

# catalogue of products



methanometry  
automation mining  
and industrial  
electronics





Methanometry, automation, mining and industrial electronics

**CATALOGUE OF PRODUCTS**



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### HISTORY

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**HASO** was founded in 1990. Its main purpose is the development and production of innovative systems and telemetry equipment in the fields of mining, industrial automation, visualization, monitoring and controlling influence on the growth of machine performance, reduce operating costs and improvement of safety.

As a manufacturer of security systems and cooperating devices, we place great emphasis on continuous development and improvement of existing products and investment in the latest technology. Individual approach to each client allows us to a precise identification of the current needs, and cooperation with world leaders enables access to innovative solutions.

Our motto is:

**„Quality is a way of thinking that causes apply and is constantly looking  
for the best solutions.”**

/E.Deming.

**30** years  
1990 - 2020



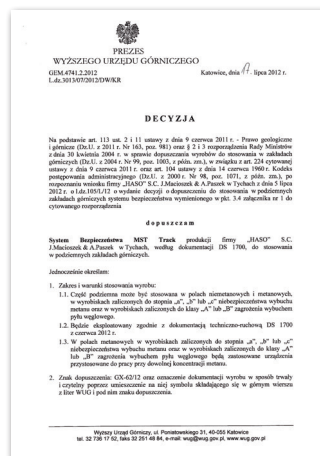
## OFFER:

As part of its activities we offer:

- Security systems designed for underground mines:
  - Integrated Safety Systems CST
  - Switch-off interlocking and controlling system SBKW
  - Presentation system of industrial processes SP3
  - Safety system for IS Communications and tracking of people and assets in underground coal mines - MST Track
- System assisting methanometry dispatchers in underground mines SW $\mu$ P-3
- Industrial Automation:
  - Systems of control, visualization and management of production processes
  - Measurement & Inspection devices
  - Measuring systems for monitoring the applications of inert gases
- The blasting technique
- Services associated with the production of electrical equipment for underground mines:
  - Twenty-four-hour service
  - Inspection, repair and maintenance of individual components for devices
  - Modernization and repair of measuring equipment

## CERTIFICATES

All of our equipment designed for underground mines have EC type examination certificates (ATEX), and safety systems have admittance issued by the President of State Mining Authority. Furthermore for improving the quality, respect for safety rules and improving organization of work has been implemented an Integrated Management System that meets the requirements of PN-EN ISO 9001:2015 „Quality Management Systems” and PN-N-18001: 2004 „Safety Management System and Occupational Health”. The company also has a Quality Assurance Notification No. GIG 18 ATEXQ 052 issued by the Central Mining Institute.

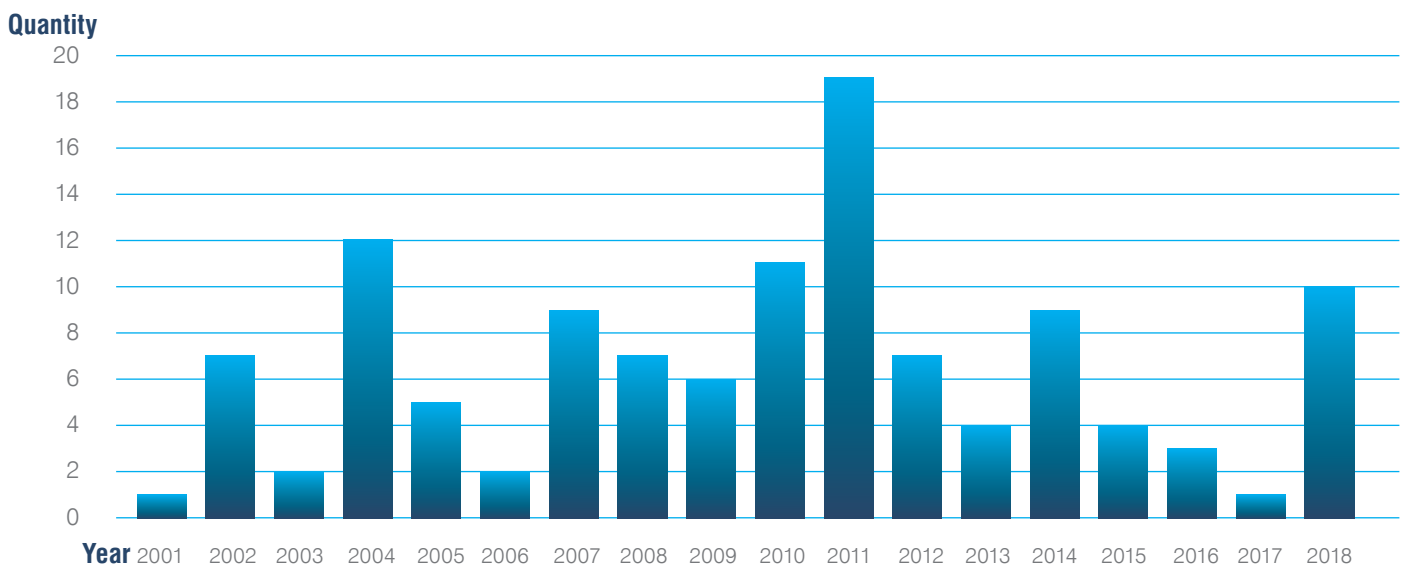


# INTEGRATED SAFETY SYSTEM CST

Integrated Safety System **CST** is built based on telemetric central stations type **CST-40**, **CST-40A**, **CST-40C**, sensors and equipment connected to them, and a master system - **SW $\mu$ P-3**.

The system is designed for:

- continuous control and recording of parameters concerning in mines with methane, fire and ventilation hazards
- switching off the power supply of machines and electric devices in cases where permissible parameters have been exceeded
- control and recording of work of selected devices having an impact on safety or production process
- performing complex inspection of work of connected sensors and switching off the power devices
- transmission of signals about occurring alarms and overflows into the alarm broadcast system.



Sales of methanometry central station stypes CST-40(A) and CST-40C in 2001-2018 (in pieces\*)

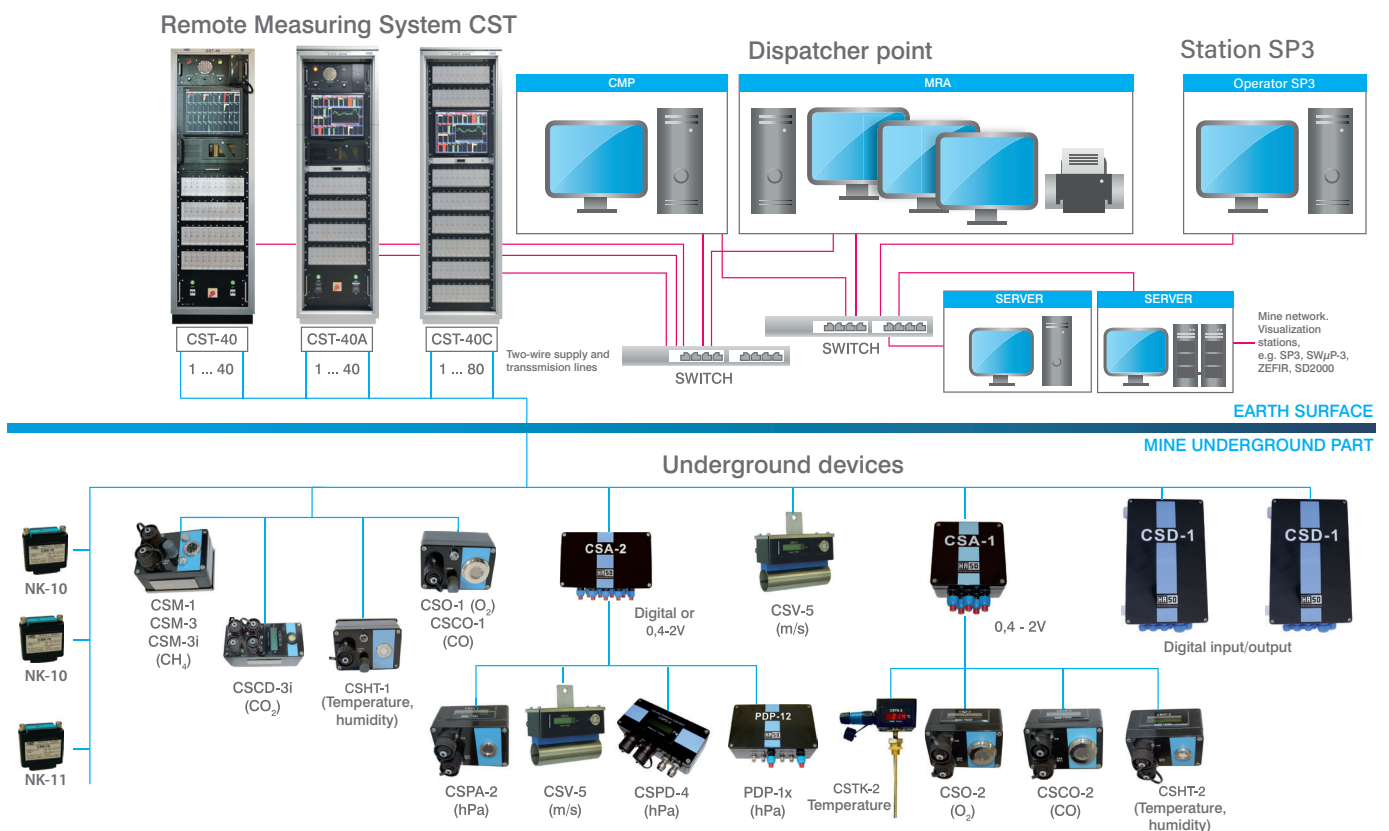


## Basic technical data:

Power supply	230 VAC (+5%, -10%)
Transmission types	digital or based on frequency
Number of measurement channels	40 – one central station CST-40(A), 80 – one central station CST-40C
Operation mode	automatic with possibility of manual query
Measurement time of one line	1 ÷ 4s depending on type of sensor
Time of one measurement cycle	1 ÷ 8s depending on type of sensor on the line
Power supply shutdown time	< 5 s - e.g., for CSM-1, CSM-3
Distance between central and sensor	≤ 10 km (CSM-1, CSCO-1, CSM-3, CSHT-1)
Recording of measurement results	computer recorder
Visualization	LCD monitor
Alarm thresholds	set up in all measurement range
Sending of overflow alarms	from any alarm circuit to any lines in the system of CST-40(A), CST-40C central stations

→ The system has admittance issued by the President of State Mining Authority, symbol: GX – 64/13.

## Configuration of system CST

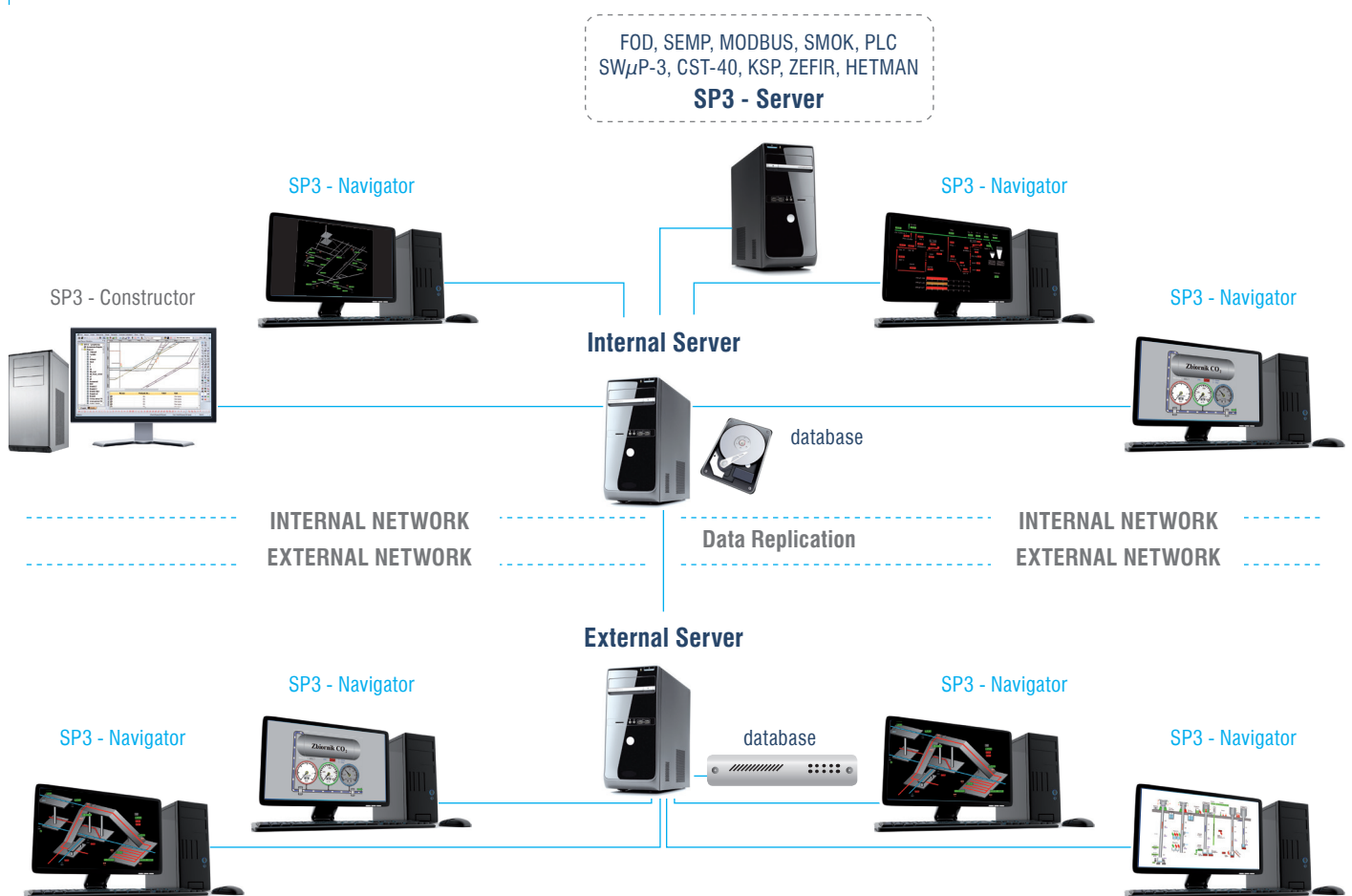


# PRESENTATION SYSTEM OF INDUSTRIAL PROCESSES SP3

Presentation system of industrial processes **SP3** provides the possibility of continuous recording, processing, archiving and visualization of measurements on the basis of data collected from sensors of measuring systems, with which **SP3** has configured connection. The system is adapted to the requirements of the mine dispatcher service through the implementation of its main functions, namely:

- graphical presentation of current and archived measurements on any size scalable boards, diagrams, maps, etc., in a way adapted to the user's perceptual capabilities taking into account the current technological and ventilation schemes of mine
- alarming in critical situations and warning of the occurring dangers
- archiving of measurements and alarms data
- displaying of archival measurement data in the form of graphs or alphanumerically
- creation and printing of reports and generating statistics based on archival measurements
- identification of the type, number and source of sensor measuring system
- the possibility of multi-monitor work, settings adjustment and save the created configuration for user convenience
- determining the extent of individual user accounts.

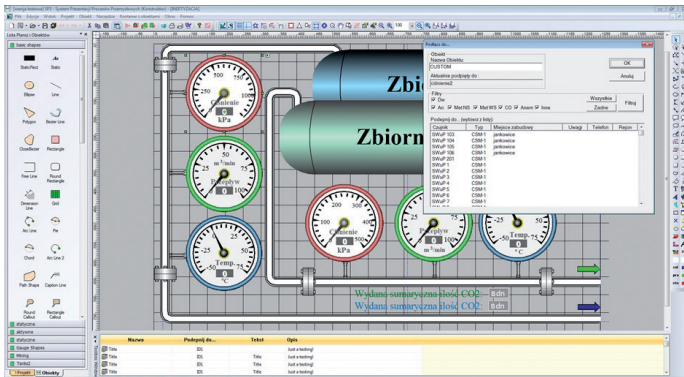
## Configuration of Presentation system of industrial processes SP3



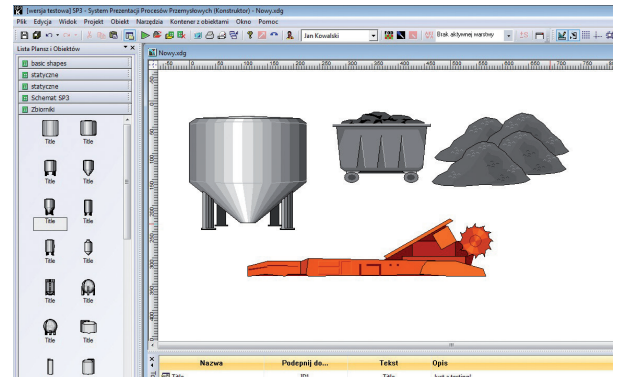
System SP3 is composed of the following, connected to each other with computer network, modules:

- SP3- Constructor
- SP3- Navigator
- SP3- Server

**SP3-Constructor** - allows the creation of any kind of fully scalable charts, maps, diagrams, on which are placed the objects animating display of user-defined sensors available in the system. The extensive set of graphical tools, like the library of ready components, allows quick creation of advanced and powerful graphical charts and edit those already existing in the system.

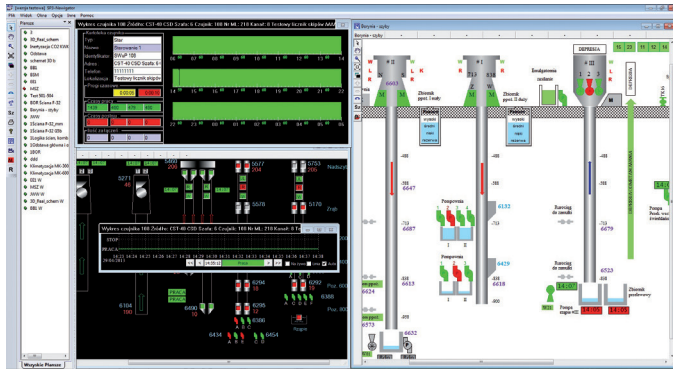


SP-3 Constructor program window.

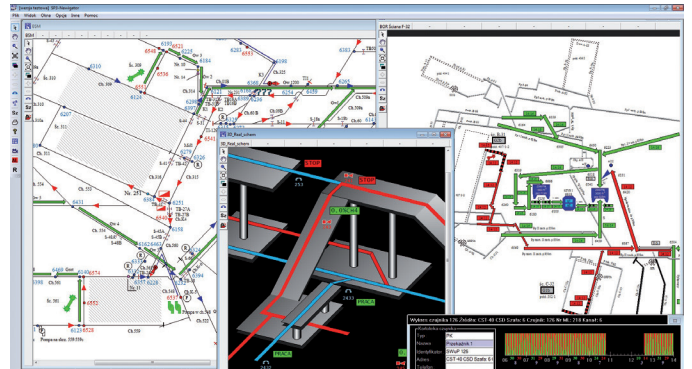


Library of objects ready to be placed on the board.

**SP3-Navigator** - allows to run previously created charts in separate windows, and provides for continuous monitoring of current measurements (also in the form of graphs). The charts and graphs are displayed in the windows that you can freely distribute on monitors or other display devices.



SP3-Navigator program window.



An example of program operation SP3-Navigator.

**SP3-Server** - is used for the collection, archiving and sharing of data for the entire system.

## The main advantages of the system SP3:

- The possibility of collection data from various systems (SWuP-3, ZEFIR, SMP, SMOK, FOD, PLC, etc.)
- Observation of measurements from various systems in one place
- An extensive palette of graphical tools
- Simple, intuitive operating.
- Reporting

# SAFETY SYSTEM MST TRACK

Safety system **MST Track** is dedicated for IS Communications and tracking of people and assets in underground coal mines. System **MST Track**:

- allows the operative management of the movement of workers during regular operation and in an emergency
- registers the transition of employees by the system checkpoints
- informs the dispatcher in emergency mode, whether there is a person in the dangerous zone or a person's residence time in the dangerous zone has been exceeded
- allows to alert a person in the dangerous area about events
- allows to archive the data.

System infrastructure **MST Track** can be used to transmit data, voice, video, checking and controlling processes and wireless communication.

- System has admittance issued by the President of State Mining Authority, Signature: GX - 62/12.



## Structure of System

Safety system **MST Track** consists of a surface part and underground part.

### Surface part

The surface part includes:

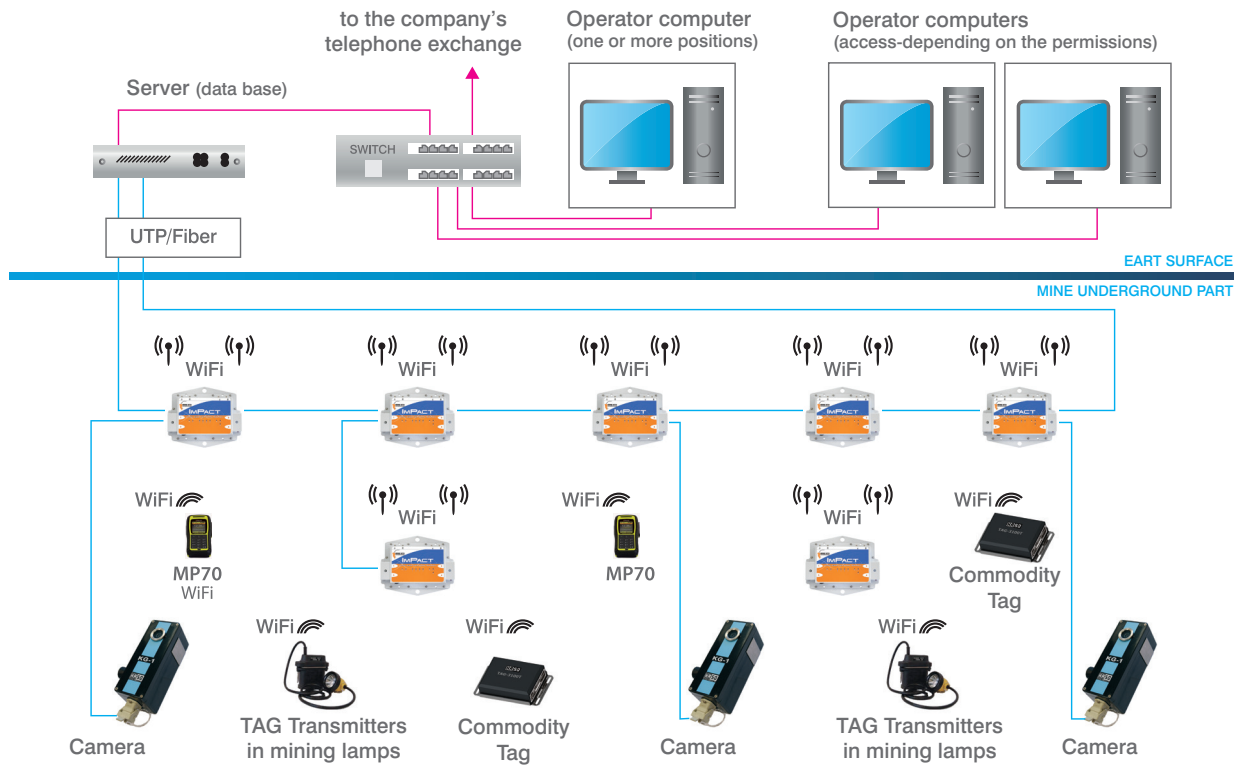
- Configured hardware server along with maps of the mine and applications of location system, and installed SQL database,
- Working positions (operators and customers) with installed applications „MineDash”.  
The „MineDash” application allows view from any position within the mine network through a web browser.  
It allows to locate all of employees at any time and from any place.
- The configuration position with **ICA** administration console software.

### Underground part

The underground part includes:

- The intrinsically safe wireless network switches NS40 (A) with antennas.
- Intrinsically safe power supplies ZIB-2 with battery.
- IDs radio Tags in two versions: portable or internal - designed for installation in mining lamp.
- Optical fiber cables and power cables.
- Banners and sounders for display information at specified positions in the mine.
- Switches, converters and network barriers.

## Configuration of Safety system MST Track



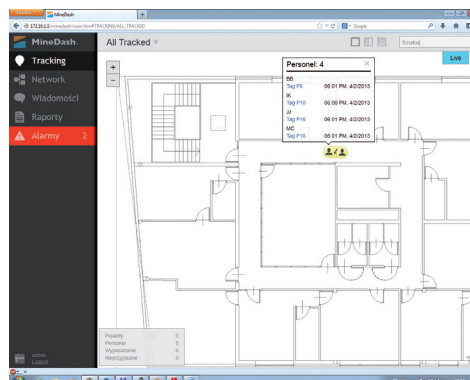
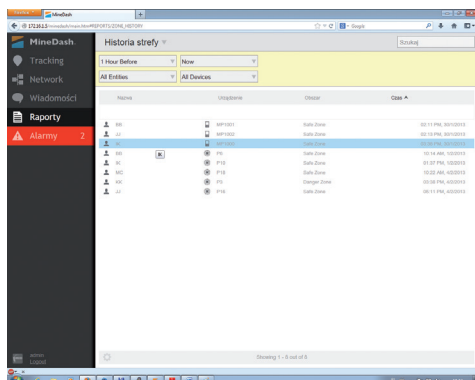
### Explanation:

1. NSxx – fiber optic switch/ access point
2. TAG - identification transmitter (built in lamp or individual)
3. MP70 – mine phone VoIP

— Cable type UTP  
— single-mode fiber optic cable

## Basic technical data:

Server power supply	230 VAC (+ 5 %, - 10 %), 50Hz; uninterruptable
Server transmission type	Ethernet fiber optic and cables
Switch transmission type	Ethernet fiber optic and WiFi
Type of fiber optic transmission	singlemode
Number of switch NS40 fiber ports	4
Speed of fiber optic transmission	100 MBit/s
Max. WiFi transmission speed	54 Mbit/s
Transmission type of tags and phone	WiFi- 2,4 – 2,5GHz
Transmission type TAG - switch NS40	radio WiFi



## COMPONENTS OF SAFETY SYSTEM CST

**Control Units** are generally intended for use with the safety system CST. They can also operate with other systems, on condition that they comply with the supply & measurement line parameters.

### Analogue Signal Control Unit CSA-1, CSA-2

The main purpose of using the CSA-1 unit is the possibility of connecting sensors with voltage analogue outputs of 0,4 – 2V to the CST system, and additionally 2-stage inputs and 2-stage outputs for Control Unit CSA-2. The unit not only does the measurements and transfers them, but also supplies the connected sensors with power. Application of the control unit highly extends the measurement capability of the CST-40, CST-40A, CST-40C units and allows to connect 4 sensors to a single line.



CSA-1	
Transmission mode	digital
Max. length of a supply-transmission line	8 km
Max. length of a sensor line	1500 m
Protection index	IP 65
ATEX certificate	KDB 05ATEX039X
Explosion-proof mark	Ⓔ I M1 Ex ia I
Number of analogue inputs	4

CSA-2	
Transmission mode	digital
Max. length of a supply-transmission line	8 km
Max. length of a sensor line	1500 m
Protection index	IP 65
ATEX certificate	KDB 10ATEX0043X
Explosion-proof mark	Ⓔ M1 Ex ia I
Number of analogue inputs	4
Number of digital inputs	4
Number of 2-state outputs	2

### Two-State Signal Control Unit CSD-1

CSD-1 highly extends the measurement capability of the system central CST-40(A), CST-40C and enables a variety of 2-state sensors to be connected to it. To each CST supply-transmission line a single CSD-1 control unit can be connected. The unit has sixteen 2-state voltage free inputs and eight voltage free 2-state outputs. Input signals are checked for shortcuts in connected lines. Furthermore unit can be programmed from the CST central system and can function as a protection for power shut-offs, enable signal lines or control other electrical equipments.



CSD-1	
Transmission mode	digital
Max. length of a supply-transmission line	8 km
Run time on own power supply	> 12h
Number of 2-state inputs	16
Max resistance of input circuit	400Ω
Line check mode	Diode at checked contact in series
Number of 2-state outputs	8
Protection index	IP 65
ATEX certificate	KDB 05ATEX010X
Explosion-proof mark	Ⓔ I M1 Ex ia I

## The CSN channel transmitter

The **CSN channel transmitter** with components is used to monitor technological processes in places at risk of methane and / or coal dust explosion. The transmitter is made in two versions CSN-10 and CSN-11 and works directly with the central telemetry system CST-40A, CST-40C. The CSN-10 channel transmitter has galvanically separated binary and analog inputs. The CSN-11 version additionally has a + 8V power output, thanks to which it is possible to supply power and cooperate with external sensors, e.g. CP10 or CPE (sensors must work in a two-state mode).

The transmitter has several mounting options using the following components:

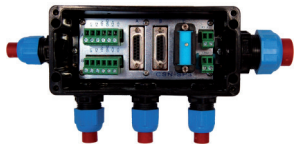
- junction boxes: CSN-SP3 and CSN-SP8 with IP65 protection rating
- DIN rail connection modules: CSN-MP11, CSN-MP10 designed for installation inside a housing with a minimum protection rating of IP54
- CSN-MP0 connection module in the form of a DB15 connector with leaded wires; the module enables installation of transmitters in a housing having its own set of connection terminals; the casing must have a minimum protection degree of IP54.



CSN transmitter

### CSN-10, CSN-11 channel transmitter

Power supply (Interface type CST-40A, CST-40C) transmission max. line length	from the power and transmission line, digital, two-way 15 km
Power consumption	max 1,2mA
Power output capacity + 8V (only CSN-11)	≤ 300 A
Operating temperature range	-20°C to +50°C
Required degree of protection of the junction box:	minimum IP54
Type test certificate	TEST 16 ATEX 0021X
Explosion-proof mark	⊕ I M1 Ex ia I Ma



CSN-SP3



CSN-SP8



CSN-MP 11

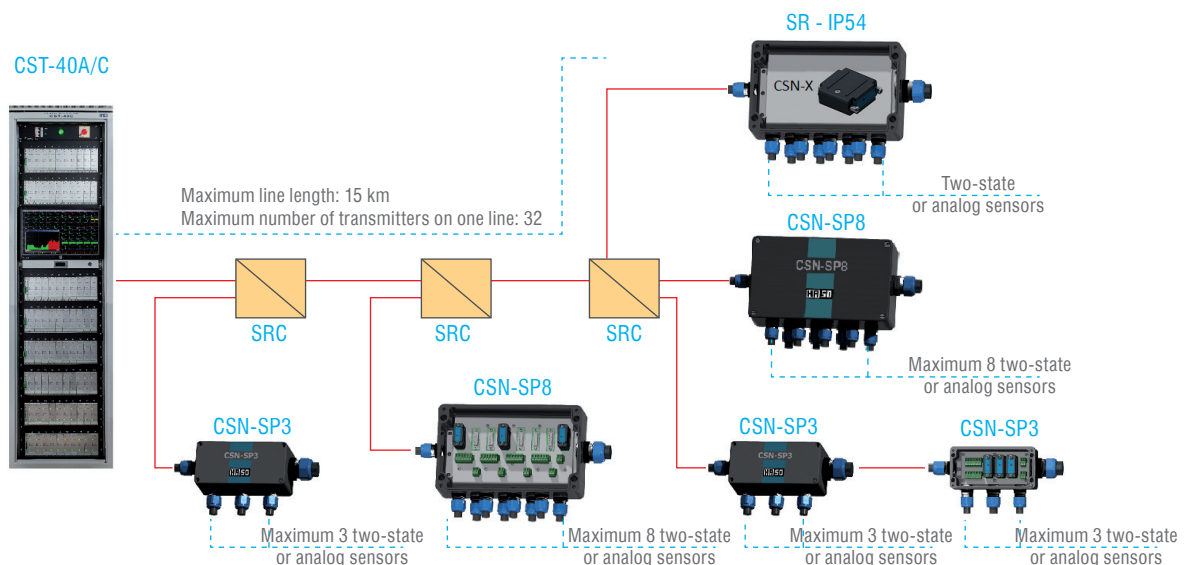


CSN-MP10



CSN-MP0

## An example of connecting the CSN-10, CSN-11 transmitters to the CST-40A / 40C control panel



# METHANE DETECTORS

## Methane Detectors CSM-1, CSM-1R, CSM-3, CSM-3i, CSM-3m

Methane Detectors CSM-1, CSM-1 version R, CSM-3, CSM-3i, CSM-3m are stationary devices for measuring methane content in explosion hazard areas in underground coal mines. They mainly cooperate with telemetric central stations type CST-40, CST-40A, CST-40C in area of data transmission. They can also cooperate with other telemetric stations, provided that the parameters of the feeder-measurement line are compatible.

Methane Detectors have one or two outputs (UW) used to control equipment switching off power supply when the preset alarm thresholds have been exceeded. Optionally, they may also be equipped with ambient temperature sensor. Its autonomous supply system (battery) supplies the methane detector when the feeder line is switched off. The communication with the methane detector is carried out by means of digital transmission through the feeder-measurement line of the central station and through the type KR-2 calibrator. The calibrator communicates with the methane detector through a radio link.

Methane Detectors are devices in category M1, therefore, they may be used in all underground mines with methane or coal dust explosion hazard.



CSM-1	
Measurement range:	0-5% CH <sub>4</sub> (catalytic) 5-100% CH <sub>4</sub> (conductometric)
Measurement method	continuous
Response time	≤ 5s
Casing internal protection	IP54
Type test certificate	KDB 06 ATEX 428
Explosion-proof mark	⊕ I M1 Ex ia I



CSM-1 version R	
Measurement range	0-100% CH <sub>4</sub> (conductometric)
Measurement method	continuous
Response time	≤ 15s
Casing internal protection	IP54
Type test certificate	KDB 06 ATEX 428
Explosion-proof mark	⊕ I M1 Ex ia I



CSM-3, CSM-3i & CSM-3m	
Measurement range	<b>CSM-3:</b> 0-5% CH <sub>4</sub> (catalytic) 5-100% CH <sub>4</sub> (conductometric) <b>CSM-3i, CSM-3m:</b> 0-100% CH <sub>4</sub> (IR)
Measurement method	continuous for CSM-3 IR, continuous for CSM-3i, CSM-3m
Response time	≤ 5s for CSM-3 ≤ 25s for CSM-3i ≤ 7s for CSM-3m
Display	LCD
Casing internal protection	IP54
Type test certificate	KDB 09 ATEX 094
Explosion-proof mark	⊕ I M1 Ex ia I Ma

## SENSORS connected directly to the control panel

**Sensors** from this group are stationary devices designed to measure atmospheric parameters in potentially explosive areas in hard coal mines. They work mainly with the CST40, CST-40A and CST-40C telemetry control panel in the scope of data transmission and transmission (they are connected directly to the control panel). They can also cooperate with other control panels, provided that the condition of the power supply and measurement line is compatible.



### Carbon monoxide concentration sensor CSCO-1

Measurement range	0-1000 ppm for digital transmission 0-200 ppm or 0-1000 ppm for transmission frequency
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Response time	≤ 40s
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### Oxygen concentration sensor CSO-1

Measurement range	0-25 % O <sub>2</sub>
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Response time	≤ 20s
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### Humidity and temperature sensor CSHT-1

Measurement range	Humidity 0÷100%RH Temperature -20÷50°C
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Response time	for humidity measurement ≤ 4s, for temperature measurement ≤ 30s
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### Hydrogen sulphide concentration sensor CSHS-1

Measurement range	0-200 ppm H <sub>2</sub> S
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Response time	≤ 40s
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### Sulfur dioxide concentration sensor CSSD-1

Measurement range	0-100 ppm SO <sub>2</sub>
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Response time	≤ 40s
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### Nitrogen oxide concentration sensor CSNO-1

Measurement range	0-250 ppm NO
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Response time	≤ 40s
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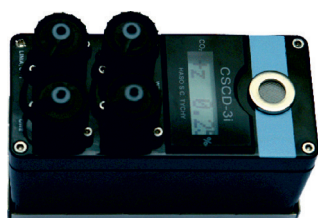
### Nitrogen dioxide concentration sensor CSND-1

Measurement range	0-20 ppm NO <sub>2</sub>
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Response time	≤ 40s
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### Common data

Measurement method	continuous
Casing internal protection	IP54
Type test certificate	KDB 08 ATEX 131
Explosion-proof mark	Ex I M1 Ex ia I



### Carbon dioxide concentration sensor CSCD-3i

Measurement range	0-5% CO <sub>2</sub>
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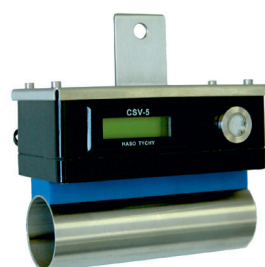
Measurement method	IR, continuous
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Response time	≤ 25s
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Casing internal protection	IP54
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Type test certificate	KDB 09 ATEX 094
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Explosion-proof mark	Ex I M1 Ex ia I
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### Anemometer CSV-5

Measurement range	± (0,1÷10) m/s
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Measurement method	continuous
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Response time	≤ 2s
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Casing internal protection	IP54
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Type test certificate	KDB 11 ATEX 097
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Explosion-proof mark	Ex I M1 Ex ia I Ex II 2G Ex ia IIB T4
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## SENSORS connected by the Control Units

The sensors in this group are stationary devices, designed to measure atmospheric parameters in explosive atmospheres in underground coal mines. They cooperate with telemetric central station type CST-40, CST-40A and CST-40C through analogue station CSA-1 and CSA-2. They may also cooperate with other devices provided that the terminal of the feeder-measurement line is compatible.



### Carbon monoxide concentration sensor CSCO-2

Measurement range	0-1000 ppm
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### Hydrogen sulfide concentration sensor CSHS-2

Measurement range	0-200 ppm H <sub>2</sub> S
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### Sulfur dioxide concentration sensor CSSD-2

Measurement range	0-100 ppm SO <sub>2</sub>
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### Nitrogen oxide concentration sensor CSNO-2

Measurement range	0-250 ppm NO
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### Nitrogen dioxide concentration sensor CSND-2

Measurement range	0-20 ppm NO <sub>2</sub>
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### COMMON DATA

Response time	≤ 40s
Measurement method	continuous
Casing internal protection	IP54
Type test certificate	KDB 07 ATEX 257
Explosion-proof mark	⊕ I M1 Ex ia I



### Oxygen concentration sensor CSO-2

Measuring range	0-25 % O <sub>2</sub>
Measurement method	continuous through diffusion
Response time	≤ 20s
Casing internal protection	IP54
Type test certificate	KDB 07 ATEX 260
Explosion-proof mark	⊕ I M1 Ex ia I



### Humidity, temperature and atmospheric pressure sensor CSPA-2

Measuring range	atmospheric pressure, standard from 800 hPa to 1300 hPa atmospheric pressure, extended from 800 hPa to 1600 hPa relative humidity from 0% RH to 100% RH temperature from -20°C to +50°C
Measurement method	continuous
Response time	≤ 2s for atmospheric pressure measurement ≤ 30s for temperature measurement ≤ 4s for relative humidity measurement
Casing internal protection	IP54
Type test certificate	KDB 09 ATEX 095
Explosion-proof mark	⊕ I M1 Ex ia I



## Differential pressure sensor CSPD-4

Measuring range	± 250 Pa (Type: 0250) ± 1250 Pa (Type: 1250) ± 2500 Pa (Type: 2500) ± 5000 Pa (Type: 5000) ± 7500 Pa (Type: 7500)
Measurement method	continuous
Response time	≤ 2s
Casing internal protection	IP54
Type test certificate	FTZU 10 ATEX 0053
Explosion-proof mark	Ex I M1 Ex ia I



## Humidity and temperature sensor CSHT-2

Measuring range	Humidity 0÷100% Temperature -20÷50°C
Measurement method	continuous through diffusion
Response time	≤ 4s for measurement of humidity ≤ 30s for temperature measurement
Casing internal protection	IP54
Type test certificate	KDB 08 ATEX 132
Explosion-proof mark	Ex I M1 Ex ia I



## Probe thermometer CSTK-2

Measuring range	from -20°C to +50°C
Measurement method	continuous
Response time	≤ 2min (air velocity: v=2 m/s)
Casing internal protection	IP54
Type test certificate	TEST 13 ATEX 0023X
Explosion-proof mark	Ex I M1 Ex ia I Ex II 2G Ex ia IIC T4



## Hydrogen concentration sensor CSH-2

Measuring range	0,1% H2 with a measuring range of 0 to 0,100% H2 (0÷1000 ppm H2) 1% H2 with a measuring range of 0 to 1,000% H2 (0÷10000 ppm H2) 4% H2 with a measuring range of 0 to 4,000% H2 = 100% DGW (0÷40000 ppm H2)
Measurement method	continuous
Response time	≤ 40s - 110s (depending on version)
Casing internal protection	IP54
Type test certificate	KDB 13 ATEX 0052
Explosion-proof mark	Ex I M1 Ex ia I Ex II 2G Ex ia IIC T4

## Intrinsically safe converter IK1 – x/x

Intrinsically safe converter IK1 – x/x is a device used to convert digital signals in following standard: Serial RS232/422/485, Ethernet 100Base-TX, 100Base-FX optical, radio WiFi IEEE 802.11b/g, Modbus/RTU RS-xxx and Modbus/TCP.

Converter is available in the following versions:

- IK1-R/F** Intrinsically safe converter RS-xxx standard into 100Base-FX optical standard
- IK1-R/W** Intrinsically safe converter RS-xxx standard into WiFi IEEE 802.11b/g standard
- IK1-R/E** Intrinsically safe converter RS-xxx standard into Ethernet 100base-TX standard
- IK1-E/F** Intrinsically safe converter Ethernet 100base-TX standard into 100base-FXoptical standard
- IK1-E/W** Intrinsically safe converter Ethernet 100base-TX standard into WiFi IEEE 802.11b/g standard
- IK1-RM/F** Intrinsically safe converter of the Modbus/RTU RS-xxx standard to Modbus/TCP via 100base-FX optical standard
- IK1-RM/E** Intrinsically safe converter of the Modbus/RTU RS-xxx standard to Modbus/TCP via 100base-TX Ethernet standard



Power supply	12÷15V DC
Serial Interface	RS-232/422/485
Network interface	electrical: 100BASE-TX
	optical: 100BASE-FX
	radio-WiFi 802.11b/g
Working temperature	from -10°C to +40°C
External dimensions	190x75x75mm
Casing internal protection	IP-54
Certificates	TEST 13 ATEX 0057X, IECEx FTZU 15.0008
Explosion-proof mark	Ⓔ I M1 Ex ia I Ma, Ex ia op is I Ma

## CONVERTER CSA-420 and CSKC-485

Converter CSA-420 is a device used to convert the current signal from 4-20mA and 0-20mA standards into digital form, whereas CSKC-485 converter is a device used to convert digital signals from RS422/RS485 standard into telemetric central station type CST-40, CST-40A and CST-40C. RS485/RS422 interface connector is a separate intrinsically safe circuit and is galvanically isolated from the rest of the system. Both converters work directly via the supply and transmission line of telemetric central station CST-40, CST-40A or CST-40C. Converters CSKC-420 and CSKC-485 are devices of M1 and 2G category. Field of use shall include all establishments of underground mining with possible methane or coal dust explosion hazard. The device can also work in threatened areas beyond the mining industry.



Name	Converter
<b>Type</b>	<b>CSKA-420</b>
Measuring range	0-25 mA
Measurement method	continuous
The input impedance	100Ω
Working temperature	from -10°C to +40°C
External dimensions	110 x 75 x 56 mm
Casing internal protection	IP54
Type test certificate	TEST 13 ATEX 0055X
Explosion-proof mark	Ⓔ I M1 Ex ia I Ma Ⓔ II 2G Ex ia IIB T4 Gb



Name	Converter
<b>Type</b>	<b>CSKA-485</b>
Serial Interface	RS422/485
Working temperature	from -10°C to +40°C
External dimensions	110 x 75 x 56 mm
Casing internal protection	IP54
Type test certificate	TEST 13 ATEX 0056X
Explosion-proof mark	Ⓔ I M1 Ex ia I Ma Ⓔ II 2G Ex ia IIB T4 Gb

## MEDIA CONVERTER CFC-\*

Media converter type **CFC-\*** is a device used to convert signals in the Ethernet, Fast Ethernet and Gigabit Ethernet standard between the electrical and fiber optic interface. The converter is available in the following versions:

**CFC-M/S** – media converter 10/100BASE-TX to 100BASE-FX (standard version)

**CFC-M/I** - media converter 10/100BASE-TX to 100BASE-FX (version for DIN rail)

**CFC-G/S** - media converter 10/100/1000BASE-T to 1000BASE-LX (standard version)

**CFC-G/I** - media converter 10/100/1000BASE-T to 1000BASE-LX (version for DIN rail)

Each device is equipped with the appropriate SFP module



Power supply	Un = 12÷48V DC for version CFC-x/I Un = 5V DC for version CFC-x/S
Parameters of the optical output	$P_{OPTO} \leq 40 \text{ mW}$
Type test certificate	JSHP 18 ATEX 0017X
Explosion-proof mark	⊕ I (M1) [Ex op is I Ma] ⊕ II (1G) [Ex op is IIB T3 Ga]

## LINEAR DISPLAY CSWL-1x

Linear display **CSWL-1x** is a device used to present the measurements results of the sensor connected to the telemetric center line of CST-40x system. It can work with module line type ML-1 and ML-2. The display is useful when the sensor/device that we want to check does not have a display or access to it is difficult. The device can display measurements from the sensor, alarm thresholds, factory number, etc.



Power (Interface type CST-40(A), CST-40C)	from the power supply and transmission line
Transmission	digital, one-way
Max. line length	up to 10 km (depending on the sensor)
Connection method	parallel to the line
Ingress protection	IP65
UE-type examination certificate	JSHP 18 ATEX 0016
Explosion-proof mark	⊕ I M1 Ex ia I Ma

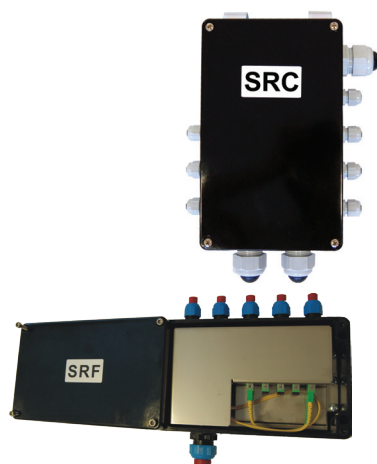
## DISTRIBUTION BOX SRX

The **SRx** distribution box is designed for making electrical and / or optical fiber connections in cables with different or the same number of pairs and fibers. The SRx box is used in teletechnical, signaling, methanometric systems and in automation control circuits in intrinsically safe installations. The box is produced in the following varieties:

**SRC-X** Cable distribution box

**SRF-X** Fiber optic distribution box

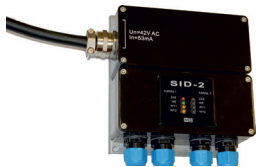
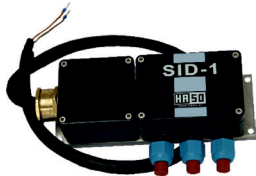
**SRCF-X** Cable and fiber distribution box



Types of connectors	<b>Distribution box SRC</b> KVA-1/a LZ B-4 LZ B-10 TOPJOB ZT-20	<b>Distribution box SRF welds</b> SC/APC connectors SC/PC connectors E2000/APC connectors E2000/PC connectors ST connectors
Cable diameter range:	glands M20x1,5: 6 ÷ 13mm glands M25x1,5: 7 ÷ 17mm glands M32x1,5: 13 ÷ 21mm glands M40x1,5: 22 ÷ 32mm	
Number of terminals	Depending on the connectors type	
Casing internal protection	IP65	
EC type examination certificate	TEST 15 ATEX 0052X	
Explosion-proof mark	⊕ I M1 Ex ia I Ma ⊕ II 2G Ex ia IIB T4 Gb	

## SEPARATORS SID-1, SID-2, SID-3

Intrinsically safe Two-Stage Separator type **SID-1**, **SID-2** & **SID-3** is a stationary device designed for transmitting two-stage information between intrinsically safe circuits. It is used for separation of intrinsically safe circuits in class "ia" or "ib" in any combination.



Power supply	42 VAC
Line check mode	diode in series
Weight	2,2 kg
Casing internal protection	IP54
Type test certificate	KDB 09 ATEX 107
Explosion-proof mark	⊕ I M1/M2 Ex ia mb I

Power supply	42 VAC
Line check mode	diode in series
Weight	3,0 kg
Casing internal protection	IP54
Type test certificate	KDB 12 ATEX 0094
Explosion-proof mark	⊕ I M1/M2 Ex ia I

Power supply	42 or 230 VAC
Line check mode	diode in series
Weight	2,3 kg
Casing internal protection	IP54
Type test certificate	FTZU 12 ATEX 0090
Explosion-proof mark	⊕ I M1/M2 Ex ia I Ma ⊕ I M2 Ex e mb [ia Ma] I Mb

## Differential pressure transducer PDP-1x

Differential pressure transducer **PDP-1x** is a stationary, contact device used to control the pressure difference. It is intended for use primarily in mines in order to control the opening, closing and sealing ventilation dam, airflow in separately ventilated wall and for signaling the level of the water in sump. The pressure is indicated as a digital signal, and the threshold value is set individually.



Measuring range	20 ÷ 4500 Pa (0,2-45 mbar)
Pressure entry	2 or 4 connectors
Cable entry	1 or 2 cable glands
Casing internal protection	IP54
Type test certificate	TEST 13 ATEX 0042X
Explosion-proof mark	⊕ I M1 Ex ia I ⊕ II 2G Ex ia IIC T6

## Calibrators

Calibrators are devices designed for carrying out tests and measurements of devices operating in explosion hazard areas in underground coal mines. **Calibrator KR-2** is a portable microprocessor device, It is mainly used to cooperate with gas detection devices, e.g., CSM-1, CSHT-1, CSCO-1, CSCO-2, CSO-2, CSPA-2, CSM-3, CSM-3i and CSCD-3i. The calibrator communicates with such devices via radio waves or by cable.



Power supply	batteries 3,6 V
Transmission method	digital, by radio or with cable
Weight	0,35 kg
Casing internal protection	IP 54
Type test certificates	KDB 07 ATEX 256X
Explosion-proof mark	⊕ I M1 Ex ia I

**Calibrator KK-1** works mainly with a portable signaling methane detector MPS-1 and MPS-1i. Calibrator allows to connect methane detector to a computer to manage accounts, set alarm thresholds, archive data, etc.

## METHANE DETECTORS

Methane detectors **MPS-1**, **MPS-1i** are portable devices for measuring atmospheric parameters and signaling exceeding methane content in explosion hazard areas in underground coal mines. Thanks to the innovative technology methane detectors MPS-1, MPS-1i can be used:

- as a private methane detector,
- as a portable methane detector, hung in a mining work place (also blasting work) or in underground vehicles e.g. railway locomotive,
- as a methane detector it cooperates with exploder of electrical and electronical fuse. Methane detector will be used to block the exploder when the methane content have been exceeded,
- as a stationary methane detector with use of switching-off outputs UW1, UW2.



Measurement range	<b>for MPS-1:</b> 0-5% CH <sub>4</sub> (catalytic) 5-100% CH <sub>4</sub> (conductometric) <b>MPS-1i:</b> 0-100% CH <sub>4</sub>
Measurement method	continuous, pellistor ( <b>MPS-1</b> ), IR ( <b>MPS-1i</b> )
Casing internal protection	≤ 5s ( <b>MPS-1</b> ) and ≤ 25s ( <b>MPS-1i</b> )
Casing internal protection	IP54
Type test certificate	FTZU 10 ATEX 0042X
Explosion-proof mark	⊕ I M1 Ex ia I Ma

The connection box type **MPS-1SP** is an additional component for the portable device MPS-X. It is used to separate and double the quantity of two-state outputs (UW1 and UW2).

## ELECTROMAGNETIC FLOWMETER MTFEx-10

Electromagnetic flowmeter **MTFEx-10** is design to measure the liquids flow in closed piping installations. Device measures the flow of clean and contaminated conductive liquids, aggressive and chemically inert liquids as well as conductive mixtures and pulps, e.g.:

- drinking water, sewage and sewage sludge, water in fire protection installations,
- acids, alkalies
- food liquids (milk, juice, beer, wine).

MTFEx-10 measures with a given accuracy class liquid flow with a linear speed from 0.1m/s to 10m/s in the standard version. The measurement is made in two directions: forward and backward. The flow meter is available in a compact version (transducer mounted directly on the sensor) and in a separate version (transducer connected to the sensor with cables)



Power supply	Un = 10-16V
Switching-off output UW	Optopmos with a serial diode
Serial interface	RS485 (two-wire)
Output	4-20mA and/or frequency output
Ingress Protection	IP67
Electrode materials	stainless steel (standard) C-386 (HASTELLOY), Tantalum, Titanium, Monel (optional)
Measuring tube diameters (DN)	50-500 mm
UE type examination certificate	JSHP 19 ATEX 0005
Explosion-proof mark	⊕ I M1 Ex ia I Ma ⊕ II 2G Ex ia IIB T4 Gb

## THE INTRINSICALLY SAFE POWER SUPPLY ZIB-x

The intrinsically safe power supply **ZIB-x** is a stationary device mainly used to supply intrinsically safe circuits. The power supply is made in variants that differ in input and output parameters. Available in two versions: without battery backup (ZIB-1) and with battery backup (ZIB-2x).

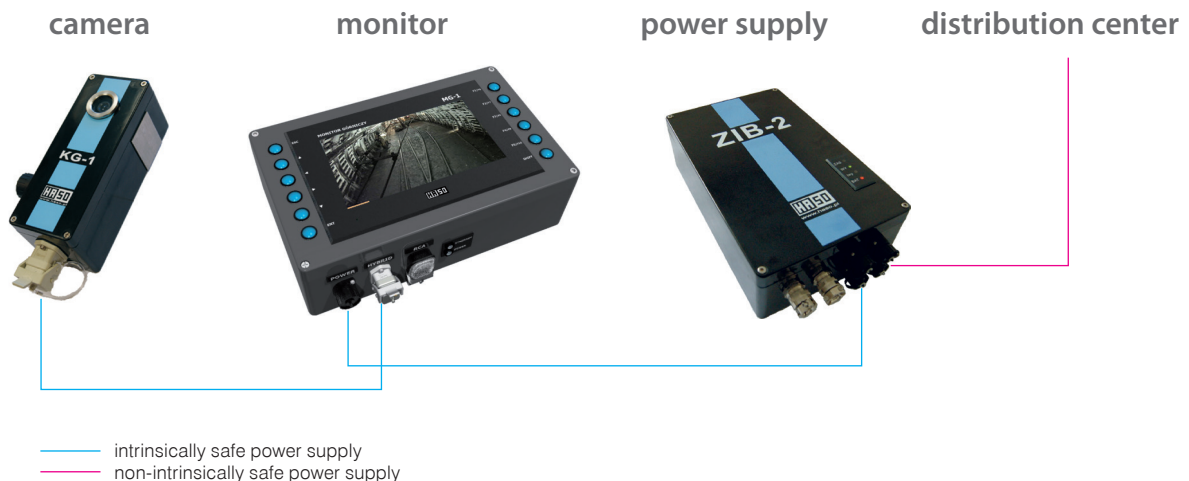
ZIB-x is powered from non-intrinsically safe voltage 24VAC, 42VAC, 230VAC or 250VDC. The output voltage of the PSU is connected to the DC1 and DC2 connectors (or DC1 and OPTO in the ZIB2F version) connected in parallel. In the ZIB-2x version, in the absence of a mains power supply, the device switches to battery operation mode.

Each version of the power supply has two communication interfaces: ZIB-1 and ZIB-2 versions have an RS-485 interface and an RS-232 interface, the ZIB-2F version has an RS-485 interface and a 100base-FX fiber optic Ethernet connector. Signaling diodes (3 for ZIB-1 and 4 for ZIB-2x) and binary outputs are used for signaling and monitoring the current status of the PSU. Operating parameters and data on the status of the PSU can also be obtained through the above-mentioned communication interfaces.



Supply voltage (nominal)	24VAC, 42VAC, 230VAC or 250VDC
Nominal output voltage	12V or 15V
Rated output current	0,5A or 1A or 1,5A
Ingress Protection	IP54
Working temperatures	from -5°C to +40°C
Working humidity range	from 15% to 95% without condensation
Dimensions (with glands and connectors)	ZIB-1: 295 x 250 x 125 mm ZIB-2x: 440 x 250 x 125 mm
Weight	ZIB-1: 10kg ZIB-2x: 15 kg
EC type examination certificate	TEST 13 ATEX 0009X
Explosion-proof mark	ZIB-1: I M2 Ex eb mb [ia] I, II 2G Ex eb mb [ia] IIB T4  ZIB-2: I M2/M1 Ex eb ma mb [ia] I, II 2(1)G Ex eb ma mb [ia] IIB T4  ZIB-2F: I M2/M1 Ex eb ma mb [ia op is] I, II 2(1)G Ex eb ma mb [ia op is] IIB T4

## An exemplary diagram of the ZIB-2 power supply application



## THE HAP- \* MINING ACCESS POINT

The **HAP- \*** mining access point is a stationary device that has the access point functionality of an WiFi IEEE 802.11 a / b / g / n wireless network.

The device is made in the following versions:

**HAP-1** Mining access point, 1-port

**HAP-4** Mining access point, 4-port

**HAP-1 / RP** Repeater WiFi

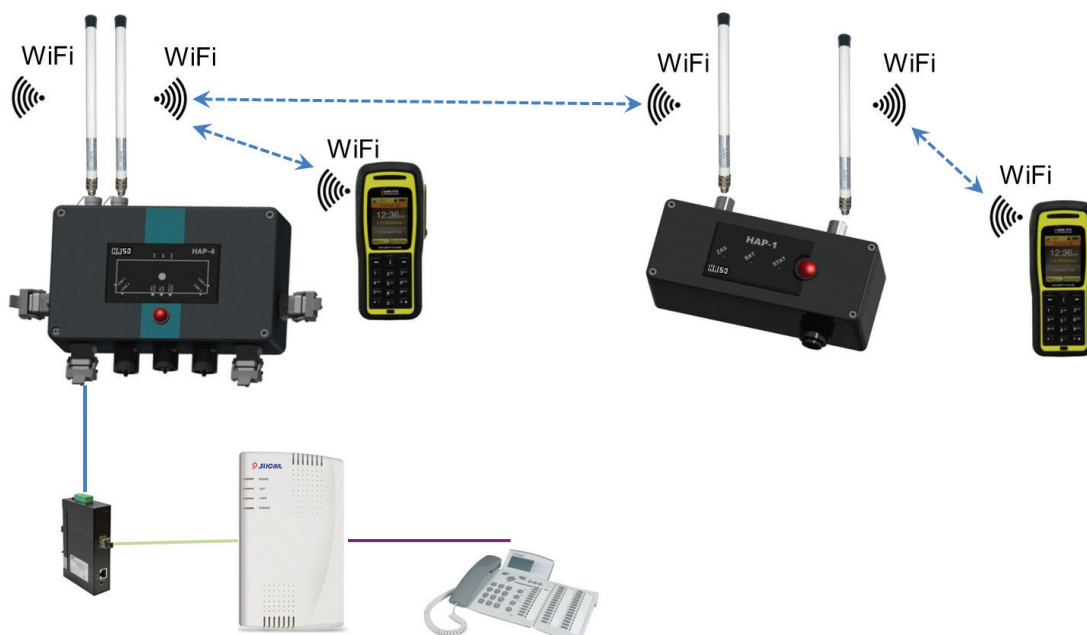
The **HAP-1** version has 1 port operating in the Fast Ethernet 100Mbps standard. Depending on the version, this port can operate in the fiber optic (100BASE-FX) or electrical (10 / 100BASE-T / TX) standard. The **HAP-4** version has 4 ports in the Fast Ethernet standard. Three ports operate in the 100BASE-FX fiber optic standard, while the fourth one can operate in the fiber or electric standard depending on the version.

In addition, selected versions may be provided with battery backup (min. 4 hours).

Power supply	Un = 12÷24V DC, max 0,5A
Communication standards	10/100Base-T/TX, 100Base-FX, WiFi IEEE 802.11 a/b/g/n 2,4GHz, 5GHz, RS485, digital outputs / inputs
Communication ports	Max 4 x Ethernet, 2 x antenna
Ingress Protection	IP65
EU type-examination certificate	JSHP 19 ATEX 0016
Explosion-proof mark	⊕ I M1 Ex ia op is I Ma ⊕ I M1 Ex ia I Ma



## Example application of HAP-4 and HAP-1/RP



## MINING CAMERA KG-x

Mining camera in versions **KG-x** is a stationary device. It is designed to convert the image into a digital data stream. The video image is compressed in H.264 standard and then transmitted via optical fiber to 100BASE-FX or 100BASE-TX standard. The camera is produced in following types: KG-1 and KG-1z. In addition, both types of cameras (KG-1, KG-1z) are produced in the following configuration:

- analog or digital HD 1080p
- with or without factory-set zoom
- interface type fiber optic or cable (Ethernet).

Camera KG-x in each version has a hybrid connector on the housing, through which the power and fiber or ethernet patchcord is supplied to the camera. Mining camera version KG-1z has additionally on housing 4-pin power connector. In this version the camera can be powered by a hybrid or power connector. Additional, through the electric circuit of camera can power the another intrinsically safe circuit (eg. Intrinsically safe switch type NS-40A produce by HASO).

KG-x is a device of M1 and 2G category and may thus be used in all underground mines with possible methane or coal dust explosion hazard. It can be used by the industry too.



KG-2

Power supply	Un = 12÷15V DC In ≤ 0,8A
Working temperature	from -10°C to +40°C
Relative humidity range	to 95% without condensation
External dimensions	230 x 75 x 75 mm without sling
Weight	about 2 kg
Casing internal protection	IP-54
Working position	any
LAN transmission parameters (fiber):	100 Mbps (100BASE-FX 100BASE-TX)
Explosion-proof mark	⊠ I M1 Ex ia op is I Ma, ⊠ II 2G Ex ia op is IIB T4 Gb
EC type examination certificate	TEST 14 ATEX 0080X



View from a camera at the bottom of the mine

## Mining camera KG-3

**KG-3** mining camera is an extended version of the KG-1 digital camera.

The camera has an integrated power supply, which enables power supply from 42VAC or 230VAC. The supply voltage is switched with dedicated fuses in the connection chamber of the power cable. The KG-3z version can also be powered from an intrinsically safe 12-15V DC power supply.



Power supply	Un = 42VAC or 230VAC -15% +10% 12 ÷ 15 VDC (option)
External dimensions	240 x 190 x 143 mm
Weight about.	about 3,5 kg
Ingress Protection	IP65
Sensitivity	0,001 lux

## INTRINSICALLY SAFE MINING SWITCH ISG-1

Intrinsically safe mining switch ISG-1 is a stationary device designed to connect devices in Ethernet standard. It has from two to eight communication ports. The ports can be configured to work in the appropriate communication standard (electric 10/100BASE-T/TX or fiber optic 100BASE-FX), according to the order.

It is possible to make a switch in a version with battery backup (min. 4 hours) and with an SC / APC optical fiber distribution box.



Power supply	Un = 12÷24V DC, In = max. 0,8A
Working temperature	from -20°C to +60°C
Relative humidity range	from 0% to 99% without condensation
External dimensions	from 160 x 260 x 90 mm from 380 x 600 x 350 mm
Ingress Protection	IP65
Transmission speed	LAN (Ethernet): 10/100 Mbps (10/100BASE-T/TX) LAN (optical): 100 Mbps (100BASE-FX)
Explosion-proof mark	⊕ I M1 Ex ia op is I Ma
EC type examination certificate	TEST 16 ATEX 0011X



## MINING MONITOR MG-1

Mining monitor **MG-1** is a stationary device for displaying images from the cameras monitoring the mining excavations. The video is transmitted via optical fiber standard 100BASE-FX via cable or standard 100BASE-TX. In addition, there is the ability to connect an external analog input PAL (composite video 1Vpp). The monitor can be equipped with the function keys in the amount of 6 or 12 pieces. Button functions can be defined by the customer (eg. change the configuration parameters of devices, switching the image on the visual system of industrial processes, etc.).



Power supply	Uz = 9÷30V DC, type. 12V DC max. 16W
Temperature range	from -10°C to +40°C
Relative humidity range	from 0% to 95% without condensation
External dimensions	400 x 300 x 130 mm
Weight	about. 8 kg
Casing internal protection	IP65
EC type examination certificate	TEST 16 ATEX 0009X
Explosion-proof mark	⊕ I M1 Ex ia I Ma ⊕ I M1 Ex ia op is I Ma

## MOBILE GAS METER GM-1

Mobile Gas Meter **GM-1** is designed to work in all types of mine railways (floor-mounted rail, monorail, diesel-locomotive, battery-powered), longwall shearers, roadheaders and all the other moving machines used in mines. It is designed for continuous operation. GM-1 has four relay outputs. These outputs can be used for driving power switch to machines e.g. in case of exceeding the concentration of methane. Gas meter beside relay (opto-mos) outputs has RS422 interface and analog output (depending on version it can be voltage output 0-10V, 0-5V or current output 4-20mA).

The Mobile Gas Meter system consist of three cooperating types of devices:

- Junction Box GM-1JB/x (main controller)
- Terminal Box GM-1TB (user terminal)
- The Remote Probe R-X (gas sensor)

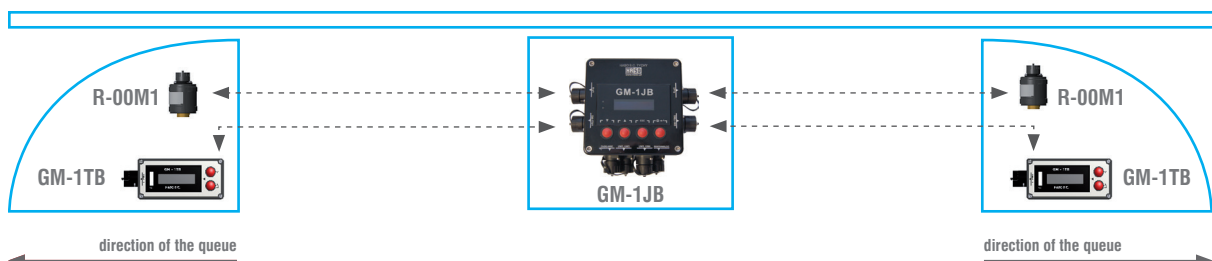
The device is equipped with rechargeable battery. In case of power failure the device can operate autonomously for about 10 hours. Mobile Gas Meter GM-1 is M1 category device.



Power supply	Un=10V±16V, In=500mA (Un=12V)
Power supply autonomy	8 hours
Measurement method	using attached probe, type R-x
Digital interface	RS422
Analog interface	0-10V/0-5V or 4-20mA
Working temperature range	from -10°C to +40°C
Relative humidity range	to 95% without condensation
External dimensions	GM-1JB/x: 160 x 160 x 90mm; GM-1TB: 75 x 160 x 56mm
Weight	GM-1JB/x: approx 2,5 kg; GM-1TB: approx 1kg
Casing internal protection	IP54
Explosion-proof mark	GM-1JB/x: I M1 Ex ia I Ma; GM-1TB: I M1 Ex ia I Ma
Type test certificate	GM-1JB/x: TEST 14 ATEX 0063X; GM-1TB: TEST 14 ATEX 0062X
Safety Integrity Level	SIL 1 (for configuration I - see manual) or SIL 2 (for configuration II - see manual)

## Example configuration of gas meter

### MONORAIL GAS METER GM-1



System consists of:

- GM-1JB/x: Gas Meter Main Controller (1 pc)
- GM-1TB: Gas Meter User Terminal (1 or 2 pcs)
- R-00M1: The Remote Probe R-X (infrared methane gas sensor) (1 or 2 pcs)

## COMBINE METHANE DETECTOR SET MKO-1X

Combine methane detector MKO-1x is a stationary device designed to measure and signal the concentration of methane in the area of combine mining work. In case of increasing the methane concentrations and exceeding the set threshold, the alarm signal is activated and the power of combine is shutdown by opening the control circuit UW1 / UW2.

MKO-1 consists of:

- ➔ The main controller GM-1JB/xS
- ➔ The user terminal GM-1TB
- ➔ Remote probe R-xM1 in combines cover OSP-Kx.

In addition, MKO-12 version has intrinsically safe power supply type ZIB-1/x with cable to GM-1JB.

Methane detector in MKO-11 version is powered by an external intrinsically safe power supply 12V DC, and MKO-12 is powered from the alternating voltage source with a value determined by power supply ZIB-1/x. Main controller GM-1JB has a built-in battery which allows activation of methane detector before powering combine, measure the initial concentration of methane and then switching power supply control circuit of combine.

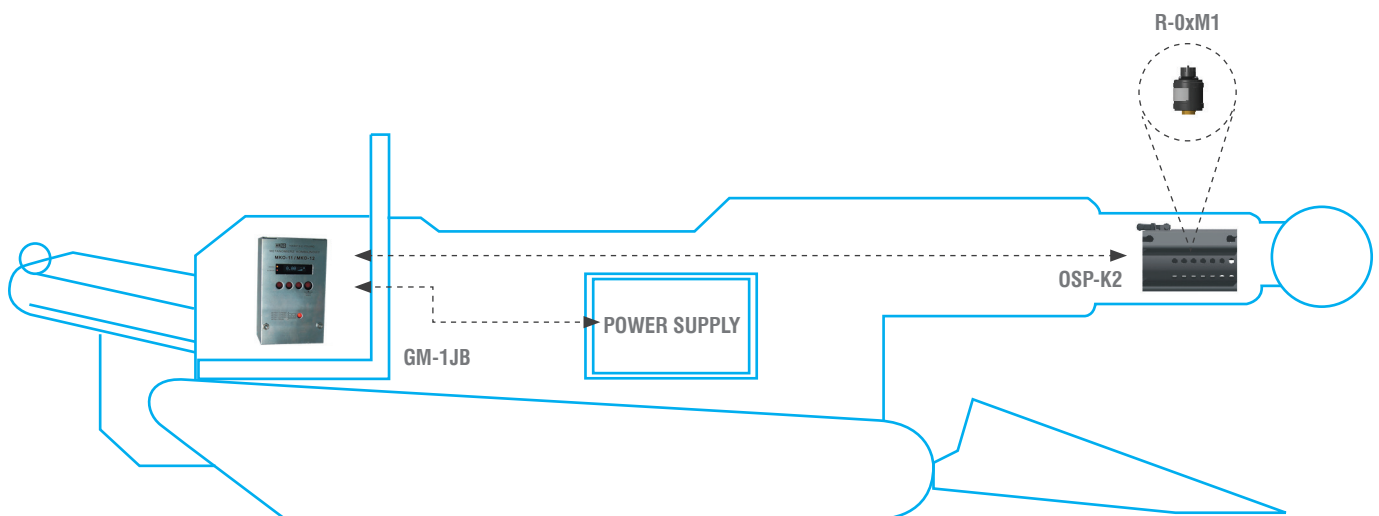


Remote probe  
R-0xM1 in combines  
with OSP-K2 cover

MKO-1x

Power supply (MKO-11 version)	10 ÷ 16V DC
Power supply (MKO-12 version)	24 V or 42V or 230V AC
Power supply autonomy	min. 8h when the battery is fully charged
Working temperature range	from -5°C to +40°C
Relative humidity range	from 10% to 95% without condensation
Measurement method	Continuous, infrared, gas penetration through diffusion
Measurement range	0 - 100% CH <sub>4</sub>
Response time T <sub>90</sub>	<30s
External dimensions / weight:	
- main controller GM-1JB/xS	160 x 160 x 90 mm / 2,5 kg
- user terminal GM-1TB	75 x 160 x 56 mm / 1 kg
- probe R-xM1 in combine cover	220 x Ø135 mm / 5,8 kg
- power supply ZIB-1/x	295 x 250 x 125 mm / 10 kg
Casing internal protection	IP 55
Explosion-proof mark	⊕ I M2(M1)/M1
EC type examination certificate	TEST 15 ATEX 0042X

## Example configuration of MKO-1x methane meter operation



Example configuration of MKO-1X

## BLASTING EQUIPMENT: OSH-1, OSH-1T, RPB-1, HZK-100x, HZKT-100



**Blasting ohmmeter type OSH-1** is designed for precise measurement of the resistance of blasting lines, blasting circuits and single electric detonators. Measurements may also be carried out in mine faces, close to loaded explosion material in blast holes. The device has two measurement ranges,  $00.00 \div 99.99 \Omega$  and  $100.0 \div 1999.9$  and may be used in all underground and strip mines. The measurement current is checked by means of OSH-1T tester.



**Stray currents recorder RPB-1** is designed for measurement of direct and alternating stray currents intensity in rock shooting sites and blasting agents storage places. It is a category M2 device and may thus be used in all underground mines with methane or coal dust explosion hazard.

## THE HZK-100x CAPACITIVE BLASTING MACHINE

The **HZK-100x** Capacitive blasting machine is a portable device designed to initiate electric detonators in series connection (class: 0.2A; 0.45A). The device has an internal Li-Ion battery providing an autonomous power supply system, and charging takes place outside the hazardous area using a dedicated power supply. The lighter is available in the version with the **HZK-100M** methane detector block, which works with the **MPS-1** portable methane meter.

The lighter has a built-in ohmmeter for measuring the resistance of the blasting circuit. The device is protected against accidental ignition of fuses with an external key and by requiring the appropriate sequence of use of the two buttons on the housing. Measurement of line resistance and firing of fuses is done through the same pair of terminals. **HZKT-100** tester is used to check the machine.



HZK-100M

HZK-100



HZKT-100

Power	Internal lithium-ion battery
Clamps max voltage	700V $\pm$ 10V
Ohmmeter measuring range	0 – 999,0 $\Omega$
Ohmmeter measuring resolution	0,1 $\Omega$
Ohmmeter measuring accuracy	0,2 $\Omega$ range from 0 $\Omega$ to 4 $\Omega$
	5% range from 4,1 $\Omega$ to 20 $\Omega$
	1,5 $\Omega$ range from 20,1 $\Omega$ to 999 $\Omega$
Auxiliary device (tester)	Capacitive blasting machine tester HZKT-100 (Explosion-proof mark: I -/M2 Ex ib I Mb )
Blasting efficiency for configuration 0.2A	220 detonators of 0,2A class (max. line resistance: 685 $\Omega$ )
Blasting efficiency for configuration 0.45A	180 detonators of 0,45A class (max. line resistance 260 $\Omega$ )
Pulse time / Maximum pulse energy	t $\leq$ 4ms / 20J
Charging time of the capacitor	< 10s
Time to press the FIRE button	15s
Ingress protection	IP65
EU-Type Examination certificate	TEST 17 ATEX 0030X
Explosion-proof mark	Ⓔ I -/M2(M1) Ex eb mb [ia Ma] I Mb

## Sensor RS1x

Sensor **RS1x** is a stationary device intended to measure gas concentrations and signaling exceeded preset limits. Sensor can be a component of a Distributed Telemetry System (RST) and is available as follows

**RS10** – without signal,

**RS11** – with optical signal

**RS12** – with optical-acoustic signal.

The gas probe S1-X is mounted in the sensor. Probes can measure gas concentrations like methane (infrared or pellistor), oxygen, oxide and carbon dioxide, hydrogen sulphide, sulfur dioxide, nitric oxide and nitrogen dioxide (electrochemical method). The sensor can be equipped with the following peripheral modules:

- communications interface RS-485 (Modbus RTU)
- output of the swithing-off circuit UW1, UW2
- digital input
- analog output (4-20mA, 04-2V or 0-10V)



Power supply	12 VDC (8-16V)
Measurement range	RS1x-M0: 0÷5% CH4 (catalic), 5÷100% CH4 (conductivity) RS1x-M1: 0÷100 CH4 RS1x-CD: 0÷5% CO2 RS1x-CO: 0÷2000ppm CO RS1x-NO: 0÷250ppm NO RS1x-ND: 0÷20ppm NO2 RS1x-SD: 0÷50ppm SO2 RS1x- HS: 0÷50ppm H2S RS1x- O: 0÷25% O2
Measurement method	Continuous measurement, gas diffusion, method dependent on the type of gas being measured
Display	OLED
Light signaler (RS11x, RS12x)	high brightness LED, red
Acoustic signaler (RS12x)	95dB at 1m distance
Casing internal protection	IP65
EC type examination certificate	TEST 17 ATEX 0005X
Explosion-proof mark	⊕ I M1 Ex ia I Ma ⊕ II 2G Ex ia IIB T4 Gb

## BLASTING EQUIPMENT: RS-20, ISO-1, OSA-2

Optical-acoustic signaling device **RS20** is a stationary device intended to generate acoustic and optical alarm signals. Device is powered by an external intrinsically safe power supply 12VDC. It can work in RS-485 communication network. The signaling alarm can be switched on via the transmission line or via signals to intrinsically safe digital inputs.



Power supply	12 VDC (8-16V)
Light signaler	high brightness LED, red
Acoustic signaler	95dB at 1m distance
Casing internal protection	IP65
EC type examination certificate	TEST 17 ATEX 0006X
Explosion-proof mark	⊕ I M1 Ex ia I Ma ⊕ II 2G Ex ia IIB T4 Gb

**Intrinsically safe signal light ISO-1** is a device dedicated for wheel transport in explosion hazard areas (It is used in underground mines – M1 category). It is a portable battery supplied device which emits pulsating light. The source of light are LED diodes.

**Optical-acoustic siren OSA-2** is a stationary device designed for optical and acoustic signals. It is equipped with a digital input, working in „diode-in-series” mode. Input state enforces specific optical-acoustic signaling. OSA-2 is a device of M1 category.

## INDUSTRIAL AUTOMATION

Our offer includes a wide range of control systems and visualization always matched to individual customer needs, including:

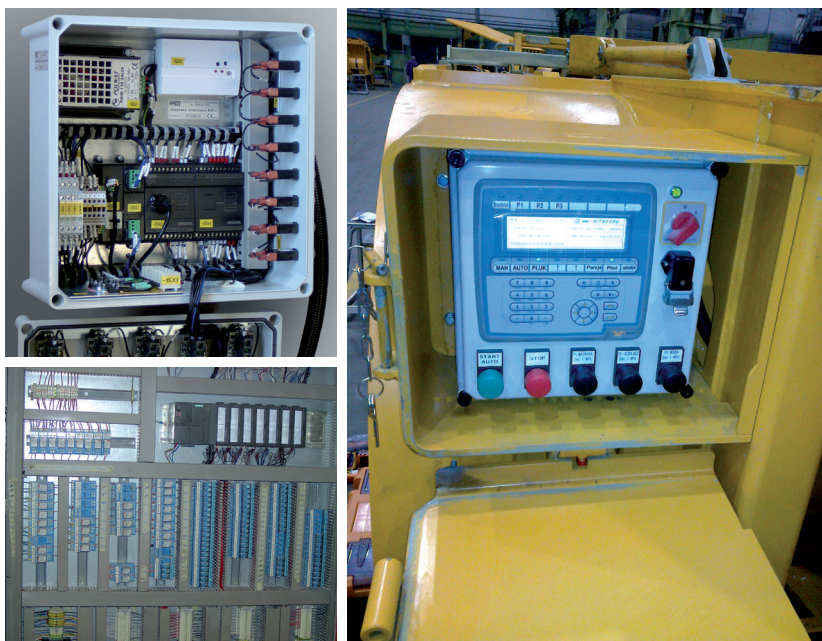
- ↳ standalone devices built based on our own electronic structures, which may include a microcontroller
- ↳ small control systems built based on PLC controller and possibly operator panel
- ↳ control and visualization systems containing, among others control cabinets, control station equipped with PCs, remote communication systems, etc.

The proposed solution can provide modernization or expansion of existing control systems, partial or total replacement of the old type of control on modern.

In performing control systems HASO offers:

- ↳ development of functional requirements in consultation with the user
- ↳ realization of the system design and electrical / electronic design
- ↳ completion of delivery devices and components
- ↳ realization of cabinets, control boxes,
- ↳ installation of actuating devices, sensors and object connection
- ↳ software of PLC controllers
- ↳ visualization systems SCADA
- ↳ development of a complete built documentation
- ↳ launch of the system and training of operators
- ↳ warranty and post warranty service.

### Realizations:



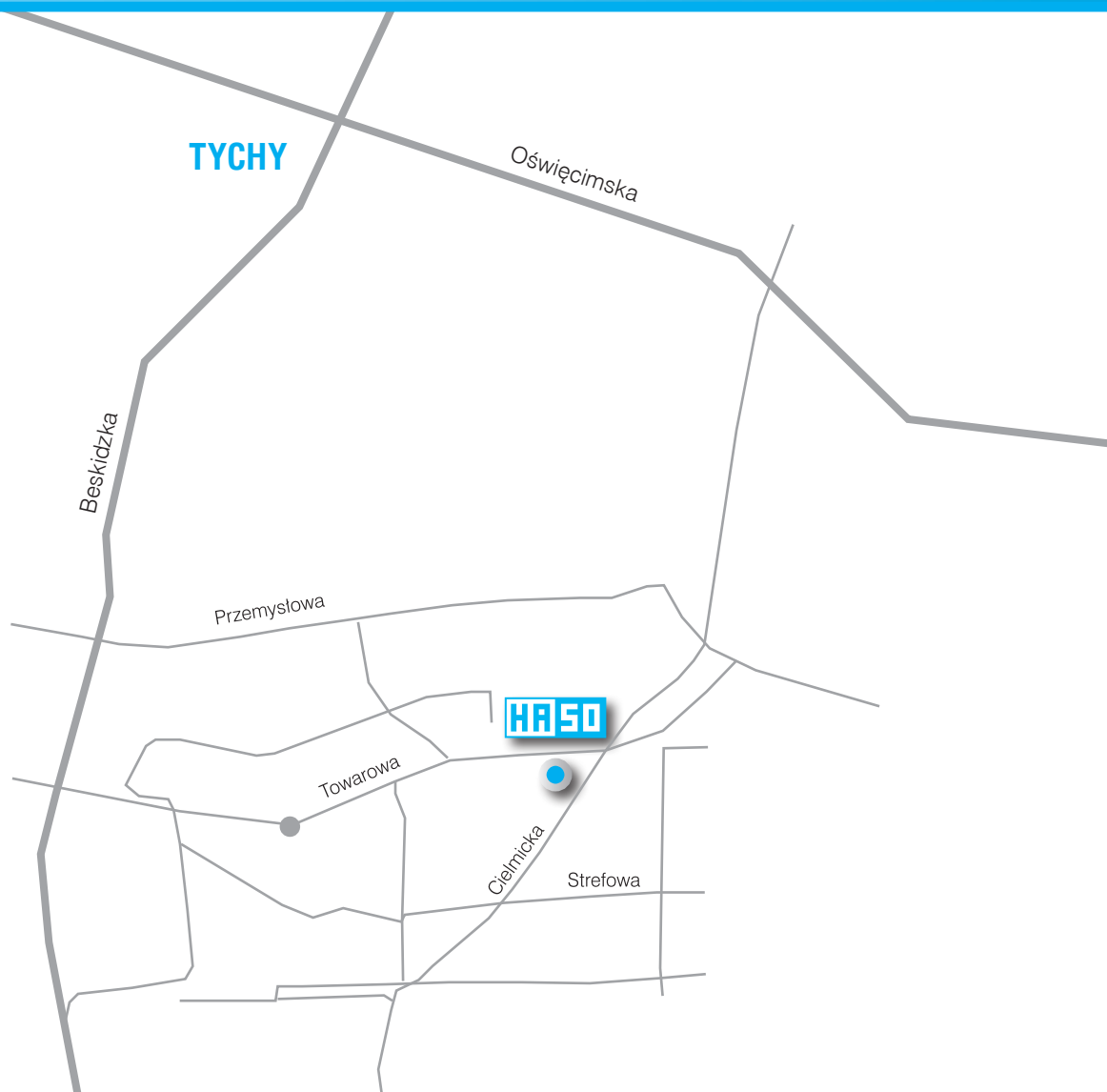
## SERVICE

Offer of HASO service includes comprehensive services:

- ↳ conducting periodic inspections and repairs of systems and methanometry equipment, during the warranty and post warranty periods
- ↳ replacing parts and components of devices which are not suitable for further use
- ↳ technical consulting
- ↳ installation and commissioning of installed safety systems and devices
- ↳ legalization and controlling of blasting equipment
- ↳ removing break down of telemetry system CST
- ↳ twenty-four-hour service readiness, seven days a week.



## CONTACT



## COMPANY HEADQUARTERS

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