

For one hoist the high frequency mine signaling system DIS 52 includes the following parts:

Receiving part

- 2 pieces of upper repeater coil TH 4, (located in the tower), protection IP 44
- 2 pieces of receiver DIS 52 P, (located in the hoist machine hall), protection IP 30

Transmission part (for one transport container)

- 1 piece of lower repeater coil TD 4, protection IP 67
- 1 piece of TD 4 M drive
- 1 piece of transmitter DIS 52V (WP), protection IP 67
- Controller DIS 52 ON, number of pieces based on the number of controlling points in the transport container, coverage IP 67

Accessory equipment for the operators

- 1 piece of charging equipment for DIS 52V, protection 1P30
- 1 piece of transmitter DIS 52V for every transport container – for replacement during charging of the accumulator

Supply

- Exchange of DIS 52 P in the machine hall: 2 x 12 V, 50 Hz, 35 VA
- Transmitter DIS 52 V located in the transport container: maintenance-free accumulator 12V/7Ah current takes less than 3mA in the self-active checking regime.
- Operation period with fully charged accumulator: 200 hours

Camera system of SKM4 – visual monitoring

Camera system of SKM 4 type is used for visual monitoring of the actual situation at shaft-levels and at the shaft bank. The machinist can monitor the situation in both locations with the aid of two monitors located in the cabin. The SKM 4 system consists of 4 industrial cameras KOR-2.1 installed at shaft levels, 4 industrial outdoor cameras KOR-1.1 installed at the shaft bank, two LCD monitors located in the machinist cabin, supply sources for outdoor cameras, squarer and sources for the KOR-2.1 cameras. System is connected through cabling (coaxial cable and cable for voltage distribution to the cameras).

Cameras KOR-2.1 are located in explosion-proof cabinets, type ORU-2. Cameras are connected to the CCD converter with sensitivity less than 0.1 lx. Image converter converts the optical picture to the colored signal with the level of 1.0 V pp/75Ω, with the option for CCIR or EIA standard that allows for very high signal-to-noise ratio. All cameras have a sufficient compensation for obtaining a readable and contrasting picture in changing illumination conditions, and they are shatterproof and struck-proof.

Basic technical parameters

- Television standard: CCIR (fH = 15625 Hz, fV = 50 Hz ; EIA (fH = 15750 Hz, fV = 60 Hz)
- Signal type and amplitude: WGS 1 V pp/75Ω
- Supply: 230 V / AC, 12 V / DC
- Protection: Ip65
- Environment: with the danger of CH, explosion (Applies only to the equipment in the shaft)
- Vibration resistance: f = 10÷35 Hz, amplitude 0.15 mm



Mine signaling system type SDS 3 – signaling between the machinist and shaft levels

Mine signaling system type SDS 3 is intended for signaling between the machinist and individual signaling posts during the operation of the hoist. Optical cabling connected to the redundant network is used for connection of individual signaling posts. This enables elimination of high amount of metallic cables used in the older systems of mine signaling, as well as the speed of signal transmission is high even in deep shafts. The mine signaling system SDS 3 is intended for usage in an explosive environment and is constructed as a brick box of two basic types of signaling posts. The first type, which is denoted "main post MS," serves as the central controlling unit of SDS 3 device, therefore it is contained in the whole system only once. The second type of the signaling post is denoted as "shaft-level post FS," and serves for installation to the signaling posts of the pushing decks, shaft heads, unloading stations, loading stations, and individual shaft levels.

System SDS 3 for connection of individual signaling posts uses optical cables which eliminate operational problems associated with the usage of metallic cables, such as decrease of the insulation because of dampness in the shaft, electro-magnetic interference, etc. The longest optical connection between the main MS post and FS shaft-level post may be up to 1800 meters. The optical network is redundant (doubled), which means that in case of an interruption of one side of the optical network, the mine signaling remains operational and communication shall be performed through the other side of the network. Thanks to the usage of modern high-quality components, the device SDS 3 ensures a reliable optical and acoustic (sub transient) signaling between individual signaling posts which participate in the operation of the hoist.

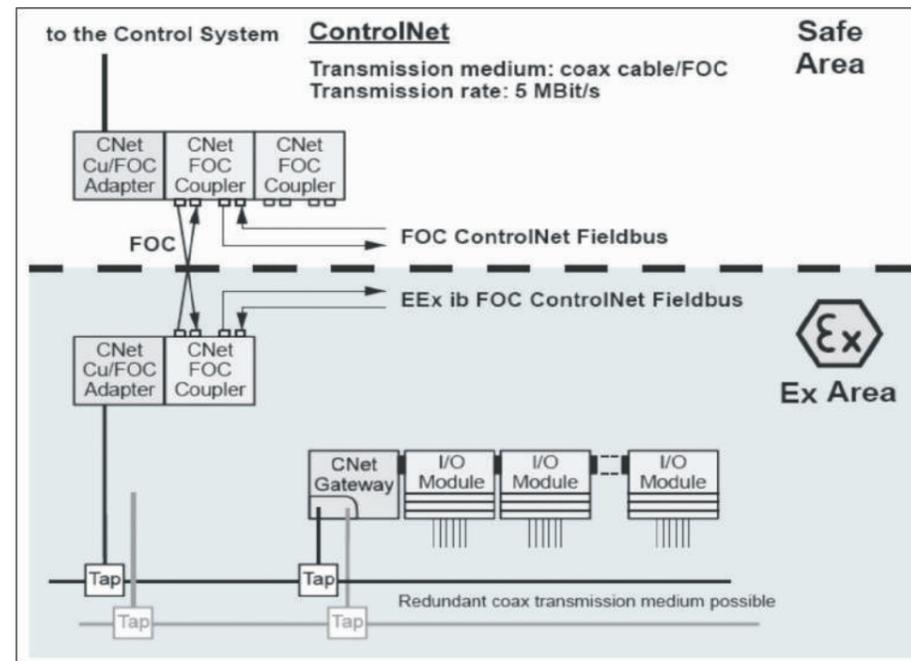


Diagram of the optical network ControlNet connection between the main and shaft-level posts

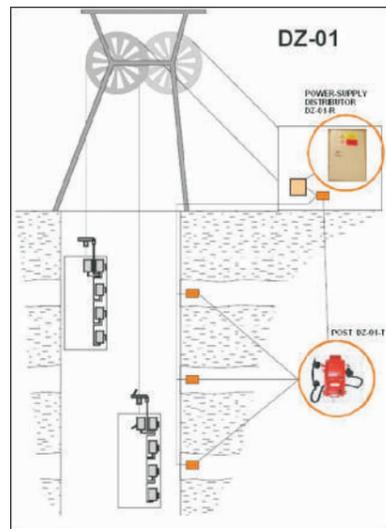
Main post MS

The main post MS is designed as an individual box switch board consisting of two fields equipped with a glass door in the front. The first field contains the power supply circuits of the mine signaling. The second field is equipped with a programmable automat type CompactLogix, and with auxiliary circuits for connection into the hoist-control circuits.

The second field of the switch board also contains the communication interface for connection of the redundant optical network to the shaft-level posts FS and for connection of distant units I/O located on the control panel of the machinist of the hoist.

Switch-board of the MS post of mine signaling, including distant units I/O at the machinist post, are both in normal design (they are not intended for the explosive environment). The basic technical

Parameter	Value
Input voltage	1NPE 50Hz 230Vac/TN-S
Input protection	16A
Parameters(dimensions)	Specific to the concrete situation
Degree of protection	IP 42/20



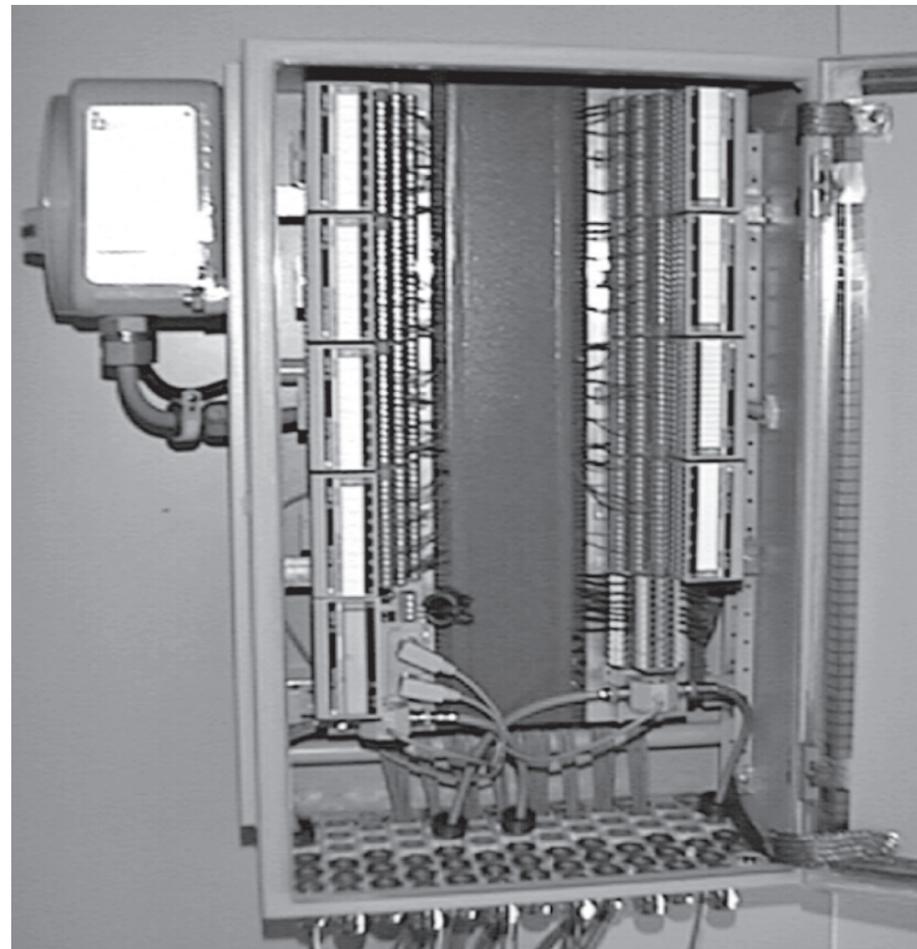
Shaft-level post FS

Each shaft-level post consists of several parts. The base is formed by a steel-plate switchboard box, containing communication interface for connection to the optical network of the mine signaling and I/O units intended for connection of input (switches) and output (optical and acoustic signaling devices) devices.

Another part of the shaft-level post FS is the optical signaling panel consisting of a set of LED indicators of various colors, which serves to inform the attendant about the currently selected mode of the hoist, configuration of the mine signaling, and also about the transmitted signals.

Signals that are transmitted via mine signaling are highlighted in the shaft-level post by an electronic acoustic signaling device.

This signaling device can be a part of the optical signaling panel, or it can be installed separately. For signal transmission from the shaft-level post FS, a set of button controllers is used, and these controllers can be a part of the above mentioned optical signaling panel, or they can be installed separately. The last integral part of the shaft-level post FS is a set of power supply units ensuring the necessary power supply voltage for spark-proof circuits of the shaft-level post. The shaft-level post FS of the mine signaling is intended for the explosive environment (spark-proof design). An example of the steel-plate switchboard box with an apparatus content of the shaft-floor post FS is in the picture.



Example of the shaft-level signaling box FS

Optical and power supply network

Connection of the main post MS and shaft-level posts FS of the mine signaling systems SDS 3 is performed via optical network in the redundant connection. The optical network itself brings following advantages:

- Galvanic separation of individual posts
- Elimination of high amount of metallic cables laid in the shaft
- Elimination of operational dangers associated with faulty insulation of metallic cables
- Very high transmission speed

These advantages result in a faultless connection of the devices located both inside and outside the explosive areas, reduction of likelihood of damage of the cabling in the shaft, increase of operational reliability. The redundant design of the network requires placement of two individual spatially separated optical cables in the shaft, between individual posts of mine signaling. It nevertheless ensures constant functioning of the communication network via one of the optical cables in the event of a breakdown. The mine signaling system SDS 3 uses the ControlNet communication protocol. The maximum transmission speed of the ControlNet network is 5Mbits/s. The principle of connection of communication between the communication interface of the main post MS and a shaft-level FS post is portrayed in the diagram.

Along with the communication network, the individual shaft-level stations also require a power supply voltage for its spark-proof power supply units. This voltage of 24V DC is led over an individual metallic cable in the shaft. Other metallic cables in the shaft are not required to ensure functioning of the mine signaling system SDS 3.

System of high frequency mine signaling – communication between the machinist and transport containers

System of high frequency mine signaling DIS 52 is intended for bi-directional signaling between the transport container and the machinist of the hoist, whilst it uses electric impulses that run through the winding rope. DIS-52P receiver in the hoist machine hall self-actively checks itself based on the diagnostics of supply sources, generator of query radio impulses and synchronization. Status of parameters that are subject to diagnostics is indicated on the panel of DIS-52P receiver. Repeater coils are used for the transmission of impulses from the hoisting rope.

High frequency mine signaling DIS 52 enables:

- Transmission of agreed signals from the moving transport containers to the machinist of hoist,
- Transmission of the so-called return signal from the machine hall back to the transport bucket,
- Self-active check of the entire equipment every 35, 30, or 25 milliseconds (can be set up),
- Uninterrupted checking of the transmitter accumulators voltage in transport containers,
- Uninterrupted checking of tilting of the transport container anchorage – if the thimble tilting is changed (for example if the transport container gets stuck and there is a danger that a rope loop will occur),
- Transmission of agreed signals from the machine hall to the transport containers, including its return confirmation from the transport containers back to the machine hall,
- Transmission of two commands (Up and Down) from transport containers to the machine hall, which together with the "STOP" signal allow for controlling the hoist under the inspection mode.

