

**OUTDOOR REMOTE CONTROLLED CIRCUIT BREAKER mv 22 kV
(RECLOSER) TYPE OSM AND CONTROL AUTOMATIC UNIT SADS - AO 2.2 R**

Recloser is an outdoor circuit-breaker mv with vacuum chambers and magnetic drive. It is designed for automation of operation of overhead distribution network. It is integrated in the SADS system (system for automation of distribution networks) and except for remote control functions it provides automation and protection functions in addition. It provides automatic division of the faulty place in the remote part of the mv network from the power supply substation, building of simple outdoor substations, automatic reserves of supply lines, etc.



Recloser

The circuit-breaker type OSM is built as a compact unit consisting of a vacuum circuit breaker with magnetic drive - everything is closed in the sealed rustless case. The insulation is provided by polycarbonates, the SF6 is not used at all. All closing and opening operations occur in a vacuum chamber, that is why no decomposition components in the gas SF6 occur.

6 mouldings of rubber bushings are fixed to the circuit breaker case, in the space of these bushings there are current and voltage sensors. In the lower part of the case there is a mechanical trip ring for manual control of the recloser. The circuit breaker is controlled by a magnetic drive. With switching, direct current is supplied to the coil of the controller, after switching the controller is kept by a maintaining permanent magnet in this position. Switching-off is carried out by supplying of current impulse with reverse polarity to the magnetic controller coil.

Main technical data:

- type OSM 27
- nominal voltage 27 kV
- impulse withstand voltage 125 kV
- permanent nominal current 630 A/400 A
- making current 12 kA/12,5 kA
- breaking current 12 kA/12,5 kA
- sensors transformer
- external operating temperature -40°C to +55°C
- weight 145 kg
- full load operations 30 000

Automatic device for the recloser AO 2.2 R

It provides control of the outdoor circuit-breaker mv - recloser (R) and provides the following functions:

- independent overcurrent and short-circuit protection
- earth admittance and course protection (I_0 component)
- indication of current asymmetry (I_2 component)
- automatic reclosing - OZ
- local and remote control, monitoring and measurement - telecontrol
- special automation functions
- current sensors - Rogowski coil
- voltage sensors - capacity sensors

Recloser with this automatic device provides automation of operation of overhead distribution networks and building of outdoor mv substations with remote control and signalling.

Generally

- digital automatic unit based on a 16-bit one-chip microprocessor
- galvanic separation of analog and digital inputs and outputs
- auto-diagnostics and failure signalling
- high EMC interference resistance
- local and remote parameterisation of functions
- local visualisation of states, parameters and scanned magnitudes by a PC notebook
- service and testing device for control of protecting functions and response measurement
- integrated communication unit 110 and 1200 Bd, FSK, possibility of radio signal retranslation
- possibility of control by means of GPRS
- integrated charger of reserve accumulators with diagnostics and signalling

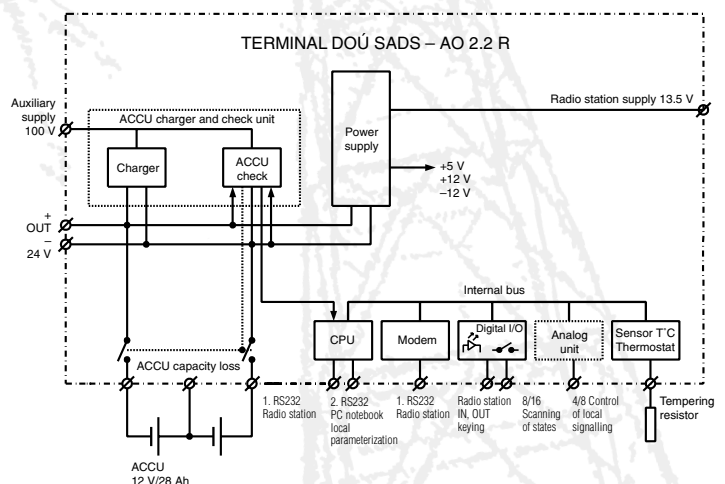


Fig.: Block diagram of the unit SADS AO 2.2 R

Technical solution

The terminal includes:

- central processor unit (CPU)
- communication unit (modem)
- unit of digital inputs and outputs
- unit of the galvanic part of analog signals (analog I)
- unit for measuring of analog signals (analog II)
- power supply unit
- unit of the charger with diagnostics ACCU

HW solution includes the central unit CPU based on the one-chip 16-bit microcomputer INTEL 196 with supporting circuits I/O, memories RAM, EPROM and EEPROM.

Input analog signals are separated galvanically by measuring transformers and subsequently processed in analog channels. Here they are level adapted. Overload protection, filtration of harmonic signals and multiplex sampling for A/D transfer are assured.

Output commands are separated by power relays and their meaning is HW assigned constantly to protecting function. The same is applicable for digital inputs that are separated optically by optical elements.

The central unit assures permanent self-tests during the terminal operation, in case of occurring a non-standard state, a signal "fault" is generated and the actuating output is interlocked. The processor is monitored by an independent circuit watchdog.

Important states of the terminal are signalled summarily by LED diodes on the front panel. The power supply is a converter DC/DC type and it is separated galvanically. Its efficiency is ca. 80 %.

A charger for permanent recharging of DOÚ accumulators and a power supply for a radio station are a part of the terminal.

The terminal includes a communication line that is switched over to the galvanically separated interface RS232 at connecting to the PC notebook through the connector CANON. At the notebook disconnecting the communication channel is connected to the output terminal box and according to choice on the modem there is the following interface:

- galvanically separated interface RS232 (radio station for trunk networks, modem GPRS)
- modem signals of the interface V.23 (radio station for phonical networks)

Construction:

The terminal is mechanically arranged in a metallic case that includes the external connecting terminal board. The printed board printer in the back part of the case provides electrical connection of the terminal board and the plug-in units. The front part is covered by a panel with signalling of important states by LED diodes. The front panel includes the connector CANON for connecting of the services PC notebook.

Terminal functions

- mv distribution line protections
- telecontrol function, monitoring and remote control
- communication with CPU on the district dispatching (RD)
- local visualization and control
- local and remote parameterization
- self-diagnostics
- charging of reserve accumulators and their diagnostics

Protecting functions

- overcurrent I > and short-circuit I >> independent protection (I)
- ground course protection (I₀)
- SW completion of the ground course protection on CPU CS SADS on RD
- current asymmetry (I₂)
- reclosing automatics OZ
- sequential protecting functions, interlocking and releasing of protecting functions

Independent overcurrent protection

Line current is measured in three phases if at least in two phases current exceeds the set comparative limit, the time delay element is started, after its elapse a temporary braking is generated under condition that its output is released.

- Two grades:** Short-circuit grade I >> parameters: up to 1000 A
Overcurrent grade I > parameters: up to 1000 A

Ground course protection (I₀ >)

The ground course protection uses two principles in combination:

- admittance principle $\Delta I_0 >$
- phase principle $\Delta \Phi(U_0, I_0) >$

The goal is explicit memory fault location „behind the recloser (R)“ from the point of supply direction view. These criteria are further completed by auxiliary admittance criterion that is SW implemented on CPU SADS-ŘS RD, that works at ambiguous function „fault behind“ at the recloser or DOÚ, see mentioned below.

The algorithm is independent on the supply direction R and DOÚ and it uses the set parameters independent on topological place of the switching element in the mv network.

Measured analog signals

- 3x voltage U_R, U_S, U_T and vector sum U₀, measurement dynamic range U₀ 0 – 120 V
- 3x phase current I_R, I_S, I_T and vector sum I₀, dynamic range 0 – 80 A, 0 ÷ 1000 A

The algorithm of the function "earth fault behind" is started under fulfilling the condition U₀ > U₀ limit and I₀ > I₀ limit, this continuous state is signalled by the LED diode "I₀ >" on the front panel.

The algorithm evaluates memory currents before the fault, during the fault, during the fault and switching the resistor, during the fault after disconnecting the resistor. There are two types of evaluation, sequential and comparative one, limits D₁ and D₂ are dynamical and not accessible for the staff, they are constants in the memory EPROM.

It is possible to change only parameters that correspond with operating parameters of supply stations 110 kV/mv. The result of the algorithm (at the explicit result) is a memory state "fault behind" from the point of the supply. The memory state is stored until the time of:

- remote dispatching resetting by a command
- local RESET of the terminal
- breaking and switching of the terminal supply

Ground course protection, SW completion on CPU ŘS RD

This function is SW implemented on the central unit of ŘS SADS on RD and it provides evaluation check of the earth fault „behind“ at ambiguity and criteria evaluation in the place R and DOÚ and especially transient and high-impedance earth faults.

Remote controlled and monitored points R and DOÚ are organized in groups according to their allocation in the mv network belonging to the pertinent supply transformer 110 kV/mv. If any of the points can change its competence to the transformer 110 kV/mv at non-standard network states, it occurs at the same in other groups.

The function of earth fault location in the relevant area (TR 110 kV/mv) is initialised by a dispatcher command „locate earth fault in the area“ with the following procedure:

- in case of communication with DOÚ and R this one is stopped
- DOÚ and R in the relevant area (TR 110 kV/mv) communicate gradually with CPU RD and they transmit the stored measured currents before the fault and during the fault (the transmitted data from DOÚ and R are different than at monitoring and remote control)
- after finishing communication of all DOÚ and R, in the area in CPU currents and especially their changes are compared (I, I₀, DI₀) and the algorithm evaluates at which DOÚ and R the fault is „behind“ or „in front“ in the supply sense. This state is visualized for the dispatcher.
- CPU CS SADS comes back then into the state before fault location

Recloser and automatics AO2.2 R set

The recloser is installed on the poles of the distribution network 22 kV, the automatic device is in the control box. The recloser and the control box are interconnected with the only multiphase cable. Other elements that are necessary for functioning the set are integrated in control box:

- supply accumulators
 - radio stations
 - power supply (modem GPRS) for recloser control
 - heating resistor
- Three voltage sensors FSU 36, supply transformer 22 kV/57 V and antenna communication are mounted on the line pole.