



# SO-54SR-3xx

## control unit with fault indicator and sectionalizer functions

SO-54SR-3xx controller is intended for performing remote engineering and automation functions required by Smart Grid technology and FDIR modules.

It is equipped with an integrated module of fault indicator and analyser, operating basis on measurements of three currents and three phase voltages.

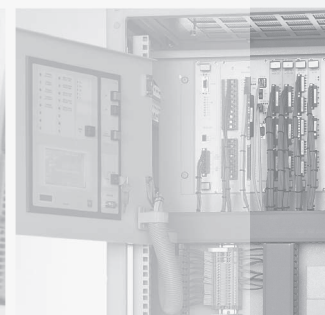
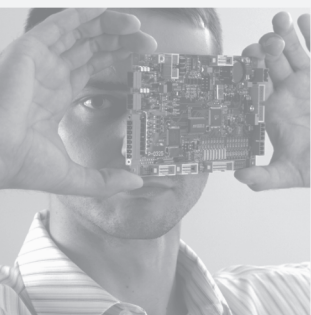
The SO-54SR-3xx controller is designed to support overhead and internal MV disconnectors, MV/LV transformer substations, as well as independent fault indicators. It integrates functions of measurement, control, remote engineering, fault indicator, sectionalizer and disturbance recorder.

Advanced communication resources support its operation in diverse networks based on Ethernet, GPRS/UMTS/LTE-APN, TETRA transmissions and radio transmission in dedicated and open channels.

SO-54SR-3xx performs measurements of currents and phase voltages in MV line. The controller realizes protection functions, such as detection of inter-phase faults and ground-faults. The controller is also equipped with a functionality of a sectionalizer - during phase/ ground faults the controller opens the supervised disconnector in the pre-set dead period of recloser cycle.

Communication with SCADA system is performed via GPRS/UMTS/LTE-APN network with the use of built-in 2G/3G/4G modem in standard communication protocols. USP-140 is also adapted for connection of external terminal of TETRA. The controller provides simultaneous communication with SCADA systems in TETRA and GPRS/UMTS/LTE-APN.

In order to assure security and confidentiality of data processed by SO-54SR-3xx unit, a set of cyber security mechanisms, compliant with IEC 62351 standard, are implemented in the controller.



## Construction

Metal enclosure of SO-54SR-3xx controller is designed for mounting on 35mm DIN. The controller is highly resistant to environmental conditions. It may be installed inside a cabinet and, after mounting additional side brackets, wall-mounted. Power supply is galvanically separated from communication interfaces and logic circuits. Galvanic separation assures operational reliability, resistance to surges, transmission invulnerability to disturbances.

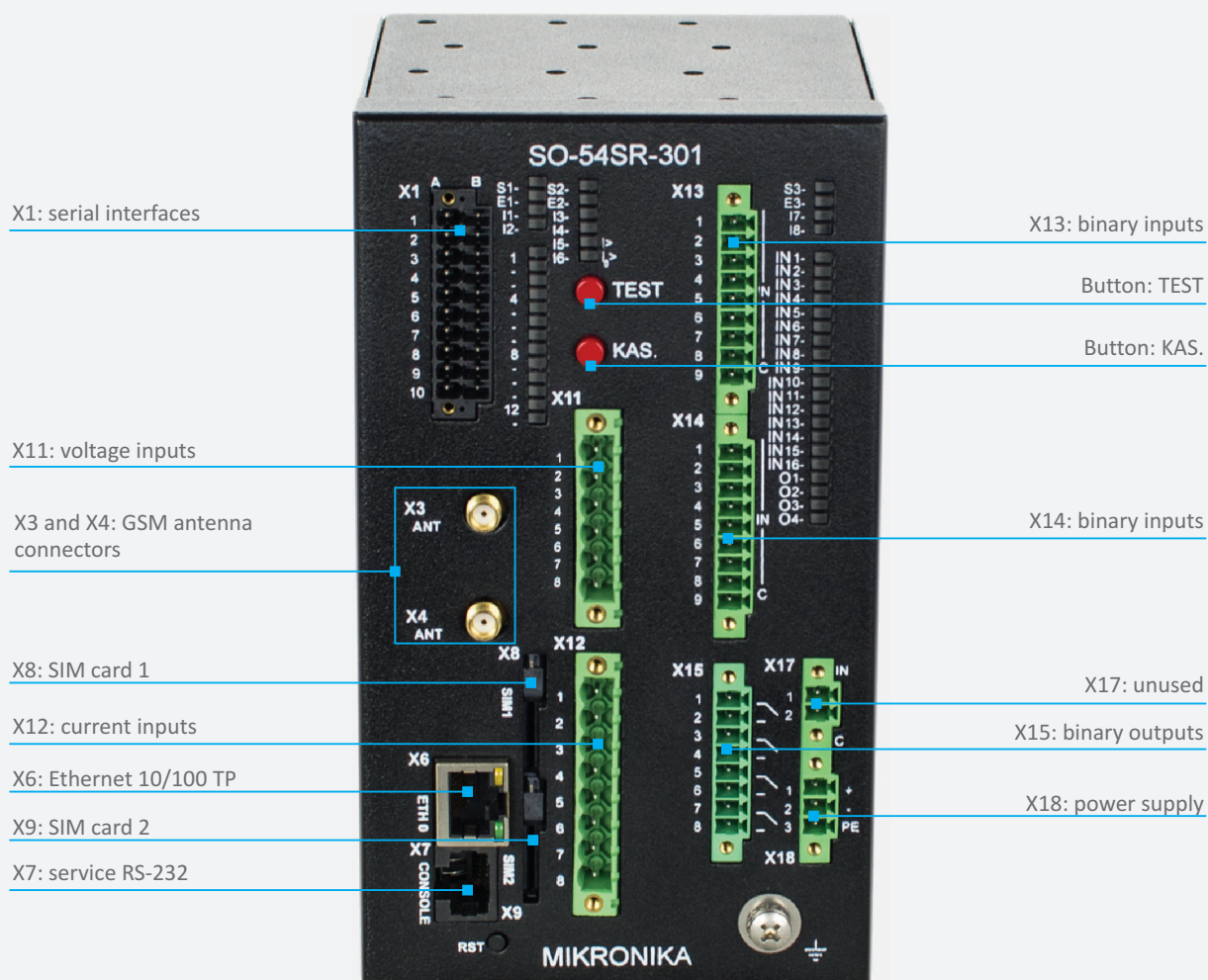
The controller is equipped with galvanically separated binary inputs for status acquisition from objects and with galvanically separated binary outputs for controls.

Available analog inputs serve for measuring currents from current transformers, Rogowski coils or other sensors, as well as for measuring voltages from reactance dividers or other sensors.

Quantity and types of binary inputs, binary outputs and analog inputs depend on the controller's version.

All interfaces are available on the front. The view of the controller together with its interfaces and dimensions is presented on the next page.

## SO-54SR-301 controller





## Telemetry and protection function

SO-54SR-3xx controller performs remote engineering and protection functions of fault indicator and analyser in MV lines in scope of readout of binary inputs, current and phase voltage measurements and fault detection. Statuses of all inputs, values of measurements and fault indications are sent on event basis or may be read cyclically by SCADA system.

On the front panel of SO-54SR-3xx controller two buttons are available:

- TEST - for launching functional check of indicator with simultaneous sending information to SCADA system
- KAS. - for deletion of fault indication

The controller detects inter-phase and ground faults in networks with various forms of network neutral point operation:

- compensated with forcing the active zero-sequence current component
- with network neutral point earthed (grounded) with a resistor
- with insulated network neutral point

Detection of inter-phase and ground faults is based on measurement of:

- three voltage currents from current transformers and  $3I_0$  current, measured in Holmgreen circuit
- three voltages, with the use of reactance dividers or other sensors; these measurements serve for calculations of  $3U_0$  voltage

or

- three phase currents from Rogowski coils or other sensors; on a basis of these measurements  $3I_0$  current is calculated
- three voltages, with the use of reactance dividers or other sensors; these measurements serve for calculations of  $3U_0$  voltage

The following protection modules are available in the controller:

ABBREVIATIONS	NAME OF PROTECTION MODULE	SYMBOL
I1NP	definite-time overcurrent protection	I1>>
I2NP	definite-time overcurrent protection	I2>>
I4NP	definite-time overcurrent protection	I4>
I0NP	earth-fault protection	I0>
PKIER*	directional earth-fault protection	I0K>
PNY*	admittance-based earth-fault protection	Y0>
PNG*	conductance-based earth-fault protection	G0>
PNB*	susceptance-based earth-fault protection	B0>

\* protection modules available only in case of 3 currents and 3 phase voltages measuring

The unit is equipped with four setting groups, facilitating its operation especially in case when the necessity of introducing changes in power network configuration occurs.

## Event recorder

It is an event log accessible from the level of pConfig configuration software, as well as from the level of SCADA control and supervision system. It serves for logging all the events, related to the supervised object. Time stamp with 1ms resolution enables analysis of activities performed both during normal operation (including on/off switching operations, setting groups switching, introducing changes in configuration etc.) and in emergency situations.

## Disturbance recorder

SO-54SR-3xx controller is equipped with multi-channel disturbance recorder. Analog courses of disturbances are registered in non-volatile memory in COMTRADE standard and may be read locally or remotely, via service channel.



## Cyber security

Cyber security mechanisms deployed in SO-54SR-3xx controller are based on ENISA, NIST, BDEW, BlueCrypt recommendations; their implementation conforms with ISO 62351, IEEE P1686, ISO/IEC 27001, BDEW White Paper „Requirement for Secure Control and Telecommunication Systems" standards.

Cyber security mechanisms include:

- Communication security
- Access control
- Sensitive data protection
- Logging in / user activity monitoring

These mechanisms may be individually configured in pConfig configuration software.

## Communication with SCADA systems

SO-54SR-3xx controller communicates with SCADA system with the use of built-in 2G/3G/4G modem, Ethernet network or via RS-485, RS-422 and RS-432 connections, by various communication protocols. Communication with SCADA system, as standard, is performed with the use of DNP 3.0 or IEC 60870-5-104 protocols.

SO-54SR-3xx is also adapted to cooperate with TETRA system. External TETRA radio terminal may be connected to the controller via serial connection. The controller provides simultaneous communication with SCADA systems in TETRA and GPRS/UMTS/LTE-APN as well.

## Configuration and diagnosis

Dedicated pConfig configuration software serves for local and remote diagnosis of SO-54SR-3xx controller. Diagnosis is also performed via web interface, SMS and remote engineering protocols or SNMP v3 protocol, which enable connection of the controller to telecommunication network's monitoring system.

Configuration and diagnosis is realized via Ethernet interface or GPRS/UMTS/LTE-APN network.

