits (optional)	2
Continuous current withstand	2,5 – 10,0 A
Current input parameters	
Rated input current	5 A
Line current inputs number	3
Measurable current range	0,1 – 150,0 A
Current thermal withstand, continuous/1s	10 / 500 A
Rated zero-sequence input current (3Io)	1 A
Measurable current range	0,01-4,00 A
Voltage input parameters	
Phase voltage	100 V
Number of inputs	3
Rated voltage range	1 – 150 V
Maximum continuous voltage	150 V
Thermal sensor input parameters	
Number of inputs	1
Temperature range	0 -125 ° C
Communication	
PC communication interface	USB - 1 pcs
Automated Control System communication interface	RS-485 - 2 pcs Ethernet (RJ45)
Data Protocol	MODBUS RTU MODBUS TCP
Connection speed via USB, RJ-485	9600...115200 bps
Connection speed via Ethernet (RJ-45)	10/100 Mbps
Binary input parameters	
Number of inputs	20
Rated AC, DC voltage	220 V
Response voltage level	132 -176 V
Response time	not less 40 ms
Current consumption at 220 V: - power-on current - continuous	 20 mA 4 mA
Maximum voltage, continuous	310 V
Dry contact binary input parameters	
Number of inputs	3
Dry contact circuits source voltage	DC 24 V
Binary output parameters	
Number of binary outputs	17
AC voltage trip	24 - 400 V
Maximum AC current	8 A (16 A for K1 output)
DC voltage trip	24 - 300 V
Maximum DC LR-circuit trip current, time constant τ ≤ 20 ms	0,3 A (0,6 A for K1 output)
Other	
Mounting type	Flush
Device dimensions (WxHxD)	265x240x195 mm
LED indicators total / configurable	20/16
Operating ambient temperature range	- 40 to + 55 °C
Maximum Humidity at 25 °C	98 %
Insulation resistance, more than	50 MΩ
Insulation overvoltage withstand, Instantaneous / continuous	2,0 kV , 50 Hz 5,0 kV pulse
Weight, less then	10 kg

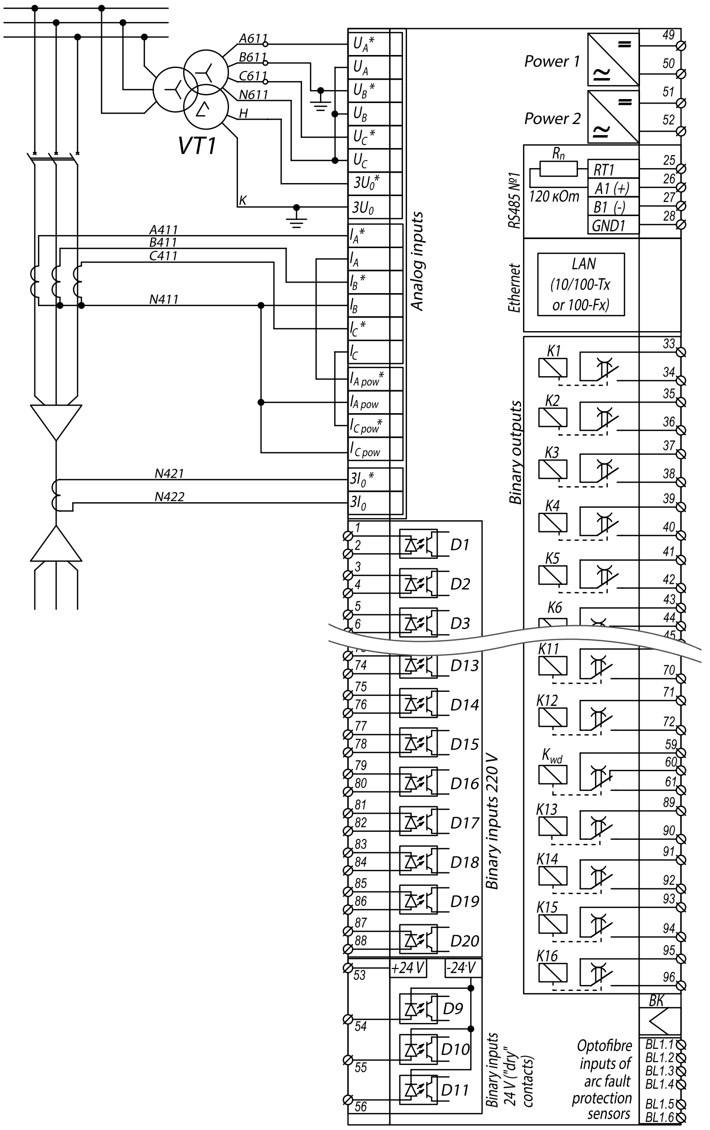
Functions

	ANSI	RZL-05.Ax							
		1	2	3	4	11	12	13	14
Backup power supply functions									
Powered by current circuits (phases of current transformer A and C)			•		•		•		•
Protection functions									
Overcurrent (OCP) (4 stages)	50/51	•	•	•	•	•	•	•	•
OCP with the dependent time-current characteristic	51	•	•	•	•	•	•	•	•
OCP with blocking from magnetizing current surge		•	•	•	•	•	•	•	•
Voltage-restrained OCP	50V/51V	•	•	•	•	•	•	•	•
OCP stage blocking by binary input		•	•	•	•	•	•	•	•
Directional OCP	67	•	•	•	•	•	•	•	•
Negative-sequence overcurrent	46	•	•	•	•	•	•	•	•
Switch on to fault high-speed protection	50HS	•	•	•	•	•	•	•	•
Overload protection		•	•	•	•	•	•	•	•
Logic Selectivity Busbar protection	68	•	•	•	•	•	•	•	•
Zero-sequence OCP (unidirectional earth-fault protection)	50N/51N	•	•	•	•				
Directional ground-fault protection (directional zero-sequence power protection)	67N	•	•	•	•	•	•	•	•
Zero-sequence overvoltage protection	59N	•	•	•	•	•	•	•	•
Overvoltage protection	59	•	•	•	•	•	•	•	•
Undervoltage protection with a current-permissive instance	27	•	•	•	•	•	•	•	•
Negative-sequence overvoltage protection	47	•	•	•	•	•	•	•	•
Phase conductor break protection (negative sequence or negative to positive sequence ratio current)	46BC	•	•	•	•	•	•	•	•
OCP/zero-sequence OCP stage activation by binary signal (current-restrained intertrip)		•	•	•	•	•	•	•	•
Arc-fault protection (by binary input) with phases currents monitoring		•	•			•	•		
Arc-fault protection (3 optofibre sensors) with current monitoring				•	•			•	•
Overthemperature protection		•	•	•	•	•	•	•	•
Automation functions									
HV Breaker control (switching-on, -off)		•	•	•	•	•	•	•	•
Auto-reclosing	79	•	•	•	•	•	•	•	•
Automatic underfrequency load shedding	81L	•	•	•	•	•	•	•	•
HV Breaker failure back-up	50BF	•	•	•	•	•	•	•	•
Automatic load transfer		•	•	•	•	•	•	•	•
Automatic initial scheme restore		•	•	•	•	•	•	•	•
Switching-off by withdrawable element		•	•	•	•	•	•	•	•
Monitoring and indication functions									
Breaker closing circuits supervision	74TCS	•	•	•	•	•	•	•	•
Temperature monitoring via thermal sensor	38/49T	•	•	•	•	•	•	•	•
Protection operation alarm lockout (LED and output state save until manual reset)		•	•	•	•	•	•	•	•
Trip alarm	30	•	•	•	•	•	•	•	•
Internal malfunction alarm	30	•	•	•	•	•	•	•	•
Warning alarm	30	•	•	•	•	•	•	•	•
Voltage transformer secondary circuits supervision		•	•	•	•	•	•	•	•
Parameter setting groups switch on binary input activation/deactivation		•	•	•	•	•	•	•	•
Service functions									
Non-volatile memory event log. 256 events		•	•	•	•	•	•	•	•
Non-volatile memory oscilloscope recorder with 600 s total record duration		•	•	•	•	•	•	•	•
Fault recorder on binary input activation		•	•	•	•	•	•	•	•
Communication with the Automated Control System									
- two RS-485;		•	•	•	•				
- one RS-485 + Ethernet RJ-45						•	•	•	•

Wiring Diagrams examples

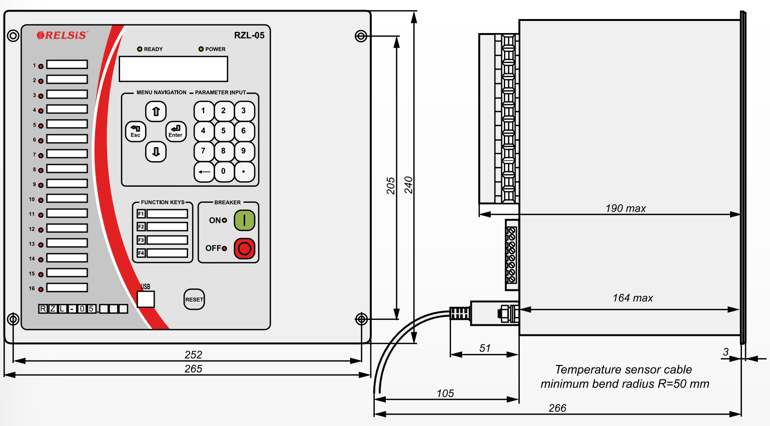


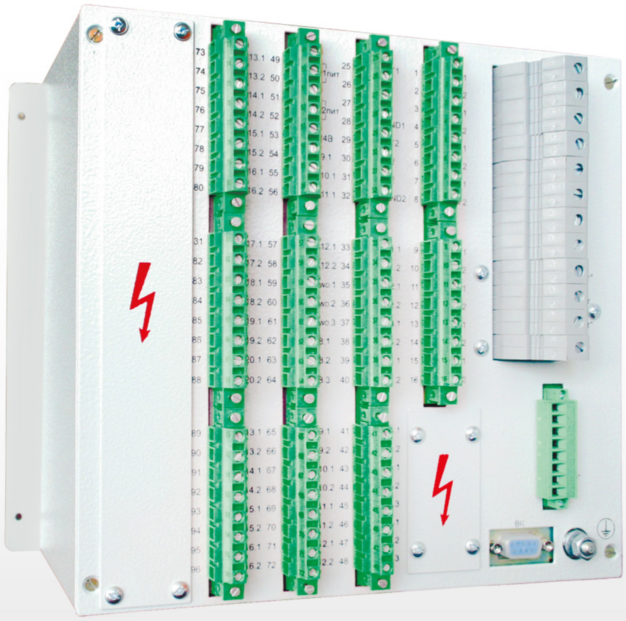
Wiring diagram of external circuits to the devices **RZL-05.A4**



Wiring diagram of external circuits to the devices **RZL-05.A14**

Dimensions





RZL-05.B, RZL-05.F

PROTECTION and CONTROL DEVICES for SUBSTATIONS and SWITCHGEARS

1 – 45 kV

A wide range of protection and automation functions

Combined power supply including CT circuits unit

Backup trip via CB current solenoids

Digital oscilloscope
Event log

Integration in SCADA-system

Environment temperature -40°C ... +55°C

User-defined logics

Fast-operating arc fault protection with lens-type photosensor

Application

New modified electronic microprocessor devices of **RZL-05.B, RLZ-05.F** series are used for protection, automation, control and monitoring of power distribution network elements. Devices are suitable for of 1–45 kV switchgears and depending on certain device type fit the best for incoming feeder bays, busbar section coupler bays and outgoing feeder.

Devices have wide possibilities of internal logic, a significant number of protection and automation functions assigned by the operator to the inputs and outputs. Devices have user-defined logics inclusion.

Devices are to be mounted into relay cubicles of switchgears, relay panels. Devices can be powered with DC operating voltage or AC voltage auxiliaries as well.

Features

- Protection, automation and control of an intended network elements.
- Operating parameters settings via built-in HMI and PC software tool: functions activation/deactivation, protection stages values and time delay for each stage e t.c.
- Individual configuration of each photosensor input.
- Flexible configuration settings.
- Three photosensors of arc-fault protection with a current control action to switch-off its own and/or incoming feeder.
- Non-volatile storage of settings, events, fault recordings.
- Total waveform recording duration 600 s.
- A solid number of output relays, incl. one reinforced relay for switching high values instantaneous currents, switching in circuits with high inductance, and one bistable relay, eliminating the need to install additional relays.
- Remote configuration and data transfer including current parameters and function settings, apparatus state, events, measurements via RS-485 interface by MODBUS RTU protocol.
- Remote control of HV devices via MODBUS RTU protocol.
- Wire connection terminals with end-position locking plug.
- Steel casing.
- Front side USB interface.
- Real-time self-supervision.
- Two switchable setting groups.
- Two mutually redundant power supply units.
- Self-blocking on internal failure to prevent false operations.
- Optional current circuits low-burden redundant power supply.
- Universal AC/DC power supply source.
- Supply input and all signal circuits are galvanically isolated.
- Solid overvoltage withstand.
- Optocoupler-insulated binary inputs.
- Interredundant hardware and software to improve the reliability of protection, automation functions and data transfering.
- Presence of digital inputs, controlled by "dry contact", and which saves execution of their functions when switching-off operational power supply.
- Solid ambient conditions withstand (-40…+55 °C).
- Multi-lingual LCD interface: English, Ukrainian, Russian.

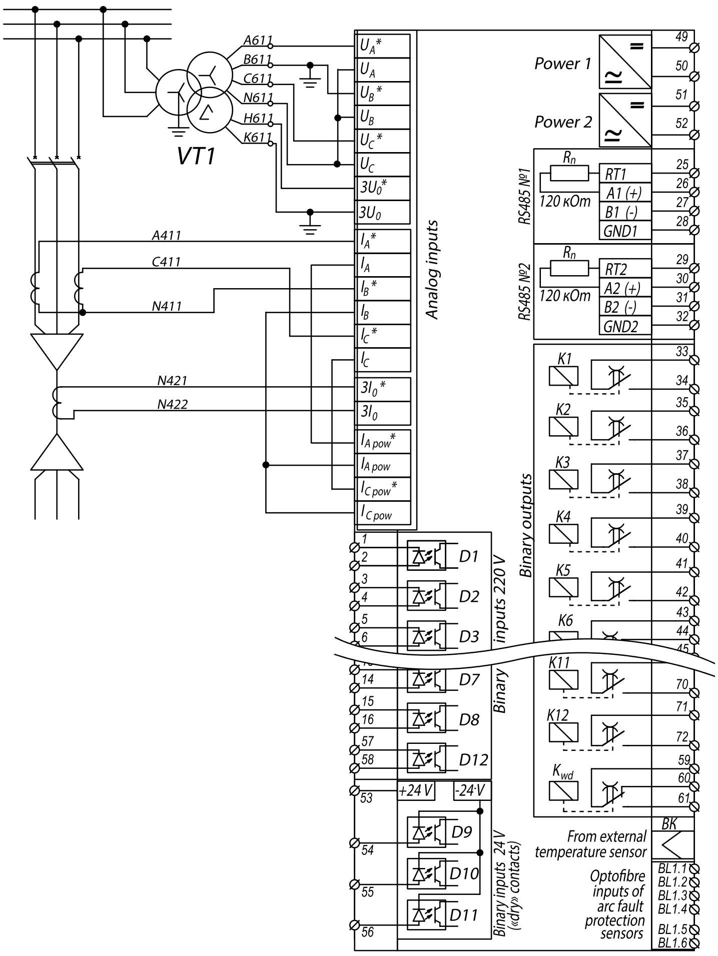
Technical parameters

Power supply units parameters	
Operating voltage range, DC or AC	90 – 254 V
Power-on availability time	0,3 s
Operating supply interruption	0,5 s
Independent supply channels (auxiliary voltage circuits)	2
Device burden	2x8 Wt
Supply from current transformer circuits (optional)	2
Continuous current withstand	2,5 – 10,0 A
Current input parameters	
Rated input current	5 A
Line current inputs number	3 (2)
Measurable current range	0,1 – 150,0 A
Current thermal withstand, continuous/1s	10 / 500 A
Rated zero-sequence input current (3Io)	1 A
Measurable current range	0,01-4,00 A
Voltage input parameters	
Phase voltage	100 V
Number of inputs	3
Rated voltage range	1 – 150 V
Maximum continuous voltage	150 V
Thermal sensor input parameters	
Number of inputs	1
Temperature range	0 -125 ° C
Communication	
PC communication interface	USB - 1 pcs
Automated Control System communication interface	RS-485 - 2 pcs
Data Protocol	MODBUS RTU
Connection speed via USB, RJ-485	9600...115200 bps
Binary input parameters	
Number of inputs	12
Rated AC, DC voltage	220 V
Response voltage level	132 -176 V
Response time	not less 40 ms
Current consumption at 220 V: - power-on current - continuous	 20 mA 4 mA
Maximum voltage, continuous	310 V
Dry contact binary input parameters	
Number of inputs	3
Dry contact circuits source voltage	DC 24 V
Binary output parameters	
Number of binary outputs	13
AC voltage trip	24 - 400 V
Maximum AC current	8 A (16 A for K1 output)
DC voltage trip	24 - 300 V
Maximum DC LR-circuit trip current, time constant τ ≤ 20 ms	0,3 A (0,6 A for K1 output)
Mounting type	Flush
Device dimensions (WxHxD)	205x240x195 mm
LED indicators total / configurable	20/16
Operating ambient temperature range	- 40 to + 55 °C
Maximum Humidity at 25 °C	98 %
Insulation resistance, more than	50 MΩ
Insulation overvoltage withstand, Instantaneous / continuous	2,0 kV , 50 Hz 5,0 kV pulse
Weight, less then	8 kg

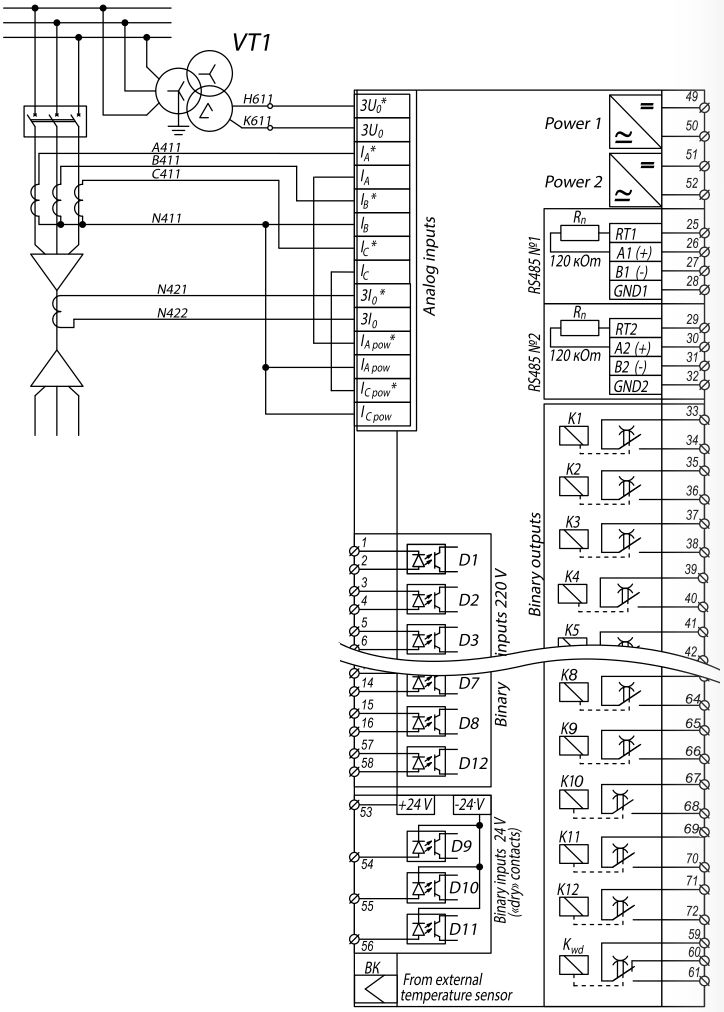
Functions

	ANSI	RZL-05.Bx				RZL-05.Fx			
		1	2	3	4	1	2	3	4
Backup power supply functions									
Powered by current circuits (phases of current transformer A and C)			•		•		•		•
Protection functions									
Overcurrent (OCP) (4 stages)	50/51	•	•	•	•	•	•	•	•
OCP with the dependent time-current characteristic	51	•	•	•	•	•	•	•	•
OCP with blocking from magnetizing current surge		•	•	•	•	•	•	•	•
Voltage-restrained OCP	50V/51V	•	•	•	•				
OCP stage blocking by binary input		•	•	•	•	•	•	•	•
Directional OCP	67	•	•	•	•				
Switch on to fault high-speed protection	50HS	•	•	•	•	•	•	•	•
Overload protection		•	•	•	•	•	•	•	•
Logic Selectivity Busbar protection	68	•	•	•	•	•	•	•	•
Zero-sequence OCP (unidirectional earth-fault protection)	50N/51N	•	•	•	•	•	•	•	•
Directional ground-fault protection (directional zero-sequence power protection)	67N	•	•	•	•	•	•	•	•
Zero-sequence overvoltage protection	59N	•	•	•	•	•	•	•	•
Overvoltage protection	59	•	•	•	•				
Undervoltage protection with a current-permissive instance	27	•	•	•	•				
Negative-sequence overvoltage protection	47	•	•	•	•	•	•	•	•
Phase conductor break protection (negative sequence or negative to positive sequence ratio current)	46BC	•	•	•	•	•	•	•	•
OCP/zero-sequence OCP stage activation by binary signal (current-restrained intertrip)		•	•	•	•	•	•	•	•
Arc-fault protection (by binary input) with phases currents monitoring		•	•			•	•		
Arc-fault protection (3 optofibre sensors) with current monitoring				•	•			•	•
Overthemperature protection		•	•	•	•	•	•	•	•
Automation functions									
HV Breaker control (switching-on, -off)		•	•	•	•	•	•	•	•
Auto-reclosing	79	•	•	•	•	•	•	•	•
Automatic underfrequency load shedding	81L					•	•	•	•
HV Breaker failure back-up	50BF	•	•	•	•	•	•	•	•
Automatic load transfer		•	•	•	•	•	•	•	•
Switching-off by withdrawable element		•	•	•	•	•	•	•	•
Monitoring and indication functions									
Breaker closing circuits supervision	74TCS	•	•	•	•	•	•	•	•
Temperature monitoring via thermal sensor	38/49T	•	•	•	•	•	•	•	•
Protection operation alarm lockout (LED and output state save until manual reset)		•	•	•	•	•	•	•	•
Trip alarm	30	•	•	•	•	•	•	•	•
Internal malfunction alarm	30	•	•	•	•	•	•	•	•
Warning alarm	30	•	•	•	•	•	•	•	•
Voltage transformer secondary circuits supervision		•	•	•	•	•	•	•	•
Parameter setting groups switch on binary input activation/deactivation		•	•	•	•	•	•	•	•
Service functions									
Non-volatile memory event log. 256 events		•	•	•	•	•	•	•	•
Non-volatile memory oscilloscope recorder with 600 s total record duration		•	•	•	•	•	•	•	•
Oscilloscope on binary input activation		•	•	•	•	•	•	•	•
Communication with the Automated Control System - two RS-485		•	•	•	•	•	•	•	•

Wiring Diagrams examples

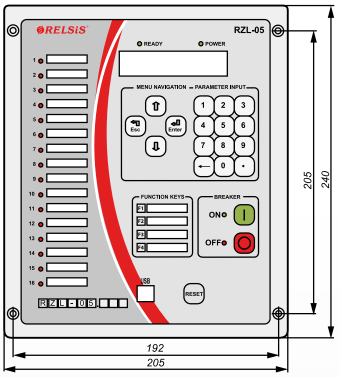


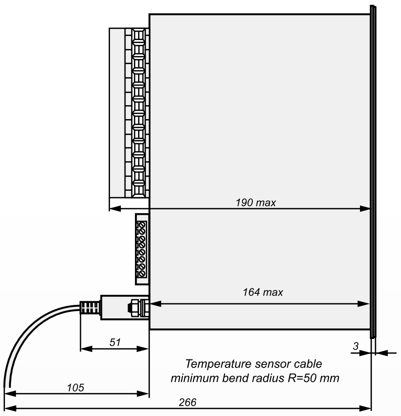
Wiring diagram of external circuits to the devices **RZL-05.B4**

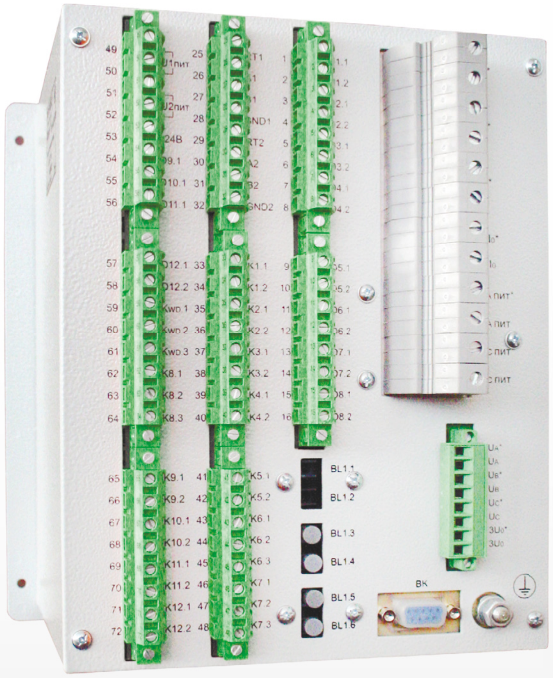


Wiring diagram of external circuits to the devices **RZL-05.F2**

Dimensions







RZL-05.M

SIMPLIFIED LOW-COST PROTECTION and CONTROL DEVICES for SUBSTATIONS and SWITCHGEARS 1 – 45 kV

A wide range of protection and automation functions

Combined power supply including CT circuits unit

Backup trip via CB current solenoids

Digital oscilloscope
Event log

Integration in SCADA-system

Environment temperature -40°C ... +60°C

User-defined logics

Fast-operating arc fault protection with optical fibre sensors

Application

Microprocessor current protection devices of **RZL-05.M** series of three-phase execution are suitable for all cases requiring the use of non-directional protection against short circuits between phases, non-directional or directional protection against earth faults and automatic reclosure function.

Nomenclature of devices of the RLZ-05M series:

- **RZL-05.M1-B (Y)*** - multifunctional device with non-directional overcurrent protection (OCP) and earth fault protection (EFP), powered by operational AC/DC voltage only.
  RZL-05.M11-B (Y) - additionally has arc fault protection with three optical fibre sensors (OFS).
- **RZL-05.M5-B (Y)** - device with non-directional OCP and directional EFP, powered by operational voltage, has backup power supply from current circuits of phases A and C.
  RZL-05.M15-B (Y) - additionally has arc fault protection with three optical fibre sensors (OFS).
- **RZL-05.M6-B (Y)** - device with non-directional OCP and directional EFP, powered by operational voltage, has backup power supply from current circuits of phases A and C, and the function of unloading current circuits of circuit breaker coils (backup trip via CB current solenoids).
  RZL-05.M16-B (Y) - dditionally has arc fault protection with three optical fibre sensors (OFS).

* **-B** - stand out case, **-Y** - flush case.

Hardware features

- Convenience of mounting according to the type of installation device case (flush or stand-out case).
- Small dimensions (device mounting depth is not more than 10 sm).
- Non-freezing OLED display.
- Number of analog inputs - up to 5 pcs.
- Number of binary inputs - 8 pcs, including 2 inputs «dry» contacts.
- Number of output relays - 9 pcs.
- Number of assigned LEDs - 10 pcs.
- 2 buttons of operational control of the circuit breaker.
- Pluggable terminal blocks with locking latches.
- Current terminals with rated current 63 A, short-term current up to 250 A.

Special characteristics

- High operational features (guaranteed operation in difficult conditions (environment temperature is from -40 to +60 °C, mechanical fulfillment group M7, M43, earthquake resistance).
- Universal device power supply (AC, DC, rectified AC, powered by current circuits).
- USB interface for communication with a PC and two isolated RS-485 for communication with automatic control system (ACS).
- Free programming of discrete inputs, outputs, LEDs.
- Arc fault protection with current control.
- Number of assignable function buttons is up to 10 pcs.
- Two setting groups, control of setting sets for binary inputs or ACS.
- Digital oscilloscope with a total recording time of more than 1 hour.

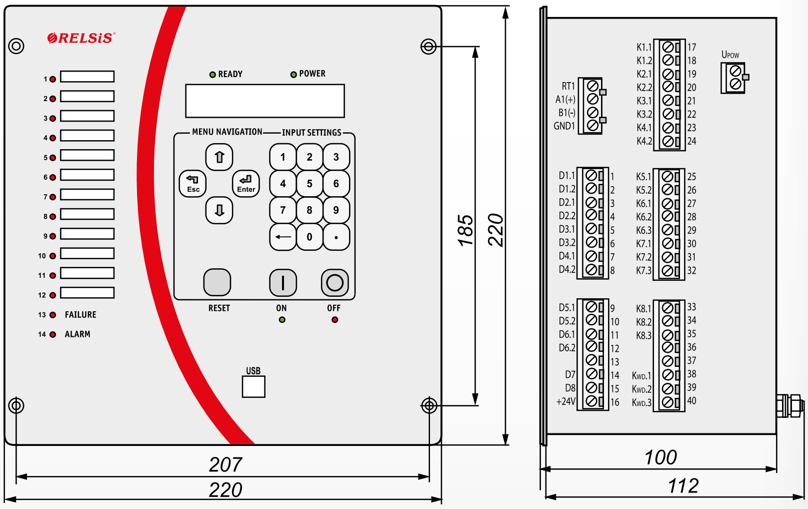
Technical parameters

Power supply units parameters	
Operating voltage range, DC or AC	90 – 254 V
Power-on availability time	0,25 s
Operating supply interruption	0,5 s
Independent supply channels (auxiliary voltage circuits)	1
Device burden	6 Wt
Supply from current transformer circuits (optional)	2
Continuous current withstand	2,5 – 10,0 A
Current input parameters	
Rated input current	5 A
Line current inputs number	3
Measurable current range	0,3 – 150,0 A
Current thermal withstand, continuous/1s	10 / 400 A
Rated zero-sequence input current (3Io)	1 A
Measurable current range	0,01-4,00 A
Voltage input parameters	
Phase voltage	100 V
Number of measured line voltage	1
Measured voltage range	1 – 150 V
Maximum continuous voltage	150 V
Communication	
PC communication interface	USB - 1 pcs
Automated Control System communication interface	RS-485 - 2 pcs
Data Protocol	MODBUS RTU
Connection speed via USB, RJ-485	9600...38400 bps
Binary input parameters	
Number of inputs	8 / 6
Rated AC, DC voltage	230 V
Response voltage level	132 -176 V
Response time	not less 40 ms
Current consumption at 220 V: - power-on current - continuous	 20 mA 4 mA
Dry contact binary input parameters	
Number of inputs	2
Dry contact circuits source voltage	DC 24 V
Binary output (relay) parameters	
Number of binary outputs / programmable	8 / 6
AC voltage trip	400 V
Maximum AC current	8 A (16 A for K1 output)
DC voltage trip	300 V
Maximum DC LR-circuit trip current, time constant τ ≤ 20 ms	0,3 A (0,6 A for K1 output)
Outputs for backup trip via CB current solenoids (M3, M6, M13, M16)	
Number of outputs (relays)	2
Operating range of currents	1,2 - 150 A
Current thermal withstand, 1s	250A
Other	
Mounting type	Flush / stand out
Device dimensions (WxHxD)	220x220x112 mm
LED indicators total / configurable	18 / 12
Operating ambient temperature range	- 40 to + 60 °C
Maximum Humidity at 25 °C	98 %
Insulation resistance, more than	50 MΩ
Insulation overvoltage withstand, Instantaneous / continuous	2,0 kV , 50 Hz 5,0 kV pulse
Weight, less then	4,5 kg

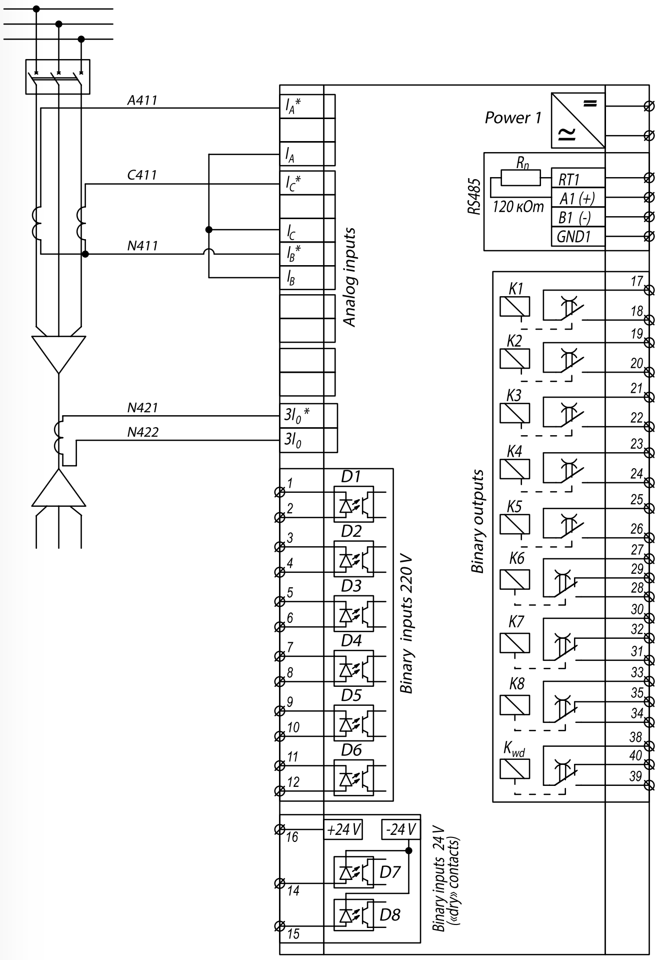
Functions

	ANSI	RZL-05.Mx		
		1 (11)	5 (15)	6 (16)
Backup power supply functions				
Powered by current circuits (phases of current transformer A and C)			•	•
Backup trip coils via CB current solenoids				•
Protection functions				
Overcurrent protection and current cut-off (OCP + CCO) with time delay (5 stages)	50/51	•	•	•
Switch on to fault high-speed protection	50HS	•	•	•
Logic Selectivity Busbar protection	68	•	•	•
Zero-sequence OCP	50N/51N	•	•	•
Directional earth-fault protection	67N		•	•
Phase conductor break protection (negative sequence or negative to positive sequence ratio current)	46BC	•	•	•
OCP/zero-sequence OCP stage activation by binary signal (current-restrained intertrip)		•	•	•
Arc-fault protection (by binary input) with phases currents or 3I0 monitoring (3 optical fibre sensors)	50ARC	(•)	(•)	(•)
Automation functions				
Auto-reclosing	79	•	•	•
Automatic underfrequency load shedding	81L	•	•	•
HV Breaker failure back-up	50BF	•	•	•
Monitoring and indication functions				
Breaker closing circuits supervision	74TCS	•	•	•
Protection operation alarm lockout (LED and output state save until manual reset)		•	•	•
Internal malfunction alarm	30	•	•	•
Parameter setting groups switch on binary input activation/deactivation		•	•	•
Service functions				
Non-volatile memory event log.		•	•	•
Non-volatile memory oscilloscope recorder with 600 s total record duration		•	•	•
Oscilloscope on binary input activation		•	•	•

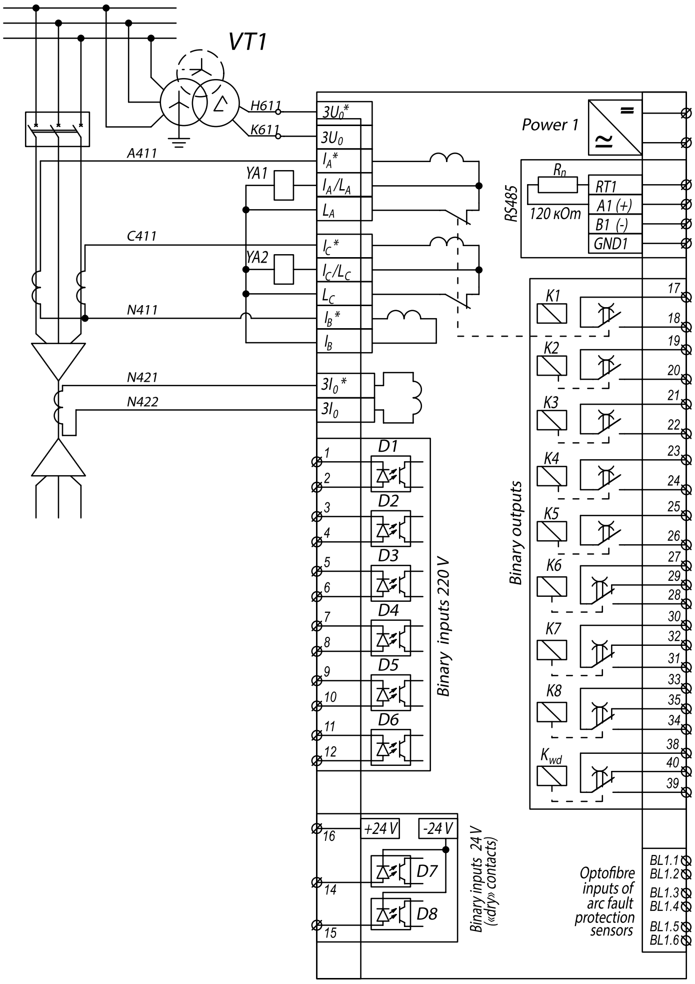
Dimensions



Wiring Diagrams examples



Wiring diagram of external circuits to the devices **RZL-05.M1**

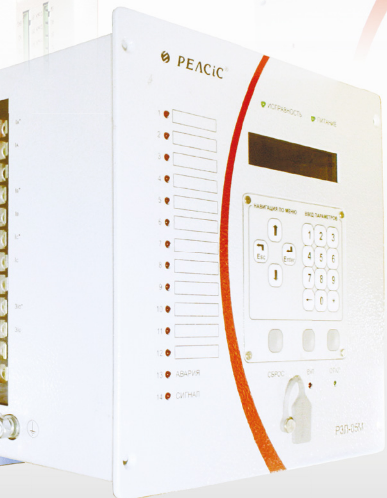


Wiring diagram of external circuits to the devices **RZL-05.M16**

RZL-05.M5-B
stand out case

RZL-05.M5-Y
flush case

RZL-05.M5-B
stand out case



RZL-05.M5-Y
flush case

RZL-05.M15-Y
flush case

RZL-05.S

INNOVATIVE DEVICES RZL-05.S SERIES

RELIABLE AND ECONOMIC PROTECTION OF POWER NETWORKS

A wide range of protection and automation functions

Combined power supply including CT circuits unit

Backup trip via CB current solenoids

Digital oscilloscope
Event log

Integration in SCADA-system

Environment temperature -40°C ... +60°C

User-defined logics

Assignment

New multifunctional relay protection and automation devices RZL-05.S series are designed to protect lines from short circuits and earth faults and do not require an external auxiliary power source. These devices can be used as primary or backup protection in medium and high voltage power systems.

Application

- Substations and utilities equipped with medium-voltage switchgears 6-45 kV;
- Redundant protection of medium / high voltage transformers;
- Replacement of electromechanical and microelectronic relays and relay protection and automation devices manufactured using outdated technologies (especially when integrating them into SCADA systems).

Features

- Universal power supply (AC, DC, powered by current circuits);
- Buttons on the front panel for operational control of circuit breaker;
- Free programming of digital inputs, outputs, LEDs;
- Preservation of full performance during prolonged power interruptions;
- Three data transfer interfaces: USB, RS-485, Ehternet (RJ-45) (option);
- Unified software "Monitor-2";
- Integration with existing communication protocols and the possibility of upgrading communication channels in the future;
- Good price-functionality ratio.

Communication and Interfaces

Devices of RZL-05.S series has three built-in communication ports, of which one RS 485 is a traditional serial interface for the Modbus RTU protocol, and the second is a serial port designed for exchanging information based on Modbus TCP network Ethernet. Ethernet TCP network allows fast data transfer between the central computer and devices, it is effective for downloading waveforms and measurement results. The third SPI port can be used to expand the number of inputs and outputs of the device (up to 128), as well as for the possibility of connecting various digital sensors (temperature, pressure, etc.)

Event recording and Oscilloscope

The RZL-05.S device memory contains 256 event records, namely: turning the device on and off, changing the status of inputs / outputs, starting and operation of all functions, operation of output relays, device reset, remote control signals. You can use USB port or other available serial ports to download event records to a computer. Event records are stored in non-volatile memory, all events have time stamps with an interval of 10 ms.

The device provides a record of waveforms of emergency processes:

- instantaneous values of phase currents I_A, I_B, I_C;
- instantaneous values of zero sequence current $3I_0$;
- instantaneous values of phase (linear) voltages U_A, U_B, U_C (U_{AB}, U_{BC}, U_{CA});
- instantaneous zero sequence voltage $3U_0$;
- state of discrete inputs and output relays.

Each waveform is linked to the device internal timer with a resolution of 1 ms. The total waveform recording time is set to 30 seconds, the duration of the waveform recording can be configured. The oscilloscope starts by the protection operation, by an external input signal or by automatic control system. All digital and analog information is stored in non-volatile memory. Waveform files are read in Comtrade format.

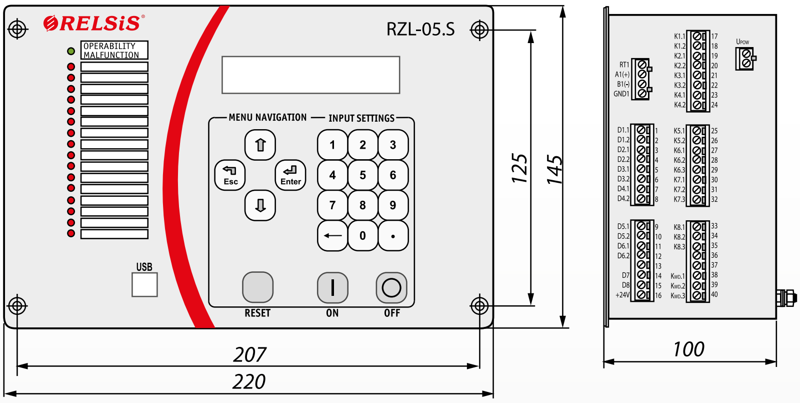
Technical parameters

Power supply units parameters	
Operating voltage range, DC or AC	90 – 254 V
Power-on availability time	0,2 s
Operating supply interruption	0,5 s
Device burden	3 Wt
Supply from current transformer circuits (optional)	2
Current withstand, continuous / 3 s	8 / 150 A
Current input parameters	
Rated input current	5 A
Line current inputs number	3 (2)
Measurable current range	0,2 – 125,0 A
Measurable current circuits thermal withstand, continuous / 1s	10 / 400 A
Thermal withstand in case of power supply from current circuits, continuous / 1s	10 / 250 A
Rated zero-sequence input current (3Io)	1 A
Measurable current range	0,01-4,00 A
Current circuit 3Io thermal withstand, continuous / 1s	5 / 100 A
Voltage input parameters	
Phase voltage	100 V
Number of measured voltages	4 (UA, UB, UC, 3Uo)
Measured voltage range	5 – 200 V
Measurable voltage circuits thermal withstand, continuous / 1 s	150 / 260 V
Binary input parameters	
Number of inputs	5 (2)
Rated AC, DC voltage	220 V
Response voltage level	132 -176 V
Dry contact binary input parameters	
Number of inputs	3
Dry contact circuits source voltage	DC 30 V
Binary output (relay) parameters	
Number of binary outputs	6
AC voltage trip	24 - 400 V
Maximum AC current	8 A
DC voltage trip	24 - 300 V
Maximum DC LR-circuit trip current τ≤20ms	1 / 0,3 A
Communication	
Communication interfaces	USB, RS-485 Ethernet (RJ45)
Data Protocols	MODBUS RTU MODBUS TCP
Connection speed via USB, RJ-485	9600...115200 bps
Other	
Device dimensions (WxHxD)	220x145x100 mm
Indicator 2x16	OLED
Operating ambient temperature range	- 40 to + 60 °C
Maximum Humidity at 25 °C	98 %
Insulation resistance, more than	50 MΩ
Weight, less then	3 kg

Functions

	ANSI	RZL-05.Sx		
		1	2	3
Backup power supply functions				
Powered by current circuits (phases of current transformer A and C)			•	•
Backup trip coils via CB current solenoids				•
Protection functions				
Overcurrent protection (OCP)	50/51	•	•	•
OCP blocking by binary input		•	•	•
Switch on to fault high-speed protection	50HS	•	•	•
Logic Selectivity Busbar protection	68	•	•	•
Zero-sequence OCP (unidirectional earth-fault protection)	50N/51N	•	•	•
Directional ground-fault protection (directional zero-sequence power protection)	67N	•	•	•
Overvoltage protection (optional)	59	•	•	•
Undervoltage protection (optional)	37	•	•	•
Zero-sequence overvoltage protection (optional)	59N	•	•	•
Phase conductor break protection (negative sequence or negative to positive sequence ratio current)	46BC	•	•	•
OCP/zero-sequence OCP stage activation by binary signal (current-restrained intertrip)		•	•	•
Overthemperature protection		•	•	•
Automation functions				
Auto-reclosing	79	•	•	•
Automatic underfrequency load shedding	81L			
HV Breaker failure back-up	50BF	•	•	•
Switching-off by withdrawable element		•	•	•
Monitoring and indication functions				
Trip alarm	30	•	•	•
Internal malfunction alarm	30	•	•	•
Warning alarm	30	•	•	•
Service functions				
Non-volatile memory event log		•	•	•
Non-volatile memory oscilloscope recorder with 30 s total record duration		•	•	•
Oscilloscope on binary input activation		•	•	•

Dimensions



RZL-05.DP

OUTGOING FEEDER DISTANCE PROTECTION

A wide range of protection and automation functions

Digital oscilloscope
Event log

Integration in SCADA-system

Environment temperature -40°C ... +55°C

User-defined logics

Fast-operating arc fault protection with lens-type photosensor

Application

RZL-05.DP devices intended for outgoing feeder distance protection and have four stages with independent time-delay characteristics. Protection doesn't operate in case of secondary voltage circuits fault and in case of nearby fault. Protection has circular impedance characteristic which sets with five settings that define the centre of circle, it's radius and angles of initial and end of operation sector as it's shown on a Figure 1. Protection controls each of three phase-to-phase impedance.

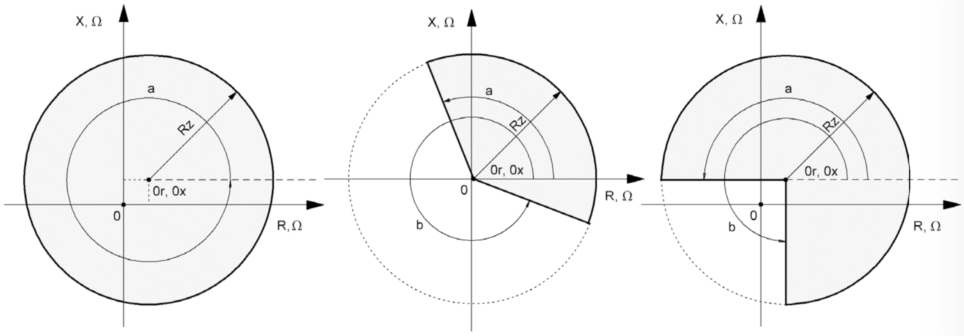


Figure 1. Circular impedance characteristics of distance protection stages.

Functions

- Distance protection, 4 stages.
- Directional and nondirectional overcurrent protection, 4 stages.
- Switch onto faultacceleration.
- Logical selectivity busbar protection.
- Overload protection.
- Directional and nondirectional ground fault protection, 3 stages.
- Undervoltage protection, 2 stages.
- Overvoltage protection.
- Phase unbalance phase-loss protection (negative-sequence).
- Arc-fault protection.
- Overheat protection.
- Breaker failure protection.
- Breaker auto-reclosing.
- Automatic load-transfer.
- Secondary voltage circuitsperformance supervision.
- Phase-to-phase fault location.
- Breaker control.
- User-defined logic.
- Solid ambient conditions withstand (-40...+55 °C).
- Multi-lingual LCD interface: English, Ukrainian, Russian.

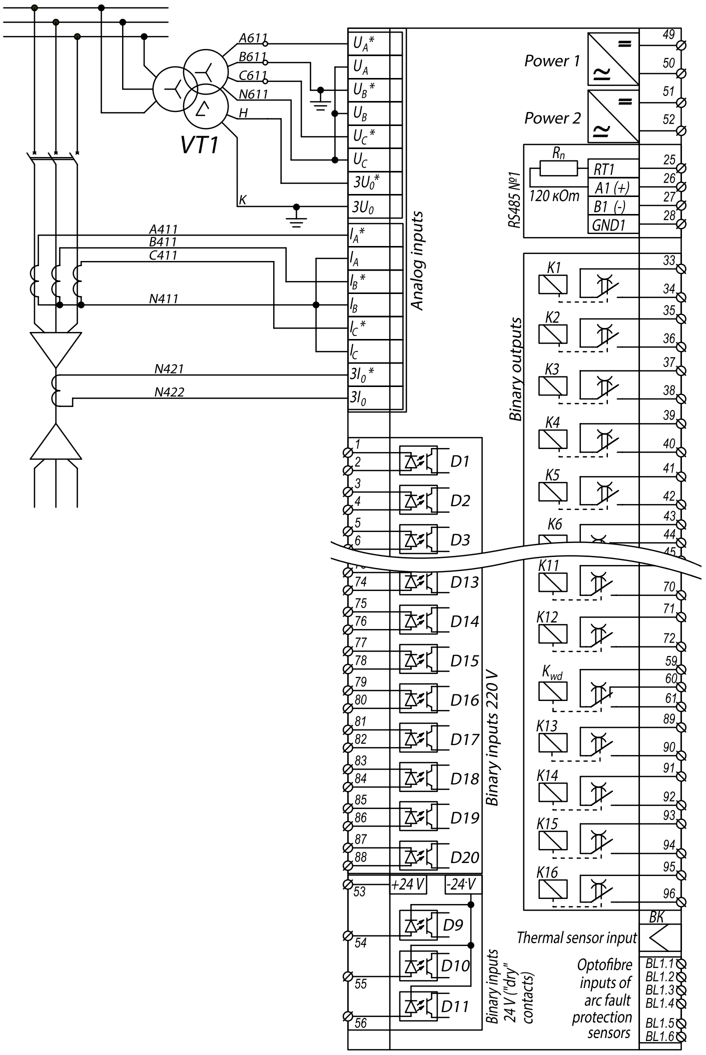
Distance protection parameters

Stages number	4
Impedance of secondary fault circuit loop setting range, RZ	0,05 – 200 Ω
Setting interval of checkzone Z impedance	0,01 Ω
Each checkzone circle centerpoint coordinates setting range (0r,0x)	0 – 200 Ω
Angles a and b setting range	0 – 360 deg
Setting interval ofa and b angles	1 deg
Time-delay setting range	0 – 10 sec
Interval of time-delay setting	0,01 sec
Minimum protection operating current	0,5 A
Maximum protection operating current	150 A
Minimum protection operating voltage	10 V
Device operating time-lag	35 ms

Technical parameters

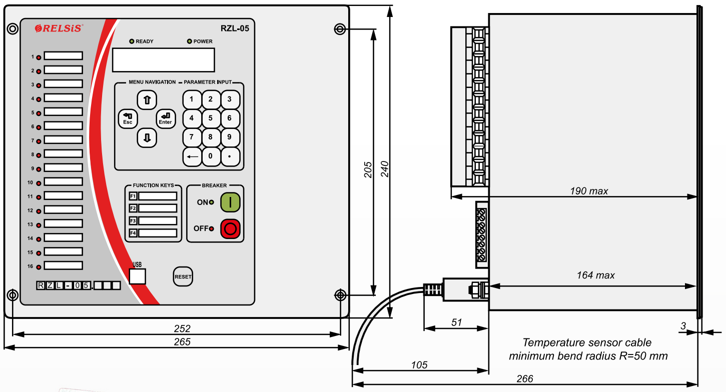
	RZL-05.DP-x			
	1	3	11	13
Power supply units parameters				
Operating voltage range, DC / AC, 50 Hz	90 – 360 V / 80 – 254 V			
Power-on availability time	0,3 s			
Operating supply interruption	0,5 s			
Independent supply channels (auxiliary voltage circuits)	2			
Device burden	2x13 Wt			
Current input parameters				
Rated input current	5 A			
Line current inputs number	3			
Measurable current range	0,1 – 150,0 A			
Maximum monitored current value	200 A			
Basic relative measurement accuracy	±2 %			
Current thermal withstand, continuous/1s	10 / 500 A			
Zero-sequence current input parameters				
Rated zero-sequence input current (3Io)	1 A			
Line current inputs number	1			
Measurable current range	0,01 – 4,00 A			
Maximum monitored current value	10 A			
Current thermal withstand, continuous/1s	10 / 100 A			
Voltage input parameters				
Phase voltage	100 V			
Number of inputs	4			
Rated voltage range	1 – 150 V			
Maximum continuous voltage	180 V			
Linear voltages measurement accuracy	±2 %			
3Uo voltage measurement accuracy	±3 %			
Voltage thermal withstand, continuous/1s	150 / 300 V			
Measurement accuracy of phase angles between current 3Io and voltage 3Uo	±3 deg			
Thermal sensor input parameters				
Number of inputs	1			
Temperature range	0 -100 ° C			
Binary input parameters				
Number of inputs	17			
Rated AC, DC voltage	220 V			
Response voltage level	132 – 176 V			
Response time	not less 40 ms			
Current consumption at 220 V: - power-on current - continuous	 20 mA 4 mA			
Maximum voltage, continuous	310 V			
Dry contact binary input parameters				
Number of inputs	3			
Dry contact circuits source voltage	DC 24 V			
Binary output parameters				
Number of binary outputs	17			
Max AC voltage trip	400 V			
Maximum AC current	5 A (10 A for K1 output)			
Max DC voltage trip	300 V			
Maximum DC LR-circuit trip current, time constant τ ≤ 20 ms	0,2 A (0,4 A for K1 output)			
Arc fault protection sensors parameters				
Number of inputs	-	3	-	3
Response threshold	900 – 1700 lux			
Communication				
PC communication interface	USB - 1 pcs			
Automated Control System communication interface	RS-485 - 2 pcs		RS-485 - 1 pcs Ethernet (RJ45)	
Data Protocol	MODBUS RTU		MODBUS TCP	
Connection speed	9600...115200 bps		10/100 Mbps	
Other				
Mounting type	Flush			
Device dimensions (WxHxD)	265x240x195 mm			
LED indicators total / configurable	20/16			
Operating ambient temperature range	- 40 to + 55 °C			
Maximum Humidity at 25 °C	98 %			
Insulation resistance, more than	50 MΩ			
Insulation overvoltage withstand, Instantaneous / continuous	2,0 kV , 50 Hz 5,0 kV pulse			
Weight, less then	10 kg			

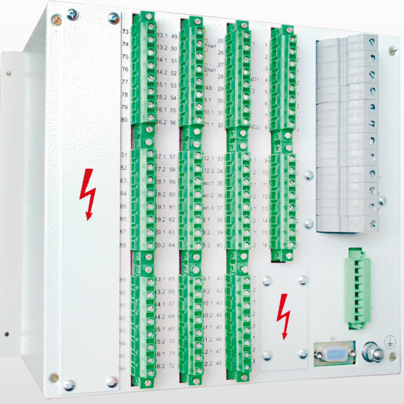
Wiring Diagram example



Wiring diagram of external circuits to the devices **RZL-05.DP-13**

Dimensions





RZL-05.VT

PROTECTION and CONTROL DEVICES for protection and control of VOLTAGE TRANSFORMER

Digital oscilloscope
Event log

Integration in SCADA-system

Environment temperature -40°C ... +55°C

User-defined logics

Application

Microprocessor devices **RZL-05.VT** are used for relay protection, automation, control, registration and alarm signaling of voltage transformers 110–35–10(6) kV of complete switchgears at power and industrial facilities.

Devices are designed for facilities: distribution networks, transformer substations, stations with guaranteed (AC, DC or rectified voltage) and non-guaranteed operational current.

Devices are to be mounted into relay cubicles of switchgears, relay panels.

Devices have user-defined logics inclusion.

Features

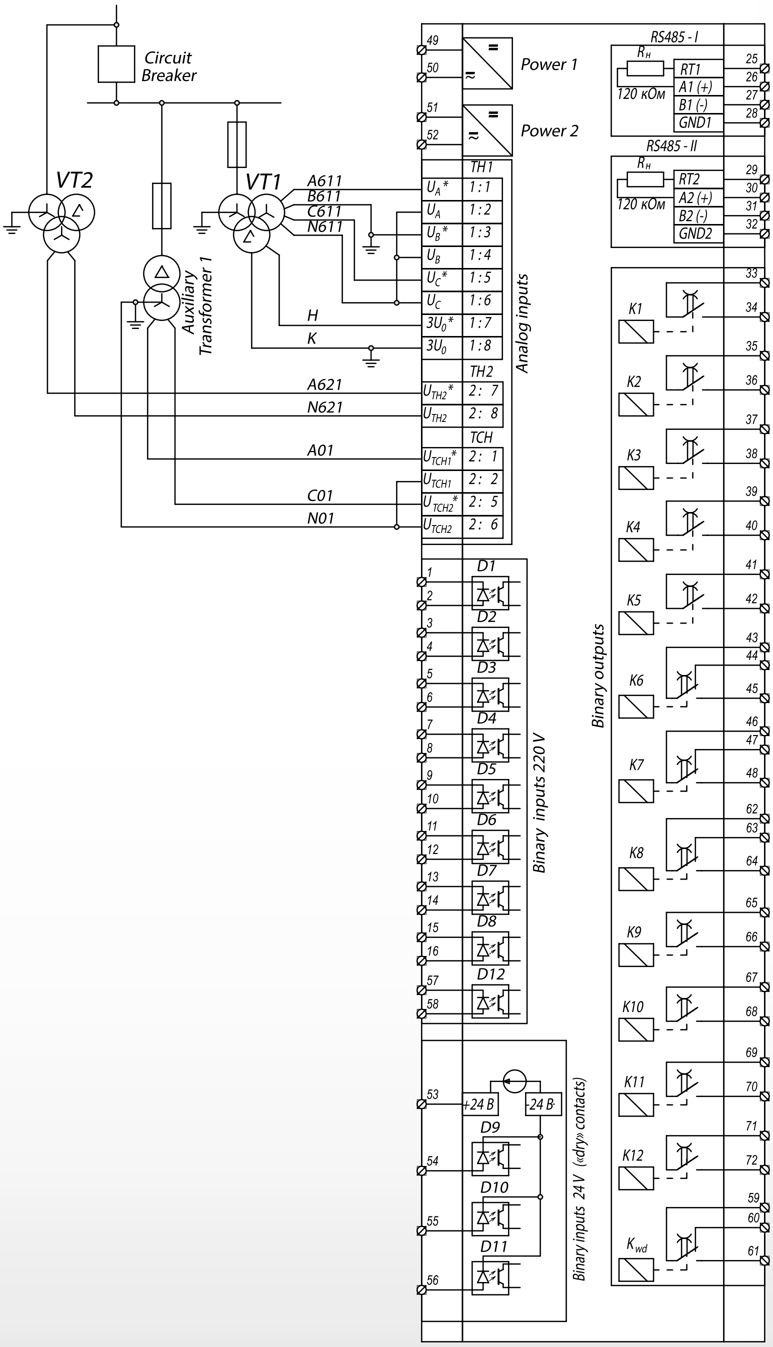
- Complex substation protection by voltage (monitoring and control of voltage transformer VT1 of the first busbar section, VT2 - auxiliary transformer).
- Operating parameters settings via built-in HMI and PC software tool: functions activation/deactivation, protection stages values and time delay for each stage e t.c.
- Individual configuration of each photosensor input.
- Flexible configuration settings.
- Non-volatile storage of settings, events, fault recordings.
- Total waveform recording duration 600 s.
- A solid number of output relays, incl. one reinforced relay for switching high values instantaneous currents, switching in circuits with high inductance, and one bistable relay, eliminating the need to install additional relays.
- Remote configuration and data transfer including current parameters and function settings, apparatus state, events, measurements via RS-485 interface by MODBUS RTU protocol.
- Remote control of HV devices via MODBUS RTU protocol.
- Steel casing.
- Front side USB interface.
- Real-time self-supervision.
- Two switchable setting groups.
- Two mutually redundant power supply units.
- Universal AC/DC power supply source.
- Supply input and all signal circuits are galvanically isolated.
- Solid overvoltage withstand.
- Optocoupler-insulated binary inputs.
- Interredundant hardware and software to improve the reliability of protection, automation functions and data transfering.
- Presence of digital inputs, controlled by "dry contact", and which saves execution of their functions when switching-off operational power supply.
- Solid ambient conditions withstand (-40...+55 °C).
- Multi-lingual LCD interface: English, Ukrainian, Russian.

Technical parameters

Power supply units parameters	
Operating voltage range, DC or AC	90 – 254 V
Power-on availability time	0,3 s
Operating supply interruption	0,5 s
Independent supply channels (auxiliary voltage circuits)	2
Device burden	8 Wt
Voltage input parameters	
Rated voltage	100 V
Number of measured phases voltages	3
Measured phases voltages range	0,5 – 130 V
Number of measured 3U0 voltage	1
Number of measured line voltage 100 V of VT2	1
Number of measured line voltage 380 V of auxiliary transformer	2
Measured phases voltages range: - line voltage of VT2 - line voltage of auxiliary transformer	 1 – 150 V 1 – 570 V
Voltage thermal withstand: - continuous / VT1, VT2 - continuous / auxiliary transformer - 1s / VT1, VT2 - 1 s / auxiliary transformer	 150 V 400 V 300 V 600 V
Thermal sensor input parameters	
Number of inputs	1
Temperature range	0 -125 ° C
Communication	
PC communication interface	USB - 1 pcs
Automated Control System communication interface	RS-485 - 2 pcs
Data Protocol	MODBUS RTU
Connection speed via USB, RJ-485	9600...38400 bps
Binary input parameters	
Number of inputs	12
Rated AC, DC voltage	220 V
Response voltage level	132 -176 V
Response time	not less 40 ms
Current consumption at 220 V: - power-on current - continuous	 20 mA 4 mA
Maximum voltage, continuous	310 V
Dry contact binary input parameters	
Number of inputs	3
Dry contact circuits source voltage	DC 24 V
Binary output parameters (relays)	
Number of binary outputs	12
AC voltage trip	400 V
Maximum AC current	8 A (16 A for K1 output)
DC voltage trip	300 V
Maximum DC LR-circuit trip current, time constant τ ≤ 20 ms	0,3 A (0,6 A for K1 output)
Other	
Mounting type	Flush
Device dimensions (WxHxD)	205x240x195 mm
LED indicators total / configurable	20/8
Operating ambient temperature range	- 40 to + 55 °C
Maximum Humidity at 25 °C	98 %
Insulation resistance, more than	50 MΩ
Insulation overvoltage withstand, Instantaneous / continuous	2,0 kV , 50 Hz 5,0 kV pulse
Weight, less then	6,5 kg

Functions

	ANSI
Protection functions	
Voltage-restrained OCP	50V/51V
Zero-sequence overvoltage protection (3 stages)	59N
Overvoltage protection (2 stages)	59
Undervoltage protection (3 stages)	27
Auxiliary channel overvoltage protection	
Reverse sequence overfrequency protection	
External protection by binary input	
Arc fault protection by binary input	
Overfrequency protection	
Device overheat protection	
Parameter setting groups switch by binary input activation/deactivation	
Automation functions	
Automatic underfrequency load shedding	81L
Monitoring and indication functions	
Combined undervoltage protection with control of operability of auxiliary channel voltage circuits	
Voltage transformer secondary circuits supervision	
Swithgear bay temperature supervision	
Voltage circuits supervision	



Wiring diagram of external circuits to the devices **RZL-05.VT**

RZL-05.T2, RZL-05.T3

TRANSFORMER DIFFERENTIAL PROTECTION

A wide range of protection and automation functions

Digital oscilloscope Event log

Integration in SCADA-system

Environment temperature -40°C ... +55°C

User-defined logics

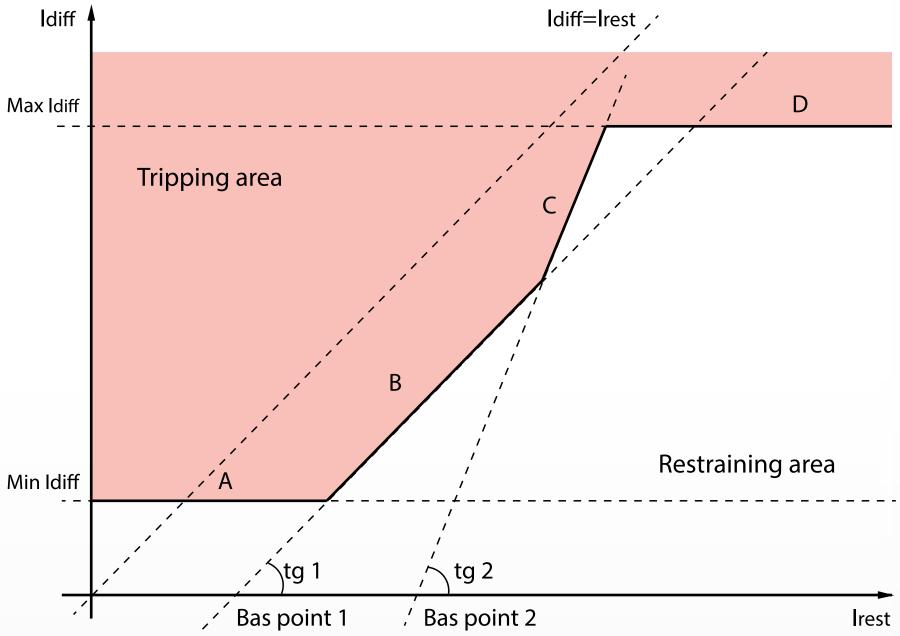
Fast-operating arc fault protection with lens-type photosensor

Application

Microprocessor devices of **RZL-05.Tx** series are intended to perform differential protection of two-winding and three-winding power transformers with 35 - 110 kV HV winding. Devices are to be mounted in relay sections of switchgears and also relay panels and substation control boards.

Features

- Two differential protection zones: differential current cutoff without restraining and sensitive differential current protection restrained in case of external fault out of protection area and from magnetising inrush current.
- Current circuits performance supervision production blocking in case of loss.
- Five-stage overcurrent protection including current cutoff with magnetizing current inrush restriction, current overload protection with the definite and independent time-delay. For overcurrent protection stages available an option of voltage controlled start.
- Logical selectivity busbar protection.
- Three-stage ground fault protection of HV winding. Zero-sequence fault current may be measured or calculated.
- Phase loss protection (negative-sequence) current protection.
- Logics of internal transformers protection performance. Each internal protection command might be configured to trip or to initiate an emergency alarm.
- Light-sensor arc fault protection.
- Breaker failure protection.
- User-defined programmable logic.
- Solid ambient conditions withstand (-40…+55 °C).
- Multi-lingual LCD interface: English, Ukrainian, Russian.

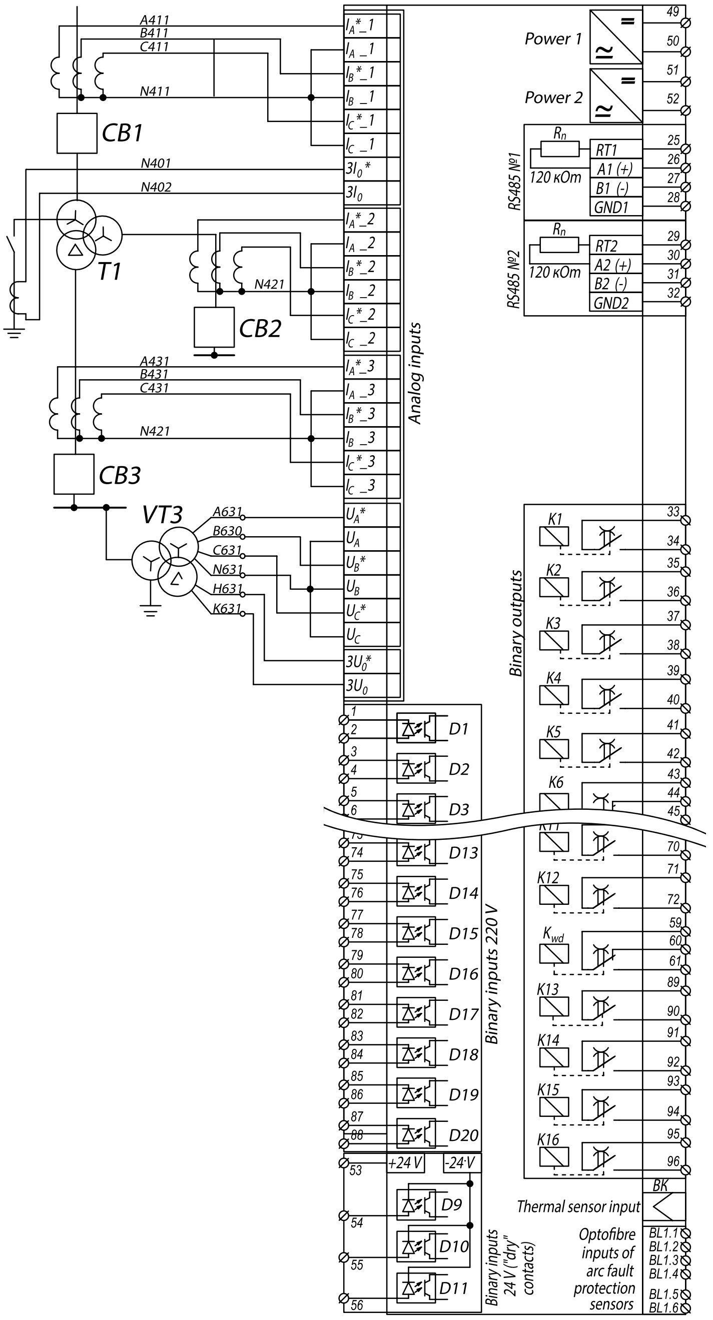


Restraining curve of differential protection

Technical parameters

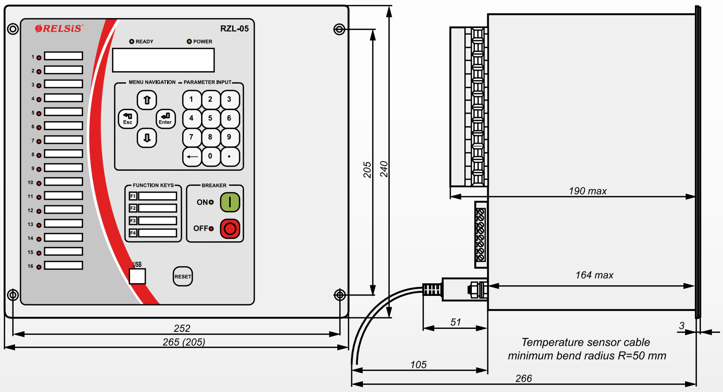
	RZL-05.T2-x		RZL-05.T3-x	
	1	5	1	5
Power supply units parameters				
Operating voltage range, DC / AC, 50 Hz	90 – 360 V / 80 – 254 V			
Power-on availability time	0,3 s			
Operating supply interruption	0,5 s			
Independent supply channels (auxiliary voltage circuits)	2			
Device burden	2x13 Wt			
Current input parameters				
Rated input current	5 A			
Line current inputs number	6		9	
Measurable current range	0,3 – 125,0 A			
Maximum monitored current value	150 A			
Basic relative measurement accuracy	±2 %			
Current thermal withstand, continuous/1s	10 / 500 A			
Zero-sequence current input parameters				
Rated zero-sequence input current (3Io)	1 A	5 A	1 A	5 A
Line current inputs number	1			
Measurable current range	0,01–2 A	0,5–125 A	0,01–2 A	0,5–125 A
Maximum monitored current value	10 A	150 A	10 A	150 A
Current thermal withstand, continuous/1s	5/100 A	15/500 A	5/100 A	15/500 A
Voltage input parameters				
Phase voltage	100 V			
Number of inputs	4			
Rated voltage range	1 – 150 V			
Maximum controlled voltage	200 V			
Linear voltages measurement accuracy	±2 %			
3Uo voltage measurement accuracy	±3 %			
Voltage thermal withstand, continuous/1s	150 / 300 V			
Measurement accuracy of phase angles between current 3Io and voltage 3Uo	±3 deg			
Thermal sensor input parameters				
Number of inputs	1			
Temperature range	0 -100 °C			
Binary input parameters				
Number of inputs	9		17	
Rated AC, DC voltage	220 V			
Response voltage level	132 – 176 V			
Response time	not less 40 ms			
Current consumption at 220 V: - power-on current - continuous	 20 mA 4 mA			
Maximum voltage, continuous	310 V			
Dry contact binary input parameters				
Number of inputs	3			
Dry contact circuits source voltage	DC 24 V			
Binary output parameters				
Number of binary outputs	13		17	
Max AC voltage trip	400 V			
Maximum AC current	5 A (10 A for K1 output)			
Max DC voltage trip	300 V			
Maximum DC LR-circuit trip current, time constant τ ≤ 20 ms	0,2 A (0,4 A for K1 output)			
Arc fault protection sensors parameters				
Number of inputs	3			
Response threshold	900 – 1700 lux			
Communication				
PC communication interface	USB - 1 pcs			
Automated Control System communication interface	RS-485 - 2 pcs			
Data Protocol	MODBUS RTU			
Connection speed	9600...115200 bps			
Other				
Mounting type	Flush			
Device dimensions (WxHxD)	205x240x195 mm		265x240x195 mm	
Weight, less then	6,5 kg		10 kg	
LED indicators total / configurable	20/16			
Operating ambient temperature range	- 40 to + 55 °C			
Maximum Humidity at 25 °C	98 %			
Insulation resistance, more than	50 MΩ			
Insulation overvoltage withstand, Instantaneous / continuous	2,0 kV , 50 Hz 5,0 kV pulse			

Wiring Diagram example



Wiring diagram of external circuits to the devices **RZL-05.T3-5**

Dimensions



RZL-05.AVC

AUTOMATIC TAP-CHANGING VOLTAGE CONTROL DEVICE

Digital oscilloscope
Event log

Integration in SCADA-system

Environment temperature
-40... +55°C

User-defined logics

Application

RZL-05.AVC intended for automatic and manual voltage control of a two- and three-winding three-phase power transformer with a motor driven on-load tap-changer. Devices are designed to automatically maintain the voltage at the LV-side of a power transformer within given limits around a set target voltage. RZL-05.AVC also has all necessary supervision and auto-blocking functions.

Operational capabilities

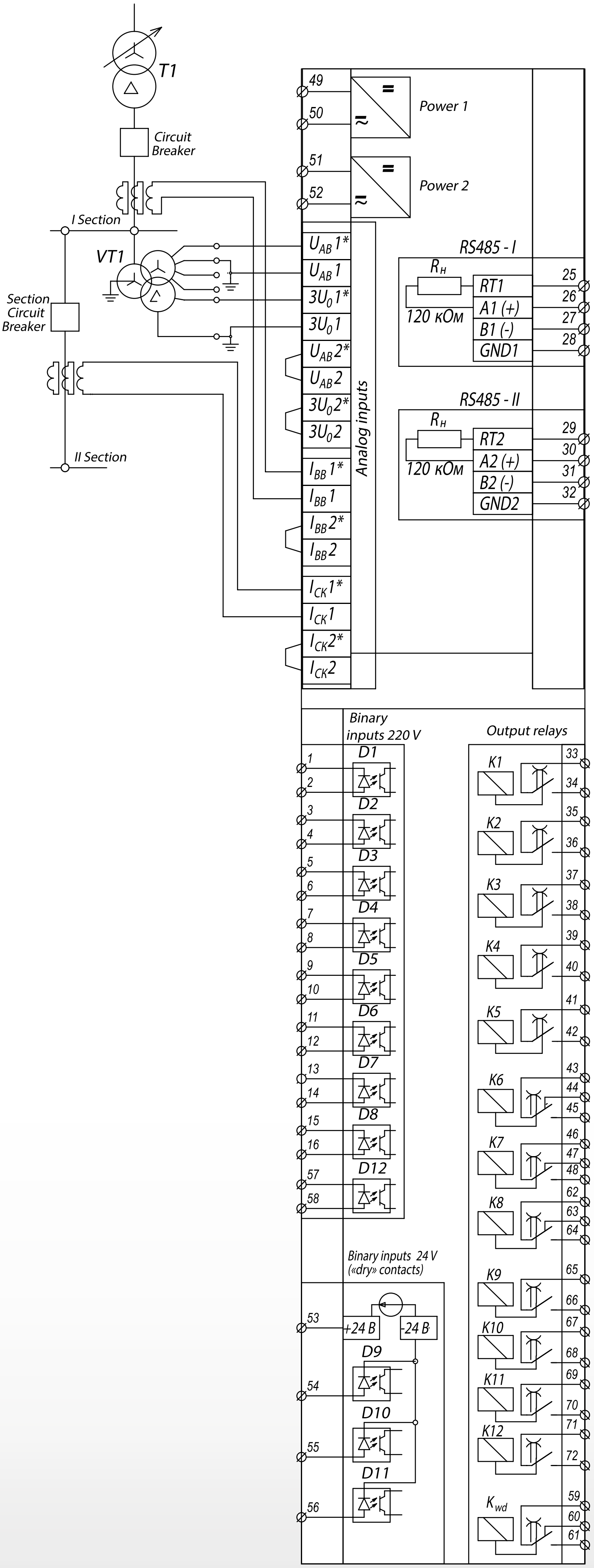
- Automatic, manual and remote on-load tap-changer control.
- Monitoring of boundary values of currents and voltage, regulation and alarm blocking if boundary conditions.
- Drive and voltage circuits supervision.
- Tap-changer interlocking via external contact.
- Simultaneous control of two bus systems.
- Correction of the regulated voltage level depending on the on-load current.
- Generation of pulse or continuous on-load tap-changer control commands.
- Operability monitoring of on-load tap-changer in pulsed operation mode.
- Operational switching of regulation from one bus system to another.
- Operation blocking and alarm upon detection of the on-load tap-changer failure.
- Operation blocking and alarm upon detection of the overload, 3Uo overvoltage or a low measured voltage.
- Fast changeover of two pre-selected settings groups and operating modes of voltage maintenance.
- Present tap-changer stage measurement.
- Non-volatile storage of settings, events, fault recordings.
- Total waveform recording duration 600 s.
- A solid number of output relays, incl. one reinforced relay for switching high values instantaneous currents, switching in circuits with high inductance, and one bistable relay, eliminating the need to install additional relays.
- Remote configuration and data transfer including current parameters and function settings, apparatus state, events, measurements via RS-485 interface by MODBUS RTU protocol.
- Remote control of HV devices via MODBUS RTU protocol.
- Steel casing.
- Front side USB interface.
- Real-time self-supervision.
- Two switchable setting groups.
- Two mutually redundant power supply units.
- Universal AC/DC power supply source.
- Supply input and all signal circuits are galvanically isolated.
- Solid overvoltage withstand.
- Optocoupler-insulated binary inputs.
- Interredundant hardware and software to improve the reliability of protection, automation functions and data transfering.
- Presence of digital inputs, controlled by "dry contact", and which saves execution of their functions when switching-off operational power supply.
- Solid ambient conditions withstand (-40...+55 °C).
- Multi-lingual LCD interface: English, Ukrainian, Russian.

Functions

- Automatic, manual and remote (via serial interface) on-load tap-changer control.
- Monitoring of boundary values of currents and voltage, regulation and alarm blocking if boundary conditions.
- Drive and voltage circuits supervision.
- Tap-changer interlocking via external contact.

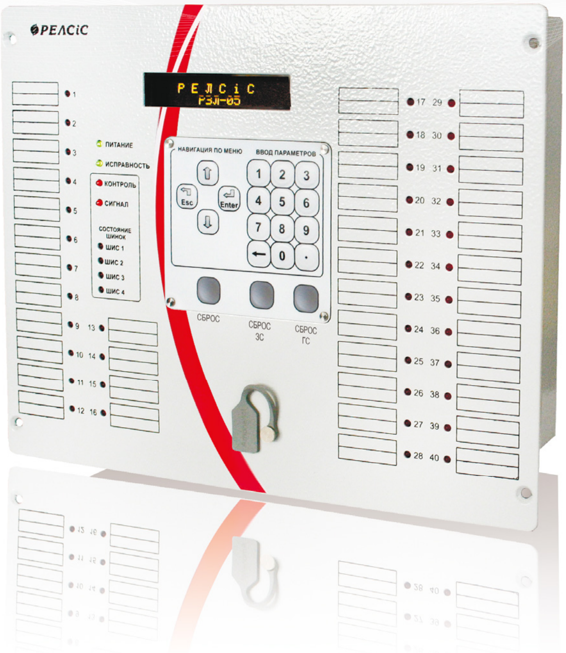
Technical parameters

Power supply units parameters	
Operating voltage range, DC or AC	90 – 254 V
Power-on availability time	0,2 s
Operating supply interruption	0,5 s
Independent supply channels (auxiliary voltage circuits)	2
Device burden	8 Wt
Current input parameters	
Rated input current	5 A
Number of line current inputs	4
Measurable current range	0,5 – 15,0 A
Current thermal withstand, continuous/1s	10 / 100 A
Voltage input parameters	
Phase voltage	100 V
Number of measurable line voltage inputs	4
Rated voltage range	1 – 150 V
Maximum continuous voltage	130 V
Thermal sensor input parameters	
Number of inputs	1
Temperature range	0 -125 ° C
Communication	
PC communication interface	USB - 1 pcs
Automated Control System communication interface	RS-485 - 2 pcs
Data Protocol	MODBUS RTU
Connection speed via USB, RJ-485	9600...38400 bps
Binary input parameters	
Number of inputs	12
Rated AC, DC voltage	220 V
Response voltage level	132 -176 V
Response time	not less 40 ms
Current consumption at 220 V: - power-on current - continuous	 20 mA 4 mA
Maximum voltage, continuous	310 V
Dry contact binary input parameters	
Number of inputs	3
Dry contact circuits source voltage	DC 24 V
Binary output parameters	
Number of binary outputs	13
AC voltage trip	400 V
Maximum AC current	8 A (16 A for K1 output)
DC voltage trip	300 V
Maximum DC LR-circuit trip current, time constant τ ≤ 20 ms	0,3 A (0,6 A for K1 output)
Other	
Mounting type	Flush
Device dimensions (WxHxD)	205x240x190 mm
LED indicators total / configurable	20/8
Operating ambient temperature range	- 40 to + 55 °C
Maximum Humidity at 25 °C	98 %
Insulation resistance, more than	50 MΩ
Insulation overvoltage withstand, Instantaneous / continuous	2,0 kV , 50 Hz 5,0 kV pulse
Weight, less then	6 kg



Wiring diagram of external circuits to the devices **RZL-05.AVC**

RZL-05.CS



CENTRALIZED ALARM SYSTEM ANNUNCIATOR DEVICE

Integration in SCADA-system

Environment temperature -40… +55°C

User-defined logics

Application

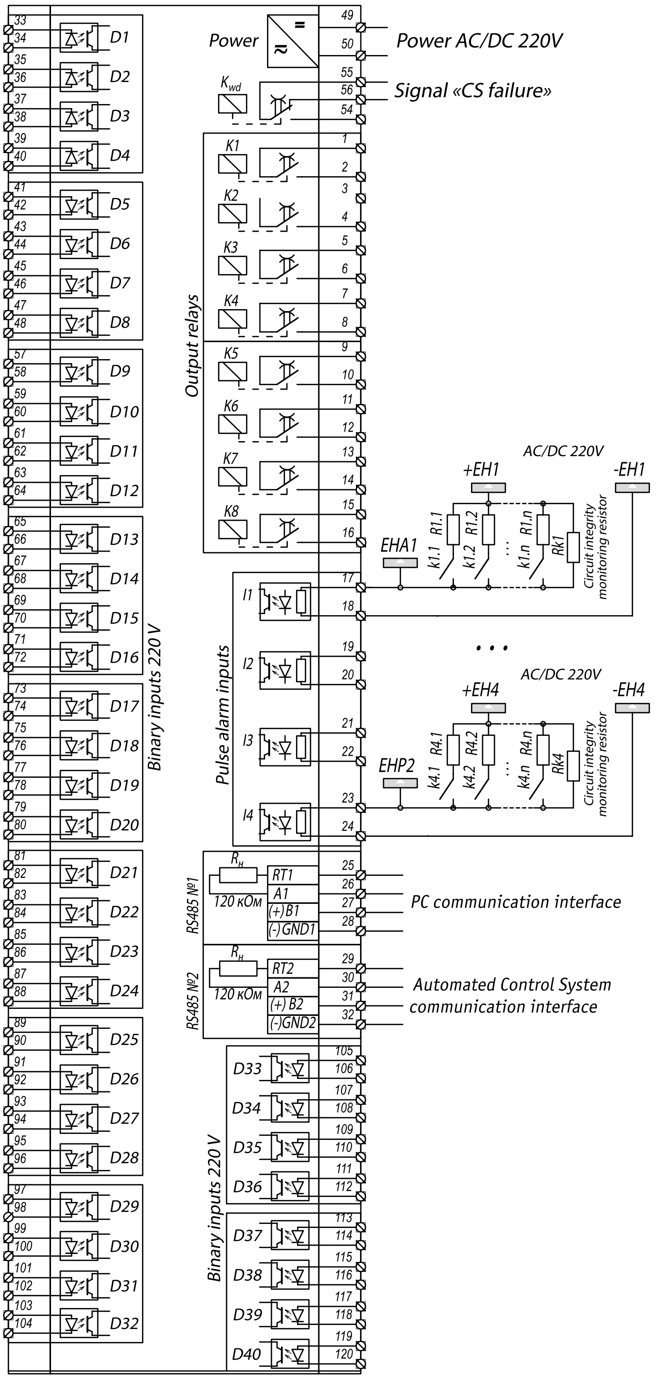
The **RZL-05.CS** is a microprocessor-based annunciator device for centralized supervision alarm systems of electrical substations, power plants and other facilities, equipped with relay protection and automation devices.

Functions

- Annunciator device for operation from NO or NC contacts.
- Adjustable time delay.
- LED-indication of each alarm channel.
- Collecting signals from output contacts of relay protection and automation devices.
- Alarm and warning signals receiveing with adjustable time delay, ensuring action repetition and visual (light) indication;
- Receiving signals of the position of switching devices with visual (light) indication;
- Receiving signals from auxiliary signaling buses with ensuring repeatability, visual (light) indication and diagnostics of auxiliary buses.
- Receiving signals from signaling buses, in response to a sudden current changing, ensuring repetition of action, visual (light) indication.
- Compatible with a wide range of typical configurations of supervision alarm auxiliaries.
- Local and remote alarm reset.
- Sound alarm control separately for alarm and warning circuits with the possibility of automatic reset with time delay;
- Group and extended alarm signals, apart for emergency and warning alarms.
- Critical and warning audible alarms separation.
- Adjustable audible alarm length.
- Event reporting.
- Nonvolatile memory of event logs and device settings.
- Serial data transfer interface.

Technical parameters

Power supply units parameters	
Operating voltage range, DC or AC	90 – 254 V
Power-on availability time	1 s
Operating supply interruption	0,5 s
Device burden	9 Wt
Number of independent power supply channels	1
Input current range continuously	2,5 – 20,0 A
Current input parameters	
Rated input current	50 mA
Line current inputs number	4
Measurable current range	0,03 – 2,0 A
Input resistance	1 Ω
Maximum number of signals (I=50 mA)	30
Time delay settings range	0 – 99 sec
Current circuits thermal withstand, continuous / 1s	2 / 10 A
Communication	
Communication interfaces	USB - 1 pcs, RS-485 - 2 pcs
Data Protocol via RS-485	MODBUS RTU
Connection speed	9600...38400 bps
Binary input parameters	
Number of inputs	40
Rated AC, DC voltage	220 V
Response voltage level	132 – 176 V
Response time	not less 40 ms
Current consumption at 220 V: - power-on current - continuous	 20 mA 4 mA
Maximum voltage, continuous	310 V
Time delay settings range: - operation - return	0,01 – 99,0 s 0,01 – 99,0 s
Binary output (relay) parameters	
Number of binary outputs	9
AC voltage trip	400 V
Maximum AC current	8 A (16 A for K1 output)
DC voltage trip	300 V
Maximum DC LR-circuit trip current τ≤20ms	0,3 A
Other	
Mounting type	Flush
Device dimensions (WxHxD)	300x240x128 mm
LED indicators total / configurable	48
Operating ambient temperature range	- 40 to + 55 °C
Maximum Humidity at 25 °C	98 %
Insulation resistance, more than	50 MΩ
Insulation overvoltage withstand, Instantaneous / continuous	2,0 kV , 50 Hz 5,0 kV pulse
Weight, less then	5 kg



Wiring diagram of external circuits to the devices **RZL-05.CS**

URCH-3M-S

POWER SYSTEM LOAD-FREQUENCY CONTROL AND AUTOMATICS

Three independent channels for frequency monitoring

Frequency value indication

Environment temperature -40°C ... +55°C

Integration in SCADA-system

Frequency change speed monitoring

Application

URCH-3M-S is an electronic relay series designed for power system **frequency monitoring, automatic frequency load shedding and automatic generation control.**

- Three independent channels for frequency monitoring and three independent output relays with setting frequency and reaction/release time.
- LED display for current frequency value indication.
- Environment temperature withstand deviates from -40°C to +55°C range.

Functions

The relay is a part of power system stability control and automation complex. It provides the following functions:

- Automatic frequency load shedding (ATLS);
- Frequency-actuated auto-reclosing (FAR);
- Automatic reserve generator start/stop (ARGS);
- Operating permission on frequency reduction rate;
- Frequency automatic network split automatics;
- Frequency decrease/increase auto-limitation.

Features

URCH-3M-S device can be used for hydraulic generators self-synchronized smooth start, for alarm signal on emerging water turbine rotor speed. Quantity rotor speed is controlled by monitoring the frequency of the generator of water turbine

URCH-3M-S, URCH-3M-S-01, URCH-3M-S-02 modifications are unified frequency control relays.

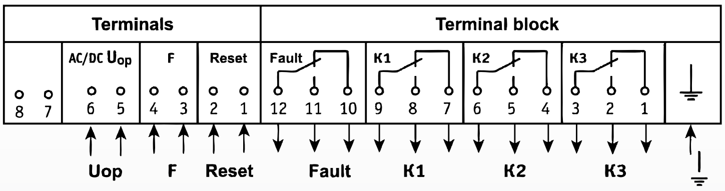
URCH-3M-S-01 relay is intended for automatics schemes of hydraulic generators.

Relay **URCH-3M-S-02** has additional input to control back-up power sources (generators or two separate electrical grids). Unload automation feature provides scheduled load group outage (or transfer to back-up power source) in order of their priority. Initial scheme auto-restoration on recovery. Other functions and technical characteristics conform to the functions and technical characteristics of relay URCh-3M-S.

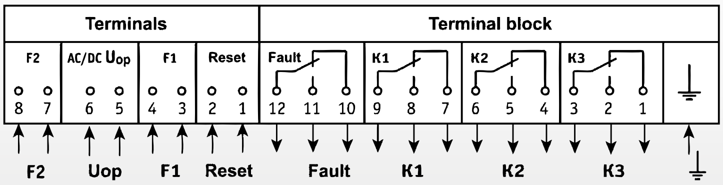
Devices auxiliary and monitored power grid and quantized input “External reset” and also the relays have terminal block with switching contacts of output relays and the relay “Fault”.

URCh modification produced in the same shell coating (HxWxD dimensions 85x140x136 mm; 0,9 kg weight).

Connection diagrams

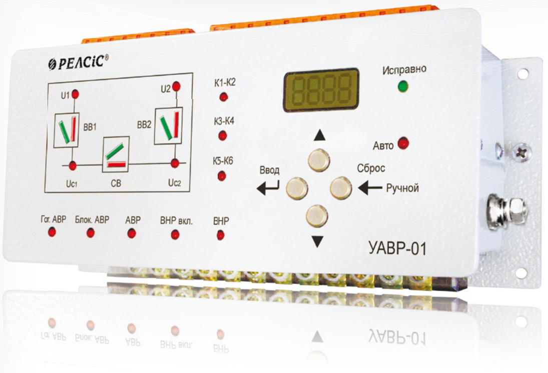


URCh-3M-S, URCh-3M-S-01 connection diagram



URCh-3M-S-02 connection diagram

UAVR-01



AUTOMATIC LOAD TRANSFER DEVICE

Application

Load transfer automation device UAVR-01 model standard for automatic switching to the reserve power source on main source fault. UAVR-01 devices may be applied for automation of power distribution facilities such as substations and switchgears of 0.4 - 45 kV with two busbar sections.

UAVR-01 also provides an automatic restoration of initial power supply scheme on main power source recovery.

Features

- High operating characteristics.
- Voltage measurement and indication on the inputs.
- Two operating modes of the function the automatic restoration of the normal mode.
- Built-in digital display.
- Service simplicity.

Functions

- Monitoring of two power sources availability via linear voltage transformers or auxiliary transformers.
- Voltage availability check on each busbar section.
- No auxiliary supply required (power supply from voltage measuring circuits).
- Operating with or without automatic initial scheme restoration on main source recovery.
- Adjustable startup voltage settings.
- Load transfer start-up with redundant source voltage check.
- Initial scheme restoration can be set to switch with no supply interruption.
- LED indication of primary apparatus state.
- Auto-load transfer and restoration of initial scheme blocking on discrete input.
- Continuous self-monitoring and serviceability diagnostics.

Technical parameters

Voltage inputs and power supply parameters	
Number of voltage inputs	4
Rated voltage (linear) Ur	100, 220, 380 V
Measured values range, % Ur	20-120 %
Basic error of voltage measurement	±5,0 %
Voltage decrease setting range	30-80 %
Voltage setting range for automatic load transfer on the serviceable section	80-120 %
Operation time setting range	0,5-30,0 s
Device burden	5 Wt
Overvoltage resistance	1,2 Ur
Binary inputs	
Number of inputs	6
Internal source voltage (depending on input rated voltage)	80-150 V
Number of voltage control inputs	2

Binary outputs	
Number of outputs	8
Maximum DC voltage trip	300 V
Maximum AC voltage trip	400 V
Maximum AC current	8 A
Maximum DC current, LR=20 ms	0,3 A
Continuous current withstand	5 A
General technical parameters	
Operating ambient temperature range	-40...+ 55 °C
Testing voltage	2000 V
Insulation resistance	50 MΩ
Weight, less then	2 kg
Device dimensions (WxHxD)	200x144x82 mm
LED indicators	15

AL-5

Overcurrent Relay

Universality: the wide range of actuating currents from 1 to 99 A in the same version with time delay from 0,1 to 99 s

The possibility of connection for using in one-phase and two-phase modes.

Using of inexpensive and reliable protection devices AL-5 series will allow to solve a problem of replacement of the outdated equipment with small financial and labor expenses.

Application

Two-phase current relays of AL-5 series are two-stage overcurrent protection devices, intended for power system protection and automation. The relays are powered from same current transformers circuits they control and do not require additional auxiliary supply.

The AL-5 devices can be used to replace a wide range of stale old-type electromechanical overcurrent relays (e.g. RT-80, RT-90, RS-80, RST-80 series etc.).

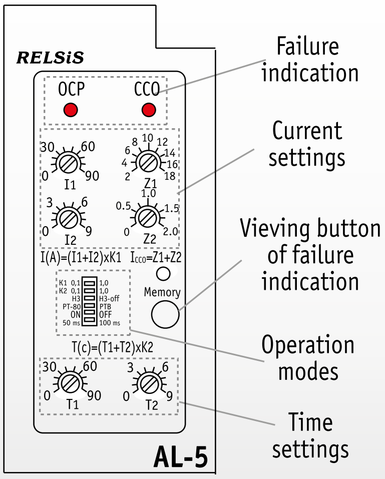
Operational capabilities

- Overcurrent protection (OCP) with one independent and two dependent time-current characteristics chosen by microswitches on the front panel.
- Current cutoff (CCO) with time delay settings (50-70) ms and (100-120) ms adjustable on the front panel.
- Current cutoff function may be manualy disabled on front panel.
- Current cutoff function may be applied to perform Logic selectivity busbar protection by using external protection blocking contact.
- OCP current settings are the same for two phases. CCO current settings are multiple to OCP current from 2 to 20 with a step 0,25.
- Two protective binary outputs.
- Up to 12 hours uninterruptable triggered LED-indication of output relays operation.

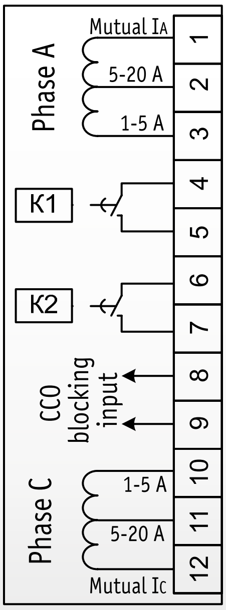
Version	Functions of output contacts		RB CCO*	Delay of CCO, ms	The replaced analogs
	Output 1	Output 2			
AL-5-1	CCO + OCP	CCO + OCP	no	50; 100	2 relays RT-81, RT-82, RT-91; 1 relay RS80M2-1,5
AL-5-2	CCO + OCP	CCO + OCP	yes	200; 400	1 relay RS80M2-1,5i (AL-5-2)
AL-5-3	CCO + OCP	CCO	no	50; 100	2 relays RT-81, RT-82, RT-91; 1 relay RS80M2-2,6
AL-5-4	CCO + OCP	CCO	yes	200; 400	1 relay RS80M2-2,6i (AL-5-4)
AL-5-5	CCO + OCP	OCP	no	50; 100	2 relays RT-83, RT-84; 1 relay RS80M2-3,7
AL-5-6	CCO + OCP	OCP	yes	200; 400	1 relay RS80M2-3,7i (AL-5-6)
AL-5-7	CCO	OCP	no	50; 100	2 relays RT-83, RT-84; 1 relay RS80M2-4,8
AL-5-8	CCO	OCP	yes	200; 400	1 relay RS80M2-4,8i (AL-5-8)
AL-5-9	CCO + OCP	OCP start-up	no	50; 100	1 relay RS80M2-9,16,17
AL-5-10	CCO + OCP	OCP start-up	yes	200; 400	1 relay RS80M2-10,15,15i

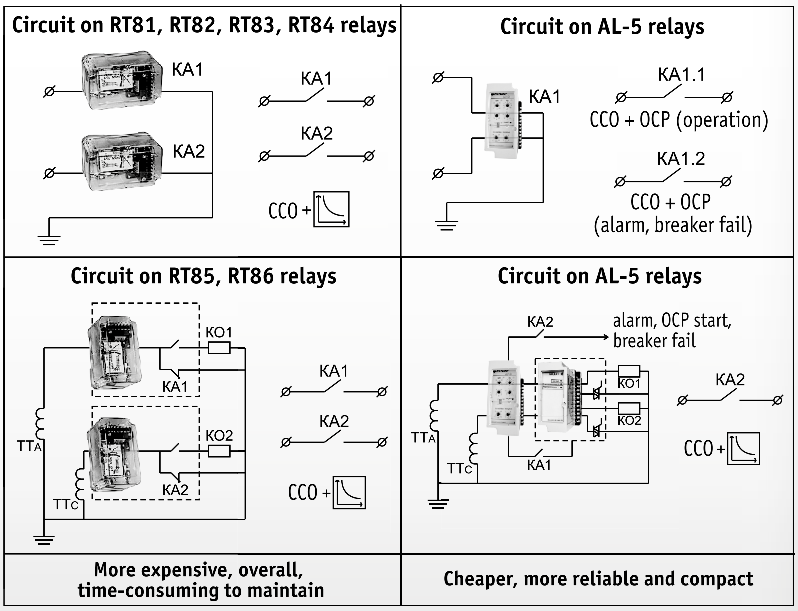
*remote blocking of a current cut-off.

Versions AL-5-9 and AL-5-10 have additional output of instant OCP start (≤ 50 ms).
Universality: the wide range of actuating currents from 1 to 99 A in the same version with time delay 0,1…99 s. There is the possibility of connection for using in one-phase and two-phase modes.

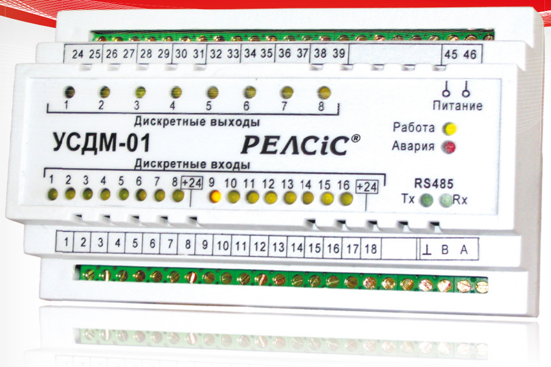


Connection diagram




Circuit on RT81, RT82, RT83, RT84 relays
KA1
KA2
KA1
KA2
CCO +
Circuit on AL-5 relays
KA1
KA1.1
CCO + OCP (operation)
KA1.2
CCO + OCP
(alarm, breaker fail)
Circuit on RT85, RT86 relays
KO1
KA1
KO2
KA2
TTA
TTC
KA1
KA2
CCO +
Circuit on AL-5 relays
KA2
alarm, OCP start, breaker fail
KO1
KO2
KA1
TTA
TTC
KA2
CCO +
More expensive, overall, time-consuming to maintain
Cheaper, more reliable and compact

USDM-01



Collecting Device of the Discrete Data

Application

USDM-01 is the collecting device of the discrete data and control with the data transmission via **MODBUS RTU** Protocol.

The device is intended for the transmission of the discrete signals condition of the automation object to the monitoring (control) system and also for the implementation of the system commands via the built-in relays. It can also be included in the system of data collection and relay or/and circuit-breaker control, in switchgear cells of power plants and substations.

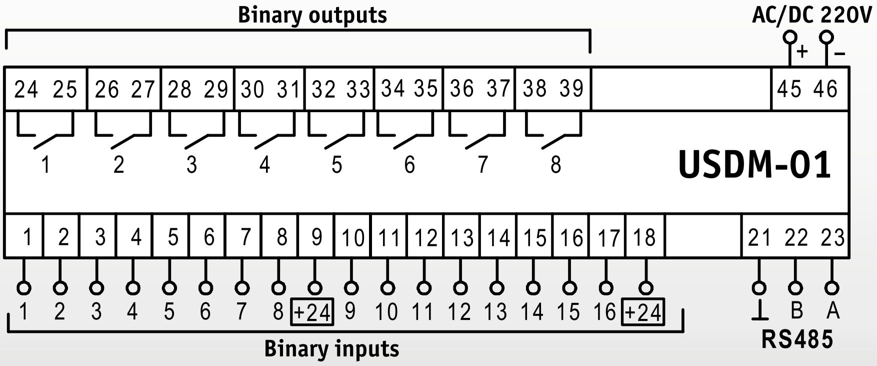
Operational capabilities

- Transmission of discrete input signals.
- Execution of system commands through built-in relays.
- Optocoupler-insulated inputs, outputs, power supply to ensure high interference immunity.
- The device has a communication channel for transfering the data about binary outputs status to the computer upon request, viewing and changing device settings, and remote control of binary outputs.

Technical parameters

Power supply	
Operational voltage	AC/DC 90-250 V
Frequency range	45-55 Hz
Rated frequency:	50 Hz
Power consumption, no more	3 VA + 0.25 VA for each coupled binary output
Short-term power failure	500 ms
The device is ready to work after power supplied	500 ms
Binary inputs	
Number of binary inputs	16
Control voltage DC, Urat	24 V
Dry contact control via built-in source + 24V / 2mA per each binary output	logic «1» > 0,8 Urat logic «0» < 0,7 Urat
Maximum dry contact resistance	200 Om
Binary outputs	
Number of output command relays	8
Binary inputs interrogation voltage (USDM-01 outputs)	24 V
Closed output relay time	100 ms
Switching power of relay contacts no more than:	
- switching AC circuits	220 V, 5 A, 1000 VA (cosφ=0,6)
- closure DC circuits	250 V, 0,4 A (τ=30ms)
- breaking DC circuits	30 Wt
- long-term allowable current	5 A
General technical parameters	
The range of ambient temperature	-30 .. + 55 ° C
Mount	DIN-rail 35 mm
Dimensions / mass, no more	140x90x63 mm / 350 g

Wiring diagram



SCADA RELSiS

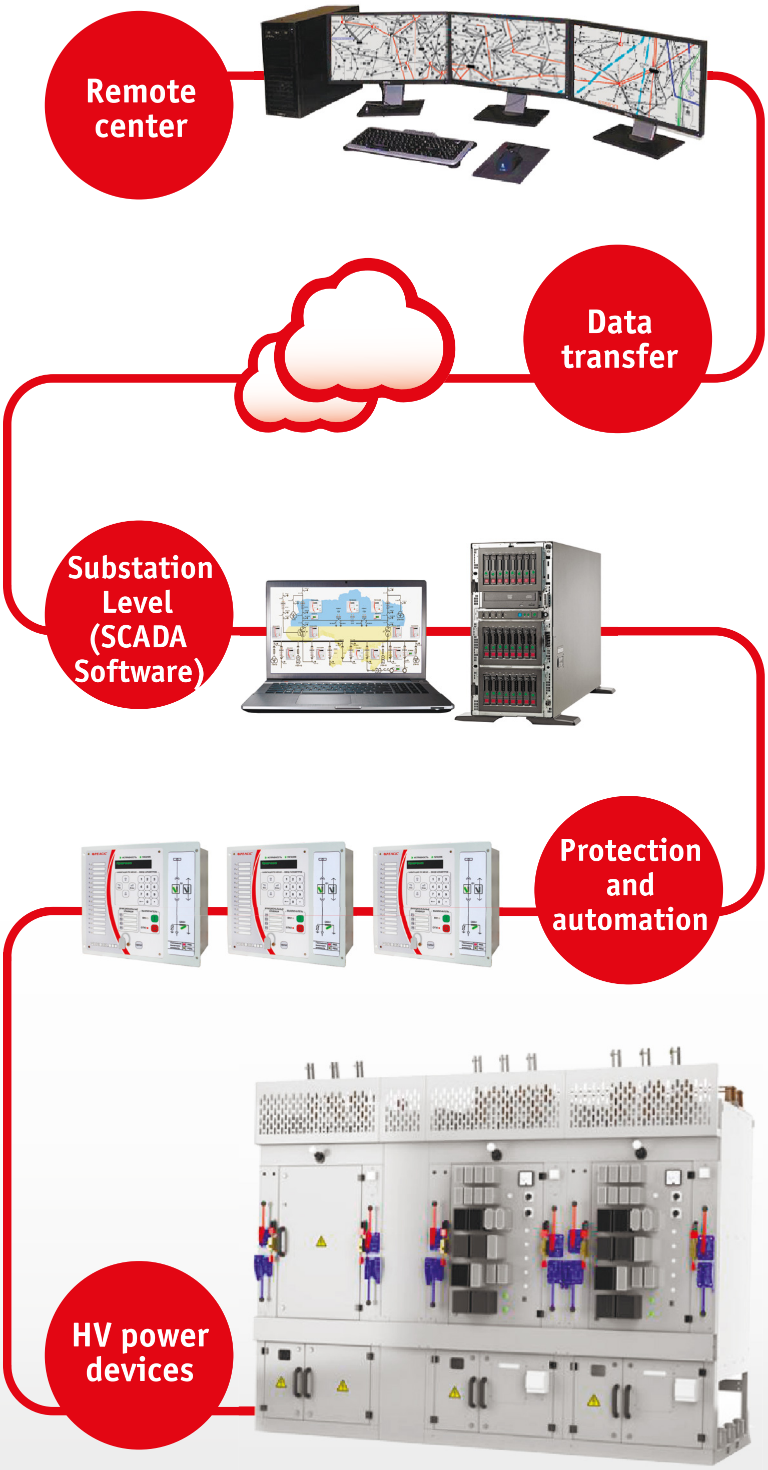
Automated control system RELSiS - industrial control system of substation level for local and remote control and monitoring.

Solution on management of accession on the basis of the Modbus protocol - the distributed building block system of management on microprocessor relays and controllers. A simple and flexible solution taking into account all wishes of the customer. The system can be expanded additional functionality.

Easy integration in the system of IED RELSiS - receiving the maximum return from implementation of end-to-end solution "devices a system".

Integration IED of other vendors under the Modbus protocol.

The system can work as the bottom low hierarchical level for distributed SCADA.



Implementation purpose

- Development of a reliable system of the automated, centralized monitoring and management.
- Monitoring of processes in real time (on-line).
- Providing operation personnel with reliable information.
- Creation of the modern automated clients PC.
- Increase in efficiency of response of personnel to alarms or fault.

Functions of a system

- Monitoring of events - data collection and processing from the protection terminals, IED, controllers (RTU).
- Visualization of the obtained and processed information on events and accidents in formats, usual for the user, - symbolic, diagrams, oscillograms, tables.
- Dispatching sheets.
- Reports on measurements, events, alarms.
- Tracking of deviations from the normal state.
- Fixing of diagrams of loadings, control of balances and overflows of capacities at the level of feeders and substation. Control of production schedules.
- Archiving of data with a possibility of viewing of a retrospective of succession of events.
- Providing the authorized remote control with a switching equipment with control of powers of the user, considering blocking (hardware and program).
- Possibility of remote setup and monitoring of a system.
- Time synchronization of devices and components of a system.
- Diagnostics of a status of components of a system.

Structure of a system

- The kernel of a system is based on Microsoft SQL Server.
- The number of clients is not limited, installations of the special software for access to a system are not required.
- Access to a system is carried out on technology web from the personal computer, the laptop, the tablet, the smartphone.
- A possibility of connection of an automated workplace of operation personnel on the basis of any operating system - Windows, Linux, Mac OS, Android, iOS.
- A possibility of connection of an automated workplace of personnel of service IED through SCADA-RELSiS ACS on the basis of the operating system - Windows.
- The SCADA-RELSiS ACS flexible setup is provided thanks to building block system and by means of the collateral specially developed software.
- Simple and intuitive and clear HMI.
- Big library of reference designations of elements of symbolic circuits. Possibility of inclusion in library of designations and User's elements.

Features of a system

- Adaptation of a system under specific requirements of the Customer.
- Speed and simplicity in connection of new automated workplaces.
- Scalability of a system - step-by-step connection of the equipment, expansion of a system without interruption in operation of the capital equipment.
- Integration devices of Relsis of different generations, devices on the basis of simple relays and devices of other vendors under the Modbus protocol.
- Possibility of connection of additional signals.
- Implementation of ACS taking into account the existing Customer's equipment.
- The system is not exacting to resources of ADP equipment of the Customer and does not demand its upgrade.
- Safety in operation and simplicity in operation.
- Centralization of all operational information: it is a lot of sources - the uniform database.
- Display of the single line diagram of an object with transitions on detailed mnemo-frames.
- The visual and sound alarm at deviations from the normal state (parameters).

Safety

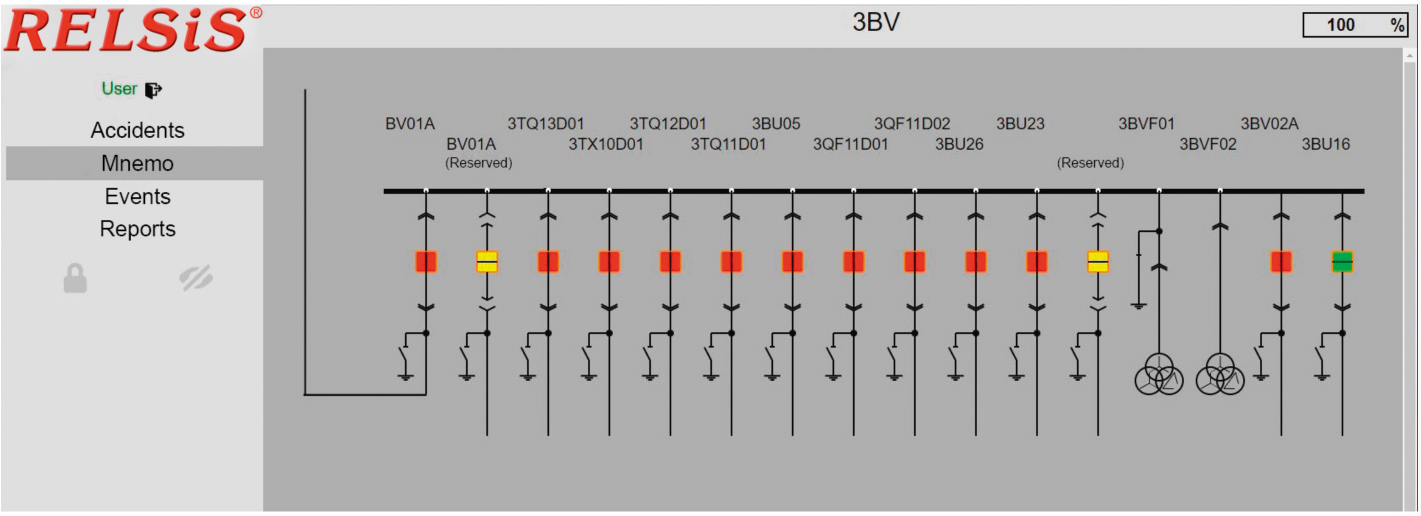
- The three-level security system with obligatory authorization of the user guarantees the reliable and protected management of an object.
- Access to resources taking into account the user's powers - viewing, management, engineering and administration of a system.
- Use of the HTTPS protocol.
- Full integration with the existing program and hardware information security systems.

Demo-box

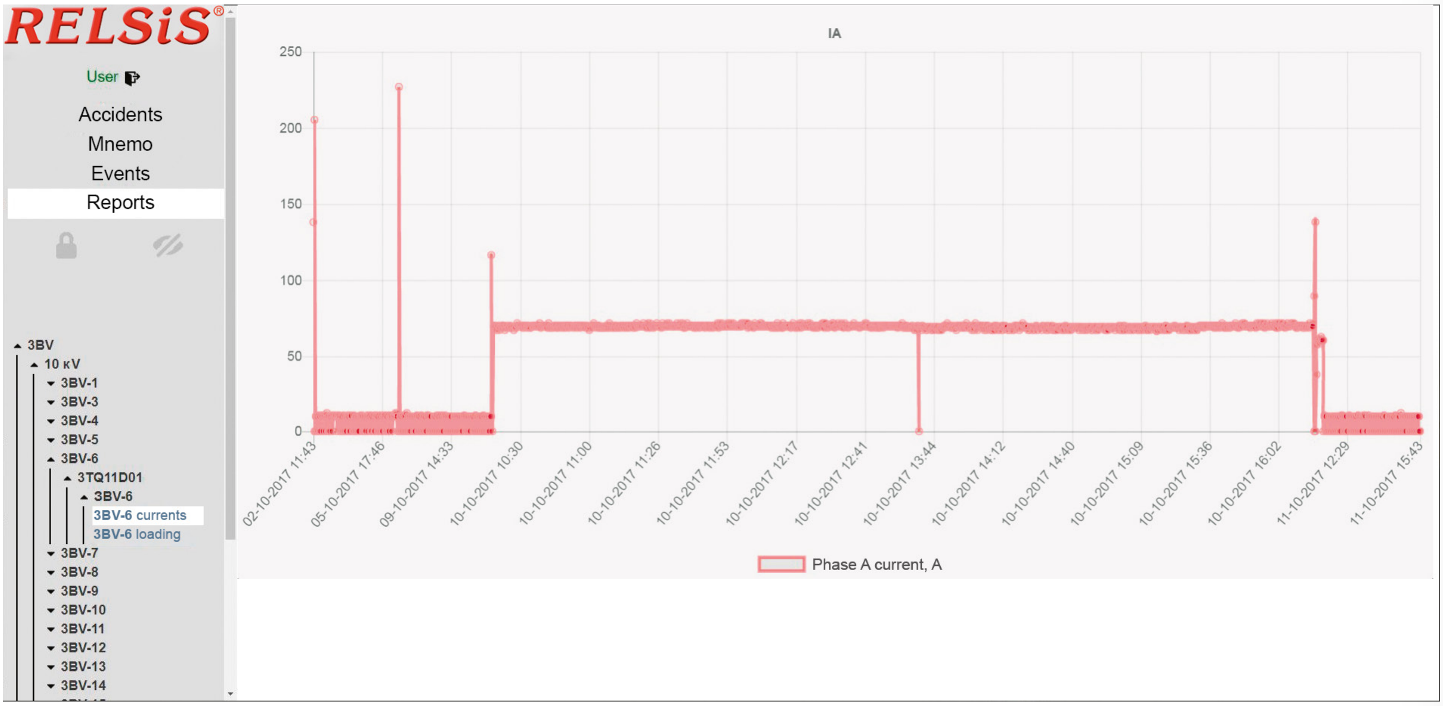
Specialists of the enterprise are ready
hold the work presentation
management systems of SCADA RELSiS.

Maintenance and support

- Complete set of operational documentation.
- The skilled staff of NPP RELSiS will help the customer at any stage of implementation or operation of ACS of SCADA-RELSiS.
- The help at design of new also retrofits old objects.
- Preparation and training of personnel on the basis of NPP RELSiS.
- Support when carrying out scheduled works.
- Service and information support.



Mnemonic scheme of automated control system substation «SCADA RELSiS".



An example of information output from the ACS "SCADA RELSiS" in the form of a graph.

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