



SO-54SR-111-REK-1.4

Control unit with protection functions for THO-RC27 recloser

The SO-54SR-111-REK-1.4 control unit with protection functions is designed to support overhead recloser-type circuit-breakers THO-RC27 manufactured by ZPUE S.A., operating in SMART GRID-type power networks, especially in realizing telemetry and automation functions related to the FDIR functionality.

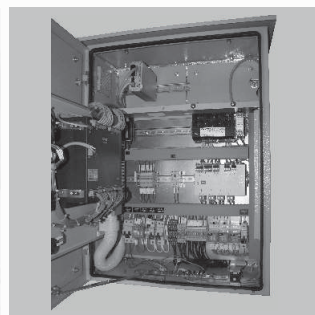
The SO-54SR-111-REK-1.4 controller with protection functions is a main component of a control unit for the THO-RC27 overhead recloser-type circuit-breaker by ZPUE S.A.

The controller is installed in SRC-1 control cubicles of THO-RC27 reclosers, suitable for mounting on each type of an electric pole..

The controller integrates measurement, protection, automation, control, telemetry and multichannel disturbance and event recorder functions. It is equipped with the following protection units: current, earth-fault, voltage, frequency and the following automation functions: AR, SOTF and 2ndHIR.

Advanced communication resources enable operation in Ethernet, GPRS/UMTS/LTE-APN, TETRA (using an external terminal) networks and in radio transmission in dedicated and open channels in standard communication protocols.

To provide an appropriate level of security and data confidentiality, cyber-security mechanisms compliant with the PN-EN 62351 standard have been implemented in the controller.



Structure

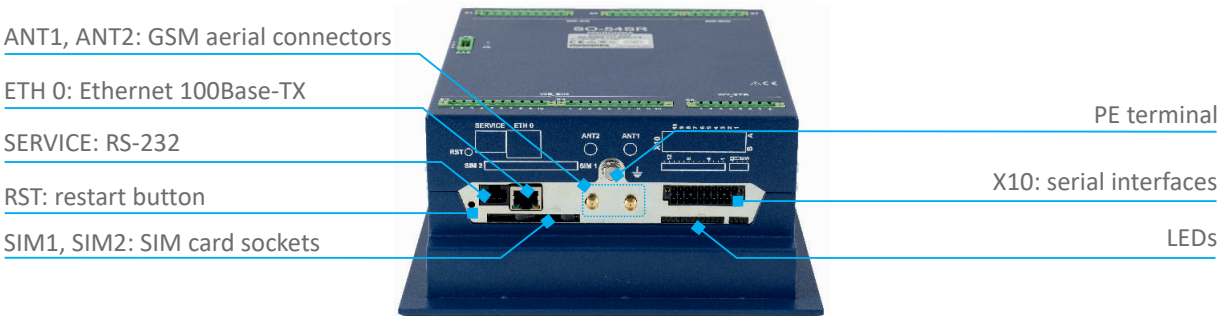
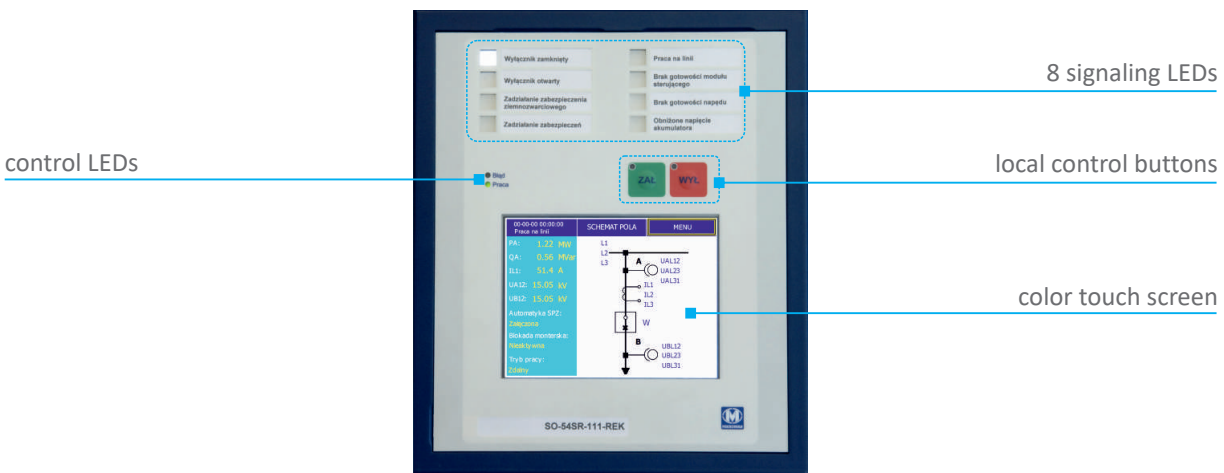
The controller is manufactured in a dedicated panel casing. It is very resistant to environmental conditions. It is equipped with a user's panel consisting of a graphic terminal with a touch screen, an additional module with 8 signaling LEDs, 2 control LEDs (Error, Operation), and ON/OFF buttons.

The power supply of the controller is galvanically separated from communication interfaces and logic units, what ensures high reliability of operation, resistance to damage caused by overvoltages and insensibility of transmission to interferences.

The controller is equipped with 20 galvanically separated binary inputs, 4 galvanically separated binary outputs, 3 analog inputs for current measurements from Rogowski coils and 6 voltage measurement inputs applying capacity dividers. All inputs and outputs are available from the back of the device.

The device is equipped with the following communication resources: 1x Ethernet 100Base-TX, 2x RS-232, 2x RS-485, x1-Wire interface and a service RS-232 interface.

All communication interfaces are available from the bottom of the device.



Configuration and diagnostics

Remote and local configuration and diagnostics of the controller is realized using a dedicated configuration-diagnostics software, pConfig. Diagnostics of the controller is also possible by means of a WWW interface, SMS messages and telemetry protocols. The access to the controller is possible over an Ethernet network or GPRS/UMTS/LTE-APN.

Telemetry functions and protection automation

The controller realizes required telemetry and protections functions, as well as automation in networks with various manners of neutral point operation, i.e. compensated with the zero-sequence resistive current forcing arrangement automation, with the neutral point earthed through a resistor or the neutral point isolated.

States of all inputs, values of measurements and operation of protections units or automation are sent on-event or may be cyclically read by a SCADA supervising system. The controller has four banks of settings, what eases operation significantly, especially when it is necessary to reconfigure a power network quickly.

Detection of faults is based on the following measurements:

- three phase currents from Rogowski coils – the $3I_0$ current is calculated
- three voltages with the use of reactance dividers – the $3U_0$ voltage is calculated basing on these measurements

The following protection units and automation functions are available in the controller:

NO.	SHORT NAME	NAME	ANSI CODE
1	I1>>	independent overcurrent protection	50
2	I2>>	independent overcurrent protection	50
3	I3>	independent overcurrent protection	50
4	I4>	independent overcurrent protection	50
5	I5>	dependent overcurrent protection	51
6	IS>	protection against current asymmetry	46/46BC
7	U<<	undervoltage protection	27
8	U<	undervoltage protection	27
9	U>	overvoltage protection	59
10	U ₀ >	overvoltage protection	59N
11	I ₀ >	earth-fault overcurrent protection	50N
12	I ₀ >>	earth-fault overcurrent protection	50N
13	I _{ok} >	earth-fault overcurrent directional protection	67N
14	G ₀ >	conductance protection	-
15	B ₀ >	susceptance proception	-
16	Y ₀ >	admittance protection	-
17	f<	under-frequency protection	81U
18	f>	over-frequency protection	81O
19	df/dt	protection against frequency change pace	81
NO.	SHORT NAME	NAME	
1	AR	Automatic Reclosing	
2	SOFT	Switch-On-To-Fault	
3	2ndHIR	Second Harmonic Inrush Restraint	

Event recorder

It is an event log available by means of the pConfig configuration program and in a SCADA dispatching system. The event log records all events related to a supervised object. A time marker, assigned with the 1ms resolution, enables to analyze actions undertaken both during normal exploitation, comprising switching on and off, changing setting banks and configurations, as well as emergency situations.



Disturbance recorder

The controller is equipped with a multichannel disturbance recorder which is able to save oscillograms of analog values, both measured and calculated, binaries representing inputs and outputs and internal states of the controller itself.

The disturbance recorder of the controller may be triggered by a pickup or operation of each protection unit and from closing a circuit-breaker.

Analog courses of disturbances and binary signals are saved in a non-volatile memory in the COMTRADE standard and are available both locally and remotely, by means of a remote service link.

Cyber-security

Cyber-security solution applied in the controller are based on ENISA, NIST, BDEW and BlueCrypt recommendations. Implementation of these mechanisms is compliant with the PN-EN 62351, IEEE P1686, PN-ISO/IEC 27001, BDEW White Paper „Requirement for Secure Control and Telecommunication Systems”. The above solutions include:

- secure communication
- access control
- sensitive data protection
- logging/monitoring users' activity

Specific functionalities are configured using the pConfig configuration-diagnostic software.

Communication with SCADA systems

The controller may operate in local or vast GPRS/UMTS/LTE-APN and/or ETHERNET networks. By default, the DNP 3.0 or PN-EN 60870-5-104 protocols are applied for communication with SCADA systems. It is possible to apply also other communication protocols, e.g. PN-EN 60870-5-101, PN-EN 60870-5-103, Modbus-RTU, Modbus-TCP. The controller is able to operate as a converter of these protocols. The device is also capable of cooperating with the TETRA system. An external radio TETRA terminal can be connected to the controller using the serial interface.

Main technical data

Power supply

PARAMETER	STANDARD	EXPOSURE VALUE	TEST LEVEL	CRITERION
power supply	PN-EN 60870-2-1	24V	-20/+20%	DCx
average power consumption	-	15W	-	-

Inputs and outputs

TYPE	NUMBER	VOLTAGE CURRENT	NOTES
binary inputs	20	24V 3mA	
binary outputs	4	24V 0.5A	
voltage analog inputs	6	-	capacity divider (20÷31pF capacitor)
current analog inputs	3	-	Rogowski coil 1 mV/1A

Electromagnetic compatibility (EMC)

Within EMC emission and resistance the controller meets the requirements for a typical electric environment class B according to the PN-EN60255-26:2014P standard. The device meets also the PN-EN 61000-6-2 standard within EMC for resistance in an industrial environment and the PN-EN 61000-6-4 standard within emission.

