

# The system of the remote controlled stations



**DRIBO, spol. s r.o.**

Pražákova 36  
619 00 Brno  
Czech Republic

Tel.: +420 533 101 111, Fax: +420 543 216 619, E-mail: [dribo@dribo.cz](mailto:dribo@dribo.cz), Internet: <http://www.dribo.eu>

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## Brief description of the system

### Introduction

The term „remote control system“ denotes an equipment used for remote control of section switches, circuit breakers and transformer stations installed in the MV 22 kV and 35 kV distribution lines. The main components of the remote control system are:

- communication network of the corresponding area,
- central and supervisory station (CSS),
- remote control station (RCS), consisting of outdoor circuit breaker (Recloser), outdoor section switch, transformation station or ice accretion station.

An inherent part of the system is the equipment installed at the central and supervisory station, as well as the equipment of the communication network at the area concerned.

The selection of the RCSs installed at the system uses the principle of addressing.

The system is protected against signal interferences and the effects of static electric charge.



### The communication network

Currently the following types of networks are offered and taken into operation:

- radio network, operated mostly on data transmission frequency ranges of 80MHz and 450MHz apportioned by the corresponding Telecommunication Office. It is helpful to make a reservation for a separate carrier frequency (different from the carrier of voice signal). The communication within the data transmission network uses an unlimited number of retransmission units. Also a remote setup of parameters on the RCS and the re-direction of sessions can be done.
- the GSM–GPRS packet-based network. Data is transmitted in packets along a shared GSM network. The RCS station is connected all the time to the network, but only the transferred data (KB), not the connection period, is invoiced.
- connection using optical or telecommunication cables. This type of connection is used primarily in transformer stations, into which the corresponding cabling is connected. This type of arrangement is valuable mainly because of its extremely high resistance against industrial interference signals.

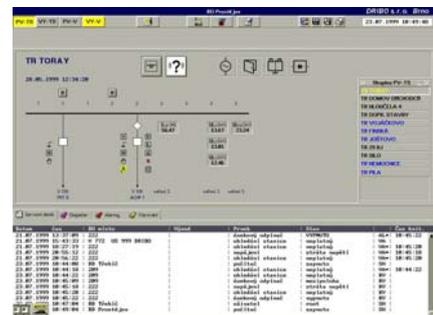
The networks may also be combined together. Quite customary is the combination of wireless (radio) network with optical cable.

In all the communication systems the information transfer (alarms, commands) is based on mutual confirmation (handshaking) of reports transferred between the central station and the remote control station. Therefore no information losses can occur in case of temporary deterioration of the quality of communication. The station repeatedly transmits the report until a corresponding confirmation arrives.

The communication protocols in all the network types feature a high level of security against accidental failures and distortion.

### The RCS control systems and their functionality

The signal processing and communication control uses a lot of field-proven systems operated with various types of protocols, such as the ADAM (from ADVANTECH), MC13 (DCOM), MOSCAD (Motorola), GSM RTU 3 (ELCOM), CGU O2 (Conel), TM 1703 ACP (VA TECH SAT). The systems offer the possibility of complicated logical operation programming and are fit for stations containing a large number of control elements and indication states. The systems feature high resistance against the transmission of failures and the possibility of remote setup of RCS parameters.



The messages, commands and the number of them differ according to the type of the RCS station (circuit breaker, transformer station, the Recloser circuit breaker, ice accretion station) and the controlled elements and their equipment level (switch disconnector, circuit breaker, protection relays, measurement systems etc.).

Functional description of the RCS remote control system:

a) Commands:

- remote opening and closing,
- automatic opening in case of unsuccessful repeated closing of the upstream circuit breaker,
- readout of actual state data,
- remote inhibit of commands.

- b) Measurement:
  - measurement of electric current in all the phase conductors,
  - indication of overcurrents (currents exceeding a specified limit value),
  - measurement of MV phase-to-phase voltages.
- c) Protection of the Recloser type of circuit breaker or breakers installed in the station:
  - overcurrent protection,
  - short-circuit protection,
  - number of repeated closings (adjustable within a range of 0 to 3-times),
  - earth-fault protection,
  - defective functioning of the protection relay,
  - current disbalance (asymmetry).
- d) Inspection and safety functions:
  - loss of the power voltage from the MV transformer,
  - dip in the 12 V powering voltage,
  - dip or loss of control voltage,
  - opening of the doors of remote control box,
  - opening of the entry doors into the building,
  - time synchronization,
  - data from the backup power unit – overvoltage, undervoltage, earth fault, etc.
- e) Data from the ice accretion stations:
  - wind speed and direction,
  - absolute and relative speed of ice accretion,
  - ambient temperature,
  - data archiving.

All messages (alarms and state information) from RCS are provided with a time label. In case of message delay the operator obtains a report with the corresponding time label for proper time identification of the event.

### Description of the remote controlled section switch disconnecter



The remote controlled station with outdoor design switch disconnecter consists of the commonly used Fla 15/60 or the Fla 15/97 switch disconnecter, completed with the end switch box for the indication of ON/OFF switching position, independently of the operation state of the driving mechanism. This arrangement is highly important for the reliability of the system. In addition a power supply transformer, aerial and a control box with the Driescher UM 20 electromechanical drive are mounted on the pole. The drive features a high margin of the operating force, and is capable of providing manipulations to the switch even in periods of thick ice accretion. The end positions feature self-clamping properties. The conductors on the pole are protected with a protective pipe.

Two standby and maintenance free power cells are capable of operating the RCS during 120 hours in case of power interruption from the MV power mains, and providing adequate level of energy for ten OFF and ON operating cycles. The box is made of 2.5 mm thick, hot galvanized steel sheets, with doubled door provided with special locks, so it is highly resistant against unauthorized access.

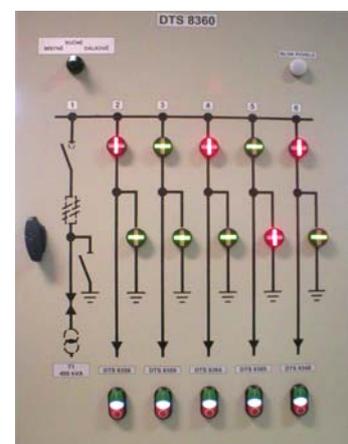
### Description of the remote controlled transformer station

The control box is of indoor design. The outer side of the door shows a mimic diagram (single-pole diagram) of the station, with switches for local control and indication.

The basic telecommunication and control equipment is identical with that of the section switch disconnecter, but differs in the significantly higher number of command signals, and measurement and monitoring signals from the circuit breakers and their protection relays.

Control can be provided to transformer stations equipped with both the circuit breakers, and switch disconnectors (disconnectors) with electromechanical drive mechanisms of the most variable brands.

Our company offers and markets high reliable switch disconnecter of the H 22 or H 27 type, and the 13300 type disconnectors. The electromechanical drive can be installed straight on onto the disconnecter shaft, or linked to the disconnecter using a pull rod.



The RCS box can also be powered from the transformer station's own backup battery if such is installed in the transformer station. Otherwise the powering takes place from the 220 V network with own backup.

## **Description of the remote controlled outdoor design „Recloser“ type circuit breaker**

The remote control unit of the switch disconnectors is a completion to the remote control system of the switch disconnectors and the transformer stations installed in the MV 22 kV distribution networks. This unit incorporates a brand new power switching element, capable of breaking short-circuit currents and earth fault currents, based on data obtained from an adequate and comprehensive protection system.

Well fit for this purpose are the vacuum-based circuit breakers of the GVR Recloser type, manufactured by the company Whipp & Bourne Switchgear, and installed in remote control networks. The advantage of these circuit breakers is the compact design, low-energy consumption magnetic drive mechanism powered by cells, with built-in current transformers and, optionally, with voltage divider installed in bushings made from EPDM.

The circuit breaker's control voltage is 90 V DC, generated by a special capacitor-based power unit. The aerial, remote control box, voltage transformer, current sensor and surge voltage protectors are mounted on the pole. The cubicle is made of 2.5 mm thick, hot galvanized steel sheets, with doubled door provided with special locks, so it is highly resistant against unauthorized access.

The cubicle incorporates a radio station, control module, circuit breaker protection system, powering and auxiliary circuits and heating elements with a thermostat.

Power is provided by two-pole insulated MV transformer connected to the power line. Backup accumulators (cells) provide adequate power for the circuit breaker in case of powering voltage interruption from the MV side, for a period of up to 80 hours. The pole bears a cantilever beam on which a directional aerial is mounted. The aerial lead-in cable is connected to the cubicle and continues to the radio station. The radio station is all the time connected to a special telecommunication and control module in which the processing of telegrams takes place, and the inputs/outputs of which are used for circuit breaker control.

## **Control system for the supervisory type of control**

The control and supervisory system has been designed and developed for the special purpose of control and monitoring of the switching elements installed as a part of the remote control system of section switch disconnectors and transformer stations in the MV networks.

This powerful control and information system is used mainly for the following:

- monitoring of the 22 kV network operation (operation states of the switching elements, failure messages, operation states of the equipment), or the measurement of current and voltage
- control of switching elements installed in the MV network
- selection and processing of failure messages and their editing into sets.

The system is of general-purpose nature and is designed in a way to provide for control of several independent areas. The system capacity is adequate to cover the needs of any dispatcher's region.

The system may also operate as an autonomous system, or be connected as a sub-system to a higher-level control system using quite common communication protocols. By default communication protocols are used that render it possible to establish connections to the MIKRODISPECINK and TELEGYR control systems.

Currently the system most frequently is used as a connection link to higher-level control systems, such as the RIS, TELEGYR, MIKRODISPEČINK, SAT. A series of communication protocols is available. In addition to functions consisting in establishing interconnection of the individual RCS with the higher-level system this supervisory system is used for the supervision of the RCS by regular scanning, time synchronization, remote setup of parameters etc.

## **Delivery of the system**

### **Delivery of the remote control system**

Our company ensures all activities related to the comprehensive delivery of the remote control, such as:

- design of a building project of remote controlled circuit breakers, switch disconnectors and transformer stations,
- design of a system for extending the radio communication with remote controlled stations, including the measurement of radio signal level,
- delivery of the GVR circuit breakers, with accessories,
- delivery of the Fla 15/60 and Fla 15/97 switch disconnectors, with accessories,
- delivery of transformer station equipment,
- delivery of the remote control cubicles,
- delivery of the system for dispatcher control, incl. the control software,
- all kind of assembly works,
- activation and commissioning of the whole remote control system,
- establishing of interconnections to higher-level systems.

On request the customer may be supplied with the comprehensive system or with only parts selected.