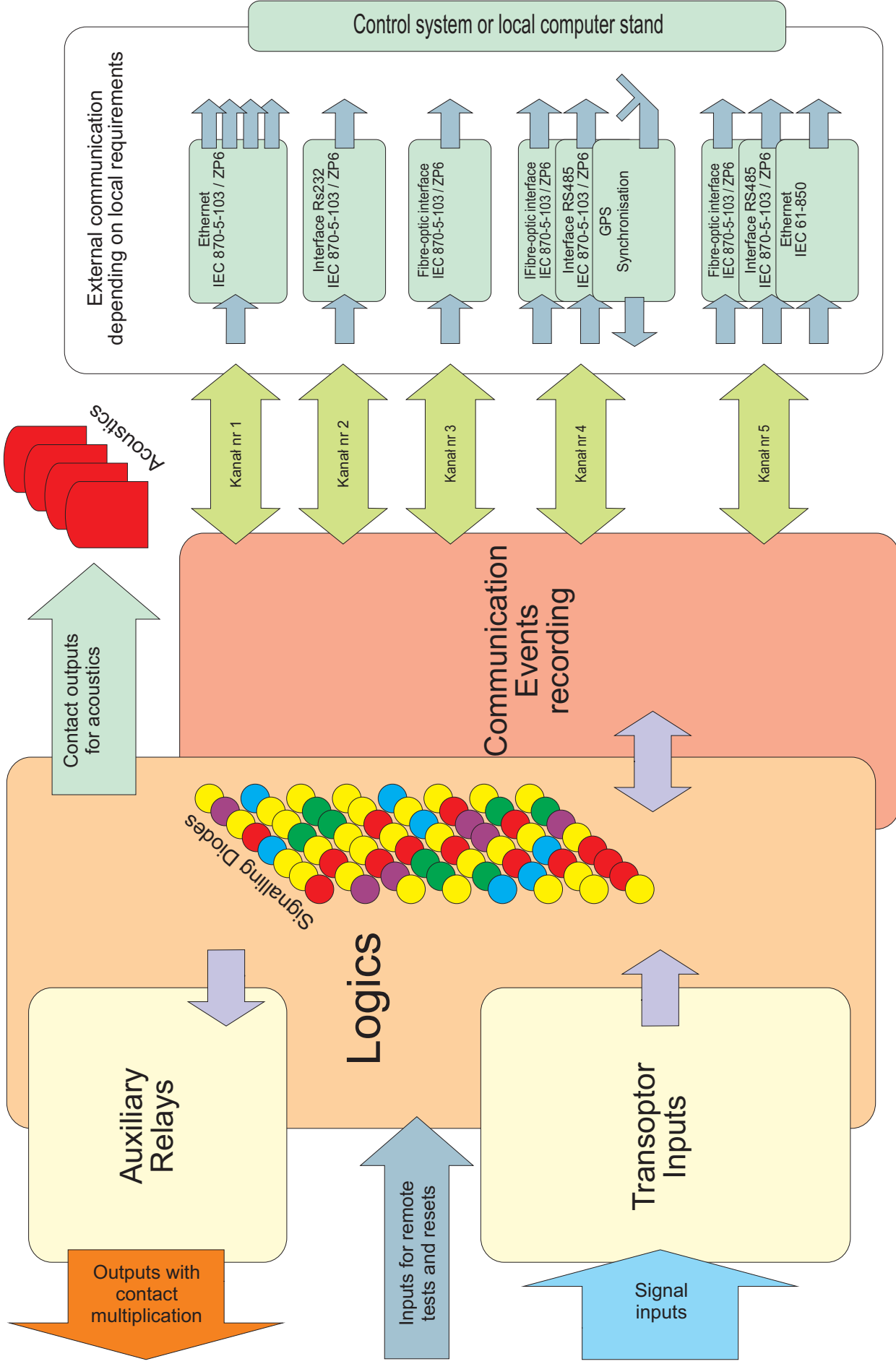




# MSA-9

**SIGNALLING  
SYSTEM**



**Structural scheme of MSA-9 signalling system**

## **1. APPLICATION.**

MSA devices are used both in permanently manned substations, as well as in high-voltage and low voltage substations without permanent staff. In case of substations controlled remotely from a supervisory dispatcher's station, they enable performing start-up and inspection works; they also provide a backup solution enabling manual operation of a substation in case of malfunction of the remote control and monitoring system. Central emergency and warning signalling systems are to certain extent backup for substation computer control systems, recording and data processing systems.

For many years ZPrAE has been manufacturing and supplying to power industry central emergency signalling devices for optical and acoustic signalling of protection activation, as well as for signalling malfunctions and disturbances in operation of power engineering equipment. The central digital signalling system MSA-9 is a device designed based not only on many years of experience in production and installation of signalling systems but also the latest trends and technologies. In comparison to MSA-6 or MSA-8 internal data exchange speed was improved resulting in increased precision of operation. Additionally the MSA-9 has an event recording module built inside. Multicolour super-bright RGB LEDs can be used to signal incoming activation signals in multiple colours. The MSA devices enable creating group multiplex signals, as well as multiplying incoming signals for remote signalling. They are used in power switching substations (and power plants) as primary signalling systems providing the operating personnel with accurate and fast information on appearing threats, malfunctions or activation of protections.

**Digital MSA-9 signalling system meets all requirements of PSE – OPERATOR defined in the "Backup Emergency Signalling" standard.** Furthermore, it is also an event recorder and enables relaying data to a substation monitoring system (substation control and monitoring system). A service port enables remote communication with the signalling system, previewing its status, reading recorded data and introducing potential changes to setup.

## **2. DESIGN.**

Elements of the MSA system can be used as a basis for designing complex central signalling systems. Backup emergency signalling for an entire facility (e.g. a substation) is usually installed in a standard cabinet. Installing the signalling units on substation mimic tables, replacing obsolete relays or lights are also common applications. However, depending on client requirements and local installation conditions, specific solutions may differ, because their final form is a result of detailed arrangements between the manufacturer, the investor and engineers. The number of input signals is limited by room available in a cabinet or on a mimic table. It appears that in case of large sets the size of a connection terminal strip and cables required to connect a given number of signals may be the limiting factors. Digitally programmable sounders installed on the roof of a cabinet or in a special chassis installed in a mimic table are used as acoustic signalling elements.

### 3. ENGINEERING SIGNALLING SYSTEMS.

Engineering process can be divided into three stages: first a “general” one that consists in defining the assumptions, second “electrical” i.e. specifying the workplace and including the control circuits of MSA-9 in the diagram, and third “programming” i.e. configuring the setups of inputs, input signal names, indication LEDs and multiplying outputs.

The main part of a signalling design should consist in defining signals and including them in the signalling input diagrams. Each input is independent and isolated from the others, and in a standard version can operate in 220 V DC or 230 V AC circuits. Other voltages: 110 V, 48 V, 24 V can be used after prior arrangement.

If required, input signals can be multiplied by an MWP module contacts: each separately, some selected or groups of selected signals. All contacts are isolated and can multiply signals while working as independent circuits.

It is recommended to feed the MSA-9 from two independent power circuits. In order to enable such solution the MSA is equipped with an MZA twin power supply unit. This ensures uninterrupted operation of the device even if one of supply voltages is lost. In case of multi-unit sets of the MSA-9 one MZA twin power supply unit can feed up to two units; the suggested solution consists in connecting all first lines in parallel to the first power supply and all second lines in parallel to the second power supply. Power supply units can be fed from 220 V DC or 230 V AC supplies. Power supply units adapted to work with 110 V DC supplies are also available.

If the signalling is to be fitted with an acoustic system notifying about disturbances sounders and an acoustic control module have to be included in the design. Use of an MWS-type module enables remote resetting and testing – via relay contacts or buttons located away from the MSA-9 device. In comparison to previous MSA versions the communication capabilities have been improved. Depending on the selected option various communication channels are available, including IEC 61850 protocol. Software supplied with the device enables remote communication with the signalling system, monitoring its status, reading recorded data and introducing potential change in setups.

*Note:*

*We can provide a **detailed MSA-9 signalling device data sheet** including full materials on the device. We also have ready-to-use **project outlines**.*

### 4. CONSTRUCTION.

Digital technology enabled designing the MSA-9, a new universal central signalling system device, which can accept and visualize multiple signals, is fitted with large lights and provides easily readable description fields. The device is fully configurable, the user can group inputs as required, assign them to specific indication LEDs and multiplying relays. Every indication LED, and multiplying relay, can be activated by any independently selected signal input or a group of (up to 10) signal inputs. A sounder control system integrated in a unit is activated by input signals assigned by the user in the software. Each input can have activation conditions configured independently (after appearance or loss of a signal); time delay can also be set. Testing and resetting panel enables manual testing (as well as resetting) of optical indication and acoustic channels directly from the front panel of the device.

Multipin connectors on the rear panel of the device are used to connect to external circuits. Every unit is fitted with twin power supply units guaranteeing continuous operation in case of loss of one of supply voltages. Additionally, an MSA-9 unit (first unit in case of extended sets) contains: a concentrator supervising work of the entire device, archiving data and providing communication via communication ports; a module of eight binary inputs – for remote resetting and testing of the set with button and relay contacts located away from the device; a module of eight relay contacts controlling sounders and operating condition indications. The MSA-9 signalling system is complemented by a panel of four digital, programmable PSA-4 sounders.

The "Standard" version of software supplied with the device enables configuring basic functions of the MSA-9, and its following operation. It provides the ability to preview current status of the signals on-line on a computer screen, read data from an event recorder and change input configuration as required. The optionally available "Plus" version of the software enables advanced configuration options. It enables signal grouping and assigning inputs to indicating LEDs or multiplying relays as required.

## 4.1. External dimensions.

The MSA-9 signalling systems are built as a EURO-19"/3U rack (or sets of racks), made of chromate plated aluminium, which provides higher resistance to EMC interference.

A standard 64-signal MSA-9 is contained in a single housing with the following dimensions:

19"/3U/240 (483×133.5×245 mm), extending the device capacity by every additional 64 signals will add to the set another rack, each with the dimensions specified above.

*Note: additional space, approximately 55 mm deep, should be available behind the device for installation cables to be connected with multipin connectors.*

The figure below shows a 128-signal MSA-9 set consisting of two 64-signal units and a PSA-4 sounder panel.

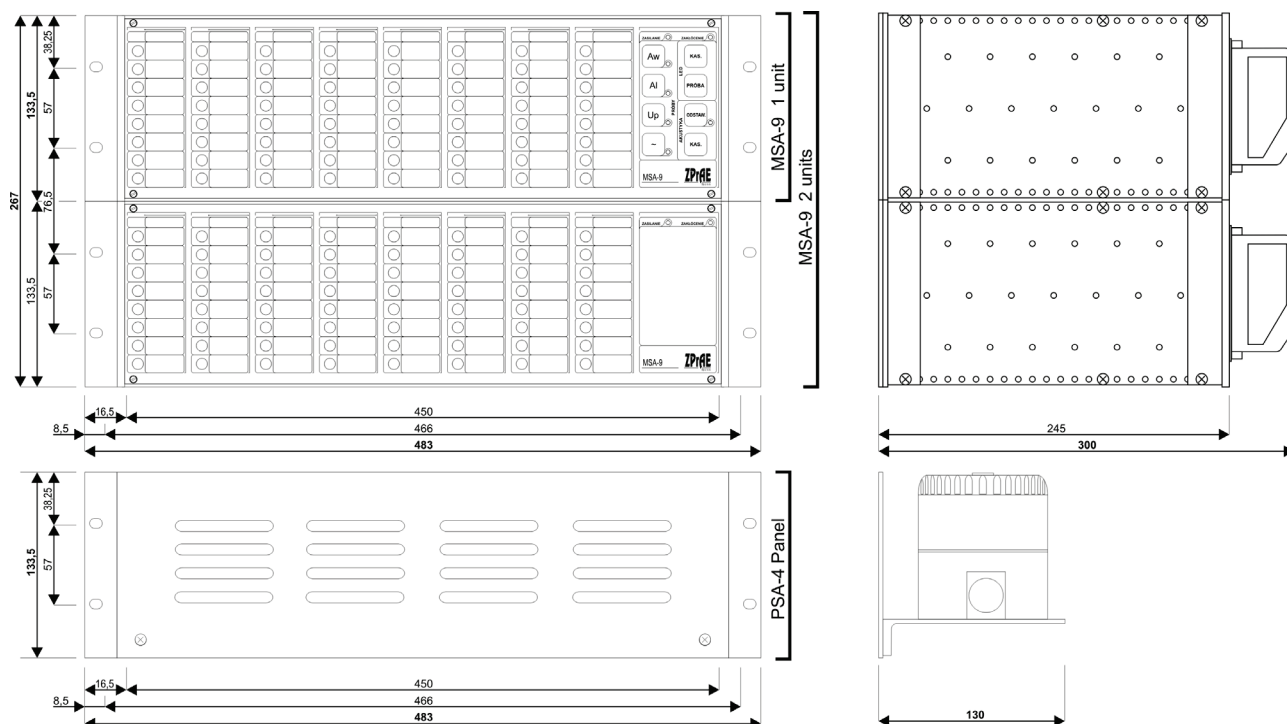


Fig. 4.1. External dimensions of an MSA-9 signalling system and a PSA-4.

## 4.2. Front panel.

Front panel of MSA-9 includes:

### 4.2.1. Testing and resetting panel.

The right side of the front panel has a control panel that consists of eight buttons arranged in three groups used for resetting and testing, and a single indication LED. In case of multi-unit sets the panel is installed only on the first unit and it supports all the units.

**LED group:** resetting LED (RES) and LED testing (TEST).

**ACOUSTICS group:** resetting of acoustic signals (RES); disabling of acoustics (DISABLE) and testing of all acoustic channels (Aw, AL1, AL2,~).

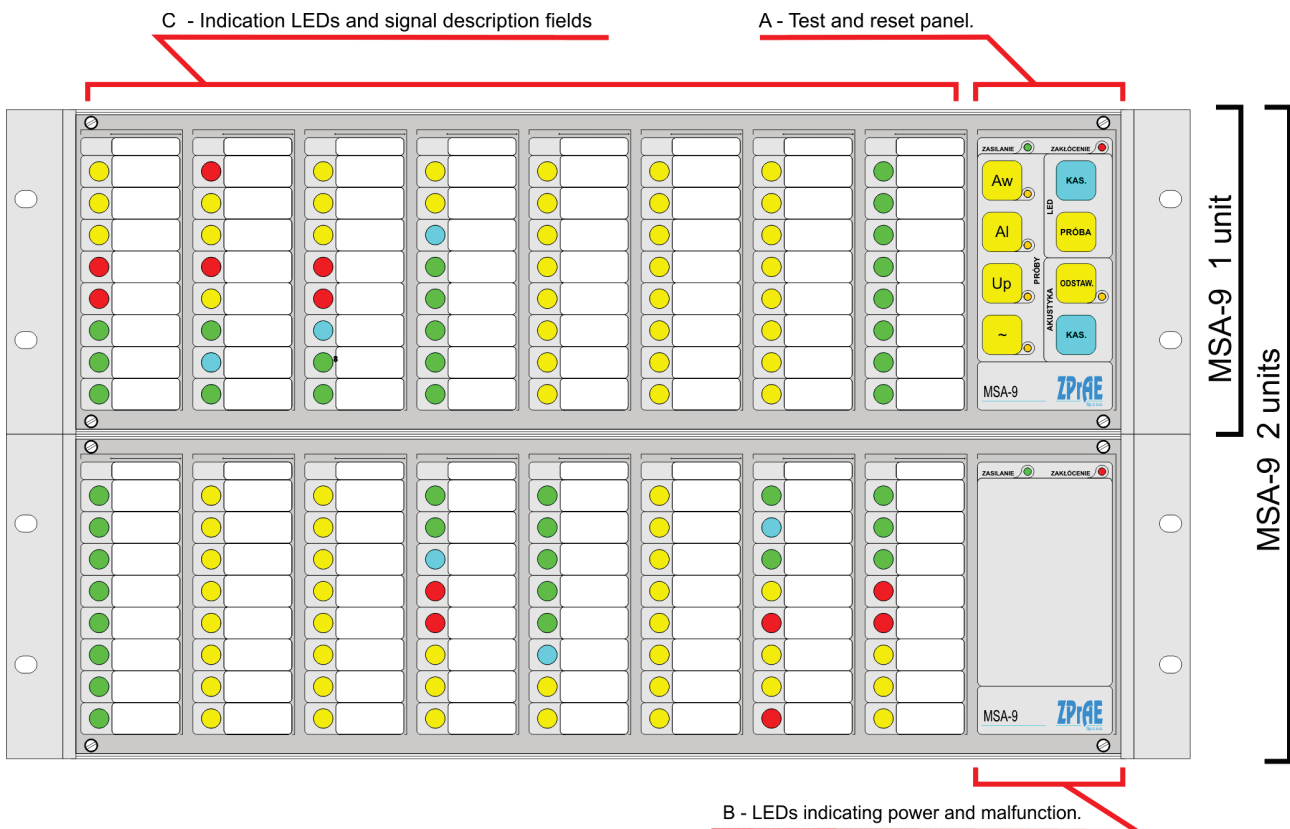


Fig. 4.2. Front panel of the MSA-9 signalling system.

### 4.2.2. LEDs indicating Power and malfunction.

In the right upper corner of the unit there are two LEDs indicating the operating condition of the unit. Green LED informs that power supply is applied to the unit, red LED indicates a malfunction.

### 4.2.3. Indication LEDs and signal description fields.

This part of the front panel contains 64 indication LEDs and description fields for identification with a suitable name of the signal. Multicolour super-bright RGB LEDs with light field diameter of eight millimetres function as optical indicators of the MSA-9 signalling device. LEDs are arranged in groups of eight in eight rows. Next to each row there are description fields. A description field for one LED is 27 mm ×13 mm (W×H). Moreover, above each row there is an additional description field with dimensions of 27 mm ×7 mm (W×H). Signal descriptions can be printed on foil or paper and inserted under the transparent part of the front panel. In standard design and with „Standard” software the

indication LEDs are assigned to the corresponding inputs following their order. With „Plus” software, however, it is possible to assign any input to the indication LEDs.

### 4.3. Rear panel and modules.

Card ports for external connections are located on the rear panel. Plugs with housings are supplied along with the device. LgY cables are recommended for external connections. The MSA units have power and inter-unit communication connectors, as well as input and multiplying connectors.

One unit consists of 8 input modules with 8 signal inputs each (i.e. 64 inputs) and 8 relay modules (optionally) with 8 multiplying outputs each (i.e. max. 64 multiplying outputs).

In standard design with „Standard” software inputs, indication LEDs and multiplying contacts are connected with each other in numerical order.

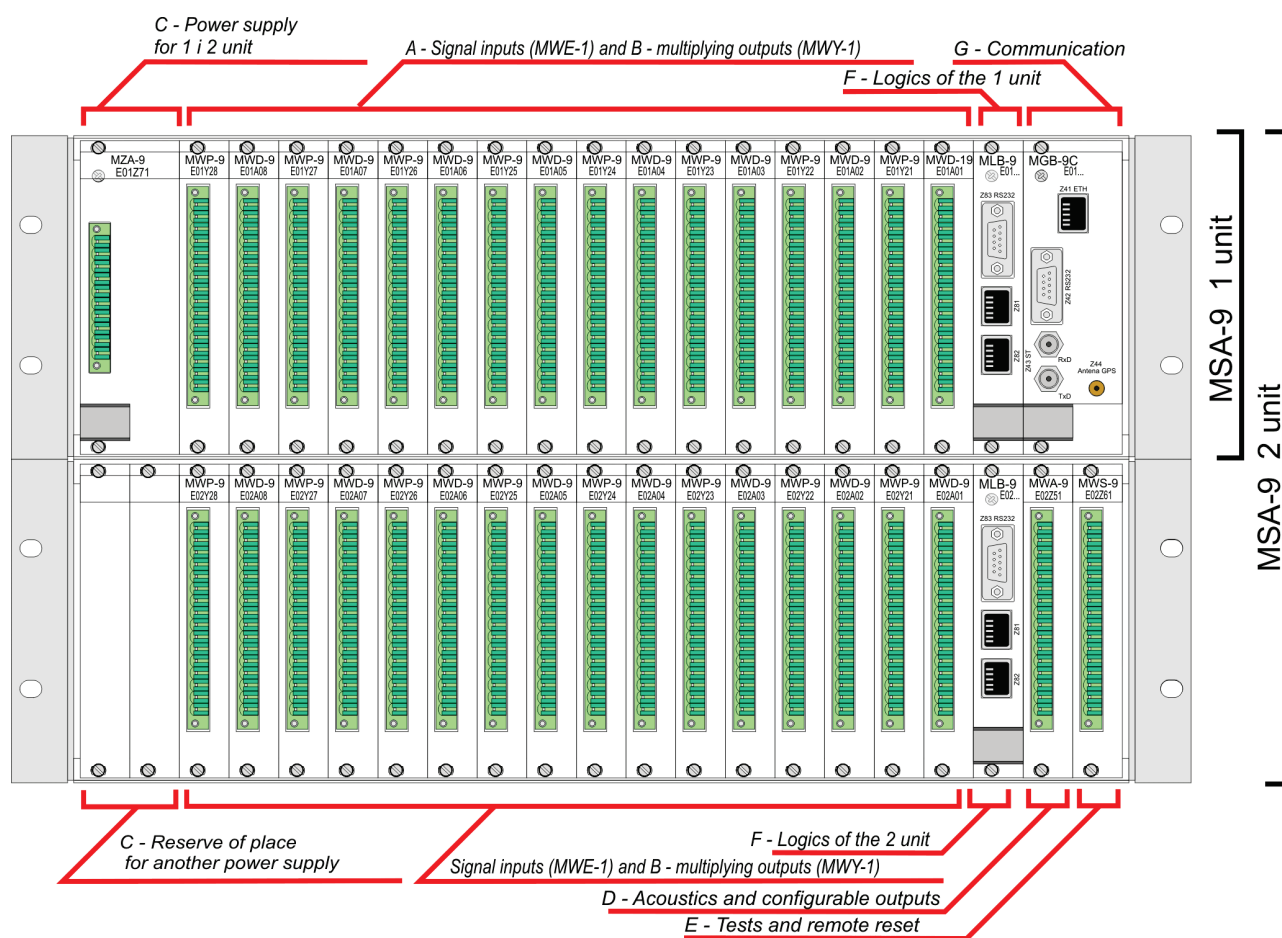


Fig. 4.3. Rear panel of the MSA-9 signalling system– two-unit set, 128 signals.

The figures show maximum number of cards and connectors available on the rear panel, it may vary depending on the signalling system.

### 4.4. Sounders.

The PSA-4 panel is used for acoustic notification of disturbances received. It enables fast identification of an incoming disturbance, as it has four sounders with a programmable sound modulation.

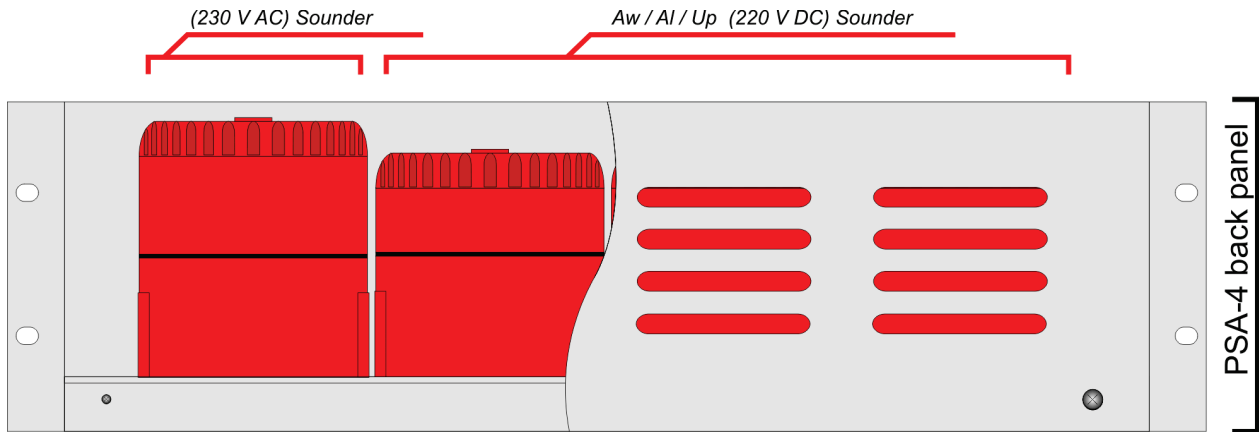


Fig. 4.4. Sounder panel PSA-4

Three sounders are adjusted for 220 (110) V DC voltage, and one for 230 V AC. The panel is designed for operation with acoustics control module, an MWA; each sounder is controlled with the appropriate outputs.

## 5. OPERATING PRINCIPLE.

The basic function of a central signalling system is to receive a signal, visualize it and give an acoustic notification, as well as group and assign input signals to the appropriate priorities. It is executed in the following way:

- activation of one of the input channels in a module starts quick flashing light (2 Hz) in this channel, operation of a multiplying relay and generation of an impulse activating the appropriate acoustic channel according to the selected configuration.
- the operator acknowledges the appearance of a disturbance first by switching off the sounder by pressing „ACOUSTICS RESET” button and then after locating and observing a given quick flashing light acknowledges it by pressing “LED RESET” button.
- depending on the needs of a given facility and user requirements the MSA-9 signalling system can run in two modes selected in the program separately for each group of eight indication LEDs – operation with slow flashing light or without slow flashing light.

### 5.1. Signal inputs.

Signal inputs can be set for appearance, as well as loss of input signal. Delaying time of activation is also possible. Signalling system detects the disturbance if it lasts for at least 5 ms in case of DC signals and 20 ms in case of AC signals. The delay time can be increased to 65 seconds. Disappearance of a disturbance is detected when it lasts for 10 ms in case of DC signals and 30 ms in case of AC signals. Inputs are configured from a computer connected to the device, on which the software supplied with the MSA-9 is installed.

### 5.2. Indication LEDs.

Indication LEDs reflect the inputs' status. Their light and logic of switching to flashing lights or switching them off is described in OPERATING PRINCIPLE above. In addition, multicolour LEDs that are installed in the device enable fast identification of disturbance type. Available LED colours are yellow, red, green, blue or purple. Testing and resetting of indication LEDs can be done from the front panel or software and in case of an



MWS-type module using the relay contacts or buttons located away from the MSA-9 device.

### 5.3. Multiplying outputs.

Multiplying outputs reflect the inputs' status. In case of typical 64-signal units with „standard” software the standard configuration is to assign the multiplying outputs individually to the specific input channels.

Depending on selected configuration of inputs, the multiplying contact assigned to a given input signal or group of signals remains closed for as long as the activation at the input of this channel or one of the channels within a group lasts and does not depend on resetting of signalling. It is also possible to select a “Sustain multiplying” option where the contact is sustained until “LED RESET” button is pushed.

### 5.4. Acoustics.

The signalling system has integrated system for controlling the sounders. A specially configured MWA-type module is responsible for activating the individual circuits. Via internal communication bus the module is cooperating with three acoustic channels Aw, AI1 (AI), AI2 (Up) and activates the appropriate sounders connected to the contacts of its relays.

As a set of sounders it is recommended to use a PSA-4 panel consisting of three sounders for 220 V DC (110 V DC) voltage and one fed by 230 V AC voltage.

### 5.5. Testing and resetting.

The MSA-9 signalling system is equipped with testing and resetting panel available on its front. Testing and resetting can also be performed remotely with relay contacts or buttons via a MWS module. It makes it possible to install the acoustic resetting closer to the control pulpit.

### 5.6. Event recorder.

The main recorder memory is capable of storing up to 10 thousand events, at 1 ms resolution. The events are generated by the logic of an MLB device and then sent to an MGB concentrator where they are stored in the memory. In case of too many recorded events the oldest data will be lost (overwritten).

Moreover, the event recorder is also equipped with a protection against inflow of false data from the damaged (activated) input channels based on the following standard principles:

- there should be no more than 3 repeated activations within 1 s,
- there should be no more than 6 repeated activations within 10 s.

If the above criterion is exceeded, the recorder will be locked for this channel. Unlocking of the channel is automatic upon establishing that the above criterion is not exceeded. These events will be recorded as:

- channel xxx recorder locked,
- channel xxx recorder unlocked.

Data from the recorder can be sent to a primary control and monitoring system. They can be also viewed in a main program window.

### 6. UTILITY SOFTWARE.

Together with the central MSA-9 signalling device the user receives software for its configuration and operation. The software is available in two versions: "standard" which is always supplied with each MSA-9 device; and „Plus" available as an additional option. Installation software is provided on CDs.

### 7. SCOPE OF SERVICES PROVIDED BY THE MANUFACTURER.

The manufacturer provides support in designing MSA-9 signalling systems. This data sheet contains only basic information. We can provide a **detailed MSA-9 data sheet** including full materials on the device. We also have ready-to-use **project outlines**. The manufacturer supplies system devices configured as agreed, takes care of the equipment during the warranty period and ensures full service after its expiry.

The manufacturer also provides services in scope of designing new and revamping existing systems – including inventory taking of the circuits and on-site installation of the supplied equipment.

## 8. TECHNICAL PARAMETERS OF THE MSA-9 SYSTEM.

|                        |   |  |
|------------------------|---|--|
| Auxiliary power supply | Rated auxiliary voltage $U_{PN}$ :  | 220 V DC / 230 V AC or other as agreed   |
|                        | Permissible range of auxiliary voltage change:  | $0.8 \div 1.15 U_{PN}$   |
|                        | Maximal power consumption of the auxiliary circuit  | < 20 W / 20 VA for one unit  |
| Signalling inputs      | Count of signal inputs  |  |
|                        | In the input module MWD:  | 8 inputs.  |
|                        | In one unit (standard):   | 8 modules * 8 inputs = 64 inputs   |
|                        | In a set of units (standard):   | 4 units * 8 modules * 8 inputs = 256 inputs.   |
|                        | Rated voltage in circuits of binary inputs $U_{WN}$ . (Binary inputs, optically/galvanic isolated). | 220 V DC / 230 V AC or other as agreed   |
|                        | Power consumption from signal inputs circuits   | < 0.3 W / input  |
|                        | Triggering event  | Programmable: decay or increase  |
| Indication LEDs        | Count of signalling LEDs:   |  |
|                        | In a group:   | 8 LEDs.  |
|                        | In one unit (max):  | 8 group * 8 LEDs = 64 LEDs   |
|                        | In a set of units (max):  | 4 units * 8 group * 8 LEDs = 256 LEDs  |
|                        | Diameter of the LEDs lighting point:  | 8 mm   |
|                        | Dimensions of the LEDs signal description field   | 27mm x 13mm (WxH),   |
|                        | Colour of the signalling LED (configured with software):  | Yellow/Red/Green/Blue/Purple   |
| Multiplying Outputs    | Count of multiplying contacts:  |  |
|                        | In the output module MWP:   | 8 contacts.  |
|                        | In one unit (standard):   | 8 modules * 8 contacts = 64 contacts.  |
|                        | In a set of units (standard):   | 4 units * 8 modules * 8 contacts = 256 contacts  |
|                        | Maximal current of the contacts:  | 4 A  |
| Control inputs         | Count of inputs   |  |
|                        | In the input module MWS:  | 8 inputs.  |
|                        | Rated voltage in circuits of signal inputs $U_{wes}$ (Binary inputs, optically/galvanic isolated).  | 220 V DC or other as agreed.   |
|                        | Power consumption from test and reset inputs  | < 0.3 W / input  |
|                        | Range of time delay of input activation   | > 5 ms up to 65 sec. for DC<br>> 20 ms up to 65 sec. for AC  |
| Acoustic outputs       | Count of acoustic steering channels:  |  |
|                        | In the output module MWA:   | 8 channels   |
|                        | Maximal continuous current of the contacts:   | 4 A  |
|                        | Making capacity of the contacts:  | 3 A / 250 V AC<br>0,15 A / 250 V DC; L/R=40 ms   |
| Communication.         | Count of communication channels:  | 6 channels   |
|                        | Channel 1 – on the back panel:  | RS232 – IEC870-5-103 / ZP-6  |
|                        | Channel 2 – on the back panel:  | Fibre-optic connection ST – IEC870-5-103 / ZP-6  |
|                        | Channel 3 – on the back panel:  | Option – fibre optic connection ST<br>IEC 870-5-103 / ZP-6 (MGB-9D)<br>Option – RS485 - Phoenix 8-pin connection<br>IEC 870-5-103 / ZP-6 (MGB-9E)  |
|                        | Channel 4 – on the back panel:  | Option – fibre optic connection ST<br>IEC 870-5-103 / ZP-6 (MGB-9D)<br>Option – RS485 - Phoenix 8-pin connection<br>IEC 870-5-103 / ZP-6 (MGB-9E)<br>Option – GPS – Antenna connection SMA<br>NMEA (MGB-9B, C) |
| Insulation             | Rated voltage of insulation:  | 250 V  |
|                        | Proof impulse voltage:  | 5000 V (1,2/50 $\mu$ s)  |
|                        | Overvoltage category:   | III  |
|                        | Insulation electrical strength:   | 2,5 kV; 50Hz; 1 min.   |
|                        | Enclosure protection degree:  | IP-40  |
| General Data           | Dimensions of the device (single unit)<br>Another units multiply height of the set                  | 19"/3U/240 (483x133,5x245 mm), WxHxD   |
|                        | Weight (one chassis):   | App. 6 kg. (depending on numer of modules)   |
|                        | Ambient temperature range:  | 268 – 318 K (from -5 to +45 C)   |
|                        | Ambient humidity:   | < 95 %   |
|                        | Ambient pressure:   | 70-106 kPa (0 – 3000 m ASL)  |

# MSA-9



## OFFER



**RSH-3, RSH-3S - tripping**

**RS-6, RPD-2, RPP-4, RPP-6 - interposing**

**RMS-2 - signalling**

**RCW-3, RCDW-1 - circuit continuity monitoring**

**RKO-3 - power supply circuit  
continuity monitoring**

**RB-1, RBS-1, RBS-2 - bistable**

**RT-22 - time**

**RUT-2, RUT-3 - time-voltage**

**RJT-1, RJT-3 - time-current**

**RKU-1, RKS-1 - final controlling**

**LZ-1, LZ-2 - operation counters**

**RPZ-1 - supply source switching**

**GPS-1 - time synchronisation**

**MDD-6, MDS-12 - Diode modules**

**PH-XX, PS-XX - Modules of switches,  
pushbuttons and control lamps**

**Relay racks**

**Busbar protections and breaker failure  
protections type TSL-9r, TSL-11**

**Auxiliary and signalization  
relays**

**Reserve Central Signalling System  
type MSA-9, MSA-12, MSA-24**

**Protection relays  
type AZT-9, APP-9**

**Disturbance recorder RZS-9**

**Energy measurement system  
and event recorder ZRZ-28**

**Load Resistors  
for measuring transformers**

**DC and AC auxiliary  
power supply switchgears**

**Cubicle-contained sets of control  
and supervision protections**

**Modular power supplies, measuring suitcases,  
measuring and registering system RFQ-8**

**PROFIL-L cubicles**

**Periodical and post-failure tests,  
as well as repairs and overhauls  
of busbar protections TSL**

**Servicing, strting-up  
and post assembly tests**

**ZPrAE**  
Sp.z o.o.

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